

# NAUGHTY FISH

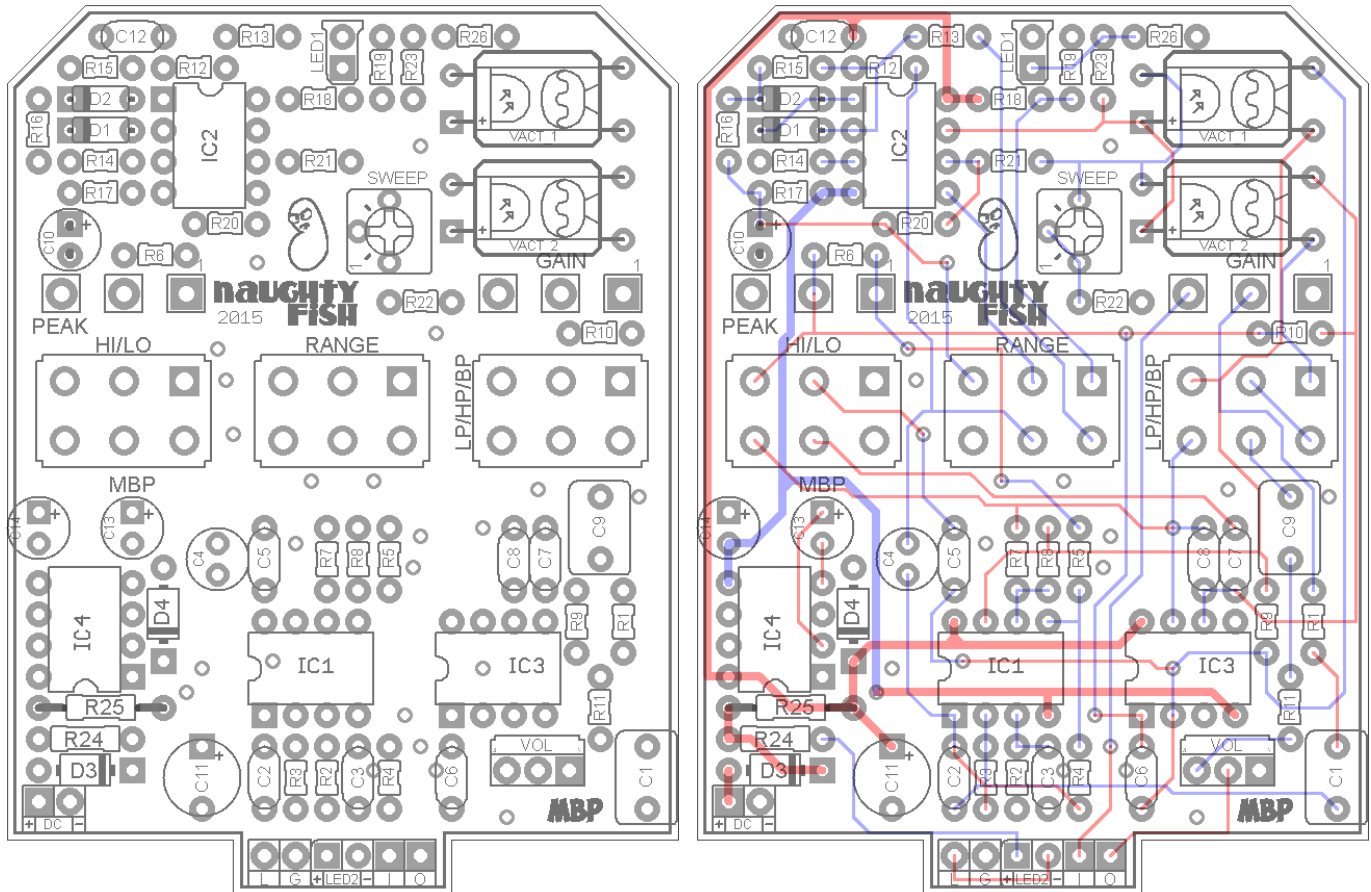
2015 Edition

FX TYPE: Filter

Based on the Mutron III™

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2.15" W x 2.7" H



## 2015 Edition Changelog

- Increased R25 from 10R to the more common 47R. **Changed to jumper 07.27.**
- Centralized I/O pads at the bottom of the PCB.
- Re-ordered schematic drawing of the LP/HP/BP switch to match switch pin configuration (previous version was functionally equivalent but this was changed to prevent confusion).

