ADDRESSING MODES

The Z8PLUS microcontroller provides six addressing modes:

- Register (R)
- Indirect Register (IR)
- Indexed (X)
- Direct Address (DA)
- Relative Address (RA)
- Immediate Data (IM)

With the exception of immediate data and condition codes, all operands are expressed as register file or Program Memory addresses. Registers are accessed using 12-bit addresses in the range of 000H-FFFH. The Program Memory is accessed using 16-bit addresses (or register pairs) in the range of 0000H-FFFFH.

Generally, registers are accessed, within the current page, by specifying an 8-bit address. The upper 4 bits of the absolute address is specified by pre-pending the lower 4 bits of the Register Pointer (0FDH) (the Page Pointer) to the 8-bit address to form a 12-bit address.

Working Registers are accessed using 4-bit addresses in the range of 0-15 (0H-FH). The address of the register being accessed is formed by the combination of the lower 4 bits of the RP (Page Pointer), the upper four bits in the Register Pointer (Group Pointer) and the 4-bit working register address supplied by the instruction.

Registers can be used in pairs to designate 16-bit values or memory addresses. A Register Pair must be specified as an even-numbered address in the range of 0–14 for Working Registers, or 0–4094 for general purpose registers.

In the following definitions of Z8PLUS Addressing Modes, the use of register can also imply register pair, working register, or working register pair, depending on the context.

NOTE: See the product data sheet for exact program and register memory types and address ranges available.

REGISTER ADDRESSING (R)

In 8-bit Register Addressing mode, the operand value is equivalent to the contents of the specified register or register pair.

In the Register Addressing (see Figure 2-1), the destination and/or source address specified corresponds to the actual register in the current page of the register file.

