

# LED\_matrix

20131021

This change brightness of LED by PWM.

Reference;

Chapter7.Counter Modules and Circuit Application Lab in Propeller Education kit Labs  
AN001-P8X32ACounters-v2.0\_2.pdf

LED\_matrix\_0.1.f

We use NCO/PWM counter-mode on PWM for PropForth.

1. Set the I/O pin to output
2. Set the frqa/frqb register
2. Set the phsa/phsb register
4. Configure the ctra/ctrb register

LED\_matrix's column-side(P) is connected to Prop-ports.

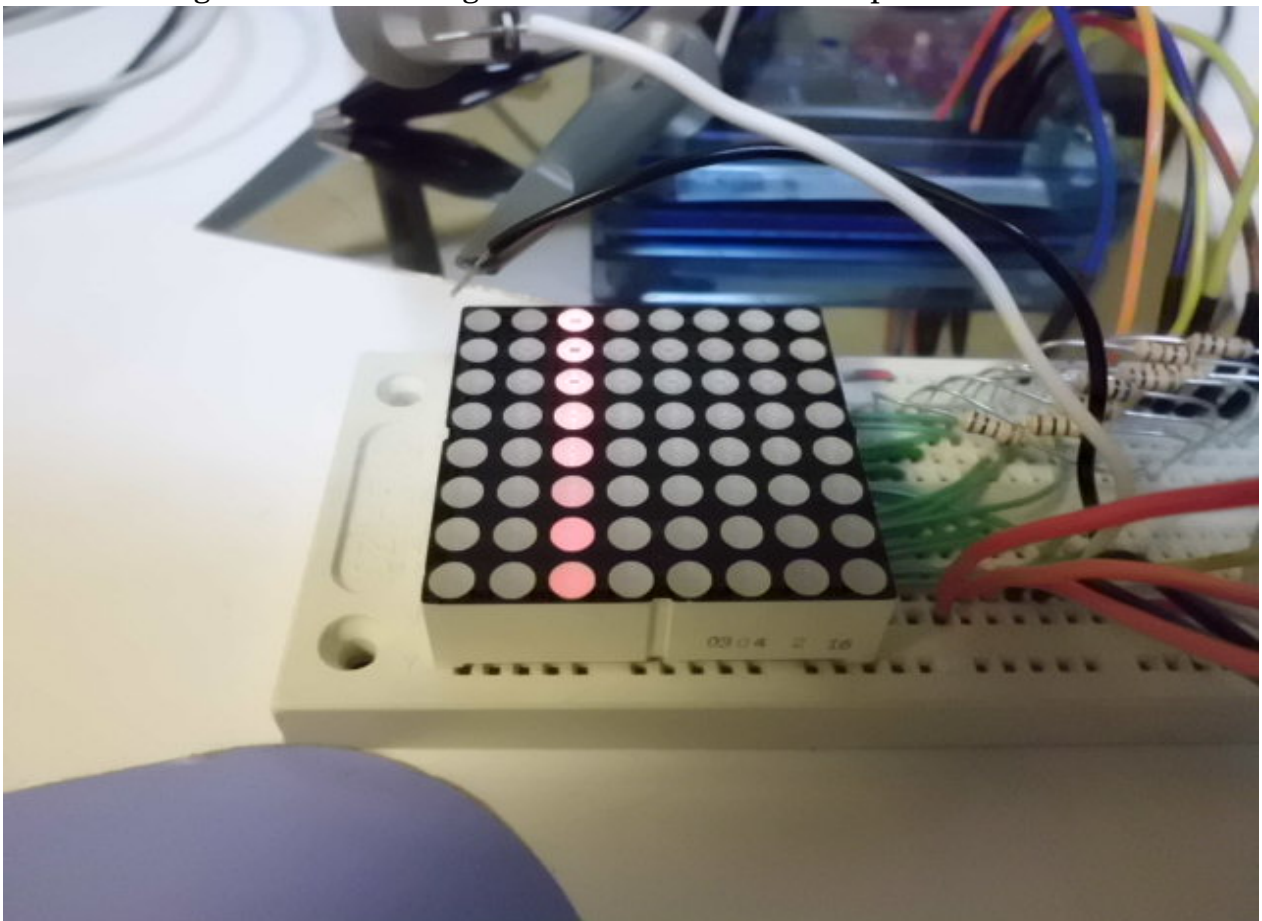
LED\_matrix's row-side(N) is connected to output of shift-register(74HC595).

## demo1

This use PWM/NCO single-ended counter-mode.

Word'drive\_matrix' is forth-word.

Camera can't get whole row image because of matrix's low speed scan.



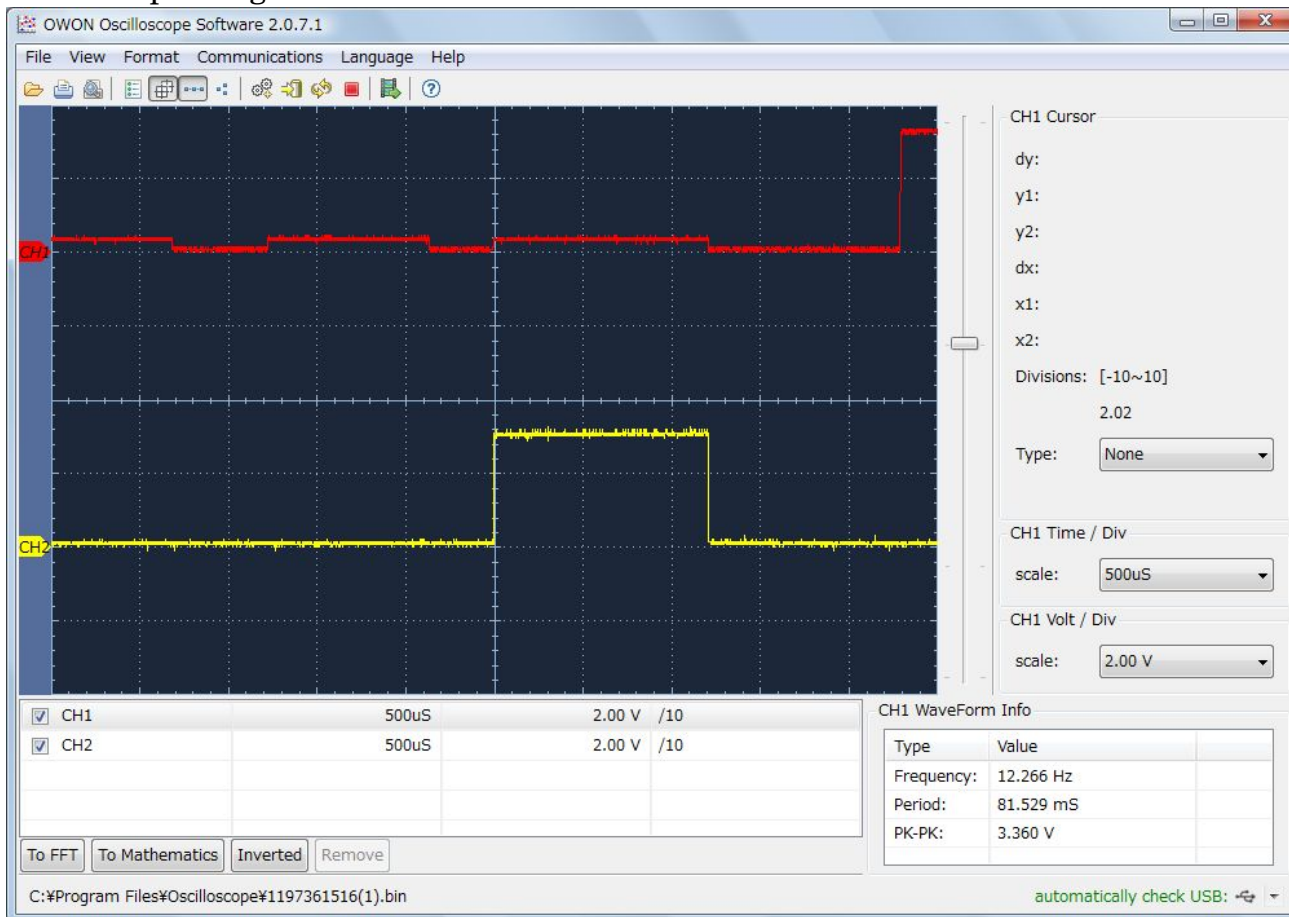


ch1(red):shift-register output Qh ch2(yellow):P7

1-element for matrix takes 1.273msec .

1-row (8-element) takes 10.2msec . (1.273msec X 8) -- shift-register output Qh

## Zoomed up P7 signal



ch2(yellow):P7 is 1.2msec.

