CHAPTER 11
ADDRESSING MODES

11.1 INTRODUCTION

11.1.1 Z8 Addressing Modes

The Z8 microcontroller provides six addressing modes:

- Register (R)
- Indirect Register (IR)
- Indexed (X)
- Direct (D)
- Relative (RA)
- Immediate (IM)

With the exception of immediate data and condition codes, all operands are expressed as register file, Program Memory, or Data Memory addresses. Registers are accessed using 8-bit addresses in the range of 00H-FFH. The Program Memory or Data Memory is accessed using 16-bit addresses (register pairs) in the range of 0000H-FFFFH.

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 upper four bits in the Register Pointer (R253) 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, 2,...., 14 for Working Registers, or 4, 6,....238 for actual registers.

In the following definitions of Z8 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, data, and register memory types and address ranges available.

11.2 Z8 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 (Figure 11-1), the destination and/or source address specified corresponds to the actual register in the register file.

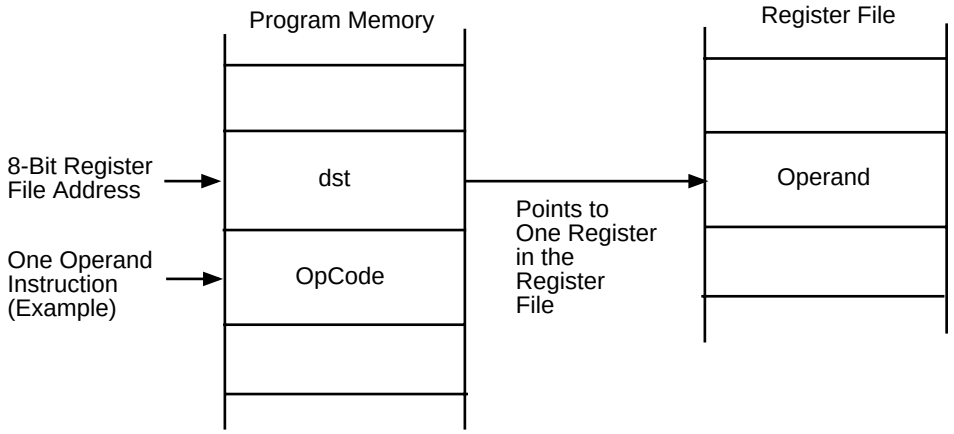

Figure 11-1. 8-Bit Register Addressing

In 4-bit Register Addressing (Figure 11-2), 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 upper four bits of the Register Pointer to form the actual 8-bit address of the affected register.

