



OSTBAYERISCHE
TECHNISCHE HOCHSCHULE
REGENSBURG

ELEKTRO- UND
INFORMATIONSTECHNIK

MSP-EXP430FR4133 Adapter for 1-Sensor-Node_V4

M.Eng. Stefan Zenger
stefan.zenger@oth-regensburg.de

*Faculty of Electrical Engineering and Information Technology, Ostbayerische
Technische Hochschule (OTH) Regensburg, Regensburg, Germany*

2018/03/28

Abstract

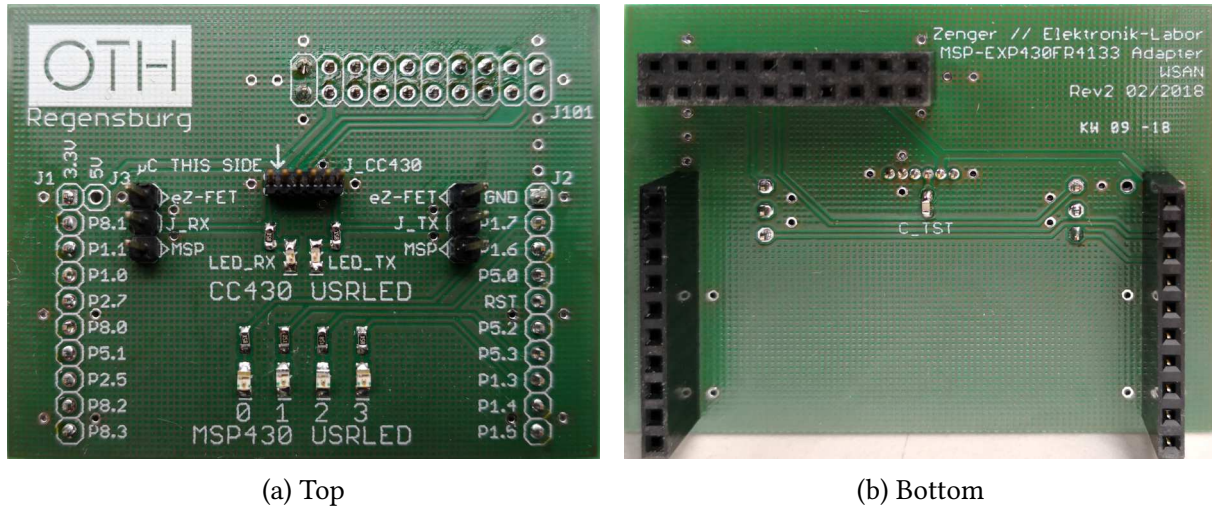
An application note about features of the Adapter-Board connecting an MSP-EXP430FR4133 with the 1-Sensor-Node_V4 by Stefan Schiller (OTHR).

Contents

1 Adapter	3
1.1 Connectors	3
1.2 Features	3
1.2.1 LEDs	3
1.2.2 UART	3
1.3 Test Programming	4
1.4 Revisions	5
2 Circuit Diagram & Layout	5
3 Next Steps	7

1 Adapter

The Adapter PCB (Fig. 1) was made as an update for the WSAN hands-on training at the OTH Regensburg. It is suited for the MSP-EXP430FR4133 Launchpad Boards (Texas Instruments) [4] as well as the 1-Sensor-Node_V4 (Schiller), featuring a CC430F613X (Texas Instruments) [1].



(a) Top

(b) Bottom

Figure 1: Pictures: EXP-MSP_2_WSAN Adapter (Rev2)

1.1 Connectors

- On bottom side (Fig. 1b) there are three connectors (J101, J1, J2), named exactly as their counterparts on the TI (Texas Instruments) Launchpad [4].
- Two jumpers (J_RX, J_TX, Fig. 1b) can select whether the UART communication is directed from the Sensor-Node to eZ-FET Debugger or MSP430 on the LP (Launchpad). See section 1.2.2, page 3.
- J_CC430F6137 (Fig. 1a) is the connection to the 1-Sensor-Node itself. The CC430F6137 should be connected with it being on the same side of the 1-Sensor-Node as both texts ($\mu\text{C THIS SIDE} \downarrow$ and J_CC430F6137) are.

Attention! While the 1-Sensor-Node should be reverse current protected a **pin-offset (unjustified pins) with applied voltage will destroy the node!**

1.2 Features

1.2.1 LEDs

On top side of the PCB (Fig. 1a) there are six LEDs in total. Two LEDs (CC430 USRLED) are connected to the CC430 [1] on the Sensor-Node as well to the UART-Outputs. The MSP430 LEDs (MSP430 USRLED) can be controlled from the MSP430- μC only (Tab. 1):

1.2.2 UART

Both Pins connected to LEDs from the 1-Sensor-Node can also be used for UART connections. With the jumpers (J_RX, J_TX, Fig. 1b in section 1.1, page 3) those may be connected to the MSP430's UART (P1.1+P1.0 [5] [2]) **or** the LP's eZ-FET debugger [4] with two jumpers.

