

fpsp

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REVISION HISTORY

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Chapter 1

fppsp

1.1 fppsp.doc

```
--Background--  
FPSPMonadic()  
FPSPDyadic()
```

1.2 fppsp.resource/--Background--

PURPOSE

This resource contains the emulation routines for FPU instructions which are non-native for the 68040 or the 68060 processor. This resource is - as all resources - not disk based. Instead, it is build by the 68040 or 68060.library on startup. The CPU driver libraries install the "FPSP" code as part of their initialization process, such that every non-impelemented FPU instruction will be emulated properly. However, this means that for every such instruction, the CPU has to go thru exception processing, and will therefore stop multitasking when emulating a non-implemented instruction. Calling the fppsp routines directly thru the new fppsp.resource will prevent this overhead and will gain some speed.

A separate patch - the FastIEEE program - will patch the system math libraries to make use of this resource.

The fppsp.resource is re-entrant, interrupt-callable code. The resource offers only two functions which emulate monadic resp. dyadic functions of the 68881/68882 FPU on a 68040 FPU.

Currently, only the V40 68040.library builds and provides this resource, future versions of the 68060.library might offer this as well.

These functions are designed to be stub functions for assembly language, they are not designed to be callable from C or any other high-level language. Typical applications would call these routines indirectly thru a link library which provides all

requires parameters. Direct calling from within application programs is not desired.

Moreover, the FPSP routines **do not** generate FPU exceptions themselves for speed reasons. If this is desired, the calling routine has to check the fpcr and the fpsr FPU registers manually and has to generate the exceptions itself.

1.3 fppsp.resource/FPSPMonadic

NAME

FPSPMonadic - emulate a monadic 68881/68882 instruction

SYNOPSIS

```
storeflag = FPSPMonadic ( opword, operand );
d0          d0          fp0
```

```
BYTE FPSPMonadic ( UWORD , IEEEExtended );
```

FUNCTION

This function emulates the 68881/68882 monadic instruction passed in in register d0, and performs the desired mathematical operation on FP0. It returns the result in the FPU register FP0 and FP1.

INPUTS

opword - The extension word of a valid 68881/68882 instruction. Valid extension words are found in the motorola family guide or the 68881/68882 manual.
Note that this is actually the SECOND (!) opword of the 68881/68882 instruction.
The bits of the opword have to be specified as follows:

Bits 15 and 13 must be cleared. The fppsp.resource does not emulate FPU control instructions. It emulates all transcendental math instructions, and "fint" and "fintrz". Even though these two instructions are "native" for the 68060, calling the resource with these opwords works correctly.

```
R/M:   Source operand mode,    bit 14.
        Must be set to zero.
Source: Source specifier,      bits 12 to 10.
        Must be set to zero.
Dest:   Destination specifier, bits 9 to 7.
        Must be set to zero.
Inst:   Instruction field,     bits 5 to 0.
        Must be filled with the opcode of the
        desired instruction, see the motorola
        documents for the list. For the special
        case of FPSINCOS, the FPC field, bits
        2 to 0, has to be set to 001 to encode
```

FP1 as secondary result register.

operand - A valid IEEE extended precision number as argument to the function to be performed.

Secondary inputs are delivered in the FPU registers FPCR and FPSR, namely to select the rounding precision and the behaviour in case of invalid arguments or infinite results.

RESULTS

storeflag - This is set to 0 in case the FPSP routine could generate a result. THIS DOES NOT MEAN that the arguments are valid. In case all exceptions are disabled, the storeflag will always be returned as zero, but the result might be infinite or a NAN.

Secondary results are delivered in the FPU registers FP0, FP1 and FPSR.

FP0 contains the (primary) result of the 68881/68882 instruction in case the storeflag is 0. *IT MIGHT WELL BE A NAN OR AN INF*

In case the storeflag is non-zero, FP0 is undefined and the FPSP routines indicate that an exception should be generated by the caller. This happens only if an exception condition was detected and the corresponding exception has been enabled in the FPCR passed in. In all other cases a NAN or a INF will be returned and the storeflag will indicate a valid result.

FP1 contains a secondary result, if any. The only case where FP1 is used is the FSINCOS instruction where the sine is returned in FP0 and the cosine in FP1. Otherwise undefined.

FPSR contains the FPU status similar to what a real 68881/68882 would have returned.