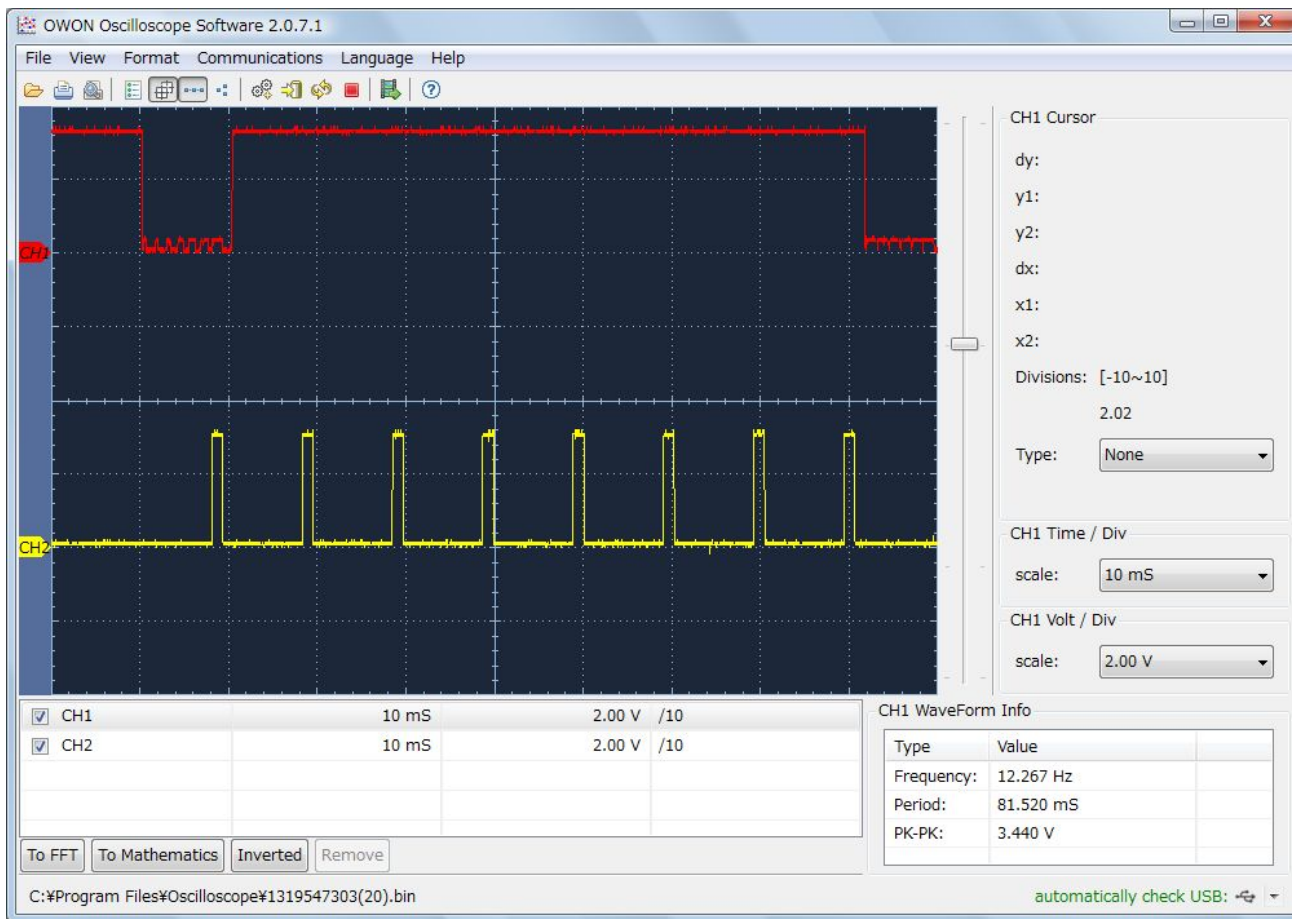
Pulse is a little short because of delay of calculating-phsa .

Each LED should takes 1.273msec( $\text{clkfreq} \div 785$  u/ constant 1.3msec).

Actually, max\_LED\_on-time take 1.2msec.

If more than d786, rollover occur.

There is flicker on this status.



ch1(red):shift-register output Qh ch2(yellow):P7

8row-scan take 82msec on oscilloscope.

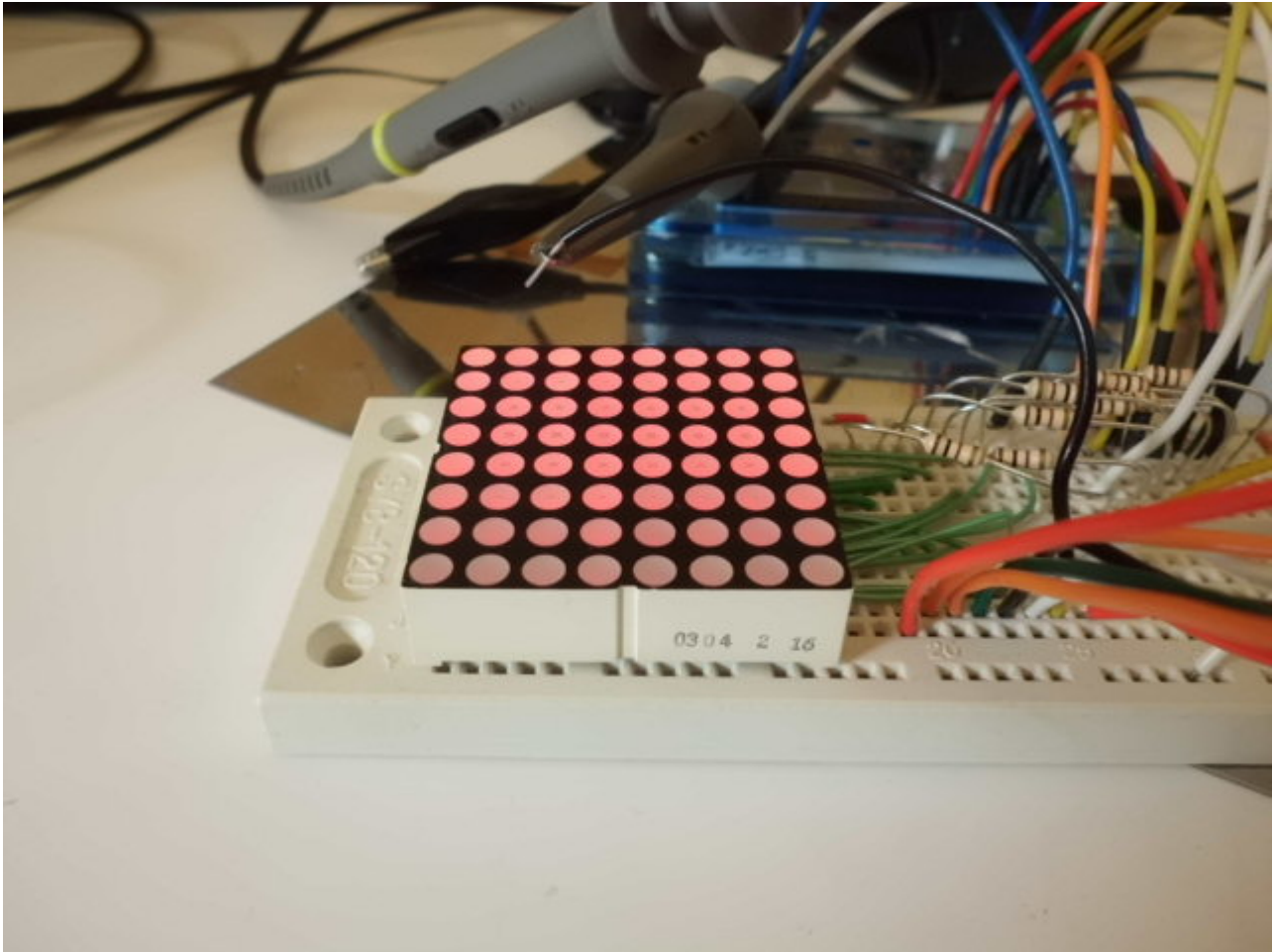
Frame-rate is 12.

Calulating time is 81.6msec. (10.2msec X 8)

It seems difference occur by 'begin do – loop – until'.

## demo2

This use PWM/NCO single-ended counter-mode by assembler-word.