	LED	PIN
CC430	LED_RX	P1.5/UCA0RXD
	LED_TX	P1.6/UCA0TXD
MSP430	0	P1.7
	1	P1.6
	2	P5.3
	3	P1.3

Table 1: LED Connections

1.3 Test Programming

The test C-code (Listing 1) can be used to test the Adapter in a setup like shown in Fig. 2. Both CC430 USRLEDs (Fig. 1a) should light up in a pattern if no UART-Jumper is connected. Recommended IDE (integrated development environment) to program the CC430¹ is Texas Instruments' Code Composer Studio (<http://www.ti.com/tool/CCSTUDIO>).

Code 1: Simple example test code

```

1 #include <msp430.h>
2
3
4 /**
5  * main.c
6  */
7 int main(void)
8 {
9     WDCTL = WDTPW + WDTHOLD;           // Stop WDT
10    P1DIR |= BIT5 + BIT6;              // P1.5 and P1.6 output
11    //P1DIR = 0;                       // uncomment for different light effect
12    P1OUT = 0;
13
14    __no_operation();
15
16    P1OUT = BIT6;
17
18    __no_operation();
19
20    TA1CTL0 = CCIE;                    // CCR0 interrupt enabled
21    TA1CCR0 = 50000;
22    TA1CTL = TASSEL_2 + MC_2 + TACLK;  // SMCLK, contmode, clear TAR
23
24    __bis_SR_register(LPM0_bits + GIE); // Enter LPM0, enable interrupts
25    __no_operation();                 // For debugger
26 }
27
28 // Timer A0 interrupt service routine
29 #if defined(__TI_COMPILER_VERSION__) || defined(__IAR_SYSTEMS_ICC__)
30 #pragma vector=TIMER1_A0_VECTOR
31 __interrupt void TIMER1_A0_ISR(void)
32 #elif defined(__GNUC__)
33 void __attribute__((interrupt(TIMER1_A0_VECTOR))) TIMER1_A0_ISR (void)
34 #else
35 #error Compiler not supported!
36 #endif
37 {
38     P1OUT ^= BIT5;                    // Toggle P1.5
39     P1OUT ^= BIT6;                    // Toggle P1.6
40     //TA1CCR0 += 50000;                // Add Offset to CCR0
41 }

```

¹If there's an issue with the reliability of the TST-Signal make sure that capacity C_TST (Fig. 1b) is present.

