

A GERRY ANDERSON PRODUCTION **THUNDERBIRDS™**

PINBALL SERVICE MANUAL



Homepin™



Thunderbirds Pinball (TAG) Service Manual

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See www.homepin.com for updates and additional information



SERVICE MANUAL & INFORMATION Thunderbirds Pinball (TAG)

22nd May 2018

This is an incomplete service manual. Much additional information, exploded diagrams and schematic diagrams are yet to be finalised and added to this manual.

Any errors or omissions are accidental and unintentional, if found please report to us so we can amend the manual.

HEX files for the various smaller driver boards can be found at www.homepin.com

Please see your authorised Homepin dealer for major software updates (if any).



Thunderbirds Pinball (TAG)

Welcome to Thunderbirds Pinball!

This machine is the result of five years of work often under the most arduous & taxing of situations. Naturally there is no single person responsible for the design and construction of this machine (and many more to come) so let's call them "The Homepin Team".

Homepin was formally started in 2013 by myself after several years making replacement pinball machine PCBs in my small home electronic workshop. My wife of 40 years Karen & I decided that we would start a factory in China and manufacture pinball machines.

Three years into the project Karen passed away and that created many serious financial and personal hurdles that had to be overcome. It also added a delay of more than a year to the initial time projections we had made to complete the Thunderbirds Pinball project.

I'm very pleased, and quite proud, to finally be able to say that our dreams of both building a viable, operational factory in another country and also a fully functional, modern pinball machine have come to fruition.

I owed it to Karen to finish what we had started together and I have now done that.

As a customer you have also helped us fulfil our sometimes seemingly unachievable goal and for that I sincerely thank every one of you. I also extend my gratitude to every member of The Homepin Team for their dedication.

I hope you enjoy playing our creation and appreciate the staggering amount of time and effort that has been expended to bring this very complex product to market.

Your Thunderbirds Pinball machine is a unique, hand made machine. No two are exactly alike because of this. We have tried to incorporate as many mechanical and electronic adjustments as possible so that your machine can be tailored and tweaked to give the best possible performance. Please ensure that you familiarise yourself with the operation and adjustments of the machine covered in the service manual to maximise your playing experience.

Best wishes for the future,

Mike Kalinowski

Director, Homepin Limited (HK)

A handwritten signature in black ink, consisting of a series of connected loops and peaks, ending with a small dot.

Homepin offers our sincere thanks to the following companies and people for their assistance or guiding ideas, no matter how small or large and in no particular order;

Bally, Williams, Stern & JJP Pinball companies

All Homepin customers

ITV Studios London

Karen Kalinowski, Sid Y., Benjamin Heckendorn, Federico Barbato, Roger Burgin, Grant Higgins, Sascha Voskull, Amanda Sun, Edy, Mr X, James Shore, Andrew B., John Popaduik.

And no doubt a host of others that don't come to mind right now!

*Thunderbirds Pinball is dedicated
to the memory of Karen*



IMPORTANT GENERAL NOTES

Thunderbirds Pinball (TAG)

(1) After using the service menu to make any changes or adjustments it is wise to reboot the machine. Remnants of your actions scrolling through the menu items can corrupt the program currently loaded in RAM.

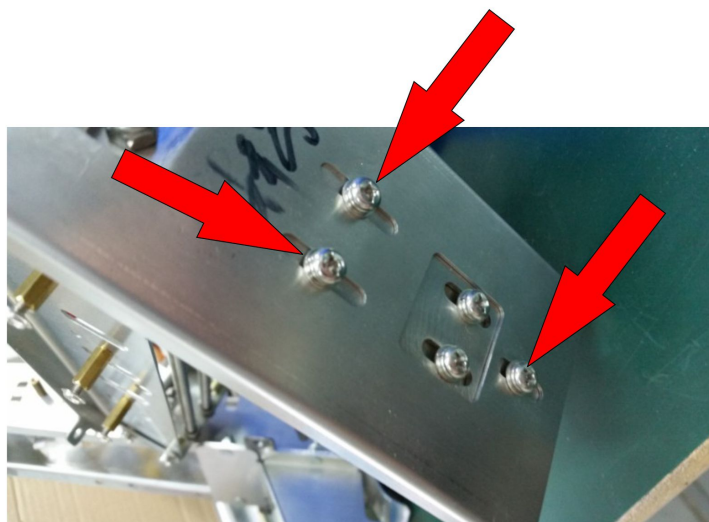
Random things have been noted after menu adjustments such as no music on game start, multiple balls being kicked into play and DMD display issues (possibly other random things as well). Safest to reboot after any menu access.

(2) For ball search to operate the 'DOOR' setting must be set to 'NO' and the 'ball search' setting to 20 seconds. This is a small anomaly in the menu software and will be investigated. NOTE: These settings are applied automatically when using "Factory OEM" to reset all settings.

(3) It has been noted that the ball trough upkicker adjustment can differ with even slightly different mains supply voltages. The reason is the solenoids are all supplied from a 50 volt unregulated power rail and this actual voltage will vary considerably with even a small mains voltage fluctuation. It can measure anywhere between 60 and 76 volts.

Symptoms can vary from 'takes several tries to kick out a ball' to 'kicks out two balls at random'.

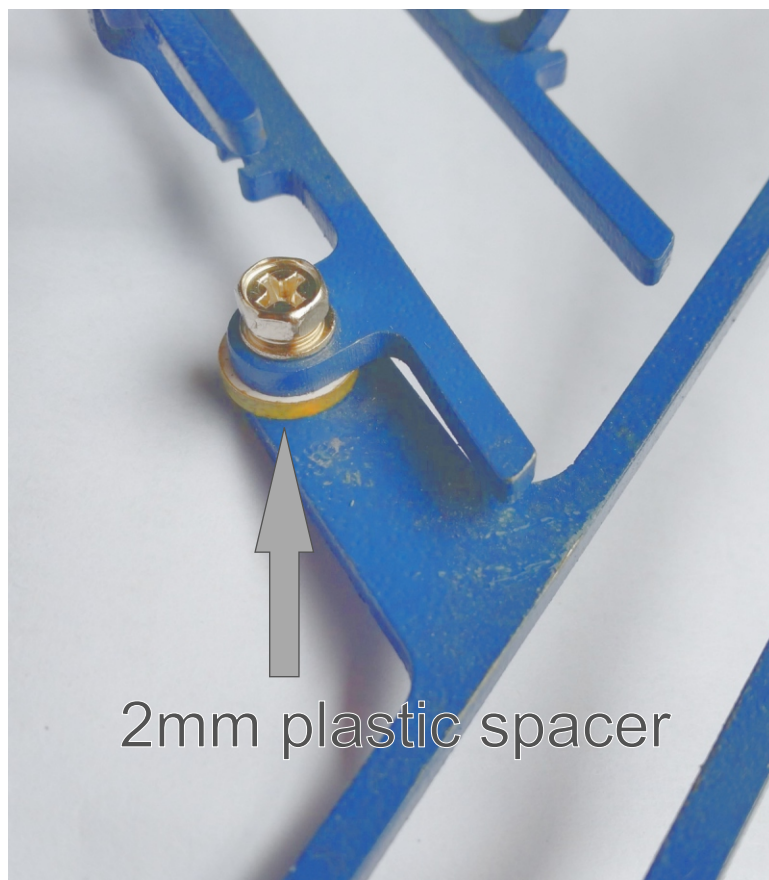
The solution is to carefully adjust the 3 coil mounting bracket screws on the ball trough coil bracket (arrowed below) and slide the entire coil and bracket up or down to find the best position. Usually, if the voltage is lower, we have found a lower position of the coil works more reliably.





Railway Join Thunderbirds Pinball

June 2018



Connect left & right rails with a 4mm bolt using a 2mm spacer between them.



TAG initial unpacking & setup NOTES
PLEASE don't skip any steps and PLEASE read it all!

- (1) DO NOT cut the strap (or plastic wrap) securing the backbox to the cabinet (yet).**
- (2) Cut the straps securing the machine to the pallet and lay the machine bottom side down. Open the coin door and remove the coin box. Inside you will find the leg bolts, backbox bolts, power cable, balls and numerous other items. The key is tied to the plunger.**
- (3) Unpack the legs & feet (in the cardboard box strapped to the pallet) and screw the feet into the legs noting short threaded and longer threaded feet for front and back.**
- (4) With assistance, attach the legs to the cabinet.**
- (5) Now cut the backbox strap or plastic wrap and CAREFULLY raise the backbox taking care to ensure the cables are not pinched as you stand the headbox up.**
- (6) The key for the translite is in the usual place on a spring hook inside the coin door. Use the key to unlock and remove the translite in the conventional way.**
- (7) Pull the latch on the top right side of the speaker/DMD panel UP and the panel will swing open. *CAUTION* - Hold pressure against the headbox as the panel swings out to prevent the headbox from folding forward.**
- (8) Fit BOTH backbox bolts and tighten firmly. These are required for electrical safety as well as mechanical security – NEVER operate the machine without these bolts fitted. These are also a requirement of our electrical approval for this machine.**
- (9) Dress the small split tubing on the left side away from the DMD panel hinges – DO NOT attach this to any cable clamps as it will damage the wiring when folding the backbox (see picture below).**
- (10) Remove the transit packing from the Mole captive ball, the ball trough and the Tilt mechanism inside the door on the left hand wall of the machine.**
- (11) Unlatch the lockdown bar, slide out the glass and lift the playfield – lift and roll the playfield all the way towards you and swing it upright against the top of the headbox. (NOTE: NEVER, EVER place glass directly onto a tiled or concrete floor)**

(12) Have a **GOOD** look around inside the cabinet. Look for connectors or screws that may have worked loose in transit. Look in the bottom of the cabinet for screws that may have shaken loose.

(13) While you have the playfield up check the tilt mechanism and adjust to your desired setting by loosening the lock nut and screwing the plumb bob up or down as required. Tighten the nut.

(14) Make sure all of the connectors going to the power transformer, the switch box on the right hand side and to the power supply PCB are all secure and the clear cover over the power supply is clipped in place.

(15) Confirm the flippers are set to the correct position and that the lock nut is tight. Check the adjustment of the EOS switches – **DO NOT** overlook this step.

(16) Lower the playfield and remove all of the protective plastic covering on the playfield and the playfield plastics.

(17) Time to check that the mains supply voltage is correct for your country. Refer to the sticker near the switch box or the service manual and confirm the machine is set correctly. If it is correct, plug in the mains power lead to the IEC socket at the rear of the machine and secure the metal cover over the socket receiver box.

(18) Clean five (5) balls with the cleaning cloth supplied in the box of balls and place them into the machine – note: **FIVE ONLY** for Thunderbirds Pinball.

Your Thunderbirds Pinball is now setup and ready for take off!

IMPORTANT NOTE

NEVER, EVER use any type of solvent to clean the playfield.

A mild detergent or car polish is best and for really dirty or stubborn areas Isopropyl Alcohol can be used. For minor scratches, Novus polish used as per the manufacturers instructions is recommended.





Program Update Instructions

July 2018

There are two ways of updating the firmware stored inside the 32 Bit PIC32 chip mounted on the daughterboard of the main MPU, H-0012.

(1)

The first is to remove the plastic screw that retains the daughterboard and, using two hands, wiggle the daughterboard towards you (away from the main board) as evenly as possible to avoid damage to the connectors.

Return the module to your dealer and ask for a replacement module with a current version of the firmware installed (the dealer may update your module and return it).

Refit the module and secure with the plastic screw (snug only, don't overtighten).

Power up the machine and make the factory setting adjustments as listed elsewhere in this manual to avoid unexpected operation of the machine.

(2)

When a new version of software is released each Homepin Authorised Dealer will have a programming tool that allows for updating of the firmware in seconds without removing anything from the machine.

The dealer will plug in the programmer (as shown elsewhere in this manual) and power up the machine as normal. When the blue LED is flashing slowly on the programmer she will press and release the button on the programmer. The red LED on the programmer will light for a few seconds as the program is updated.

When the red LED on the programming tool is extinguished the programming is finished. This usually only takes a few seconds.

Power off the machine and unplug the programming tool. Power the machine back on and make the factory setting adjustments as listed elsewhere in this manual to avoid unexpected operation of the machine.

TAG FACTORY SETTINGS

(THESE SHOULD BE APPLIED AFTER ANY PROGRAM UPDATE)

NOTE: These settings can be applied all at once by using “Factory OEM” in the service menu

USER SETTINGS

FREE PLAY – YES

COINS/CREDIT - 1

BALLS/GAME - 3

TILT MESSAGE - 2

MUSIC MODE - CLASSIC

FX VOLUME - 50%

MUSIC VOLUME - 50%

DOOR MESSAGE - NO

RESET HIGH SCORES – RESET UPON PROGRAM UPDATE TO AVOID
CORRUPTION

BALL SEARCH AFTER - 20 SECOND

FIND TIMER - 4000

GAME SETTINGS

EXTRA BALLS - YES

POP BUMPERS - 6

BALL SAVE - 5 SECONDS

REPLAY VALUE - 20 MILLION

ALLOW REPLAY - YES

ALLOW MATCH - YES

ATTRACT VOICE - NO

EXTRA BALL AT - 10 HITS

AUTO REPLAY - 2 PERCENT

END CREDITS - YES

NO SCORE BALL - ON

RBALL LOCK DELAY - LONG

TARGET MODE - EASY

COIL SETTINGS

SLINGS - 4

POP BUMPERS - 8

AUTO PLUNGER - 9

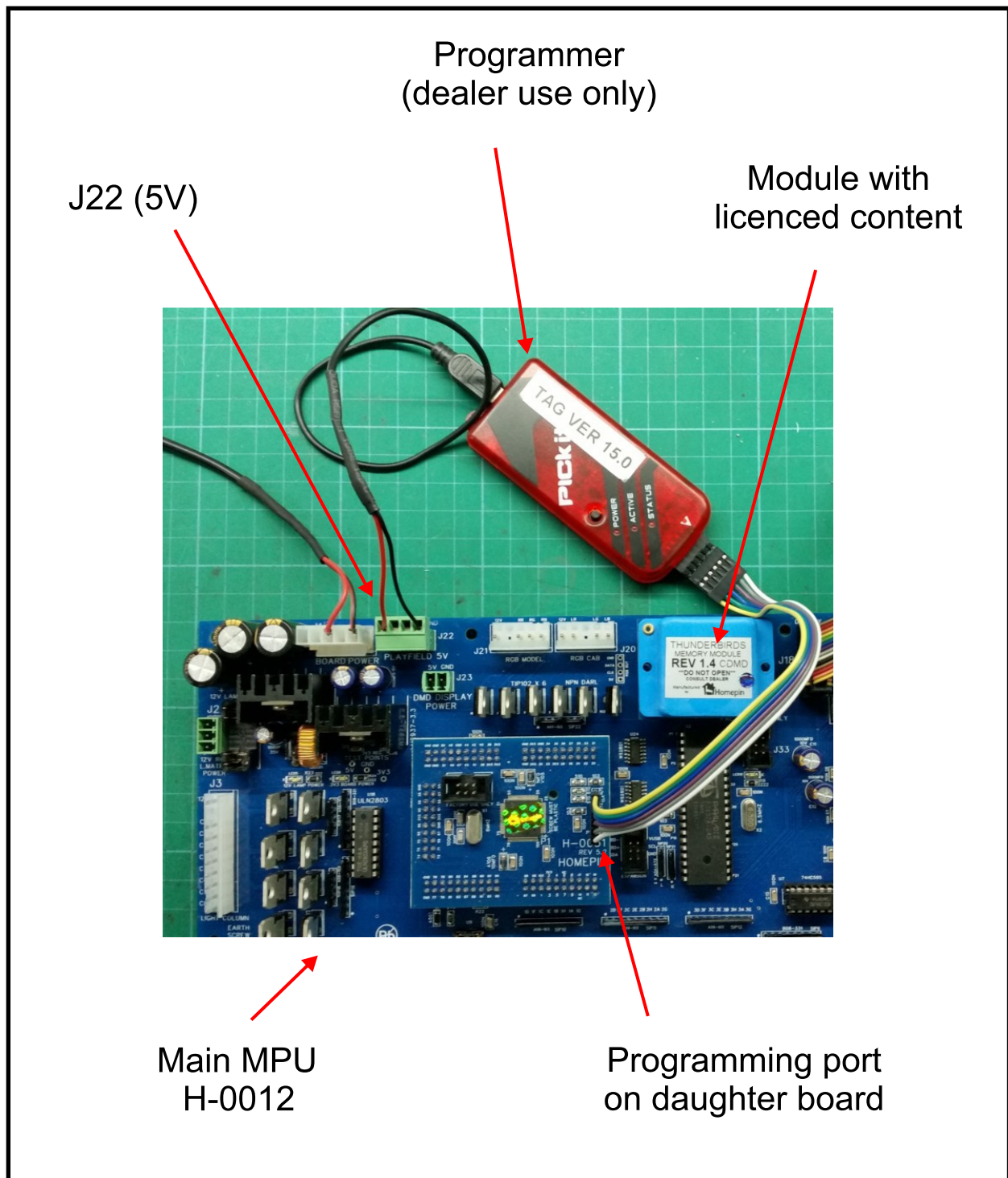
BALL TROUGH - 4

ACCOUNTING*

CLEAR ACCOUNTS – CLEAR ALL WHEN FIRST SET UP

* The accounts settings are NOT affected if using “Factory OEM” reset.

Programmer connections for updating game software



Parts Listing

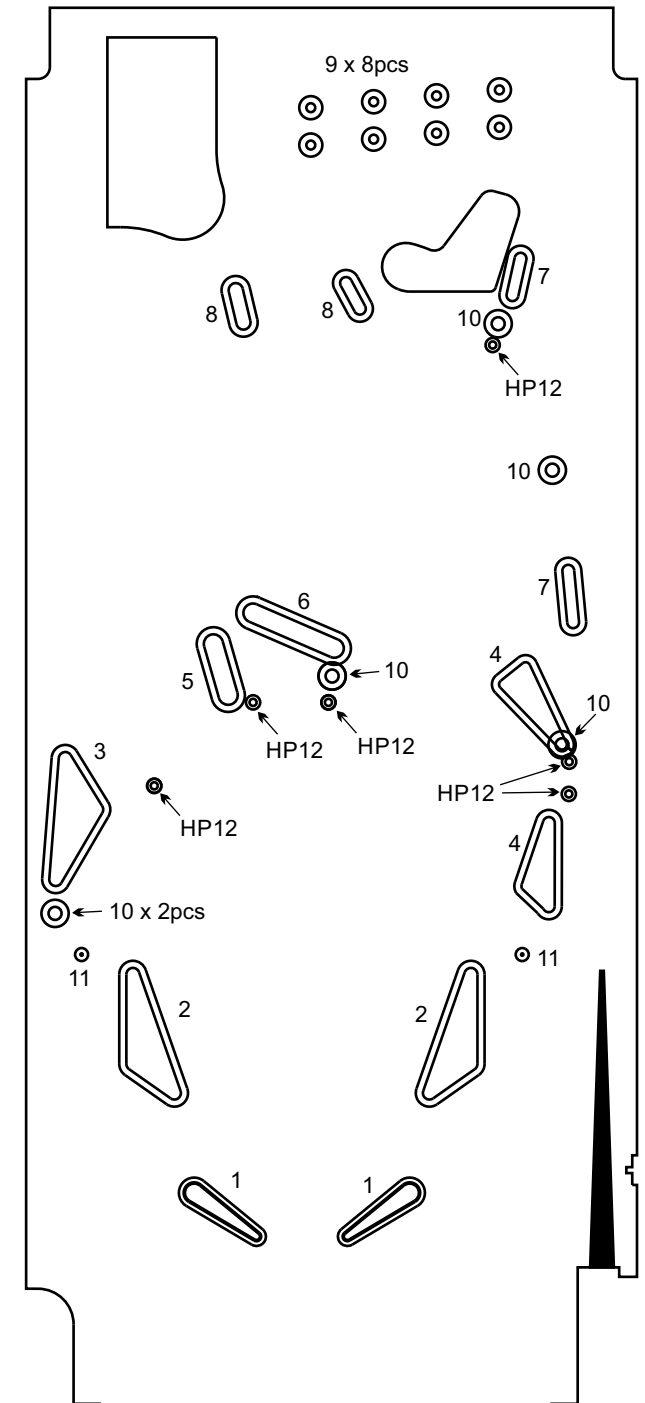
Thunderbirds: Rubber Rings

Number on drawing	Description and Placement	Size	Quantity
11	Lane Posts	1.5 mm (7/16" - OD)	2
2	Slingshots	70 mm (2 3/4")	2
10	Left Lane Bumper Post	11 mm (7/16")	2
3	Left, Below Mole	63 mm (2 1/2")	1
4	Right, Above Outlane	52 mm (2")	1
4	Behind Hood Target	52 mm (2")	1
5	Under Clear Ramp	32.5 mm (1 1/4")	1
6	"	38 mm (1 1/2")	1
10	"	11 mm (7/16")	1
7	Above Shooter Lane Gate	25 mm (1")	1
10	Above Hoverbike Targets	11 mm (7/16")	1
8	FAB Target	19 mm (3/4")	1
8	Under T2 Assembly	19 mm (3/4")	2
7	"	25 mm (1")	1
10	"	11 mm (7/16")	2
9	Top Rollovers	7.5 mm (9/32")	8
HP12	Black Post Rubbers (straight)		6
	Plunger Tip		1
1	Flipper Rubbers		2
	Playfield stay securing rubber	52 mm (2")	1

