Serial Interface Dual 8-Channel Relay, LED, Stepper Driver

Tests performed:

1. **Basic outputs ON/OFF control and states read back**
   - Fig 1, Send 0x55 (#1) and 0xAA (#2) to two DRV8860s in daisy chain connection.
   - Fig 2, Read back outputs states of device #1 and #2.
   - Fig 3, Example of read back OCP fault (Set outputs ON first).
2. **Relay driving example with energizing time and PWM control**
   - Fig 4, Send output data to turn on OUT4 of #1 with a 12V relay connected.
   - Fig 5, Send control register for 30ms energizing time followed by 75% duty PWM at all outputs.
   - Fig 6, Shows the OUT4 output with 30ms energizing and 75% PWM. (Control register: 0xE6)
   - Fig 7, Zoom in on the PWM duty of Fig 6.
   - Fig 8, OUT4 output with 30ms energizing time followed by 50% PWM duty. (Control register: 0xC6)
   - Fig 9, Delay between the rising edge of LATCH and outputs updated.
   - Fig 10, Delay between ENABLE and outputs ON.
3. **PWM output duty test**
   - Fig 11, Output voltage – set to 12.5% PWM duty (12.5kHz).
   - Fig 12, Output voltage – set to 25% PWM duty (25kHz).
   - Fig 13, Output voltage – set to 37.5% PWM duty (50kHz).
   - Fig 14, Output voltage – set to 50% PWM duty (50kHz).
   - Fig 15, Output voltage – set to 62.5% PWM duty (50kHz).
   - Fig 16, Output voltage – set to 75% PWM duty (50kHz).
   - Fig 17, Output voltage – set to 87.5% PWM duty (50kHz).
4. **Unipolar stepper driving pattern test**
   - Fig 18, Full step commutation output pattern without motor connected.
   - Fig 19, Half step commutation output pattern without motor connected.
   - Fig 20, Full step commutation output pattern with stepper connected
   - Fig 21, Half step commutation output pattern with stepper connected

Section 1: Basic outputs ON/OFF control and states read back

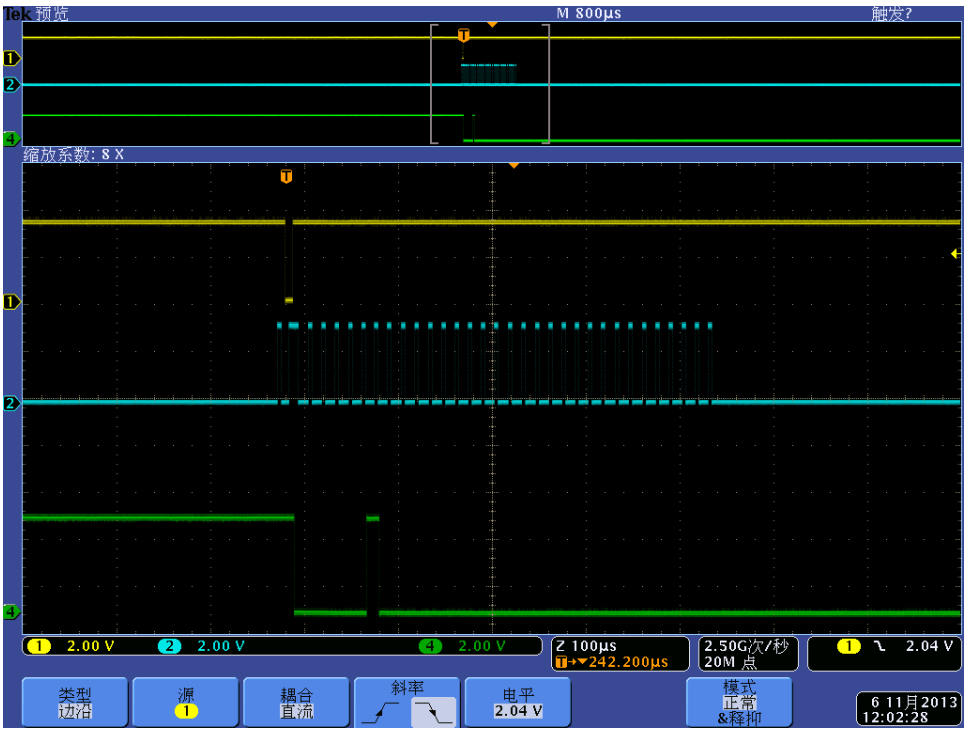
(Yellow: LATCH; Blue: CLK; Purple: DIN)

Fig 1, Send 0x55 (#1) and 0xAA (#2) to two DRV8860s in daisy chain connection.

(Yellow: LATCH; Blue: CLK; Green: DOUT2)

Fig 2, Read back outputs states of device #1 and #2.

OUT3 of #2 is short to VM on purpose. Sent output data to turning on OUT3 of #2 first. Then, OCP tripped at OUT3 #2. F11 (OUT3 OCP) of #2 is set to “1”. The fault data is clocked out at the falling edge of CLK signal.



(Yellow: LATCH; Blue: CLK; Green: DOUT2)

Fig 3, Example of read back OCP fault (Set outputs ON first).

