DWG NO. 95F1326

REVISIONS					
REV	EN	CHG CODE	DESCRIPTION	DR	APPD
A	64929	Ø	PRODUCTION RELEASE	——	1/5/77

NEXT ASSEMBLY ——	MODEL NO. ——	varian data machines /a varian subsidiary 2722 michelson drive / irvine / california / 92664

DR	——	——
CHK	[illegible]	1/7/77
DSGN	——	—
ENGR	D. W. Kenyon	1/10/77
APPD	S. Miller DK	1/10/77
APPD		

CODE IDENT NO. 21101

TITLE PROCESSOR, Central (V77-400)
Firmware Performance Specification

SIZE	DWG NO.	REV
A	95F1326	A

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FIGURES AND TABLES

SECTION 1
INTRODUCTION

1.1 PURPOSE

This document describes in detail the standard firmware of the (400) CPU. The description is in the form of flowcharts that provide a highly accurate and consistent source of information regarding the operation of the (400) CPU.

1.2 REFERENCE DOCUMENTS

This document assumes a general knowledge of the hardware of the (400) CPU as described in the following document:

Title	Document Number
Processor, Central (400) HPS	98A1177
XMIDAS Usage Description	81W0306-031
PROM, (400) CPU	49A0369

SECTION 2
FUNCTIONAL DESCRIPTION

2.1 FLOWCHART CONCEPT

The flowcharts are a visual aid to understanding the firmware as well as a precise method of documentation. It is a picture showing each microword and the sequence in which they are executed. With the aid of consistent abbreviations and interconnection, the reader can grasp the overall pattern of operation as well as the detailed operation of each microword.

2.2 FLOWCHART STRUCTURE

Each microword of the available 1023 that is used by the CPU appears as a box somewhere in the flowcharts. One and only one box is present for each microword. Unused microwords do not appear since they are meaningless and are never executed.

Each box is identified by a control store address and a mnemonic. The address appears above the box on the right-hand side and is a hexidecimal representation of the address applied to the control store to produce the microword which is then loaded into the control store buffer and executed. The address is in the range 000 to 3FF. The second identifier is the mnemonic located above the box and to the left. This mnemonic is assigned to the microword for easy identification and allows functional grouping of microwords without regard to address. Each word has a unique mnemonic and address and appears only once in the flowchart.

The boxes are interconnected by lines showing the possible routes that can be taken through microland. Each microword describes the addressing and, together with various conditions, determines the next microword in sequence. Where a connection goes off the page, a balloon is supplied with the mnemonic of the destination micro (or one of the destinations if a field select goes off the page). Below, the balloon is the page number where the destination is found. On the destination page, an identical baloon is shown near the top to define the entry point and connects to the next micro in sequence. Balloons entering a page show page numbers of all sources that use the page connect balloon.

There are three special connections that deviate from the balloons as follows:

1) Decoding an instruction

2) Interrupts

3) Subroutines

When an instruction decode is performed, the connector goes to a box with "TO NEXT INSTRUCTION" in it. Depending on the next instruction in the Instruction Buffer (IB), the sequencing will go to one of various microwords. This word is determined by looking up the mnemonic in Appendix A which references a page number. That page will have another box with "FROM DECODE" in it with that instruction referenced nearby. This is the entry point for the next microword.

When any interrupts are allowed by the CPU, a diamond will appear below the microword with "INTERRUPT" designating the sideward path. If an interrupt is pending, take this path. A balloon will take you to a decision tree describing which interrupts are allowed and where the next micro is found. This is the only case where a balloon does not contain a microword mnemonic. In this case, it contains INT and a binary representation of the interrupt-allow bits of the control word.

When a subroutine is called by a microword, another box is shown with pointed sides. This box indicates a subroutine and the flow sequence after the subroutine returns. Inside the box is "SUBR" followed by the mnemonic of the first microword of the subroutine (i.e., the next microword to be executed). Outside the box is the page number containing the starting point of the subroutine. On that page you will find an identical box showing the entry point of the subroutine. When a return is invoked, another box with pointed sides will appear with "RETURN" in it. This causes a return to the microword following the last call.

Another structural device is the conditional branch diamond. Whenever, a conditional branch opcode appears at a micro, one of two paths may be taken. If the condition is met, the path to the side of the diamond is taken. This may be to the right, or left for convenience of drawing. However, if the condition specified is not met, flow is out the bottom and leads to the here-plus-one address.

The last structural device described here is the important field select. Here a multi-way branch is specified as a result of a field select operation. Each of the possible destinations is labeled by the hexidecimal representation of the field value. Thus if a two bit field of the Instruction Register (IR) is specified, there will normally be four destinations: 0, 1, 2, or 3 depending on the value in the Instruction Register. Sometimes fewer destinations are shown because it is impossible to be at a certain microword with that particular field value without a processor malfunction. In that case, analysis of the control word is necessary to determine the next location. Finally, if a balloon is required at a field select, the mnemonic is chosen to be of the smallest address even though another microword may be the actual destination.

2.3 MICROWORD DESCRIPTIONS

The description of each microword is contained in the corresponding box of the flowcharts. The box is divided into two halves. The left half corresponds to the left half of the microword; likewise, the right half corresponds to the right half of the microword. Functions of the left half include selection of the next microword, 16 bit literal value, or specialized control functions while the right half specifies memory requests and data loop operations. Table 2.3 summarizes the two halves.

TABLE 2.3 - CONTROL WORD HALVES

Left Half	Right Half
- Selection of next microword	- Memory requests
- Literal values	- Data loop operations
- Specialized control functions	

The formats of the various microword types are specifically defined. The position of each item must appear in the box not only as defined but in the proper location. This consistency is maintained for ease in learning and understanding. The following sections present the various formats of the microwords.

2.3.1 Right Half

The format of the right half is shown in Figure 2.3.1. An optional memory request is always the first item. The memory request definitions are as follows:

IF — Instruction Fetch - Requests a memory fetch with data directed to the Instruction Buffer (IB) and Memory Data register (MD). The address is the 15 LSB's of the ALU output. This causes a wait if memory is not available. A wait inhibits the processor clock and the waiting microword remains in the control buffer until the wait condition is met.

