Instruction Manual for the “M-DrAGON” LV8714TAGEVK

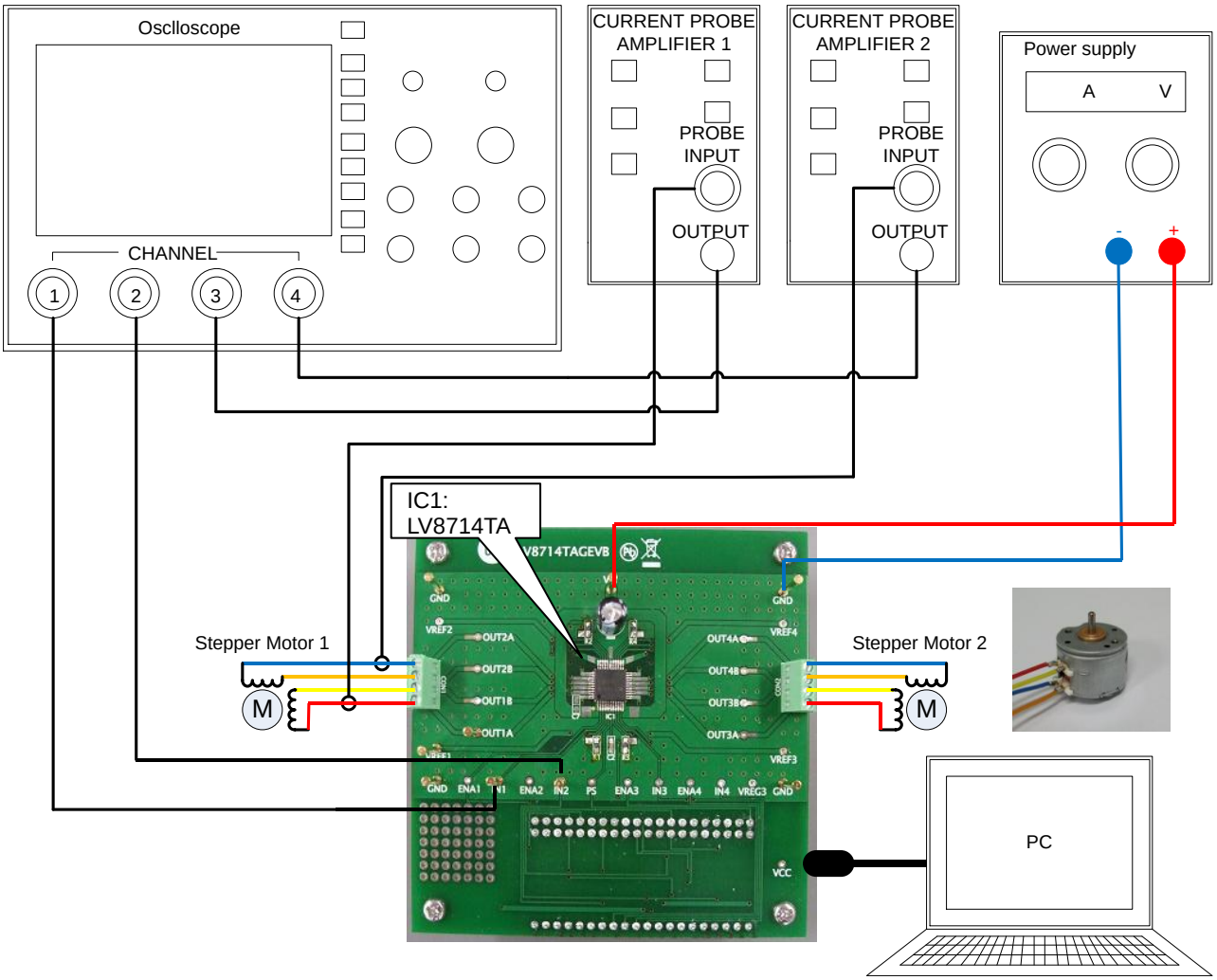
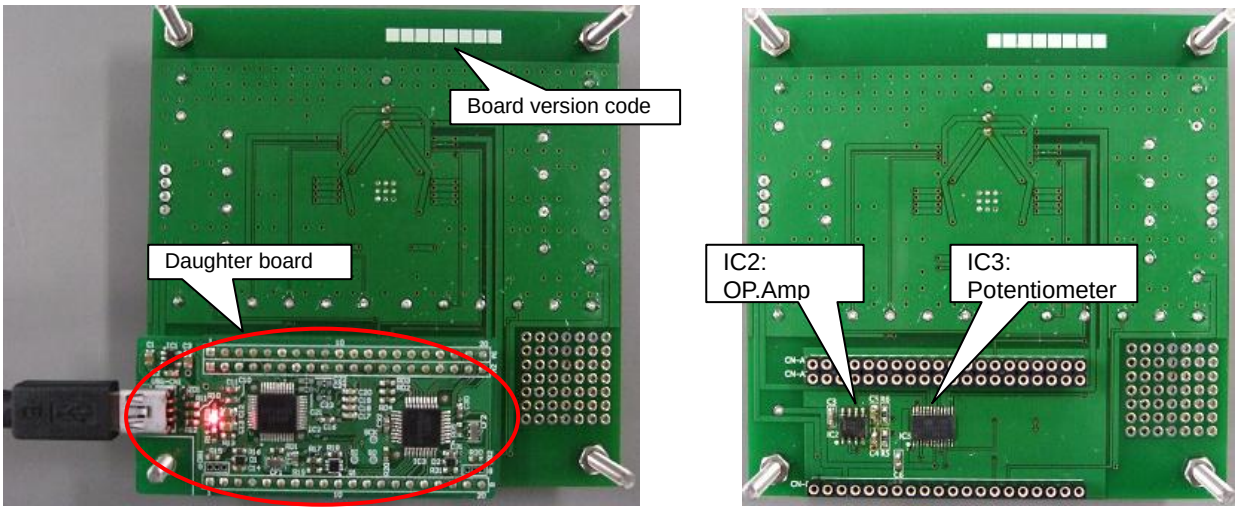