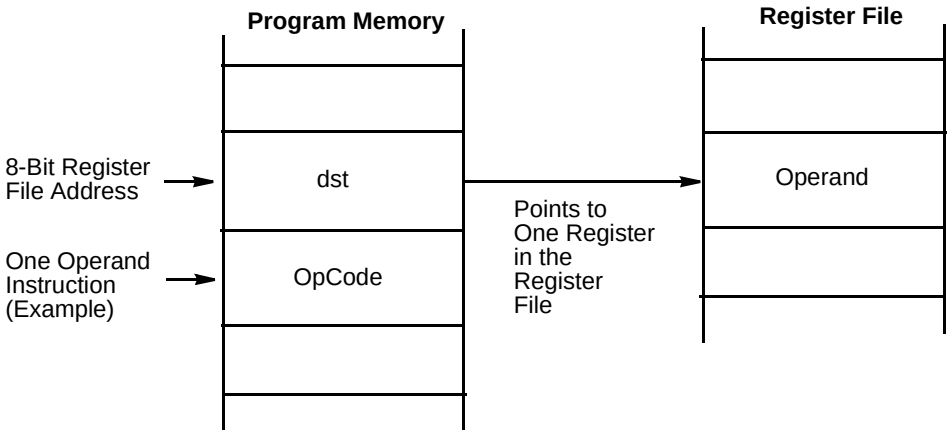

Figure 2-1. 8-Bit Register Addressing

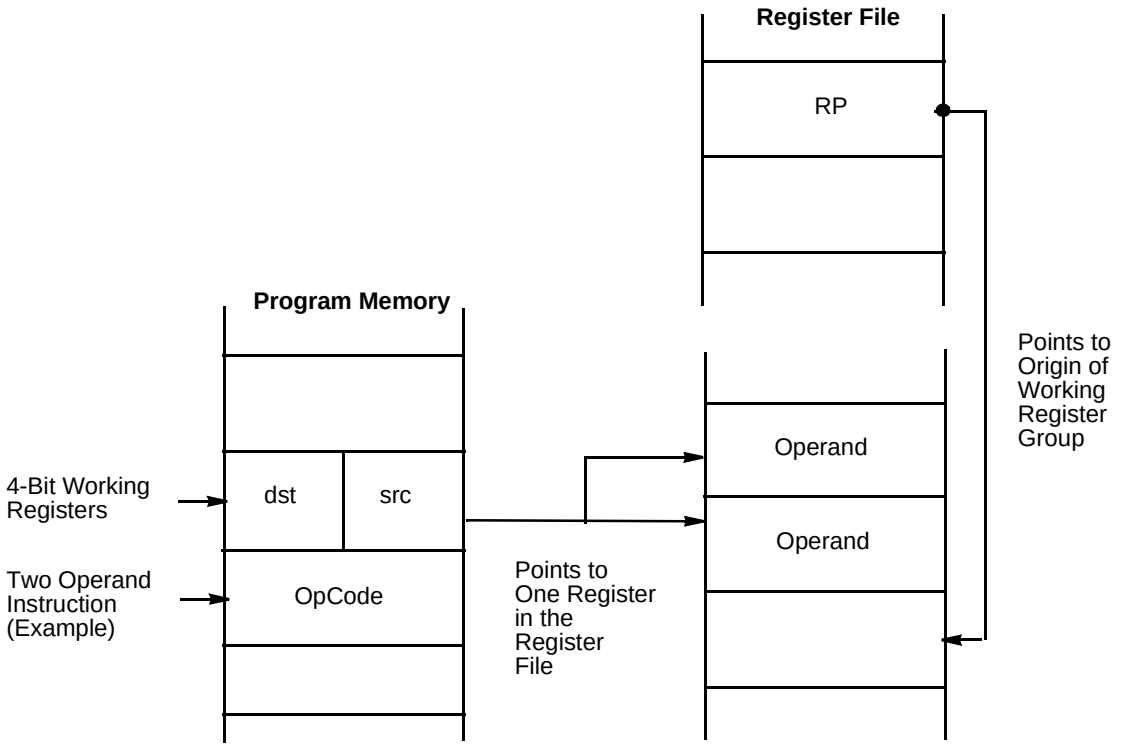

Figure 2-2. 4-Bit Register Addressing

In 4-bit Register Addressing (see Figure 2-2), the destination and/or source addresses point to the Working Register within the current Working Register Group. This 4-bit address is combined with the Register Pointer to form the actual 12-bit address of the affected register.

INDIRECT REGISTER ADDRESSING (IR)

In the Indirect Register Addressing Mode, the contents of the specified register are equivalent to the address of the operand (see Figure 2-3 and Figure 2-4).

Depending upon the instruction selected, the specified register contents points to a Register or Program Memory location.

When accessing program memory, register pairs or Working Register pairs are used to hold the 16-bit addresses.

