TMC2100 / TMC2130 / TMC2208 are here

TMC (TMC2100 / TMC2130 / TMC2208) family are here!

These famous silent stepper drivers integrate the following advanced features:

- **stealthChop (TMC2130 – TMC2208) / stealthChop2 (TMC2100)**
- **spreadCycle**
- **coolStep (TMC2130)**
- **stallguard (TMC2130)**
- **dcStep-load (TMC2130)**

Features in detail:

Here is the description of each feature

- **StealthChop & Spreadcycle**

StealthChop allows to have silent and performant stepper motors

Stepper motors running at low speed show a phenomenon called magnetostriction producing high pitch audible frequencies.

The driver is regulating the voltage modulation of the motor in order to minimize current fluctuations. The resulted noise level is around 10dB(A) which is lower than standard modes.

The **Stealthchop** performances are described in details here: Pdf available here

Torque Comparison between **StealthChop** vs **Spreadcycle**

(disponible en pdf ici)

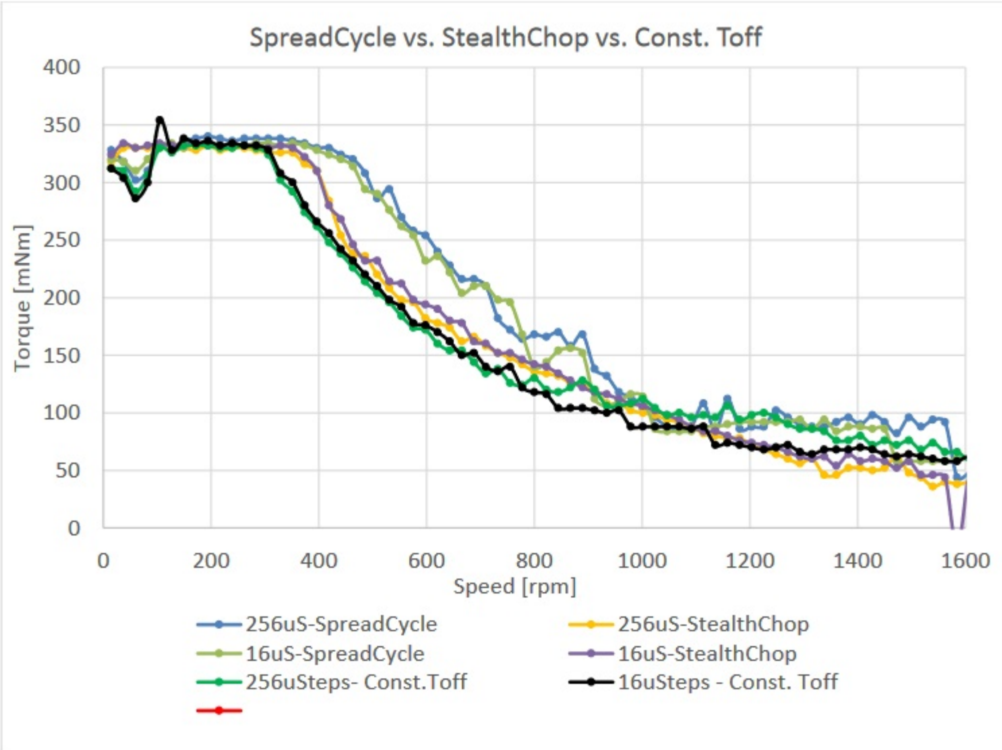


Figure 8: Combined torque/speed chart with comparison of three chopper modes @ 16 and 256 µSteps and the original manufacturers pull out torque curve @ 24V and half stepping.