FIGURE 2.3.1 - RIGHT HALF

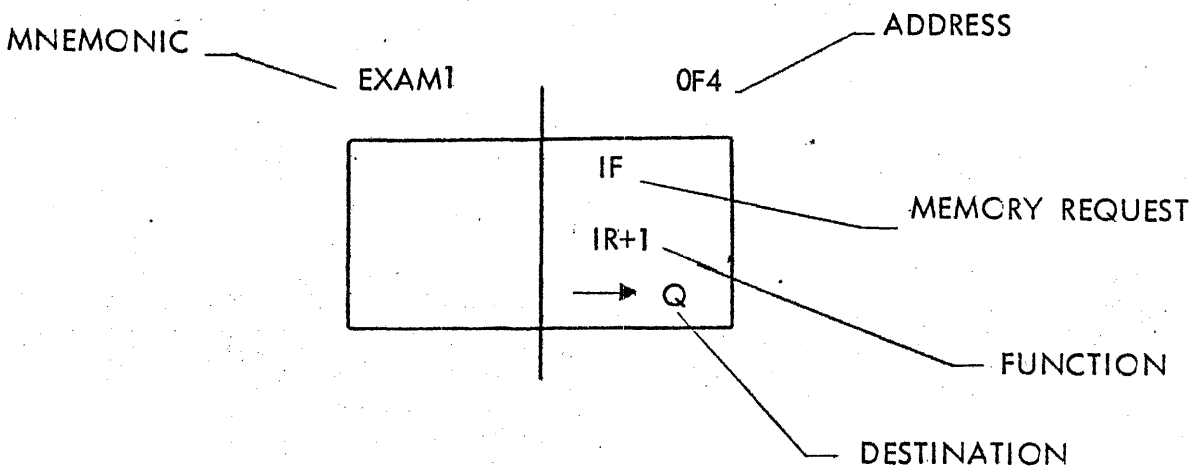


FIGURE 2.3.2 - CONDITIONAL BRANCH

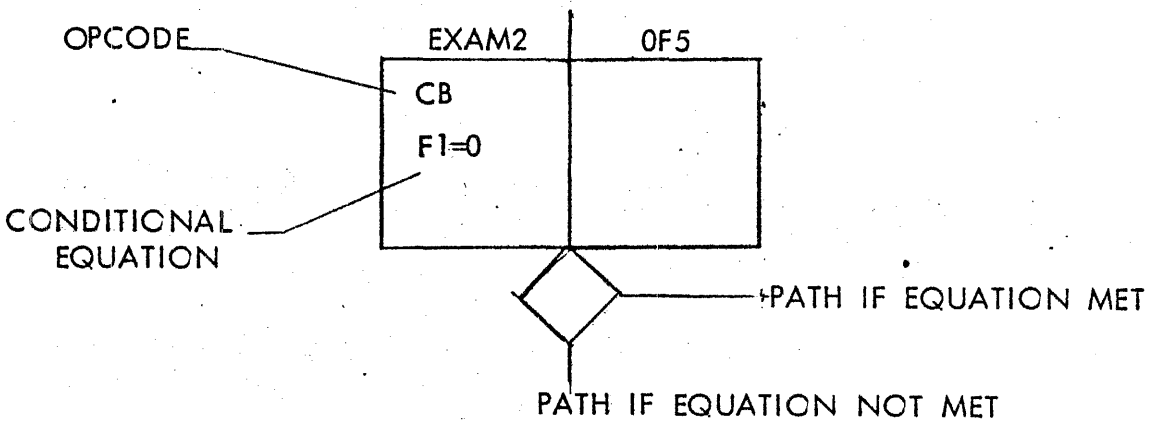
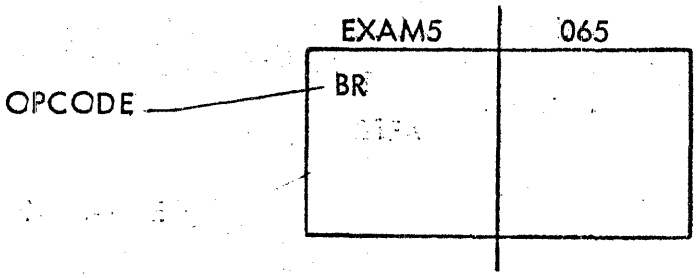


FIGURE 2.3.3 - BRANCH



OF	Operand Fetch - Requests a memory fetch with data directed to the Memory Data register. The address is the 15 LSB's of the ALU output. This causes a wait if memory is not available.
OS	Operand Store - Requests a memory store using the address specified by the 15 LSB's of the ALU output. Data is a full word put into the Store Data Register (SDR) in the following micro. This causes a wait if memory is not available.
OSRB	Operand Store Right Byte - Requests a memory store using the address specified by the 15 LSB's of the ALU output. Data is the 8 LSB's of the word put into the SDR in the following micro. This causes a wait if memory is not available.
OSLB	Operand Store Left Byte - Requests a memory store using the address specified by the 15 LSB's of the ALU output. Data is the 8 MSB's of the word put into the SDR in the following micro. This causes a wait if memory is not available.
(blank)	No memory request is made.
NOP	No Operation - Used if the entire right half is unused and causes nothing to happen.

In the second position of the right half is an optional function designator. The function definitions are as follows:

R0-R7	Register - References registers 0 through 7 of the register file.
W1-W7	Working Register - References working registers 0 through 7 of the register file.
P	Program Counter - A working register used by the (400) CPU as a pseudo Program Counter. It indirectly keeps track of the real Program Counter.
Q	Q Register - An intermediate holding and shift register.
LIT	Literal - A constant value specified by the entire left half of the microword.
MD	Memory Data - Contents of the Memory Data register. If the register is 'empty', this microword will cause a wait until the MD has been 'full' for at least one clock period. An MD reference will cause MD to become 'empty'.

IB	Instruction Buffer - Contents of the Instruction Buffer. If the register is 'empty', this microword will cause a wait until the IB has been 'full' for at least one clock period. An IB reference will cause IB to become 'empty'.
IR	Instruction Register - Contents of the Instruction Register.
BC	Boot and Console - A sixteen bit word whose 4 MSB's are the Boot PROM contents currently addressed by the IR and whose 8 LSB's are the current console character from the UART. The remainder of the word is zeroes.
IO	Input Output - Input data from the IO bus.

Preceding the function may be a shift modifier that operates on the result of the function. These are defined as follows:

SHR ARITH	Shift Right Arithmetic - The value of the function that follows is shifted right with sign extension.
ROT RIGHT	Rotate Right - The value of the function that follows is rotated right.
SHR LOG	Shift Right Logical - The value of the function that follows is shifted right with a zero shifted into the MSB.
SHL LOG	Shift Left Logical - The value of the function that follows is shifted left without regard to a sign bit.
ROT LFT	Rotate Left - The value of the function that follows is rotated left.
SHR MUL	Shift Right Multiply - Special multiply iteration.
SHL DIV	Shift Left Divide - Special divide iteration.

If a function is provided, a destination phrase must follow. It consists of a right arrow followed by a destination described below:

Q	As defined above
R0-R7	As defined above
W1-W7	As defined above
P	As defined above

IR	As defined above
CON	Console - The 8 LSB's of the ALU output are directed to the console UART.
IO	Input Output - Data is output to the IO bus.
MPM	Memory Protect Mask - ALU data bits 6 and 7 are directed to the MP Mask.
MPD	Memory Protect Data - QB00 is entered into the MP RAM.
SDR	Store Data Register - Data to be stored by the memory store request made in the previous microword.
ALU	Arithmetic and Logic Unit - Actually a default destination when none of the above are selected.