**Terms of Use:** You are free to use purchased **Naughty Fish** circuit boards for both DIY and small commercial operations. You may not offer **Naughty Fish** boards for resale or as part of a "kit" in a commercial fashion. Peer to peer re-sale is, of course, okay.

Resistors		Caps		Diodes	
R1	3k3	C1	1uF	D1	1N914
R2	120k	C2	10pF	D2	1N914
R3	120k	C3	100n	D3	1N5817
R4	4k7	C4	2u2 NP	D4	12v Zener
R5	12k	C5	2n2	LED	3MM
R6	390k	C6	1n8	IC	
R7	22k	C7	2n2	IC1	TL072
R8	22k	C8	1n8	IC2	TL072
R9	220k	C9	1uF	IC3	TL072
R10	220k	C10	4u7	IC4	LT1054
R11	560R	C11	220uF	Vactrols	
R12	22k	C12	100n	VACT_1	VTL5C3
R13	12k	C13	10uF	VACT_2	VTL5C3
R14	1M	C14	10uF	Switches	
R15	1M			RANGE	DPDT
R16	330R			HI/LO	DPDT
R17	47k			HP/LP/BP	DPDT
R18	180k			Trimpot	
R19	120k			SWEEP	5k
R20	120k			Pots	
R21	120k			GAIN	1MC
R22	330R			PEAK	250kB
R23	1k			VOL (optional)	100kB
R24	4k7				
R25	jumper				
R26	1k				

**7.27.15 Update:** The three DPDT switches can now be either lug or PCB mount. This change was made due to a request from some customers who have had trouble getting PCB mounted switches.

PCB mounted switches:

On/On: <http://smallbear-electronics.mybigcommerce.com/dpdt-on-on-pc-mount/>

On/On/On: <http://smallbear-electronics.mybigcommerce.com/dpdt-on-on-on-0221c1/>

Use these 16mm pots for the Gain and Peak controls:

<http://smallbear-electronics.mybigcommerce.com/alpha-single-gang-16mm-right-angle-pc-mount/>

And, this Alpha pot for the optional Volume control:

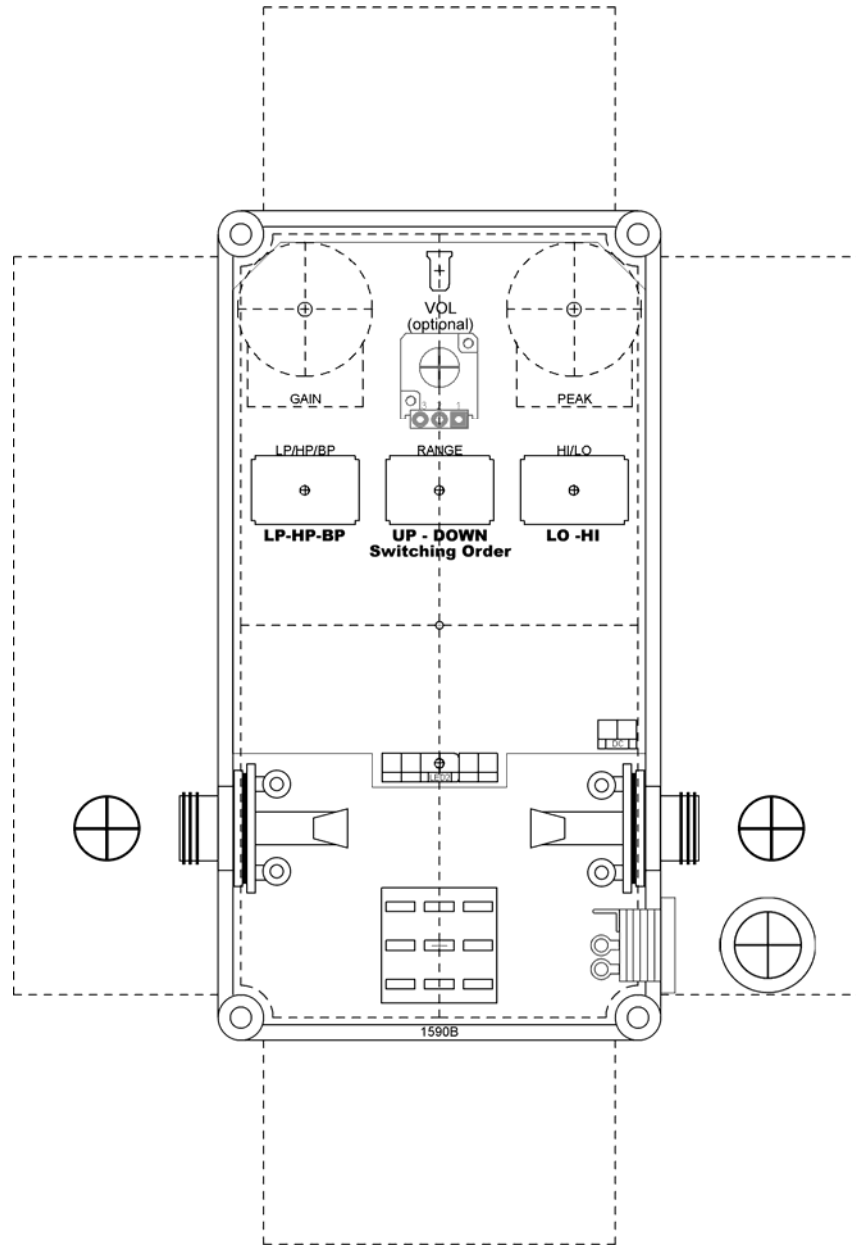
<http://smallbear-electronics.mybigcommerce.com/alpha-single-gang-9mm-pc-mount/>