Comparison chart between both modes SpreadCycle Vs Stealthchop

Here is a summary chart showing you which mode is better suited for your application

–**For low speeds** and **average acceleration**: use mode **Stealthchop**

–**For average/fast speeds** and **accelerations** : prefer mode **SpreadCycle**

Feature	stealthChop	spreadCycle
Motor noise	Low, mainly ball bearings	Some chopper noise audible depending on layout quality and motor / supply voltage selection and chopper settings
Motor vibration	Extremely low at low and medium velocity, dampening required at higher velocity (belt drive, flywheel mass)	Low with good microstep resolution
Torque	Full torque, unless automatic current regulation cannot follow in high acceleration phase	Full torque at all velocities
Motor power dissipation	Low, due to reduced current ripple	Normal, can be reduced by coolStep
High acceleration and deceleration	Limited by regulation parameters for automatic scaling, no special limit with feed forward scaling	No special limit
Low velocity performance	Extremely smooth, even with motors not optimum for microstepping	Smooth
High velocity performance	Depending on motor and load situation – flywheel mass or dampening by load is required	Very good
coolStep	Automatic load dependent current in high velocity range	Using stallGuard in medium velocity range
stallGuard	No, but load can be estimated from PWM duty cycle (*PWM_STATUS*) at medium and high velocity	Yes, in medium velocity range
Current regulation	Automatic, slower using PI regulator, or feed forward using input pulse width. Lower current limit determined by motor resistance and supply voltage in automatic scaling mode	Direct cycle-by-cycle, can regulate high and low currents and reacts as fast as possible

SpreadCycle & Stealthchop. Pros and cons

here is the official video about **Stealthchop** and **SpreadCycle**

- **Stallguard2 & Coolstep**

– full documentation of **StallGuard2** & **Coolstep** [available here]

Stallguard2 Allows to senselessly measure with high precision the load resistance using back EMF feedbacks inside the motor coils.

In order to get reliable measurements, the stepper motor must work in micro stepping mode.

Coolstep adapts the current inside the coils based on the load on the motor shaft measured **Stallguard2** . The energy consumption can be reduced by 75%. Heat dissipation is also greatly impacted.

Here is another official video showing **Stallguard** and **Coolstep** modes

About **Coolstep**:

- **DcStep** ([documentation here](#))

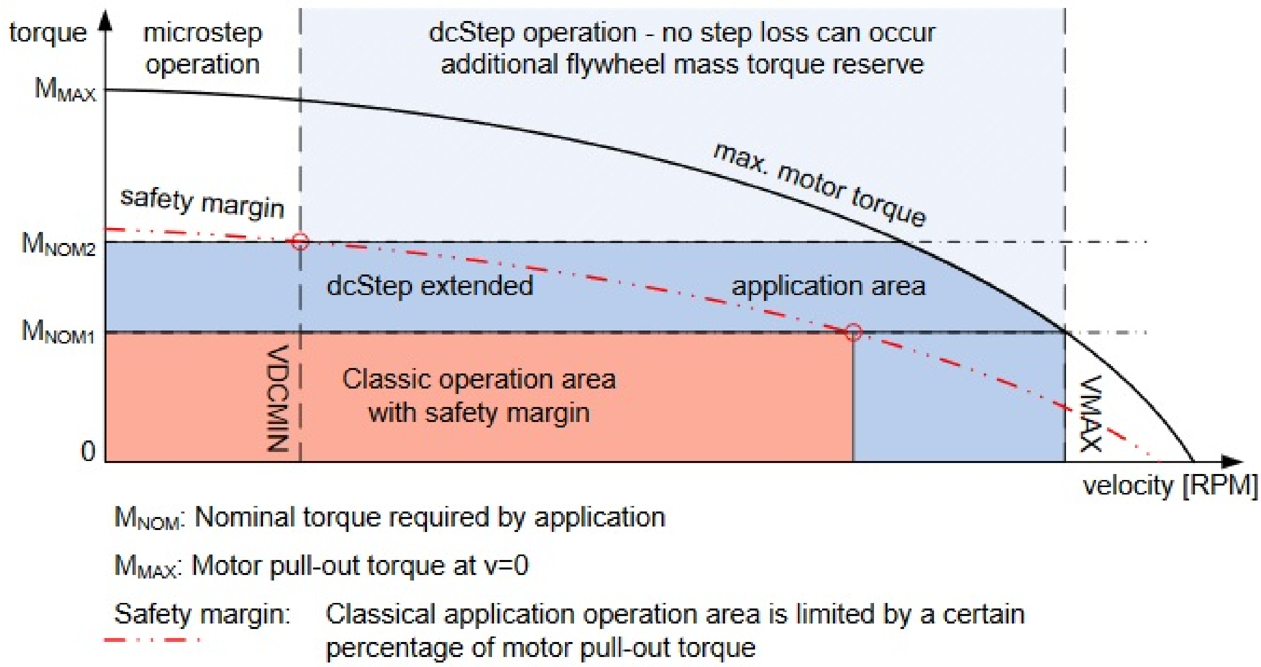
When an open loop driver is about to loose a step feature **DcStep** will reduce the motor speed in order to adapt to the load. **DcStep** maintains the motor position and step count.

