

SANWA ESC BLINKY MODE ANALYSIS & GUIDE

This document provides a detailed breakdown of **Blinky Mode** (Zero-Timing / Boost OFF spec mode) support across Sanwa's Electronic Speed Controller (ESC) product lineup, including verification indicators, setup instructions, firmware considerations, and competition compliance.

1. Overview & Compatibility Matrix

"Blinky Mode" refers to an ESC configuration where all electronic timing advances (Boost, Turbo, and dynamic timing curves) are completely disabled. It is mandated in stock and spec RC racing classes (e.g., ROAR, IFMAR, BRCA, EFRA) to ensure parity. Compliance is visually verified by tech inspectors via a blinking LED when the throttle trigger is at neutral.

ESC MODEL	BLINKY MODE SUPPORTED?	PRIMARY TARGET CLASS	ROAR APPROVED?	NOTES
Super Vortex ZERO	Yes	1/10 On-Road / Off-Road	Yes	1st-generation Super Vortex ESC. Mode 4 = Boost OFF.
Super Vortex STOCK	Yes	1/10 Stock Spec Racing	Yes	Factory-configured for stock spec racing with zero-timing compliance.
Super Vortex Gen2	Yes	1/10 Modified & Stock	Yes	Firmware <code>Ver.01.02.r006</code> is the official ROAR approval release.
Super Vortex Gen2 PRO	Yes	1/10 Modified & Stock	Yes	Evolution of Gen2 with lower internal FET resistance and SXR response mode support.
SV-D2	Yes (with Gen2 PRO FW) / No (with Drift FW)	RWD Drift (Stock FW) / Spec & Mod (Gen2 PRO FW)	With Gen2 PRO FW: Yes	With native drift firmware, the LED does NOT blink at neutral (non-spec). Hardware is identical to Gen2 PRO; when cross-flashed with Gen2 PRO FW (<code>G2103002</code>), it blinks the exact same way as a native Gen2 PRO (Flashing Blue).
Super Vortex TYPE-D	No	Drift	No	Drift-tuned variant of the original Zero; not intended for spec-stock racing.
Super Vortex SPORT	No	Entry / Sport	No	Budget / club level unit with fixed performance curves.
SV-PLUS Series (Zero/Sport/Type-D)	Hardware Yes / Rules No	Integrated Receiver + ESC	Limited / Restricted	Contains the Super Vortex Zero circuitry, but integrated receiver units are generally disallowed by stock racing rules.

2. Technical Implementation: LED Status Indicators

Sanwa ESCs distinguish between Boost ON and Blinky (Boost OFF) mode using the multi-color onboard status LEDs while the throttle trigger is at neutral:

THROTTLE POSITION	MODE 4 BOOST SETTING	SSL CONNECTION STATUS	LED INDICATION	MEANING
Neutral	#1 (Disabled)	SSL Connected (Valid)	Solid GREEN & Flashing BLUE	Blinky Mode (Zero Timing active)
Neutral	#1 (Disabled)	SSL Inactive / Normal Port	Flashing BLUE	Blinky Mode (Zero Timing active)
Neutral	#2 (Enabled)	SSL Connected (Valid)	Flashing GREEN & Solid BLUE	Boost / Timing active
Neutral	#2 (Enabled)	SSL Inactive / Normal Port	Solid BLUE	Boost / Timing active

THROTTLE POSITION	MODE 4 BOOST SETTING	SSL CONNECTION STATUS	LED INDICATION	MEANING
Forward Throttle	Any	Any	Green LED brightens proportional to throttle (Solid at 100%)	Throttle input active
Brake / Reverse	Any	Any	Red LED illuminates proportional to brake	Braking / Reverse active

[!IMPORTANT] A **Flashing Blue LED** while resting at neutral throttle is the mandatory visual cue required by technical scrutineering at sanctioned race events.

3. Configuration & Parameter Mapping

Mode 4: Boost (Timing Control)

In the internal menu structure of the Super Vortex Gen2 / Gen2 PRO / Stock / Zero:

- **Mode 4 = #1 (Boost Disabled / Blinky):**
 - Timing advance is completely disengaged.
 - Parameters **Mode 10 through 13** (Boost Rate, Turbo, Boost Starting RPM, Boost Acceleration) become inactive and cannot alter motor timing.
 - Neutral Blue LED begins flashing.
- **Mode 4 = #2 (Boost Enabled):**
 - Dynamic timing advance is active according to values set in Modes 10 to 13.
 - Neutral Blue LED remains solid ON.