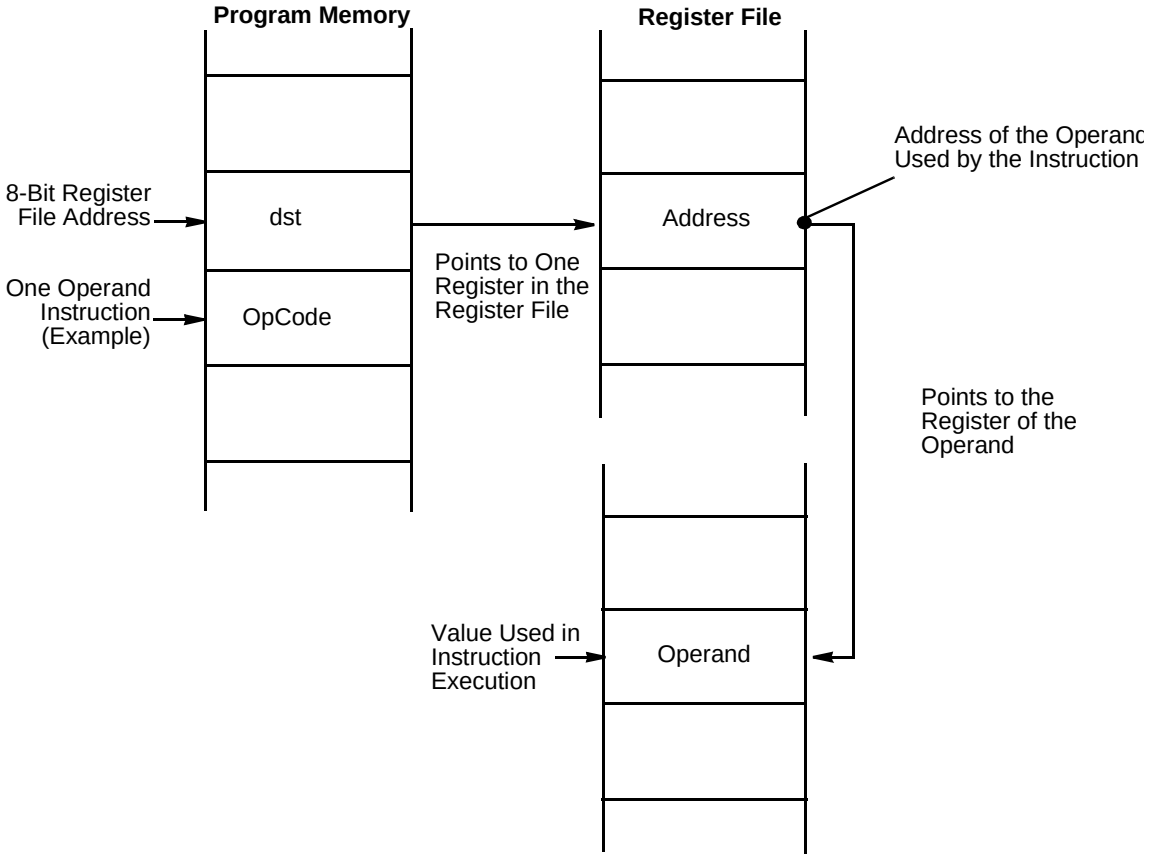

Figure 2-3. Indirect Addressing of Register File Memory

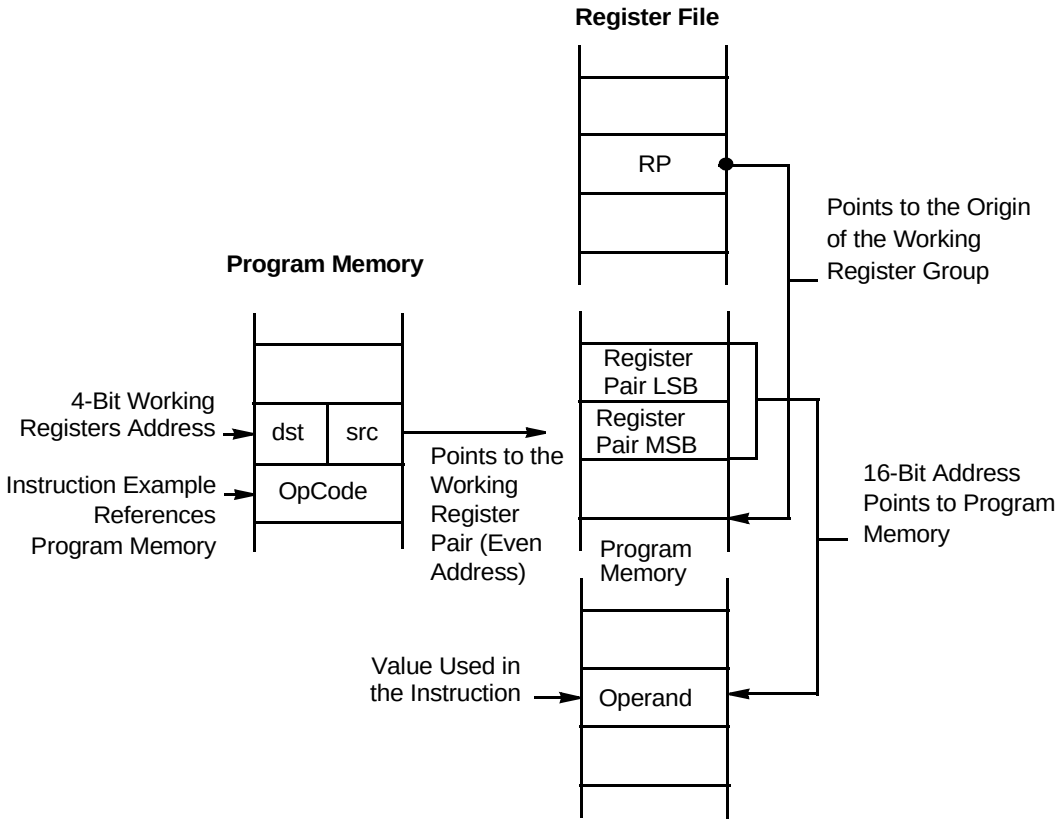

Figure 2-4. Indirect Register Addressing to Program Memory

INDEXED ADDRESSING (X)

The Indexed Addressing Mode is used only by the Load (LD) instruction. An indexed address consists of a register address offset by the contents of a designated Working Register (the Index). This offset is added to the register address to obtain the address of the operand. Figure 2-5 illustrates this addressing convention.