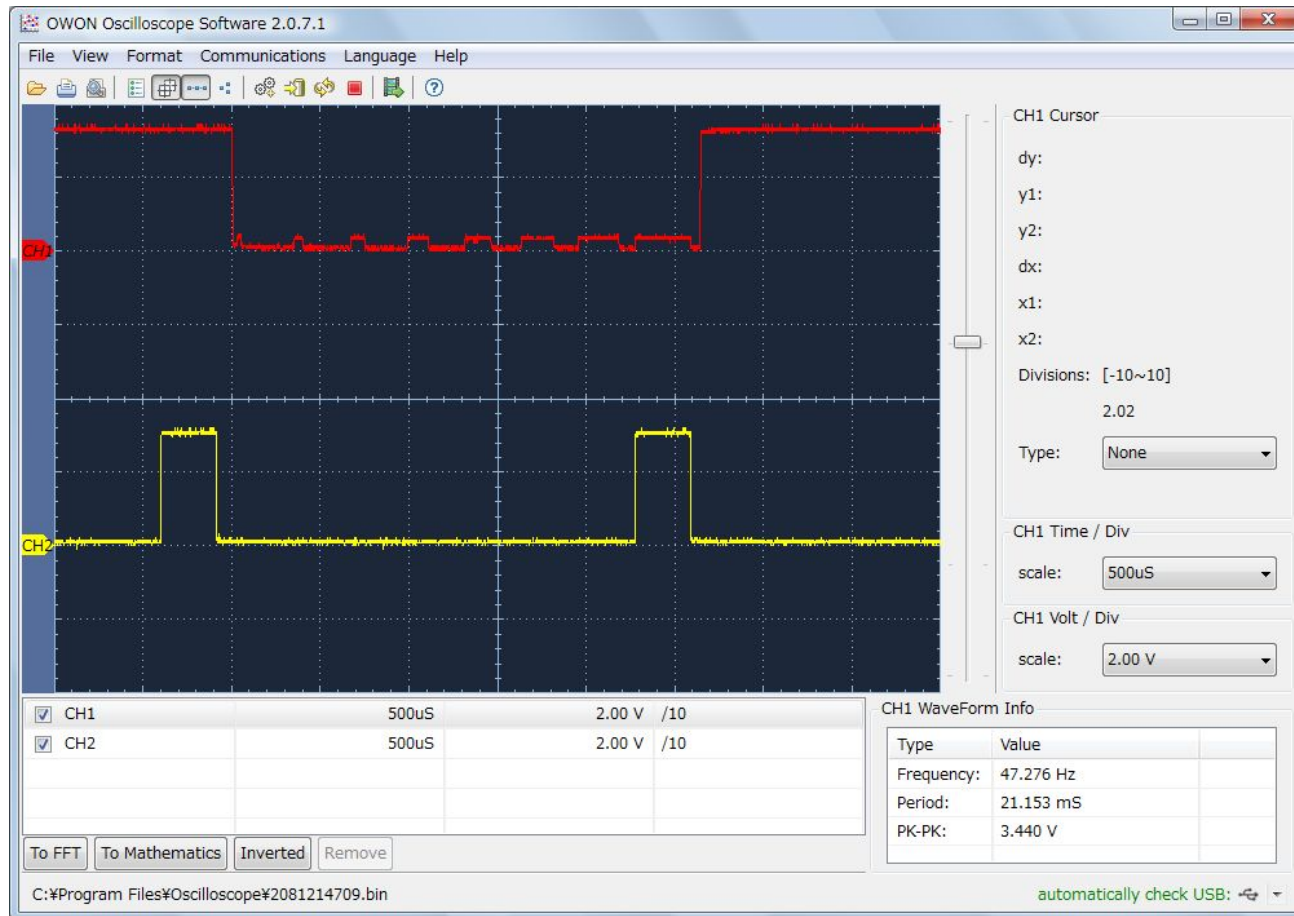




Wordbelow is assembler.

Driving shift-register(74HC595) 'a\_shift\_data '

Driving LED\_matrix 'a\_drive\_LED\_matrix '



ch1(red):shift-register output Qh ch2(yellow):P7

1-element for matrix takes 320usec .

1-row (8-element) takes 2.65msec . -- shift-register output Qh

Caluculating value is 2.56msec. (0.32msec X 8)

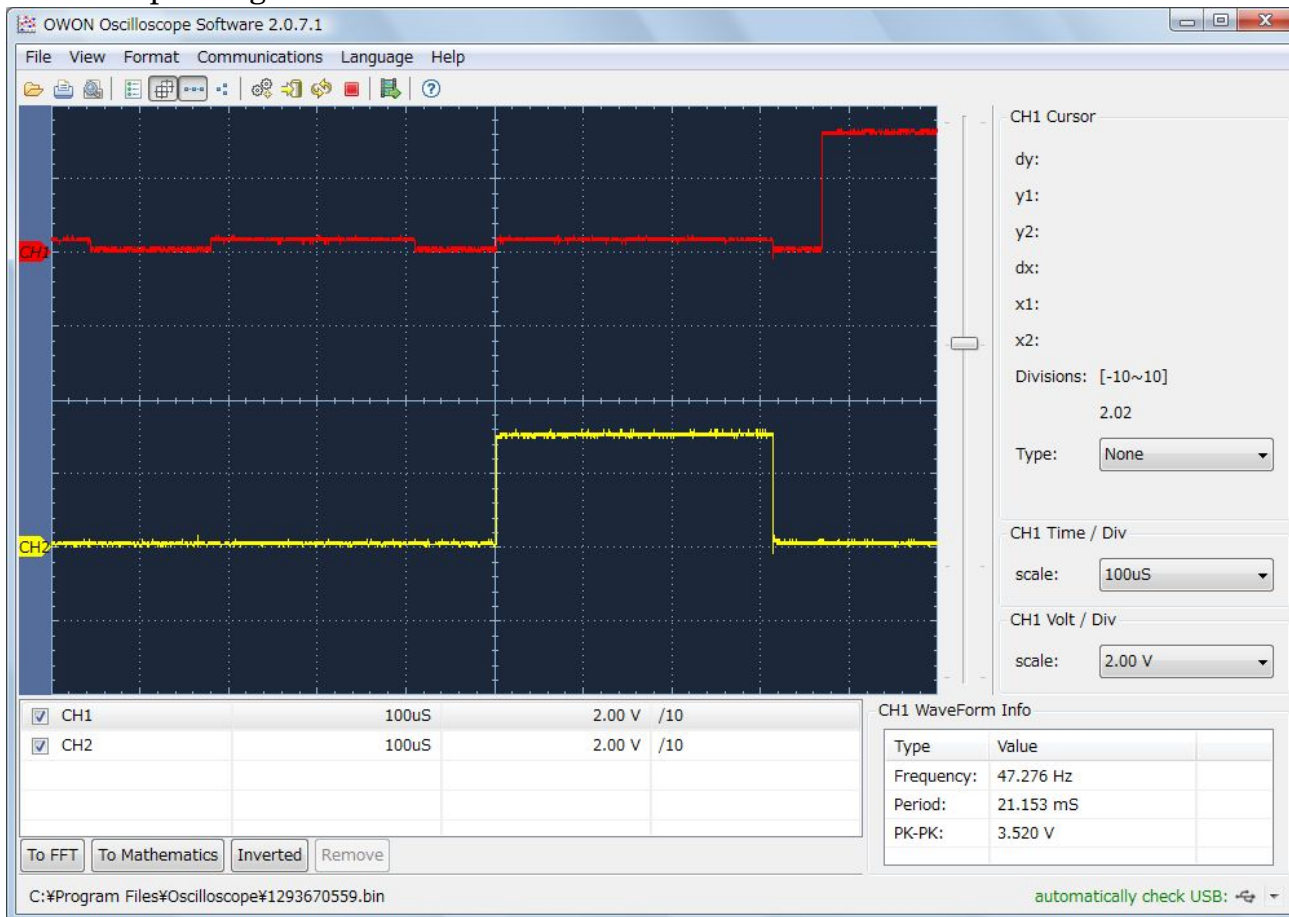
It seems difference occur by 'begin do – loop – until'.

Word'a\_shift\_data ' convert serial to parallel by 74HC595.

Word'a\_drive\_LED\_matrix ' display data inside LED\_matrix array on each element.

If there is '0' inside LED\_matrix array, this don't operate.

## Zoomed up P7 signal



ch2(yellow):P7 is 320uSec.