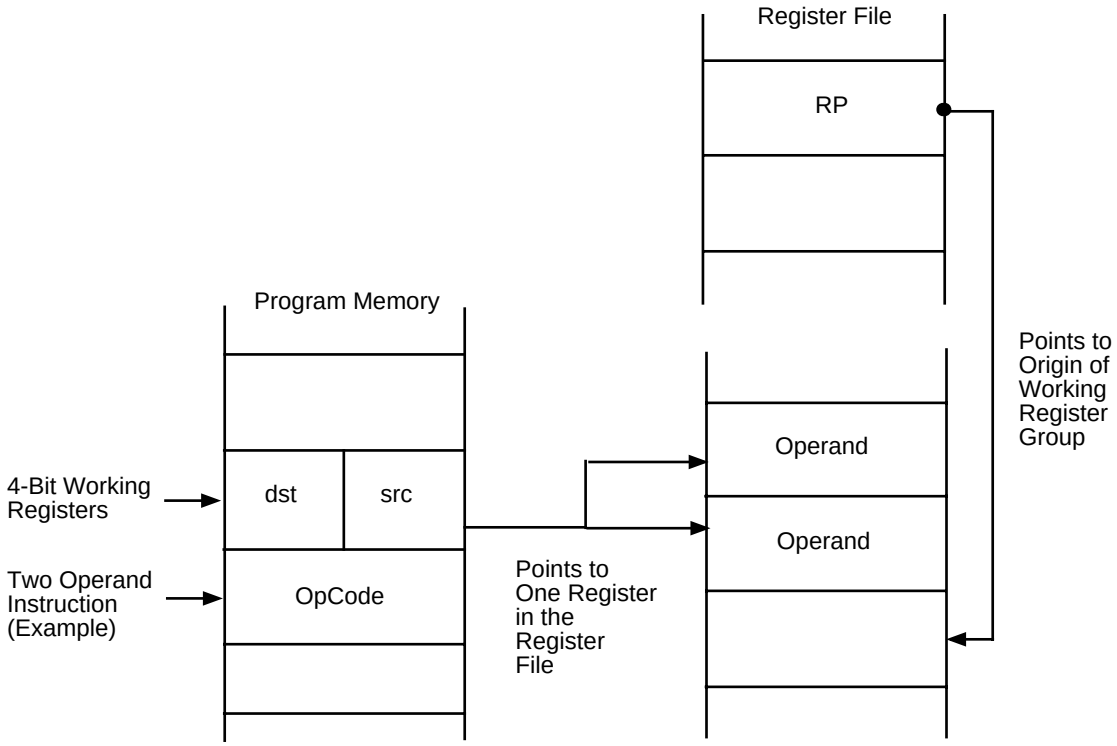

Figure 11-2. 4-Bit Register Addressing

11.3 Z8 INDIRECT REGISTER ADDRESSING (IR)

In the Indirect Register Addressing Mode, the contents of the specified register are equivalent to the address of the operand (Figures 11-3 and 11-4).