Section 2: Relay driving example with energizing time and PWM control

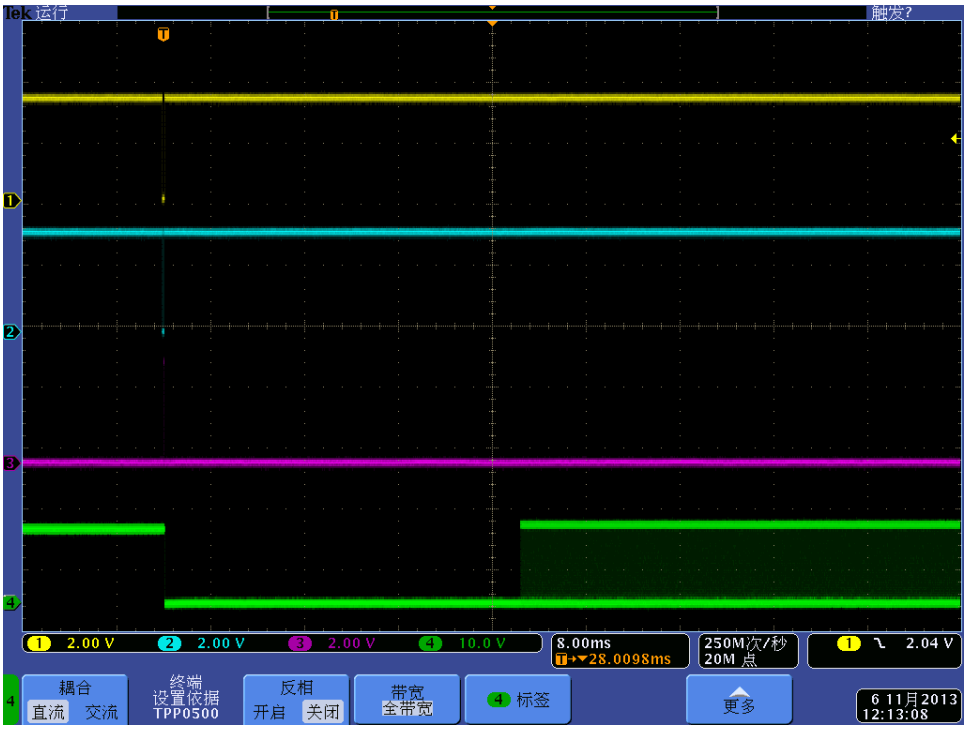
VM = 12V. A 12V relay is connected between OUT4 of #1 and VM.

(Yellow: LATCH; Blue: CLK; Purple: DIN; Green: OUT4 of #1)

Fig 4, Send output data to turn on OUT4 of #1 with a 12V relay connected

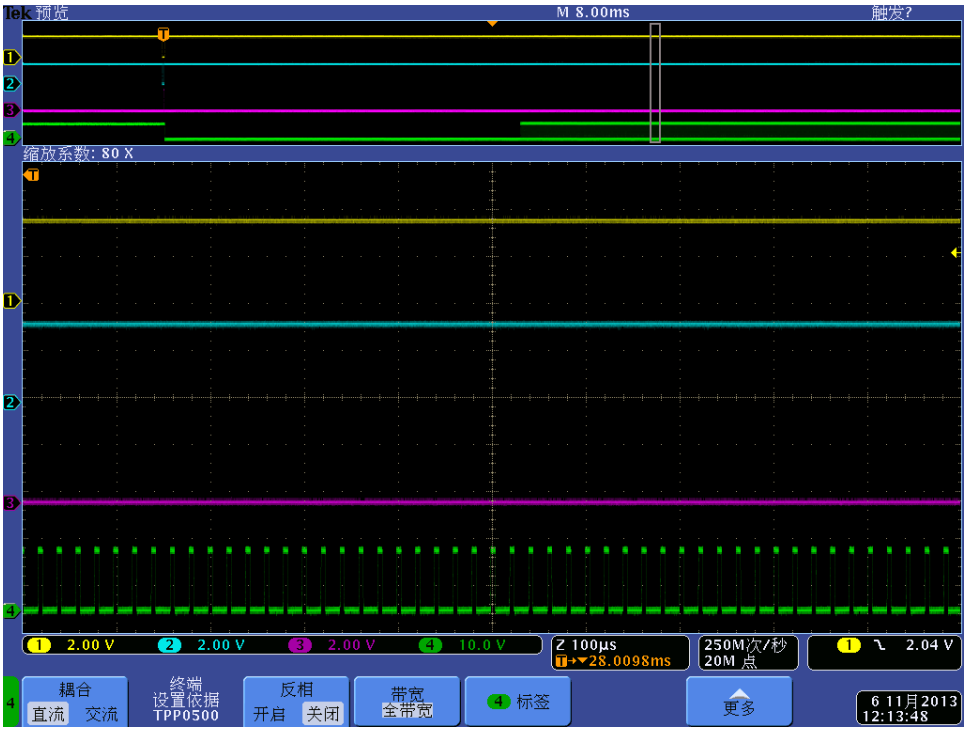
(Yellow: LATCH; Blue: CLK; Purple: DIN)

Fig 5, Send control register for 30ms energizing time followed by 75% duty



(Yellow: LATCH; Blue: CLK; Purple: DIN; Green: OUT4 of #1)

Fig 6, Shows the OUT4 output with 30ms energizing and 75% PWM. (Control register: 0xE6)

