

AN/UYK-20 & AN/UYK-20A COMPUTER REPERTOIRE OF INSTRUCTIONS

Table with columns: OCTAL FORMAT, HEXIDECIMAL FORMAT, CODING FORMAT, INSTRUCTION, OPERATION, C OV CC. Contains instructions like Diagnostic return, Byte load, Load (Register), etc.

Optional Math Pac Instructions 1 Count = 31 for all zeros or all ones. 2 if # m 3 a,m,y must be even 4 if a+1 # m 5 cc set on Ra+1 only 6 if class II interrupts enabled

Table with columns: OCTAL FORMAT, HEXIDECIMAL FORMAT, CODING FORMAT, INSTRUCTION, OPERATION, C OV CC. Contains instructions like Algebraic Right Double shift, Algebraic Left shift (Register), etc.

2 if # m 3 a,m,y must be even

Table with columns: OCTAL FORMAT, HEXIDECIMAL FORMAT, CODING FORMAT, INSTRUCTION, OPERATION, C OV CC. Contains instructions like Compare Masked (Indirect), Compare Masked (Constant), etc.

Optional Math Pac Instruction 3 a,m,y must be even 7 cannot be executed via execute remote 8 operands must be normalized

TRIGONOMETRIC AND HYPERBOLIC FUNCTIONS
(Operation Code 37)

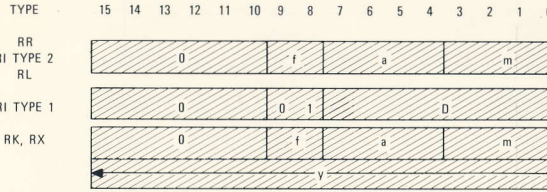
x, y Cartesian coordinates. Radix point assumed to be the same
 θ Angle of rotation Trigonometric mode (BAMS) Bit 15 = 180°
 θ Angle of rotation Hyperbolic mode Radix point assumed between bits 15 and 14
 0.46672_8
 1.15217_8
 K_1

Note: 0 results are ± 1 LSB

CODING FORMAT	FUNCTION	INPUT PARAMETERS		OUTPUT RESULTS	
		R_a	R_{a+1}	$Y \rightarrow R_a$	$W \rightarrow R_{a+2}$
0 f a m					
37 0 a 00	Trigonometric vector	y	0	$X = \frac{R}{K} \sqrt{x^2 + y^2}$ $W = \theta = \tan^{-1} \frac{y}{x}$	
37 0 a 01	Trigonometric rotate	x	θ	$Y = \frac{y \cos \theta + x \sin \theta}{K}$ $W = \theta = \tan^{-1} \frac{y}{x}$	
37 0 a 02	Trig. vector with prescale	x	0	$X = \frac{R}{K} \sqrt{x^2 + y^2}$ $W = \theta = \tan^{-1} \frac{y}{x}$	
37 0 a 03	Trig. rotate with prescale	x	θ	$Y = y \cos \theta + x \sin \theta$ $W = \theta = \tan^{-1} \frac{y}{x}$	
37 0 a 04	Hyperbolic vector	x	0	$X = \frac{x \cosh v + y \sinh v}{K_1}$ $W = v = \tanh^{-1} \frac{y}{x}$	
37 0 a 05	Hyperbolic rotate	x	v	$Y = \frac{y \cosh v + x \sinh v}{K_1}$ $W = v = \tanh^{-1} \frac{y}{x}$	
37 0 a 06	Hyp. vector with postscale	x	0	$Y = y \cosh v + x \sinh v$ $W = v = \tanh^{-1} \frac{y}{x}$	
37 0 a 07	Hyp. rotate with postscale	x	v	$Y = \sin \theta$ $W = \cos \theta$	
37 0 a 01	Sin θ ; Cos θ	0	0.46672_8	$Y = \frac{R \sin \theta}{K}$ $W = R \cos \theta$	
37 0 a 03	Sin θ ; Cos θ	0	θ	$Y = \sin \theta$ $W = R \cos \theta$	
37 0 a 01	Polar to Cartesian without prescale	0	R	$Y = R \sin \theta$ $W = e^v = \cosh v + \sinh v$	
37 0 a 03	Polar to Cartesian with prescale	0	R	$Y = R \sin \theta$ $W = e^v = \cosh v + \sinh v$	
37 0 a 06	Log _e x	x-1	0	$2 \sqrt{x}$ $W = 1/2 \log_e x = \tanh^{-1} \frac{x-1}{x+1}$	
37 0 a 07	Exponential	1	v	$Y = e^v = \cosh v + \sinh v$ $W = e^v = \cosh v + \sinh v$	