or, this 12mm one: <http://smallbear-electronics.mybigcommerce.com/alpha-single-gang-12mm-solder-terms/>

Shopping List			
Value	QTY	Type	Rating
330R	2	Metal / Carbon	1/8W
560R	1	Metal / Carbon	1/8W
1k	2	Metal / Carbon	1/8W
3k3	1	Metal / Carbon	1/8W
4k7	2	Metal / Carbon	1/8W
12k	2	Metal / Carbon	1/8W
22k	3	Metal / Carbon	1/8W
47k	1	Metal / Carbon	1/8W
120k	5	Metal / Carbon	1/8W
180k	1	Metal / Carbon	1/8W
220k	2	Metal / Carbon	1/8W
390k	1	Metal / Carbon	1/8W
1M	2	Metal / Carbon	1/8W
10pF	1	Ceramic	25v min
1n8	2	Film	25v min
2n2	2	Film	25v min
100n	2	Film	25v min
1uF	2	Film	25v min
2u2 NP	1	Non-Polar Electrolytic	25v min
4u7	1	Electrolytic	25v min
10uF	2	Electrolytic	25v min
220uF	1	Electrolytic	25v min
1N914	2		
1N5817	1		
12v Zener	1		1W
LED	1		3MM
TL072	3	DIP	
LT1054	1	DIP	
VTL5C3	2	Macron MI1210CLF-R or VTL5C3	
DPDT	2	PCB / Solder Lug	ON/ON
DPDT	1	PCB / Solder Lug	ON/ON/ON
5k	1	Bourns 3362P	
1MC	1	PCB Mount	16mm
250kB	1	PCB Mount	16mm
100kB	1	Alpha (optional)	9mm