A working range is needed in order to make sure the feature is functioning properly so that the motor torque and speed are maintained in a reasonable range.

With this feature, the stepper motor is acting as a DC motor in terme of energy efficiency.Meaning that the speed is reduced if the load is too high in order to increase motor's torque.This allows to keep the motor position and step counts.

This mode is used in average or high speed ranges

Here is a graphic showing the working range of **DcStep**



Plage d'application du mode DcStep des drivers TMC

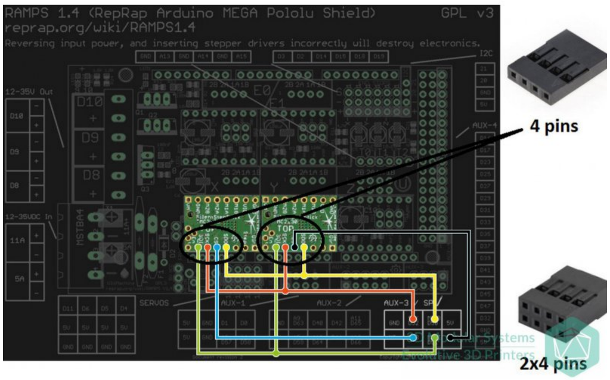
SPI cable for [TMC2130](#)

This cable is compatible with Ramps 1.4 / MKS GEN 1.4 / MKS

GEN-L and is [available here]

It allows to connect 2 [TMC2130] drivers to the SPI port (often used for X/Y axis).

it’s connected to the AUX-3 of the Ramps 1.4 board



Special Note about the SPI cable:

With **Ramps 1.4** Using this as is requires that you don’t use any LCD screen as the SPI channel will be used / link with the LCD screen. You can still use this port + LCD screen if you somehow manage to attach the wire on top of the LCD connector bread board.

If you are using **MKS GEN boards**, you will have a separate sets of pins available and you will be able to use LCD screen without soldering.

