

(october 2015, ... march 2016, jan 2018)



[noForth website](#)

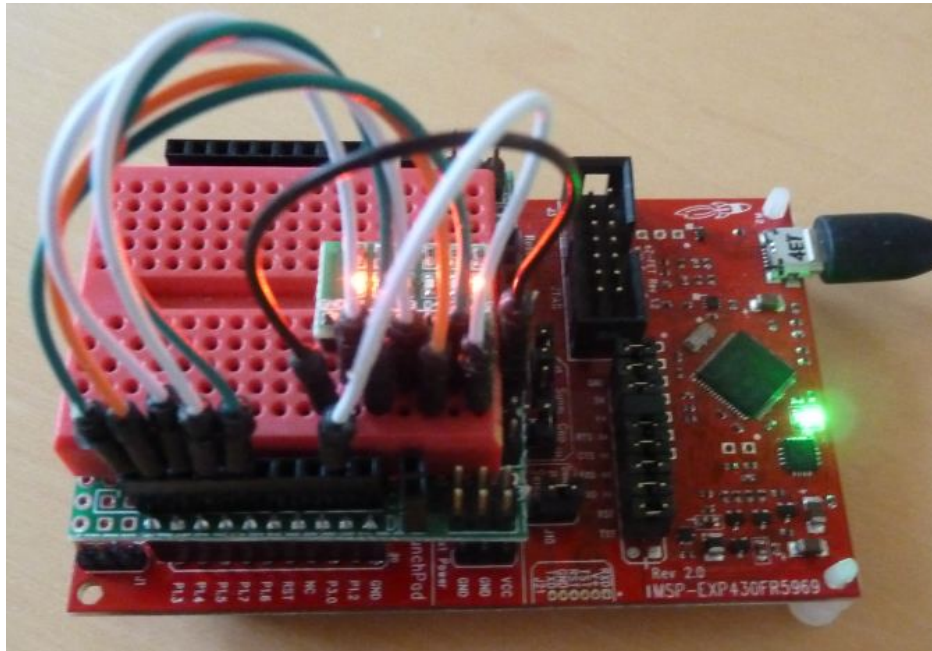
MSP-EXP430FR5969 Experimenter Board with noForth 59x9

1. MSP-EXP430FR5969 Experimenter Board with noForth 59x9
 - i/o port connections on Experimenter Board
 - Connectors on Experimenter Board
 - Hardware on Experimenter Board
2. MSP430FR5969 i/o Ports
 - Port addresses
 - PxDir, PxREN and PxOUT
 - PxSel
 - RS232/USB driver
3. MSP430FR5969 RAM & ROM
4. MSP430FR5969 interrupt vector table
5. Processor registers in noForth

In this text we refer to these two documents:

- SLAS704E.PDF "MSP430FR58xx, MSP430FR59xx mixed signal microcontroller"
- SLAU367G.PDF "MSP430x5xx Family User's Guide"

1. MSP-EXP430FR5969 Experimenter Board with noForth 59x9



MSP430FR5969 Experimenters board

Core Sub-Architecture: MSP430X

Kit Contents: LaunchPad Emulator, Mini USB-B Cable, Quick Start Guide

- Farnell - Ordercode: 2428998, TEXAS INSTRUMENTS - MSP-EXP430FR5969
- Aliexpress - Product ID: 32594843278, MSP-EXP430FR5969

i/o port connections on Experimenter Board

Port 1

P1.0 - Led 2
P1.1 - S2
P1.2 - ...
P1.3 - ...
P1.4 - ...
P1.5 - ...
P1.6 - ...
P1.7 - ...

Port 2

P2.0 - RX
P2.1 - TX
P2.2 - ...
P2.3 - ...
P2.4 - ...
P2.5 - ...
P2.6 - ...
P2.7 - ...

Port J

PJ.0 - ...
PJ.1 - ...
PJ.2 - ...
PJ.3 - ...
PJ.4 - XINB
PJ.5 - XOUTB

Port 3

P3.0 - ...
P3.1 - ...
P3.2 - ...
P3.3 - ...
P3.4 - ...
P3.5 - ...
P3.6 - ...
P3.7 - ...

Port 4

P4.0 - ...
P4.1 - ...
P4.2 - ...
P4.3 - ...
P4.4 - ...
P4.5 - S1
P4.6 - Led 1
P4.7 - ...

