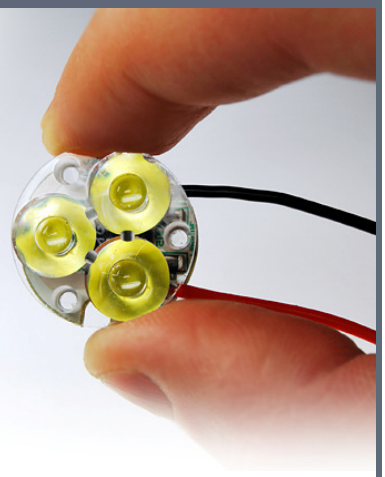
334

Subminiature High-Efficiency All-In-One 3UP LED Engine



- 3UP CREE XP-G/XP-E (Samsung 3535 or Nichia 219), up to 1400 Lumens
- Input Voltage Range Optimized for Lithium Cells 1S/2S (from 2.5V to 9.5V)
- High-Frequency Constant Current Boost Regulator (1.6 MHz)
- Mode-Control Function with Memory, Battery and Temperature Monitoring[1]
- Thermally-Enhanced Metal Core PCB Ø20mm
- Electrically Neutral Thermal Path
- Ultra-Low EMI Noise (Shielded Inductor)
- Integrated Safety Functions and Reverse Polarity Protection
- 30µA Typical Quiescent Current in Stand-by Mode
- Shock and Vibration Tolerant Materials and Components

Note 1: There are three possible configurations: master, slave and single-mode. For the functional details of each version see the functions map below in the document.

The 334 engine is a highly customizable constant current boost (step-up) regulator integrated with three emitters designed to provide a simple, robust, cost-effective solution for light-demanding applications such as vehicle headlights, LED flashlights, interior and exterior illumination etc. The switching regulator is optimized for lithium cell voltage range (1S/2S) and exhibits an exceptionally high efficiency (< 96%). This product is compatible with most wireless devices due to its low EMI noise level obtained by an optimal high-frequency board design and low-profile shielded inductor. The engine takes advantage of a thermally-enhanced metal core PCB (MCPCB) which provides very low thermal resistance and guarantees extremely high shock and vibration tolerance. The metal core is an electrically neutral which allows multiple engines to share the same heat sink with no need for insulation.