Figure 1. Setup for motor control



With the Daughter Board plugged into USB

Without the Daughter Board

Figure 2. Bottom view of the Evaluation Board

Table1: Reference Equipment

Equipment	Specifications
DC Power supply	30V-3.0A
Oscilloscope	4 channel
Reference Stepper Motor	MSCA020A55*2(Winding Res: 15±1.5Ω) / Nidec Sankyo Corporation
Current probe	
LV8714TAGEVB Evaluation Board	
MOTOR DRIVER DAUGHTER BOARD	
USB Type A to Type mini-B cable	
PC with M-DrAGON*1 GUI installed	32bit: Windows 7 /8 64bit: Windows 7

*1: It means "Motor- Driver And GUI produced by ON semiconductor".

*2: In case of using the stepper motor "MSCA020A55".
When you continuously energized the 200mA at 25°C ambient temperature, temperature of the motor windings will be 25 + 84.4 = 109.4°C. Because the guaranteed temperature of the motor windings is 115°C, upper limit of the allowable current is 200mA.
In case of the other motor, please refer to the specification of it.

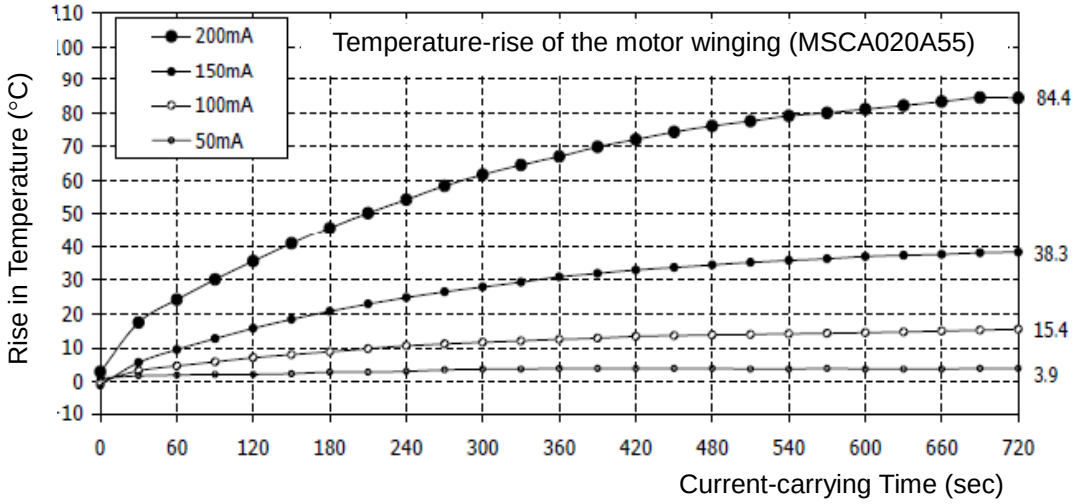


Figure 3. Temperature-rise characteristic of the motor winding

Allowable Operating Ratings

Motor supply voltage (VM1/2/3/4): 4.0 to 16.5V
Reference voltage for constant current (VREF1/2/3/4): 0 to 1.5V

Detection current setting method
Based on the voltage input to the VREF pin and the resistance between RCS and GND.
The output current is set using the following calculation formula:

Iout(A) = (VREF/3)/RCS×4000 ("3" and "4000" are the fixed compression rate of the IC.)

e.g. VREF = 0.23V, RCS = 1500Ω
Iout(A) = (0.23V/3)/1500Ω×4000 = 0.204 (A)

Operation Procedure

- Connect the peripheral equipment as shown Figure 1.
- Connect the motor wires to the screw socket like below.

  Red: OUT1(3)A
  Yellow: OUT1(3)B
  Blue: OUT2(4)A
  Orange: OUT2(4)B

- It is important to follow the order shown for starting the system:
  1. Plug the USB cable into the Daughter Board.
  2. Start up the GUI for LV8714TA.
  3. Apply input voltage to the terminal “VM”=12V.
  4. Apply drive signals with GUI.