SUMMARY:



1.5 mm (7/16" - OD)	2
7.5 mm (9/32")	8
11 mm (7/16")	6
19 mm (3/4")	3
25 mm (1")	2
32.5 mm (1 1/4")	1
38 mm (1 1/2")	1
52 mm (2")	3
63 mm (2 1/2")	1
70 mm (2 3/4")	2
Post Rubbers	6
Shooter Tip	1
Flipper Rubbers	2



15 August 2018	QTY SET	DWN	CKD	APR	MK
DESCRIPTION:	TAG		REVISION:	1.1	
NOTES:	Rubber Rings		PAGE:	1	

Solenoid Allocation & Wire Colours

Thunderbirds Pinball (TAG)

SOLENOID #	PIN #	BOARD PLUG	WIRE COLOUR	VOLTAGE	SOLENOID FUNCTION
50V POWER	10	J7 -FUSE 1	LEFT DRIVER BOARD	50V SUPPLY	
1	9		Black – thin wire	SWITCH	Tracy Island SOFT EJECT (no beacon light – ball search mode)
2	8		Brown – thin wire	SWITCH	Tracy Island FULL EJECT – (normal game play)
3	7				
4	6		Purple	12	Trees fall
5	5		Pink – link to MPU		Knocker
6	4				
KEY	KEY		KEY		
7	2		Grey – thin wire	SWITCH	Ramp UP (T2)
8	1		Red – thin wire	SWITCH	Ramp DOWN (T2)
	10	J8 -FUSE 2	MIDDLE DRIVER BOARD	50V SUPPLY	
9	9		Black	50	LEFT Sling
10	8		Brown	50	RIGHT Sling
11	7		Blue – thin wire	SWITCH	Mole
12	6		Purple – link to MPU	18	Shaker
13	5		Green	50	Right Ramp Ball Lock up Post
14	4		White	50	LEFT Pop Bumper
KEY	KEY		KEY		
15	2		Grey	50	RIGHT Pop Bumper
16	1		Red	50	MIDDLE Pop Bumper
	10	J9 – FUSE 3	RIGHT DRIVER BOARD	50V SUPPLY	
17	9		Black – thin wire	SWITCH	Flipper mute
18	8				
19	7				Output drive to Ticket Dispenser interface PCB (where fitted)
20	6				
21	5		Green	50	Ball Trough (ball kickout to shooter lane)
22	4		White	50	Ramp Divertor HIGH Pull
KEY	KEY		KEY		
23	2		Grey	50	Auto Plunger (ball launch)
24	1		Red		Ramp Divertor LOW – HOLD
			BLACK	GROUND	
			YELLOW	50V	
			ORANGE	12V	
Flipper Boards		J39 – FUSE 4 (12V)	Yellow	50V	To both flipper boards – each board has 50V fuse on the board
			Orange	12V	
			Black	Ground	

NOTE: Pin numbers on driver boards are numbered from PIN 1 on the RHS

TAG Solenoid Allocation 2nd May 2018

General Illumination

Thunderbirds Pinball (TAG)

Topper Control #1	MPU J12	Separate Connector	GI 1
Topper Control #2	MPU J12	Separate Connector	GI 2
Translite Lighting	MPU J34	Separate Connector	GI 3

***** ABOVE GI IS NOT WIRED TO PLAYFIELD *****

Right Sling Lamp		Brown	GI 4
Left Sling Lamp		Purple	GI 5
Below MOLE void		Grey	GI 6
Left Rollover Posts		White	GI 7
Second Rollover Posts		Yellow	GI 8
Third Rollover Posts		Red	GI 9
Right Rollover Posts		Green	GI 10
RHS T2 Posts		Blue	GI 11
Right void near ball lock post		Black	GI 12
HOOD void		Pink	GI 13
Pop Bumper LEFT	Down	Light Green	GI 14
	Up	Light Blue	GI 15
	Flash	White/Green	GI 16
Pop Bumper MIDDLE	Down	Light Green	GI 14
	Up	Light Blue	GI 15
	Flash	White/Green	GI 16
Pop Bumper RIGHT	Down	Light Green	GI 14
	Up	Light Blue	GI 15
	Flash	White/Green	GI 16

TAG – GI allocation 5th Jan 2018

List of PCBs

Thunderbirds Pinball (TAG)

Part Number	Description and Use	Quantity
H-0002	Pop Bumper LED (3 circuits)	3
H-0003	Flipper Button Illumination LED (blue LEDs)	2
H-0007	Power Supply	1
H-0008	Audio	1
H-0009	Door Switches	1
H-0012	MPU – MAIN	1
H-0012A	Isolated Solenoid Driver	3
H-0013	IR TX (Ramp, Rail & Tracy Island)	3
H-0014	IR RX (Ramp, Rail & Tracy Island)	3
H-0015	Spotlight PCB (Mole, Tracy top & Tracy under pool)	3
H-0016	Homepin Programmer (Agent use only)	1
H-0017	Right GI Post Illumination LED (0.4mm PCB)	1
H-0018	Left GI Post Illumination LED (0.4mm PCB)	1
H-0019	Rollover GI Illumination LED (0.4mm PCB)	5
H-0020	Tracy Island Main Control	1
H-0021	Tracy Island Pool optos limit board	1
H-0022	International Rescue LED (Back of Playfield)	1
H-0024	Swinging Target Motor EMI filter	1
H-0025	Missions Complete LED	1
H-0026	Level Illumination LED	1
H-0029A	3 x Opto (inc launch timer warning output)	1
H-0030	Hood Eyes & Mouth LED	1
H-0031	H-O-O-D LED	1
H-0032	3 x Arrows LED	1
H-0033	2 x Arrows LED	1
H-0034	Mole & 4 Arrows LED	1
H-0035	F-A-B Arrows & Hover Bike LED	1
H-0037	International Rescue LED (Lower Playfield)	1
H-0038	Universal Interface (Tracy Is.+ Mole Spots & Level)	3
H-0039	T2 Control	1
H-0041	Tracy Island 'lift' optos & T2 Ramp Limit optos	4
H-0043	Hood Interface to Lamp Matrix	1
H-0045	Mole Push Up Control	1
H-0046	Topper Control (optional)	1
H-0047	Mole Interface Control	1
H-0048	Flipper Control	2
H-0049	Multi LED Single Lamp LED	8
H-0050	Single 12V lamp (no resistor) LED	8
H-0051	MPU CPU Daughter Board	1
H-0052	MPU Memory Daughter Board	1
H-0053	Shooter Lane IR TX	1
H-0054	Shooter Lane IR RX	1
H-0056	12V Cabinet Buss Connectors	1
H-0057	Small 12V Buss (L&R Trees, GI Rollovers & Slings)	5
H-0059	Flipper Button Opto Control (SMD connector)	2
H-0060	Trough opto RX	1
H-0061	Trough opto TX	1
H-0062	Solenoid Delay Board	1
H-0068	Speaker Interconnect	2



J15 – J16 – J27 connections INC: Direct switches Thunderbirds Pinball (TAG)

On main MPU

J27 – Flipper connection

P1 – Left Flipper OUT, drive to flipper PCB (to IN on flipper PCB)	blue/white
P2 – Right Flipper OUT, drive to flipper PCB (to IN on Flipper PCB)	yellow/white
P3 – Left Flipper IN from flipper control PCB (from OUT on flipper PCB)	blue
P4 – Right Flipper IN from flipper control PCB (from OUT on flipper PCB)	yellow
P5 – Launch Warn signal IN from H-0029A (3 opto board)	purple/white

J16 - Cabinet

P1 – Left Flipper IN from flipper opto board (cabinet push button)	blue
P2 – Right Flipper IN from flipper opto board (cabinet push button)	yellow
P3 – 5V	N/C
P4 – Tilt IN from plumb bob	green
P5 – Menu (switch on door PCB)	(early builds was light blue) orange/white
P6 – Enter (switch on door PCB)	grey

J15 - Cabinet

P1 – Coin IN (optically isolated – usually from coin mech)	purple
P2 – Door (not used in TAG)	N/C
P3 – Start IN (front cabinet button game start button)	pink
P4 – Start Lamp OUT (LED mounted inside start button) (early builds was brown)	red/white
P5 – 3V3	N/C
P6 – 5V	red
P7 – Ground	black



Thunderbirds Pinball (TAG)

DC Motors

Pool Slide, Pool Lift & T2 Ramp	3RPM	3 x motors
The Hood swinging target	6RPM	1 x motor
The Mole (push up)	30RPM	1 x motor
The Mole (drill)	60RPM	1 x motor/gearbox
Shaker	(proprietary Homepin)	2400RPM (unloaded)

Coils

Flipper	HP-850/3000 (850T x 0.56mm – 3000T x 0.20mm)	2 x coils
Diverter	HP-2-1000 (1000T x 0.45 – 1000T x 0.15)	1 x coil
General	HP-26-1300 (1300T x 0.45mm)	9 x coils*
Solenoid for trees	JF-0530B 12VDC 300ma - 10mm stroke	2 x coils

***ball trough, shooter lane, knocker, up post, kickers x 2, pop bumpers x 3**

SWITCH MATRIX - REV 3.0

Homepin Thunderbirds Pinball

July 2018

COLUMNS ROWS	COL 8	COL 7	COL 6	COL 5	COL 4	COL 3	COL 2	COL 1
	BLACK	BLUE	YELLOW	GREEN	ORANGE	RED		
ROW 1 WHITE/ BLUE	56 HOOD SWING TARGET	48 LEFT OUT LANE	40 LH TOP ROLL OVER	32 SPINNER	24 RIGHT OUT LANE	16 RIGHT TOP TARGET	8	0
ROW 2 WHITE/ PURPLE	57 SHOOTER LANE	49 LEFT IN LANE	41 CENTER TOP ROLL OVER	33 FAB1 TARGET	25 RIGHT IN LANE	17 RIGHT BOTTOM TARGET	9	1
ROW 3 WHITE/ GREEN	58 TROUGH BALL 1	50 LEFT SLING	42 RH TOP ROLL OVER	34 RIGHT UPPER LANE	26	18 SPOT TARGET "F"	10	2
ROW 4 WHITE/ RED	59 TROUGH BALL 2	51	43	35 LEFT HIT PASSIVE	27 RIGHT RAMP OPTO BACK	19 SPOT TARGET "A"	11	3
ROW 5 WHITE/ YELLOW	60 TROUGH BALL 3	52	44 RIGHT HOOD BUMP	36 TRACY ISLAND BALL 3 OPTO	28 TRACY ISLAND BALL EJECTED	20 SPOT TARGET "B"	12	4
ROW 6 WHITE/ BLACK	61 TROUGH BALL 4	53 RIGHT SLING	45 MIDDLE POP BUMPER	37 LEFT POP BUMPER	29 TRACY ISLAND FAULT	21	13	5
ROW 7 WHITE/ ORANGE	62 TROUGH BALL 5	54 PLASTIC RAMP OPTO	46 RIGHT POP BUMPER	38 RIGHT TREES PLASTIC	30	22	14	6
ROW 8 WHITE	63 DRAIN TROUGH	55 T2 RAMP UP	47 UNDER RAMP TOP SIDE	39 MOLE SOFT	31 MOLE MEDIUM	23 MOLE HARD	15	7

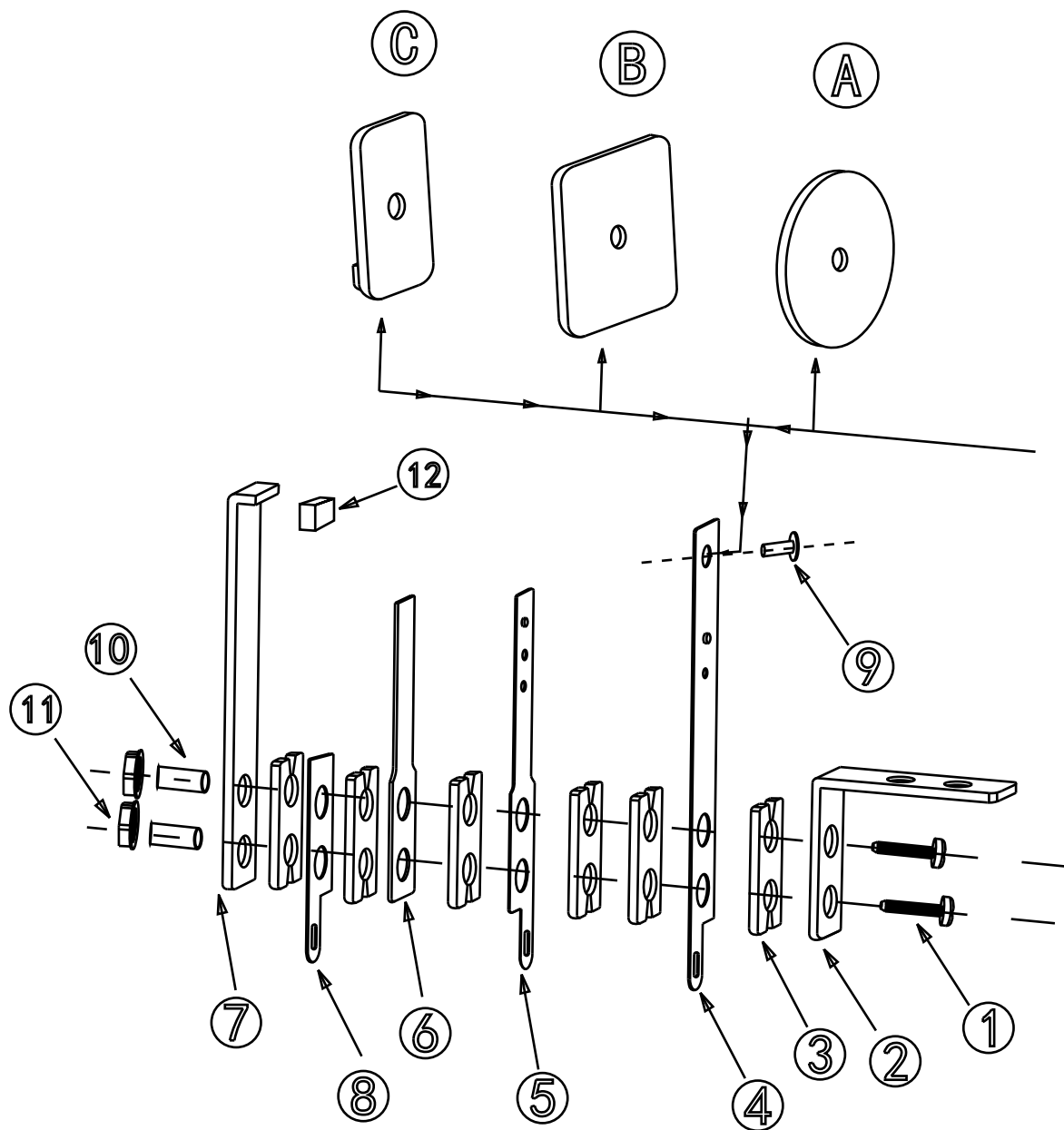
NOTE: From July 2018 wire colours changed from a white wire with a marker to a solid colour wire with a white trace. Read "white/red" as "red wire with a white trace."



TAG LAMP MATRIX – July 2018 – REV 5.0

LED CATHODES FACE ROWS (H00** indicates which lamp board LED is on)

	C8 GREY	C7 PURPLE	C6 PINK	C5 YELLOW	C4 LIGHT GREEN or Green/White	C3 DARK BLUE	C2 RED	C1 BROWN or Purple/White
R1 BLACK	56 I.R. Logo H0037	48 T2 Arrow Run Bottom H0032	40 F FAB Top Arrow H0035	32 Top Rollover T	24 FAB1 "F" Arrow H0034	16 Unused	8 Hood H H0031	0 FAB 1 Target
R2 WHITE/ BLUE or Blue/White	57 Mission 1 H0025	49 T2 Arrow Run Middle H0032	41 A FAB Middle Arrow H0035	33 Top Rollover B	25 FAB1 "A" Arrow H0034	17 Unused	9 Hood O H0031	1 Mole Arrow H0034
R3 ORANGE	58 Mission 2 H0025	50 T2 Arrow Run Top H0032	42 B FAB Bottom Arrow H0035	34 Top Rollover 4	26 FAB1 "B" Arrow H0034	18 Unused	10 Hood O H0031	2 Hood Eye L H0030
R4 WHITE/ ORANGE or Orange/White	59 Mission 3 H0025	51 Plastic Ramp Arrow Bottom H0033	43 Plastic Ramp Arrow Top H0033	35 HOOD Motor Interface	27 FAB1 "1" Arrow H0034	19 Unused	11 Hood D H0031	3 Hood Eye R H0030
R5 GREEN	60 Mission 4 H0025	52 Left out lane	44 I H0022	36 N H0022	28 T H0022	20 E H0022	12 R H0022	4 Hood Mouth H0030
R6 WHITE	61 Mission 5 H0025	53 Left in lane	45 N H0022	37 A H0022	29 T H0022	21 I H0022	13 O H0022	5 Ball lock 1 H0025
R7 LIGHT BLUE or Yellow/White	62 Mission 6 H0025	54 Right in lane	46 N H0022	38 A H0022	30 L H0022	22 R H0022	14 E H0022	6 Ball lock 2 H0025
R8 White/Black or Black/White	63 Unused	55 Right out lane	47 S H0022	39 C H0022	31 U H0022	23 E H0022	15 Hover Bike Top Arrow H0035	7 Hover Bike Bottom Arrow H0035



Parts Listing for Thunderbirds : Leaf Switch Assembly

Part Number	Description and Part	Quantity Leaf Switch Assy
A	Round Target, Colour Various	1
B	Square Target, Colour Various	1
C	Narrow Rectangle Target, Colour Various	1
D	NO target fitted	
1	M3x20mm Rd.Hd Screw	2
2	Switch mounting Bracket	1
3	Fibre Insulation Spacer	5
4	Actuation Leaf, 72mm OA	1
5	Contact Leaf	1
6	Tension Leaf	1
7	Back stay Leaf	1
8	Wiring Leaf	1
9	Target Mount Rivet (If Required)	1
10	Plastic Insulation Tube 4x14mm ID3mm	2
11	M3 Castellated Nut	2
12	Rubber Cushion	1

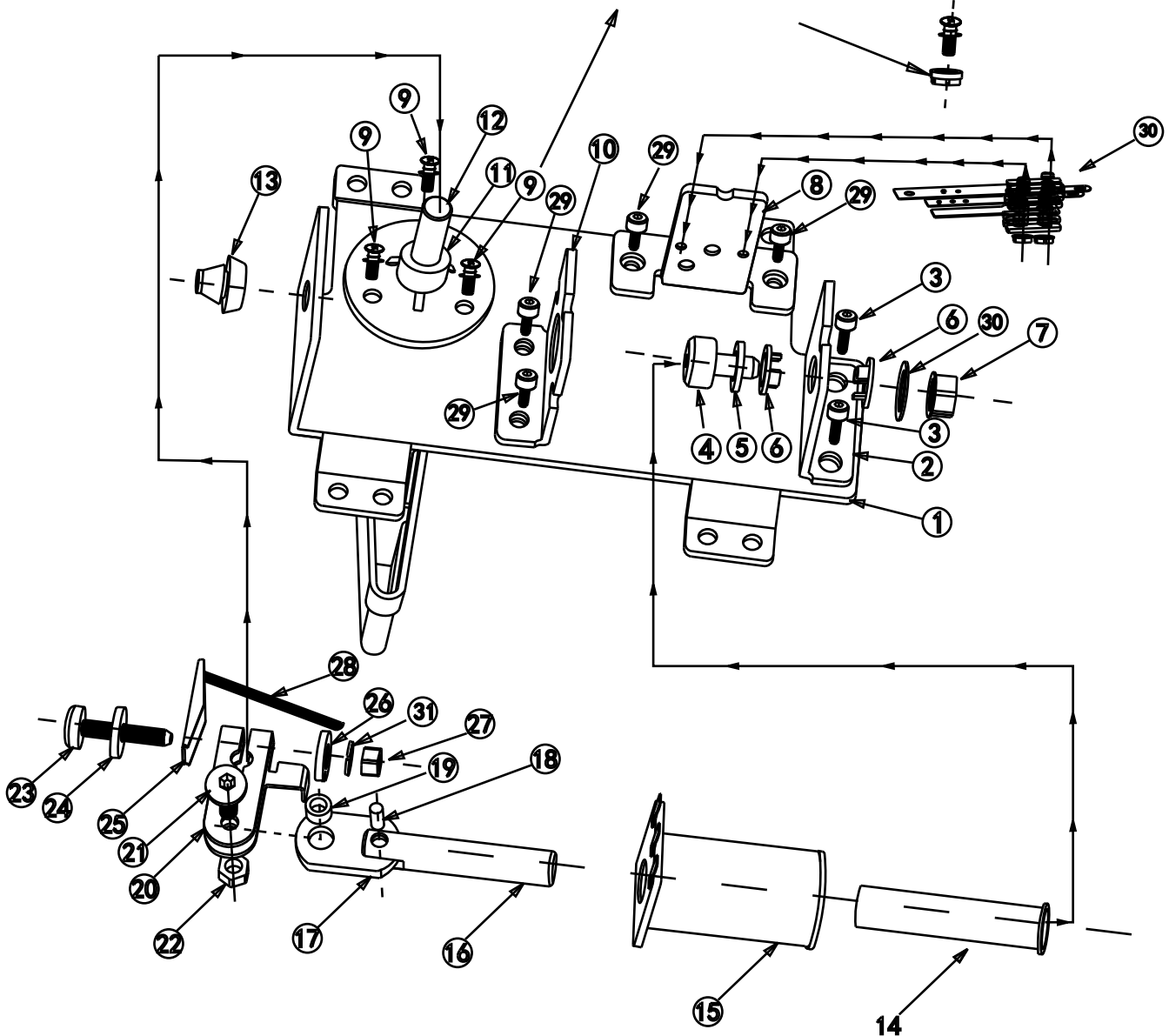
Note

A Generic Switch which is configured for several Playfield Applications.