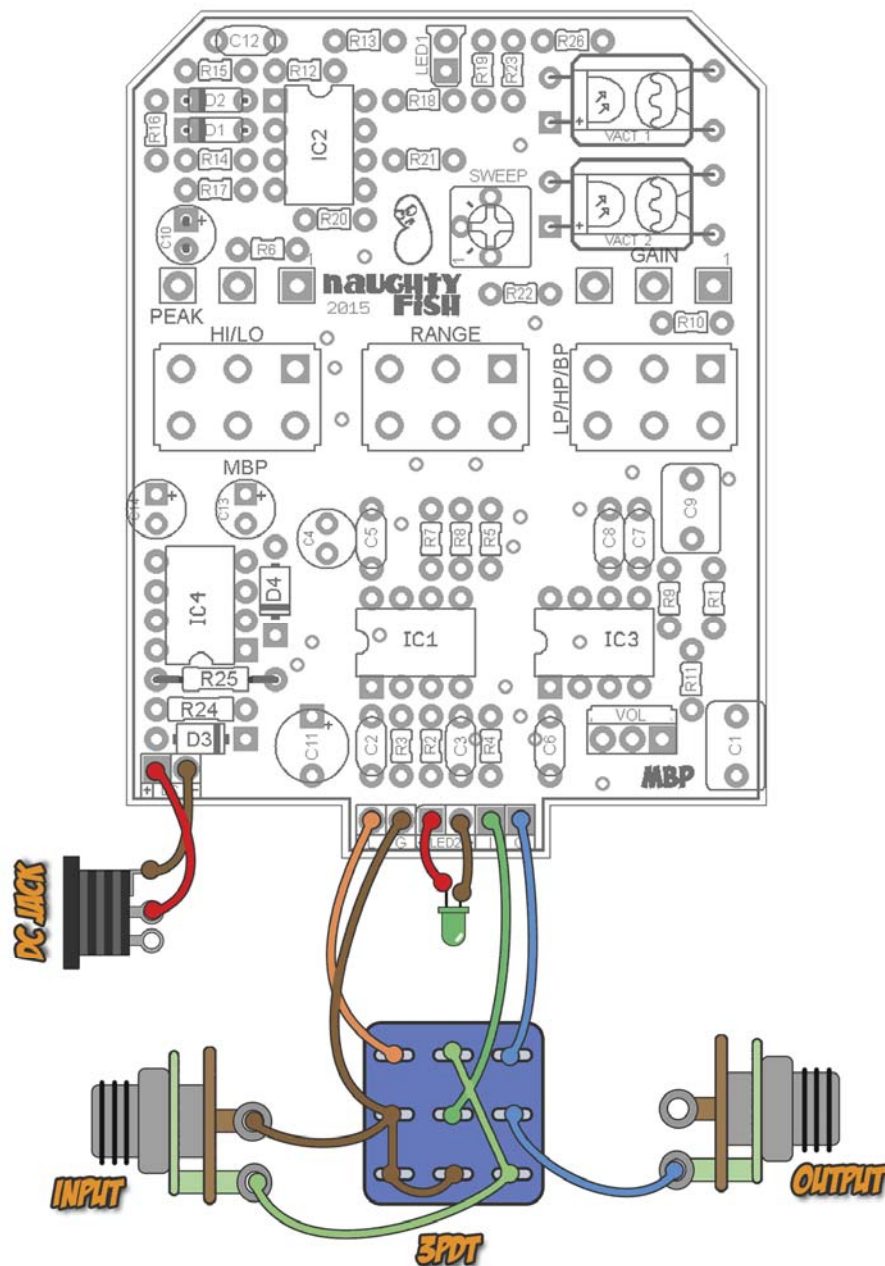


**1590B Drill Guide**  
**4.43" W x 6.44" H**



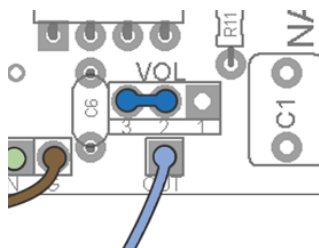
Obviously, this is a very tight fit. To make your life easier, I suggest using smaller profile input, output and DC jacks, if possible. Alternatively, you can build this in a 125B which has more room. If using a 125B, you should also be able to top mount all the jacks.

## Wiring Diagram



You can wire the two LEDs anywhere you like or simply solder them directly to the PCB.

If you do not wish to use the optional Volume pot, simply jumper pads 3 and 2 together on the PCB and wire everything else as shown above.



What is best in life? Crush your enemies? See them driven before you? Hear the lamentation of their women? Yes. And so is making a clone of a super expensive piece of vintage gear in a small enclosure...like the Naughty Fish.

The **Naughty Fish** is a Mutron III™ clone, like the madbeanpedals Nautilus, but shrunk down and simplified. Whereas the Nautilus required a large rotary switch and a 1590BB enclosure, the Naughty Fish uses no rotary and fits in a 1590B. The Naughty Fish also replaces the output section of the Nautilus with an optional volume control to save space (neither of those are present in the Mutron III). In that sense it is a more accurate clone than the Nautilus, although both the Nautilus and Naughty fish are nearly identical in terms of results.