2.3.2 Conditional Branch

The format of the Conditional Branch microword is shown in Figure 2.3.2. CB must appear at the top as its opcode. A conditional equation always follows with one of the following definitions:

F1 thru F3	Flags - The state of one of the four CPU flags.
MPTST	Memory Protect Test - Special condition peculiar to the Memory Protect feature.
TWI	Two Word Instruction - Indicates the length of the most recent instruction.
TPIN	Trap In - Indicates a pending trap-in IO request.
TOUT	Trap Out - Indicates a pending trap-out IO request.
TRAP	Trap - Indicates either a pending trap-in or a trap-out IO request.
IUR	Interrupt Request - Indicates a pending IO interrupt.
SER	Sense Request - The sense line on the IO bus.
PFUT	Power Fail Up Test - Indicates power is coming up rather than going down.

EAUTC	Extended Arithmetic Unit Test Condition - An external condition from the EAU interface.
MPRA	Memory Protect Request (A) - Indicates a pending memory protect interrupt.
OSS	Operation Status Sign - The sign the the ALU function in the previous microword.
OSZ	Operation Status Zero - The ALU function was zero for the previous microword.
OSC	Operation Status Carry - The carry of the ALU function in the previous microword.
OVFL	Overflow - The overflow status bit.
SCEM1	Shift Counter Equals Minus One - The counter portion of the IR is all ones.
T620F	Test 620F - The special test function for conditional instructions.
NDTST	Indirect Test - Bit 15 of the ALU input is low or SCEM1 is true. Used for terminating indirect loops.
TXRDY	Transmitter Ready - Console UART is ready to accept another character.
TYDR	Teletype Data Ready - Console UART has received a character of data.
STABL	Start ABL - The 'LOAD' switch on the panel has been activated.
DIN15	Data Input (15) - The MSB of the data to the ALU.
$\overline{QB00}$	Q Buffer (00) Bar - The LSB of the Q register generated by the previous microword.

2.3.3 Branch

The format of the Branch microword is shown in Figure 2.3.3. BR must appear at the top as its opcode. Nothing else appears in the left half.

2.3.4 Page Branch

The format of the Page Branch microword is shown in Figure 2.3.4. PBR must appear at the top as its opcode. An optional CALL may appear below if a subroutine call is performed.

2.3.5 Literal

The format of the Literal microword is shown in Figure 2.3.5. LIT must appear at the top as its opcode. A four place hexidecimal value follows indicating the literal value.

2.3.6 Field Select

The format of the Field Select microword is shown in Figure 2.3.6. FS must appear at the top as its opcode. A field designation follows consisting of from one to four bit positions.

2.3.7 Flag

The format of the Flag microword is shown in Figure 2.3.7. FLG must appear at the top as its opcode. A transfer follows indicating the flag operation. Optional special control functions may follow as defined below.

2.3.8 Control

The format of the Control microword is shown in Figure 2.3.8. CNTL appears at the top as the opcode. Following is one or more miscellaneous control designations from the list below.

DECODE	If there are no allowed interrupts, the next micro is determined by the instruction in the IB. This next micro is determined by the decoder logic. If the IB is 'empty', this causes a wait until IB is full. Execution of the decode will cause IB to go 'empty'.
RETURN	This causes the next microword to be addressed by the Subroutine Return register (SR). This is used to return from a subroutine initiated by a PBR CALL.
SET IIF	Set Interrupt Instruction Flag - Control interrupts during an interrupt instruction.
RTC DISABLE	Disables the Real Time Clock interrupt.
RTC ENABLE	Enables the Real Time Clock interrupt.
MP DISABLE	Disables Memory Protect logic.