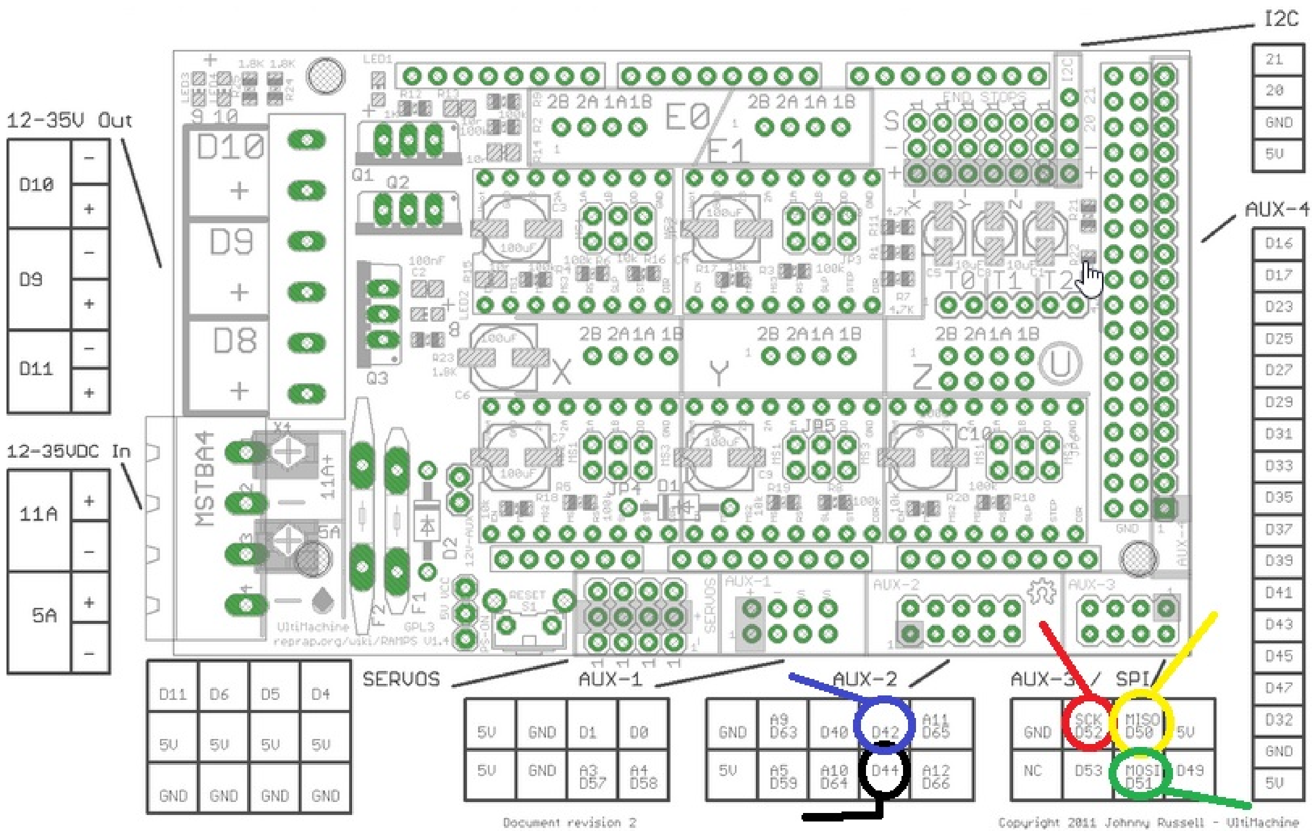
Note however that pin **D49** (**black wire**) is **used for the SD card detect pin** so it will be already in use when you will configure your Y axis driver!

Also note that pin **D53** (**Blue wire**) is **used for the SD card Init pin** so it will be already in use when you will configure your X axis driver!

The **workaround** is to **remove the black wire** from the 2×4 pins connector and **connect** it to pin **D44** on the **AUX-2 .**

Same for for the **blue wire**, connect it to **D42** on the **Aux-2**

Tip with the Dupont housing: With the TMC2100 drivers you should already have a 4 pins cable with separate pins. You can remove 1 single pin black dupont connector housing and use it on the black wire you have just rewired.



