FLYING CAMP DESIGN

# MSP430 BSL Programmer
FCD-PRG01

Highlights

- Supports all MSP430 device families supported by TI example "Bootstrap Loader Hardware" in SLAU319[1]

- Standard 6 pin, 0.1" header interface

- USB bus powered

- 3.3V target supply output (up to 400mA)

- Cross platform driver support for Windows, Linux, and Mac OS

- Full Python MSP430 Tools support

- Full TinyOS support

- Fully Open-Source hardware design[2]

Product Description

The FCD-PRG01 is a USB bootstrap loader[3] (BSL) programmer for the Texas Instruments MSP430 microcontroller. For designs where low cost or small form factor prohibit the integration of custom programming logic or a large JTAG header, the FCD-PRG01 enables in-system programming by including a single 6 pin header in the target device design.
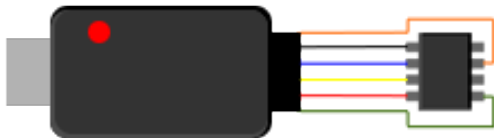
Originally designed to work with the cross platform TinyOS toolchain, the FCD-PRG01 provides an open source, cross platform alternative to platform dependent development tools for the MSP430 microcontroller.

The FCD-PRG01 integrates a USB-to-serial converter and on board regulated power supply into a small USB dongle, allowing programming and test capability over a single interface. It exposes a standard 6 pin, 0.1" header which can be used to interface to the target board via a device specific cable harness. This modular approach provides designers with the flexibility to select the optimal physical programming interface for the unique design constraints of each target platform.

Ordering Information

FCD-PRG01   MSP430 BSL Programmer
FCD-CBL01   Programming interface cable (6x1, 0.1" ↔ 3x2, 2mm)

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[1]   FCD-PRG01 does not include inverting buffers as shown in the TI reference hardware. Requires PC software to support specific MSP430 device families. Not all MSP430 devices have been tested for hardware compatibility. See page 5 for device family support.
[2]   Design files available at http://www.flyingcampdesign.com/msp430-bsl-programmer.html
[3]   "MSP430 Programming Via the Bootstrap Loader (SLAU319)" Application Note (http://www.ti.com/lit/pdf/SLAU319)

Programming Interface

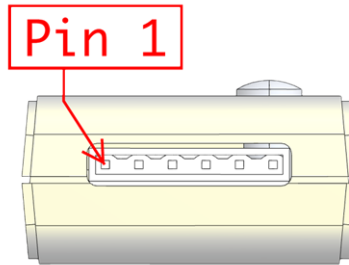The FCD-PRG01 provides a standard 6x1, 0.1" programming header for powering and communicating with the target device.

Figure 1: 6x1, 0.1" Header

Pinout

FCD-PRG01 Signal	FCD-PRG01 Pin	MSP430 devices with TEST pin	MSP430 devices without TEST pin
DTR	1	TEST	TCK
RXD	2	UART_TX	UART_TX
TXD	3	UART_RX	UART_RX
VCC	4	VDD	VDD
RTS	5	RST	RST
GND	6	GND	GND

Electrical Characteristics

VCC Target Supply Output (Pin 4)

Parameter	Minimum	Typical	Maximum	Units	Conditions
Output Voltage	-	3.3	-	V	
Output Current	-	-	0.4	A	
Short Circuit Current	-	450	-	mA	Vout = 0 V
Dropout Voltage	-	75	200	mV	Iout = 400 mA
Accuracy	-	1	-	%	

UART and I/O (Pins 1,2,3,5)

Parameter	Minimum	Typical	Maximum	Units	Conditions
DC Input Voltage	-0.5	-	3.8	V	
Output Drive Strength	-	12	-	mA	
Output Voltage High	2.2	2.8	3.2	V	Isource = 3 mA
Output Voltage Low	0.3	0.4	0.6	V	Isink = 8 mA
Input Switching Threshold	1.0	1.2	1.5	V	
Input Switching Hysteresis	20	25	30	mV	

Programming Cables

FCD-CBL01

A programming cable harness which mates with standard 3x2, 2mm PCB headers is available from Flying Camp Design for use with the FCD-PRG01. Pinout for this cable is available in schematic form at FCD-CBL01.

Figure 2: FLYING CAMP DESIGN FCD-CBL01

Flying Camp Design recommends using the following through hole and surface mount headers for use with the FCD-CBL01:

(a) Hirose DF11-6DP-2DSA(01)   (b) Hirose DF11G-6DP-2V(50)
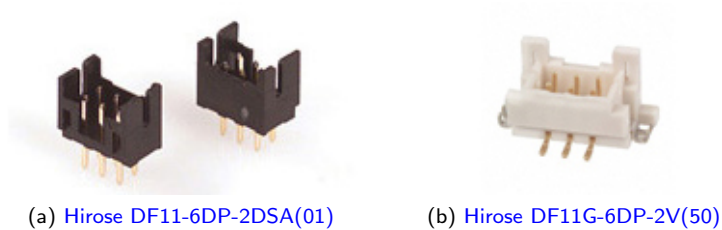
Figure 3: Recommended headers for use with the FCD-CBL01 cable

A Cadsoft Eagle CAD library which contains land pattern footprints for these headers is available for download on the FCD-PRG01 product page: http://github.com/FlyingCampDesign/eagle

Custom Programming Cables

For those customers wishing to design their own custom programming cables, Flying Camp Design recommends the following mating connector for use with the 6 pin BSL programming interface:

Figure 4: Molex 50-57-9006

Installation

The FCD-PRG01 uses a USB ↔ Serial interface chip (FTDI Chip FT232R) and corresponding operating system driver to provide a Virtual COM Port (VCP) interface layer to the BSL programming software. The BSL programming software depends upon this VCP interface layer to control the communication pins on the programmer.