NOTES

This function should not be called directly. It should either be called by the system math libraries, or by compiler link libraries.

Note that a non-zero store flag indicates that an exception condition was detected. NOTE THAT THE FPSP CODE DOES NOT CAUSE AN EXCEPTION ITSELF. It is the responsibility of the caller to check the FPSR, the FPCR and the storeflag to generate this exception itself, if desirable. In case the storeflag is non-zero, no useful result is returned in FP0 or FP1.

Useful instruction opwords can be found in the motorola documentation, either the MC68K family guide, or in the 68881/68882 manual.

This function does not require a6 to be loaded with the FPSP resource base. It is interrupt-callable.

BUGS

SEE ALSO

libraries/68040.h, FPSPDyadic,
the Motorola 68881/68882 manual, the MC68K family guide.

1.4 fppsp.resource/FPSPDyadic

NAME

FPSPDyadic - emulate a dyadic 68881/68882 instruction

SYNOPSIS

```
storeflag = FPSPDyadic ( opword, operand1, operand2 );
d0          d0          fp0          fp1
```

```
BYTE FPSPDyadic ( UWORD , IEEEExtended , IEEEExtended );
```

FUNCTION

This function emulates the 68881/68882 dyadic instruction passed in in register d0, and performs the desired mathematical operation on FP0 and FP1. It returns the result in the FPU register FP0.

INPUTS

opword - The extension word of a valid 68881/68882 instruction. Valid extension words are found in the motorola family guide or the 68881/68882 manual.
Note that this is actually the SECOND (!) opword of the 68881/68882 instruction.
The bits of the opword have to be specified as follows:

Bits 15 and 13 must be cleared. The fppsp.resource does not emulate FPU control instructions. It emulates all transcendental math instructions, and "fint" and "fintrz". Even though these two instructions are "native" for the 68060, calling the resource with these opwords works correctly.

R/M: Source operand mode, bit 14.
Must be set to zero.
Source: Source specifier, bits 12 to 10.
Must be set to zero.
Dest: Destination specifier, bits 9 to 7.
Must be set to zero.
Inst: Instruction field, bits 5 to 0.
Must be filled with the opcode of the desired instruction, see the motorola documents for the list. For the special case of FPSINCOS, the FPC field, bits 2 to 0, has to be set to 001 to encode FP1 as secondary result register.

operand1 - A valid IEEE extended precision number as argument to the function to be performed. This is the source operand of dyadic instructions.

operand2 - The destination operand of the dyadic 68881/68882 instructions.

Secondary inputs are delivered in the FPU registers FPCR and FPSR, namely to select the rounding precision and the behaviour in case of invalid arguments or infinite results.

RESULTS

storeflag - This is set to 0 in case the FPSP routine could generate a result. THIS DOES NOT MEAN that the arguments are valid. In case all exceptions are disabled, the storeflag will always be returned as zero, but the result might be infinite or a NAN.

Secondary results are delivered in the FPU registers FP0, FP1 and FPSR.

FP0 contains the (primary) result of the 68881/68882 instruction in case the storeflag is 0. *IT MIGHT WELL BE A NAN OR AN INF*

In case the storeflag is non-zero, FP0 is undefined and the FPSP routines indicate that an exception should be generated by the caller. This happens only if an exception condition was detected and the corresponding exception has been enabled in the FPCR passed in. In all other cases a NAN or a INF will be returned and the storeflag will indicate a valid result.

FP1 contains a secondary result, if any. As there is currently no dyadic opcode with a secondary result, this register should be ignored.

FPSR contains the FPU status similar to what a real 68881/68882 would have returned.

NOTES

This function should not be called directly. It should either be called by the system math libraries, or by compiler link libraries.

Note that a non-zero store flag indicates that an exception condition was detected. NOTE THAT THE FPSP CODE DOES NOT CAUSE AN EXCEPTION ITSELF. It is the responsibility of the caller to check the FPSR, the FPCR and the storeflag to generate this exception itself, if desireable. In case the storeflag is non-zero, no useful result is returned in FP0 or FP1.

Useful instruction opwords can be found in the motorola documentation, either the MC68K family guide, or in the 68881/68882 manual.

This function does not require a6 to be loaded with the FPSP resource base. It is interrupt-callable.

BUGS

SEE ALSO

libraries/68040.h, FPSPMonadic,

the Motorola 68881/68882 manual, the MC68K family guide.