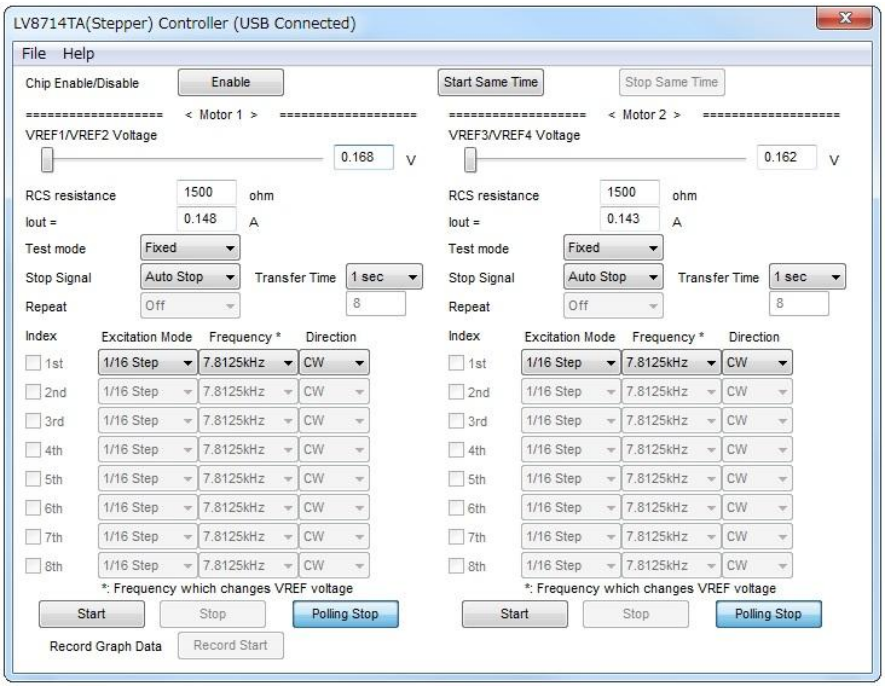
  If the MCU is used to drive the LV8714TA the USB Daughter board should be removed and input signal into IN1-4, ENA1-4 and VREF1-4 from MCU.

GUI Operation

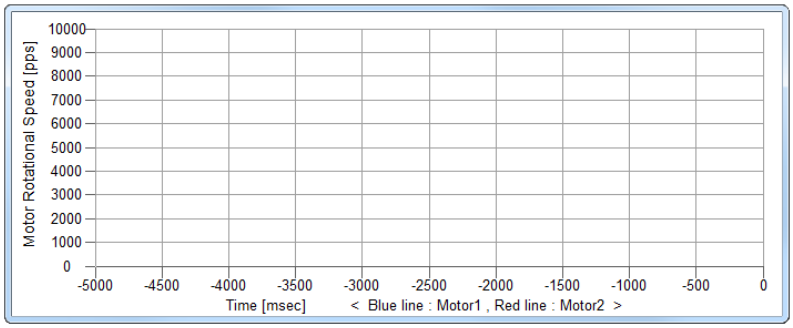
Figure 4. Motor type and Driver setting window 1

When you double click the icon the above window appears.

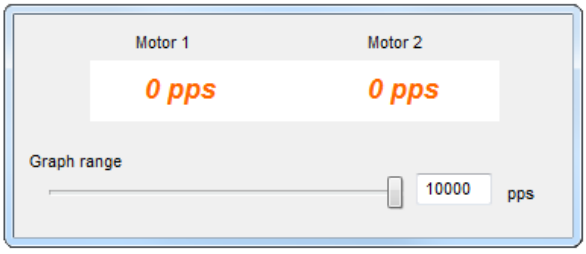
1. Select “Stepper” in Motor Type.
2. Select “LV8714TA” in Driver type.
   When Driver type which you expected is not displayed, please check whether it is a suitable evaluation board.
3. Click the “OK” button.
   The windows of next page should appear:



Controller



Graph



Indicator

Figure 5. GUI windows for LV8714TA

Controller window 1

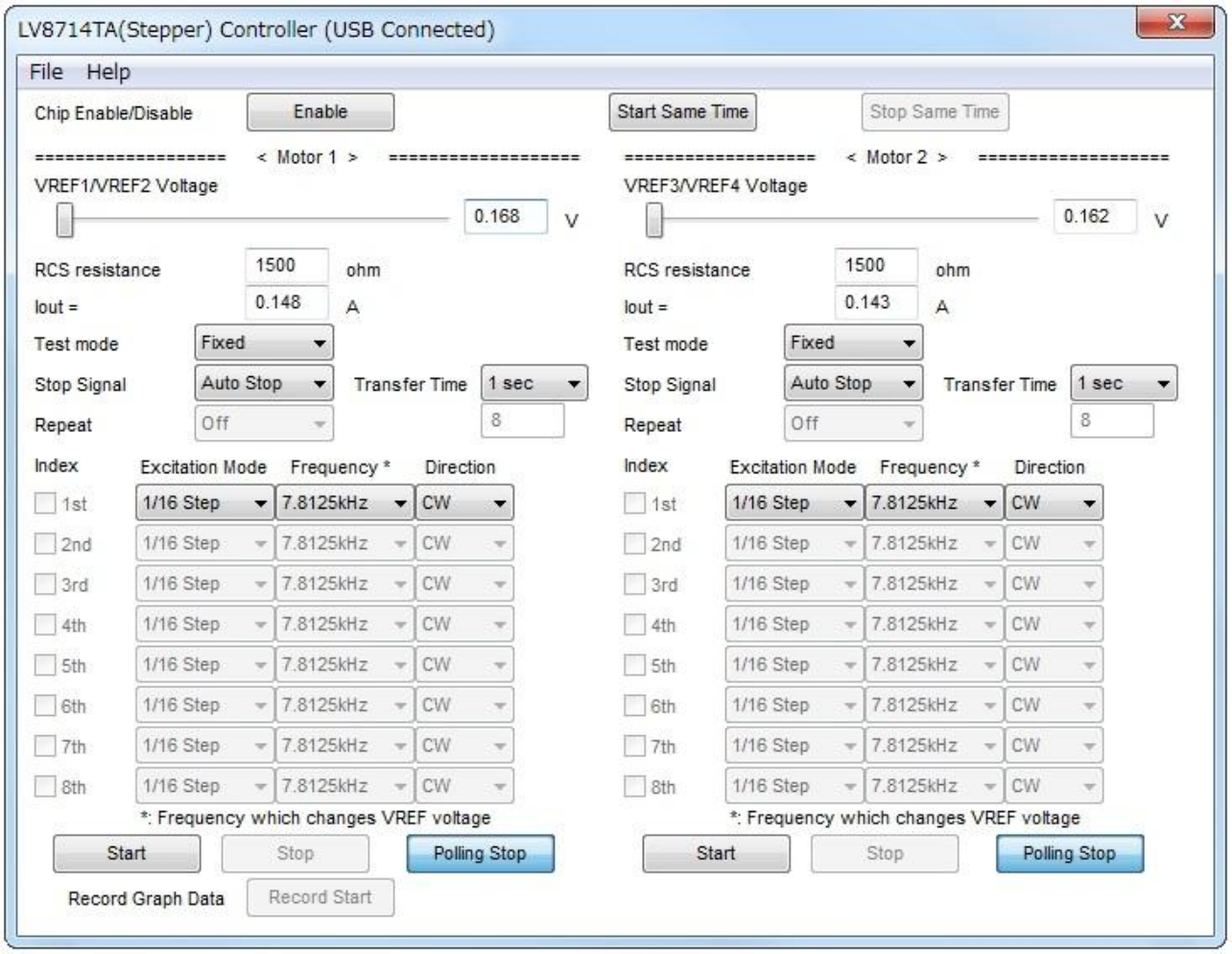


Figure 6. Controller window 1

This GUI can control two stepper motors independently.
<Motor 1> of GUI is the motor connected to OUT1 and OUT2.
<Motor 2> of GUI is the motor connected to OUT3 and OUT4.

- **Chip Enable / Disable**: Switching the signal to the terminal PS of LV8714TA.
  IC will be enable state by clicking "Enable" button, and the indicator shows “Disable” from “Enable”.
  IC will be disable state by clicking “Disable” button, and the indicator shows “Enable” from “Disable”.

- **VREF1/2/3/4 Voltage**: For setting the reference voltage of the output current.
  PWM signal (0 – 3.3V) comes from the Daughter board then the signal is smoothed on the main board.
  Smoothed DC voltage is displayed in the text box after “Polling Start” button at the bottom of GUI is clicked.
  Caution: The VREF voltage sets 1.5V or less

- **RCS Resistance**: For setting the resistance value of the detection resistor of the output current.
  Default set value is 1500Ω.

- **Iout**: This Iout is calculated by set VREF Voltage and RCS resistance after “PollingStart” button is clicked. This value is not actual value but calculated value.
  Since an attached motor becomes high temperature at over 200 mA, if this value exceeds 200 mA, it will change to a red character for cautions.

- **Test mode**: Selection of signal sending method for motor operation.
  "*Fixed*": Sending fixed signal (one pattern only) means sending one Excitation Mode, one Frequency, and one Direction.
  "*Sequence*": Sending sequential pattern means sending the three parameters (Excitation Mode, Frequency and Direction) at maximum of 8 patterns.
  To reset all parameters back to default values, select "File" in the menu bar at the top of GUI, then select "Rollback to Initial value".

- **Transfer Time**: For setting the value of the motor drive time. A unit is a second.
  Select the value from drop-down list or select "others" and input the value into the textbox.
  The maximum value that can be set is up to 65535.
  This set value is common value for all sequence stage.

- **Stop Signal**: Selection of conditions "Auto Stop" or "Stop Button".
  "*Auto*": An input signal is stopped automatically when the set Transfer Time is completed.
  "*Stop Button*": The drive of a motor stops by "Stop" button located at the bottom of the GUI, and "Stop Same Time" button located at the top of the GUI.
  Clicking "Stop" button, signal transfer will stop immediately. In case of "Fixed" Test mode, Transfer Time text box will gray out after "Stop Button" is selected in the Stop Signal.
  In case of "Sequence" Test mode, "Stop" button must be clicked to stop the signal transfer in the last stage.

- **Repeat**: "*On*": sequence pattern repeats while test mode is in "Sequence" mode.
  "*Off*": last set sequence stage will be kept until the signal transfer is manually stop.
  A repeat function can set up when "Sequence" mode and "Stop button" are chosen.

- **Excitation Mode**: Selection of the excitation mode. (1/16,1/32,1/64,1/128Step)
  A motor rotates more smoothly and more slowly by changing VREF voltage smaller.
  1/128 Step is the smoothest of the four step(1/16, 1/32, 1/64, 1/128 Step)

- **Frequency**: The velocity of stepper motor is usually described by [pps] pulse per second. In other words, the number of steps per second. VREF voltage changes at this frequency, and the motor current changes by changing VREF voltage.
  When quicker Frequency was selected, the change speed of VREF voltage is quicker, and the rotary speed of the motor is fast. The setting of the frequency is seven varieties.