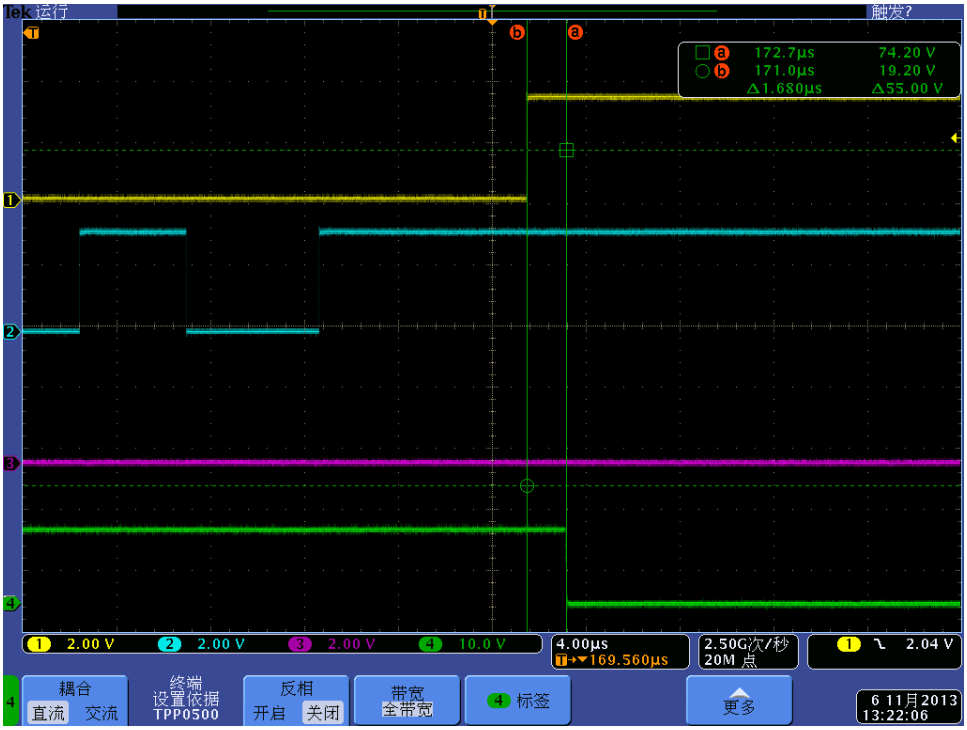


(Yellow: LATCH; Blue: CLK; Purple: DIN; Green: OUT4 of #1)

Fig 7, Zoom in on the PWM duty of Fig 6

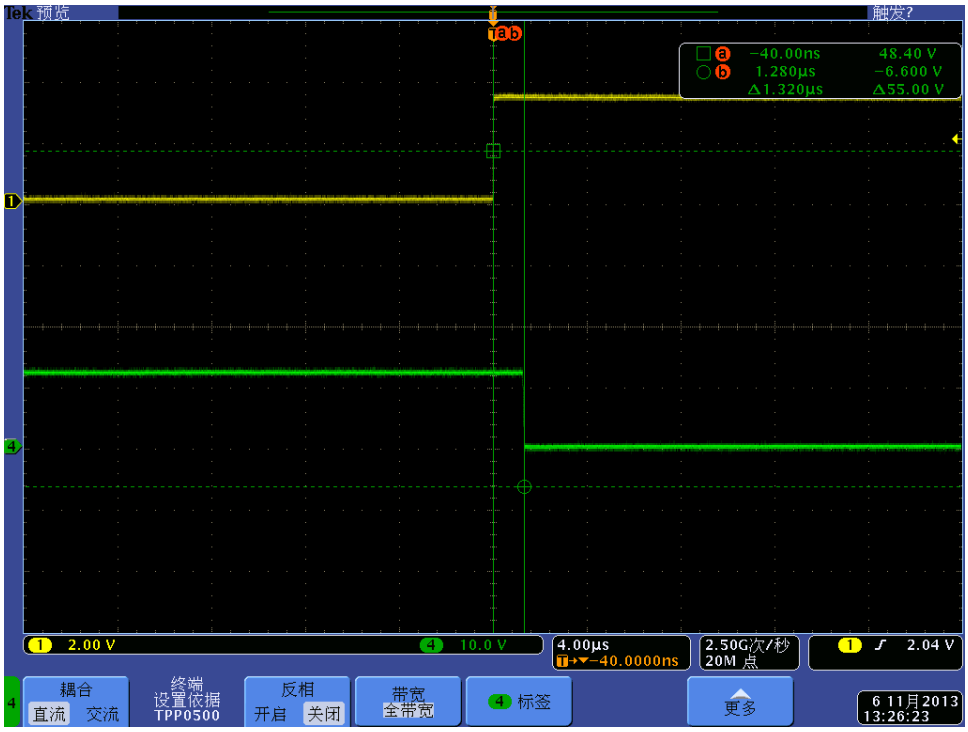
(Yellow: LATCH; Blue: CLK; Purple: DIN; Green: OUT4 of #1)

Fig 8, OUT4 output with 30ms energizing time followed by 50% PWM duty. (Control register: 0xC6)



(Yellow: LATCH; Blue: CLK; Purple: DIN; Green: OUT4 of #1)