FIGURE 2.3.4 - PAGE BRANCH

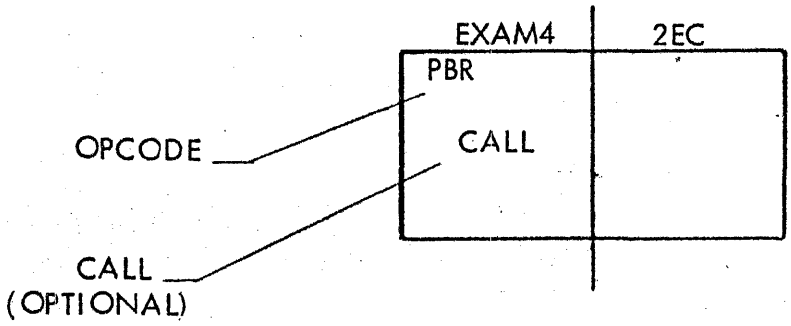


FIGURE 2.3.5 - LITERAL

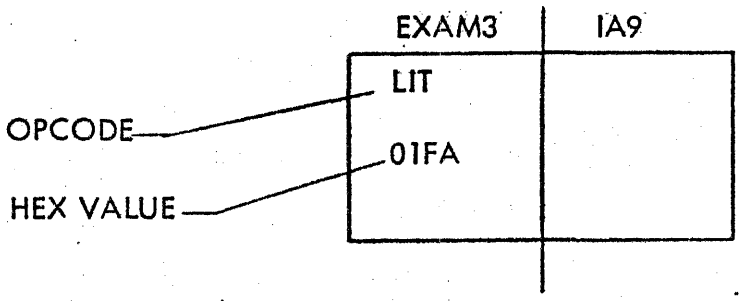


FIGURE 2.3.6 - FIELD SELECT

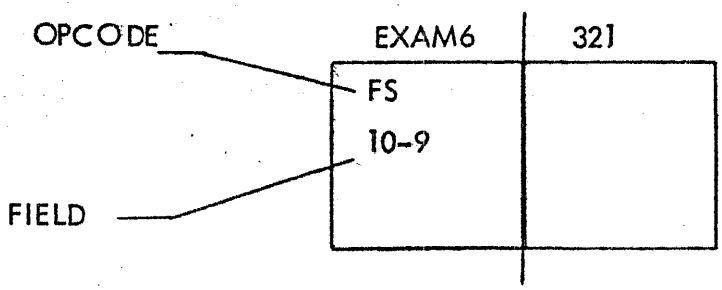


FIGURE 2.3.7 - FLAG

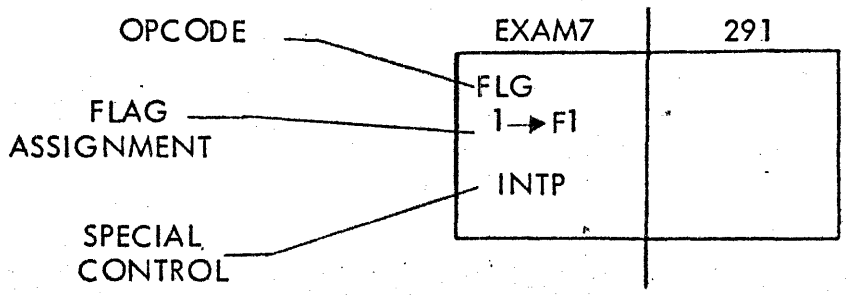


FIGURE 2.3.8 - CONTROL

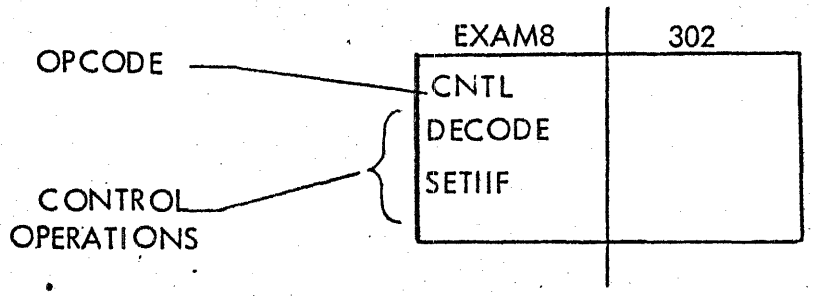
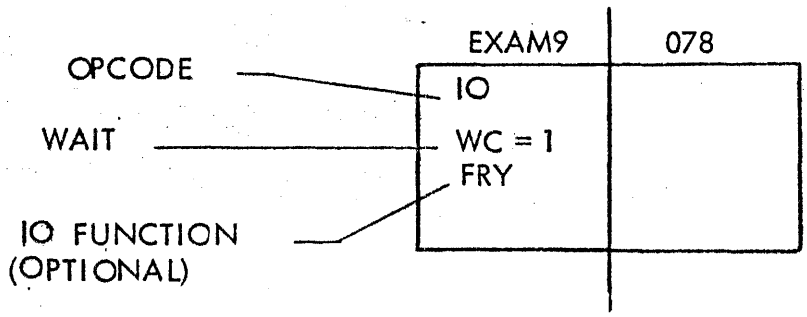


FIGURE 2.3.9 - INPUT OUTPUT



MP ENABLE	Enables Memory Protect logic.
MEM ERR DISABLE	Disables Memory Error logic.
MEM ERR ENABLE	Enables Memory Error logic.
INIT CON	Initializes the console UART.
RESET DTA RDY	Resets the data ready condition of the console UART.
SET STEP	Sets the step interrupt flip-flop which creates a step interrupt request.
RESET STEP	Resets the step interrupt flip-flop.
RESET ABL	Resets the ABL request activated by the panel.
MCLR ENABLE	Enable the master clear logic.
MCLR DISABLE	Disables the master clear logic.
RESET OVERFLOW	Resets the status overflow.

2.3.9 Input Output

The format of the Input Output microword is shown in Figure 2.3.9. IO appears at the top as the opcode. Following is always a wait condition from the list below.

WC = 0	No wait specified.
WC = 1	Wait for IACK1+; allows time for data resolution on the IO bus.
WC = 2	Wait for IOC1+; allows time for interrupt synchronization on the IO bus.

Following the wait condition may be special IO functions listed below.

DRY	Data Ready - Issues a data ready onto the IO bus.
FRY	Function Ready - Issues a function ready signal onto the IO bus.

SINTF	Set Interrupt Flag - Stops the interrupt clock and issues an IUAX to the IO bus.
RINTF	Reset Interrupt Flag - Starts the interrupt clock and removes IUAX from the IO bus.

2.4 MICRO ASSEMBLY LISTING

The output listing of the micro-assembler (XMIDAS) is provided in Appendix B. This output was generated along with the (400) firmware and is supplied for reference.

2.5 FUTURE CHANGES AND UPDATES

The (400) flowcharts are hungry for any fix or update no matter how small. Please forward even the smallest flaw to the Computer Development department and you will be acknowledged and praised.

The page designators near the balloons are an important part of the flows. They should be consistent and kept up-to-date. Other items to watch are listed below.

1. Flowcharts must be consistent.
2. Paper is 'C" size vertical vellum with borders and title block.
3. Boxes are no less than 2" wide and 3/4" high.
4. Boxes will be in two halves, left half control, right half data loop.
5. The conditional branch format requires a condition equation. The condition is to the left of the equals sign. The value of the M field is to the right. If the equation is satisfied, the yes (Y) branch is taken always out the side. The no(N) for Here Plus One is always out the bottom.
6. Labels can have up to six letters or numbers; address is hexidecimal.
7. Connector balloons always have label of destination. Off page connections are shown near the balloon with all pages and labels.
8. Input balloons are nearest top of page while outputs are nearest bottom.
9. Merging of two lines are angled to indicate direction of flow.
10. Sidenotes are used to describe incoming conditions and important values currently at the ALU output, etc.

11. Mnemonics, symbols, and operations must be standardized and consistent.

12. Parentheses are not used for "the contents of". (e.g. R1 means "the contents of R1."

13. The control side of the box begins with the format designation. The data loop side begins with memory starts (if any) and then the ALU function.

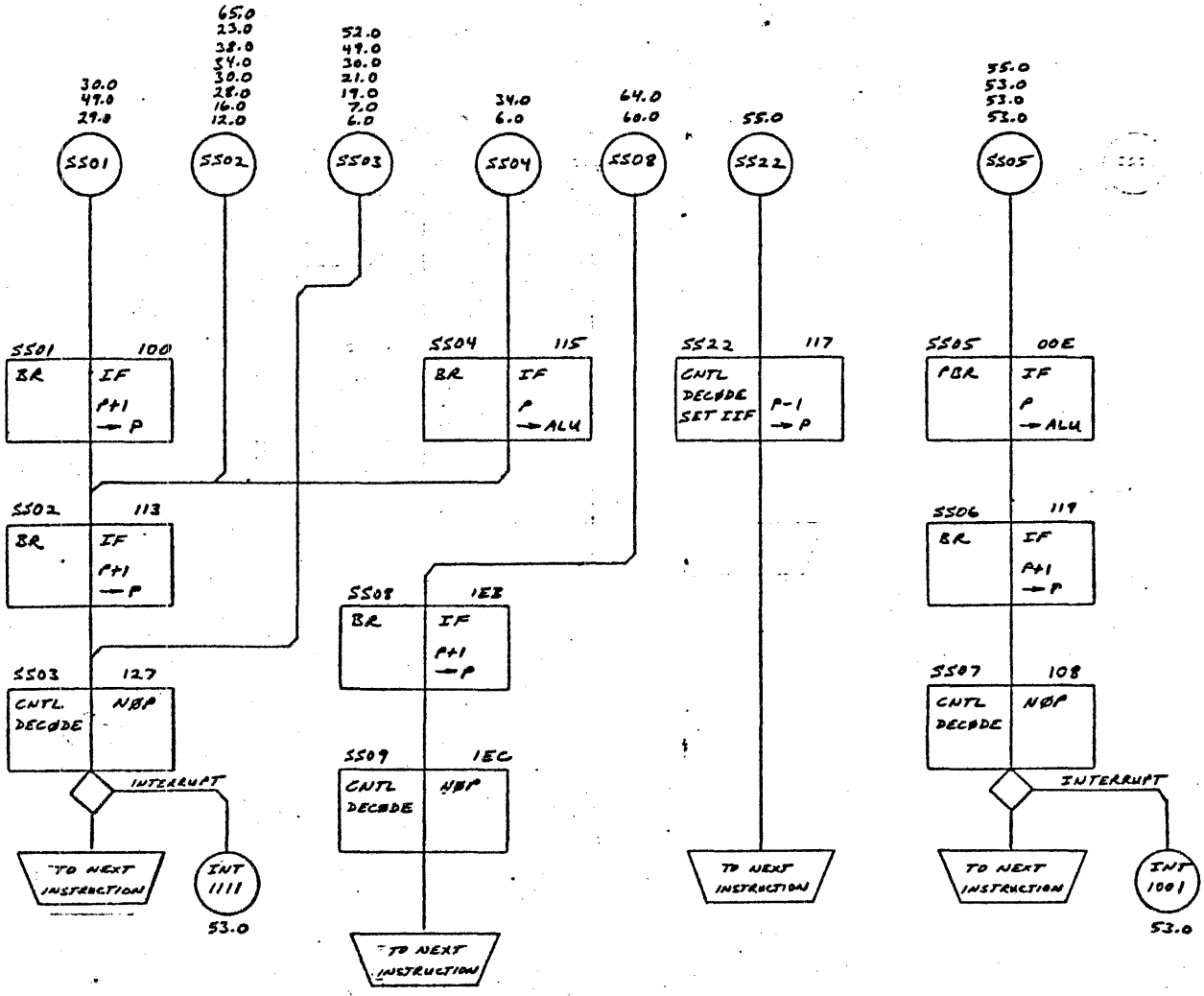
14. Connectors may be drawn into the side of boxes if space requires it.