- **Direction**: Selection of the direction of motor rotation. CW (clockwise) and CCW (counterclockwise).

  Start: Sending the set parameters to IN1-4, ENA1-4 and VREF1-4. The "Start" button of <Motor 1> sends the signal of IN1-2, ENA1-2 and VREF1-2. The "Start" button of <Motor 2> sends the signal of IN3-4, ENA3-4 and VREF3-4. This button can not update the parameter while a motor is operating.

  Stop: Regardless of "Fixed" mode and "Sequence" mode, IN1-4, ENA1-4 and VREF1-4 signal transfer is stopped by this button. The "Stop" button of <Motor 1> stops the signal of IN1-2, ENA1-2 and VREF1-2. The "Stop" button of <Motor 2> stops the signal of IN3-4, ENA3-4 and VREF3-4.
  These signals become all Low state and a motor doesn't keep its position.

- **Start Same Time**: Sending the set parameters to IN1-4, ENA1-4 and VREF1-4 at the same time. This button can not update the parameter while a motor is operating.

- **Stop Same Time**: Regardless of "Fixed" mode and "Sequence" mode, IN1-4,ENA1-4 and VREF1-4 signal transfer is stopped by this button at the same time.

- **Polling Start/Stop**: Update VREF1/2/3/4 Voltage, Graph and Indicator. These three are updated in real-time when "Polling Start" button is clicked. Default setting is "Polling Start", and the button shows "Polling Stop".