On marlin side you just have to reroute the **D49** pin to **D44** and

D53 into pin **D42**

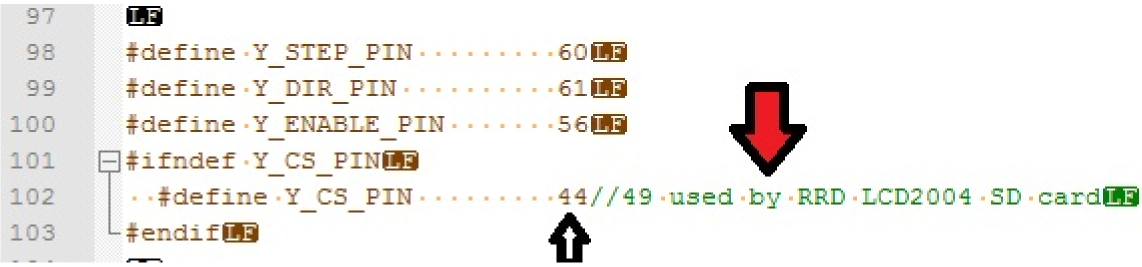
Go into ***pins_RAMPS.h*** around

change

#define Y_CS_PIN 49

by

#define Y_CS_PIN 44



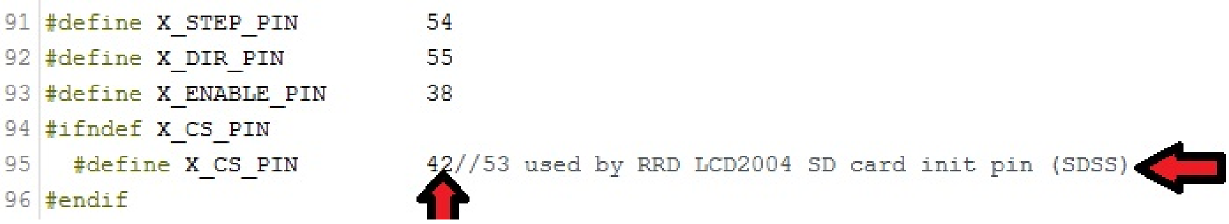
```
#define Y_STEP_PIN         60
#define Y_DIR_PIN          61
#define Y_ENABLE_PIN       56
#ifndef Y_CS_PIN
  #define Y_CS_PIN         44//49 used by RRD LCD2004 SD card
#endif
```

Also change

#define X_CS_PIN 53

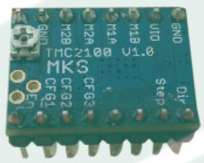
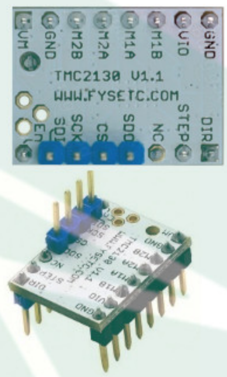
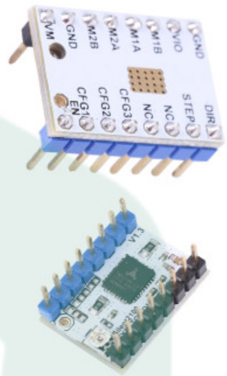
by

#define X_CS_PIN 42



```
#define X_STEP_PIN         54
#define X_DIR_PIN          55
#define X_ENABLE_PIN       38
#ifndef X_CS_PIN
  #define X_CS_PIN         42//53 used by RRD LCD2004 SD card init pin (SDSS)
#endif
```

TMC Comparison chart

Trinamic Model	TMC **2100**	TMC **2130**	TMC **2208**
			
Interface	Step / Dir	**SPI**	Step / Dir
Configuration	CFG Pins	**SPI**	CFG Pins / **UART**
Native MicroSteps	Up to 1/16	Up to 1/256	Up to 1/16
Interpolated MicroSteps	1/256	1/256	1/256
(VIO) Control voltage	5V	3-5V	3-5V
(VM) Voltage Motor	4.75 -> 46V	5.5 -> 46V	5.5 -> 36V
Motor Phase Current	**1.2A** RMS / 2.5A Peak	**1.2A** RMS / 2.5A Peak	**1.2A** RMS / 2.5A Peak
RDSon	>= 0.5 Ohm	>= 0.5 Ohm	<= 0.3 Ohm
Internal Voltage Regulator	No	**yes**	**yes**
Quite mode (StealthChop)	**yes**	**yes**	**yes**
CoolStep	No	**yes**	No
StallGuard	No	**yes**	No
DcStep	No	**yes**	No