1. **Before plugging in the FCD-PRG01 to your computer**, install the appropriate driver for your operating system by following the corresponding installation guide available online at:
   http://ftdichip.com/Documents/InstallGuides.htm

   A full listing of the latest VCP drivers for all supported operating systems is available online at:
   http://ftdichip.com/Drivers/VCP.htm

   Note: A Linux driver for the FT232R is included in most newer kernels (> 2.4.20 or greater). However, on some kernels an older F232BM driver may be used which is compatible with the FT232R.

2. After installing the appropriate driver for your operating system, insert the FCD-PRG01 into a free USB port on your computer.

3. If installation was successful, the FCD-PRG01 should appear as a VCP on your computer:
Windows	COM[X]
Linux	/dev/ttyUSB[X]
Mac OS X	/dev/tty.usbserial-[...]

MSP430 Device Family Support

Any MSP430 device family that is supported by the example hardware described in SLAU319 section 4.1 "Hardware Description" should also be compatible with the FCD-PRG01. The following table provides information about MSP430 device families that may not be compatible with the FCD-PRG01 hardware.

Device Family	Summary
MSP430F543xA	FCD-PRG01 is incompatible with MSP430F543xA pre-Rev H silicon devices. There is a bug in MSP430F543xA pre-Rev H devices which requires that the second low pulse on TEST must be shorter than 15us, which the VCP drivers for the FCD-PRG01 are unable to achieve. Please reference SYS10 in http://www.ti.com/lit/pdf/slaz290 for more details. TI has confirmed that this bug has been fixed in Rev H silicon and later.

Software Support

The Virtual COM Port (VCP) drivers provide a serial port interface to the BSL control software. This generic software interface enables the use of third party BSL tools, as well as provides a simple abstraction to those users wishing to write their own BSL tools. The mapping between the VCP signal and the programmer pins is shown in the table on page 2. The following examples show how to use the FCD-PRG01 with the BSL tools available from TI and a couple popular MSP430 toolchains.

TinyOS

The TinyOS toolchain includes built in support for the FCD-PRG01. The following example can be used to compile a TinyOS application and install it onto an MSP430 based TinyOS "platform":

```
make [platform] install miniprog
```

More information about the TinyOS toolchain is available online at: TinyOS

SLAU319

The TI support files[4] for SLAU319 include a command line demo utility for communication with 1/2/4xx BSLs. This utility is called "BSLDEMO2.exe" and is designed to work with the example hardware described in SLAU319 section 4.1 "Hardware Description". The FCD-PRG01 mimics this hardware by providing a VCP interface to the BSL control software. However, the FCD-PRG01 does not include inverting buffers on RST and TCK as shown in the TI reference hardware. Furthermore, the FCD-CBL01 swaps the RST and TCK pins (with respect to the virtual COM port RTS and DTR pins). Therefore, the BSLDEMO2.exe utility source code provided by TI must be patched and recompiled to work correctly with the FCD-PRG01 + FCD-CBL01 combination. A patched version of BSLDEMO2.exe can be downloaded from http://www.flyingcampdesign.com/msp430-bsl-programmer.html while the patched source code can be obtained from https://github.com/FlyingCampDesign. The following example programs the target with the TI-TXT firmware file "firmware.txt":

```
BSLDEMO2.exe -s2 -cCOMx firmware.txt
```

Python MSP430 Tools

The Python MSP430 Tools project includes built in support for the FCD-PRG01. The Python MSP430 Tools can be installed from http://pypi.python.org/pypi/python-msp430-tools/ via "pip" by running:

```
pip install pyserial python-msp430-tools
```

The following example clears all flash memory, programs the target with the Intel HEX firmware file "firmware.hex", and then resets the target:

```
msp430-bsl-fcdprog.py -p /dev/path-to-msp430-bsl-programmer -r -e path/to/firmware.hex
```

MSP430 BSL Utility (no longer under active development)

The Flying Camp Design MSP430 BSL Utility is an open source GUI utility which was designed to be fully compatible with the FCD-PRG01. Open source code can be obtained from: https://github.com/FlyingCampDesign
More information about using the FCD-PRG01 with this software is available on the MSP430 BSL Utility product page: http://www.flyingcampdesign.com/msp430-bsl-utility.html

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[4]   http://www.ti.com/lit/zip/slau319

Questions?

Contact support@flyingcampdesign.com or visit http://www.flyingcampdesign.com/support.html

Revision History

Revision	Date	Summary
C	12/09/2012	- Add MSP430 Device Support page
		- Add Revision History page
		- Add SLAU319 software section
		- Update links to Python MSP430 Tools
		- Add note saying MSP430 BSL Utility is no longer under active development
D	12/11/2012	- Add date column to Revision History table
		- Update MSP430 BSL Utility description and add link to Github page
E	02/09/2013	- Update MSP430 Device Support page regarding MSP430F543xA SYS10 BSL fix
		- Fix revision-hard-coded link to a TI errata sheet
F	02/11/2013	- Update FCD-CBL01 mating connector CAD symbol library URL

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