15. Page references must reflect all sources and destinations.

APPENDIX A
FROG FLOWCHARTS

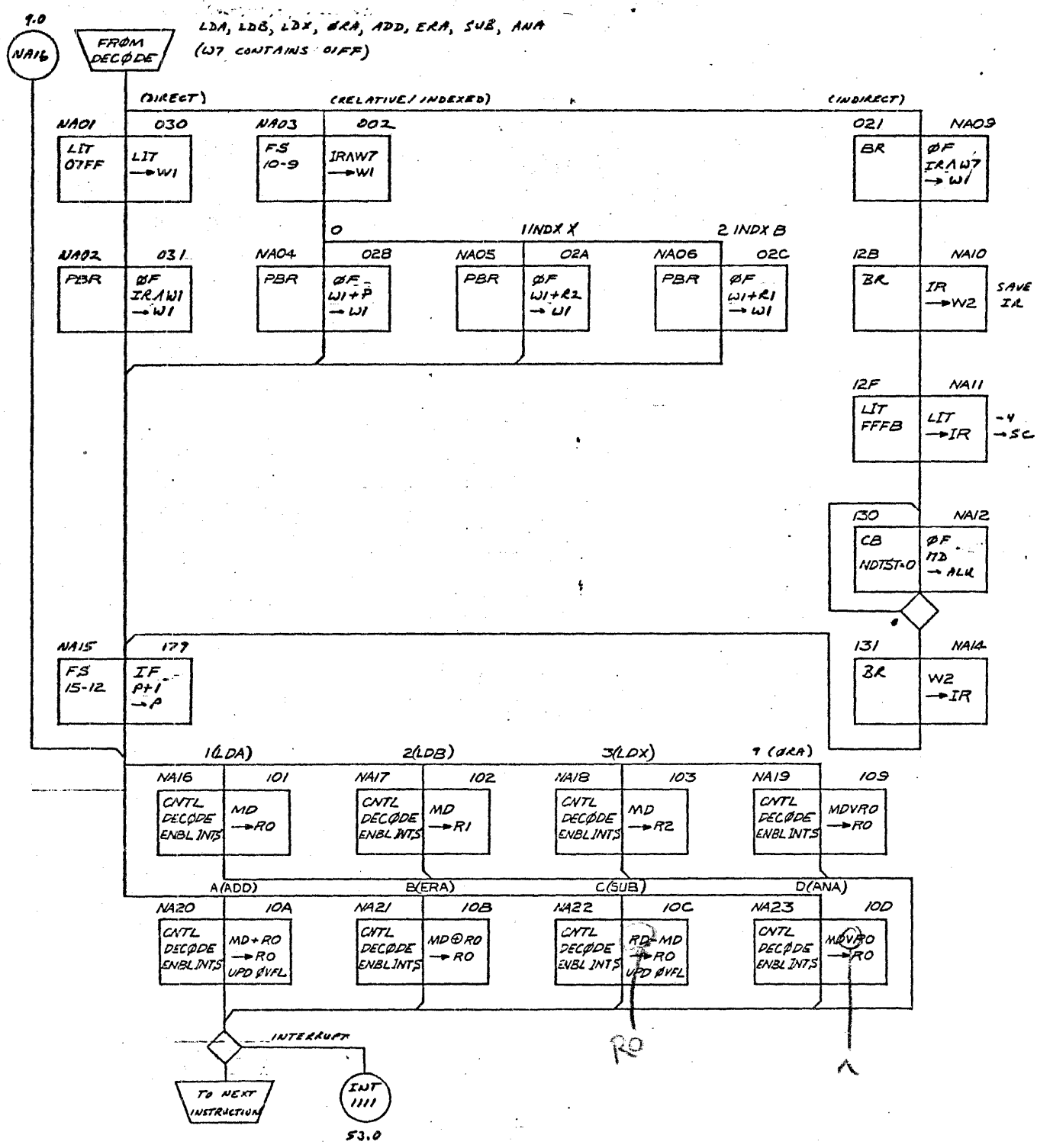
Table of Contents:

STANDARD STATES



CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 3.0 OF	

SINGLE WORD ADDRESSING



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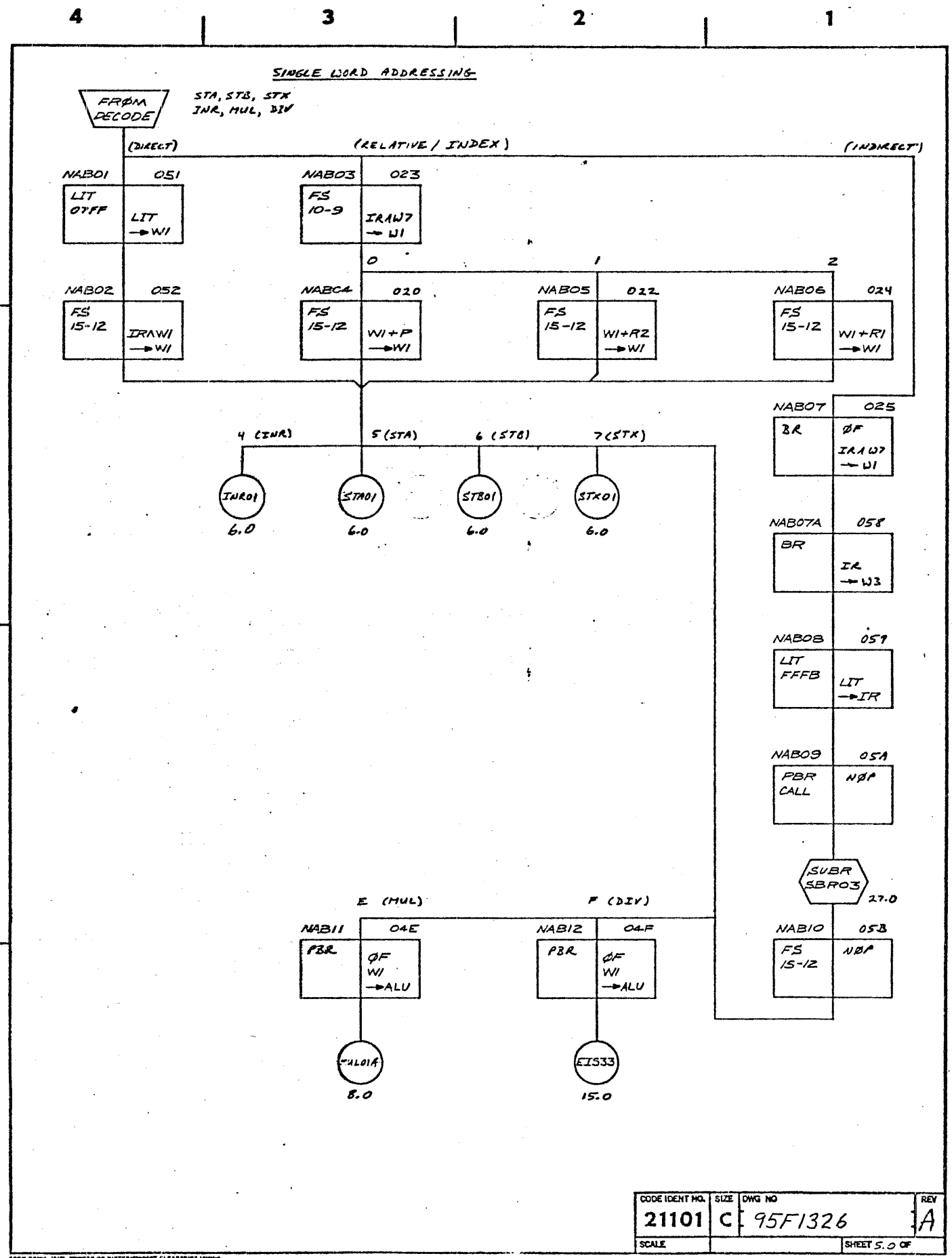
SCALE		SHEET 4.0 OF	



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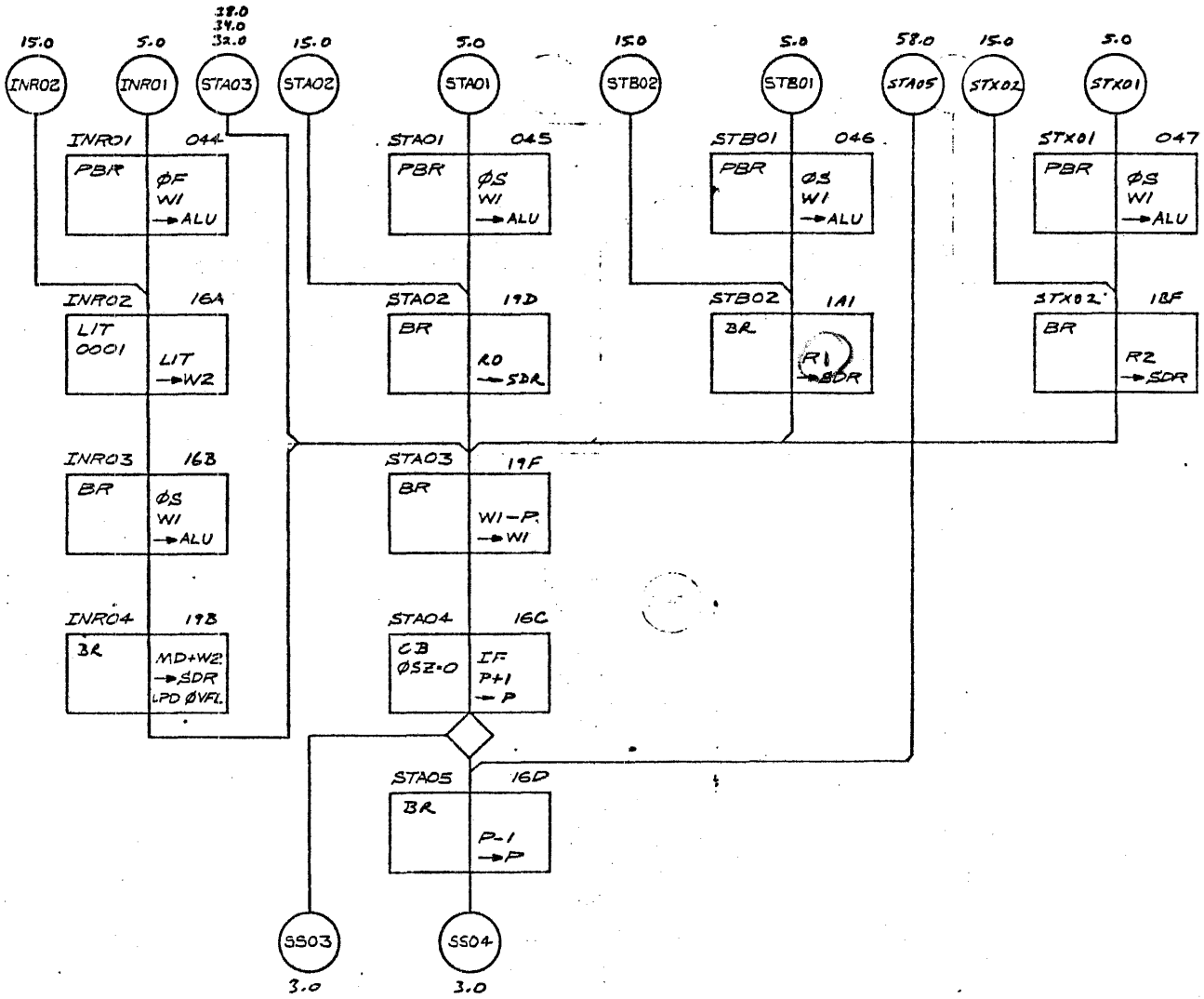
SCALE		SHEET 5.0 OF	

