

Assumptions about SIC/XE ISA



RSUB uses format 3/4 (Appendix A)

DIV m stores rounded off value in register A

COMP m sets condition code = Less Than (LT)

if (A) < (m..m+2)

COMPR r1, r2 sets condition code = Less Than (LT)

if (r1) < (r2)

AND m Bitwise and operation

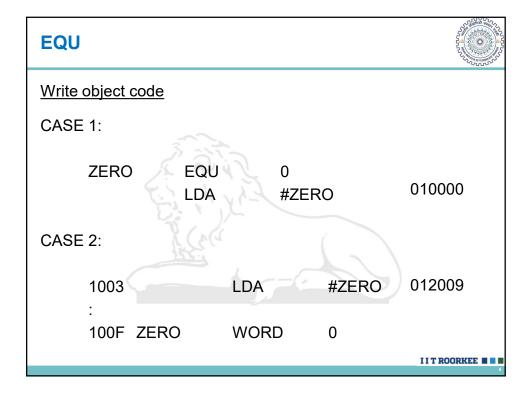
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Assembler directive EQU

MAXLEN EQU 4096

+LDT #MAXLEN

- When the assembler encounters the EQU statement, it enters MAXLEN into SYMTAB with value 4096.
- During assembly of LDT it searches SYMTAB for MAXLEN, using its value (address or constant?) as the operand in the instruction.
- The resulting object code is exactly same, however it is easier to understand the source statement.
- It is also much easier to find and change the value of MAXLEN.



- · Defining mnemonic names for registers.
- If the assembler only understands register numbers and not names:

RMO A, X RMO 0,1

• A EQU 0

X EQU 1 etc.

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Normally used when machine has general purpose registers.

BASE EQU R1

ORG

 Assembler directive that can be used to indirectly assign values to symbols.

ORG value

- · Value is a constant or an expression.
- Resets the value of LOCCTR to the specified value.
- As the values of the symbols used as labels are taken from LOCCTR, this will affect the values of all labels defined until the next ORG.

COPY START 0 **FIRST** LDA **ALPHA** ADD **BETA ORG** 256 ALPHA WORD 2 **BETA** WORD 5 **END FIRST**

Altering LOCCTR may result in an incorrect assembly
 Example – defining a symbol table

SYMBOL(6)	VALUE(3)	FLAGS(2)
STAB	RESB	1100
SYMBOL VALUE FLAGS	EQU EQU EQU LDA	STAB STAB+6 STAB+9 VALUE, X
STAB SYMBOL VALUE FLAGS	RESB ORG RESB RESW RESB ORG	1100 STAB 6 1 2 STAB+1100 VALUE, X
	STAB SYMBOL VALUE FLAGS STAB SYMBOL VALUE	STAB RESB SYMBOL EQU VALUE EQU FLAGS EQU LDA STAB RESB ORG SYMBOL RESB VALUE RESW FLAGS RESB

 In case of EQU / ORG all symbols used on the right-hand side of the statement must have been defined previously in the program.

ALPHA RESW 1

BETA EQU ALPHA permitted

BETA EQU ALPHA

ALPHA RESW 1 not permitted

• Why?

• Product of the forward reference problem:

ALPHA EQU BETA
BETA EQU DELTA
DELTA RESW 1

 Cannot be resolved by an ordinary two-pass assembler regardless of how the work is divided between the passes.

Similar restrictions apply to ORG

Example

	ORG	ALPHA	*
BYTE1	RESB	1	
BYTE2	RESB	1	
BYTE3	RESB	1	
	ORG		
ALPHA	RESB	1	

Expressions



- Most assemblers allow expressions in place of single operand.
- Expressions may use +, -, *, /.

MAXLEN EQU BUFFEND - BUFFER

LOC EQU BUFFEND + 100

- · Division is usually defined to produce an integer result
- Individual terms in the expression may be constants¹, user-defined symbols², or special terms³ (*).
- Assembler must evaluate this value and produce a single operand address or value.

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- Some values in the object program are relative and some are absolute.
 - ⇒ expressions are also either relative or absolute depending on the value they produce.
- absolute expression.
 - contains only absolute terms or
 - relative terms occur in pairs with opposite signs.
- None of the relative terms may appear into a multiplication or division operation.
- Relative expression
 - all of the relative terms except one can be paired.
 - The remaining unpaired relative term must have a positive sign

MAXLEN EQU BUFFEND – BUFFER absolute ABC EQU BUFFEND + BUFFER (?)

Expressions



ABC EQU BUFEND - BUFFER - RETADDR

CDE EQU BUFEND - BUFFER + RETADDR

LMN EQU BUFEND - 100

XYZ EQU BUFFER * 10 – BUFEND

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