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

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

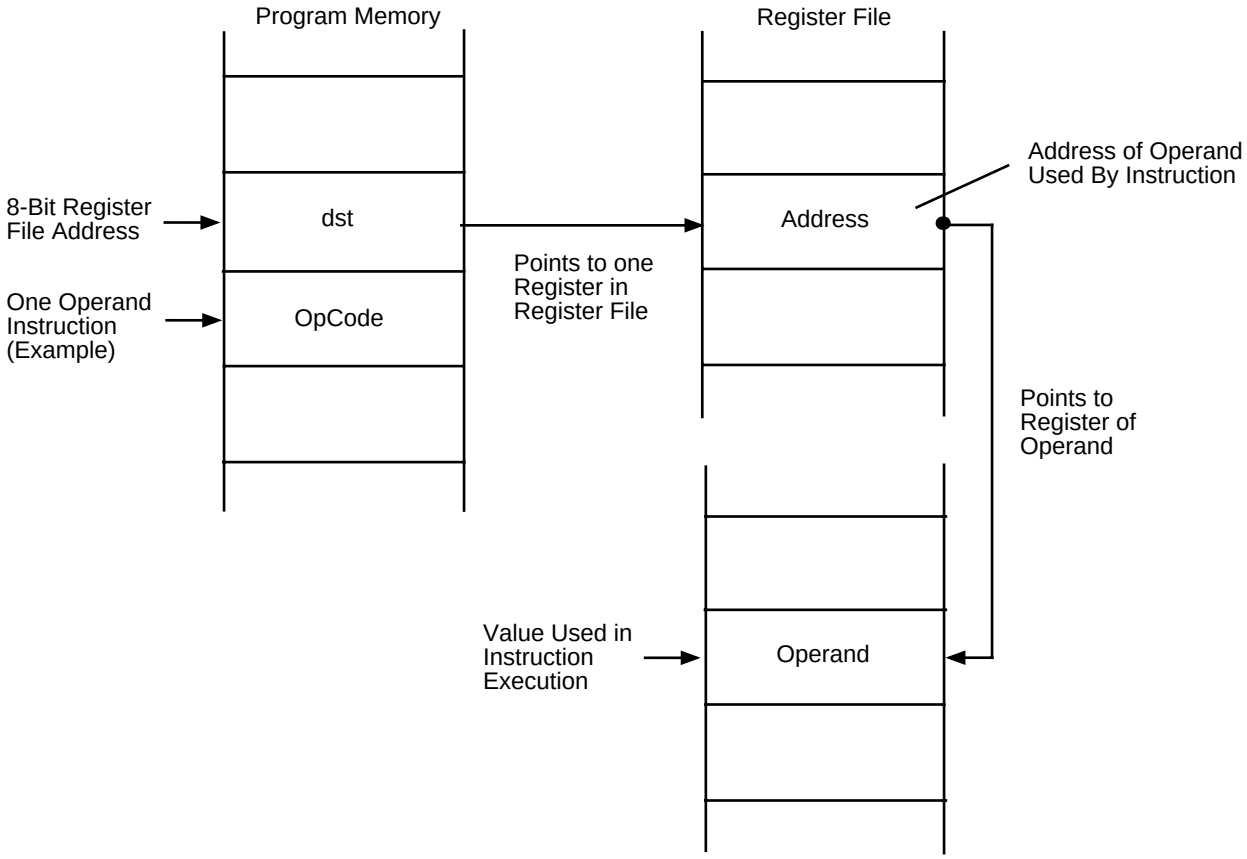

Figure 11-3. 4-Bit Register Addressing

11.3 Z8 INDIRECT REGISTER ADDRESSING (IR) (Continued)

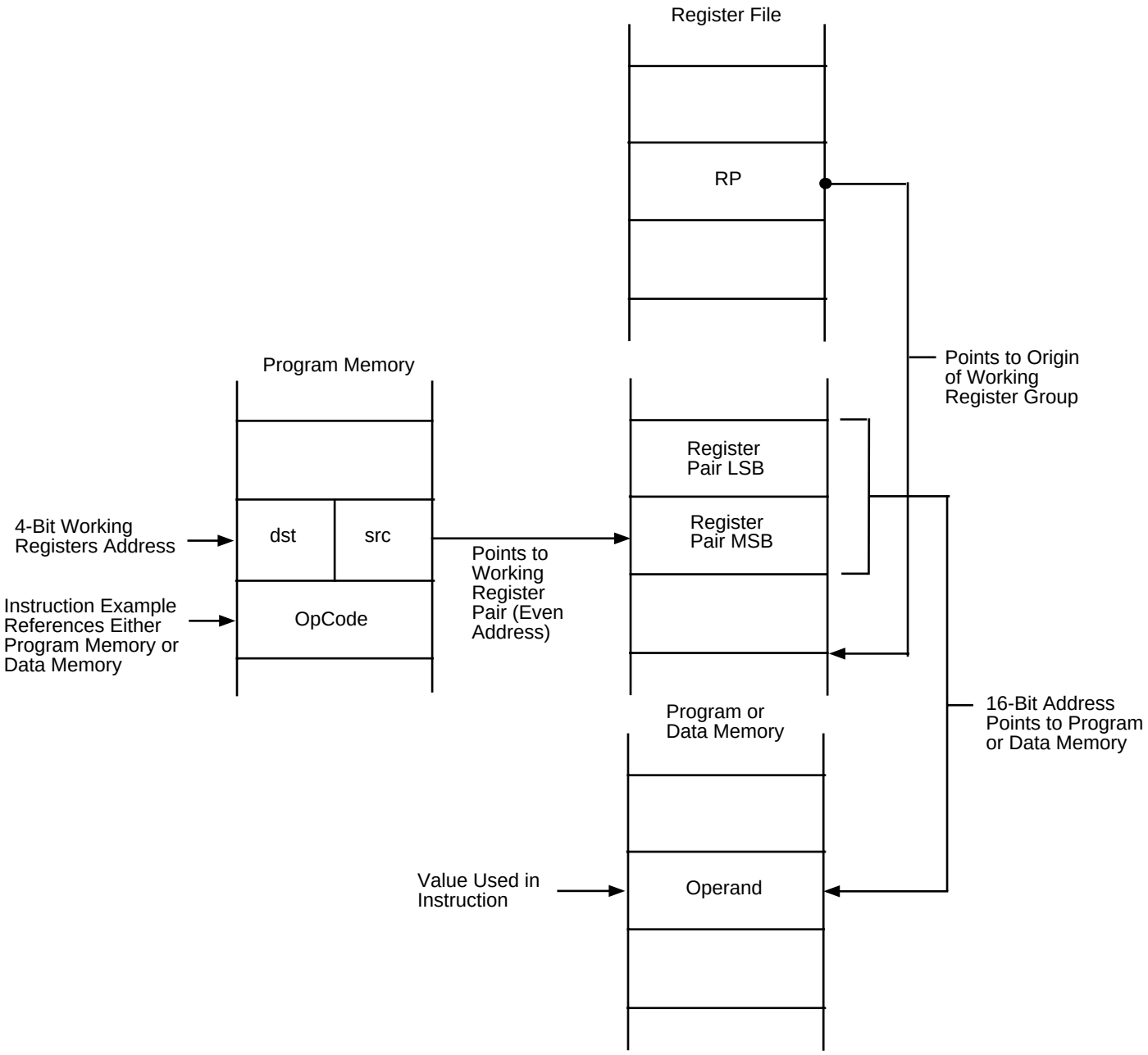

Figure 11-4. Indirect Register Addressing to Program or Data Memory