Controller window2

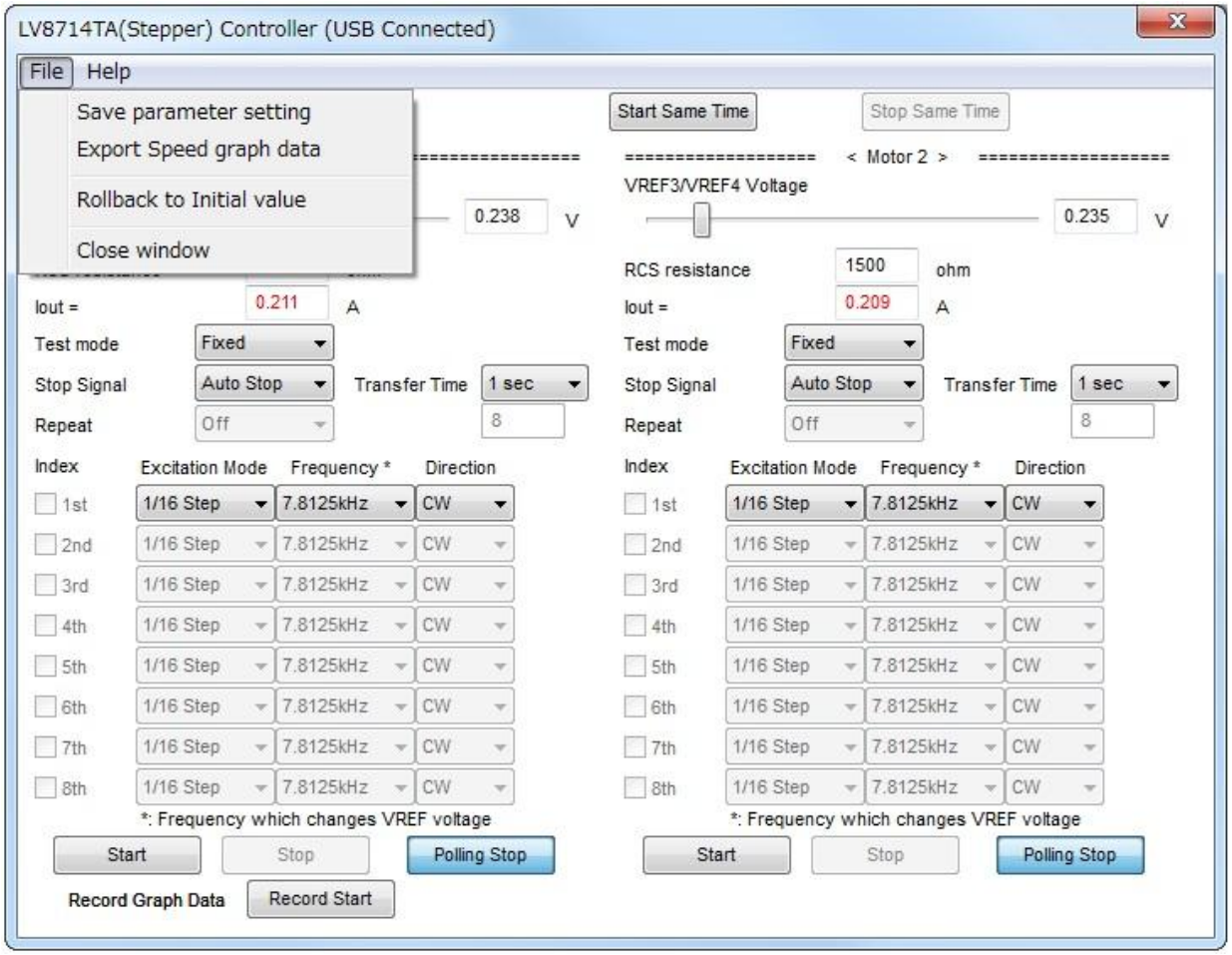


Figure 7. Controller window 2

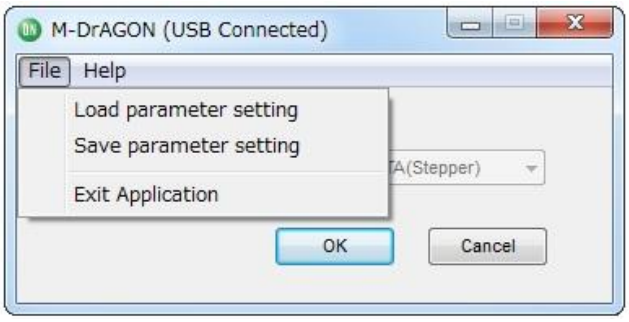


Figure 8. Motor type and Driver setting window2

- **Save parameter setting**: Output the setting data of GUI. Select “File” in the menu bar at the top of GUI Controller window or Motor and Driver setting window, then select “Save parameter setting”.

- **Load parameter setting**: Load the file which you saved by "Save parameter setting". Select “File” in the menu bar at Motor and Driver setting window, then select “Load parameter setting”.

- **Rollback to Initial value**: All parameters of the Controller window is returned to an initial value.

- **Export Speed graph data**: Output the Excel data of “Time” – “Motor Rotational speed (Frequency)”. When the file which already exists is chosen, newest data is saved under a previous data. Select “File” in the menu bar at the top of GUI Controller window, then select “Export Speed graph data”, and then input file name, and start preservation of data after “Record Start” is clicked, and stop it when “Record End” is clicked.

Indicator window

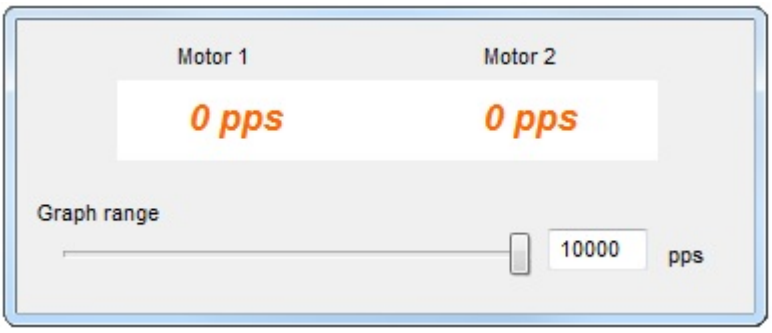


Figure 9. The indicator window

- Current PPS: The indicator for pulse rate which is controlled by microcontroller. The pulse rate of LV8714TA is the same as the change timing of VREF voltage. Therefore, the value displays Frequency of GUI.
- Graph range: To adjust maximum value for Graph.

Graph window

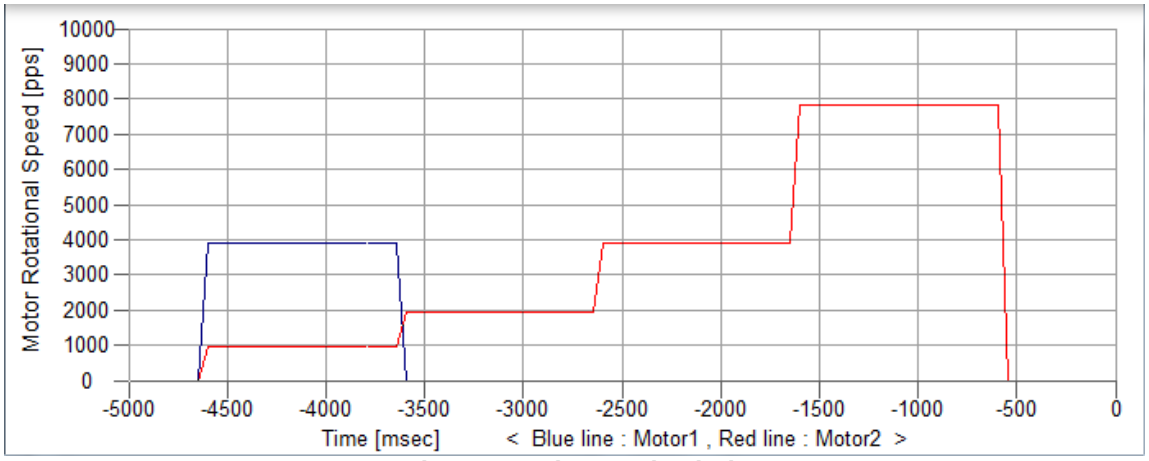


Figure 10. The graph window

- This graph shows relationship between elapsed time(X-axis) and motor pulse rate(the change timing of VREF voltage: Y-axis).
- Pulse rate(Y-axis) is the same as the value of the indicator window, Maximum level of Y-axis is adjusted by “Graph range”.
- The scale of X-axis is 500msec/div. Graph is automatically scrolled according to elapsed time.

- **The example of setting**
  1. Plug the USB cable into the Daughter Board.
  2. Start up the GUI for LV8714TA.
  3. Apply input voltage to the terminal “VM”=12V.
  4. GUI setup as below.

