G2Shield – onboard steppers

Using TinyG2/G2core on an Arduino Due, connect up to 6 onboard stepper controllers (not included) and limit switches for both XYZ and ABC direction. Directly connect laser/spindle and coolant relay to control a small CNC or laser cutter/enrgaver.

List of components

SMD:

Qty	Value	Device	Parts
1	BSS138	SOT23	Q1
12	100n	C-1206	C1-C12
18	10k	R-1206	R1-R18

Through-hole:

Qty	Value	Device	Parts
6	100uF/35V	C-pol-3.5-8	C13-C18
2	2-pin	Con-DG300-5	SPINDLE, VMOTOR
1	2-pin	Con-kk	COOLANT
1	3-pin	Con-kk	SUPPLY
1	4-pin	Con-kk	SPINDLE_INTERFACE
1	1x10,4x1x8,2x18	Con-pinhead	DUEG2
6	1x4	Con-pinhead	MOTOR1-6
6	2x3	Con-pinhead	CONFIG1-6
1	2x4	Con-pinhead	Control switches
1	2x6	Con-pinhead	Limit switches ABC/XYZ (in 1-12)
12	1x8	Con-socket	DRIVER1-6
1		Switch	RESET
1	IRL540N	TO-220	Q2

Introduction

Thanks for buying this G2Shield kit with onboard steppers! SMD components have been premounted for your convenience, so only the remaining through-hole parts need to be mounted. Make sure you read the complete instructions before you start mounting. Assembly can be done by an experienced hobbyist in about half an hour.

List of components

Please check if the list of components is complete. If desired, you can adapt them to your needs.

Tools

- ✔ Soldering iron and solder
- ✔ Multi-meter (voltage and resistance)
- ✔ Side-cutting pliers

General instructions

Mounting

With the SMD components premounted, mounting the remaining through-hole connectors is straightforward. As usual go from components with the lowest height to the highest height.

Hint: to make sure the female pinheaders for the stepper controllers have the right distance you can connect a stepper during soldering! Same applies to the Arduino Due connection on the bottom side of the pcb.

External components

Connect external components according to the instructions shown in the schematic:

- External VMOTOR voltage 12-24V (make sure the voltage is supported by the stepper drivers, or laser/spindle)
- Stepper drivers
  - Designed for Pololu A4988 or DRV8825 drivers (not included)
  - Using jumpers (not included) on M0-M2 you can select the amount of microstepping
- Limit switches
  - 12 general purpose inputs, labeled as Xmin/max to Cmin/max on the pcb, G2core allows them to be freely configured
  - Both NC and NO suported by G2core
- Control switches
  - not yet supported by G2core
- Coolant relay
  - For external 5V relays
- Laser/spindle control
  - Onboard IRL540N mosfet driver for direct connection of spindle/laser
  - Interface using enable/direction/pwm

G2core software

For a thorough introduction to the G2core software, please check the Synthetos website. A quick introduction on how to get G2core and use it in combination with the G2Shield:

https://www.djuke.nl/en/support/18-cnc/46-using-g2-core

Testing

Do not connect external components yet until below voltages are checked!

Connect the G2Shield on top of a Arduino Due with G2core software. Power the Arduino Due using USB or external supply.

- The voltage between corresponding pins (1-2, 3-4 etc) of the limit switch inputs is 3.3V
- The voltage on pin 1 of the Motor connectors should be equal to the external voltage on VMOTOR
- The voltage on COOLANT-1 is 5V

Now, the external components can be connected and tested from G2core. The easiest way to do so is to clone the GIT repository from https://github.com/Djuke-DIYAudio/g2 and build the firmware with settings_Djuke_test.h

Connect to the Arduino Due using USB and a terminal program.

Useful test commands:

Command	Description
$in	Shows input values
$clear	Clears alarm state
M3 S100	Enables spindle clockwise with 100% PWM output
M4 S50	Enables spindle anti-clockwise with 50% PWM output
M5	Disable spindle
M7	Enable coolant relay
M9	Disable coolant relay
G0 x#	Move x-axis to position # (similar for y/z/a/b/c axis)

Schematic

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G2core shield features:
* onboard stepper controllers
  - interface to Pololu A4988 or DRV8825
  - place for up to 6 controllers
  - individual stepper enables
* limit/homing switches
  - normally-open (NO) and normally-closed (NC)
  - connectors for XYZ switches (min/max travel)
  - connectors for ABC switches (min/max angle)
  - signal conditioning (pull-up and low pass filter)
* control switches for reset, feed hold, cycle start
* laser/spindle control
  - onboard IRL540N mosfet driver for direct
    connection of spindle/laser
  - interface to external driver using enable/direction/pwm
* coolant control
  - connector for external relay
  - low-side driver with 5V supply