Fig 9, Delay between the rising edge of LATCH and outputs updated



(Yellow: ENABLE; Green: OUT4 of #1)

Fig 10, Delay between ENABLE and outputs ON

Section 3: PWM output duty test

VM = 15V; On board LED load

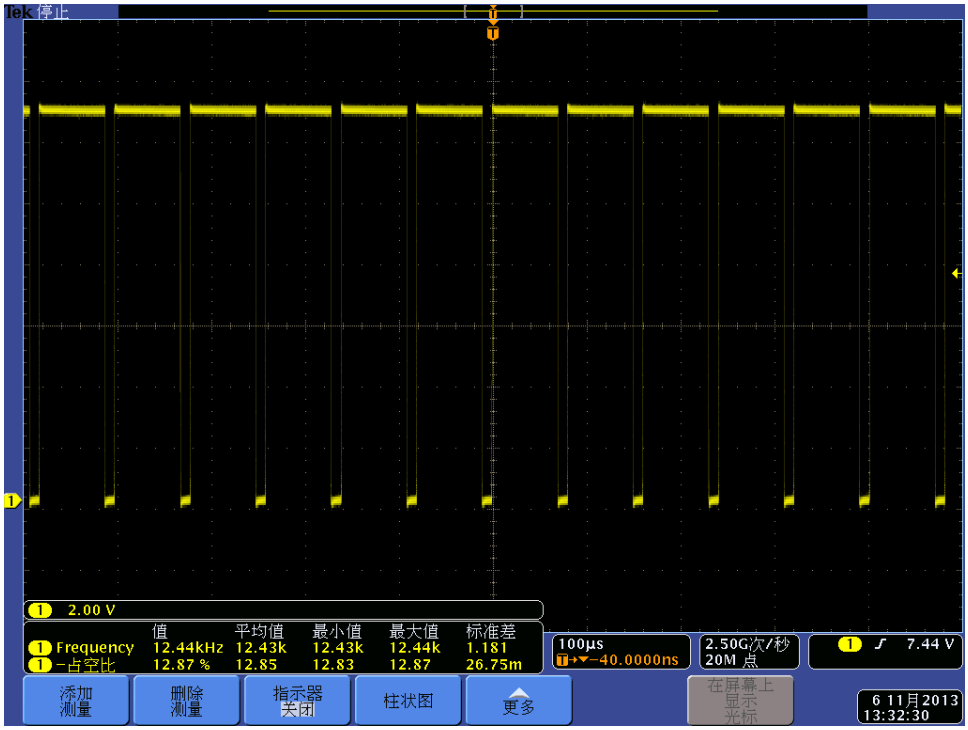


Fig 11, Output voltage – set to 12.5% PWM duty (12.5kHz)

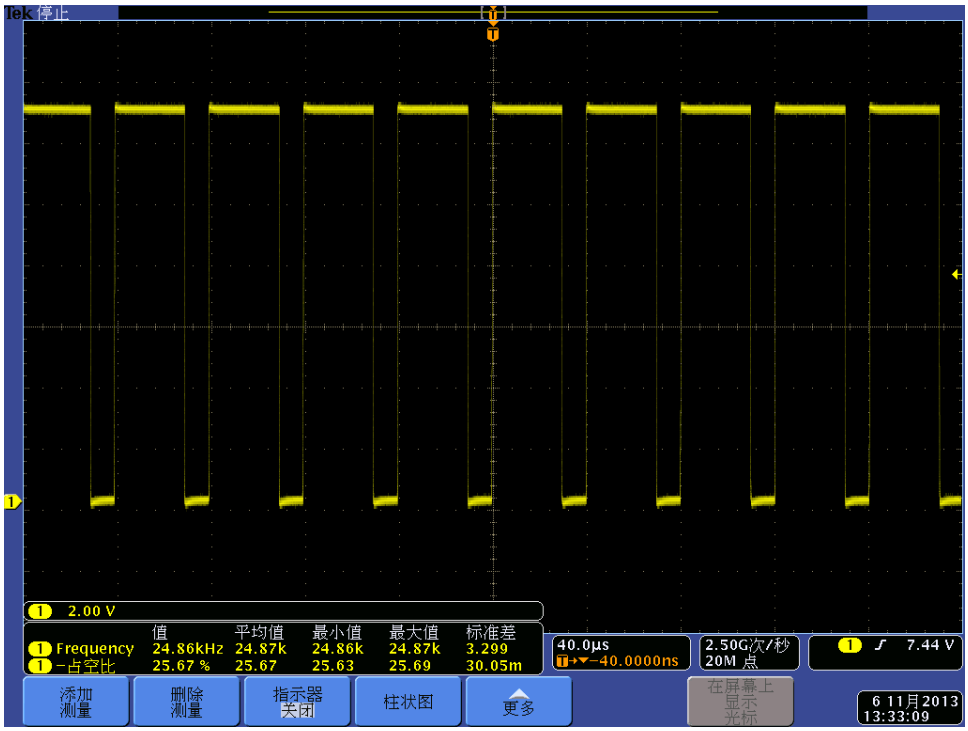


Fig 12, Output voltage – set to 25% PWM duty (25kHz)