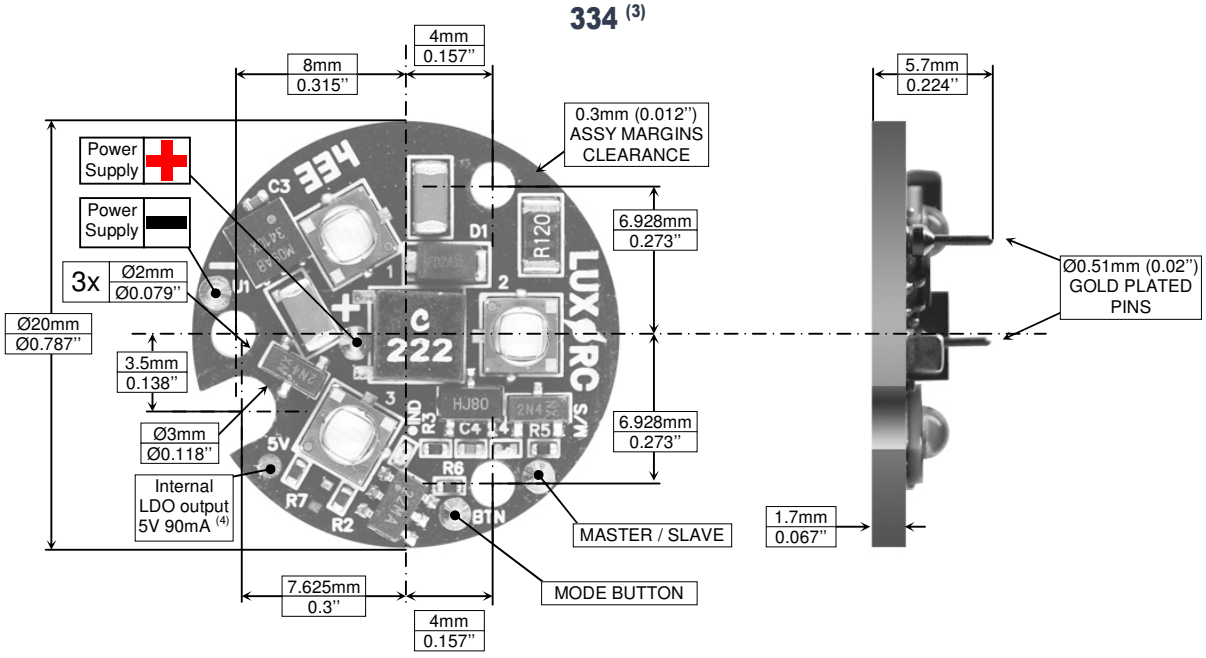
lead-free RoHS 2002/95/EC

Absolute Maximum Ratings

Input Voltage Range	from 2.5V to 9.5V
Stabilized LED Current	from 0.4A to 1.5A
LED Luminous Flux [2]	up to 1400 Lumens
Temp. Management Cut-offs	80 °C / 120 °C
Absolute Maximum Input Current	< 2.8 A
Absolute Maximum Consumed Power	< 16 Watts
Typical Conversion Efficiency	92% ÷ 97%

Note 2: Absolute maximum luminous flux is provided by CREE XP-G R5/S2 LED's in a 16W configuration (A-type). If you need a custom module please contact us before placing your order. The engine supports CREE's XP series (XT-E, XP-G, XP-E, XP-C), Nichia 219 and Samsung 3535.

334 [3]

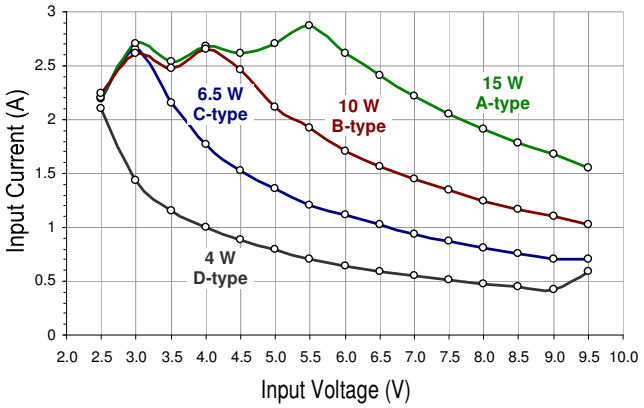


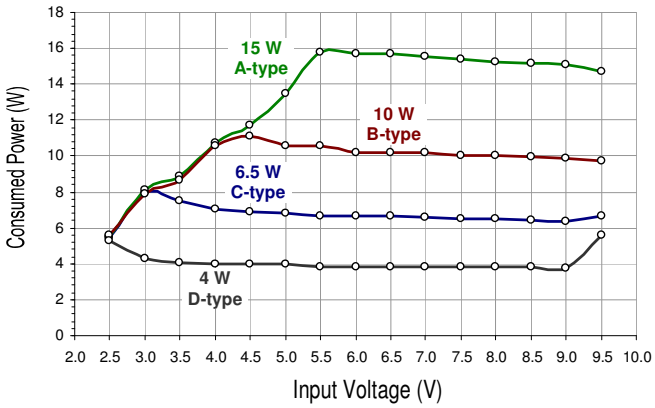
Note 3: The 334 should be installed on a flat clear heat sink. The engine can be either glued using a thermally conductive adhesive or fastened by a ring or nut. We recommend applying DOW CORNING 1-4173 thermally conductive adhesive or similar to minimize thermal resistance and attain maximum performance.