DUEG2 Shield

Limit switches XYZ (in 1-6)

JP2

X_MIN
X_MAX
Y_MIN
Y_MAX
Z_MIN
Z_MAX

R6 10k R5 10k R4 10k R3 10k R2 10k R1 10k
+3V3 +3V3 +3V3 +3V3 +3V3 +3V3

100n 100n 100n 100n 100n 100n
C6 C5 C4 C3 C2 C1
GND

RESET
RESET Switch

Control switches
JP7
RESET
SOFT_RESET
FEED_HOLD
CYCLE_START

R11 10k R10 10k R8 10k R9 10k
+3V3 +3V3 +3V3 +3V3

SUPPLY-3 GND +5V/2
SUPPLY-2 +5V/2
SUPPLY-1 +3V3 GND GND

SCL1
SDA1
AREF
Gnd1
Gnd_A
Gnd_B
5V_A
5V_B

Tx3(14)
Rx3(15)
Tx2(16)
Rx2(17)
Tx1(18)
Rx1(19)
Tx0(D1)
Rx0(D0)

NC
IOref
Reset
3v3
5V
Gnd_1
Gnd_2
Vin

A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 DAC0 DAC1 CANRX CANTX

M1_STEP
M3_STEP
M1_DIR
M3_DIR
M2_DIR
G_ENABLE
SPINDLE_PWM2
SPINDLE_ENABLE
SPINDLE_DIR
M2_STEP

2.m1step
3.m2step
4.m3step
5.m1dir
6.m2dir
7.m3dir
8.genable
9.sppwm2
10
11.srpwm
12.spenable
13.spdir

22 M1_ENABLE
23 M1_MS0
24 M1_MS1
25 M2_ENABLE
26 M2_MS0
27 M2_MS1
28 M3_ENABLE
29 M3_MS0
30 M3_MS1
31 M4_STEP
32 M4_DIR
33 M4_ENABLE
34 M4_VREF
35 M4_MS0
36 M4_MS1
37 M5_STEP
38 M5_DIR
39 M5_ENABLE
40 M5_MS0
41 M5_MS1
42 M6_STEP
43 M6_DIR
44 M6_ENABLE
45 M6_MS0
46 M6_MS1
47 Kdebug2
48 NC
49 Kdebug1
50 NC
51 C_MAX
52 NC
53 Ksync

SDA
SCL

Limit switches ABC (in 7-12)
JP1

R13 10k R14 10k R15 10k R16 10k R17 10k R18 10k
+3V3 +3V3 +3V3 +3V3 +3V3 +3V3

A_MIN
A_MAX
B_MIN
B_MAX
C_MIN

SOFT_RESET
FEED_HOLD
CYCLE_START

COOLANT_ON

100n 100n 100n 100n 100n 100n
C7 C8 C9 C10 C11 C12
GND

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To onboard stepper modules

Motor + spindle supply 12-24V
V+
VMOTOR-1
VMOTOR-2 GND

CONFIG1
M1_ENABLE
ENABLE
M0
M1
M2
RESET
SLEEP
M1_STEP STEP
M1_DIR DIR
A4988

ENABLE VMOT
M0 GND1
M1 B2
M2 B1
RESET A1
SLEEP A2
STEP VDD
DIR GND2

V+ GND C13
VMOT
GND1
MOTOR1
+3V3

CONFIG2
M2_ENABLE
A4988
M2_STEP
M2_DIR

CONFIG3
M3_ENABLE
A4988
M3_STEP
M3_DIR

CONFIG4
M4_ENABLE
A4988
M4_STEP
M4_DIR

CONFIG5
M5_ENABLE
A4988
M5_STEP
M5_DIR

CONFIG6
M6_ENABLE
A4988
M6_STEP
M6_DIR
MOTOR6
V+ GND C18

C14 MOTOR2
C15 MOTOR3
C16 MOTOR4
C17 MOTOR5

Direct connection
Laser/Spindle
Spindle+
Spindle-
SPINDLE-1 Spindle+
SPINDLE-2 Spindle-
Max 20A with IRL540N

PWM driver for
spindle/laser
SPINDLE_PWM
R7 10k
Q2 IRF540
V+
GND

Interface
Laser/Spindle
SPINDLE_DIR SPINDLE_INTERFACE-1 Direction
SPINDLE_ENABLE SPINDLE_INTERFACE-2 Enable
SPINDLE_PWM SPINDLE_INTERFACE-3 PWM
SPINDLE_INTERFACE-4 Logic GND
GND
3.3V logic

COOLANT_ON
+5V/1
COOLANT-1
COOLANT-2
R12 10k
Q1 BSS138"
GND
Coolant connection

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