Connectors on Experimenter Board

J4 = i/o P1, P3, P4 and GND
J5 = i/o P1, P2, P3, Test and VCC
H2 = Programmer connection and USB RS232
J3 = JTAG connector
J21 = eZ430 interface
J12 = External power (2,5V tot 3,6V)
EZ_USB = USB RS232 and programmer interface
J9 = MSP current measure
J10 = Power select
J2 = Bypass/Supercap
J11 = Supercap charge

Hardware on Experimenter Board

- Two leds on P4.6 and P1.0
- Switch S1 on P4.5
- Switch S2 on P1.1
- Super capacitor of 0.1 Farad
- Reset switch RST
- LCD 96x96 pixels (Sharp96)
- JTAG 14-pin connector

2. MSP430FR5969 i/o ports

Addresses

The MSP430FR5969 port registers are memory mapped. An overview:

<u>Label</u>	<u>P1</u>	<u>P2</u>	<u>P3</u>	<u>P4</u>	<u>PJ</u>	<u>Function</u>
PxIN	200	201	220	221	320	Input
PxOUT	202	203	222	223	322	Output
PxDIR	204	205	224	225	324	Direction
PxREN	206	207	226	227	326	Resistor enable
PxSEL0	20A	20B	22A	22B	32A	Select 0
PxSEL1	20C	20D	22C	22D	32C	Select 1
P1IV	20E	21E	22E	22F		Interrupt vector word
P1SELC	210	211	230	231		Complement selection
PxIES	218	219	238	239		Interrupt edge select
PxIE	21A	21B	23A	23B		Interrupt on
PxIFG	21C	21D	23C	23D		Interrupt flag

PxDir, PxREN and PxOUT

The three registers PxDIR, PxREN and PxOUT are used to configure an i/o pin:

<u>PxDIR</u>	<u>PxREN</u>	<u>PxOUT</u>	<u>Pin configuration</u>
0	0	x	Floating input
0	1	0	Input with resistor to GND
0	1	1	Input with resistor to VCC
1	x	x	Output

More info in SLAU367G.PDF page 338.

Texas Instruments recommends to configure unconnected i/o pins as Output.

PxSEL and PxSEL2

The registers PxSEL and PxSEL2 are used to assign a special function to an i/o pin. In this way, for example, the ADC of UART can be activated. See SLAS704E.PDF page 78-104.

<u>PxSEL2</u>	<u>PxSEL</u>	<u>i/o-function</u>
0	0	Normal i/o
0	1	Basic extra function
1	0	Controller specific!
1	1	Second extra function

RS232/USB driver

The Windows USB-driver for this board is: [ezFET-Lite-Driver1.zip](#). Extract and install it. If by accident Windows does not install the correct driver, you have to install the [MSP Flasher](#) from Texas Instruments and run it once. Follow the directions and the MSP Flasher will install the correct driver for you.

The eUSCI A0 is used as UART. Pins P2.0 (TX) and P2.1 (RX) are used, the default baudrate is 38400 baud.

3. RAM and ROM

RAM 1C00 - 23FF, ROM 4400 - 13FFF

4. MSP430FR5969 interrupt vector table

FFCC - End of free flash
FFCE - RTC

FFD0 - P4
FFD2 - P3
FFD4 - TIMER B2 CCR1 CCR2
FFD6 - TIMER B2 CCR0
FFD8 - P2
FFDA - TIMER B1 CCR1 CCR2
FFDC - TIMER B1 CCR0
FFDE - P1

FFE0 - TIMER A1 CCR1 CCR2
FFE2 - TIMER A1 CCR0
FFE4 - DMA
FFE6 - USCI 1 RX/TX
FFE8 - TIMER A0 CCR1 CCR2
FFEA - TIMER A0 CCR0
FFEC - ADC10
FFEE - USCI 0 RX/TX

FFF0 - USCI 0 RX/TX
FFF2 - WATCHDOG
FFF4 - TIMER B0 CCR1 CCR2
FFF6 - TIMER B0 CCR0
FFF8 - COMPARATOR
FFFA - NMI USER
FFFC - NMI SYSTEM
FFFE - RESET (from many sources)

See SLAS639J.PDF page 47-48 for details.

5. Processor registers in noForth

All processor registers (R0..R15) have their own name in noForth assembler:

PC	RP	(SP in TI texts!)	SR	CG	MSP430 system registers
SP	IP	TOS	DOX	NXT	noForth system registers
W	DAY	SUN	MOON		Registers, locally used by noForth
XX	YY	ZZ			Unused (free) registers