Table2: Example of a GUI setup

INPUT	OUTPUT
VREF1/VREF2≈0.23V Test mode: Fixed Stop Signal: Auto Stop Transfer Time: don’t care Excitation Mode: 1/16 Step Frequency: 7.8125kHz Direction: CW Clicking "Enable” button Clicking "Start” button	Iout≈0.2A Indicator shows “Disable” indicator shows “Stop”

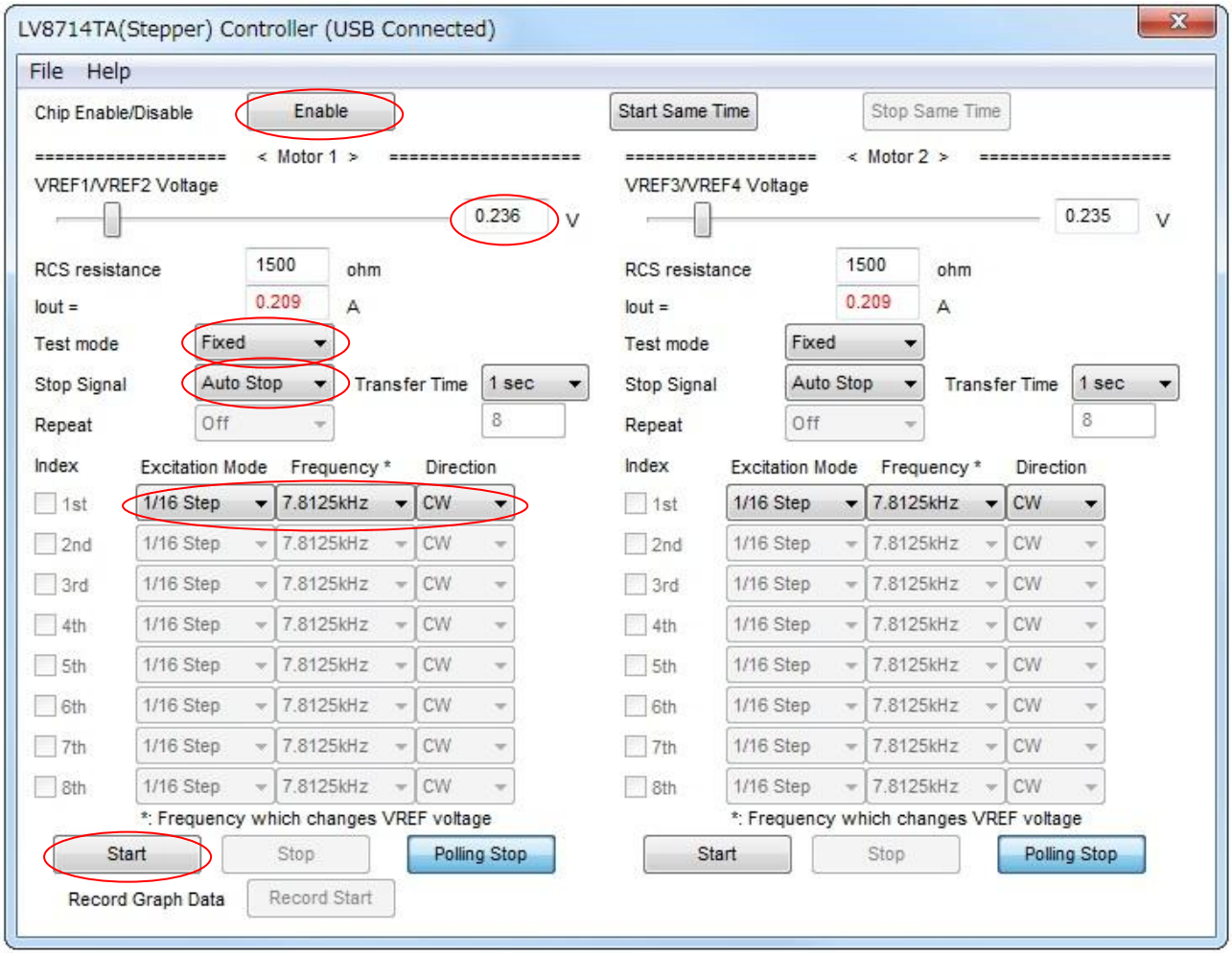
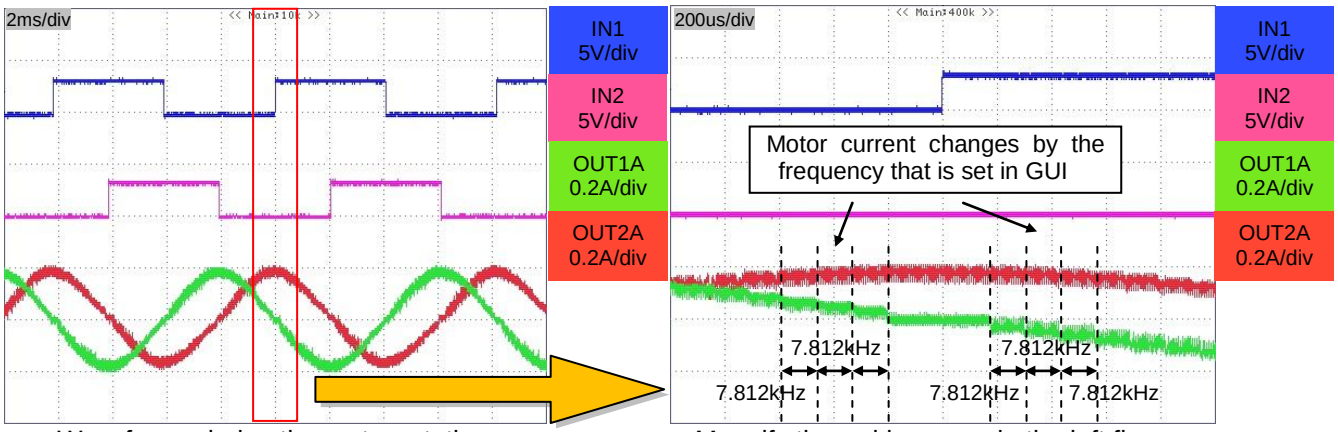