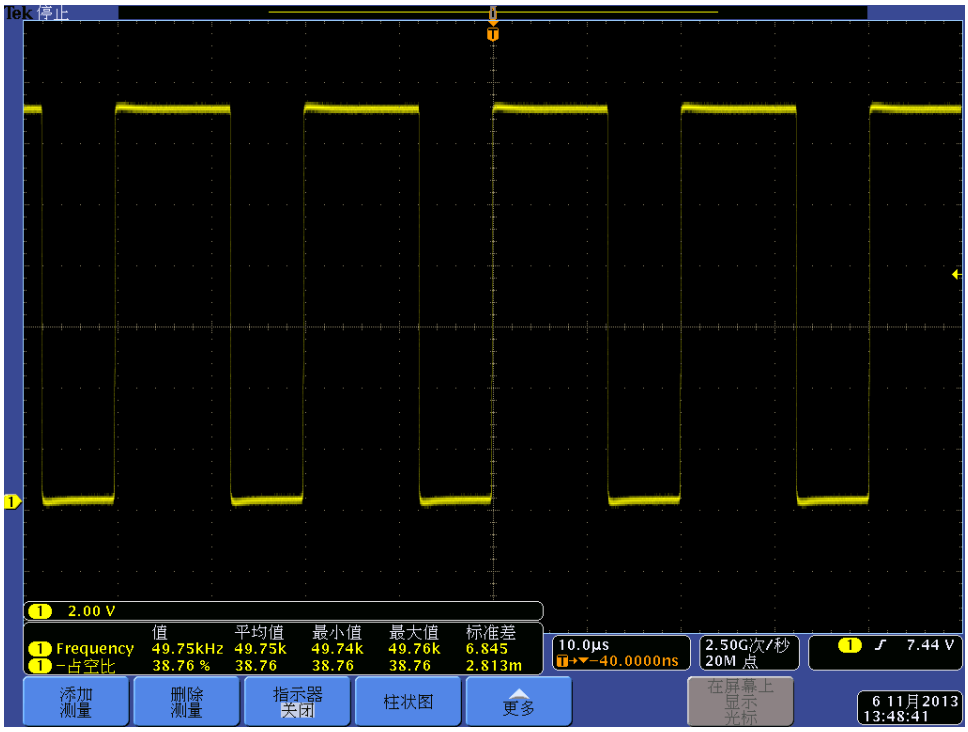


Fig 13, Output voltage – set to 37.5% PWM duty (50kHz)

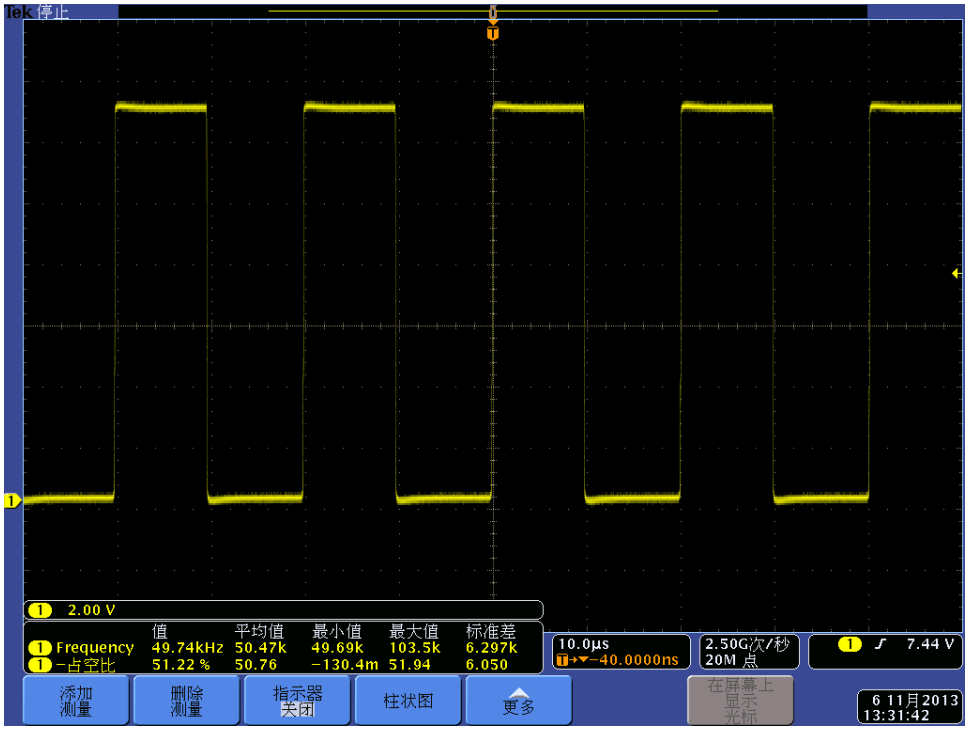


Fig 14, Output voltage – set to 50% PWM duty (50kHz)