MACHINE NAME:	TAG	REVISION:	1.0
DESCRIPTION:	Leaf Switch Assembly	PAGE:	1
NOTES:			
Generic switch configured for several applications			
17 MARCH 2018	QTY USED	DWN TK CKD SID APR MK	

FLIPPER BUSH MOUNTING SCREWS ARE SECURED WITH A LOCK NUT AS SHOWN.



FLIPPER	
Homepin	



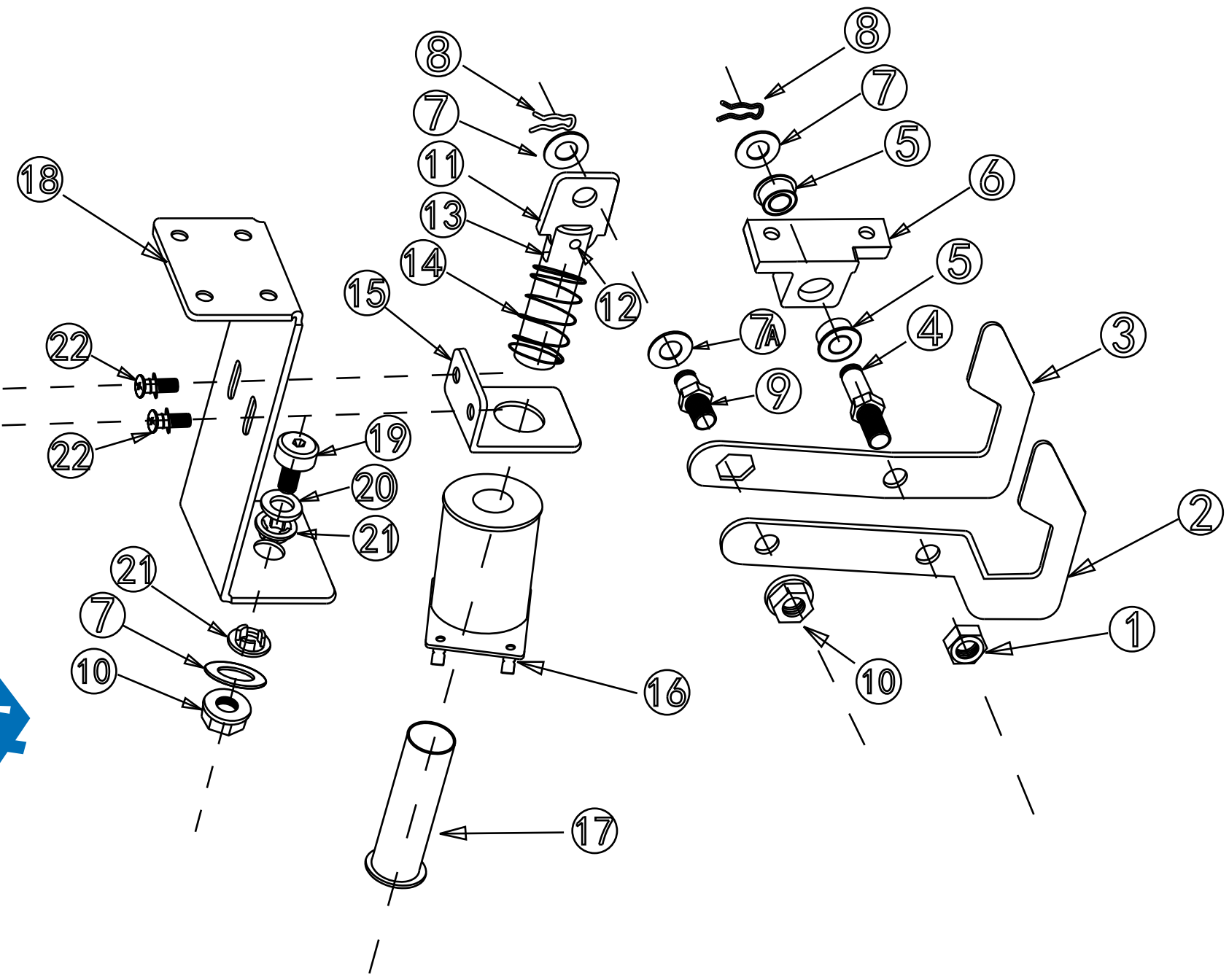
MACHINE NAME:	TAG	REVISION:	1.0
DESCRIPTION:		PAGE:	1
NOTES:			
Flipper Mech			
17 MARCH 2018	QTY USED 2	DWN TK	CKD MK APR

Parts Listing for Thunderbirds : Flipper Assembly

Part Number	Description and Part	Quantity Flipper Switch Mech.
1	Flipper Base Right Hand & Left Hand	1
2	Flipper Stop Bracket	1
3	M5x8mm Socket Hd. Screw	2
4	Solenoid Stop	1
5	6x1mm Flat washer	1
6	Magnetic Circuit Isolator	2
7	6x0.5mm Fat Washer	1
8	End of Stroke Switch Mounting Bracket	1
9	M4x12mm Rd.Hd. C/W Spring & Flat	3
9A	M4 Lock Nut	3
10	Solenoid Bracket	1
11	Flipper Bushing	1
12	Not used	
13	Stop Plastic 6x12x4mm	1
14	Solenoid Sleeve	1
15	Solenoid HP-850/3000	1
16	Solenoid	1
17	Solenoid Toggle	1
18	4mm Roll Pin	1
19	Sleeve	1
20	Flipper Shaft Lock Collar	1
21	M4x18mm Socket Hd. High Tensile	1
22	M5 Lock Nut	1
22A	5mmx1mm Flat Washer	1
23	M4x30mm Socket Hd High Tensile	1
23A	4mm Spring Washer	1
24	Flat Washer 4.2x2mm NO NOTCH	1
25	Return Spring Attachment plate	1
26	Flat Washer 4.2x2mm NOTCHED	1
27	M4x6mm Special Build	1
28	Flipper Return Spring 4x23mm	1
29	Switch Isolation Sleeve	1
30	End of Stroke Switch Assembly	1



MACHINE NAME:	TAG	REVISION:	1.0
DESCRIPTION:		PAGE:	2
NOTES:	Flipper Mech		
17 MARCH 2018	QTY USED 2	DWN TK	CKD MK APR



MACHINE NAME: TAG REVISION: 1.0

DESCRIPTION: PAGE: 1

NOTES:

Auto Launch Mech

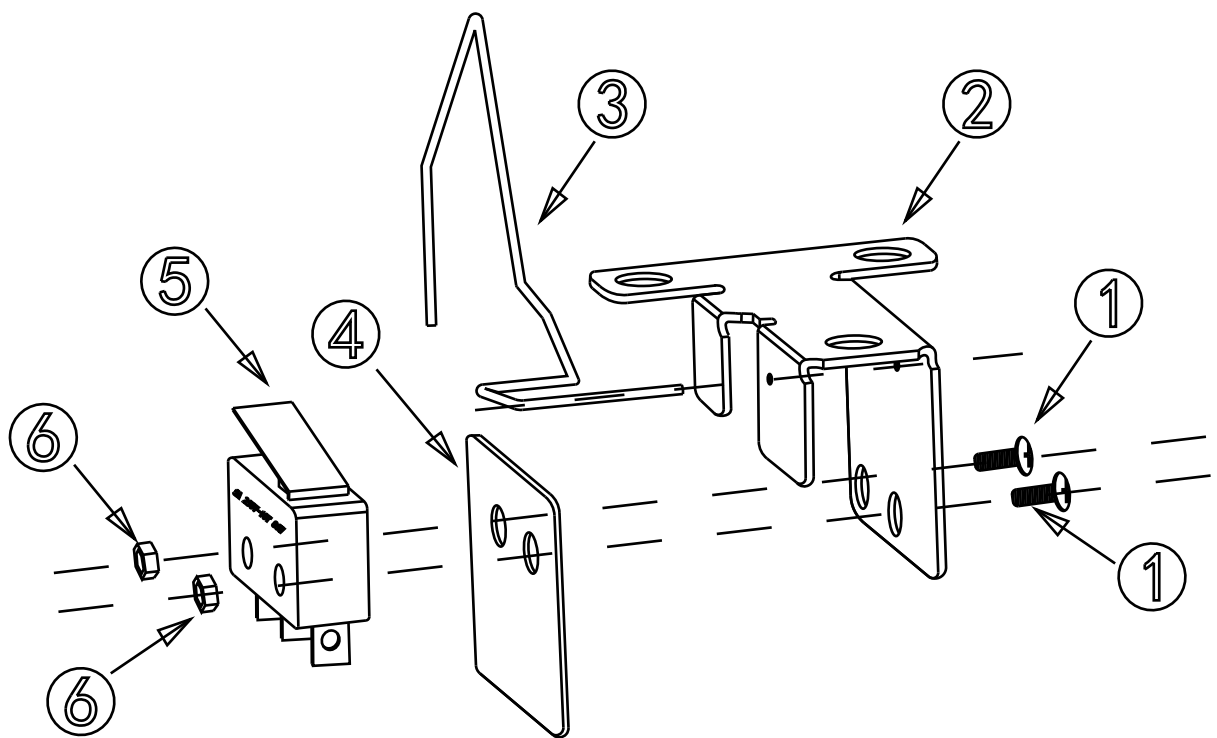
17 MARCH 2018 QTY 1 USED DWN TK CKD MK APR

Parts Listing for Thunderbirds : AUTOLAUNCHER

Part Number	Description and Part	Quantity Auto Launch
1	M6 Lock Nut	1
2	ARM Left Hand	1
3	Arm Right Hand	1
4	Stepped Pivot Post 6x14, 3x8Hex,M6x10mm	1
5	Bearings MF1066ZZ 6x10x3mm	2
6	Brass Bearing	1
7	6x0.5mm Flat washer	2
7A	6x0.5mm Flat washer	1
8	5mm Hairpin Clip	1
9	Stepped Pivot Post 6x7,3x8Hex,M6x10mm	1
10	M6 Castellated Nut	1
11	Fibre Solenoid Toggle	1
12	4mm Roll Pin	1
13	Solenoid	1
14	Solenoid Spring	1
15	Solenoid Stay Bracket	1
16	Solenoid, Diode Fitted HP-26-1300	1
17	Coil Sleeve with Shoulder	1
18	Z base Bracket	1
19	Coil Stop	1
20	6x0.5mm Flat washer	2
21	Magnetic CCT Isolator	2pcs
22	M4x8mm Rd.Hd. c/w Flat and Spring	2



MACHINE NAME:	TAG	REVISION:	1.0
DESCRIPTION:		PAGE:	2
NOTES:			
Auto Launch Mech			
17 MARCH 2018	QTY USED 1	DWN TK CKD MK	APR

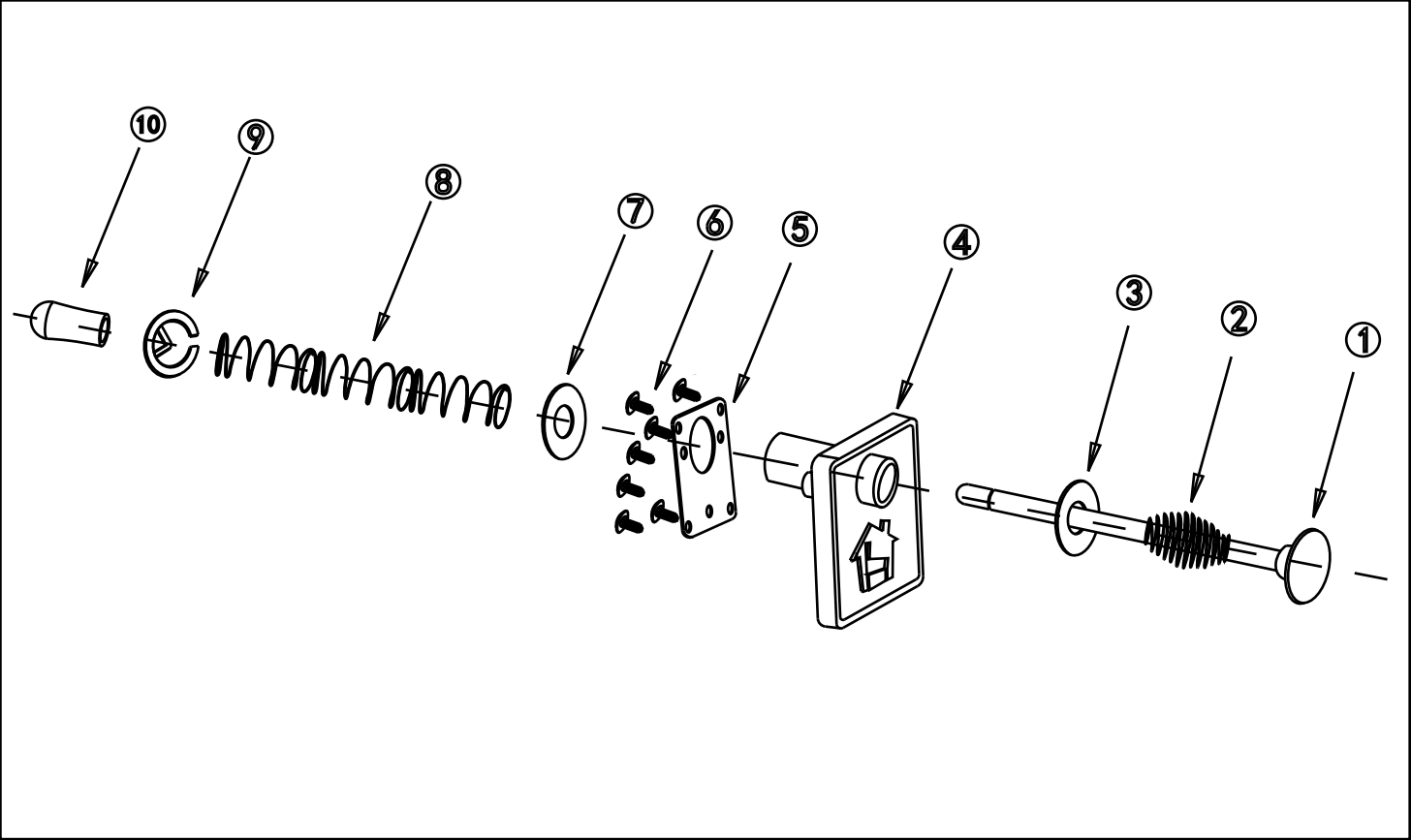


Parts Listing for Thunderbirds : MICRO SWITCH Assy.

Part Number	Description and Part	Quantity
1	M2.5x15 Rd Hd Screw	2
2	Micro Switch Base	1
3	Activation Spring	1
4	Insulation Plate	1
5	Micro Switch Type 10T85μ	1
6	M2.5 Nuts	2



MACHINE NAME:	TAG	REVISION:	1.0
DESCRIPTION:		PAGE:	1
NOTES:	Micro SW Ass		
17 MARCH 2018	QTY USED	DWN	CKD APR

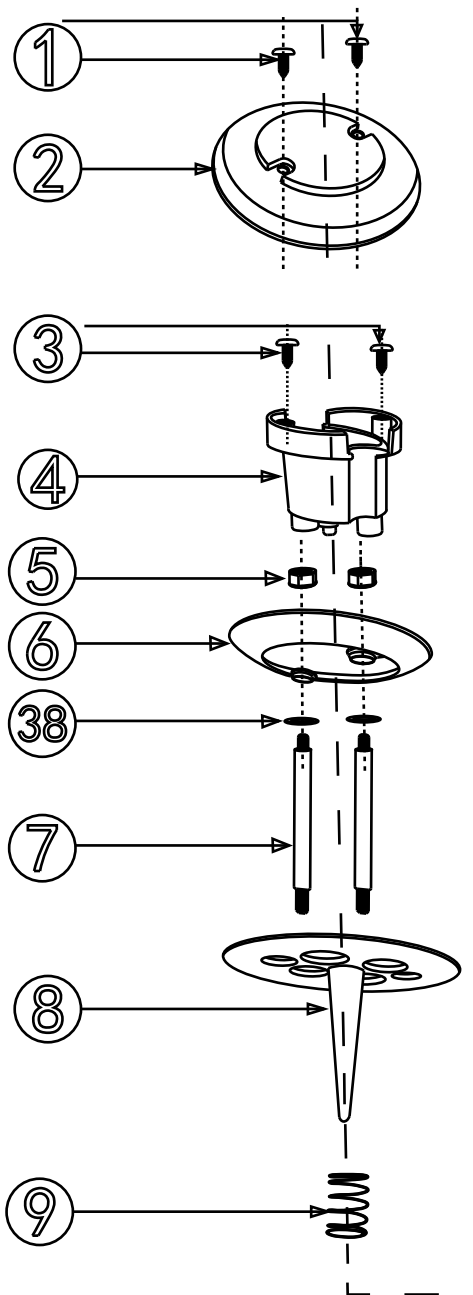
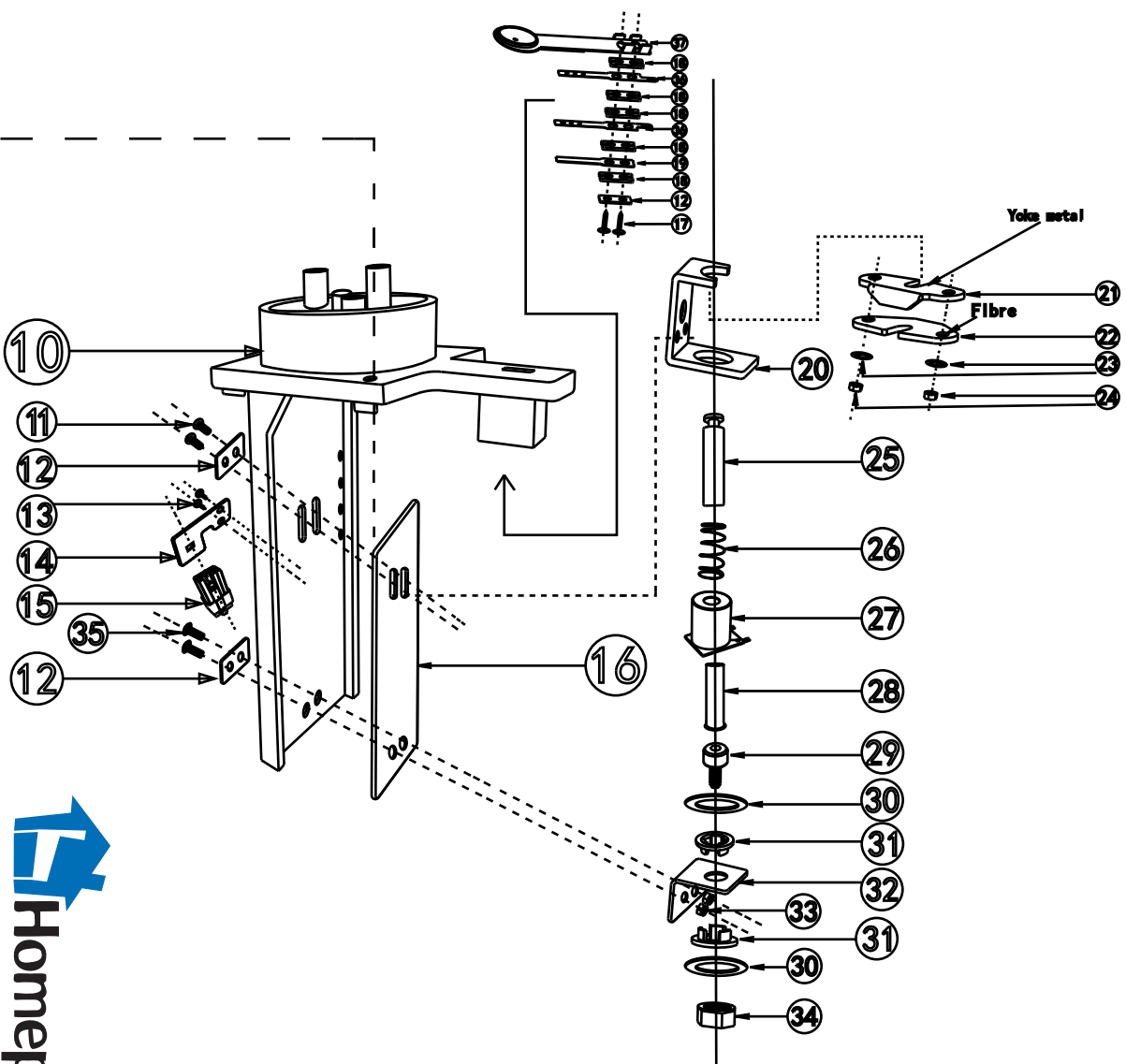