Figure 11. The example of controller window



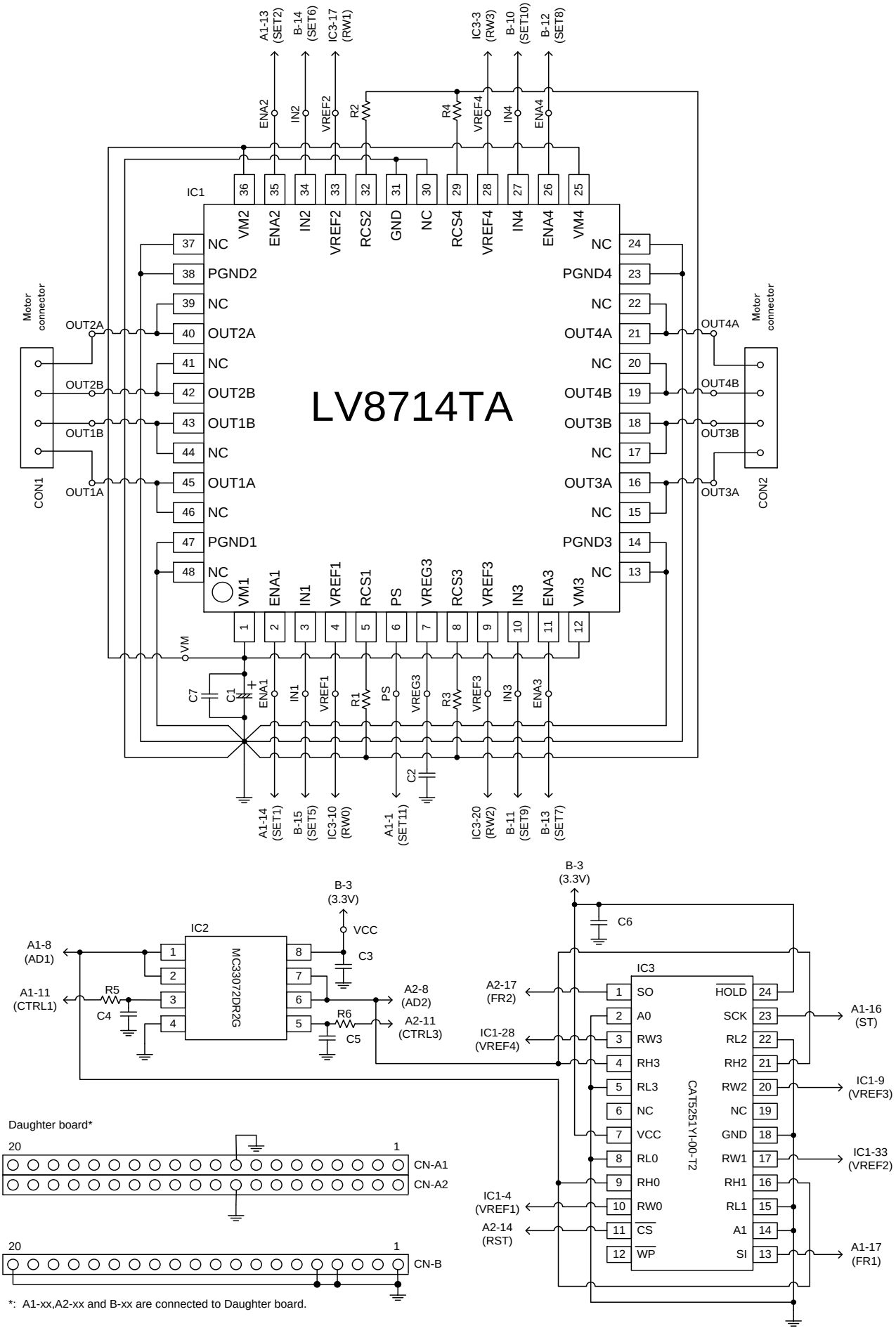
Waveforms during the motor rotation

Magnify the red box area in the left figure

The motor connected to OUT3 and OUT4 rotates with same waveform by setting of GUI <Motor 2>.

Figure 12. The image of waveforms for example

Schematic for the LV8714TA Demonstration



Cautions

- This system is intended for an initial evaluation of LV8714TA. Since this evaluation board is not supporting all drive modes, we appreciate your understanding. We will not guarantee measured values as full evaluation and validation must be performed on your system independently.
- Never hold the motor with the lead wire or shaft. The motor should be affixed to a stand prior to operation.
- Depending on the conditions of use or installation, the motor produces excessive heat when it runs. Install a heatsink, cooling fan or take other measures against excess heat.
- Before turning on the power supply, we recommend that you connect all motor leads.

Safety

- Do not touch the rotating part when the motor is powered. Doing so may result in injury.
- Do not touch conductive parts such as connectors when the motor is powered. Doing so may result in electric shocks.

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