
Manual for SmInterfaceEncoder

Description of application note

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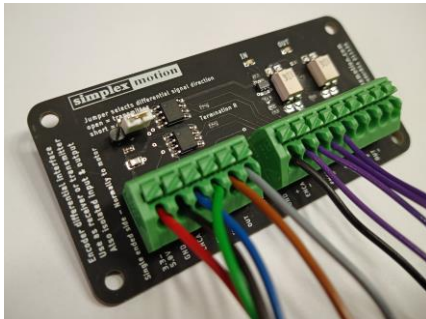
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1 Overview

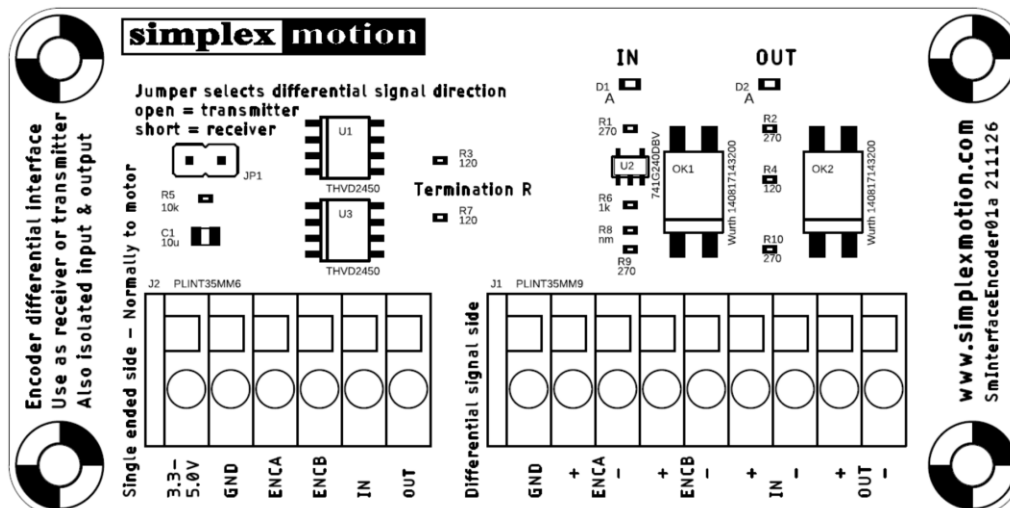
Simplex Motion produces integrated servo motors. These motors can be controlled using a quadrature encoder input signal, such for example when synchronizing several motors for identical motion. To enhance robustness for such signals it is common to use differential signaling. This document describes an accessory to the Simplex Motion range of motor products to allow control using differential signals.