11.4 Z8 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 11-5 illustrates this addressing convention.

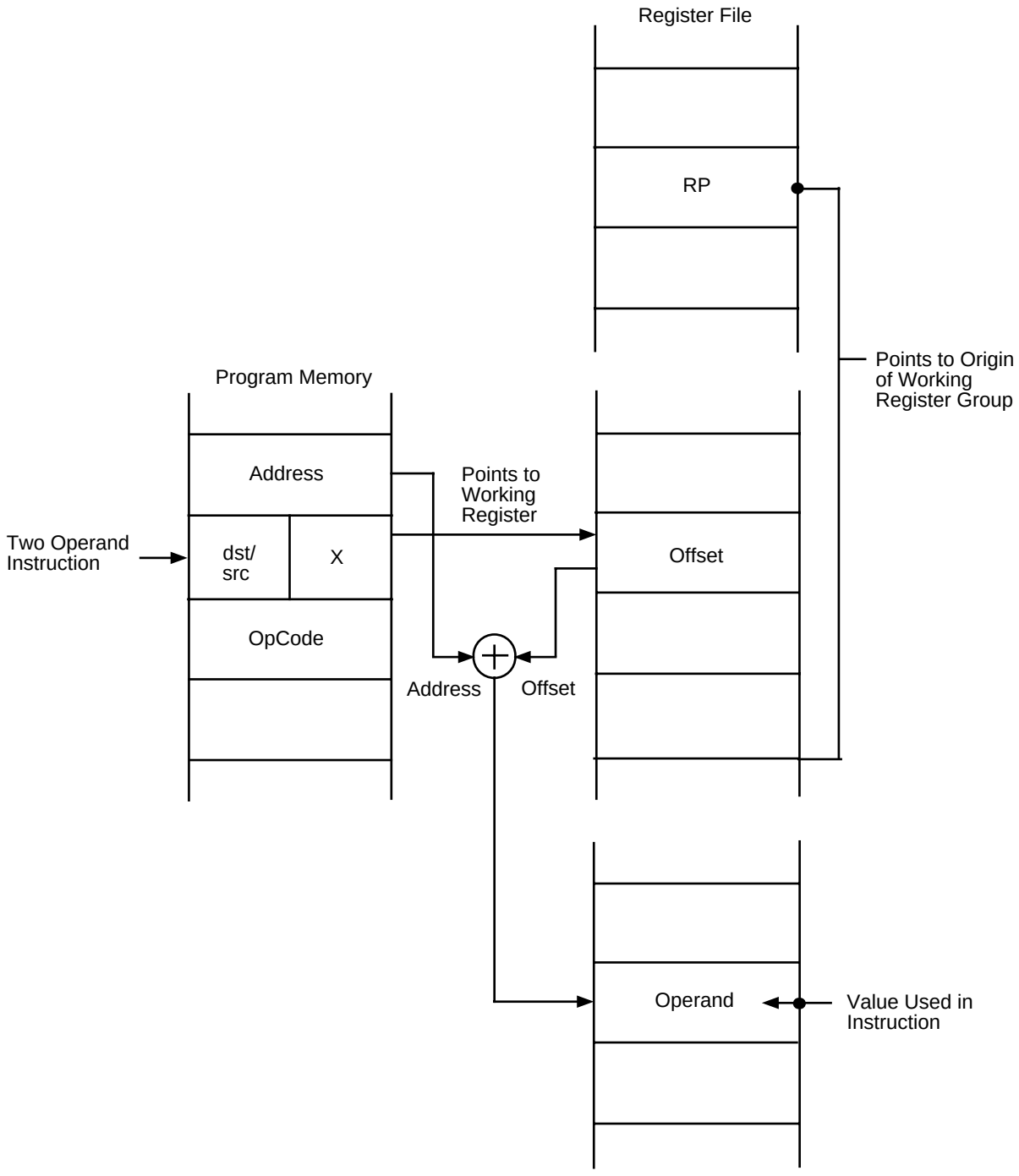

Figure 11-5. Indexed Register Addressing

11.5 Z8 DIRECT ADDRESSING (DA)

The Direct Addressing mode, as shown in Figure 11-6, specifies the address of the next instruction to be executed. Only the Conditional Jump (JP) and Call (CALL) instructions use this addressing mode.