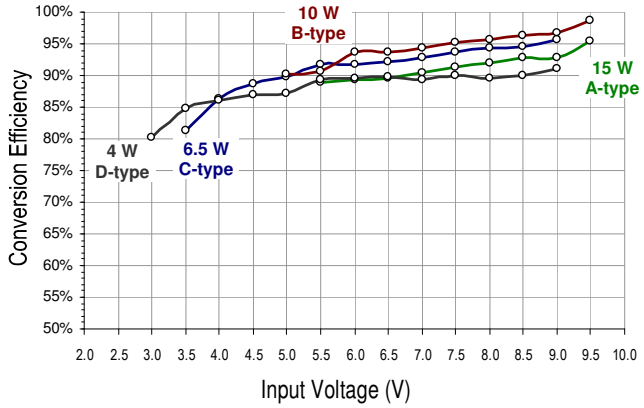
Note 4: The internally protected LDO output is set to 5V. Maximum load current should not exceed 90mA.

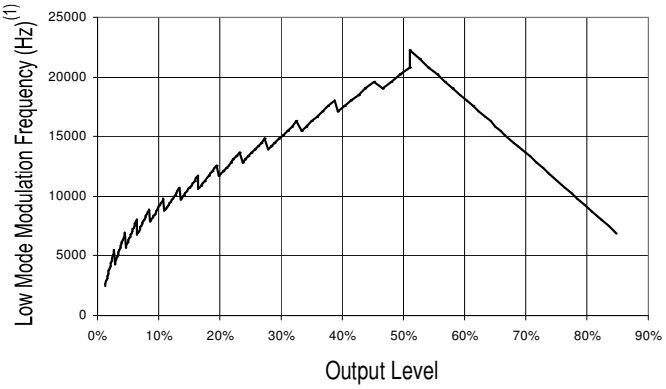
RoHS Compliance Note: All components are RoHS compliant. Lead-free SMT solder paste specification INDIUM8.9HF/NC 96.5Sn/3.0Ag/0.5Cu (ME89%)

Electrical Characteristics









Note 1. MC/SL versions employ a high-frequency PWM in low modes (below 100%). The full mode is always constant-current.

Functions Map

	Safety				User Interface										
	Low Voltage Cut-Off at 2.2V	Critical Overheating Cut-off at 120°C	Reverse Polarity Protection	Overvoltage Cutoff	Stand-by Mode (Sleep)	Stand-by Flash (In-the-dark Finder)	Battery Stretch Function	Battery Monitor Function with automatic cell count detection	Programmable Heat Control with "High Temperature" Warning Signal	Simple 3 Mode UI (Factory Predefined Levels)	User Programmable UI with simple, extended and tactical configurations	Soft Mode Change	Button Security Lock Function	Instant-access Moonlight Mode	SOS, Strobe and Beacon Signals
Single Mode	●	●	●												
Slave	●	●	●	○ (1)	○ (1)		○ (1)	○ (1)		○	○ (1)	○ (1)		○ (1)	○ (1)
Master Power Pulse Control	●	●	●	●			●	●	○ (2)	●		○ (3)			
Master Mom Button Control	●	●	●	●	●	●	●	●	●		●	●	●	●	●

Note 1: This function is provided by the master connected to the slave.
Note 2: There's no "high temperature" warning here.
Note 3: Only fade-in transition is supported by the power pulse control.

Hardware Safety Functions

All configurations come with electronic reverse polarity protection, critical overheating cut-off (full off at 120℃) and low voltage cut-off at 2.2V. These thresholds are implemented in the hardware level and cannot be configured.

Lithium Battery Monitor

Battery monitoring function is newly introduced in 334 master engines (MC). It implements a fully-automatic lithium battery protection function with cell count detection. By default it's set to 3.6-3.7 nominal voltage and admits single (1S, 3.7V) or two-in-series (2S, 7.4V) battery configurations. For a custom configuration please contact sales or RnD department.

The master light engine blocks the operation if the input voltage drops below 3.0V per cell (factory default) under the load during at least 2.5 seconds. MOM version also disables the button and stand-by flash. Normal operation is resumed on memory reset or after a new fresh battery is connected (the input voltage should exceed 3.5V per cell threshold).

