

The APOLLO Command Module (ACM) INPUTS



- CLK: 50 MHz TTL square wave input, derived from the 5× multiplied Booster output, which in turn comes from our GPS clock.
- 1_PPS: 1 pulse per second output from the GPS clock. The green LED indicates a pulse.
- PIN: Input from the photodiode to indicate laser fire. This connects to the 9327 discriminator, which outputs a 100 ns TTL pulse indicating that the laser has fired.
- CAL: Diffuser motor index (1 pulse per revolution)
- IDX: Index input from the TR motor. This bleeps every time the motor does a full revolution
- ENC: Encoder input from the TR motor, with 1000 or 2000 TTL pulses per cycle. The ACM is programmed to set ZAP high and fire the laser X encoder pulses after every TR index pulse.
- I/O 1, etc: These five connectors (I/O 1 through I/O 5) are jumper-configurable to act either as inputs to the TIMER chip, or can be outputs.

The APOLLO Command Module (ACM)

OUTPUTS



- LUN_ST: A 20-ns TTL whose rising edge is coincident with the turn-on of the APD gate associated with the lunar photon. This output is used to request TDC START events for the purpose of calibration.
- CAL_ST: A 20-ns TTL whose rising edge is coincident with the turn-on of the APD gate associated with the laser fire (via PIN).
- OPN: A generic gate-open announcement, and represents the always-enabled OR combination of the previous two signals--any time the gate opens for any purpose.
- CLS: A 20-ns TTL announcing the gate is about to close. The gate shuts off with the trailing edge of this pulse. Thus OPN and CLS are nestled inside the gate pulse (which is a multiple of 20 ns long).
- STOP: Same as CLS, but specifically intended to request a STOP pulse for the TDC. Given propagation delays, the first clock pulse following gate closure is selected.
- TME: A 160-ns TTL sent to the GPS clock upon the first CLS event within a given second (as announced by the 1_PPS signal). This signal latches the GPS time to the nearest microsecond.
- GTE: A TTL signal of variable duration (a multiple of 20 ns) coincident with the request for APD gate action. See the example ACM waveform for a picture. The associated (white) LED pulses with the gate (stretched).
- APD: The output of GTE AND APD_EN. Thus, it only goes high when both GTE goes high, and the enable signal is high. This is the signal that turns the APDs on.
- LSR: A DC signal indicating that the laser is enabled. This signal tells the laser to constantly charge its capacitor bank. The associated (green) LED announces the high state of this line.
- ZAP: A 50 μ s TTL pulse requesting a fire event from the laser. The associated (blue) LED pulses with the fire request.
- BLK: A DC signal that requests blockage of the laser beam. When the output is high the beam is unblocked. A red LED indicates when the beam is unblocked.
- I/O 1: Diffuser motor step request.

The Booster Board

INPUTS

- GPS (on back): 10 MHz sine wave, from GPS clock
- PHOTODIODE:
- TTL STOP: Input from ACM (via STOP) that will become the ECL1 STOP. This is the common stop pulse for the TDC. Inside the Booster board there is a comparator that generates ECL1 STOP. The inputs to the comparator is the 50 MHz clock and 0V DC. When TTL STOP is high, the comparator is enabled. So, you need the right length of cable between the ACM's STOP and the Booster's TTL STOP such that the ACM's stop pulse encloses one peak. Look at pin 9 on U9 and pin 13 on U11 of the Booster board.

OUTPUTS

- TTL CLOCK: Outputs 50 MHz square wave, derived from the 10 Mhz sine wave output of the GPS clock.
 - ECL1 STOP: ECL signal sent to the TDC as a common stop.
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- ECL1 START
 - RAN STOP
 - RAN START1
 - ECL2 START
 - RAN START2
 - PHOTOSIG
 - EXT NOISE GEN
 - NOISE GEN ENABLE

The Time to Digital Converter (TDC)

INPUTS

The TDC has configuration jumpers on back. We set the jumpers so the TDC has a 100ns range, and the common signal to the 16 channels is a common **stop**. What is written below is for a common stop setting.

- COM: ECL input that stops the stopwatch on all channels.
- CLEAR
- TEST: ECL input that starts the stopwatch on all channels.
- INPUTS (1-16): ECL input that starts the stopwatch on a particular channel.

Normal Configuration