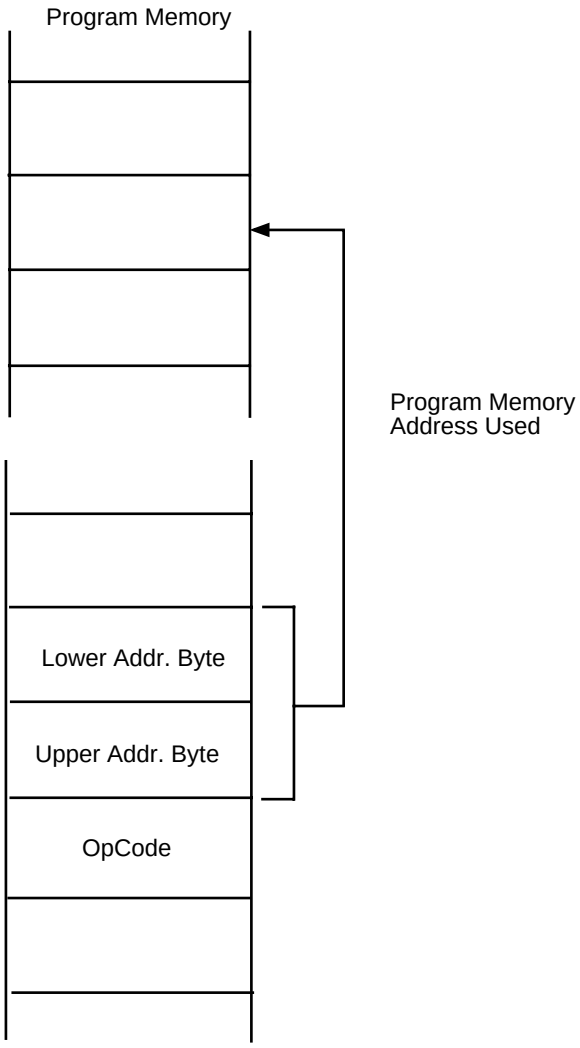

Figure 11-6. Direct Addressing

11.6 Z8 RELATIVE ADDRESSING (RA)

In the Relative Addressing mode, illustrated in Figure 11-7, the instruction specifies a two's-complement signed displacement in the range of –128 to +127. This is added to the contents of the PC 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.