- **Gain** – The input gain of the filter effect. This drives not only the filter portion, but also the envelope. As the control is turned up, more overdrive is produced and the envelope becomes more sensitive to dynamics.
- **Peak** – Adjusts the intensity of the resonant peak of the filters.
- **Sweep** – This trimmer follows directly from R.G. Keen's suggestion. It allows one to make small adjustments to the overall LED brightness in the envelope section. The LEDs are what drive the Vactrols which in turn produce the sweeping filter effect.
- **Hi/Lo** – Selects between two sets of filters, high and low.
- **Up/Down** – Selects two different modes for the LED drivers. The Up setting drives the LEDs from dark to light and the Down setting is the opposite.
- **LP/HP/BP** – Selects three different filter types. HP is high-pass, LP is low-pass and BP is band-pass.
- **Vol** – This is an optional output volume control. I highly recommend using it since the output volume can increase quite a bit when the Gain pot is turned up.

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The original Mutron used a custom made dual Vactrol which is no longer available. The Vactrol consisted of two photocells, one for each filter stage, and an LED driver in a cylindrical case. The Nautilus uses two Vactrol drivers so there are two photocells, but one LED per photocell. It is imperative that you use the correct Vactrol for this build, otherwise it will not work correctly.

VTL5C3:

<http://smallbear-electronics.mybigcommerce.com/photocoupler-xvive-vtl5c3-work-alike/>

**Nov 11 2016: Based on recent reports there seems to be an issue with some of the Macron replicas of the 5C3 vactrol (originally listed in the BOM), so I recommend using the Xvive work-alike linked above. Smallbear no longer sells the original Vactec VTL5C3 but if you have these on hand or get them somewhere else use those.**

If you are unable to get either of these, then roll your own Vactrol using an LED and photocell with specs as close to 20-50k light and 10M dark as possible. The closest match for this is the 9203 photocell listed here: <http://smallbear-electronics.mybigcommerce.com/photocells-cds-5mm-diameter/>

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The LED on the Naughty Fish PCB is envelope driven. It will give you some visual feedback as to how the envelope is behaving, and thus how the Vactrols are being driven. You should mount this LED to the external part of the enclosure.

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Technology of Envelope Controlled Filters: [http://www.geofex.com/Article\\_Folders/ECFtech/ecfttech.htm](http://www.geofex.com/Article_Folders/ECFtech/ecfttech.htm)  
Musictronics Mutron III info: <http://www.effectsdatabase.com/model/musitronics/mutron/3>

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There are many subtle settings to be found in conjunction with the switches and potentiometers. Take time to explore...it is one of the most enjoyable effects to fiddle around with.

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The 1MC Gain pot is a bit too high in value, IMO. The first 1/3<sup>rd</sup> of the pot turn feels a little on the dead side to me...but that is the value used in the Mutron. If you find it bothersome, use a smaller value like 500kC. I even built one with 250kC and it still had plenty of gain range for my taste.

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Start with the Sweep trimmer in the middle of its rotation. As you play around with the Naughty Fish, try tweaking the trimmer up and down in small increments to get a feel for how it changes the envelope response. There is no one "ideal" or preferred settings here...it is simply a tweak to alter the envelope to your liking.

Voltages 9.42v Supply				
IC1	TL072	IC2	Right TL072	Left
1	3mV	1	1.34	.56V
2	3mV	2	1.1mV	1.2mV
3	.8mV	3	.7mV	1.1mV
4	-8.59	4	-8.6	-8.6
5	2.9mV	5	3.61	0.7
6	1.8mV	6	3.41	0.73
7	2.3mV	7	6.67	2.5
8	9.16	8	9.15	9.15

IC3	TL072	IC4	LT1054
1	0	1	1.5
2	2.2mV	2	4.98
3	0.8mV	3	.9mV
4	-8.61	4	-3.9
5	0.7mV	5	-8.6
6	0.5mV	6	2.55
7	0.3mV	7	1.41
8	9.16	8	9.15

Voltage readings will change depending on where the Range switch is set. The list above shows both sets for left and right positions on the switch (up and down).