4 3 2 1

SINGLE WORD ADDRESSING



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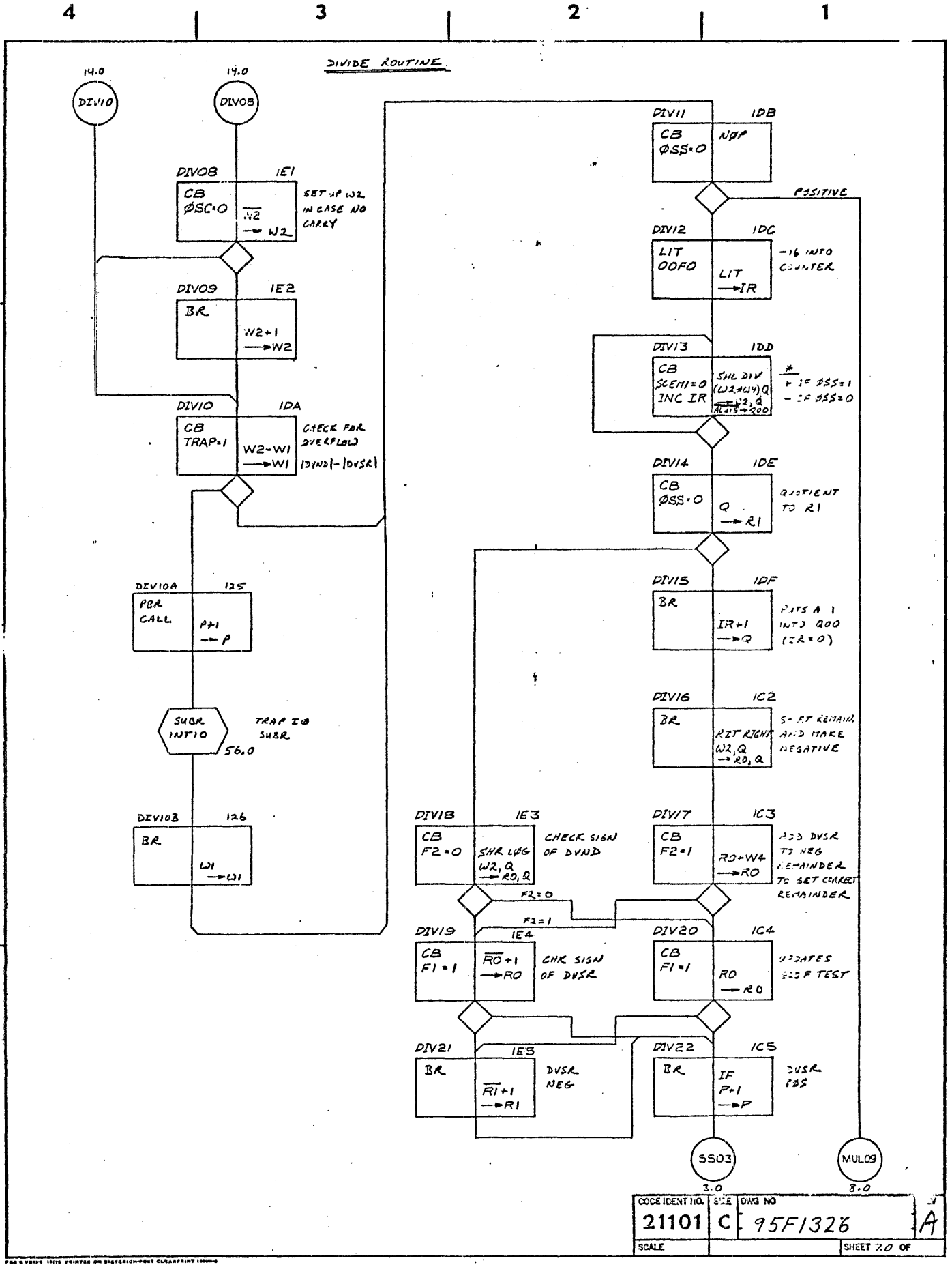
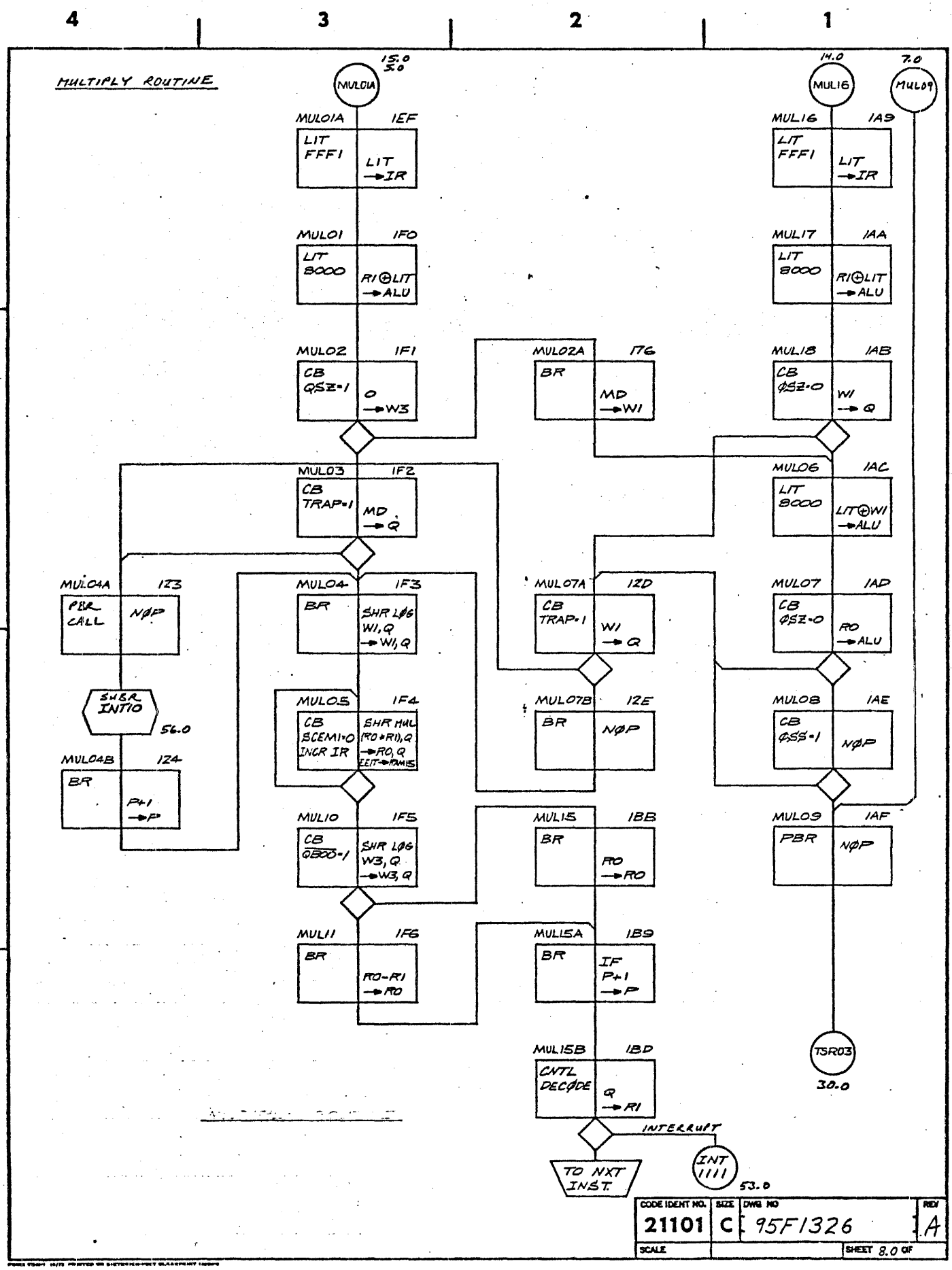
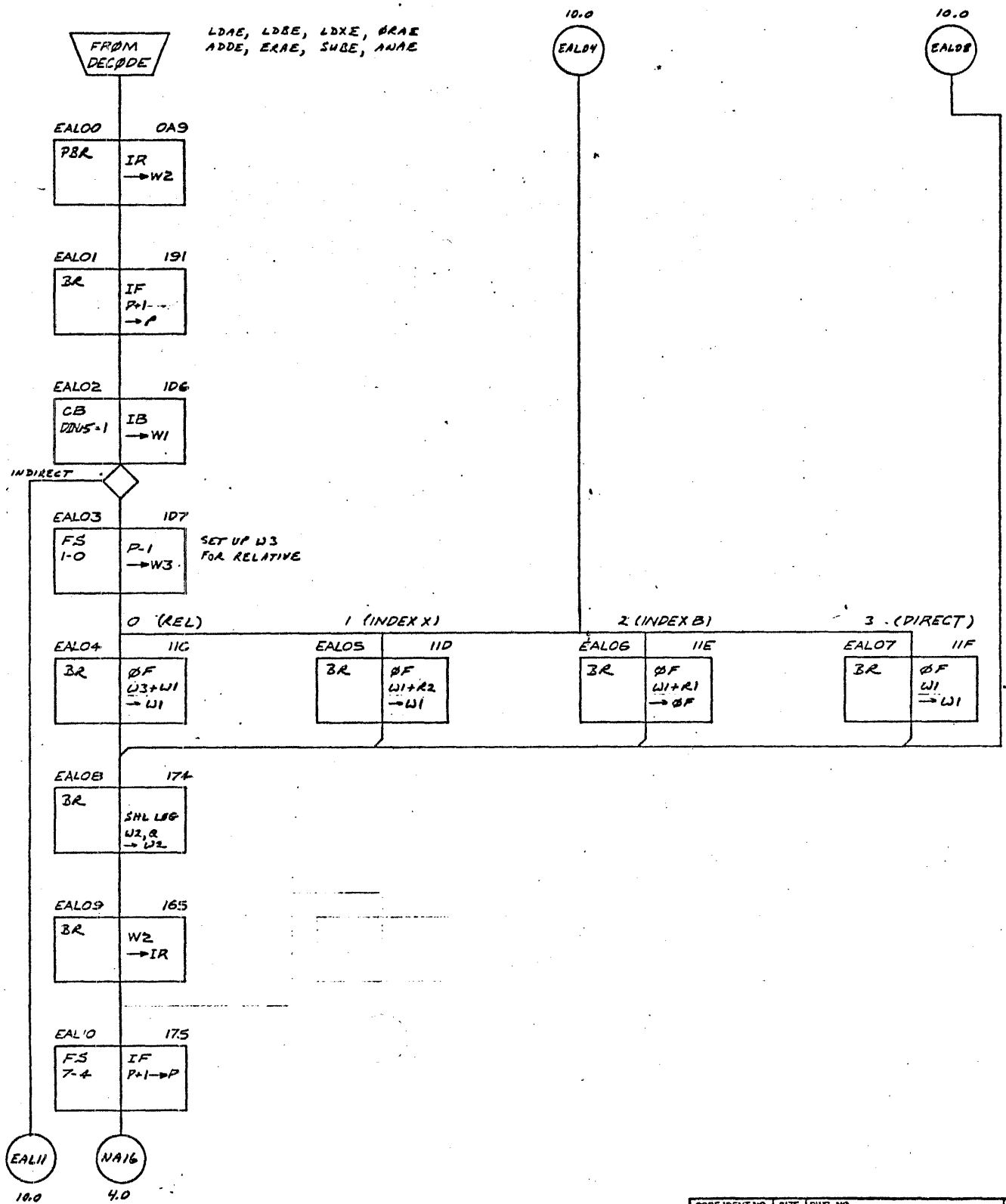
SCALE		SHEET 6.0 OF	