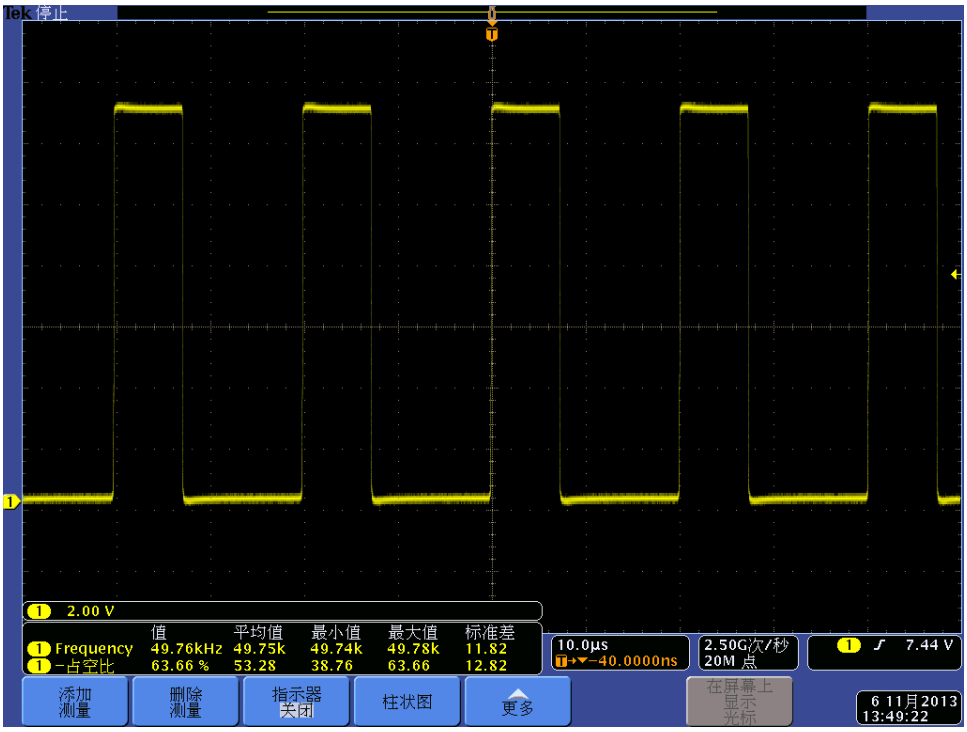


Fig 15, Output voltage – set to 62.5% PWM duty (50kHz)

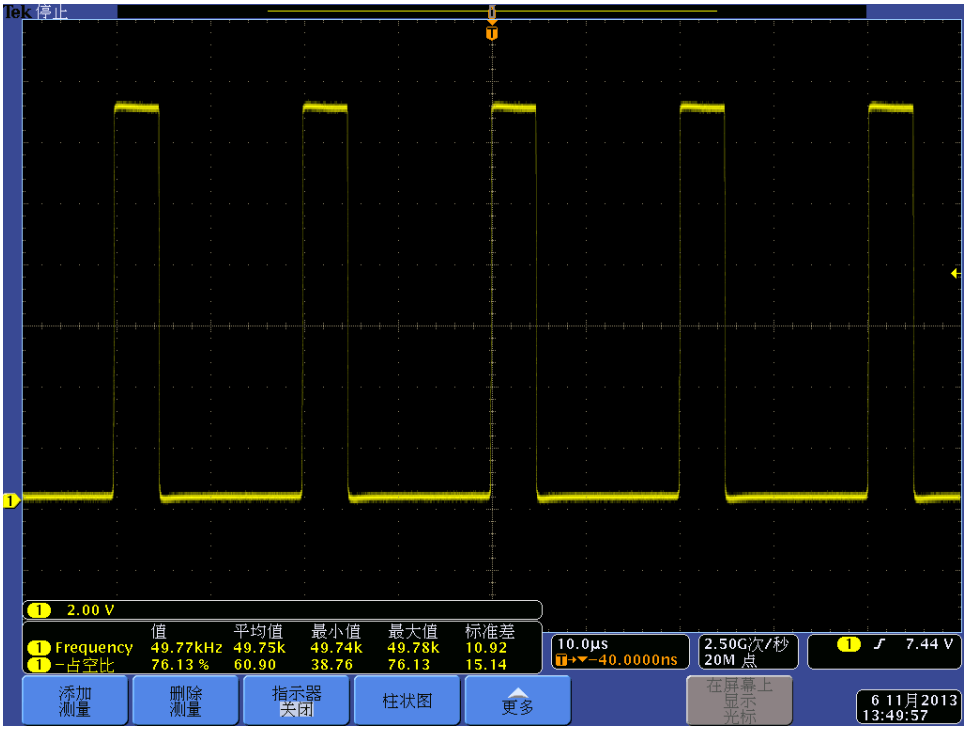


Fig 16, Output voltage – set to 75% PWM duty (50kHz)