The master light engine also blocks the operation if input voltage exceeds 4.4V per cell threshold (over-voltage check).
The monitoring logic is always active (even in the stand-by mode).

Stand-by with Flash

The master boards include the electronic switch (FET) which eliminates a need for an external power switch. Using a logic-level momentary button it's possible to fully control the operation. In stand-by mode the engine is not active and minimizes the parasitic current drain (typical 30μA quiescent current). A short red flash (10ms each 5 sec) indicates normal battery condition (the flash is disabled in blocked state and tactical configuration). This flash is often referred as "in-the-dark finder" allowing easy locating the switched-off flashlight in the dark.

Battery Stretch Function

This feature is newly introduced in 334 master engines and nearly doubles the runtime when the full mode is initially used. The output is reduced to 10% at 10% of the battery. So it lets the remaining 10% of battery to last 10 times longer. This mode change is not compulsory, in other words it's still possible to return to full mode when it's required by the situation. If favorite mode is programmed at less than 10%, the engine uses the user favorite instead of the 10% default.

Temperature Management

In addition to the hardware overheating cutoff (at 120℃) the master engines implement a factory programmable level at which the output is reduced to prevent lithium battery overheating (when it shares the same housing with the light engines). High-temperature warning is introduced in the stand-by mode (fast red-indicator blinking during which it's not recommended to touch the flashlight head).

Button Security Lock

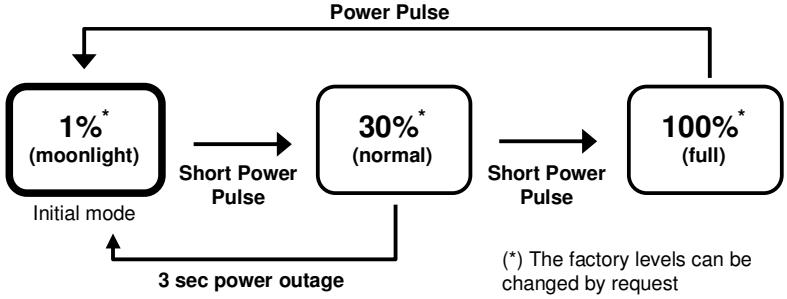
Four fast clicks in any mode lock the momentary button preventing occasional switching on. The button is unlocked by four-clicks as well.

Instant-access Moonlight Mode

In any configuration you can use "long" click (0.5 sec) to switch the light in minimal mode (about 1%).