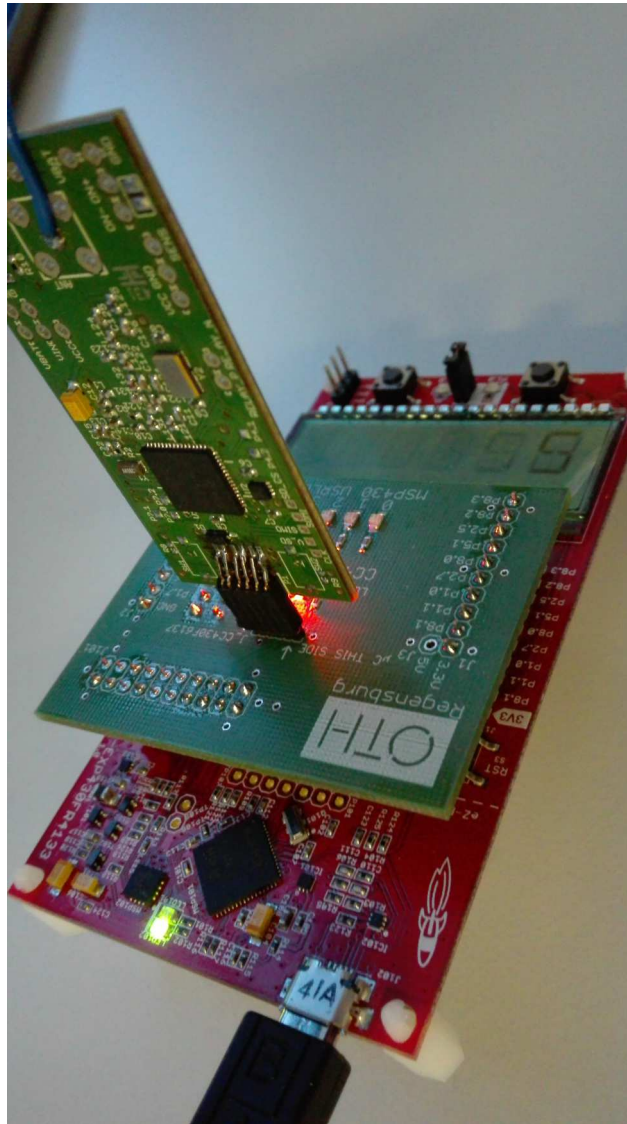
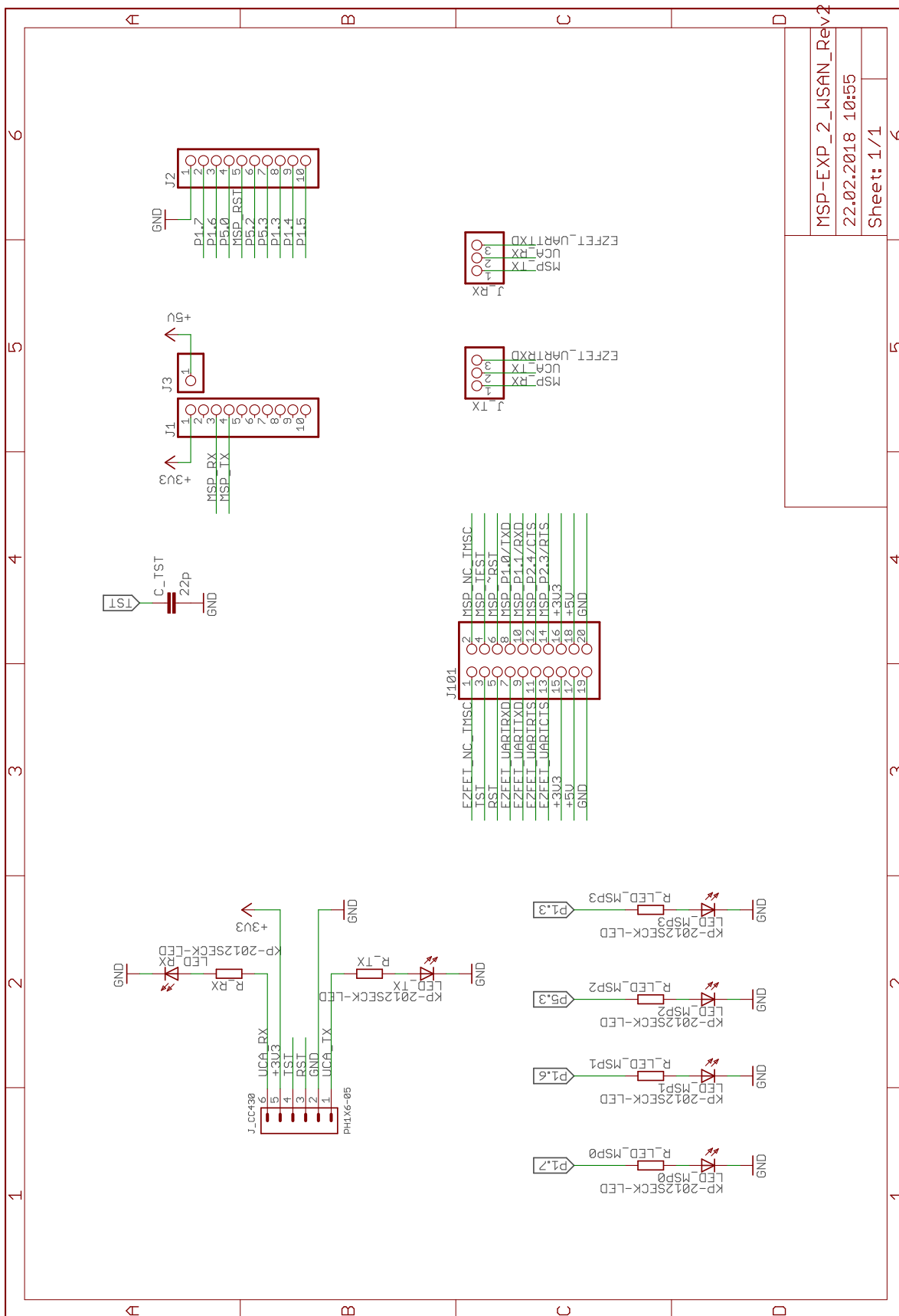


Figure 2: Picture: Combined Boards and Test-Setup (Adapter Rev1)

1.4 Revisions

- Rev0: initial layout
- Rev1: fixed J101, added UART-jumper (ability to communicate with eZ-FET)
- Rev1.1: added jumper configuration text
- Rev2: moved UART-jumper to top layer, fixed description text mirroring