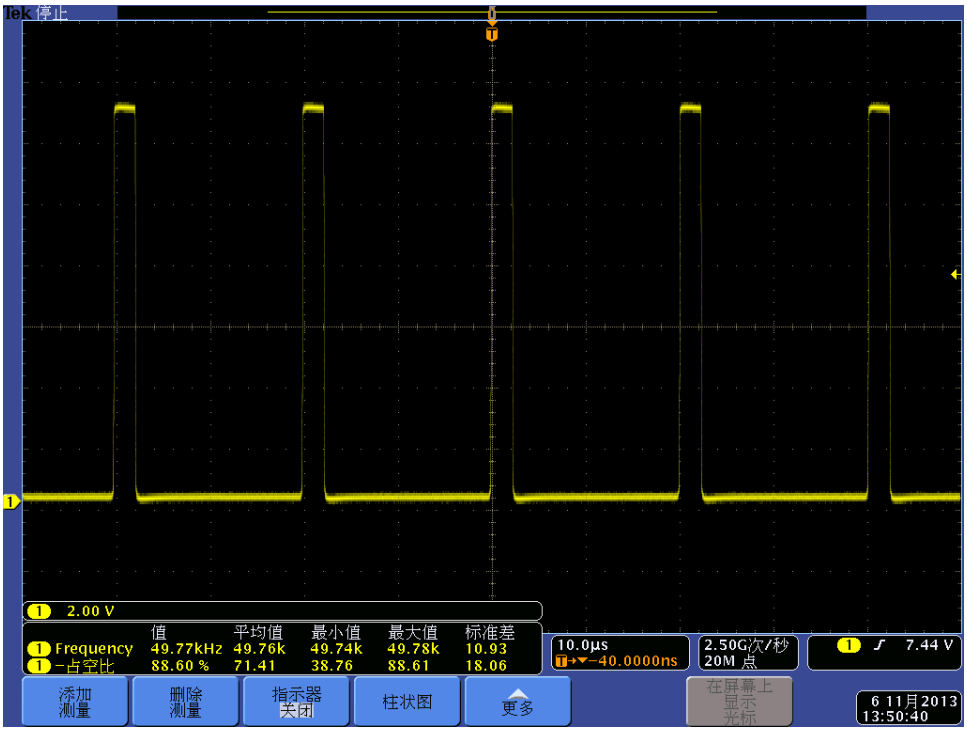
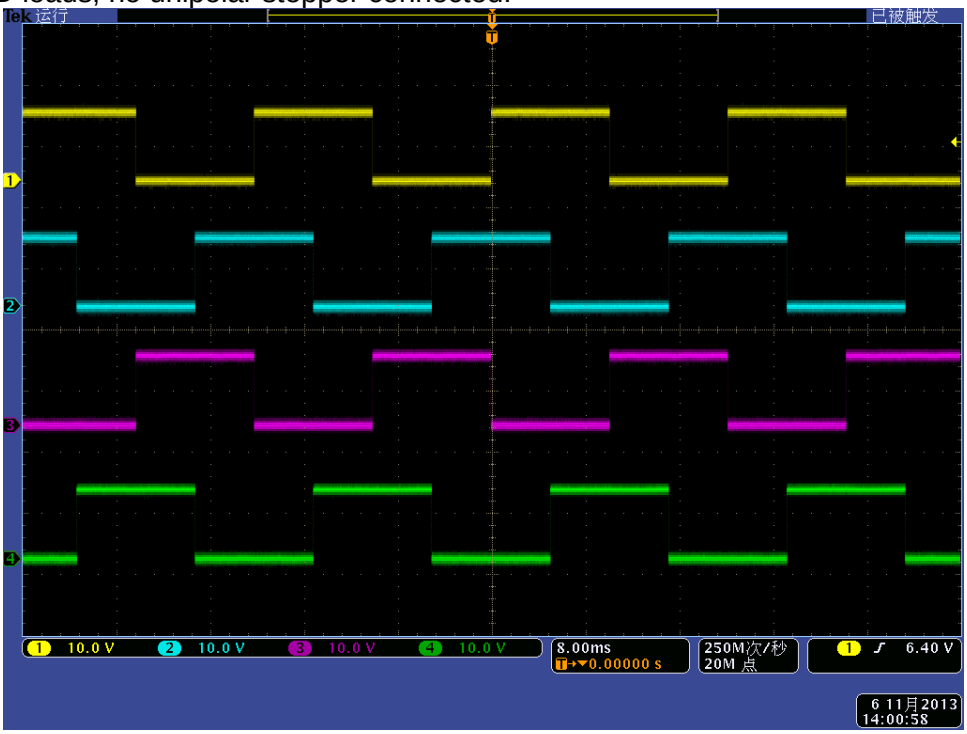


Fig 17, Output voltage – set to 87.5% PWM duty (50kHz)

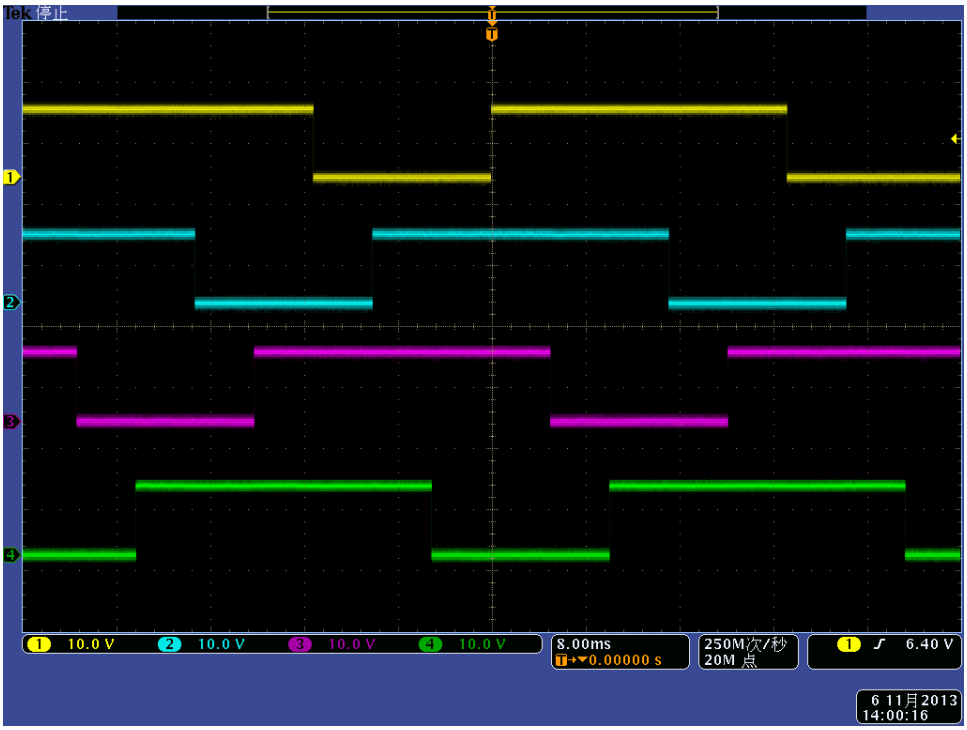
Section 4: Unipolar stepper driving pattern test