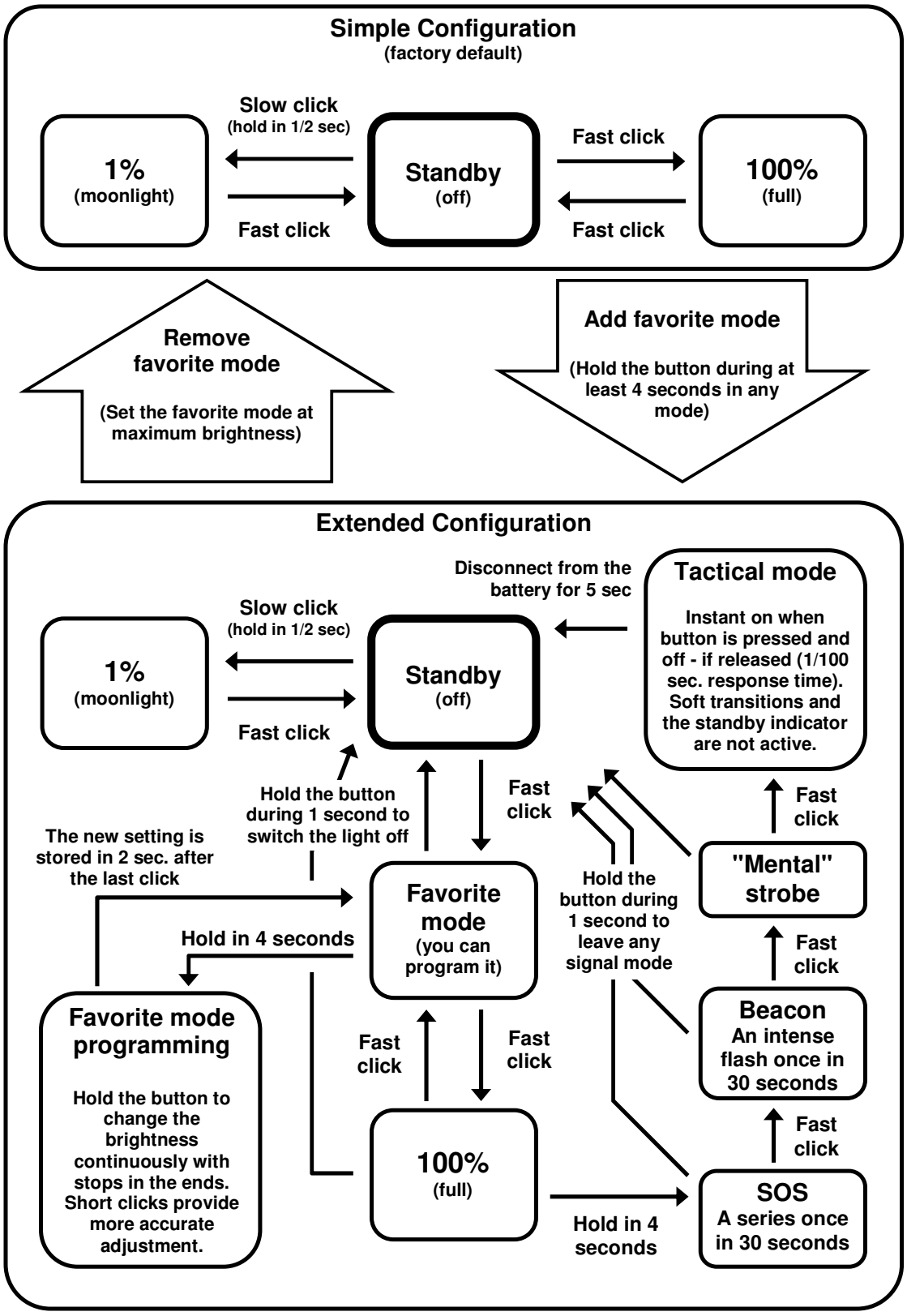
Simple 3-mode Operation

There are two different firmware configurations available for master engine (set by the factory). Unlike the 333 version, new engines support only one configuration at a time. In other words the engine controllable by a mom button ignores the power pulses. In "power pulse control" configuration short power interrupts are used to switch between 3 factory-predefined levels:



User-Programmable UI

Mom button controllable master engine provides three user-selectable operational modes: simple, extended and tactical. This version ignores power pulses and resumes the selected mode after the outage (power pulses do not change modes). The initial mode after memory reset is stand-by (switched off).



Mom-button Shortcuts

- Use single click to switch modes;
- Hold the button during 1 second to switch the light off (from any mode including signals);
- Use "long click" in stand-by (hold in 1/2 sec) to switch on in minimal mode (moonlight);
- Use four fast clicks to lock/unlock the button;
- Hold the button during 4 seconds to access programming or signals.

Red Indicator Signals

Bright short flash once in 5 seconds	Bright fast blinking	No signal	Very dim slow blinking (visible in the dark)
Stand-by mode, battery in good condition **OR** Signal mode is active (SOS or Beacon)	High-temperature warning, don't touch the light engine	Disconnected from the battery **OR** Wrong polarity **OR** Tactical mode is active	The battery is fully discharged and should be replaced as soon as possible (the operation is blocked)

Soft Mode Change

Master engines use soft transitions between modes that simulate incandescent bulb inertia and minimize negative blinding effect which may be caused by very fast change of luminous flux. Sort transitions are disabled in tactical mode.