Parts Listing for Thunderbirds : Ball Launch Plunger

Part Number	Description and Part	Quantity Launch Plunger
1	Ball Launch Knob, Loctite to 1A	1
1A	Ball Launch Rod 9.5mm	1
2	Barrel Spring	1
3	10x1mm Flat washer	1
4	Ball Shooter Housing "H"	1
5	Ball Shooter Mounting Plate	1
6	M5x12mm Rd. Hd. Screw	3
7	10x1mm Flat washer	1
8	Ball Shooter Inner Spring	1
9	E-Circlip	1
10	Ball Shooter Tip	1.0



MACHINE NAME:		TAG		REVISION: 1.0	
DESCRIPTION:				PAGE: 1	
NOTES:					
Ball Launch Plunger Assy					
17 MARCH 2018	QTY USED	1	DWN	CKD	APR



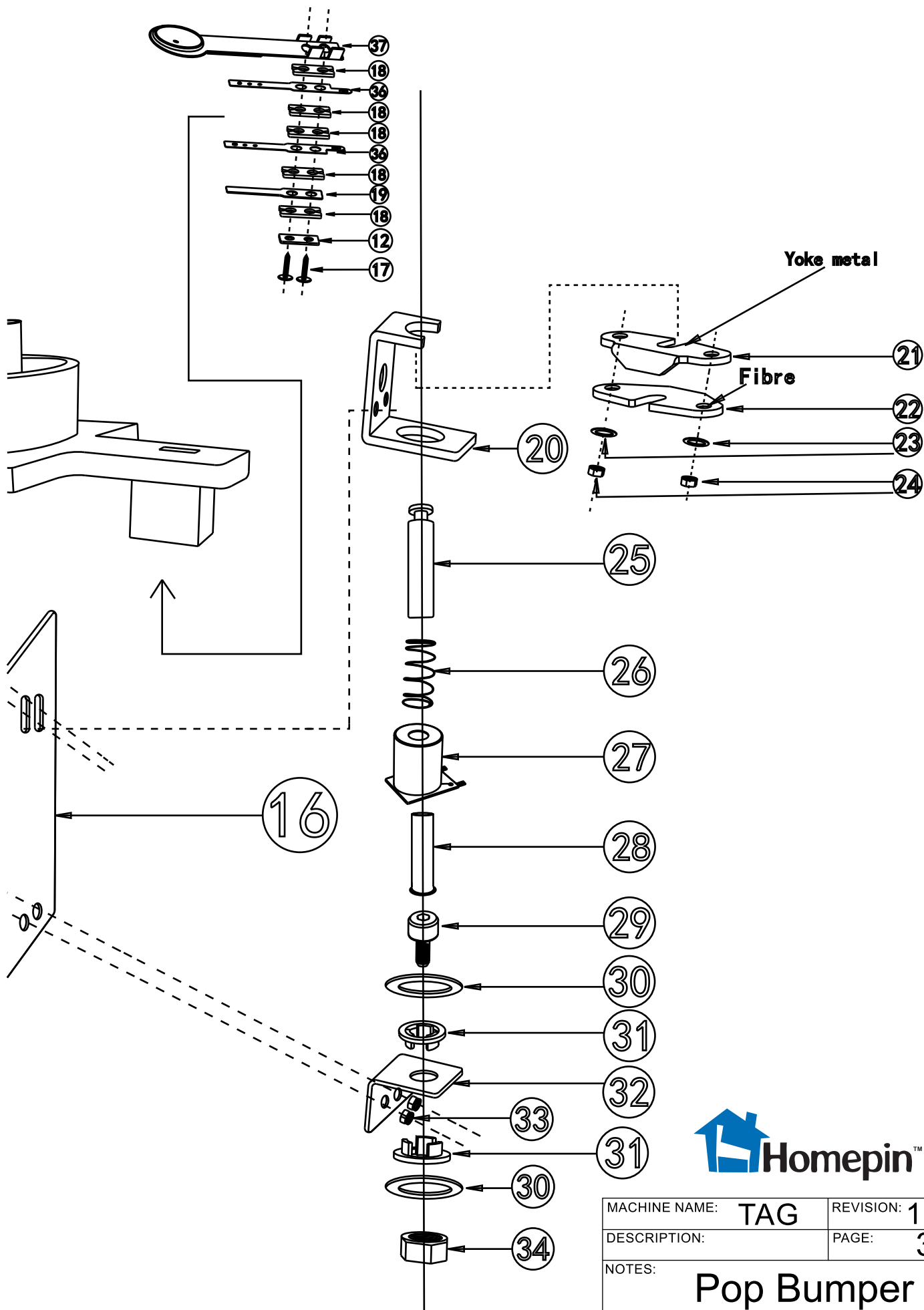
MACHINE NAME:		TAG		REVISION:		1.0	
DESCRIPTION:				PAGE: 1			
NOTES:							
Pop Bumper							
17 MARCH 2018		QTY	3	DWN	CKD	APR	

Parts Listing for Thunderbirds : POP BUMPER

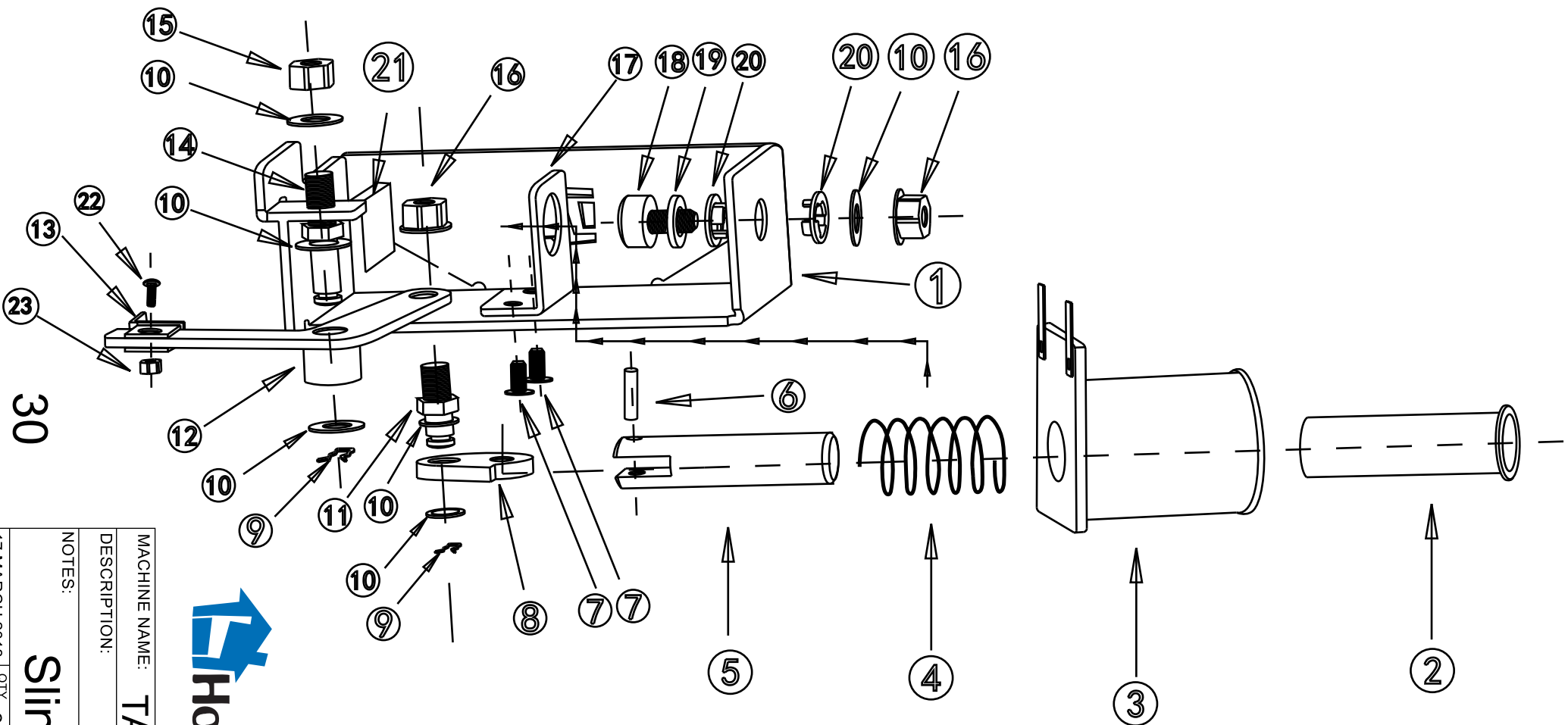
Part Number	Description and Part	Quantity Pop Bumper
1	3xmmm Self Tapping Screw	2
2	Top Cap	1
3	3x5mm Self Tapping Screw	2
4	Body	1
5	4mm Lock nuts	2
6	Ring	1
7	Drive Rod	2
8	Switch Plate	1
9	Switch Return Spring	1
10	Frame	1
11	M4x12mm Rd. Hd. c/w Flat and Spring	2
12	Load Plate	2
13	3x10mm Self Tapping Screw	2
14	Plug Mount Bracket	1
15	Plug 10pin	1
16	Solenoid Mounting Plate	1
17	3x18mm Self Tapping Screw	2
18	Switch Insulator spacers	5
19	Switch Leaf Adjuster	1
20	Solenoid Retainer	1
21	Yoke Metal	1
22	Yoke Fibre	1
23	4mm Spring washer	2
24	4mm Castellated Nuts	2
25	Solenoid Armature	1
26	Solenoid Spring	1
27	Solenoid HP-26-1300	1
28	Solenoid Sleeve	1
29	Coil Stop	1
30	Shim Washers	2pcs
31	Magnetic CCT Isolator	2pcs
32	Coil Stop Bracket	1
33	4mm Lock nuts	2pcs
34	Coil Stop Nut 6mm	1
35	M4x18mm Rd. Hd. C/W Flat and Spring	2pcs
36	Leaf Switch Blades 60mm O/All	2pcs
37	Spoon	1
38	4mm Lock Washers	1
39	LED plate	1
40	Switch Matrix Diode 1N4007	1



MACHINE NAME: TAG	REVISION: 1.0
DESCRIPTION:	PAGE: 2
NOTES: Pop Bumper	
17 MARCH 2018	QTY USED 3 DWN CKD APR



MACHINE NAME: TAG		REVISION: 1.0	
DESCRIPTION:		PAGE: 3	
NOTES: Pop Bumper			
17 MARCH 2018	QTY USED 3	DWN	CKD APR



MACHINE NAME:	TAG	REVISION:	1.0
DESCRIPTION:		PAGE:	1

NOTES:

Sling Mech

17 MARCH 2018 QTY 2 DWN CKD APR

Parts Listing for Thunderbirds : SLINGSHOT/KICKER

Quantity

Part

Number

Description and Part

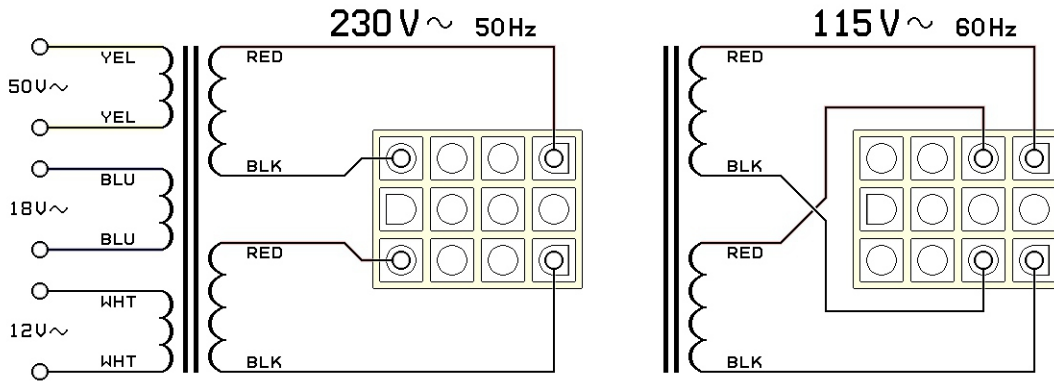
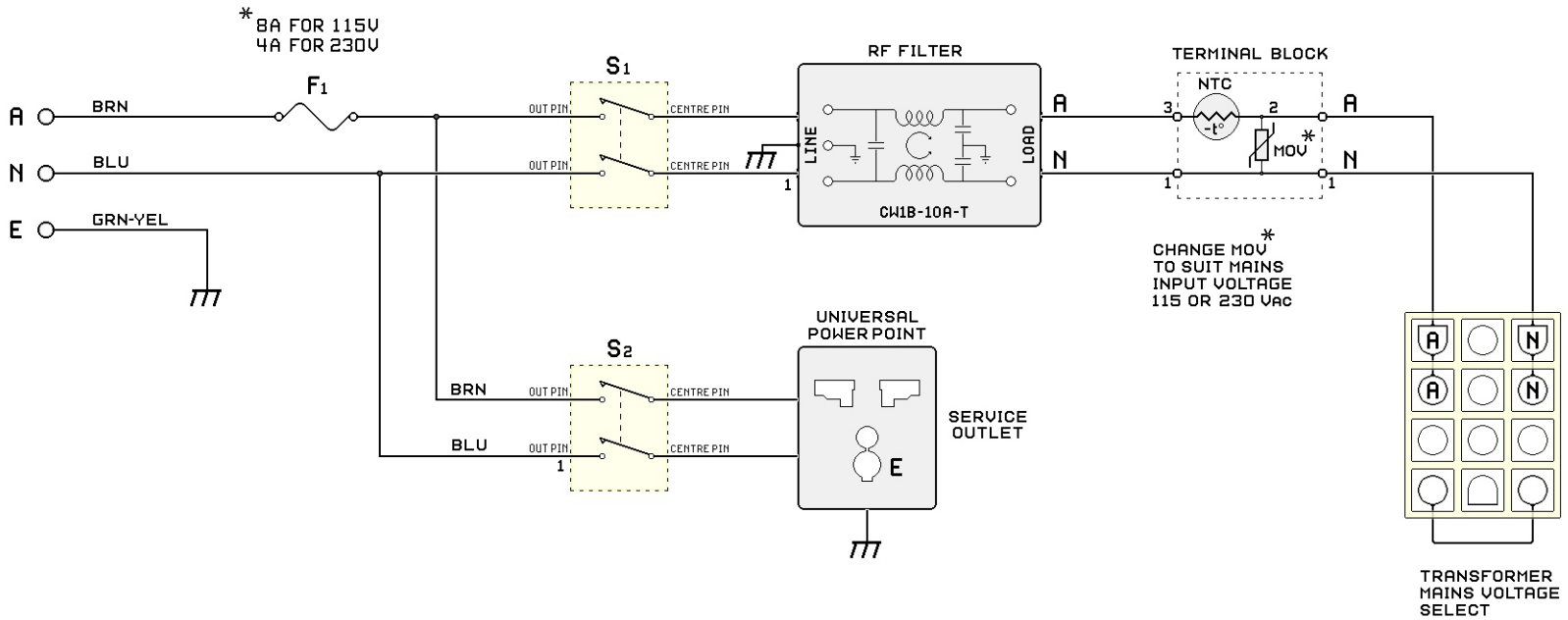
KICKER

1	Solenoid Base	1
2	Coil Sleeve	1
3	Solenoid HP-26-1300	1
4	Solenoid Spring	1
5	Solenoid Armature	1
6	4x10mm Roll Pin	1
7	M4x8mm Rd.Hd. c/w Flat and Spring	1
8	Fibre Toggle	1
9	5mm Hairclip circlip	1
10	6x0.5mm Flat Washer	4
11	Stepped Pivot Post 6x7,3x8Hex,M6x10mm	1
12	Kicker Crank Assembly	1
13	Kicker Crank Hand	1
14	Stepped Pivot Post 6x14, 3x8Hex,M6x10mm	1
15	M6 Lock Nut	1
16	M6 Lock Nut	1
17	Solenoid Retaining Bracket	1
18	Coil Stop	1
19	M6x0.5mm Flat Washer	1
20	Magnetic Circuit Isolator	2
21	Bakelite Solenoid Stop	1
22	M3x10mm Rd Hd c/w washer	1
23	M3 Castellated Nut	1



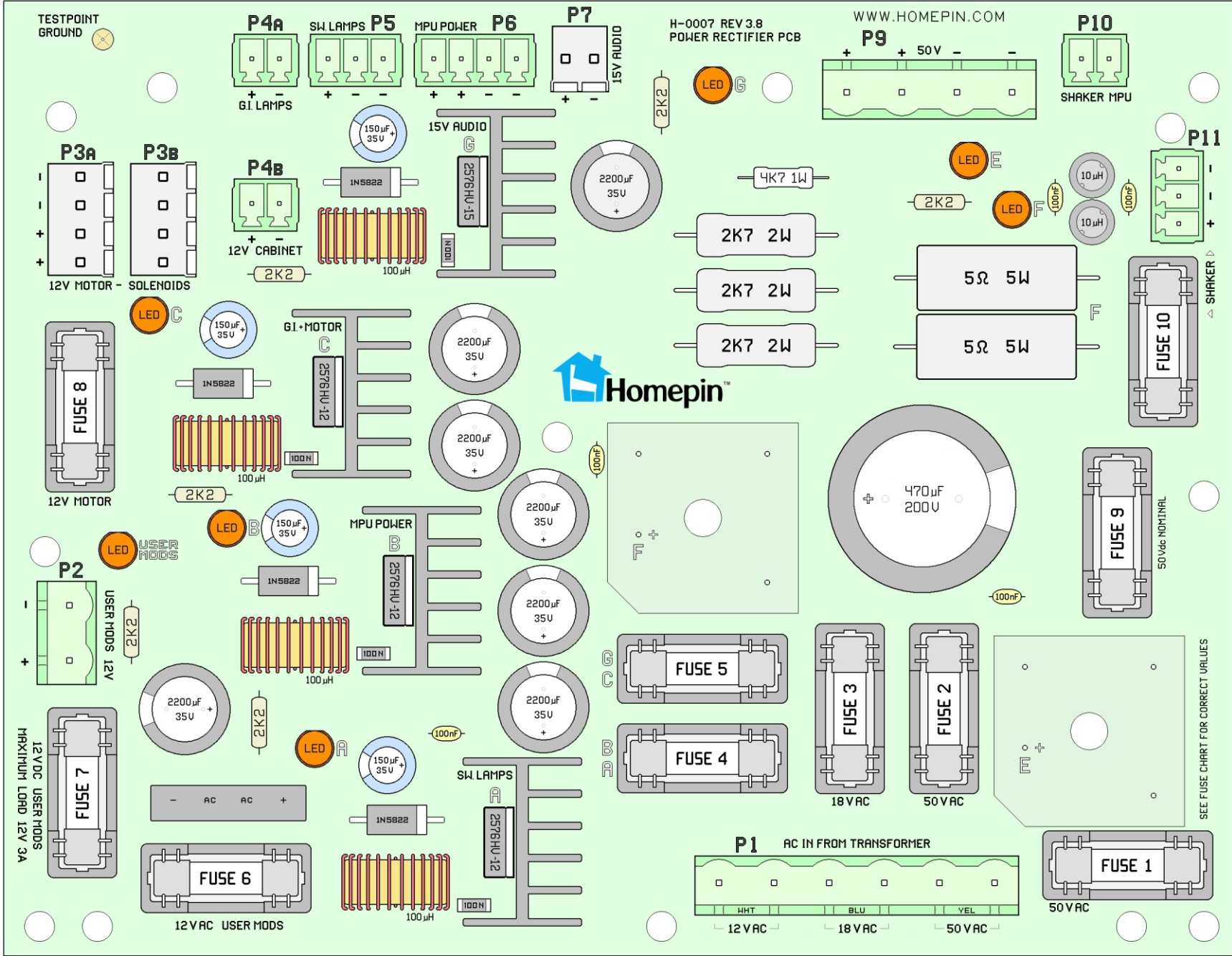
MACHINE NAME: TAG	REVISION: 1.0
DESCRIPTION:	PAGE: 2
NOTES: Sling Mech	
17 MARCH 2018	QTY USED 2 DWN CKD APR

