

CurrentStabilisation

Funktion

One device, multiple tasks:

- Power Supply for LEM ULTRASTAB via D-Sub
- Read current & transduce to Voltage with high precision option
- Set current via analog input
- switch current on/off via MOSFET control
- PID feedback to (high current) power supply including sample and hold option
- PID feedback to MOSFET to control / switch current with output offset
- interlock (ULTRASTAB status, external)

Optionen und Alternativen

- There is a footprint for [ultra high precision current sensing resistor](#).
- instead of ULTRASTAB D-Sub, a BNC can be connected to current input
- via population you can select whether to measure current or voltage (no shunt resistor). Then it should be usable as dual PID.
- PSU output limit (0-10V) can easily be disabled

Performance



Date

Begin of Project: Oktober 2016

Status

- schematic and pcb layout done on KiCad
- version v1a ordered at Basista on 2016-11-01, 3 pc for prototyping

Aufwand für Nachbau: 

Entwickler

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Main Ideas based on prototypes and schematics from Klaus Zipfel.

Anwender

VLBAI Magnesium

Schaltungsprinzip

current from LEM ultrastab is transduced to voltage using a shunt and a diffamp. A error signal is generated by adding a inverted set signal. This error signal is fed into two PIDs. PID A has A Sample and hold option which works as follows: the PID output is fed into the S&H circuit, once activated the S&H outputs a constant voltage which was previously the PID output signal. At the same time the difference between this constant voltage and the actual PID output voltage is fed as a new error signal to the PID input.

- The S&H feature can be enabled / disabled via TTL. If disabled the output returns to zero on disable.
- PID B returns to zero on disable using the same mechanism but without the S&H feature.
- all digital inputs are optocoupled
- all analog inputs are differential
- the MOSFET out can drive high capacity
- the PSU output is limited to 0-10V

Schematic

- All files can be found on <http://bibo/git/CurrentStabilisation.git>
 - Schaltplan
- in PDF-Format
- Die Source des Schaltplans ist auf der [Download-Seite des Wiki](#) abgelegt.

Layout

- PCB size: 160 x 100 mm
- Supply: > +/-15V
- Inputs:
 - Ultrastab (D-Sub) or Current/Voltage (BNC)
 - control voltage to set the current,

- TTL enable
- TTL enable S&H
- TTL interlock
- Outputs:
 - current monitor
 - error monitor
 - PSU control
 - MOSFET control
- Displays: none
- PCB population plan: [frontback](#)
- Die Bestückungsliste:
- Die [gezippten Gerberdaten](#) für die Bestellung der Platine
- Die Source des Layouts im pcb-Format liegt auf der [Download-Seite des Wiki](#).



Housing

In progress, Hammond for 160*100 mm, Height?



Test

Up to now only PID A is populated (except D) after Hacking the logic at the S&H IC, it works as expected. after switching in hold mode, the current seems to be a bit lower than the initial setpoint. this might be caused by the big hold capacitor. Maybe after 0.5 sec. it is not entirely loaded. The hold time seems to be huge, after 30s there is almost no change visible, seems to be a fraction of a Millivolt. So it might be an option to change the Cap to a smaller one, leading to a smaller hold time, but a more precise hold value.

The idea of having the current on for a longer time before switching to hold mode didn't really help, so it doesn't seem to be an problem related to the loading curve of the hold cap. after a hold time of ~4 minutes, the current monitor voltage dropped from ~39.6 mV to 39 mV.