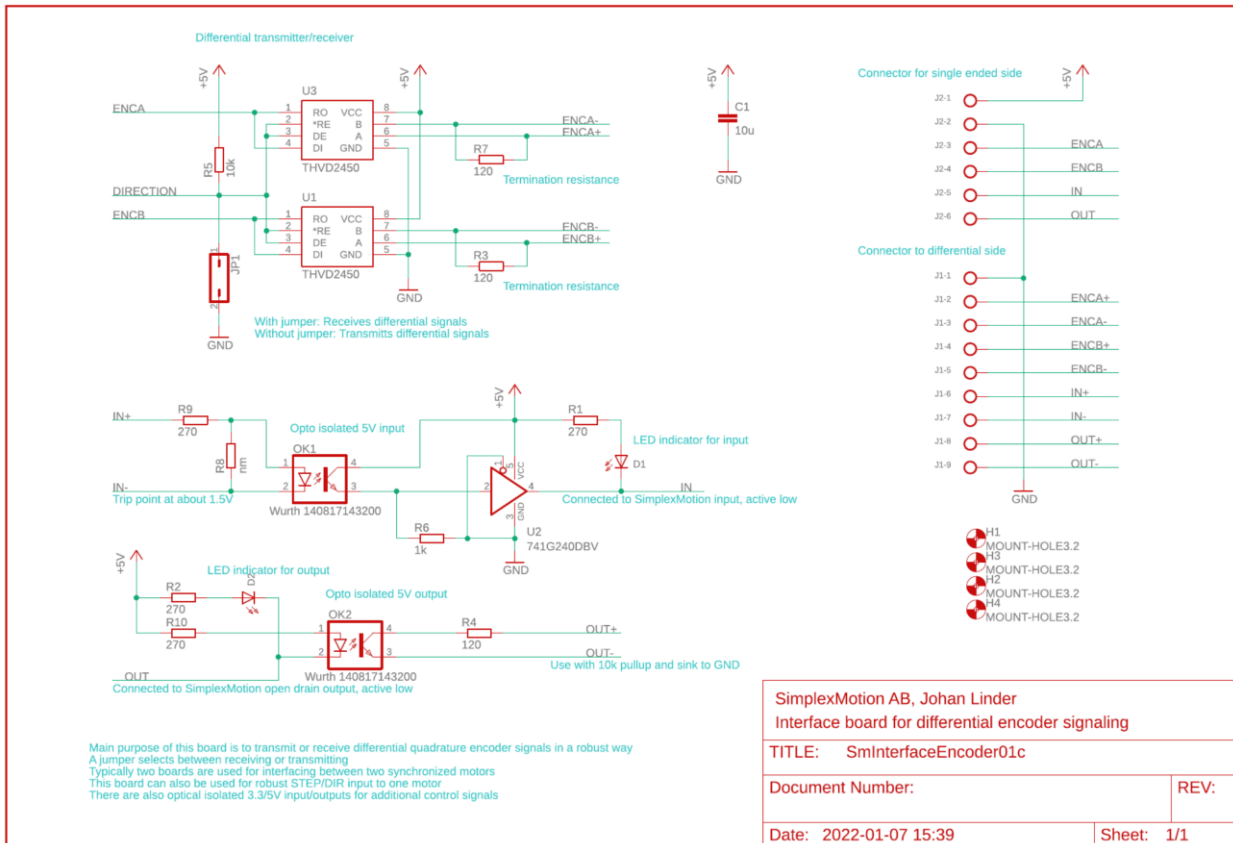
2 Description

The SmInterfaceEncoder circuit board is a simple accessory that converts between single ended and differential signals. The benefit of using differential signaling is that it does not directly rely on the ground level for signal interpretation, instead it uses two differential signal lines that are compared to each other. This greatly reduces the effects of external noise and ground bouncing, issues that are common in installations with motors and power electronics.



The interface board utilizes RS485 driver chips to transmit or receive differential signals. There is a jumper on the board to select if the board should act as a transmitter or receiver. If the jumper is in place the board will receive differential signals and transmit single ended signals.





Apart from the encoder signals there are also one optically isolated input and one optically isolated output. These are provided to allow control signals such as ENABLE, ERROR or similar functions. There are LED indicators that shows active signal state.

2.1 Isolated input

The input is intended to be driven by a voltage applied to IN+ and IN-. A voltage greater than 2.0V will represent an active input, while a voltage less than 1.0V will be a passive input. The signal IN should be connected to any of the inputs IN1-4 on the SimplexMotion motor terminal and is active low, utilizing the default pull-up resistor configuration of the motor.

2.2 Isolated output

The isolated output provides an output current on the OUT+/- connections that can be used with an external pull-up resistor of 10kOhm. Typically the output voltage is on OUT+ with a pull-up resistor to the target system selected voltage to use (Max 30V), and the OUT- connection connected to GND.

The OUT signal should be connected to any of the OUT1-4 connections on the motor terminal. Both input and output are active low with this configuration. But the output can also be configured for active high with the OUT- terminal as the output with a pull-down resistor to GND, and OUT+ connected to the target supply voltage.

3 Connections

Below are the connection points of the circuit board.

Connector for single ended side – Typically connected to a Simplex Motion motor

Pin	Signal	
1	3.3/5V	Handle both 3.3V and 5V from motor.

2	GND	GND of the motor.
3	ENCA	Encoder signal A.
4	ENCB	Encoder signal B.
5	IN	Input to the motor, active low.
6	OUT	Output from the motor, active low.

Connector to other side, encoder

Pin	Signal	
1	GND	GND reference.
2	A+	Differential encoder signal A, positive.
3	A-	Differential encoder signal A, negative.
4	B+	Differential encoder signal B, positive.
5	B-	Differential encoder signal B, negative.
6	IN+	Differential and isolated input, positive.
7	IN-	Differential and isolated input, negative.
8	OUT+	Differential and isolated output, positive.
9	OUT-	Differential and isolated output, negative.

4 Typical use

There are several typical applications that will benefit from this accessory; the most apparent ones are described below.

4.1 External encoder

When a motor should follow motion from another mechanical system it is possible to use a quadrature encoder signal and let the encoder signals control the motor. For noisy environments and/or long cables it is recommended to use differential signals, and this is often available directly from the encoder unit.

In this case the SmInterfaceEncoder board is connected in between the encoder and the motor, and should be placed close to the motor. The board will convert the differential signals to the single ended ones required by the motor inputs.

The jumper should be placed on the JP1 terminal to configure the board for reception of differential signals.

4.2 STEP/DIR control from motion controller

Typically in CNC applications it is common to use a motion control systems and control the X/Y/Z axis motors by STEP/DIR signals. For excellent robustness some motion controllers allow differential STEP and DIR signals. These signals should be routed to the motor and the SmInterfaceEncoder board located close to the motor converts the signals to single ended format. The Isolated IN/OUT signals can be used for ENABLE and ERROR signals.

Synchronized motors

In applications when it is needed to have several motors moving exactly the same it is possible to connect them together using quadrature encoder signals.

One motor is the master, being controlled by some external system. This motor should be configured for encoder output, and will produce encoder signals according to its motion.

The other motors (slaves) receive these encoder signals and use them for motion control.

If all motors are located closely with short cables and very good ground connections this is usually possible with direct connection between the motors.

But in many applications there are long cables and high currents that cause ground levels to vary between the motors. In these cases it is recommended to use differential signaling, and the SmInterfaceEncoder board should be used.

Each motor needs one SmInterfaceBoard. The master board should have the jumper removed, while the slave motors should have the jumper mounted.