MACHINE NAME:	TAG	REVISION:	1.0
DESCRIPTION:	PAGE: 1		
NOTES:			
Mains Switch Box			
17 MARCH 2018	QTY USED 1	DWN TK	CKD MK APR MK

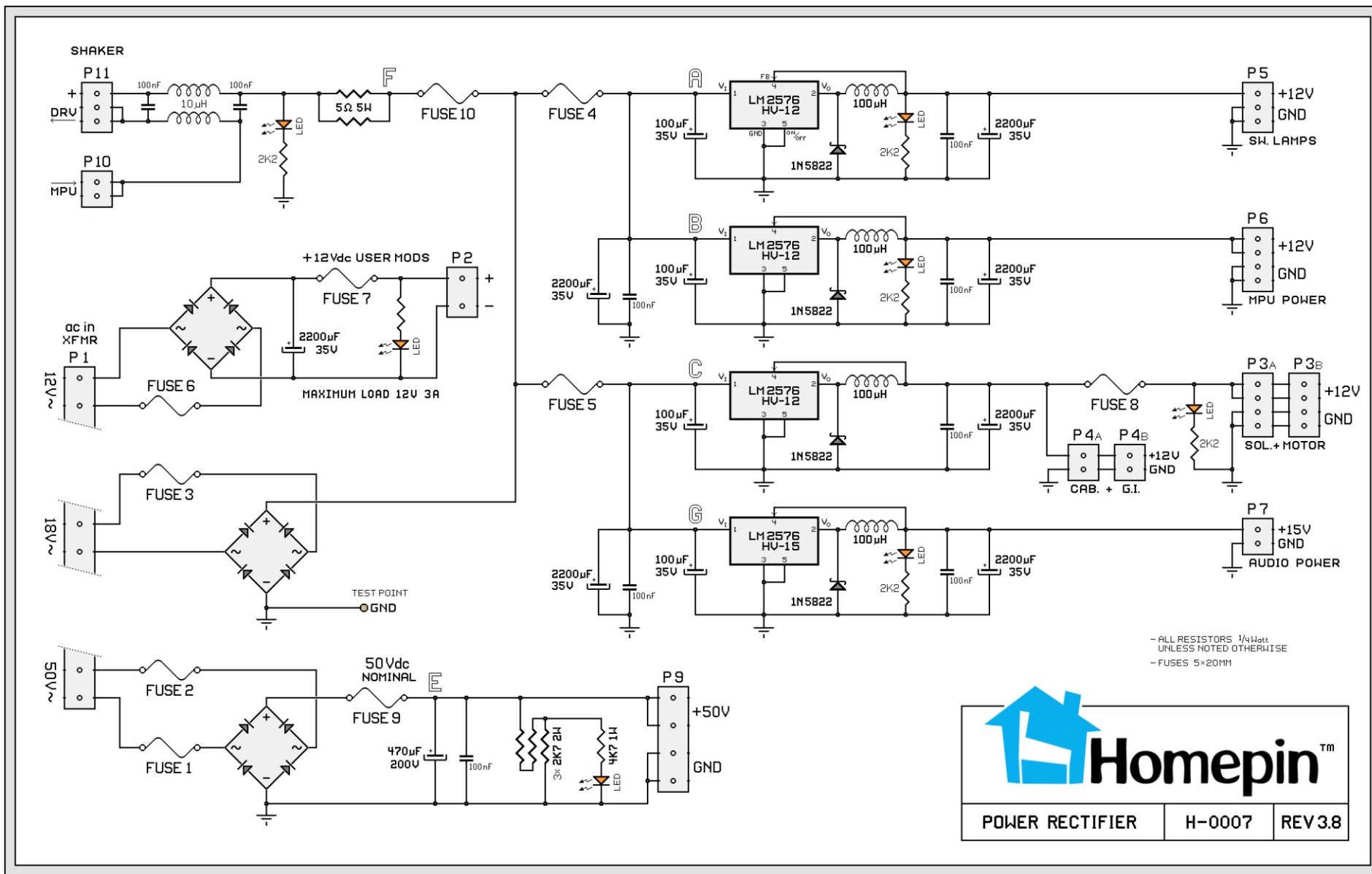


MACHINE NAME: TAG		REVISION: 1.0	
DESCRIPTION:		PAGE: 2	
NOTES:			
H-0007 Power Regulator			
17 MARCH 2018	QTY USED 1	DWN	CKD APR

33A



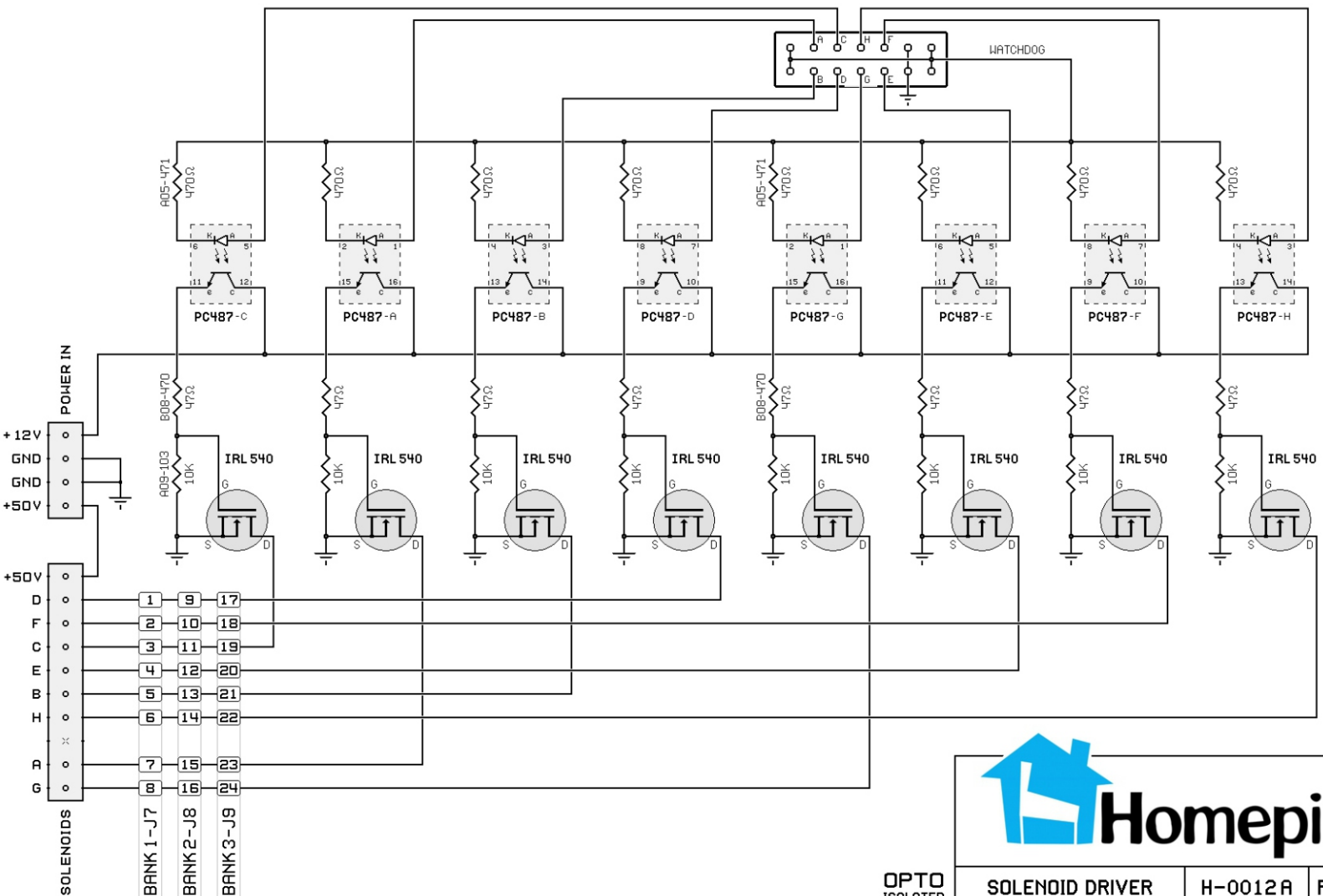
MACHINE NAME: TAG		REVISION: 1.0
DESCRIPTION: H-0007 Power Regulator		PAGE: 1
17 MARCH 2018	QTY 1	DWN CKD APR





Solenoid Driver PCB

MACHINE NAME:		TAG		REVISION: 1.0	
DESCRIPTION:				PAGE: 1	
NOTES:					
Solenoid Driver PCB					
17 MARCH 2018		QTY USED	1	DWN	CKD APR



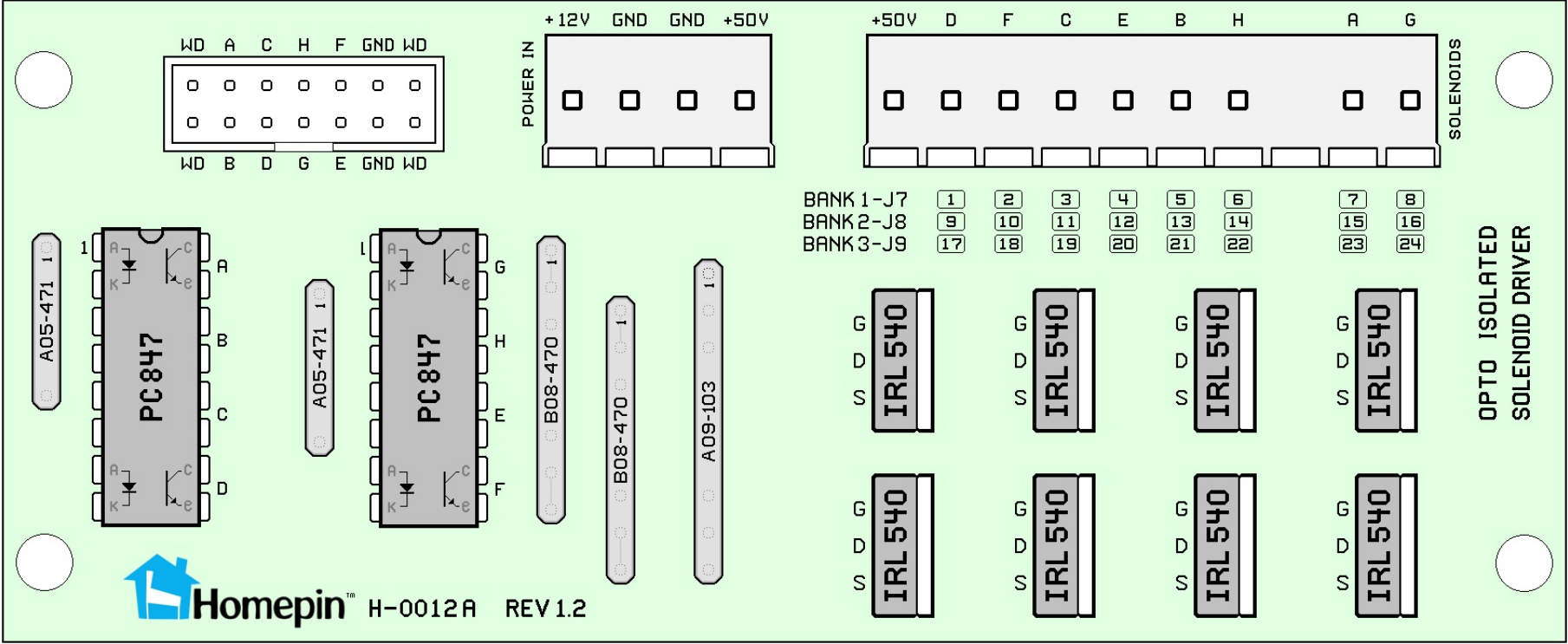
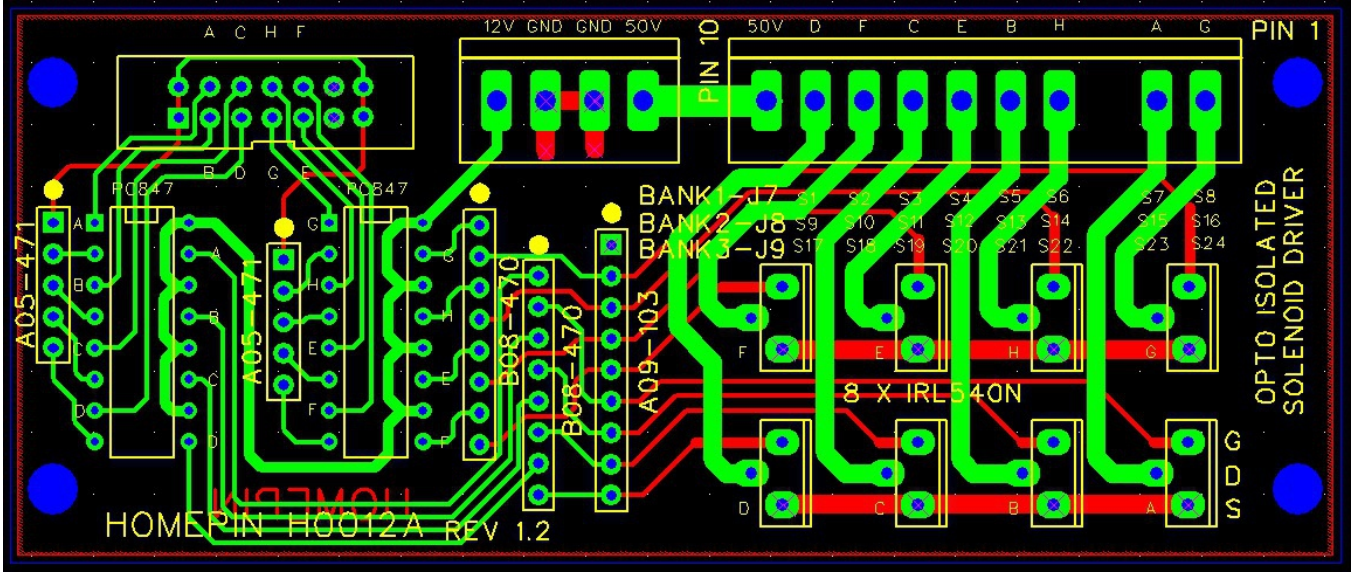
**OPTO
ISOLATED**

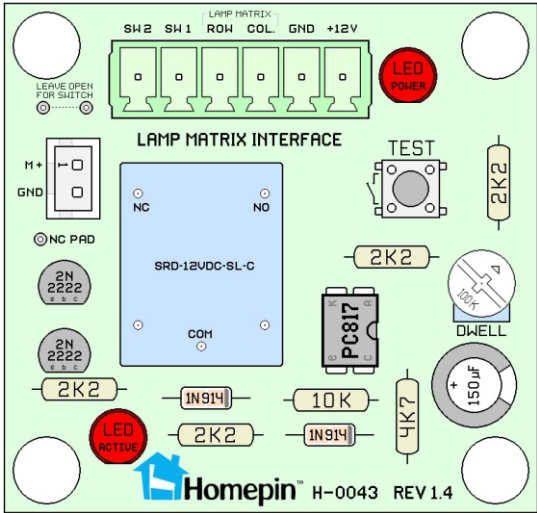
SOLENOID DRIVER

H-0012A

REV 1.2

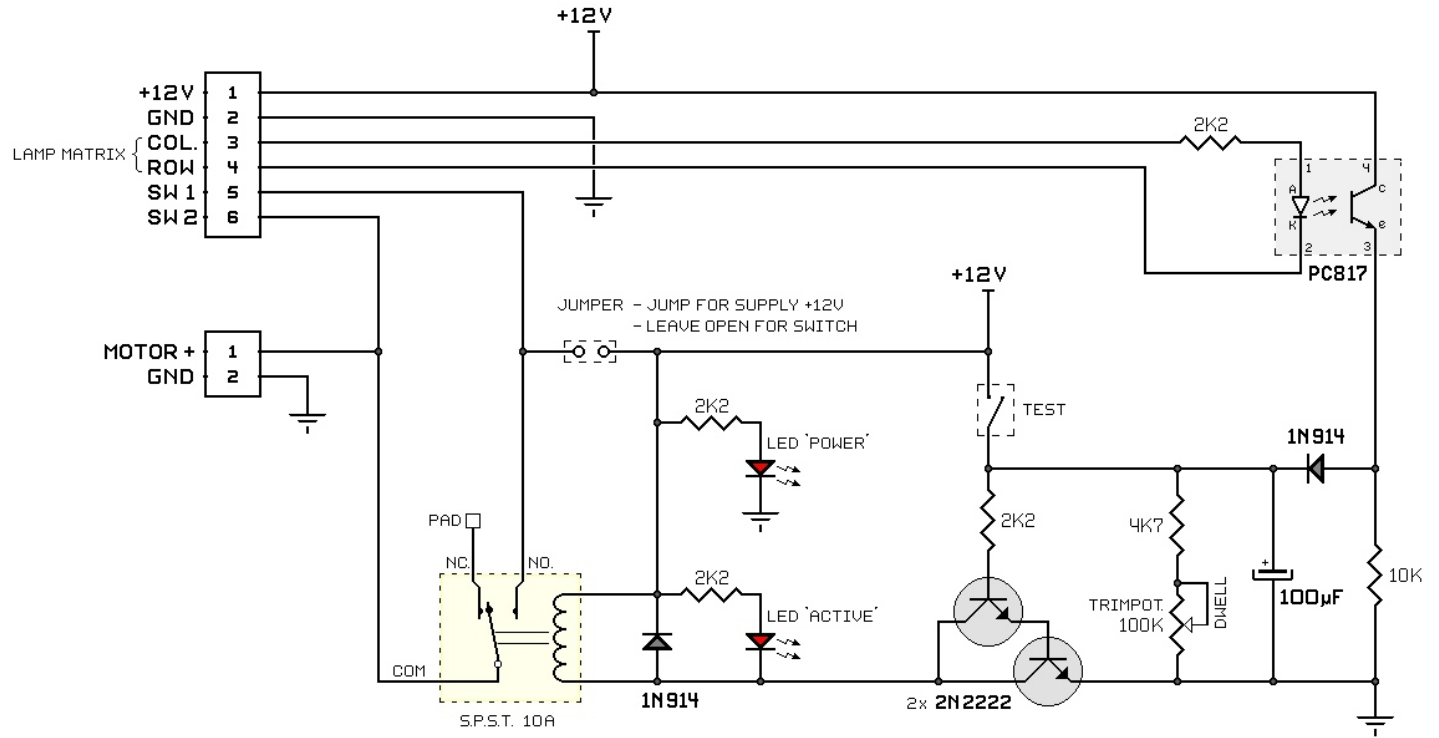
MACHINE NAME:		TAG		REVISION:		1.2	
DESCRIPTION:				PAGE:		2	
NOTES:							
Solenoid Driver PCB							
17 MARCH 2018		QTY USED 3		DWN		CKD APR MK	





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MACHINE NAME:	TAG	REVISION:	1.4
DESCRIPTION:		PAGE:	1
NOTES:			
H-0043 Hood Interface			
17 MARCH 2018	QTY 1	DWN TK	CKD MK APR