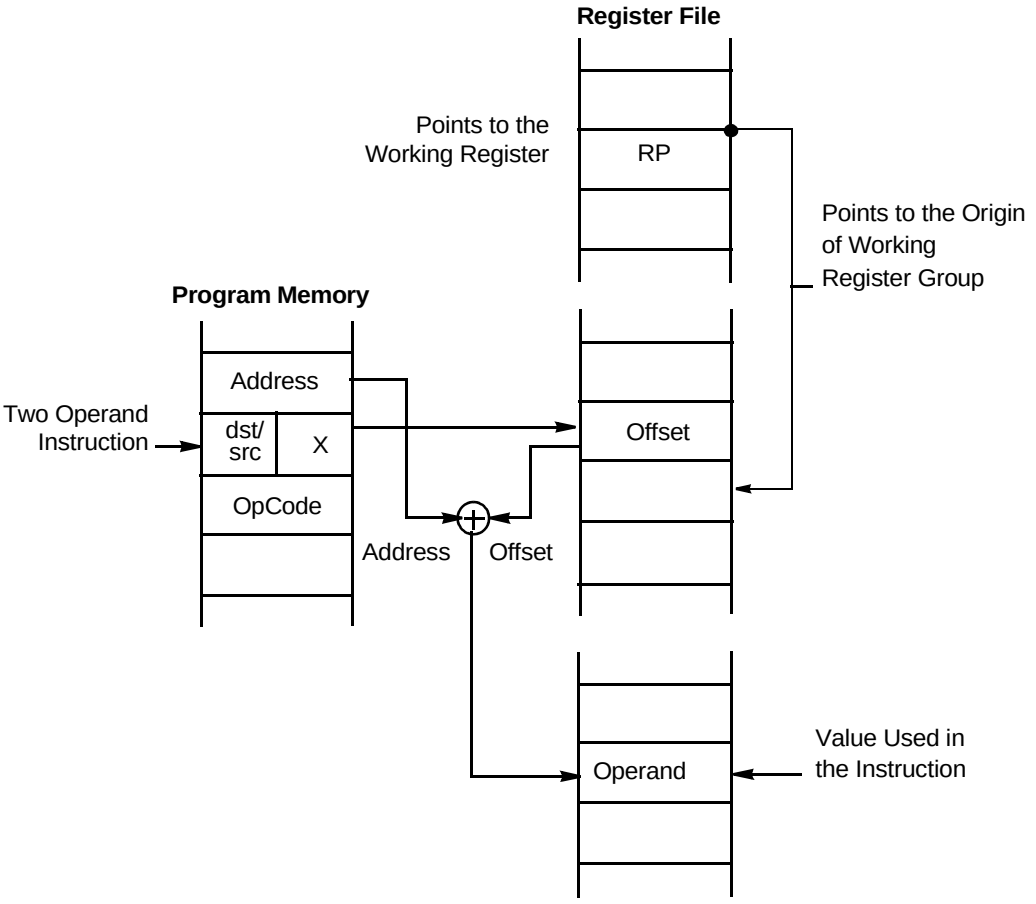

Figure 2-5. Indexed Register Addressing

DIRECT ADDRESSING (DA)

The Direct Addressing mode, as shown in Figure 2-6, specifies the address of the next instruction to be executed. Only the Conditional Jump (JP) and Call (CALL) instructions use this addressing mode.

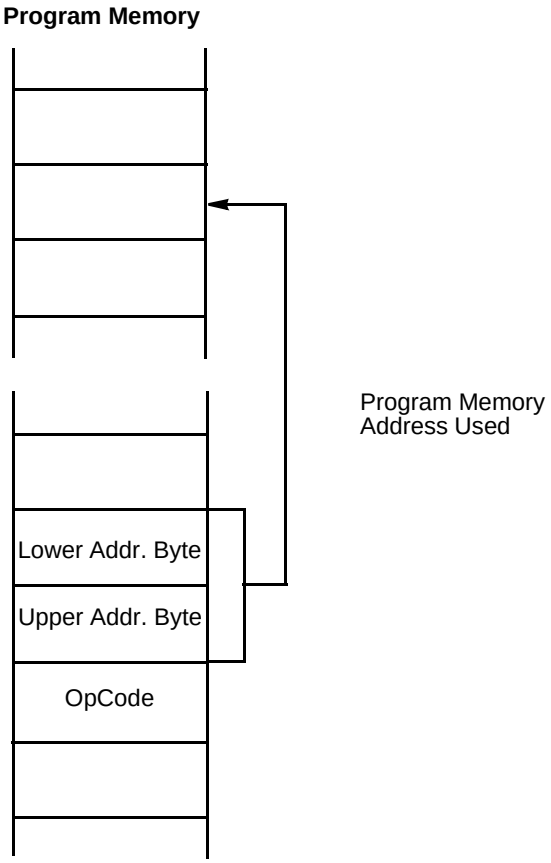

Figure 2-6. Direct Addressing

RELATIVE ADDRESSING (RA)

In the Relative Addressing mode, illustrated in Figure 2-7, the instruction specifies a two's-complement signed displacement in the range of –128 to +127. This is added to the contents of the Program Counter to obtain the address of the next instruction to be executed. The PC (prior to the add) consists of the address of the instruction following the Jump Relative (JR) or Decrement and Jump if Non-Zero (DJNZ) instruction. JR and DJNZ are the only instructions which use this addressing mode.

