

## Application note: Floating point Coprocessor Application for SC1x3

### Functionality

This application realizes a coprocessor for double precision floating points at the IPC@CHIP® DK60 development Board with IPC@CHIP® SC1x3 controller. Supported are calculations, compare- and convert- operations.

### Requirements

To start up with this application the hardware and software described below are required.

Hardware:

- The IPC@CHIP® DK60 development board.
- The FB60-FPU01 floating point coprocessor function board.

Software:

- IPC@CHIP® FPU software archive
- @CHIPTOOL
- Paradigm C/C++ Beck IPC Edition

### Installation

Before you install this application on your IPC@CHIP® you have to configure it.

IPC@CHIP® Configuration:

- Install the @CHIPTOOL.
- Connect the FB-FPU01 floating point Coprocessor board with the connectors S8, S10, S39, S9 and SPI at the DK60 development board.
- Make sure that the blank solder pads without any name (not TR1 and either TR2) on the bottom side of the DK60 board are bridged with solder.
- Make sure that the Xilinx CPLD is reprogrammed so that you'll measure a 48MHz clock at the pin CPLD2 at connector S10. (see: [www.beck-ipc.com](http://www.beck-ipc.com))
- Connect power supply and ethernet cable to your IPC@CHIP® board. Your development PC must be also connected to the same ethernet.
- Start the @CHIPTOOL. After some seconds the @CHIPTOOL shows your IPC@CHIP®.
- Open the pop-up menu with a right mouse click on your IPC@CHIP® and choose 'IP Configuration'.
- Configure your IPC@CHIP®. For further information to the IP configuration please ask your network administrator.

### IPC@CHIP® Software Installation:

- Extract the IPC@CHIP® FPU software archive
- Open the @CHIPTOOL pop-up menu with a right mouse click on your IPC@CHIP® and choose 'FTP'.
- Enter username (by default 'ftp') and password (by default 'ftp') and click on 'Connect'
- Enter the directory 'IPC@CHIP' in the IPC@CHIP® FPU software archive.
- Enter the paradigm24 directory.
- Download the FPU.EXE file to the IPC@CHIP®.
- Close the @CHIPTOOL FTP-Client Window.

### Run

Now your IPC@CHIP® floating point coprocessor device is ready for use. The IPC@CHIP® floating point coprocessor device provides the following functionality:

Functionality	Operation Sign	Operation Command
Calculations:		
Add	+	ADD
Subtract	-	SUB
Multiply	*	MUL
Divide	/	DIV
Square root	sqrt	SQRT
Compare operations:		
Less	<	CMPLS
Less or equal	<=	CMPLSEQ
Greater	>	CMPGT
Greater or equal	>=	CMPGTEQ
Not equal	!=	CMPNEQ
Unordert	<>	CMPU
Convert operations		
Double precision to single precision floating point number	;->;	FLTOFL
Double precision floating point to 32Bit fixed point number	;->;	FLTOFI
32Bit fixed point to double precision floating point number	;->;	FITOFL

The example program FPU.EXE supports a command line interface. You can use a telnet client to get access to the command line interface. To do that open the @CHIPTOOL pop-up menu with a right mouse click on your IPC@CHIP® and choose 'Telnet'. Enter username (by default 'tel') and password (by default 'tel') and click on 'Connect'. Now press 'h' to get the list of available command.

To execute a floating point operation type: "FPU.EXE (value1) (operation sign) (value2)".

The result will appear in the next line.

Use the FB60-FPU01 coprocessor in your own software

(For succeed compare operation the coprocessor will return zero. No succeed compare operation will return an error)

## Use the FB60-FPU01 coprocessor in your own software

To use the FB60-FPU01 floating point coprocessor function in your own software you need to do the following:

- Install the Paradigm C/C++ Compiler in the Beck IPC Edition
- Start a new project and select the options 24Bit address mode and floating point emulation mode in the Paradigm Compiler environment.
- Copy the "fpu.h" header file into your local project directory. You'll find the file at the IPC@CHIP® FPU software archive in the "source" sub directory.
- Include the "fpu.h" file into your project while type: #include "fpu.h".

Now you are able to use the floating point coprocessor functions. You'll find detailed information about the coprocessor functions in the @CHIP-RTOS C Library V2.XX at the Beck IPC webpage . You can also look at the "fpu.c" source code at the IPC@CHIP® FPU software archive in the "source" sub directory, to get an example of how to use the coprocessor.

## Coprocessor Register

Address	Meaning
Configuration Register (16bit read-write)	
0E00h	Bit 0 : OP(0)
	Bit 1 : OP(1)
	Bit 2 : OP(2)
	Bit 3 : OP(3)
	Bit 4 : new date
	Bit 5 : fpu enable (start calculation)
	Bit 6 : reset fpu
	Bit 7 : n/a
0E01h	Bit 8 : fpu is ready for new data
	Bit 9 : operation done
	Bit 10: invalid value(s) for operation
	Bit 11: overflow
	Bit 12: underflow (value is between zero and the lowest number of a double float)
	Bit 13: divide by zero
	Bit 14: compare operation failed
Bit 15: n/a	
Input Register for value 1 (64-bit write-only)	
0E02h – 0E09h	The 64 Bit floating point number of value 1
Input Register for Value2 (64-bit write-only)	
0E0Ah – 0E11h	The 64 Bit floating point number of value 2
Output Register for the result (64-bit read-only)	
0E12h – 0E19h	The 64 Bit floating point number of the result

OP Bit combination	Meaning
OP(3..0)	Operation
00h	Multiply
01h	Divide
02h	Add
03h	Subtract
04h	Square root
05h	Convert double to single precision floating point
06h	Convert 32Bit fixed point to double floating point
07h	Convert double floating point to 32Bit fixed point
08h	Unordert
09h	Greater
0Ah	n/a
0Bh	Greater or equal
0Ch	Less
0Dh	Not equal
0Eh	Less or equal
0Fh	n/a

#### Further Documentation and Links

<http://forum.beck-ipc.com>

<http://www.beck-ipc.com>