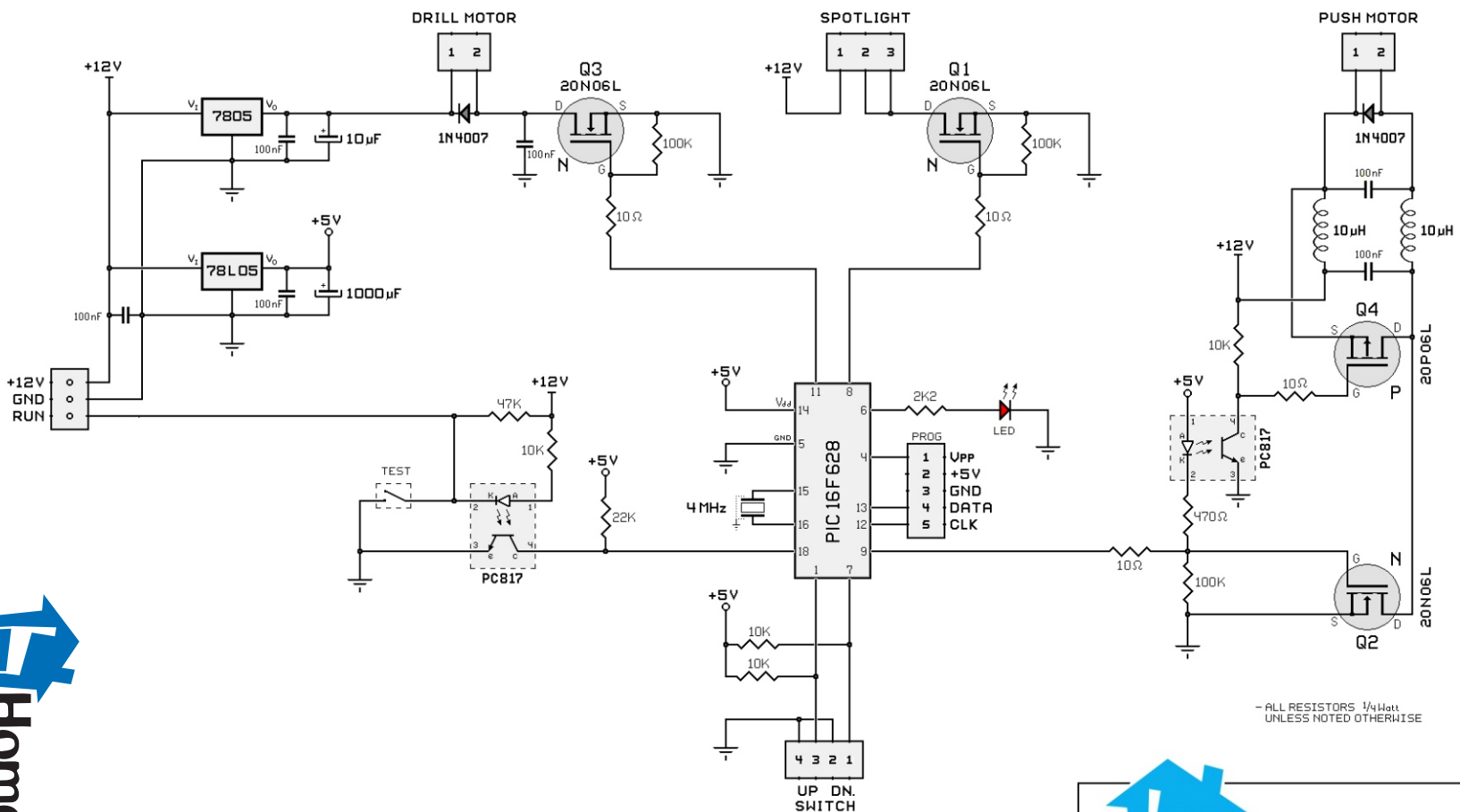
- ALL RESISTORS 1/4 Watt





H-0045

REV 2.0



- ALL RESISTORS 1/4Watt
UNLESS NOTED OTHERWISE

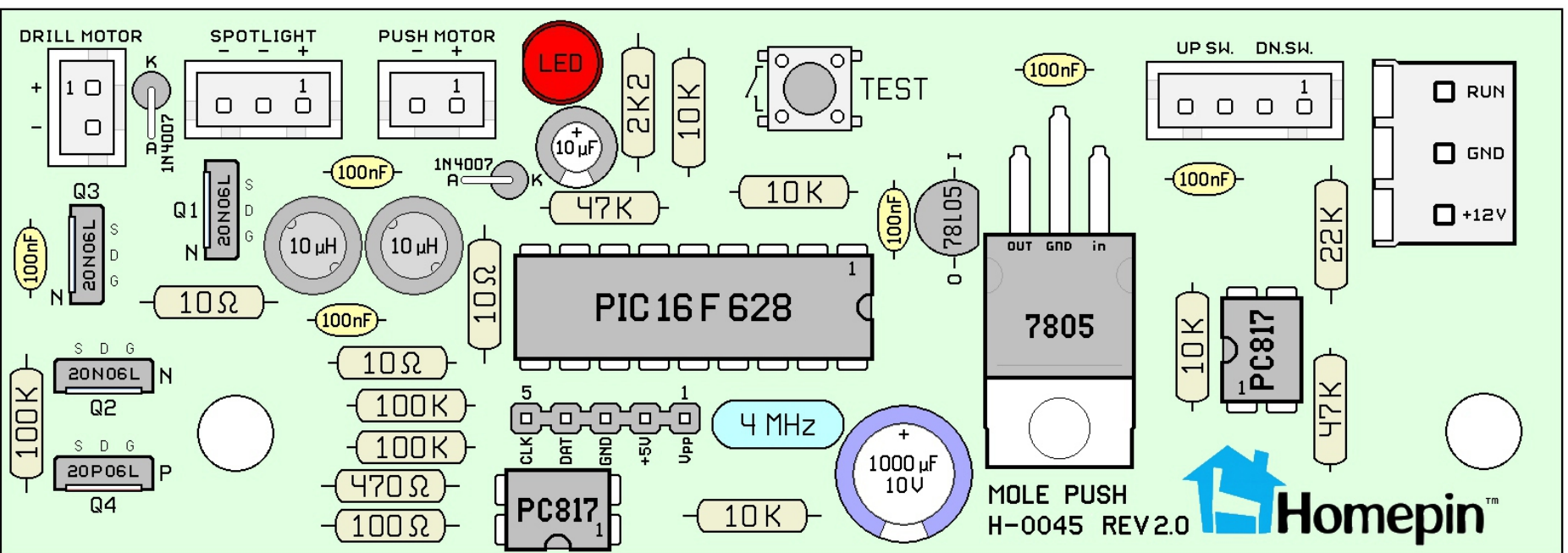


H-0045

REV 2.0



MACHINE NAME:		TAG		REVISION: 2.0	
DESCRIPTION:		PAGE: 2			
NOTES:					
H-0045 Mole Push Control					
17 MARCH 2018	QTY 1	DWN TK	KCD MK	APR	



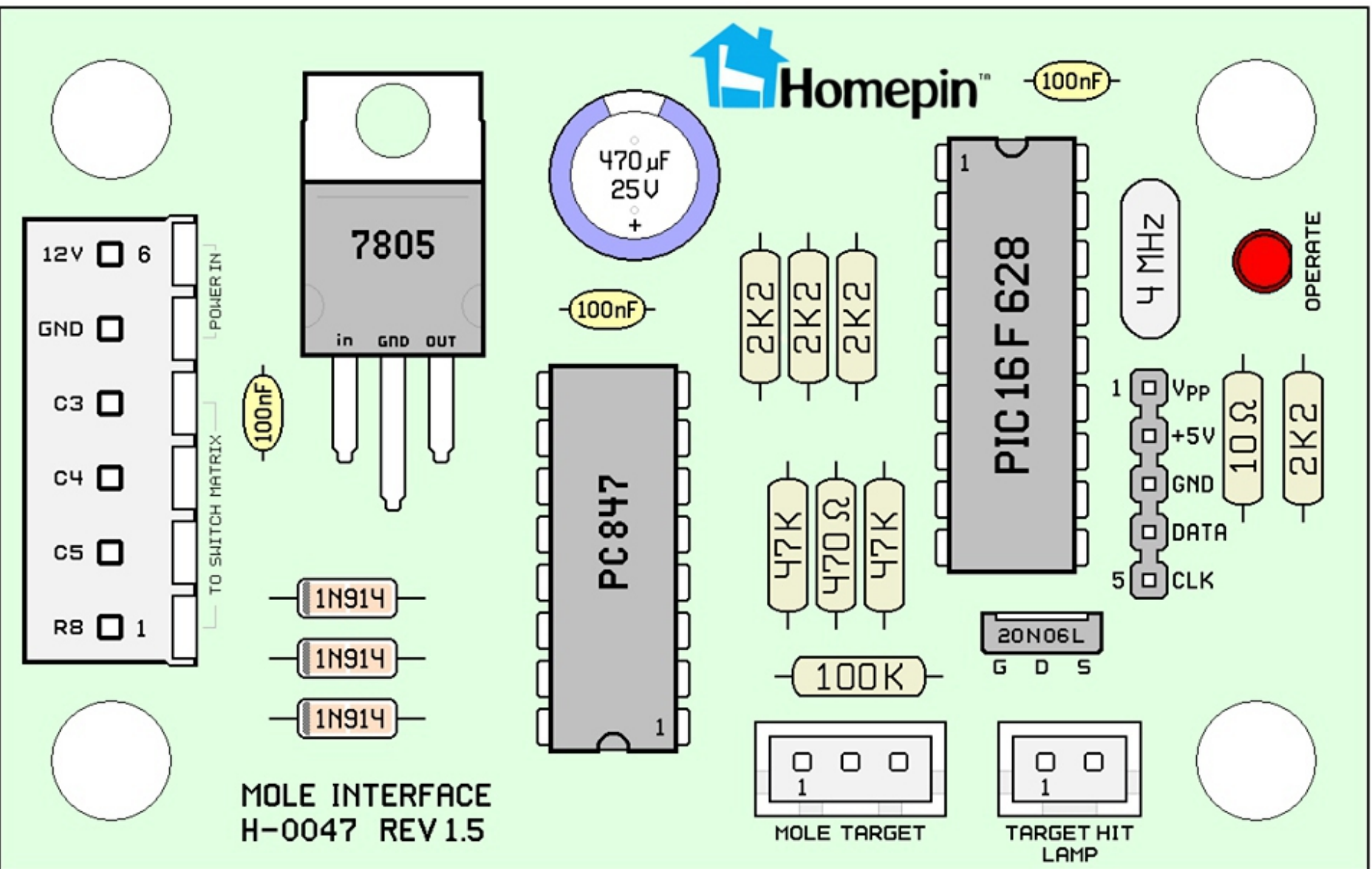


MOLE INTERFACE

H-0047

REV 1.5

MACHINE NAME:	TAG	REVISION:	1.5
DESCRIPTION:		PAGE:	2
NOTES:			
H-0047 Mole Interface			
17 MARCH 2018	QTY USED 1	DWN TK	CKD MK APR





Operation & Adjustment of T2 ramp mechanism

Thunderbirds Pinball (TAG)

The T2 ramp is controlled by its own board, H-0039 and connected to this board are two small opto boards, both H-0041. One is the 'ramp UP' sensor and the other is 'ramp DOWN'.

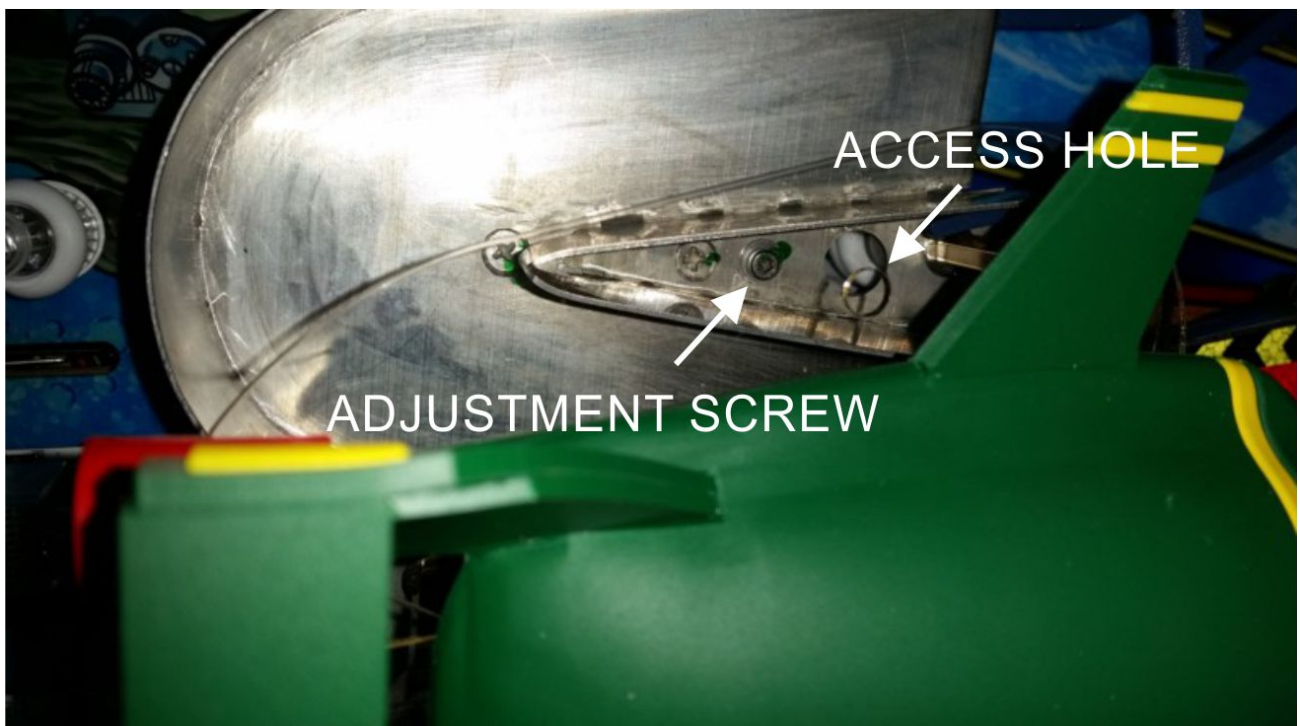
In normal operation, when the ramp is instructed by the MPU to move to the down position, the ramp motor is driven by the H-bridge circuit comprising MOSFETS Q1, 2, 3 & 4.

There is a current sensing resistor, 10R 1/2W in series with the motor circuit and, should the ramp be obstructed by the ball in play, the voltage across this resistor rises and causes the 'over current' opto to conduct and trigger the microcontroller via pin 7. This causes the motor to reverse, travel to the up position and then drive to the down position again until the down opto is triggered thus completing the 'ramp down' cycle.

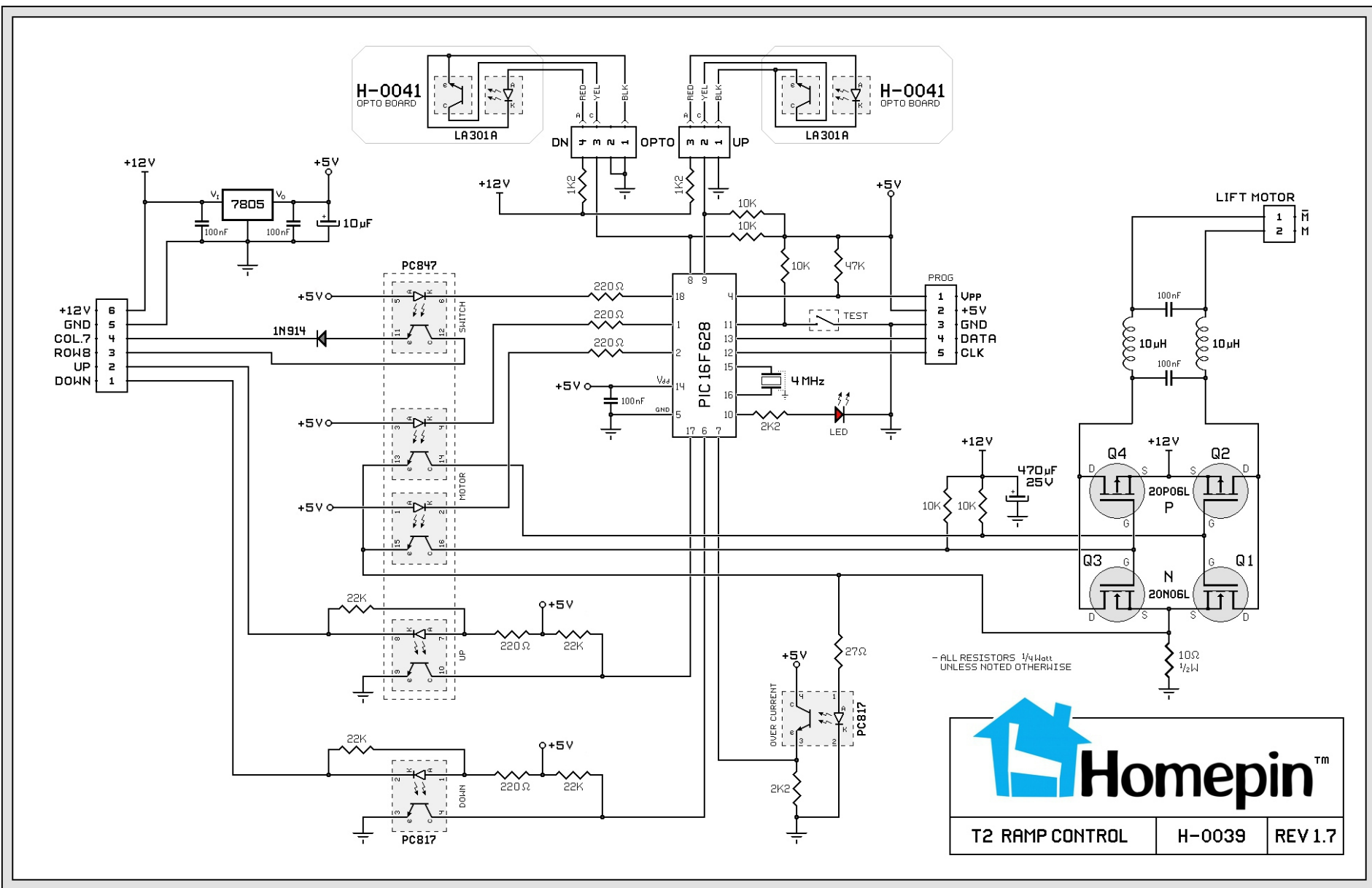
The down opto is adjusted via a small 2.5mm allen head screw accessible from the top of the mechanism and it should be noted that if this adjustment is incorrect, the ramp may appear to cycle down, up, down and so on as the over current circuit comes into play BEFORE the limit (down) opto is triggered or, the ramp won't reach the correct down position.

Turning the adjustment screw clockwise allows the ramp to travel further down before the down opto is triggered. To adjust the ramp position, it is suggested that this screw be adjusted several turns anti-clockwise which will cause the down opto to trigger too early, before the ramp has reached the down position.

The ramp can then be cycled using the 'TEST' switch on H-0041 or the 'ramp up/down' commands in the service menu (solenoids) and this screw adjusted carefully to find the correct down position that is reached before the over current circuit operates.



MACHINE NAME: TAG		REVISION: 1.7
DESCRIPTION:		PAGE: 1
NOTES:		
H-0039 T2 Ramp Control		
17 MARCH 2018	QTY 1	DWN TK CKD MK APR





Flipper control description

Thunderbirds Pinball (TAG)

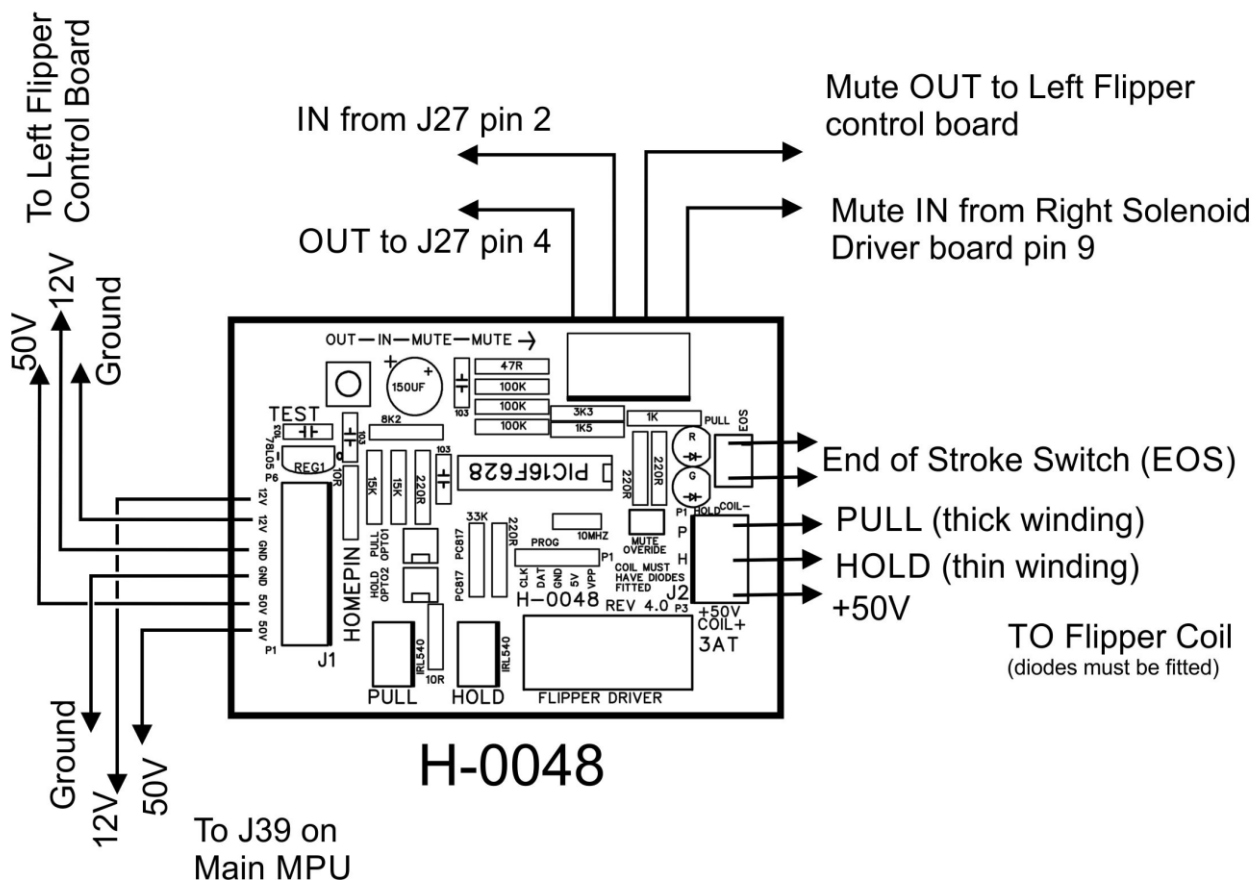
The flippers in TAG are electronically controlled by a flipper board mounted near each flipper assembly, H-0048.