Usage

Input Signals

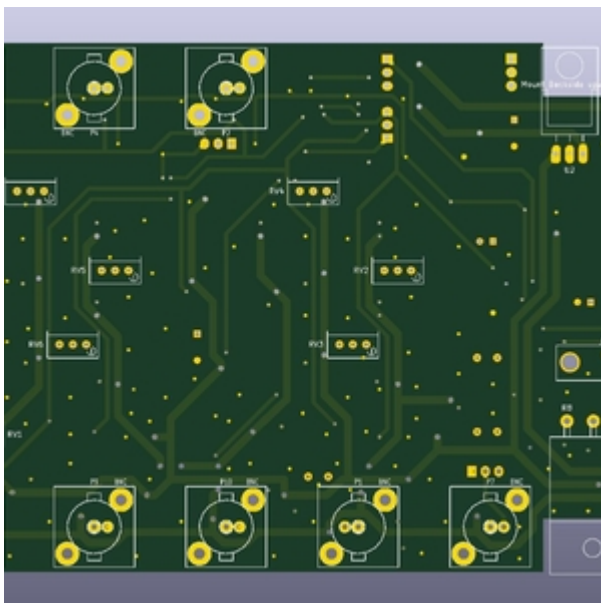
Input	Type	Description
ULTRASTAB (D-SUB)	analog current (differential)	current input from current transducer,\\can be modified to differential voltage input.
Current set	analog voltage (differential)	current setpoint
enable	digital voltage (optocoupled)	high: PIDs enabled, outputs active low: disabled, MOSFET out turned to zero.
S&H	digital voltage (optocoupled)	high: S&H active, PID A holds voltage on disable low: S&H diasbled, PID A returns to zero on disable
interlock	digital voltage (optocoupled)	high: device operational, low: all outputs off, PIDs return to zero

Jumper Settings

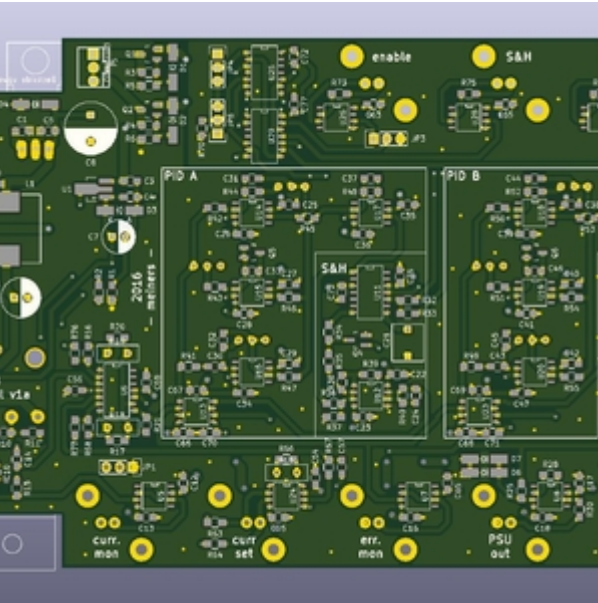
Jumper #	Feature	options
1	Current monitor output reference	pin 1 (right): normal gnd pin 3 (left): clean gnd
2	MOSFET output selection	pin 1 (right): PID B (without S&H) pin 3 (left): PID A (with S&H)
3	Enable Input usage	pin 1 (left): connect enable in pin 3 (right): connect to gnd, permanent enable
4	ULTRASTAB interlock usage	pin 1 (top): ULTRASTAB interlock used pin 3 (bottom): ULTRASTAB interlock ignored
5	External Interlock usage	pin 1 (left): ext. interlock used pin 3 (right): ext. interlock ignored
6	Sample and Hold usage	pin 1 (bottom): S&H input connected pin 3 (top): S&H permanently enabled No Jumper: S&H permanently disabled



Bilder



[current_stabilisation_v1a_back.jpg](#)