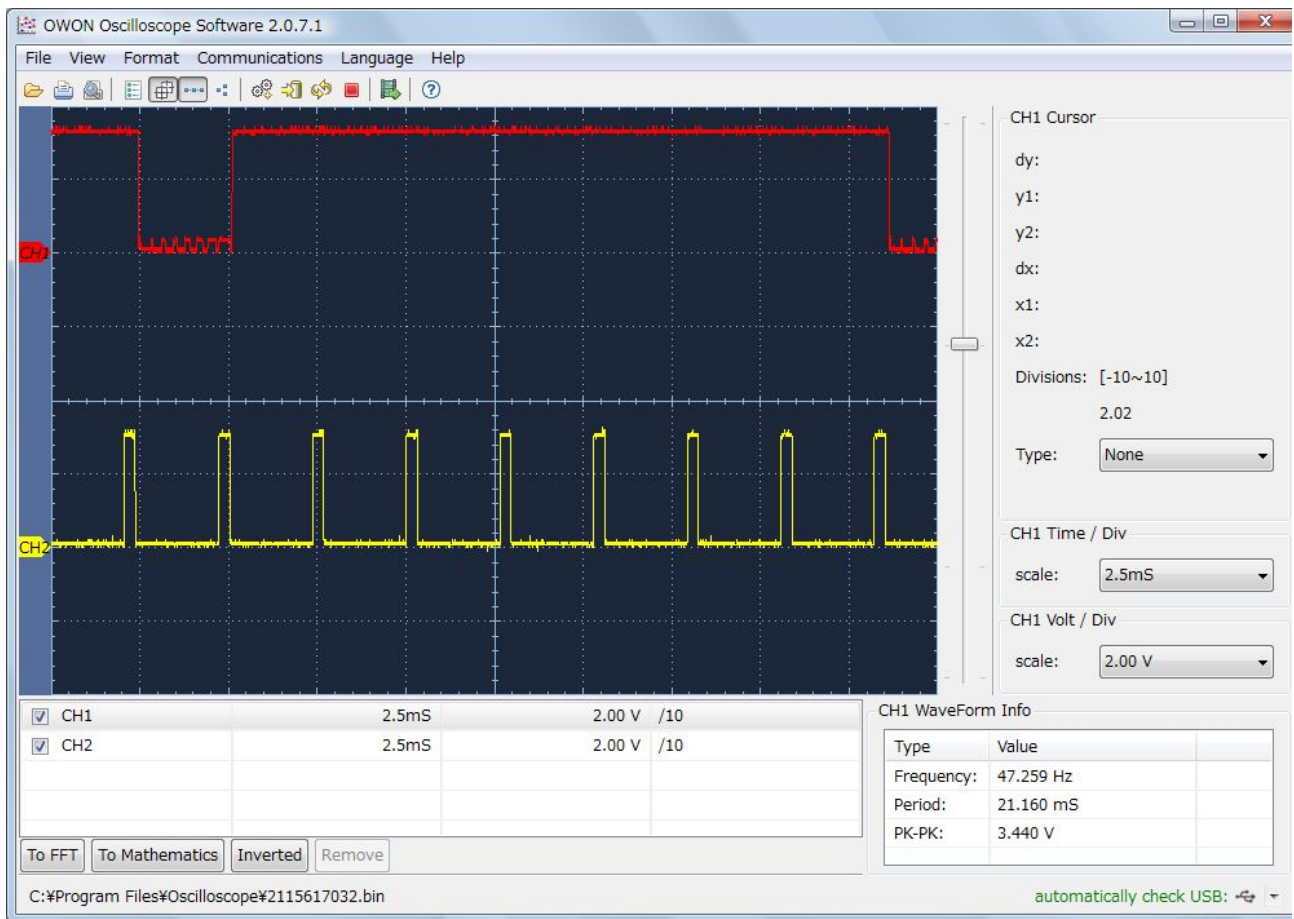
It seems there is no delay of calculating-phsa .

Each LED takes 320uSec.

Ther is no flicker.

8row-scan take about 21.4msec.

Frame-rate is 47.



ch1(red):shift-register output Qh ch2(yellow):P7

8row-scan take about 21.4msec on oscilloscope.  
 Calculating time is 20.48msec. (0.32msec X 8 X 8)

It seems difference occur by 'begin do – loop – until'.

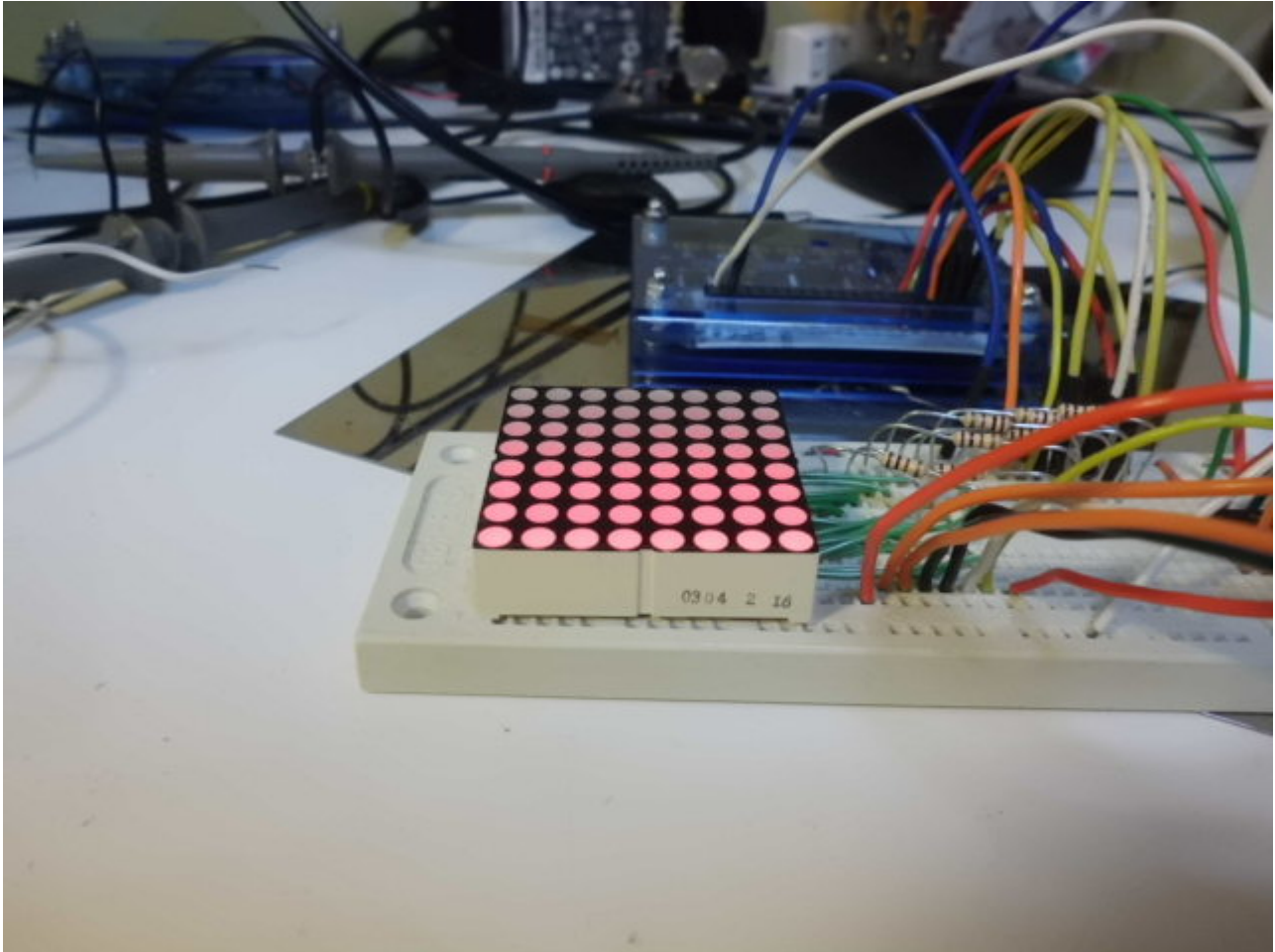
[demo3](#), [demo4](#), [demo5](#)

