

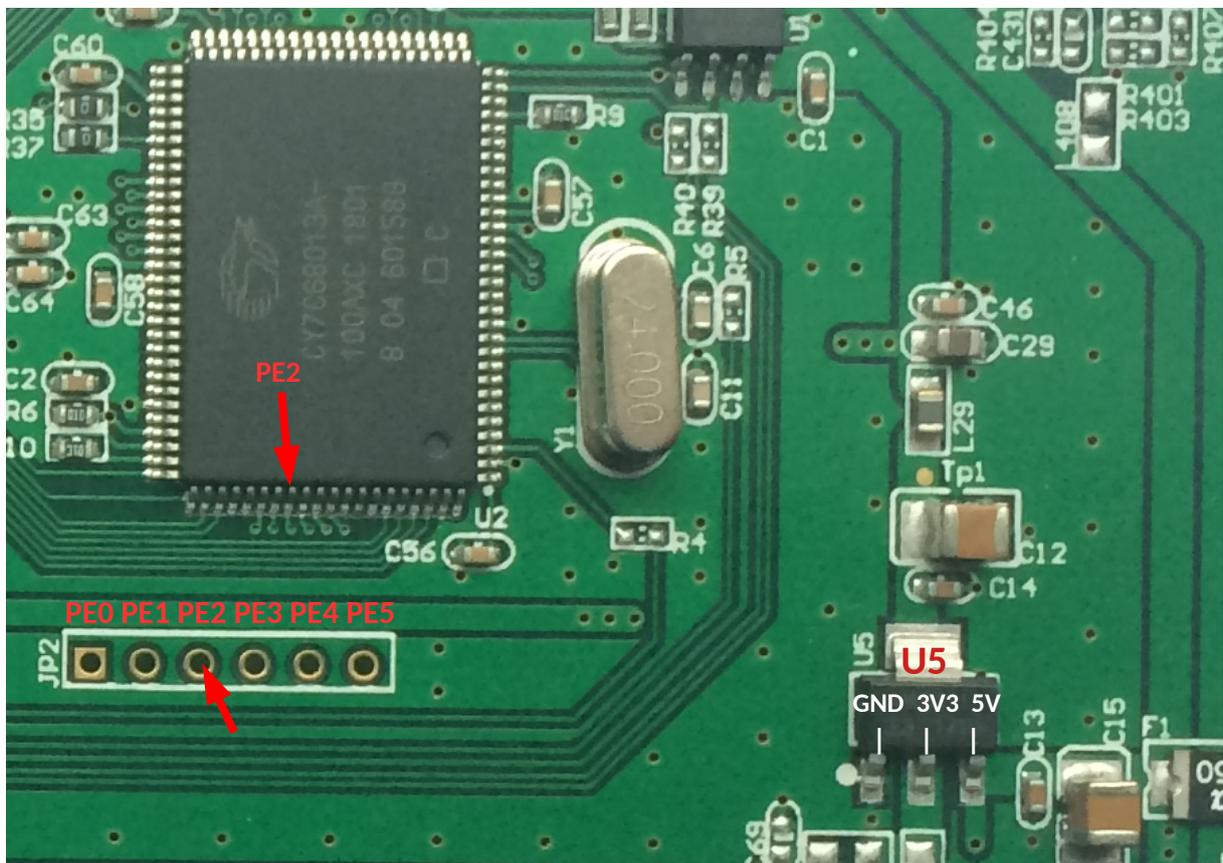
Jitter-free Calibration Out for HANTEK 6022BE/BL

An issue of the Hantek scope is the jitter of the calibration out signal. It is generated by toggling an output pin in an interrupt routine triggered by counter/timer 2 overflow.

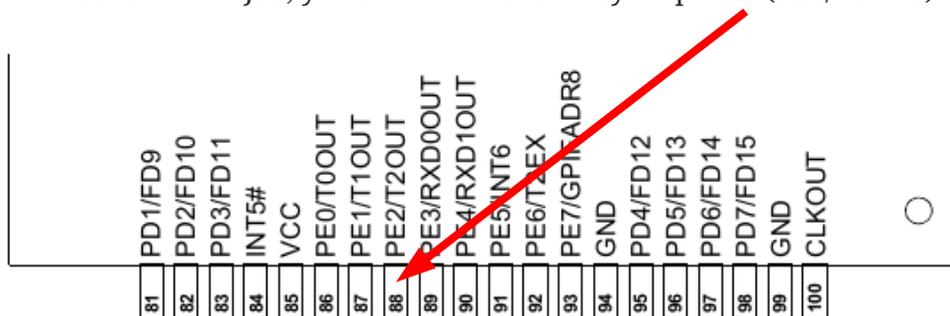
Due to interrupt latency the signal jitters by some μs , this leads to a high phase jitter on high output frequencies. The EzUSB can provide the T2 overflow signal on pin PE2/T2OUT (PE2, available on JP2 of the PCB, at least 6022BE) as an alternate port function. According to TRM (rev. G, p.193) the signal is "one CLKOUT pulse".

Connect a toggle flipflop to PE2 to create the correct output frequency with 50% duty cycle. You can use e.g. 74HC74 (dual D flipflop), 74HC161 / 74HC163 (4-bit binary counter), or 74HC4024 (7-bit binary counter). These are even available in *maker-friendly* DIL packages.

Depending on your needs, supply the chip either with 5V (pin 3 of U5 - AMS1117-3.3) or with 3.3V (pin 2 of U5), GND is U5/pin1.



The 6022BL has no JP2, you must solder directly on pin 88 (PE2/T2OUT)



Original Software Solution

Software created calibration output for 6022BE:

```
#define TOGGLE_CALIBRATION_PIN()\
do { \
    PA7 = !PA7; \
} while ( 0 )

void timer2_isr( void ) __interrupt TF2_ISR {
    /* Toggle the probe calibration pin. */
    TOGGLE_CALIBRATION_PIN();
#ifdef LED_RED_TOGGLE
    // Avoid nasty sdcc 4.0 REGRESSION:
    // Do not use "if ( ledcounter && --ledcounter == 0 )"
    // Write separate statements!
    // Otherwise the ISR uses registers for reload -> additional push/pop
    ...
    // ... more cycles, fails for 100 kHz
    if ( ledcounter ) {
        --ledcounter;
        if ( ledcounter == 0 ) { // led timed out?
            ledcounter = ledinit; // reload
            LED_RED_TOGGLE();
        }
    }
}
#endif
    TF2 = 0;
}
```

SDCC builds this assembler code, that toggles almost immediately ([line 1209](#)):

```
000136          1205  _timer2_isr:
000136 C0 E0          [24] 1206          push   acc
000138 C0 D0          [24] 1207          push   psw
                                1208 ;          scope6022.inc:78:
TOGGLE_CALIBRATION_PIN();
00013A B2 87          [12] 1209          cpl   _PA7
                                1210 ;          scope6022.inc:85:
                                if          ( ledcounter ) {
00013C E5*06          [12] 1211          mov    a,_ledcounter
00013E 45*07          [12] 1212          orl   a,(_ledcounter +
1)
000140 60 19          [24] 1213          jz    00110$
...
```

The necessary firmware modification sets bit 2 of PORTECFG to 1, this enables the alternate function T2OUT on PE2.

```
/* PE2: T2OUT for HW calibration output, other bits are port E output */
#define INIT_PORTECFG 0x04
```