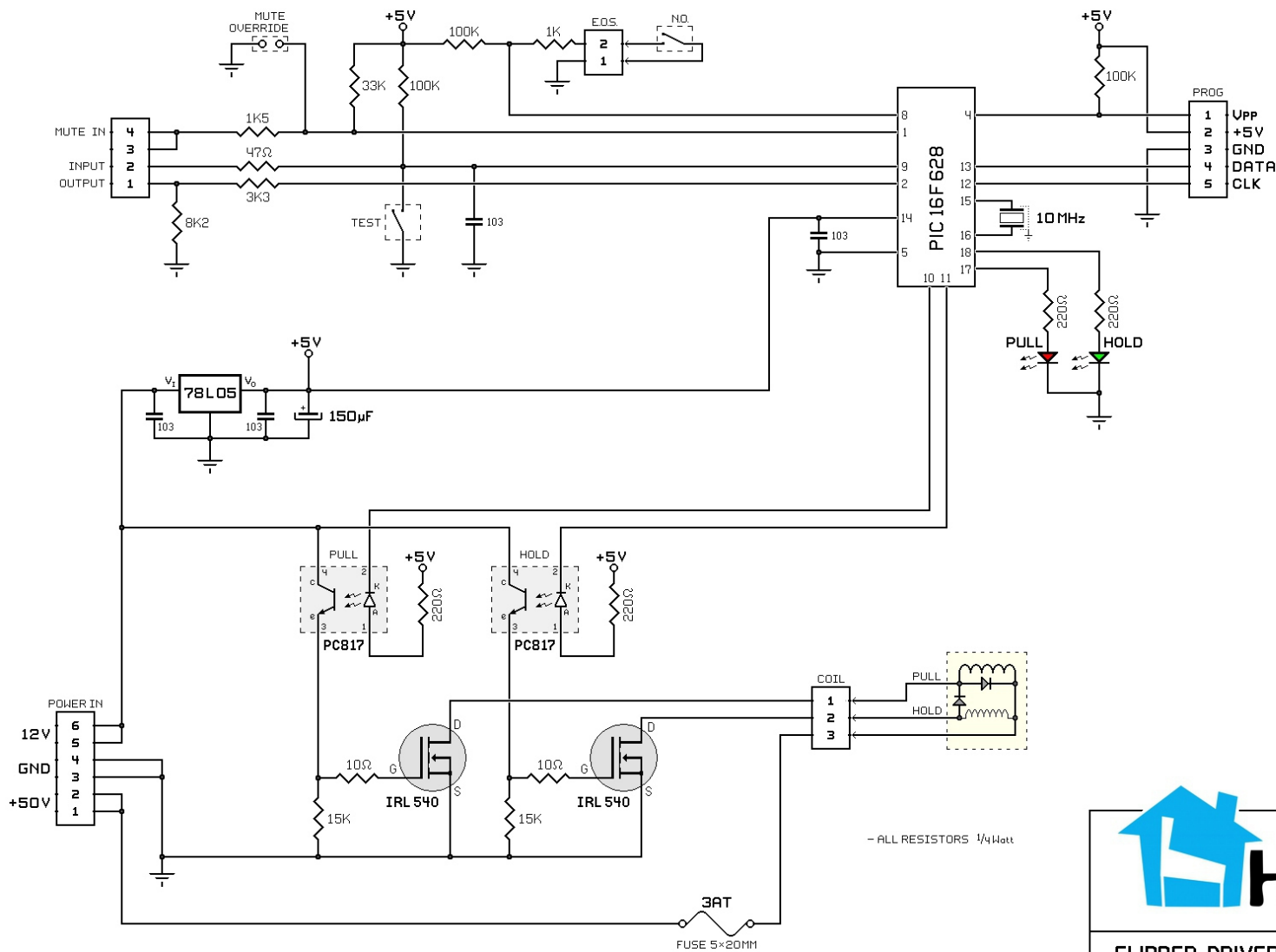
They are muted during game over and at certain other times during game play. The mute signal, ground and the 12 & 50 volt supplies are daisy chained from the right flipper board across to the left.

The 50V is fused on each flipper control board while the 12V is fused at the MPU by F4.

There is a shorting link on the board that will over ride the mute signal and allow the test switch on this board to operate the flipper for adjustment and testing.

The connections to the right flipper board only are shown below.





MACHINE NAME:

TAG

REVISION: 4.0

DESCRIPTION:

PAGE: 1

NOTES:

H-0048 Flipper Control

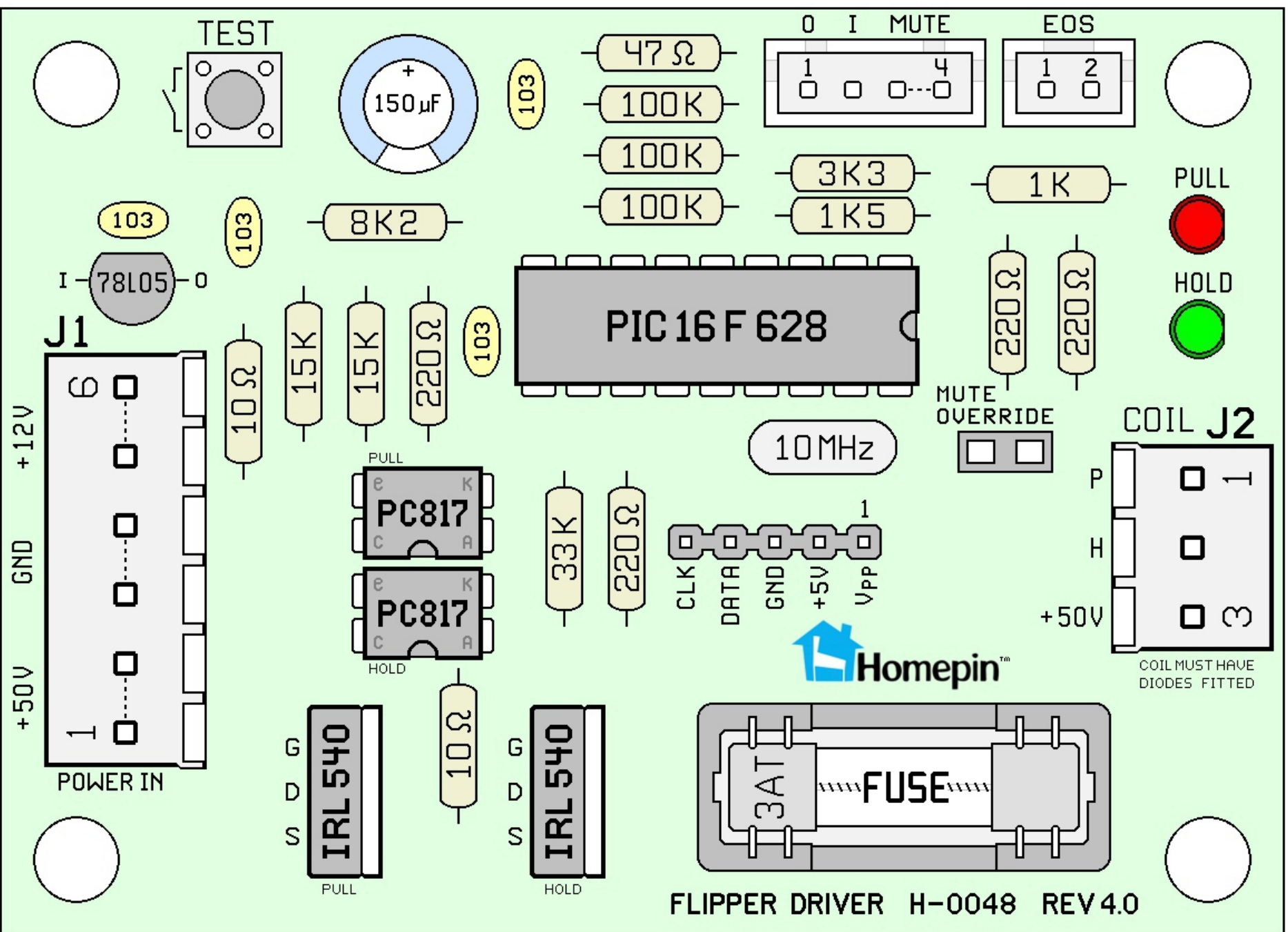
17 MARCH 2018

QTY 2

DWN TK

CKD MK

APR

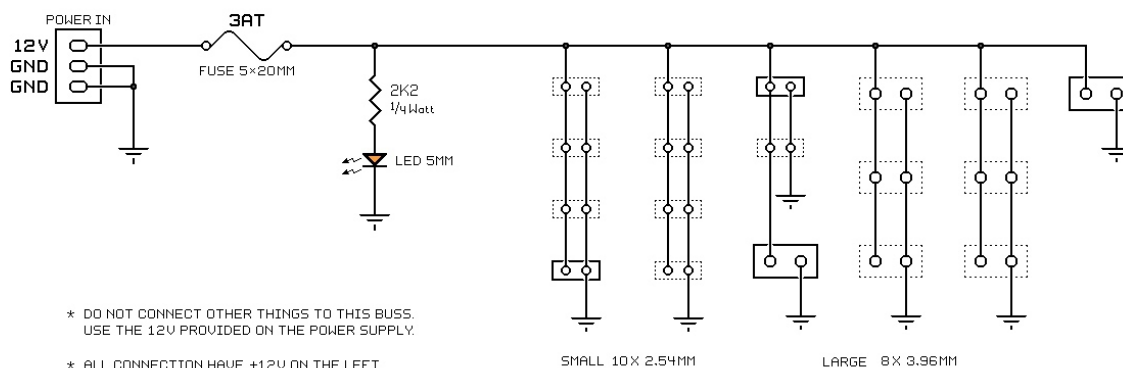


FLIPPER DRIVER H-0048 REV 4.0

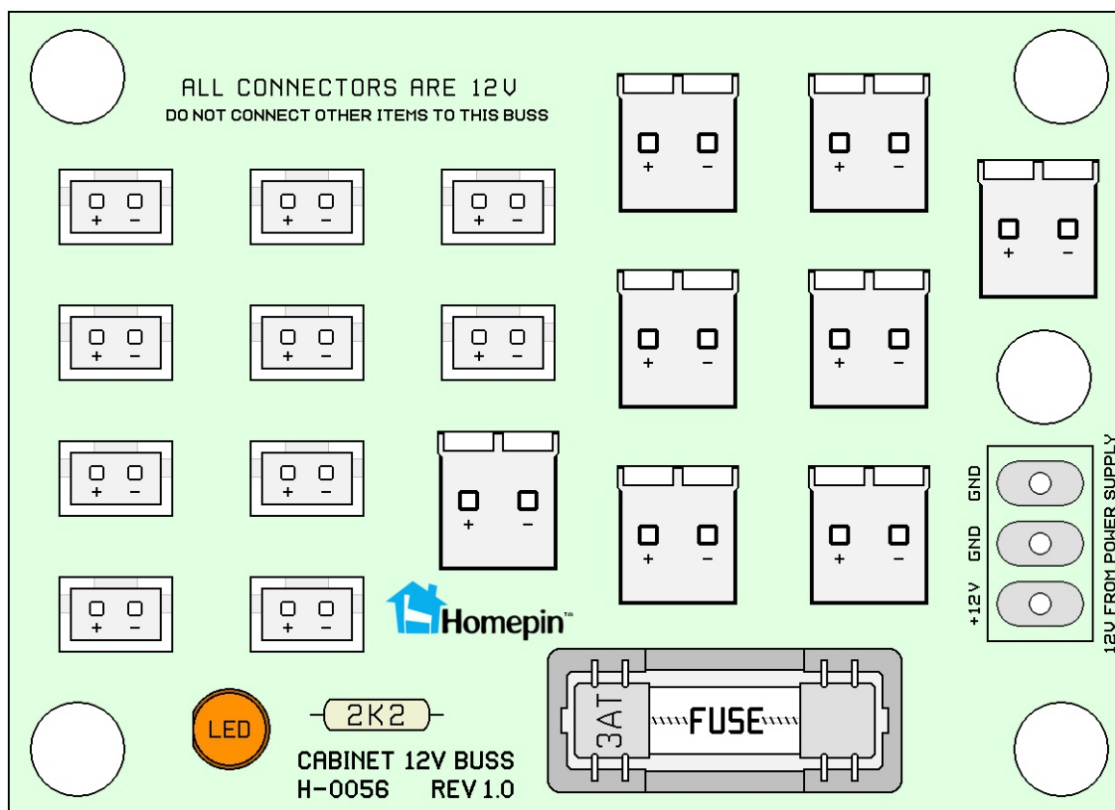


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MACHINE NAME:	TAG	REVISION:	4.0
DESCRIPTION:		PAGE:	2
NOTES:			
H-0048 Flipper Control			
17 MARCH 2018	QTY 2	DWN TK	CKD MK APR



NOTE: Not all connector positions are populated



MACHINE NAME:	TAG	REVISION:	1.0
DESCRIPTION:		PAGE:	1
NOTES:			
H-0056 12V Cabinet Buss			
17 MARCH 2018	QTY USED 1	DWN TK	CKD MK APR



Operation & adjustment of Tracy Island mechanism Thunderbirds Pinball (TAG)

Tracy Island mechanism is controlled by its own board, H-0020. Connected to this board are two small opto boards, both H-0041. One is the 'launch UP' sensor and the other is 'launch DOWN'. Other sockets on this board connect to the ball landed IR sensor (marked as ball opto), the lift motor, pool motor, pool end sensor board and the red beacon & spot light.

In standby position the launch slide is in the down position and the pool is closed. The dot (full stop) on the small seven segment display (on H-0020) will be lit indicating the mechanism has reset correctly and is ready for operation.

ADJUSTMENTS

The launch up and down opto boards (H-0041) can be moved for adjustment by loosening the two screws, sliding the opto board to the desired position and tightening the two screws. CAUTION: do not overtighten the screws as the retaining plate is made from PETG (plastic) and too much force will strip the thread in this plate. 'Snug' is all that is needed for these.

The pool end positions can be adjusted by sliding the pool opto board (H-0021) left or right as desired and tightening the two locknuts to hold it in the new position.

TESTS

This mechanism can be fully tested either in the pinball machine or on the workbench by applying 12 volts to pins 12V and GND marked on the edge connector of H-0020.

The mechanism has two test modes, (1) is the opto test and (2) is the full mechanism cycle test. The tests are accessed by pressing the "TEST" button on H-0020. This will cause the display to show a line in the middle (test mode). Once in test mode then press (and hold for 2 secs) either the DOWN or UP buttons.

(1) The five IR optos can be tested by pressing the "UP" switch for two seconds. Both motors will drive to a position that opens all optos.

As each opto beam is broken the corresponding number for that opto is displayed indicating that it is working correctly.

“1” - Launch UP opto

“2” - Launch DOWN opto

“3” - Pool OPEN opto

“4” - Pool CLOSED opto

“5” - Ball landed opto

Pressing the TEST switch again will reset the mechanism.

(2) The full mechanism test is initiated from test mode by pressing the DOWN switch. The mechanism will do a full cycle, sliding the pool open, raising the launch arm, lowering the launch arm and closing the pool.

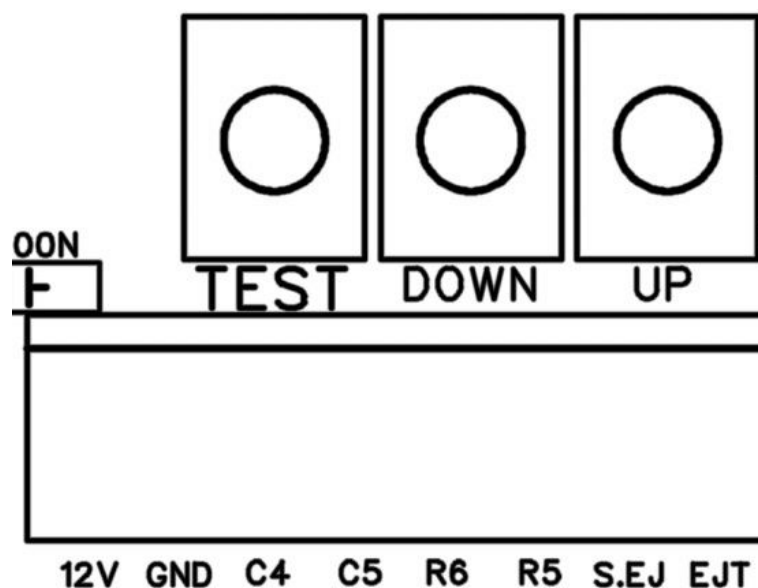
NOTES

There are two triggers from the MPU that can activate Tracy Island.

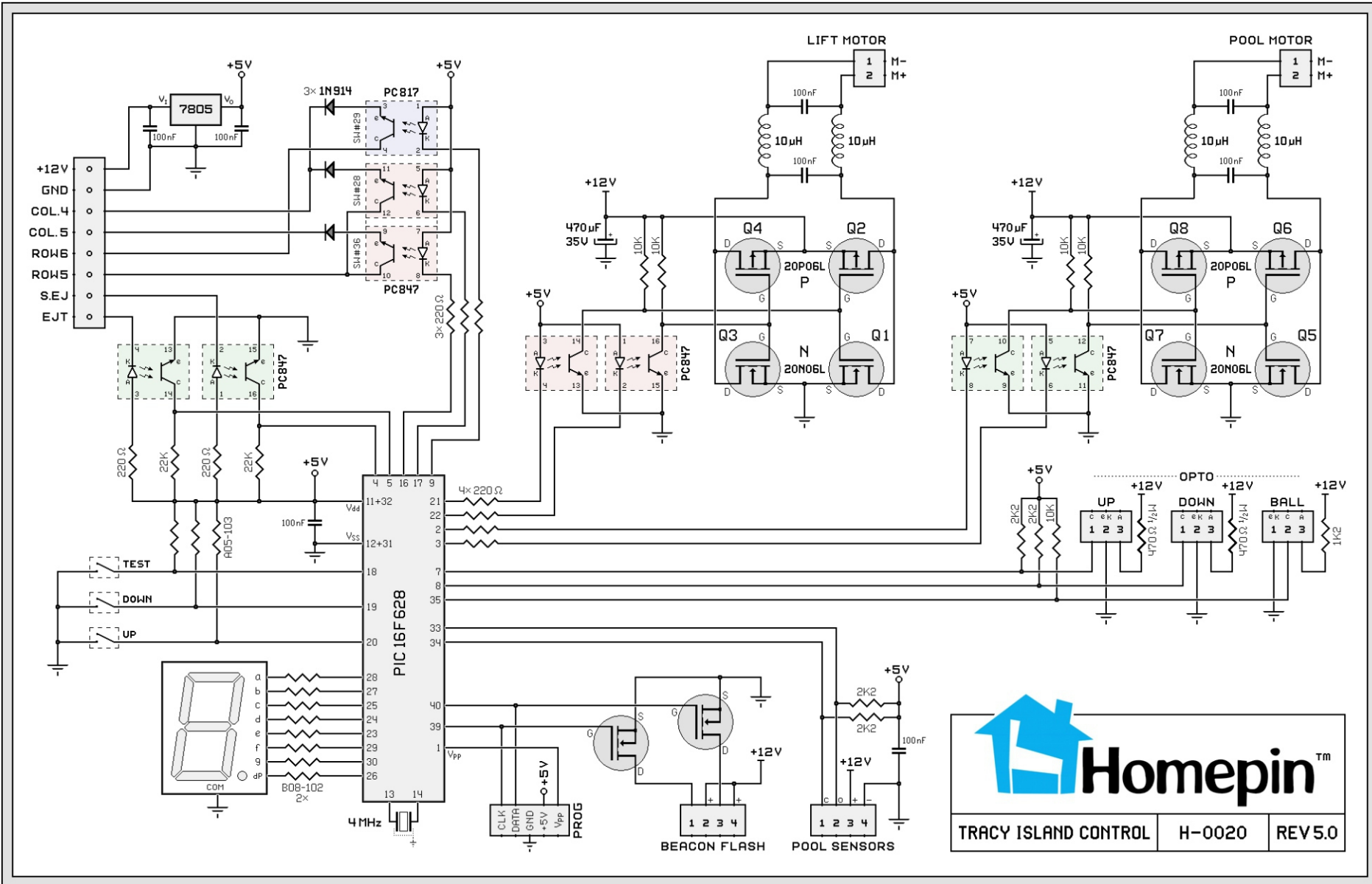
‘S.EJ’ means Soft Eject and this is activated when resetting the mechanism and during ball search. It can also be activated via the service menu in the machine under ‘SOLENOIDS’.