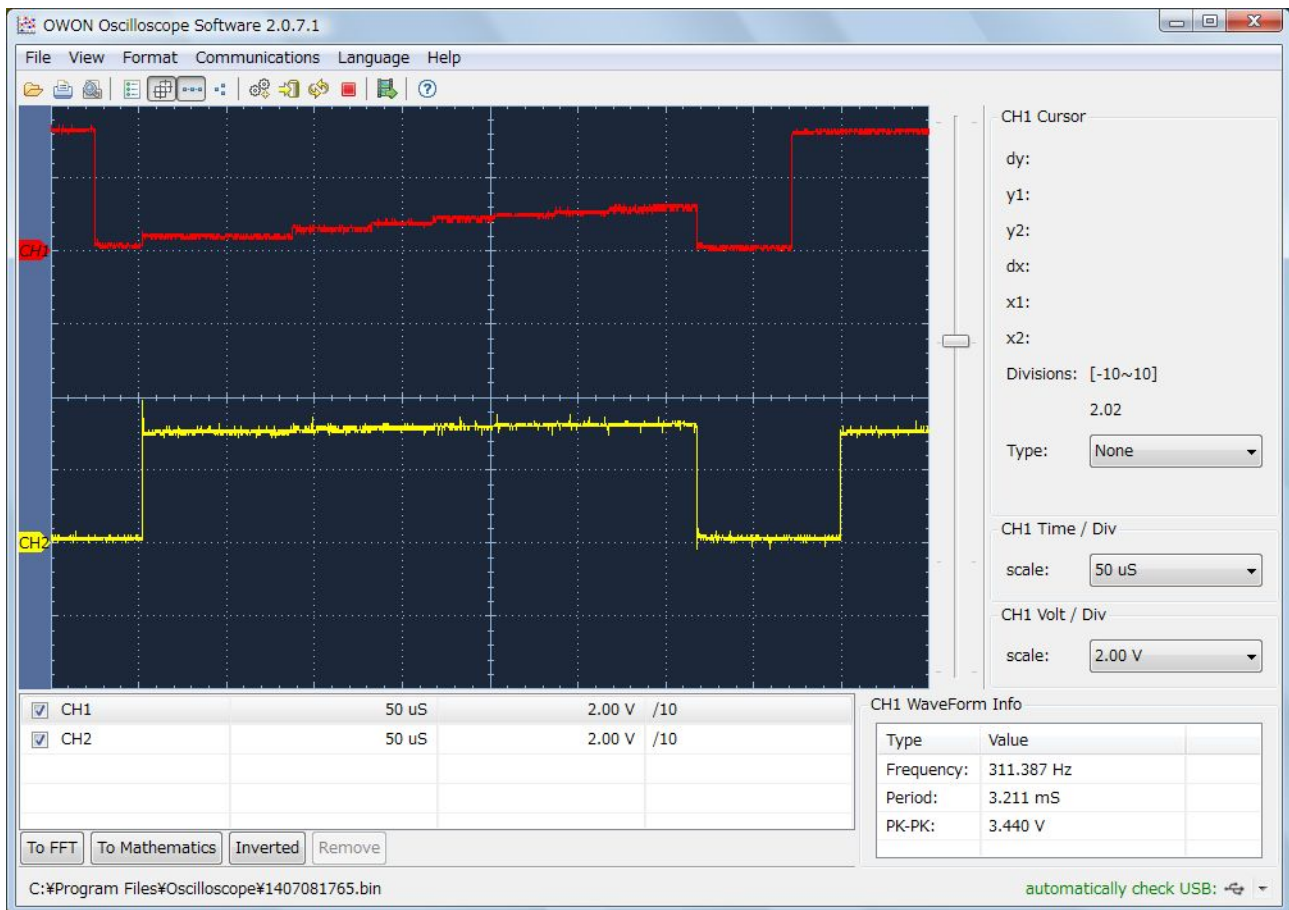
Pattern is moving.



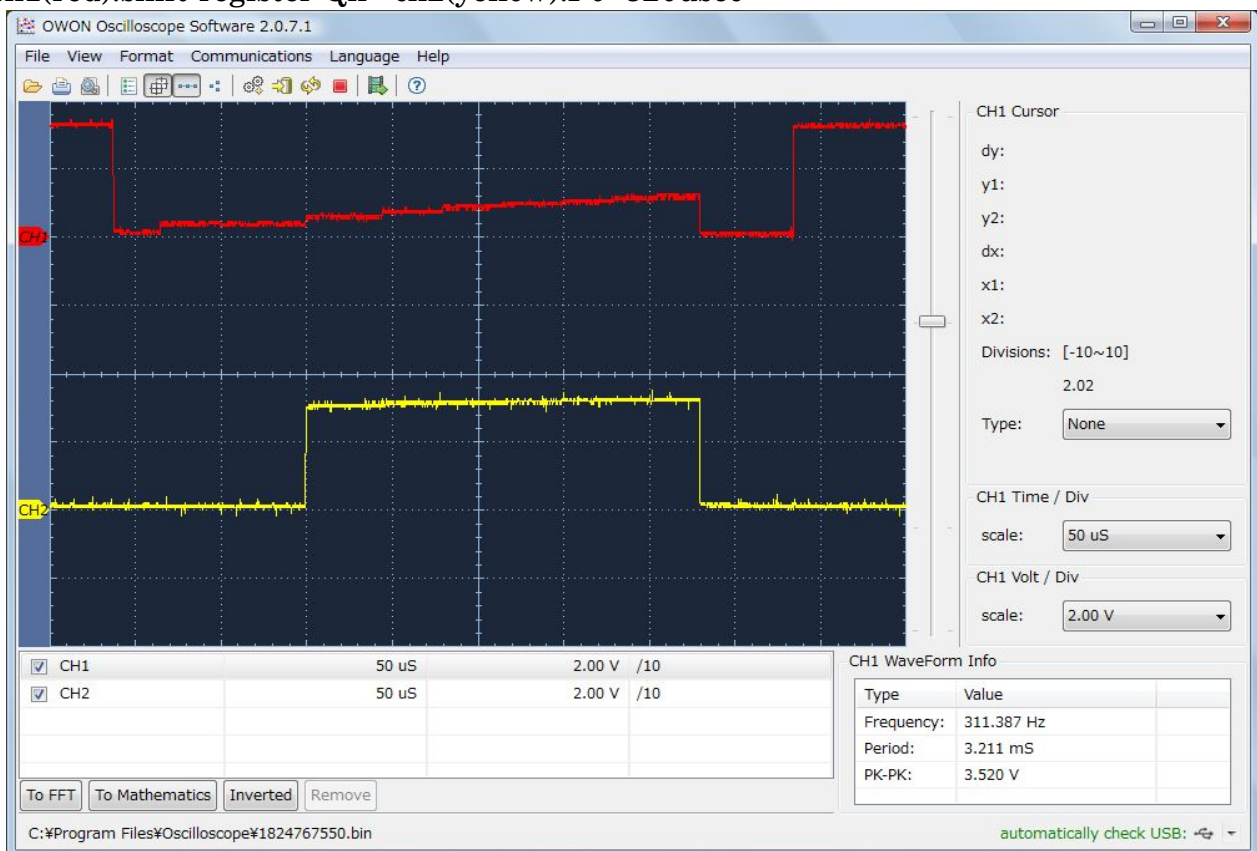
## demo6

This don't use counter mode(NCO/PWM).  
Instead of counter, using TS(TimeSlot) on assembler.  
Word'a\_pwm' use TS as basic time.  
Bright-level'64' continue to be high during 'TS X 64'.