Optional Math Pac Instructions

INSTRUCTION WORD FORMAT



DEFINITION OF FIELDS

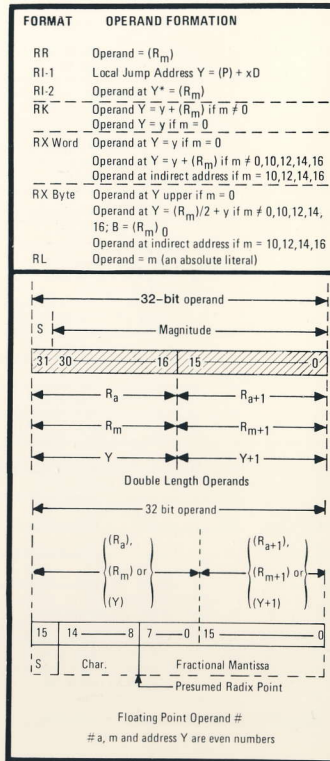
- 0 Operation (Function) Code
- f Format Designator
- 00 \Rightarrow Format RR, Register to Register or RL-1 Format
- 01 \Rightarrow Format RI, Register Indirect Memory or RL-2 Format
- 10 \Rightarrow Format RK, Register-Literal Constant or RL-3 Format
- 11 \Rightarrow Format RX, Register-Indexed Address, Constant or RL-4 Format
- a General Register or Subfunction Designator
- m General Register or Subfunction Designator
- 4-bit Unsigned Literal Constant in RL Format
- D Signed Deviation Value (Two's Complement)
- y Address or Arithmetic Constant

LEGEND

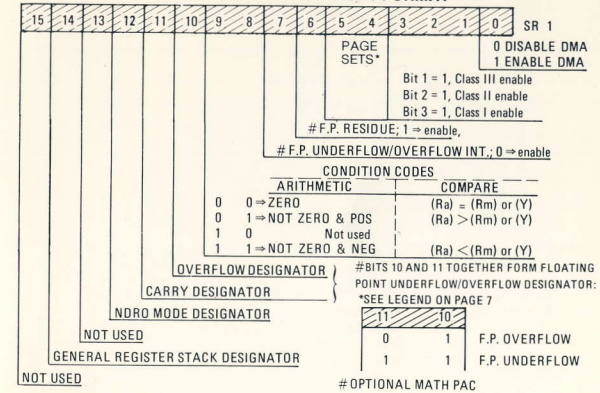
- B Byte pointer, 0 \rightarrow Upper, 1 \rightarrow Lower
- C Carry
- CC Condition Code
- OV Overflow
- IW Indirect Word
- J Designator Field in IW
- x General Register Designator in IW1
- y Contents of Second Instruction Word or IW2
- Y Effective Operand Address or Constant
- Y* Effective Operand Address in R_m
- TM I/O Transfer Mode
- 00 - Abort Input Transfer
- 01 - 8-bit Byte Transfer
- 10 - 16-bit Word Transfer
- 11 - 32-bit Dual Word Transfer
- BTC Buffer Transfer Count
- BAP Buffer Address Pointer
- CM Control Memory Word
- CAP Chain Address Pointer
- RTC Real-Time Clock
- () Contents of register or address
- r (R_a) 5-0
- u (R_a) 13-8
- v 2's Complement
- For AN/UYK-20A only:
- r (R_a) 7-0
- u (R_a) 15-8
- :
- Compare

- SR 1 Bits 5-4
- 00 Page Set 0
 - 01 Page Set 1
 - 10 Page Set 2
 - 11 Page Set 3