Subordinate Modes Governed by Mode 4

When Mode 4 is set to **#1** (Disabled), the following timing-related modes are automatically locked out:

- **Mode 10 (CODE 6):** Boost Rate (Maximum timing advance per 1,000 RPM)
- **Mode 11 (CODE 7):** Turbo (Full throttle timing advance boost)
- **Mode 12 (CODE 8):** Boost Starting RPM (Engagement threshold RPM)
- **Mode 13 (CODE 9):** Boost Acceleration (Advance ramp rate)

4. Firmware Details (Latest Files Released by Sanwa)

Based on the latest files released by Sanwa:

Super Vortex Gen2 (`super_vortex_gen2/`)

- **Latest ESC Firmware:** `G2102006_SUPER_VORTEX_Gen2_Firmware.zip` (`G2102006.PRO` / `G2102006.PRG` , Ver. 01.02.r006)
 - Release Date: January 16, 2017
 - Status: **Official ROAR Approval Version** (`ROAR認可ver.`) — final official release before discontinuation.
- **Latest Program Box Firmware:** `PBOXA001_0102002_PROGRAM_BOX_Firmware_for_SUPER_VORTEX_Gen2.zip` (Ver. 01.02R002)

Super Vortex Gen2 PRO ([super vortex gen2 pro/](#))

- **Latest ESC Firmware:** [G2103002 SUPER VORTEX Gen2 PRO Firmware SXR compatible.zip](#) ([G2103002.PRO](#) / [G2103002.PRG](#) , Ver. 01.03.002)
 - Release Date: January 28, 2019
 - Feature: SXR (Sanwa eXtreme Response) mode compatibility when paired with M17.
- **Legacy ESC Firmware:** [G2103001 SUPER VORTEX Gen2 PRO Firmware.zip](#) (Ver. 01.03.001)
- **Latest Program Box Firmware:** [PBOXA001_0103001 PROGRAM BOX Firmware for SUPER VORTEX Gen2 PRO.zip](#) (Ver. 01.03.001)

SV-D2 ([SV-D2/](#))

- **Latest Native Drift Firmware:** [D2104100.zip](#) / [D2104100.pro](#) (Ver. 01.04.100)
 - *LED Behavior:* With native drift firmware, the LED does **NOT** blink at neutral, regardless of parameter settings (non-compliant for Blinky racing).
- **Latest Program Box Firmware:** [PBOXA001_0104100 PROGRAM BOX SV-D2 Firmware.zip](#) (Ver. 01.04R100)
- **Gen2 PRO Cross-Flashing (Blinky Mode):**
 - The SV-D2 shares the same core hardware and power FET board architecture as the **Super Vortex Gen2 PRO**.
 - **SV-D2 can be flashed with the latest Super Vortex Gen2 PRO firmware** ([G2103002 SXR](#)).
 - Once flashed with Gen2 PRO firmware, the ESC functions identically to a Super Vortex Gen2 PRO: all standard Gen2 PRO racing features are unlocked, and **Blinky Mode (Mode 4 = #1 Boost Disabled)** is fully operational, **blinking the Blue LED at neutral in the exact same way as a native Gen2 PRO**.
- *Note on Program Box:* To cross-flash or configure the converted unit, ensure the Program Box Gen2 is loaded with the Gen2 PRO firmware ([PBOXA001_0103001](#)) rather than the SV-D2 firmware.

M17 Transmitter ([M17/](#))

- **Latest System Firmware:** [M17_Ver.1.01.10.zip](#) ([M17.prg](#) , [M17.res](#) , Ver. 1.01.10)
 - Features: Fixes R-MODE COPY bug, adds SV-D2 and SGS-02 CODE10 presets, and enhances Multi Setting Gear functions.
- **Language Resource Packs:** [M17_ENG.zip](#) (English) and [M17_JPN.zip](#) (Japanese)
- **Supplemental Documentation:** [M17_SXR_補足説明書.pdf](#) , [M17_補足Manual_Ver.1.01.05.pdf](#) , and [Multi Setting Gear Manual for M17.pdf](#)

5. How to Set Up Blinky Mode

Method A: Using the ESC SET Button (No Box / No Transmitter Needed)

