

3.7 String Instructions

Specifying the Operands' Size and Address and the String Direction

STRING = a data collection in memory.

String **ELEMENTS** can be: bytes, words or double-words.

A **SOURCE STRING** and a **DESTINATION STRING** can be specified.

The **CURRENT ELEMENT** in the **SOURCE STRING** is pointed by **DS:SI**.

The **CURRENT ELEMENT** in the **DESTINATION STRING** is pointed by **ES:DI**.

A **STRING INSTRUCTION** operates by default on **current elements** in the **Source String** and in the **Destination String** or only **one of them**. The operands **don't need to be specified** for String Instructions, unless their **size** (byte, word, double-word) has to be specified this way.

A simplified way to specify the operands' size is to add suffix **B**, **W** or **D** to Mnemonic.

Executing a **STRING INSTRUCTION** the implied Index Registers (**SI**, **DI** or **both**) are automatically updated to point the next element in the string, which becomes the **CURRENT ELEMENT** for the next **STRING INSTRUCTION** involving the same String. The update means **increment** or **decrement** the Index Register content by byte number of the string element. (1 if elements are bytes, 2 for word elements and 4 if elements are double-words).

The **DIRECTION** of pointer updating is imposed by the **DF** (Direction Flag) in **FLAGS** register: **SI** and/or **DI** are incremented if **DF=0**, (decremented if **DF=1**).

Examples:

$$DI \leftarrow DI + 4 * (-1)^{DF}$$

After a String Instruction implying a double-word Destination String

Setting Direction Flag:

CLD ;clear DF = auto-increment

$$SI \leftarrow SI + (-1)^{DF}$$

After a String Instruction implying a byte Source String

STD ;set DF = auto-decrement

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The MOVS instruction

Mnemonic	Meaning	Format	Operation	Flags affected
MOVS	Move String	MOVSB, MOVS Dest,Source	$(DI) \leftarrow (SI), DI \leftarrow DI + (-1)^{DF}, SI \leftarrow SI + (-1)^{DF}$	none
		MOVSW, MOVS Dest,Source	$(DI) \leftarrow (SI), DI \leftarrow DI + 2 * (-1)^{DF}, SI \leftarrow SI + 2 * (-1)^{DF}$	
		MOVSD, MOVS Dest,Source	$(DI) \leftarrow (SI), DI \leftarrow DI + 4 * (-1)^{DF}, SI \leftarrow SI + 4 * (-1)^{DF}$	

Destination	Source
Memory (ES:DI)	Memory (DS:SI)

Moves an element from the source string in the destination string. Increase or decrease (depending on DF) both SI and DI by the byte-number of the operands.

The CMPS instruction

Mnemonic	Meaning	Format	Operation	Flags affected
CMPS	Compare Strings	CMPSB, CMPS Dest,Source	$? \leftarrow (DI) - (SI), DI \leftarrow DI + (-1)^{DF}, SI \leftarrow SI + (-1)^{DF}$	CP, PF, AF, ZF, SF, OF
		CMPSW, CMPS Dest,Source	$? \leftarrow (DI) - (SI), DI \leftarrow DI + 2 * (-1)^{DF}, SI \leftarrow SI + 2 * (-1)^{DF}$	
		CMPSD, CMPS Dest,Source	$? \leftarrow (DI) - (SI), DI \leftarrow DI + 4 * (-1)^{DF}, SI \leftarrow SI + 4 * (-1)^{DF}$	

Destination *	Source
Memory (ES:DI)	Memory (DS:SI)

Performs the subtraction **(ES:DI)-(DS:SI)**, **doesn't store** the result, but **sets flags** accordingly. Increase or decrease (depending on DF) both SI and DI by the byte-number of the operands.

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The SCAS instruction

Mnemonic	Meaning	Format	Operation	Flags affected
SCAS	Scan String (compare with acc.)	SCASB, SCAS Dest SCASW, SCAS Dest SCASD, SCAS Dest	? \leftarrow -AL-(DI), DI \leftarrow -DI+(-1) ^{DF} ? \leftarrow -AX-(DI), DI \leftarrow -DI+2*(-1) ^{DF} ? \leftarrow -EAX-(DI), DI \leftarrow -DI+4*(-1) ^{DF}	CP, PF, AF, ZF, SF, OF

Destination *	Source
Memory (ES:DI)	-

Performs the subtraction **AL-(ES:DI)** or **AX-(ES:DI)** or **EAX-(ES:DI)**, doesn't store the result, but sets flags accordingly. Increase/decrease only SI.

The LODS instruction

Mnemonic	Meaning	Format	Operation	Flags affected
LODS	Load String (element into acc.)	LODSB, LODS Source LODSW, LODS Source LODSD, LODS Source	AL \leftarrow -(SI), SI \leftarrow -SI+(-1) ^{DF} AX \leftarrow -(SI), SI \leftarrow -SI+2*(-1) ^{DF} EAX \leftarrow -(SI), SI \leftarrow -SI+4*(-1) ^{DF}	none

Destination	Source
AL or AX or EAX	Memory (DS:SI)

Load (move) into **AL** or **AX** or **EAX** the content of the memory location pointed by **(DS:SI)**. Increase/decrease only SI.

The STOS instruction

Mnemonic	Meaning	Format	Operation	Flags affected
STOS	Store String (element from acc.)	STOSB, STOS Dest STOSW, STOS Dest STOSD, STOS Dest	(DI) \leftarrow -AL, DI \leftarrow -DI+(-1) ^{DF} (DI) \leftarrow -AX, DI \leftarrow -DI+2*(-1) ^{DF} (DI) \leftarrow -EAX, DI \leftarrow -DI+4*(-1) ^{DF}	none

Destination	Source
Memory (ES:DI)	AL or AX or EAX

Store (move) the content of **AL** or **AX** or **EAX** to the memory location pointed by **(ES:DI)**. Increase/decrease only DI.