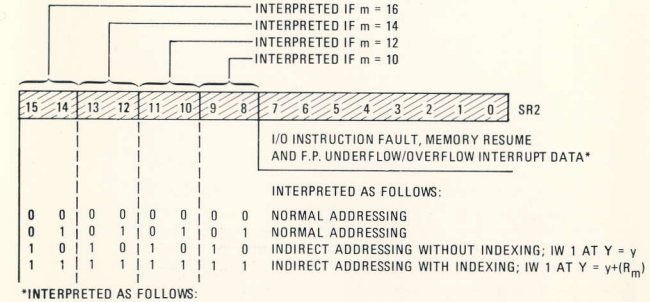
OR	XOR	AND
0 0 1	0 1 1	1 0 1
0 1 0	0 0 1	0 0 0
1 1 1	1 1 0	1 1 0



STATUS REGISTER NO. 1 FORMAT



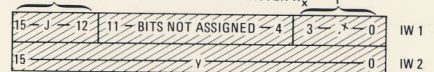
STATUS REGISTER NO. 2 FORMAT



INDIRECT ADDRESSING

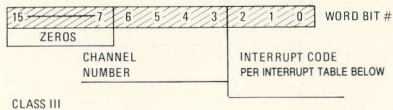
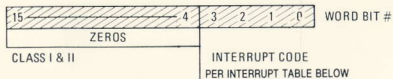
OCTAL J-VALUE	OPERAND/IW1, LOCATION
0	WORD AT $Y = (IW2)$
1	BYTE AT UPPER HALF OF $Y = (IW2)$
2	WORD AT $Y = (IW2) + (R_a)$
3	WORD AT $Y = (IW2) + (R_m) * 2$
4	WORD AT $Y = (IW2) + (R_m) * 4$
5	WORD AT $Y = (IW2) + (R_m) * 8$
6	WORD AT $Y = (IW2) + (R_m) * 16$
7	WORD AT $Y = (IW2) + (R_m) * 32$
10-17	NOT ASSIGNED

SPECIFIES GENERAL REGISTER R_x



* B = LSB of register

INTERRUPT ENTRANCE ADDRESS INDEX



ASSIGNED MEMORY ADDRESS

Function	Address Assignment to Class		
	III	II	I
Store P addresses	110	120	130
Store SR # 1 addresses	111	121	131
Store SR # 2 addresses	112	122	132
Store RTC lower addresses	113	123	133
P Reload addresses	114	124	134
SR # 1 Reload addresses	115	125	135
SR # 2 Reload addresses	116	126	136
Store RTC upper addresses	117	127	137
I/O Command cells	140-141		
Auto start entrance	177		
External interrupt word storage	200-217		
NDRO	00-77, 300-477		

INTERRUPT PRIORITY

Class	Priority Within Class	Interrupt	Binary Interrupt Code Generated
Class I, Hardware Errors	1	Power Fault	0000
	2	Memory Resume	00010
Class II, Software Interrupts	1	CP Instruction Fault	00000
	2	I/O Instruction Fault	00010
	3	#F.P. Overflow/Underflow Interrupt	00100
	4	Executive Return Instruction	00110
Class III, IOC Interrupts	5	RTC Overflow	01000
	6	Monitor Clock	01010
	7	Write Protect	11000
	1	Intercomputer Time-Out	110
	2	External Interrupt or Discrete Interrupt	000
	3	Output Chain Interrupt	100
	4	Input Chain Interrupt	010

① Serial MIL-STD-188C, VACALES, or EIA-STD-RS-232C Channels # Optional Math Pac function

* AN/UYK-20A ONLY

* AN/UYK-20A ONLY

CM ₂ 13	CHANNEL NUMBER	PAGE SET
0	N/A	00
1	0 - 7 ₈	10
1	10 - 17 ₈	11

I/O CONTROL MEMORY

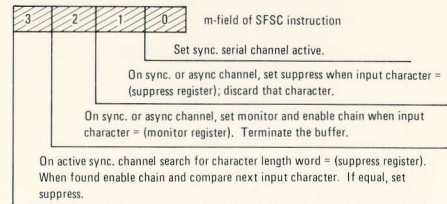
a-Value	m-Value	CONTROL MEMORY Register Selected
		15 14 13 12 11 0
0		TM *0 B BTC (IN)
1		BAP (IN)
2		CAP (IN)
3		Reserved
4		TM *0 B BTC (OUT)
5		BAP (OUT)
6		CAP (OUT)
7		Reserved
10		Monitor register (Serial)
11		Suppress register (Serial)
12		Serial mode information*
13-17		Reserved
0-17		Channel designator