1. Turn on transmitter, ensure throttle trims and sub-trims are set to [0](#) , and Dual Rate (D/R) and End Point Adjustments (EPA) are set to [100%](#) .
2. Connect a charged battery to the ESC.
3. Power on the ESC while pressing and holding the **SET button** until the LED cycles and enters programming mode.
4. Advance through the modes until you reach **Mode 4 (Boost)** (indicated by **4 Blue LED flashes**).
5. Press and release the SET button to inspect the current setting:
 - **1 flash (Green):** Setting [#1](#) (Boost Disabled / Blinky).
 - **2 flashes (Green):** Setting [#2](#) (Boost Enabled).
6. If set to [#2](#) , press and hold the button until the LED turns Red, then press once to switch the setting to [#1](#) .

- Power cycle the ESC to save settings.
- Verify that upon startup, with throttle at neutral, the **Blue LED is flashing**.

Method B: Using the Program Box Gen2

- Connect the Program Box Gen2 to the ESC using the dedicated cable.
- Turn on the ESC.
- Navigate to **SETTING DATA > VIEW & EDIT**.
- Scroll down to **M04 BOOST**.
- Set **M04 BOOST** to **OFF** (or **#1**).
- Press **ENTER** to write data to the ESC (**WRITE OK? → YES**).
- Disconnect Program Box and power cycle the ESC. Verify that the neutral Blue LED flashes.

6. Transmitter Control & SSL Architecture (M17 / M12S / MT-44)

Can Blinky Mode (On/Off) be changed from the transmitter during a race?

No, it is technically impossible by design.

Sanwa specifically engineered the ESC firmware and SSL protocol to separate parameters into two distinct domains:

MODE REGISTER	PARAMETER NAME	CONTROL CHANNEL	REMOTE RADIO ADJUSTMENT (SSL)?	OPERATIONAL STATUS IN BLINKY MODE
Mode 1	Cut-Off Voltage	Hardware / Program Box Only	✗ No (Non-SSL)	Active (Battery Protection)
Mode 2	Reverse Cancel	Hardware / Program Box Only	✗ No (Non-SSL)	Active (Forward / Brake Only)
Mode 3	Thermal Protection	Hardware / Program Box Only	✗ No (Non-SSL)	Active (ESC Thermal Cut)
Mode 4	BOOST (Timing Master)	Hardware / Program Box Only	✗ No (Non-SSL)	Locked to #1 (Disabled / Blinky)
Mode 5	Throttle Punch (CODE 1)	Transmitter SSL / Telemetry	✓ Yes	Adjustable from Radio
Mode 6	Neutral Brake (CODE 2)	Transmitter SSL / Telemetry	✓ Yes	Adjustable from Radio
Mode 7	Drive Feel (CODE 3)	Transmitter SSL / Telemetry	✓ Yes	Adjustable from Radio
Mode 8	Neutral Feel (CODE 4)	Transmitter SSL / Telemetry	✓ Yes	Adjustable from Radio
Mode 9	Brake Feel (CODE 5)	Transmitter SSL / Telemetry	✓ Yes	Adjustable from Radio
Mode 10	Boost Rate (CODE 6)	Transmitter SSL / Telemetry	🔒 Locked Out	Ignored / Inactive (Governed by Mode 4)
Mode 11	Turbo (CODE 7)	Transmitter SSL / Telemetry	🔒 Locked Out	Ignored / Inactive (Governed by Mode 4)
Mode 12	Boost Start RPM (CODE 8)	Transmitter SSL / Telemetry	🔒 Locked Out	Ignored / Inactive (Governed by Mode 4)

MODE REGISTER	PARAMETER NAME	CONTROL CHANNEL	REMOTE RADIO ADJUSTMENT (SSL)?	OPERATIONAL STATUS IN BLINKY MODE
Mode 13	Boost Accel (<code>CODE 9</code>)	Transmitter SSL / Telemetry	Locked Out	Ignored / Inactive (Governed by Mode 4)
Mode 14	Dead Band (<code>CODE 10</code>)	Transmitter SSL / Telemetry	Yes	Adjustable from Radio

Technical Design Safeguards

1. Mode 4 is Isolated from SSL:

- **Mode 4 (Boost On/Off)** is classified strictly as a **Non-SSL Compatible Function**. It has no corresponding `CODE AUX` register in the communication protocol.
- It can **only** be changed physically via the ESC's onboard **SET button** or the **Program Box Gen2**.