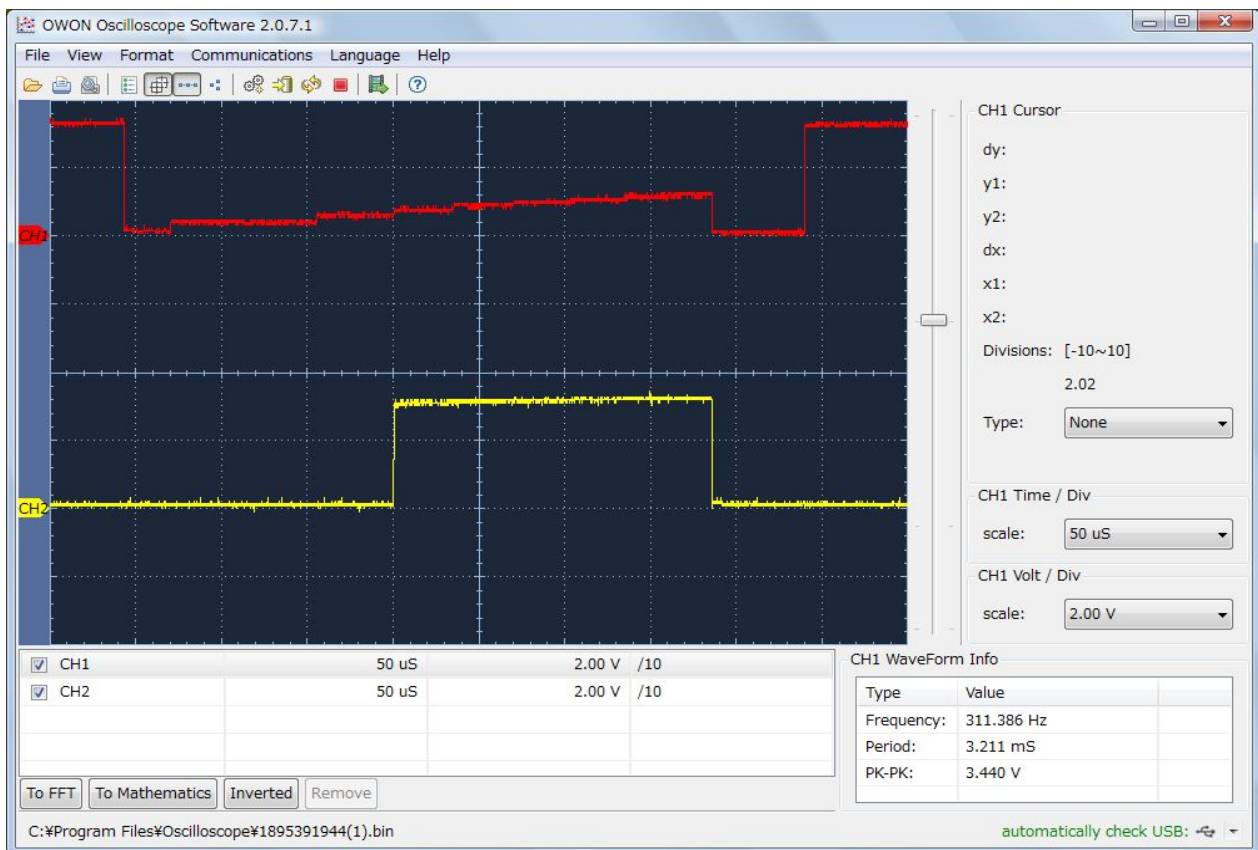




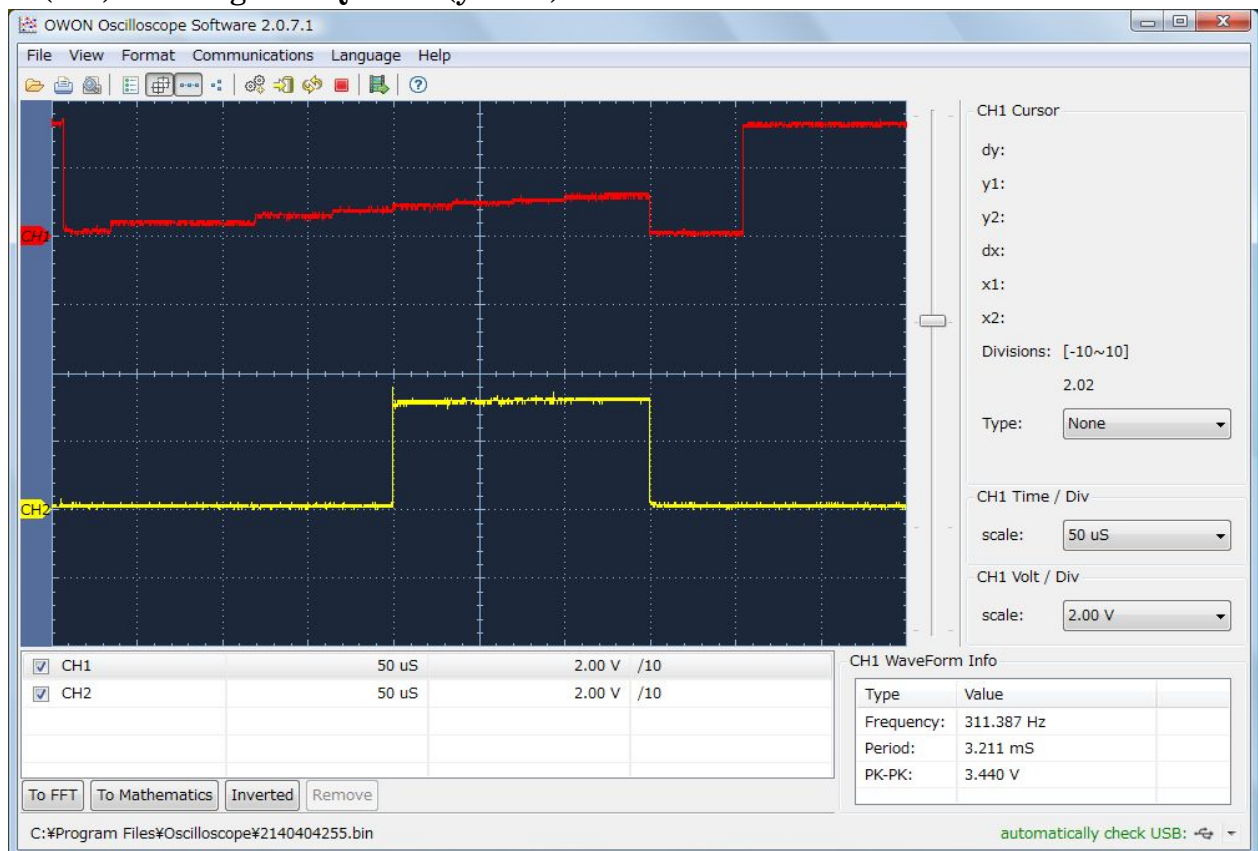
ch1(red):shift-register Qh ch2(yellow):P0 320usec