2 Circuit Diagram & Layout



MSP-EXP_2_USAN_Rev2
22.02.2018 10:55
Sheet: 1/1

Figure 3: Circuit Diagram

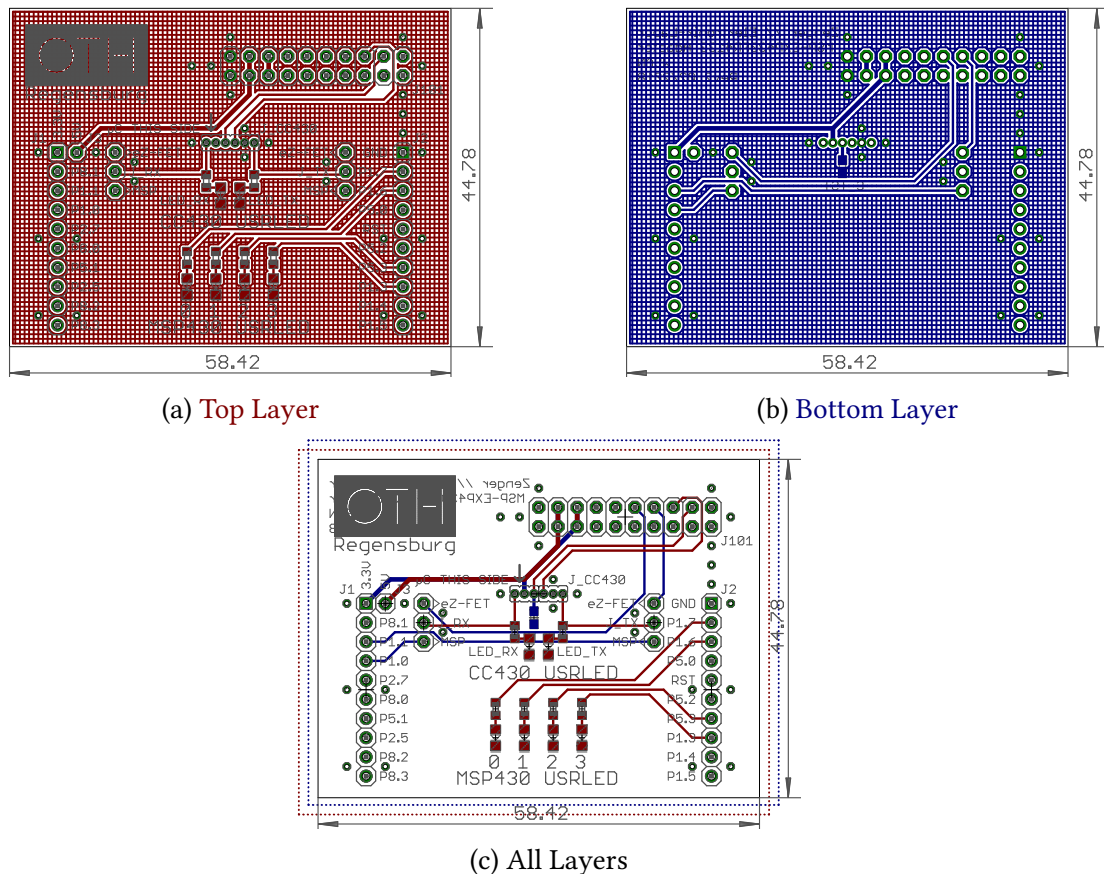


Figure 4: Layout (Rev2)

3 Next Steps

Possible points to develop next for WSAW hands-on training².

- Updating the WSAW-Dokumentation and including the use of launchpad in some form
- Firmware for MSP430 on LP
The author suggests to develop some firmware for the MSP430FR4133 [4] on used MSP-EXP430FR4133 launchpad [4] in order to communicate with the 1-Sensor-Node via UART, enabling the use of the MSP430 USRLEDs (Fig. 1a) as well as the LCD-Display on board.

²As seen from the current state of the art on 20.02.2018.

References

- [1] Texas Instruments, “[datasheet] cc430f613x, cc430f612x, cc430f513x msp430 soc with rf core datasheet (rev. h)”, 2009. [Online]. Available: <http://www.ti.com/lit/ds/symlink/cc430f6137.pdf> (visited on 02/16/2018).
- [2] —, “[datasheet] msp430fr413x mixed-signal microcontrollers datasheet (rev. b)”, 2014. [Online]. Available: <http://www.ti.com/lit/ds/symlink/msp430fr4133.pdf> (visited on 02/16/2018).
- [3] —, “[guide] cc430 family user’s guide (rev. e)”, 2009. [Online]. Available: <http://www.ti.com/lit/ug/slau259e/slau259e.pdf> (visited on 02/16/2018).
- [4] —, “[guide] msp430fr4133 launchpad™ development kit (msp-exp430fr4133) (rev. b)”, 2017. [Online]. Available: <http://www.ti.com/lit/ug/slau595b/slau595b.pdf> (visited on 02/16/2018).
- [5] —, “[guide] msp430fr4xx and msp430fr2xx family (rev. g)”, 2014. [Online]. Available: <http://www.ti.com/lit/ug/slau445g/slau445g.pdf> (visited on 02/16/2018).