

SWAP Function

SWAP S4

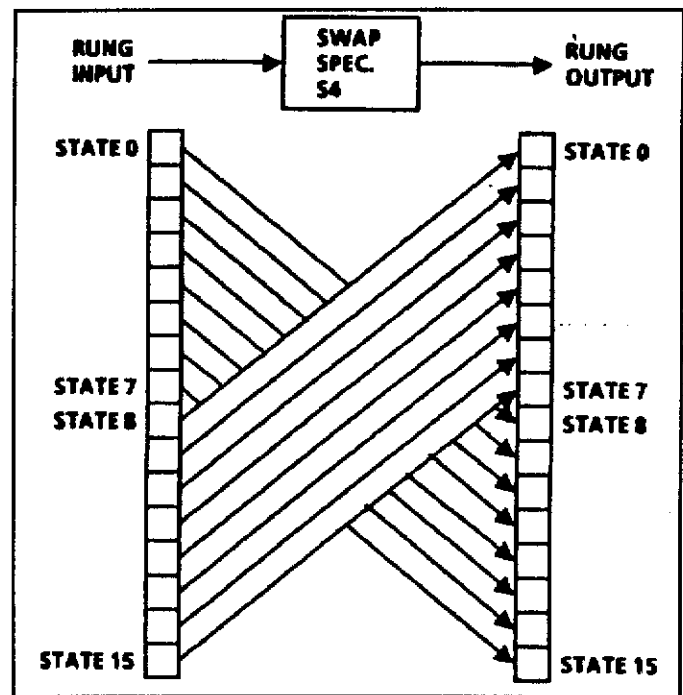
DESCRIPTION

The SWAP function provides a simple means of manipulating data when a single data table location is used to store two independent numbers. It is particularly useful for extracting the two count values from the counter module 8160 when used for two 8-bit counters. It can also be used for combining and separating numbers from thumbwheel switches and decade displays.

The SWAP function interchanges the two halves of a data location. This is equivalent to multiplying the lower half by 256 and simultaneously dividing the upper half by 256.

FEATURES

- Simple, easy to use
- Fast execution
- No possibility of fault conditions



SPECIFICATION

Control language:-

SWAP
 X-----SPEC-----Q
 S4

Table 1 **Program rung data**

Sym	Location	Range
X	Rung Input	@0000 to @FFFF. Each half range @00 to @FF equivalent to 0 to 255
Q	Rung Output	

Note: Since the whole location represents two independent numbers, it is best presented in hexadecimal code (prefix @). The first 2 digits represent the upper half, the last two digits represent the lower half.

Table 2 Value data

SWAP function requires no VALUE location. If one is included in user program it has no effect i.e. SWAP works normally

APPLICATION NOTES

1. Extraction of 2 numbers

Example: A counter module 8160 when used for two 8-bit counters, is connected at panel address A3. The program rungs below extract the two count values by using AND instructions to mask one half, and SWAP to move the upper half.

COUNTS			COUNT1	Extract
<AND>	<AND>		<OUT>	1st
A3	@00FF		G1	count
COUNTS		SWAP	COUNT2	Extract
<AND>	<AND>	SPEC	<OUT>	2nd
A3	@FF00	S4	G2	count

2. Combination of 2 numbers

Example: A 4 decade display referenced B4 is to display the time in hours (from location E3) and minutes (from location E2). The BCDOUT function is included for code conversion.

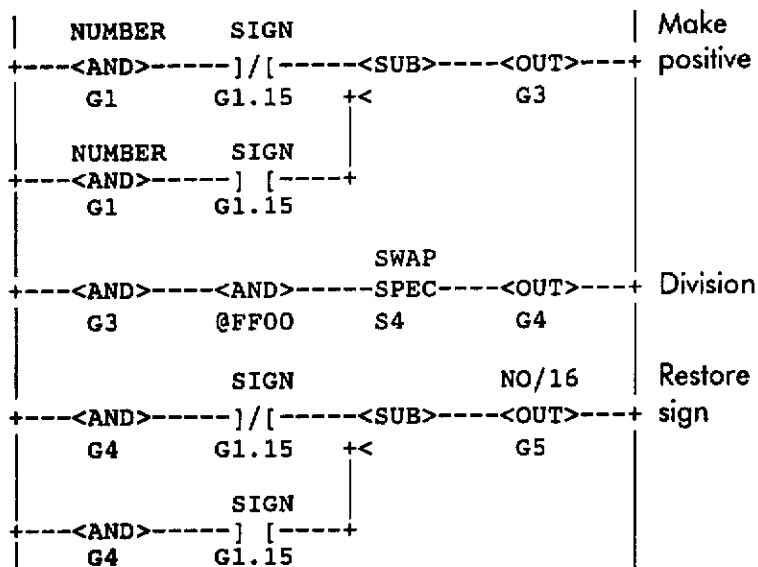
MINUTES	BCDOUT		TIME
<AND>	SPEC		<OUT>
E2	S2		B4
HOURS	BCDOUT	SWAP	
<AND>	SPEC	SPEC	
E3	S2	S4	

3. Crude division by 256

For positive numbers ONLY, SWAP may be used for a crude integer division by 256. Notice that the lower half of the dividend is masked using an AND instruction.

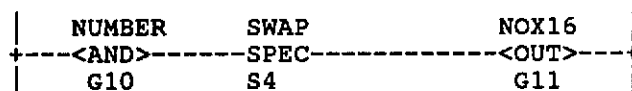
NUMBER		SWAP	NO/16
<AND>	<AND>	SPEC	<OUT>
G1	@FF00	S4	G2

If dividend can be negative, its sign may be used to convert it to a positive number for the division.



4. Multiplication by 256

For positive numbers in range 0 to 127, ONLY SWAP may be used to multiply by 256.



Additional rungs for sign changing can cope with negative numbers up to -127. The multiplication gives a grossly wrong answer if the input to SWAP goes outside the stated range.



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