Master-Slave Topology

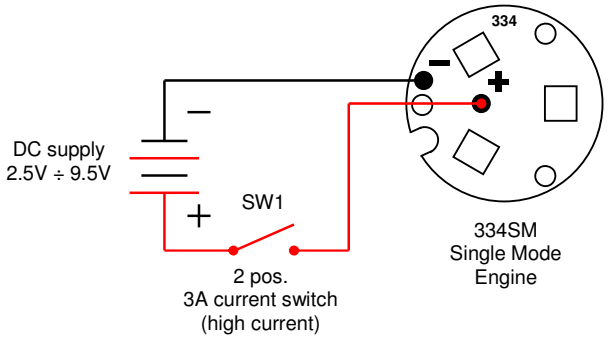
The master-slave interface enables boards cascading for very high output multi-engine topologies. All engines should share the same ground (typically it means parallel connection to supply). Many slaves can be connected to one master at a time. All engines are kept in-sync by means of just one wire which links all boards together. A master-slave setup behaves exactly the same way as a single master.

Memory Retention

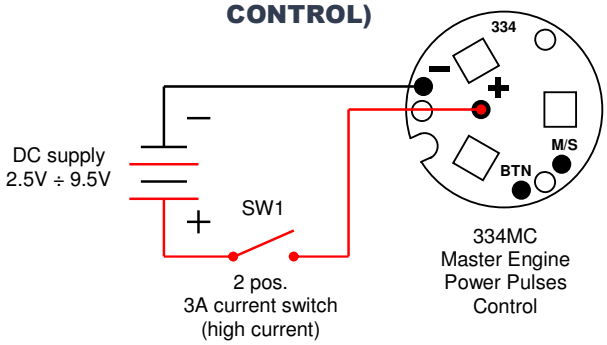
The favorite mode setting is stored in transient RAM which is flushed in about 30 seconds when disconnected from the battery. The memory retention period may be longer if the engine is exposed to the light.

APPLICATION NOTES

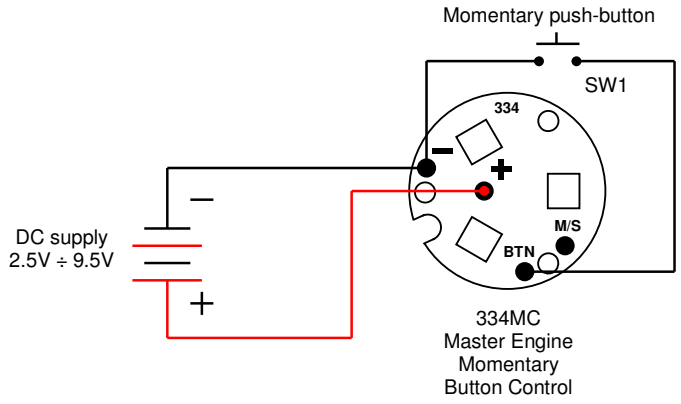
A1. SINGLE MODE ENGINE



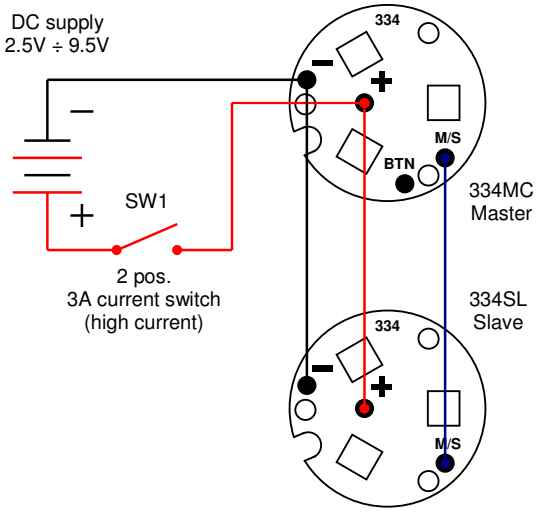
A2. MASTER ENGINE (POWER PULSES CONTROL)



A3. MASTER ENGINE (MOM BUTTON CONTROL)



A4. 2UP MASTER-SLAVE (POWER PULSES CONTROL)



A5. 3UP MASTER-SLAVE (MOM BUTTON CONTROL)