‘EJT’ means Full Eject and is activated when a ball lodges under the pool and multiball mode is in progress.

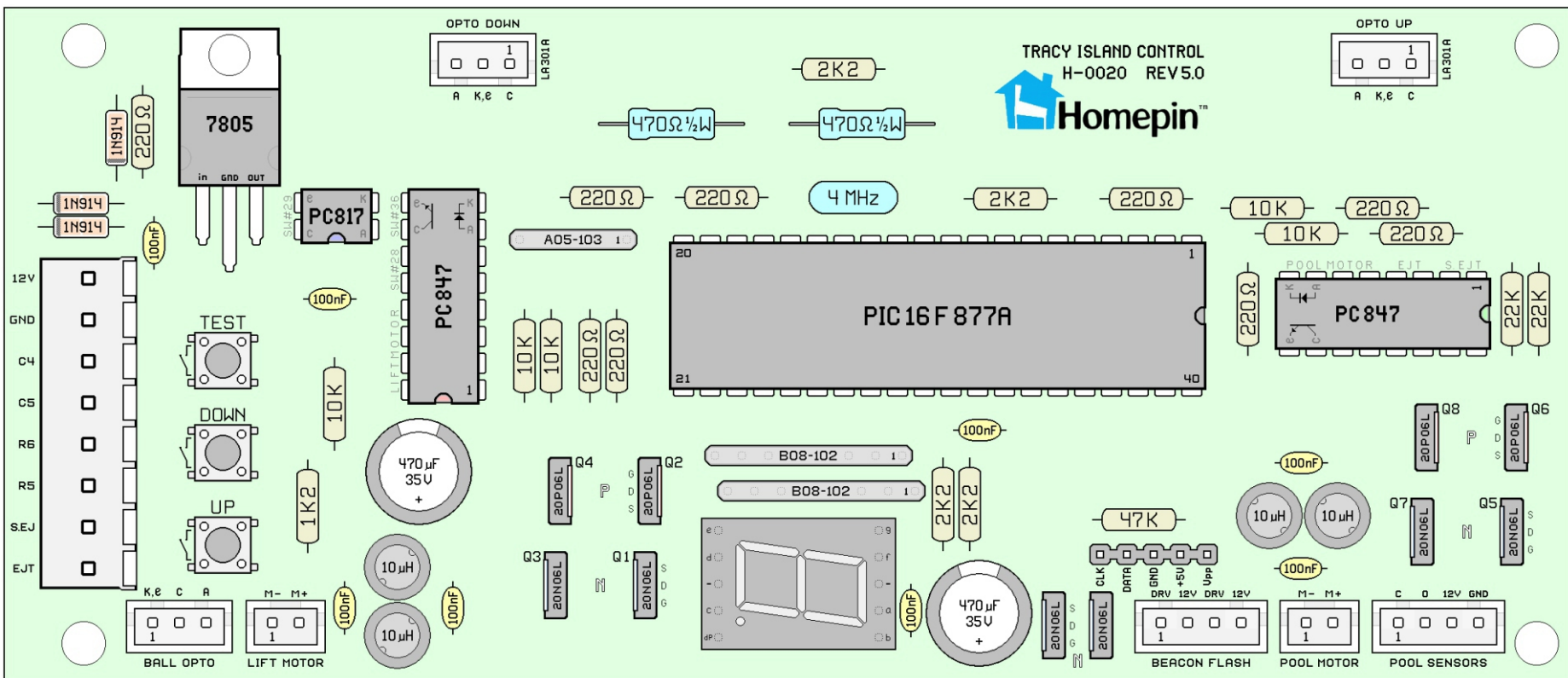
The only difference between these modes is that the red beacon and the flashing under pool lamp are not activated in Soft Eject mode.



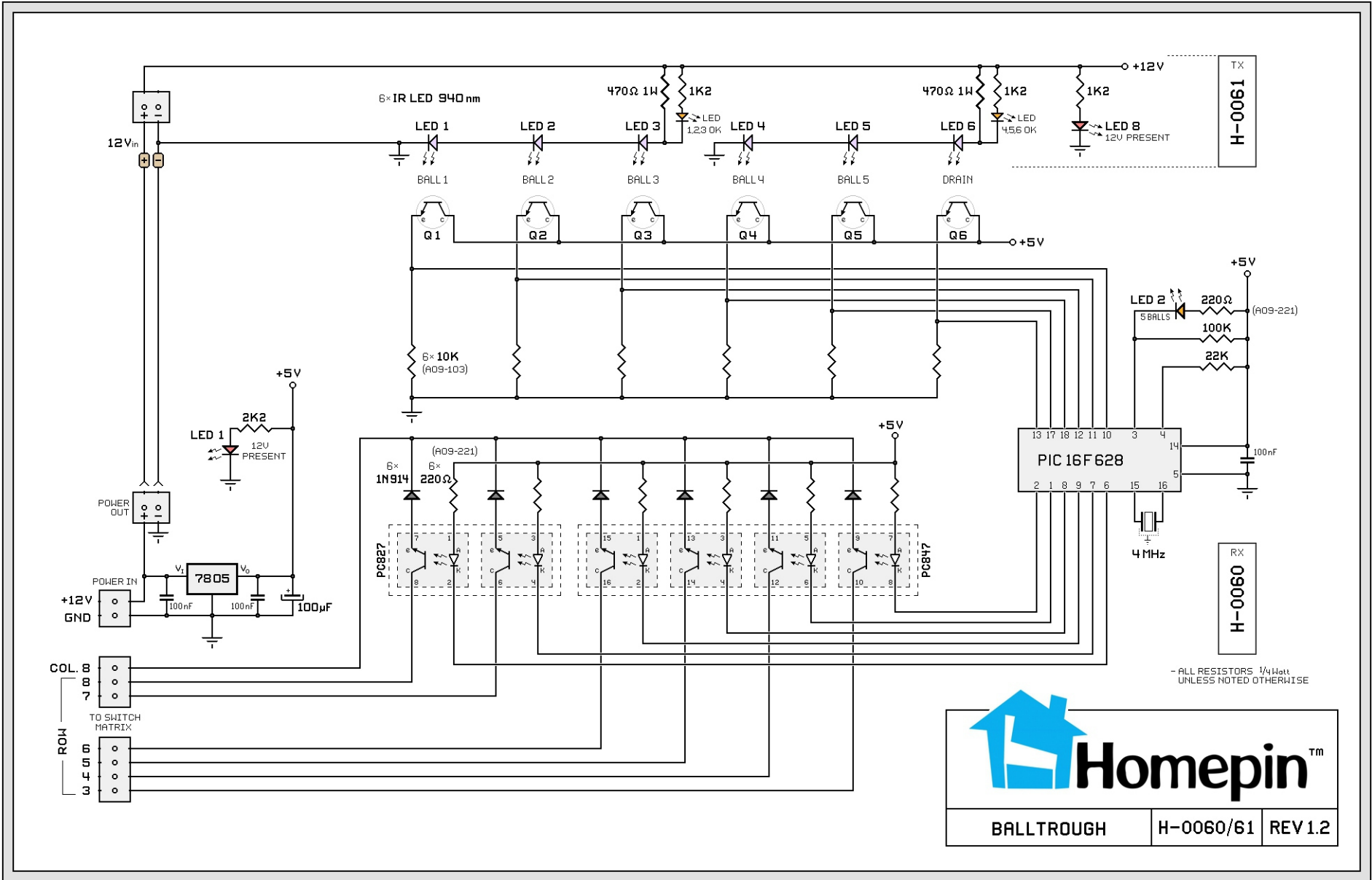
MACHINE NAME: TAG		REVISION: 5.0
DESCRIPTION: H-0020 Tracy Island Control		PAGE: 1
NOTES:		
17 MARCH 2018	QTY 1	DWN TK CKD MK APR

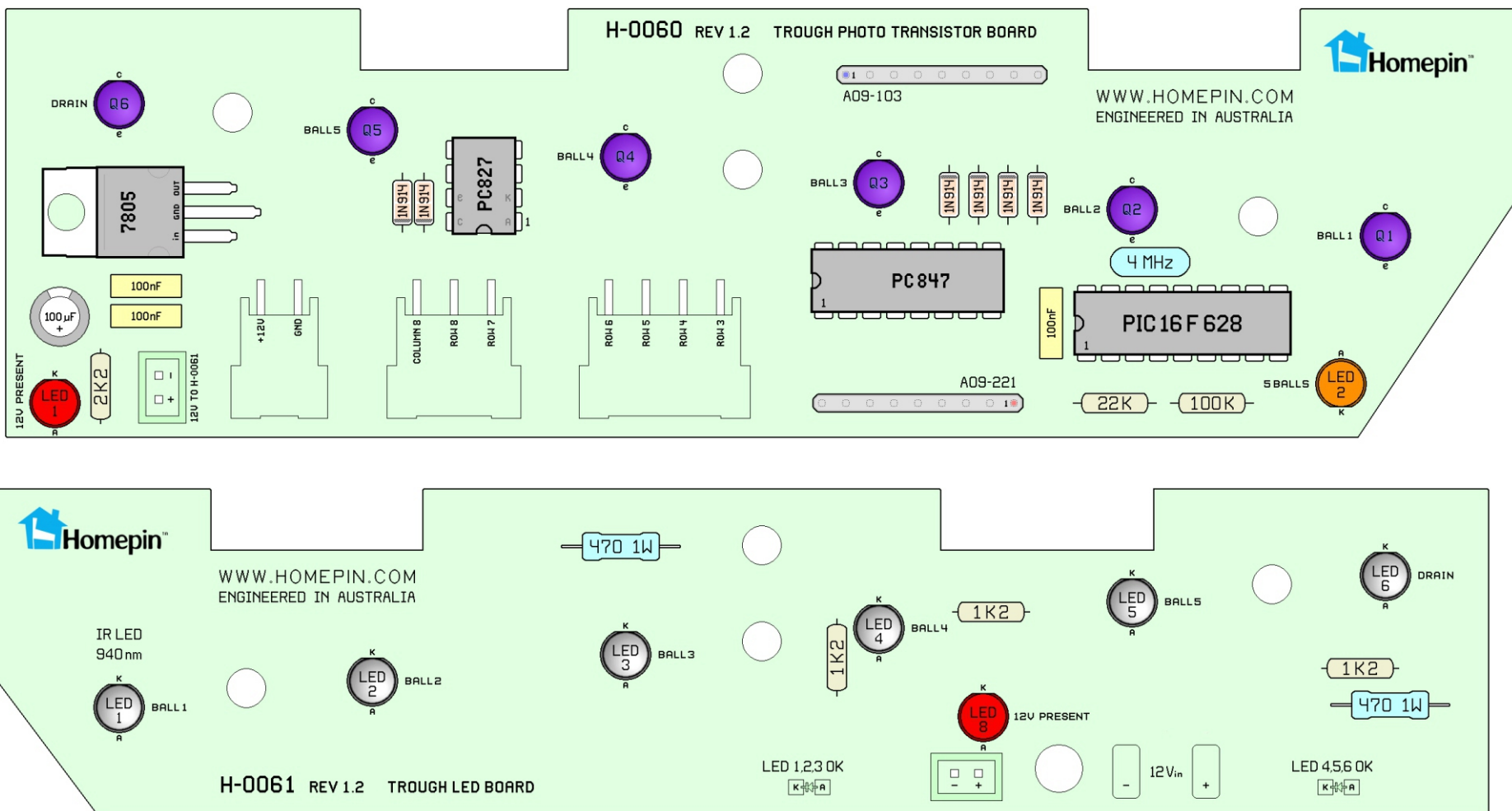


MACHINE NAME:	TAG		REVISION:	5.0
DESCRIPTION:			PAGE:	2
NOTES:				
H-0020 Tracy Island Control				
17 MARCH 2018	QTY USED	1	DWN TK	CKD MK APR

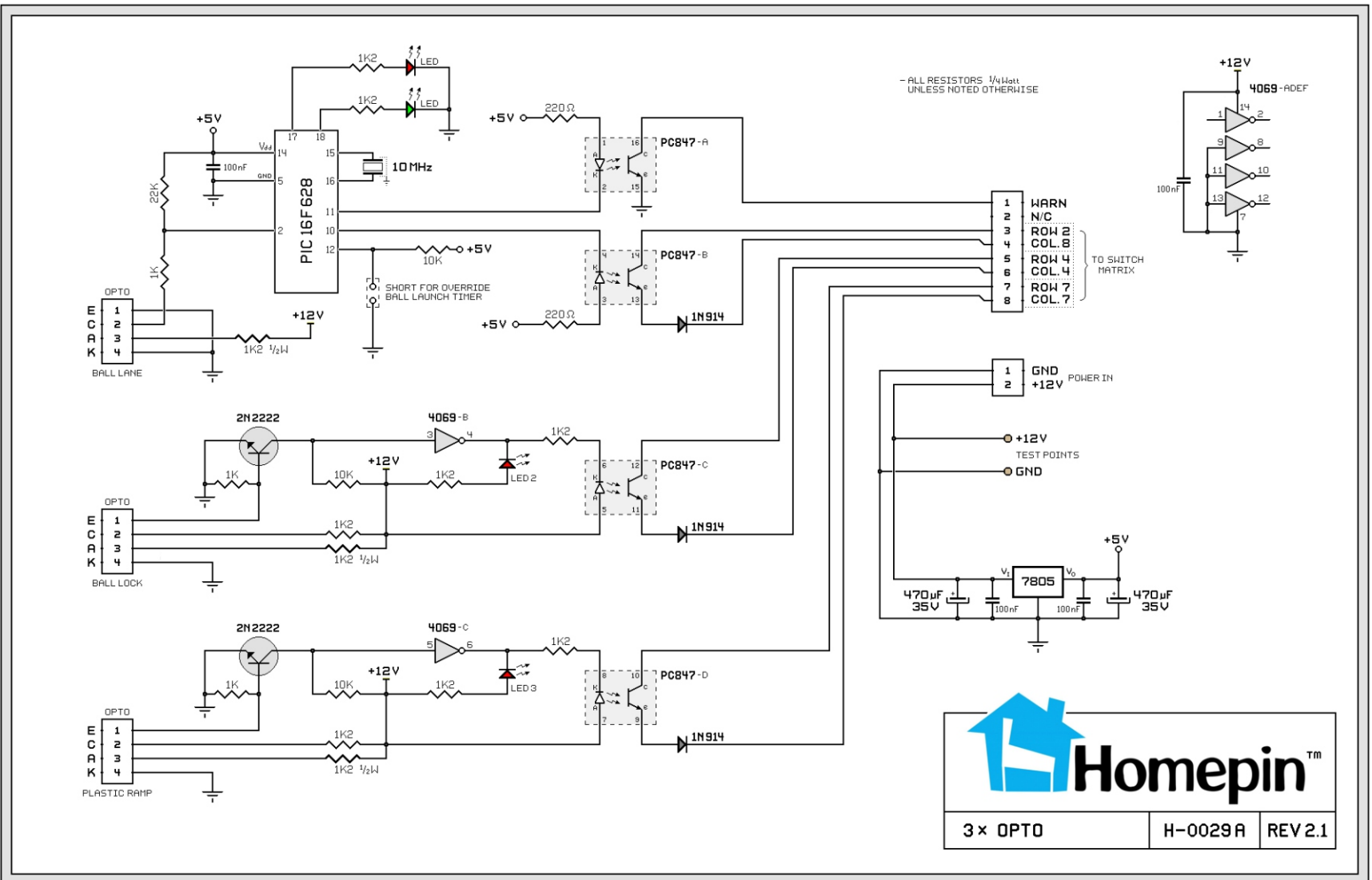


17 MARCH 2018	QTY USED 1	DWN	CKD	APR
NOTES:				
Ball Trough				
MACHINE NAME: TAG		REVISION: 1.2		
DESCRIPTION:		PAGE: 1		

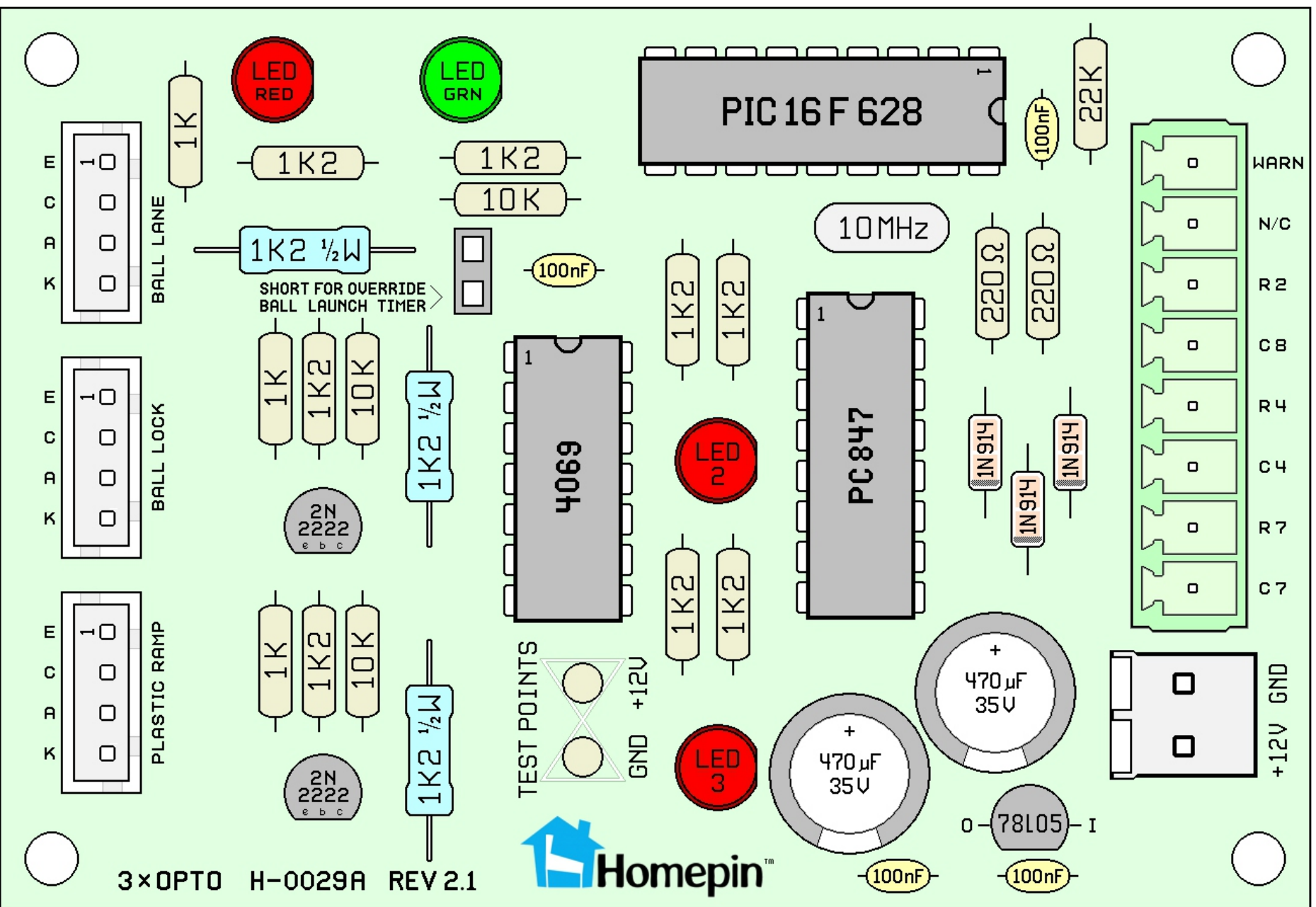




MACHINE NAME:		TAG		REVISION:		1.0	
DESCRIPTION:				PAGE: 1			
NOTES:							
H-0029A 3 opto/lane timer							
11-OCT-2018		QTY USED 1		DWN		CKD APR	



MACHINE NAME:		TAG		REVISION: 1.0	
DESCRIPTION:		PAGE: 2			
NOTES:					
H-0029A 3 opto/lane timer					
11-OCT-2018	QTY USED	1	DWN	KCD	APR





HomepinTM