*MIL-STD-188C or RS-232

6 5 4 3 2 1 0	BITS INTERPRETED
0 0	⇒ 5-BIT CHARACTER
0 1	⇒ 6-BIT CHARACTER
1 0	⇒ 7-BIT CHARACTER
1 1	⇒ 8-BIT CHARACTER
0 ⇒	SELECT ODD PARITY
1 ⇒	SELECT EVEN PARITY
0 ⇒	DISABLE PARITY CHECKING
1 ⇒	ENABLE PARITY CHECKING
0 ⇒	ONE STOP BIT - ASYNCHRONOUS
1 ⇒	TWO STOP BITS OUTPUT ONLY
ASYNCHRONOUS CLOCK SPEED SELECTION	
00 ⇒	LOWEST SPEED
11 ⇒	HIGHEST SPEED

15 - 12	11 - 4	3	2	1	0
VACALES					
NOT USED					
0 ⇒ ODD PARITY					
1 ⇒ EVEN PARITY					
0 ⇒ DISABLE PARITY					
1 ⇒ ENABLE PARITY					
NOT USED					
0000 ⇒ 1 BIT/CHARACTER					
1111 ⇒ 16 BITS/CHARACTER					

SFSC OPERATIONS



Bits 2 and 3 used for VACALES "Search for Sync"

SERIAL CHANNEL INTERRUPT WORD FORMAT

BITS	MIL-STD-188	RS-232	VACALES
0-7	ALWAYS ONES	ALWAYS ONES	ALWAYS ONES
8	1 ⇒ B DISCRETE TURNED ON	1 ⇒ RING INDICATOR ON	1 ⇒ B DISCRETE TURNED ON
9	1 ⇒ C DISCRETE TURNED OFF	1 ⇒ RECEIVED LINE SIGNAL DETECTOR OFF	1 ⇒ CARRIER DETECT TURNED OFF
10	1 ⇒ I DISCRETE TURNED ON	1 ⇒ I DISCRETE TURNED ON	1 ⇒ ALARM INDICATE TURNED ON
11	ALWAYS ONE	ALWAYS ONE	1 ⇒ SYNC ERROR TURNED ON
12	ALWAYS ONE	ALWAYS ONE	1 ⇒ TRANSMIT FULL ON TURNED OFF
13-15	ALWAYS ONES	ALWAYS ONES	ALWAYS ONES

SERIAL I/O DISCRETE FUNCTIONS

Octal m-Value	Function	MIL-STD-188C/VACALES		EIA-STD-RS232		
		Discrete	Line Designator (188C)	Line Designator (Vacaless)	Discrete	Line Designator
0	Set	Loop test (internal)	-	-	Loop test (internal)	-
1	Clear	Loop test (internal)	-	-	Loop test (internal)	-
2	NoOp	Not used	-	-	Spare	-
3	NoOp	Not used	-	-	Spare	-
4	Set	Control Line 6	J	J	J (non-std.)	-
5	Clear	Control Line 6	J	J	J (non-std.)	-
6	Set	Control Line 5	H	TRAN. PREP	Disable Ring Indicator Interrupt (internal)	-
7	Clear	Control Line 5	H	TRAN. PREP	Enable Ring Indicator Interrupt (internal)	-
10	Clear	Control Line 4	G	G	Request to Send	CA
11	Set	Control Line 4	G	G	Request to Send	CA
12	Clear	Control Line 3	F	F	New Sync	-
13	Set	Control Line 3	F	F	New Sync	-
14	Clear	Control Line 2	D	D	Data Terminal Ready	CD
15	Set	Control Line 2	D	D	Data Terminal Ready	CD
16	Clear	Control Line 1	A	LOOP BACK	Loop Test (external)	CD
17	Set	Control Line 1	A	LOOP BACK	Loop Test (external)	CD

SERIAL I/O STATUS INTERPRETATION

Word Bit #	MIL-STD-188 Function	EIA-STD-RS232 Function	VACALES FUNCTION
2 ⁰	Parity Error	Parity Error	-
2 ¹	Overrun	Overrun	Overrun
2 ²	Break	Break	Parity Error
2 ³	E Active	Clear to Send	Sync Error