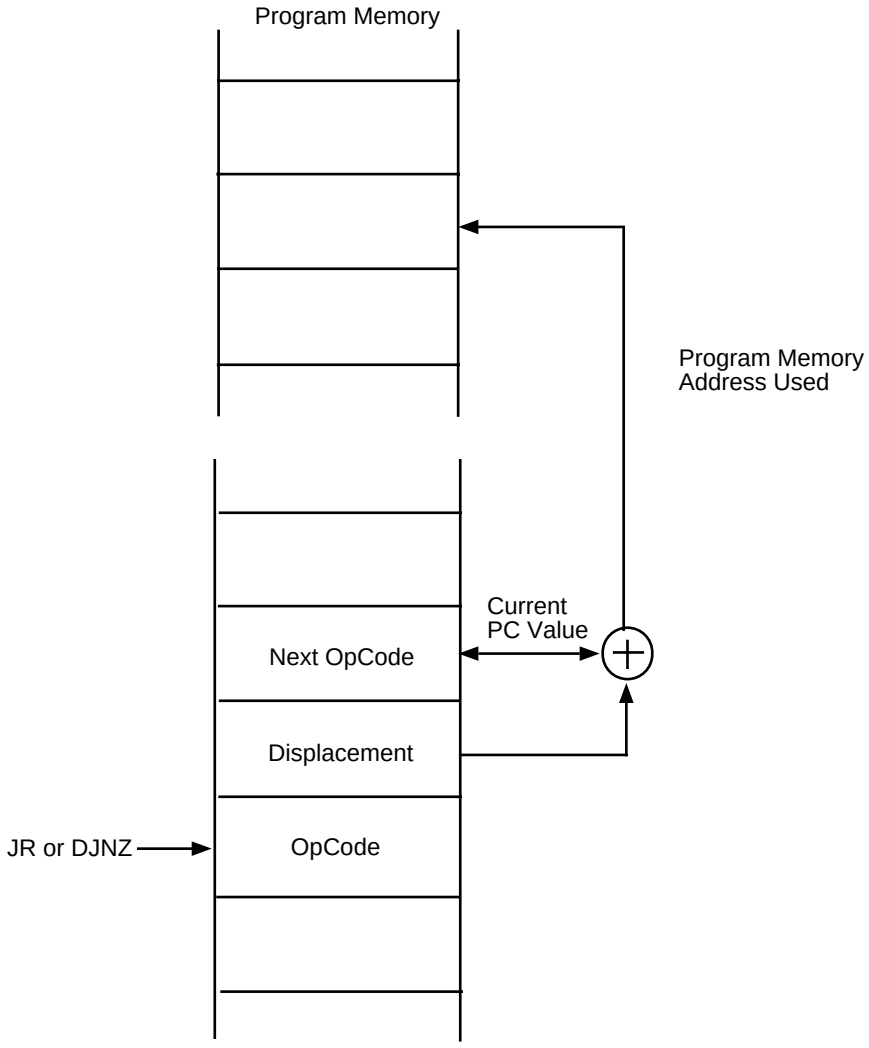

Figure 11-7. Relative Addressing

11.7 Z8 IMMEDIATE DATA ADDRESSING (IM)

Immediate data is considered 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 (Figure 11-8).

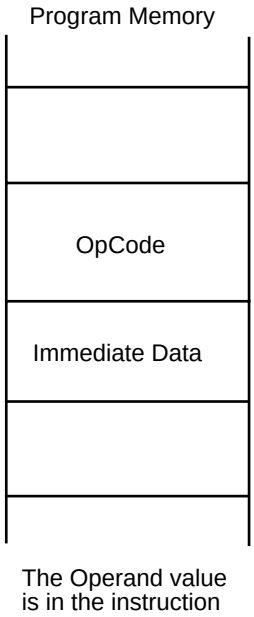

Figure 11-8. Immediate Data Addressing