current_stabilisation_v1a_front.jpg

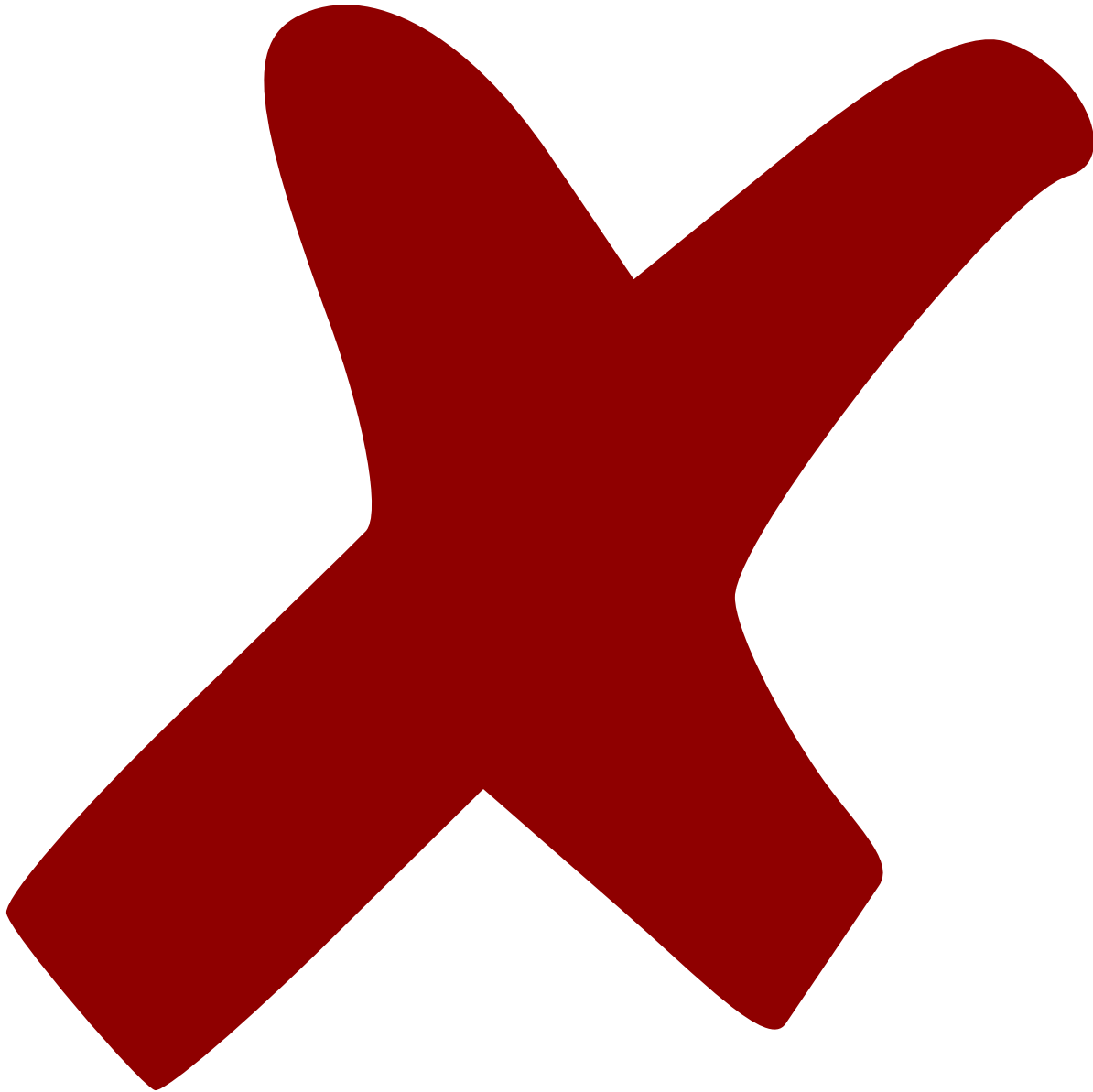
Kalkulation



was	wieviel	E-Preis	Preis	Anmerkung
Leiterplatte	1x	??.?? €	€	1/n von XXX EUR
Gehäuse	1x	??.?? €	€	
*	?x	??.?? €	€	...
R,C	??x	0.02 €	€	Bauform 0805
Bestückung		??.00 €		bei SRM
Verschnitt		?.?? €		
Summe			€	

Meckerliste

Was für die nächste Version zu tun ist: (



: verworfen,



: in Arbeit,



Schaltplan, aber noch nicht im Layout,

: im



: erledigt)



- at S&H is wrong. On prototypes (v1a) it can be hacked (pins 10 & 11 have to be interchanged). Logic



- values for Zener diodes

add



- diodes across voltage regulators to protect them

add



- regulator is TS78L05ACY pinout (out - gnd - in)

5V



- change Mosfet output stage to twice noninverting. negative offset added on the negative input of first OpAmp, such that the MOSFET pulldown works



- footprints for IC shields for instr. Amps and sum

add



- larger cutout for XLR Power input
- increase through hole sizes (hard to unsolder)



- supply capacitors laying on rear side



- interlock status leds



- second ref footprint parallel in current set path for more gain flexibility

add

From:
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<https://elektroniq.iqo.uni-hannover.de/doku.php?id=eigenbau:currentstabilisation:start&rev=1581071005>

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