2. Internal Master-Lockout for Timing Codes:

- When Mode 4 is set to `#1` (Boost Disabled / Blinky), the ESC firmware internally locks out and ignores **Mode 10 through 13** (CODE 6 through CODE 9).
- Even if a driver alters Boost or Turbo values on the M17 screen (`CODE 6` – `9`), the ESC completely ignores these inputs; timing advance remains hard-locked to zero.

Competition & Scrutineering Rationale

- **ROAR / IFMAR Rule Compliance:** Sanctioning bodies strictly mandate that a non-timing ESC cannot allow a competitor to alter timing curves remotely from the driver stand.
- By isolating Mode 4 from the SSL telemetry channel, Sanwa ensured that once tech inspection confirms the **Flashing Blue LED** at neutral on the starting grid, the driver cannot defeat Blinky mode during the heat or main.
- *Note on Race Scrutineering:* While Mode 4 cannot be defeated via radio, certain national sanctioning bodies (e.g., BRCA in the UK) require physical disconnection of the SSL telemetry lead (`BATT/SSL` port) during spec-stock races to eliminate any dispute regarding transmitter-based adjustments. Always verify local track tech requirements.

7. Firmware Integrity & Tamper Protection: Can Boost be Enabled with a Blinky Indicator?

Is it possible to have Boost enabled while keeping the Blinky (Flashing Blue) LED indicator?

In official firmware: No.

Via firmware modification / hacking: Prevented by hardware safeguards and multi-tier race scrutineering.

1. Hardcoded State Coupling in Official Firmware

- In all Sanwa Super Vortex firmware builds (Zero, Stock, Gen2, Gen2 PRO, SV-D2), the LED state routine is **intrinsically coupled** to the internal state variable of `Mode 4 (Boost)`:
 - When `Mode 4 = #2` (Boost Enabled), the MCU executes the timing calculation algorithms and forces the Blue LED pin **HIGH (Solid ON)**.
 - When `Mode 4 = #1` (Boost Disabled), the timing calculation routines are completely bypassed, and a timer interrupt generates the **continuous Flashing Blue pattern**.
- There are no hidden parameters, debug modes, or official firmware builds that decouple the LED flashing routine from the timing disable state.

2. Barriers to Firmware Hacking & Binary Tampering

Attempting to tamper with Sanwa firmware images encounters several technical hurdles:

- **Proprietary Encryption & Format:** Sanwa `.PRO` firmware files are not raw binary dumps or plain Intel HEX files. They are encrypted/scrambled proprietary payload binaries designed for Sanwa's internal bootloader.

- **Bootloader Checksum & ID Verification:** Both the Program Box Gen2 and the ESC's onboard bootloader perform strict checksum, length, and model-ID validation prior to flashing. Altering instructions in the payload triggers a verification error (`Write Error` / `Wrong Version`) or permanent MCU lockout (bricking).
- **Hardware Read-Out Protection:** The microcontroller chips inside Sanwa ESCs utilize hardware-level code readout protection (ROP), preventing extraction of factory source assembly from the board.

3. How Race Scrutineering Catches Timing Beyond the LED

Sanctioning bodies (ROAR, IFMAR, EFRA, BRCA) design their technical inspection protocols specifically around the assumption that visual indicators alone are insufficient:

1. Free-Rev Motor Tachometer Tests:

- In spec-stock racing (e.g., 17.5T or 13.5T), motors operate with fixed physical stator ratings (KV).
- At full battery charge (8.40V), maximum zero-timing RPM under no-load conditions falls into a well-defined theoretical and bench-tested baseline.
- If electronic timing advance (Boost or Turbo) is active, no-load free-rev RPM increases dramatically (often by 15% to 40%+). Tech inspectors frequently conduct bench tachometer RPM checks in post-race inspection.

2. Program Box Checksum & Version Query:

- Scrutineers connect an official inspection Program Box to query the internal firmware version string and read out the ESC parameter tables directly from memory.

3. Strict Firmware Homologation Lists:

- Rulebooks stipulate that only specifically listed, laboratory-tested firmware hashes/versions (e.g., `62102006` Ver. 01.02.r006 for Gen2) are legal. Any custom signature or unrecognized version results in immediate disqualification.