ch1(red):shift-register Qh ch2(yellow):P1 230usec

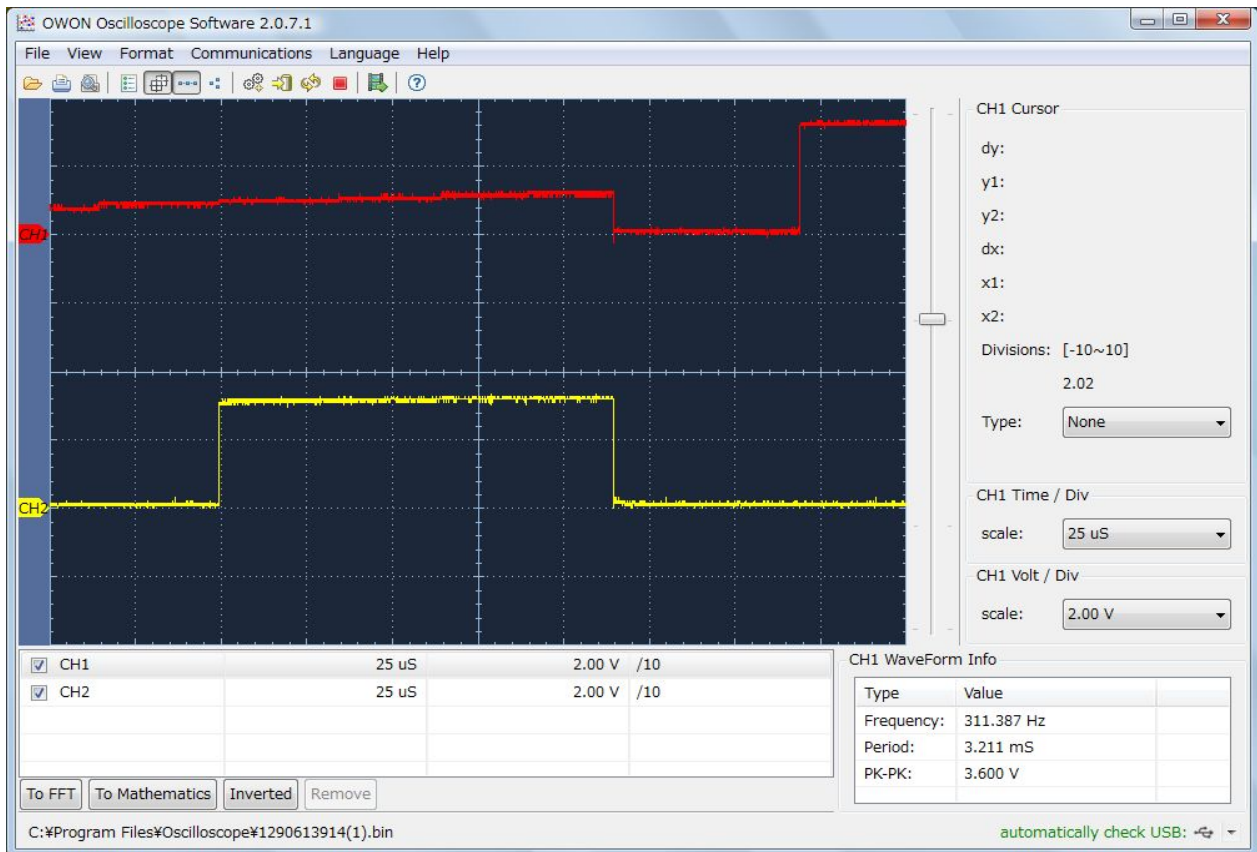


ch1(red):shift-register Qh ch2(yellow):P2 185usec

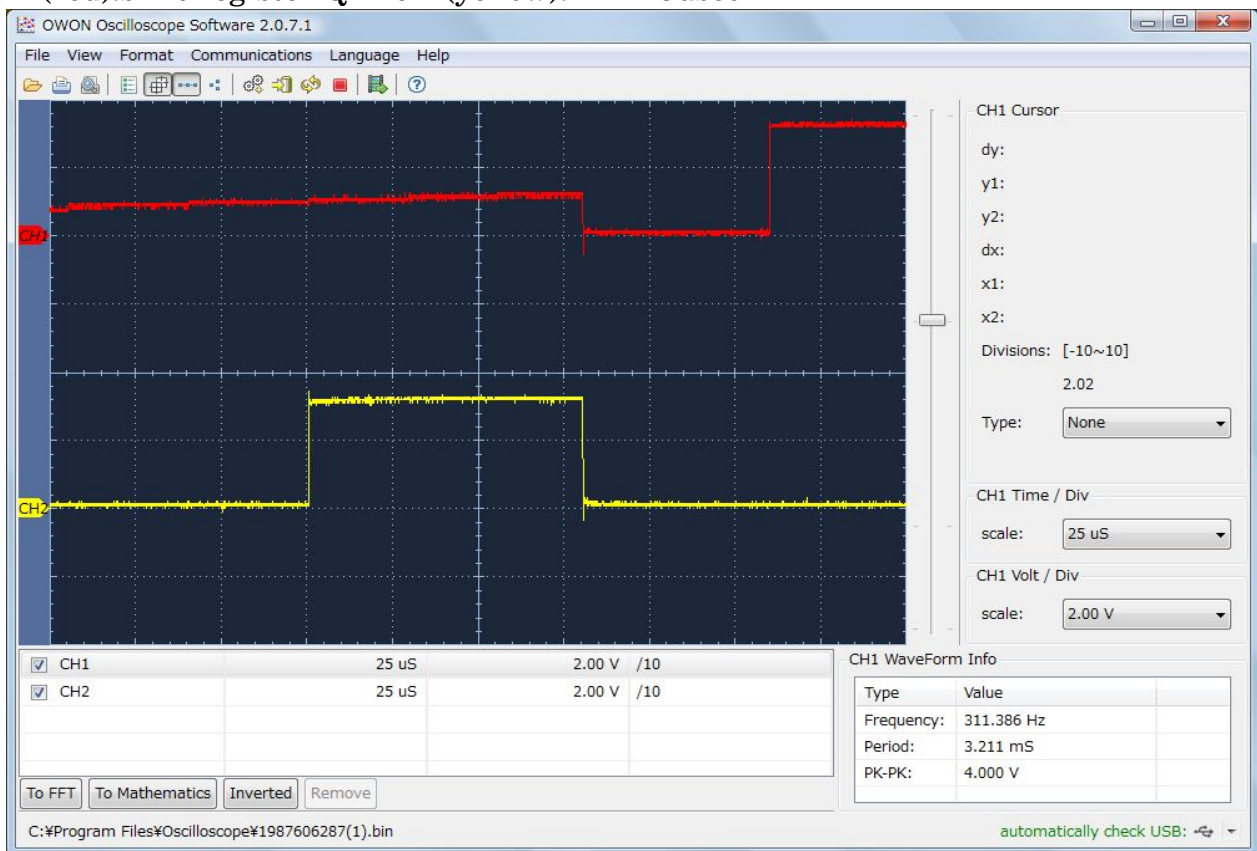


ch1(red):shift-register Qh ch2(yellow):P3 150usec

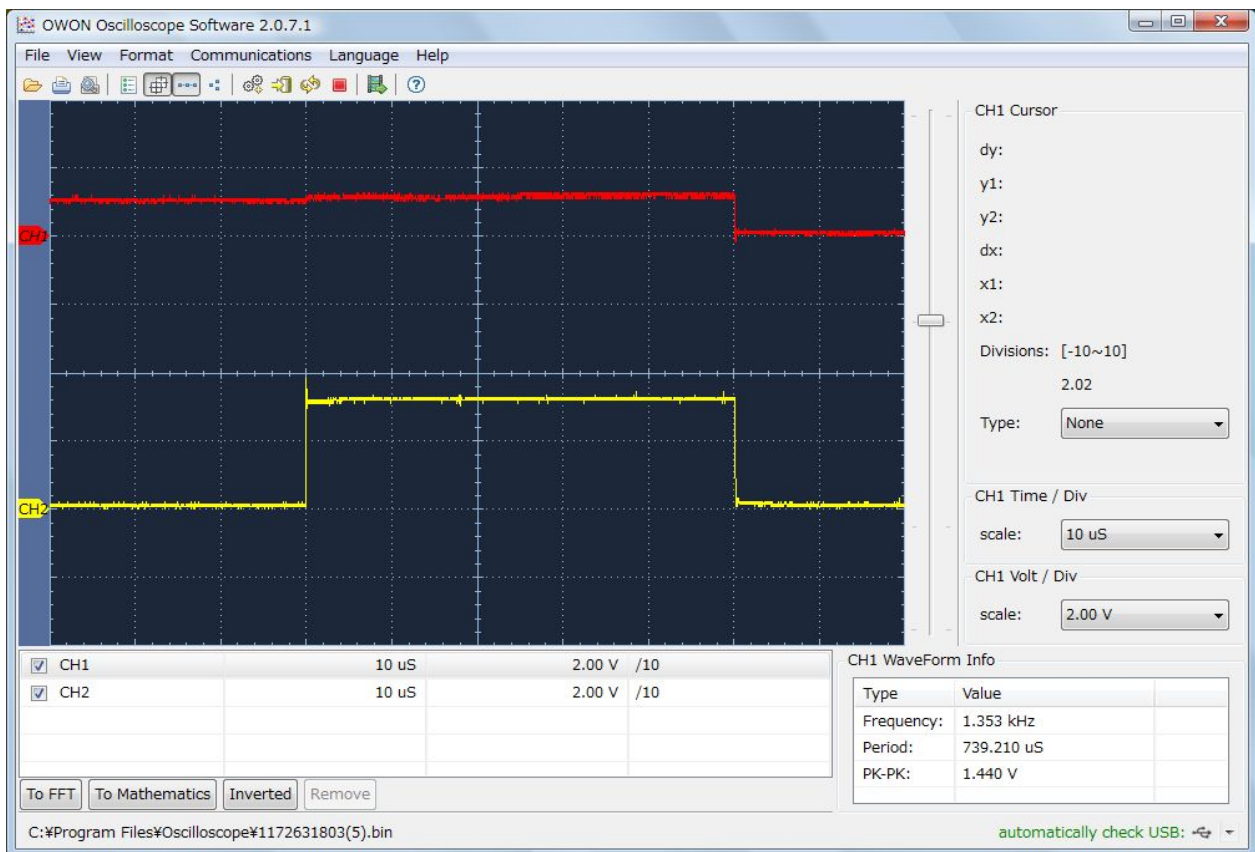




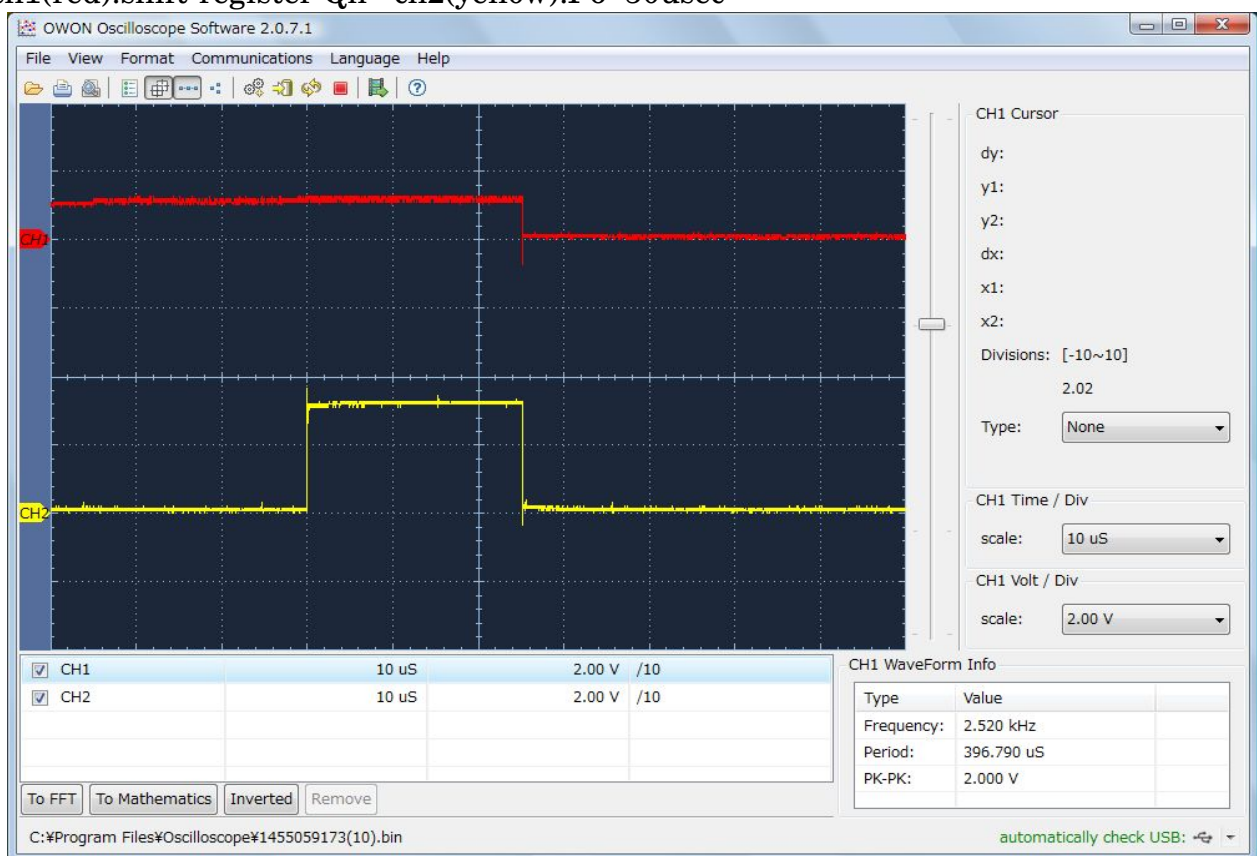
ch1(red):shift-register Qh ch2(yellow):P4 115usec