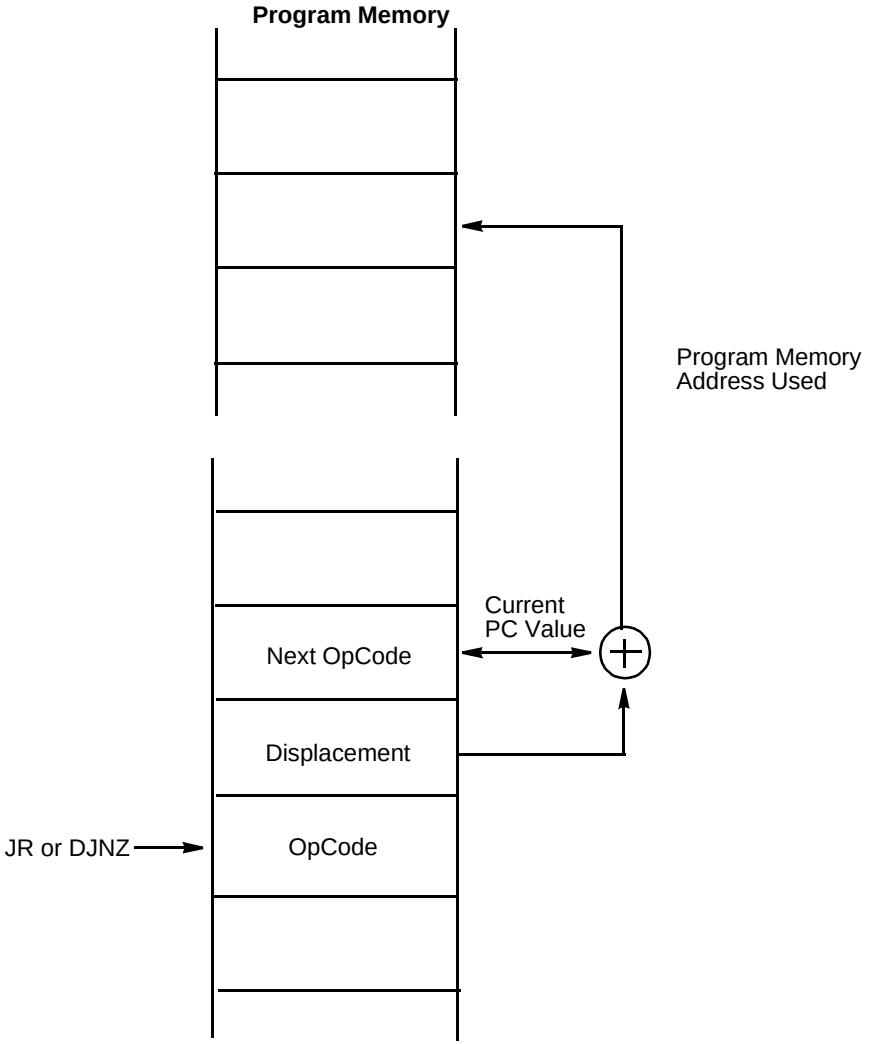

Figure 2-7. Retrieve Addressing

IMMEDIATE DATA ADDRESSING (IM)

Immediate data is considered to be an addressing mode for the purposes of this discussion. It is the only addressing mode that does not indicate a register or memory address as the source operand. The operand value used by the instruction is the value supplied in the operand field itself. Because an immediate operand is part of the instruction, it is always located in the Program Memory address space (see Figure 2-8).

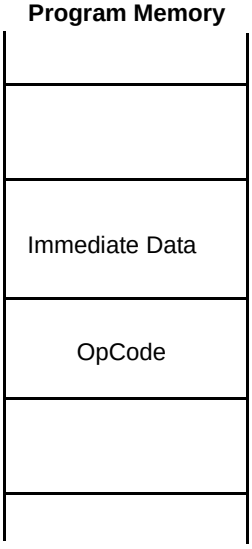

Figure 2-8. Immedate Data Addressing