

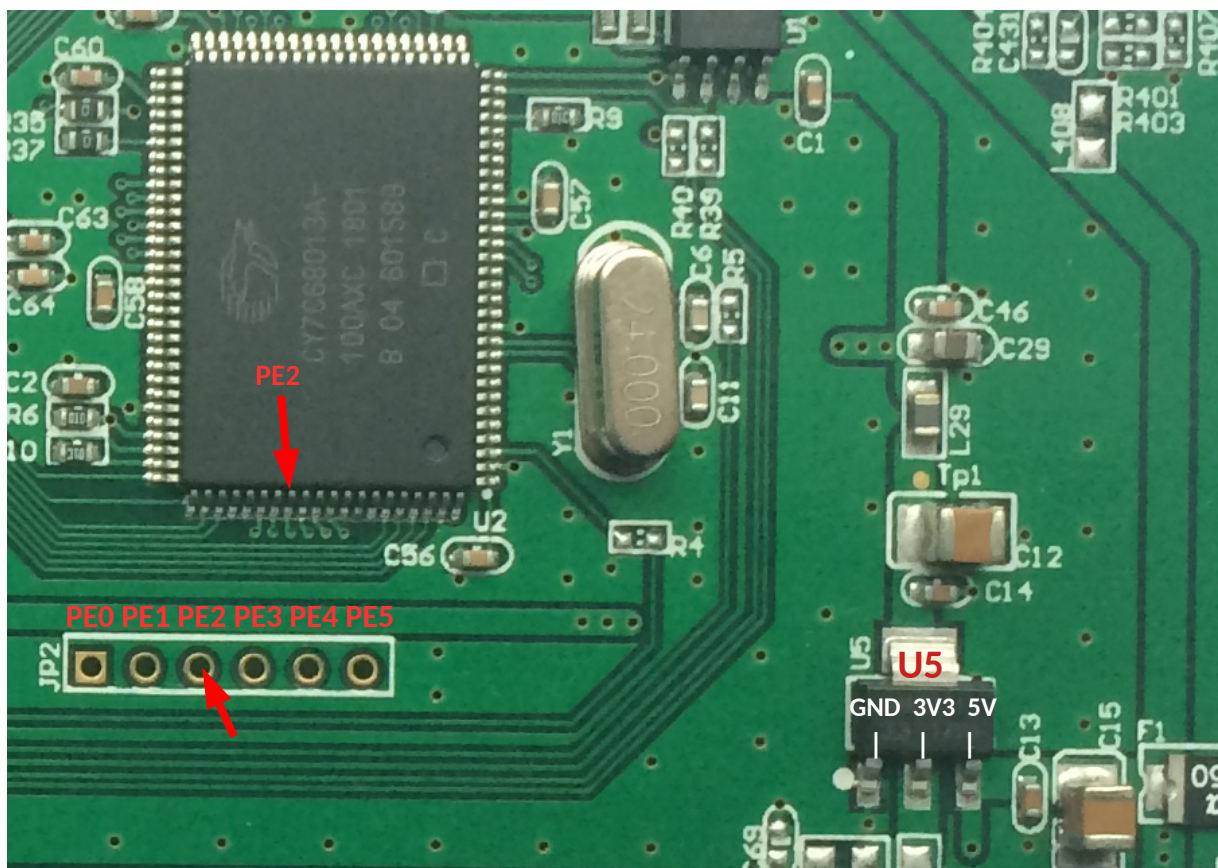
Jitter-free Calibration Out for HANTEK 6022BE/BL

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)

81	PD1/FD9	88	PE2/T2OUT	95	PD4/FD12
82	PD2/FD10	89	PE3/RXD0OUT	96	PD5/FD13
83	PD3/FD11	90	PE4/RXD1OUT	97	PD6/FD14
84	INT5#	91	PE5/INT6	98	PD7/FD15
85	VCC	92	PE6/T2EX	99	GND
86	PE0/T0OUT	93	PE7/GPIADR8	100	CLKOUT
87	PE1/T1OUT	94	GND		

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:
			(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
```