

# Service Bulletin N° 80

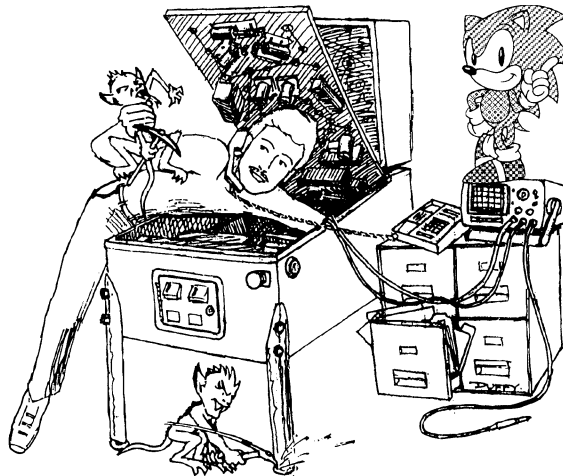
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TO: Parts & Service Managers

DATE: December 21, 1995

SUBJ: **Theory of Operation: Apollo 13 Playfield Magnet Interface  
and 7-Segment Display Board (520-5130-06)**

We would like to introduce a feature on Apollo 13 which grabs the ball off a ramp and orbits it around the moon dropping it into the under playfield Trough Assembly.

Digitally this board consists of output ports that reside at three dedicated address locations.- These locations are determined both by pinout choices (at the I/O Board) and by hardware decoding on both CPU/Sound and I/O Boards.

A CPU write operation to Hex address \$3601 clears the outputs of latch **U2** (74LS273) (The /CLR line goes low, and all outputs of **U2** go low.) A write to address \$3600 brings the /CLR line high, and enables data output from latch **U2**. The actual data bits present during these two write operations are ignored.

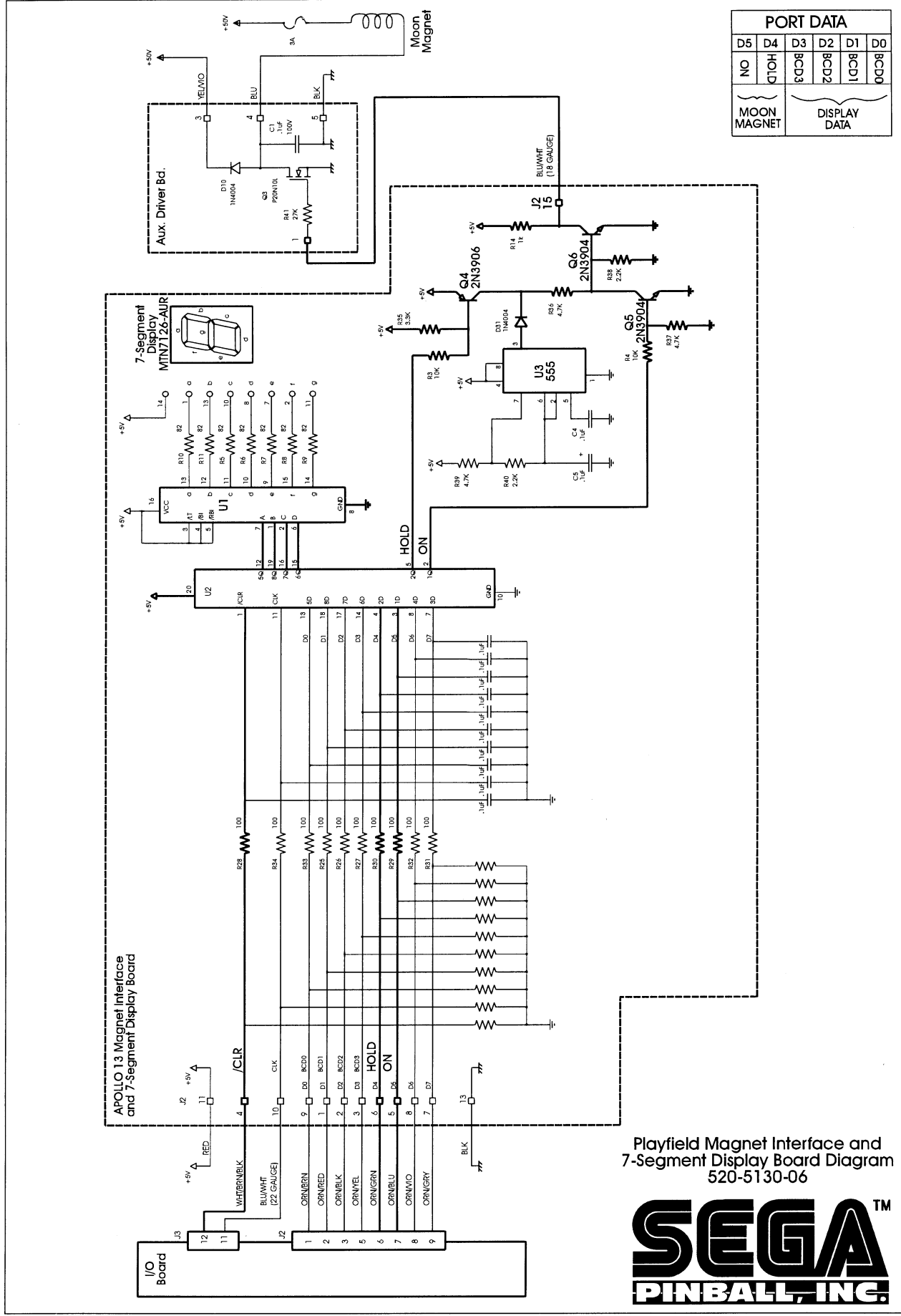
A write to address \$3500 can then take place, with the data bits present being latched into the outputs of **U2**. Bits D0 thru D3 are latched to generate the Binary-Coded-Decimal (BCD) digit which is visible via decoder/driver **U1** and the 7-Segment LED display.

Data bits D4 and D5 are latched into the outputs of **U2** to enable the moon magnet. When the magnet is turned off both Bits D4 and D5 are low which means the hold output of **U2** will be low turning **Q4 ON** which supplies 5v DC to the collector of **Q5** and the base of **Q6**. The **ON** output of **U2** will be low turning **Q5 OFF** which will turn **Q6 ON** which brings the output at J2 pin 15 low leaving the magnet **OFF**.

When bit D5 goes high and D4 stays low (**ON** condition) **Q5** is switched on, turning off **Q6** and resulting in a high drive signal or voltage at J2 pin 15.

When bit D4 is high with D5 low (**HOLD** condition) **Q4** is turned off, **Q5** is turned off, and the (10% duty cycle) square wave output of **U3** is applied to **Q6**, resulting in a 10% drive signal at J2 pin 15.

The two different drive signals result in a powerful **GRAB** effect and milder **HOLD** action of the Moon Magnet similar to pull-in and hold power in our flipper coils.



PORT DATA					
D5	D4	D3	D2	D1	D0
NO	HOLD	BCD3	BCD2	BCD1	BCD0
MOON MAGNET			DISPLAY DATA		

Playfield Magnet Interface and 7-Segment Display Board Diagram  
520-5130-06