VM = 12V; LED loads, no unipolar stepper connected.



(Yellow: OUT1 #1; Blue: OUT2 #1; Purple: OUT3 #1; Green: OUT4 of #1)

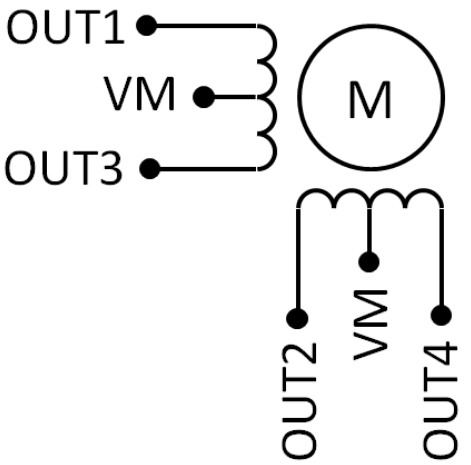
Fig 18, Full step commutation output pattern without motor connected



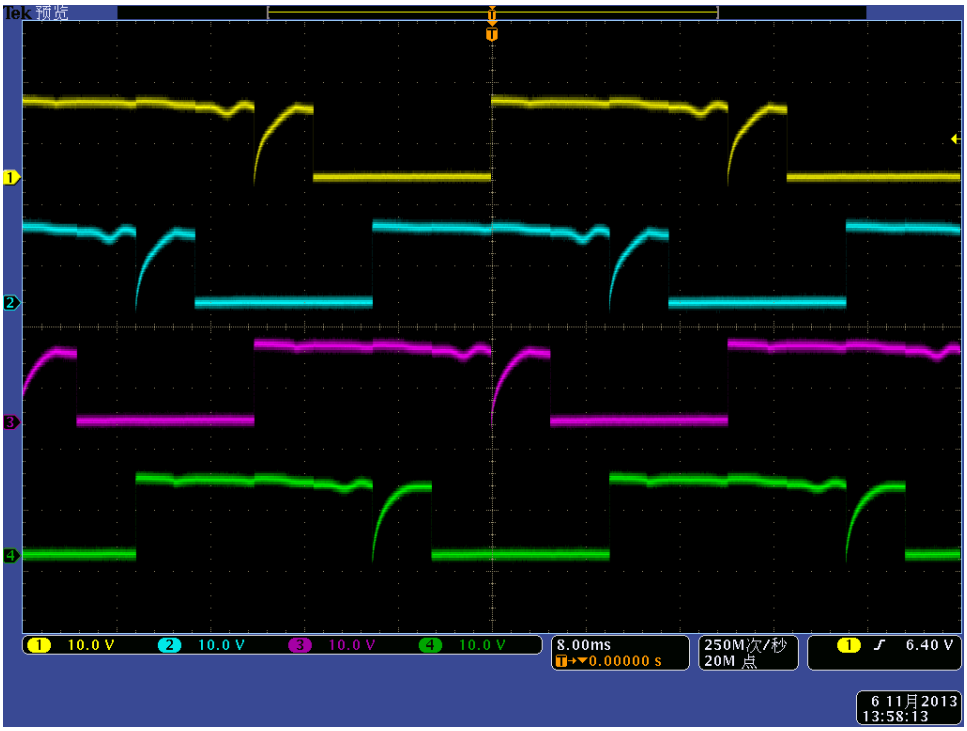
(Yellow: OUT1 #1; Blue: OUT2 #1; Purple: OUT3 #1; Green: OUT4 of #1)

Fig 19, Half step commutation output pattern without motor connected

Fig 20 and Fig 21 show the output voltage pattern with a unipolar stepper connected as following picture. VM = 12V; Phase resistor (OUTx to VM): 75 ohm; Phase inductance (OUTx to VM): 42mH@1kHz.



(Yellow: OUT1 #1; Blue: OUT2 #1; Purple: OUT3 #1; Green: OUT4 of #1)
Fig 20, Full step commutation output pattern with stepper connected



(Yellow: OUT1 #1; Blue: OUT2 #1; Purple: OUT3 #1; Green: OUT4 of #1)

Fig 21, Half step commutation output pattern with stepper connected

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