ch1(red):shift-register Qh ch2(yellow):P5 80usec



ch1(red):shift-register Qh ch2(yellow):P6 50usec

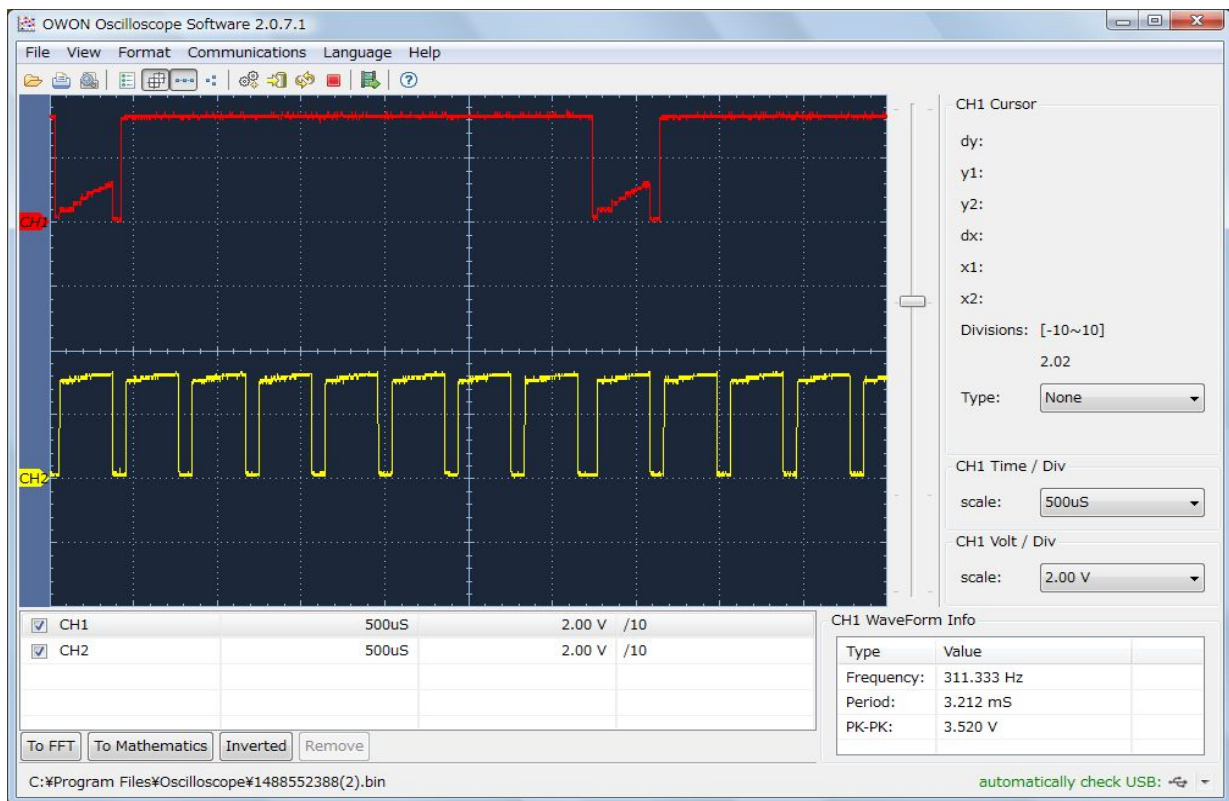


ch1(red):shift-register Qh ch2(yellow):P7 25usec



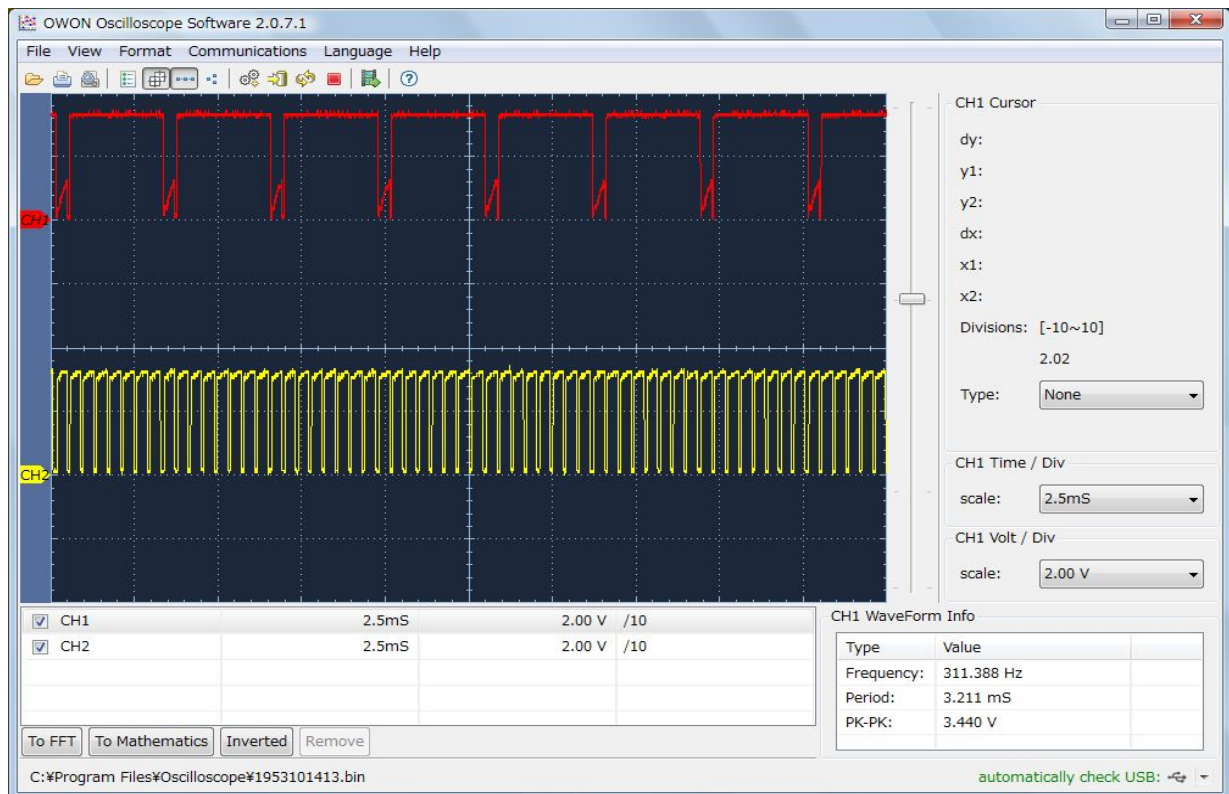
	scale	actual	calculate
P7	5	25usec	25usec
P6	10	45usec	45usec
P5	16	80usec	80usec
P4	23	115usec	115usec
P3	30	150usec	150usec
P2	37	185usec	185usec
P1	46	230usec	230usec
P0	64	320usec	320usec

Actual values are same as calculated.



ch1(red):shift-register Qh ch2(yellow):P0

Output(Low) of shift-register take 400usec.  
1-row time is 3.2msec.



ch1(red):shift-register Qh ch2(yellow):P0  
8-row time is 25.6msec.

Frame rate is 39.  
Of course, there no flicjker.

Pattern data is same as demo2.  
But pattern is reverse.  
Matrix-elements are brighter than demo2.  
Frame rate is snall than demo2.  
Because of TS is 400ticks inside 'a\_pwm'.  
TS can be more small.