

## 23. Self-Programming the Flash, ATmega48P

### 23.1 Overview

In ATmega48P, there is no Read-While-Write support, and no separate Boot Loader Section. The SPM instruction can be executed from the entire Flash.

The device provides a Self-Programming mechanism for downloading and uploading program code by the MCU itself. The Self-Programming can use any available data interface and associated protocol to read code and write (program) that code into the Program memory.

The Program memory is updated in a page by page fashion. Before programming a page with the data stored in the temporary page buffer, the page must be erased. The temporary page buffer is filled one word at a time using SPM and the buffer can be filled either before the Page Erase command or between a Page Erase and a Page Write operation:

Alternative 1, fill the buffer before a Page Erase

- Fill temporary page buffer
- Perform a Page Erase
- Perform a Page Write

Alternative 2, fill the buffer after Page Erase

- Perform a Page Erase
- Fill temporary page buffer
- Perform a Page Write

If only a part of the page needs to be changed, the rest of the page must be stored (for example in the temporary page buffer) before the erase, and then be re-written. When using alternative 1, the Boot Loader provides an effective Read-Modify-Write feature which allows the user software to first read the page, do the necessary changes, and then write back the modified data. If alternative 2 is used, it is not possible to read the old data while loading since the page is already erased. The temporary page buffer can be accessed in a random sequence. It is essential that the page address used in both the Page Erase and Page Write operation is addressing the same page.

#### 23.1.1 Performing Page Erase by SPM

To execute Page Erase, set up the address in the Z-pointer, write “00000011” to SPMCSR and execute SPM within four clock cycles after writing SPMCSR. The data in R1 and R0 is ignored. The page address must be written to PCPAGE in the Z-register. Other bits in the Z-pointer will be ignored during this operation.

- The CPU is halted during the Page Erase operation.

#### 23.1.2 Filling the Temporary Buffer (Page Loading)

To write an instruction word, set up the address in the Z-pointer and data in R1:R0, write “00000001” to SPMCSR and execute SPM within four clock cycles after writing SPMCSR. The content of PCWORD in the Z-register is used to address the data in the temporary buffer. The temporary buffer will auto-erase after a Page Write operation or by writing the RWWWSRE bit in SPMCSR. It is also erased after a system reset. Note that it is not possible to write more than one time to each address without erasing the temporary buffer.