DIVIDE ROUTINE
14.0
DIV10
14.0
DIV08
DIV08
1E1
CB
ØSC=0
W2
→W2
SET UP W2 IN CASE NO CARRY
DIV09
1E2
BR
W2+1
→W2
DIV10
1DA
CB
TRAP=1
W2-W1
→W1
CHECK FOR OVERFLOW
|DVND|-|DVSR|
DIV10A
125
PBR
CALL
P+1
→P
SUBR
INT10
56.0
TRAP TO SUBR
DIV10B
126
BR
W1
→W1
DIV11
1DB
CB
ØSS=0
NOP
POSITIVE
DIV12
1DC
LIT
00F0
LIT
→IR
-16 INTO COUNTER
DIV13
1DD
CB
SCEN1=0
INC IR
SHL DIV
(W2,W4),Q
→W2, Q
ALWAYS →Q00
* + IF ØSS=1
- IF ØSS=0
DIV14
1DE
CB
ØSS=0
Q
→R1
QUOTIENT TO R1
DIV15
1DF
BR
IR+1
→Q
PUTS A 1 INTO Q00 (IR=0)
DIV16
1C2
BR
RET RIGHT
W2,Q
→R0, Q
SET REMAIN AND MAKE NEGATIVE
DIV18
1E3
CB
F2=0
SHR LØG
W2, Q
→R0, Q
CHECK SIGN OF DVND
DIV17
1C3
CB
F2=1
R0+W4
→R0
ADD DVSR TO NEG REMAINDER TO SET CORRECT REMAINDER
F2=0
F2=1
DIV19
1E4
CB
F1=1
R0+1
→R0
CHK SIGN OF DVSR
DIV20
1C4
CB
F1=1
R0
→R0
UPDATES R0 IF TEST
DIV21
1E5
BR
R1+1
→R1
DVSR NEG
DIV22
1C5
BR
IF
P+1
→P
DVSR POS
SS03
3.0
MUL09
8.0
COCE IDENT NO.
21101
SIZE
C
DWG NO
95F1326
REV
A
SCALE
SHEET 7.0 OF

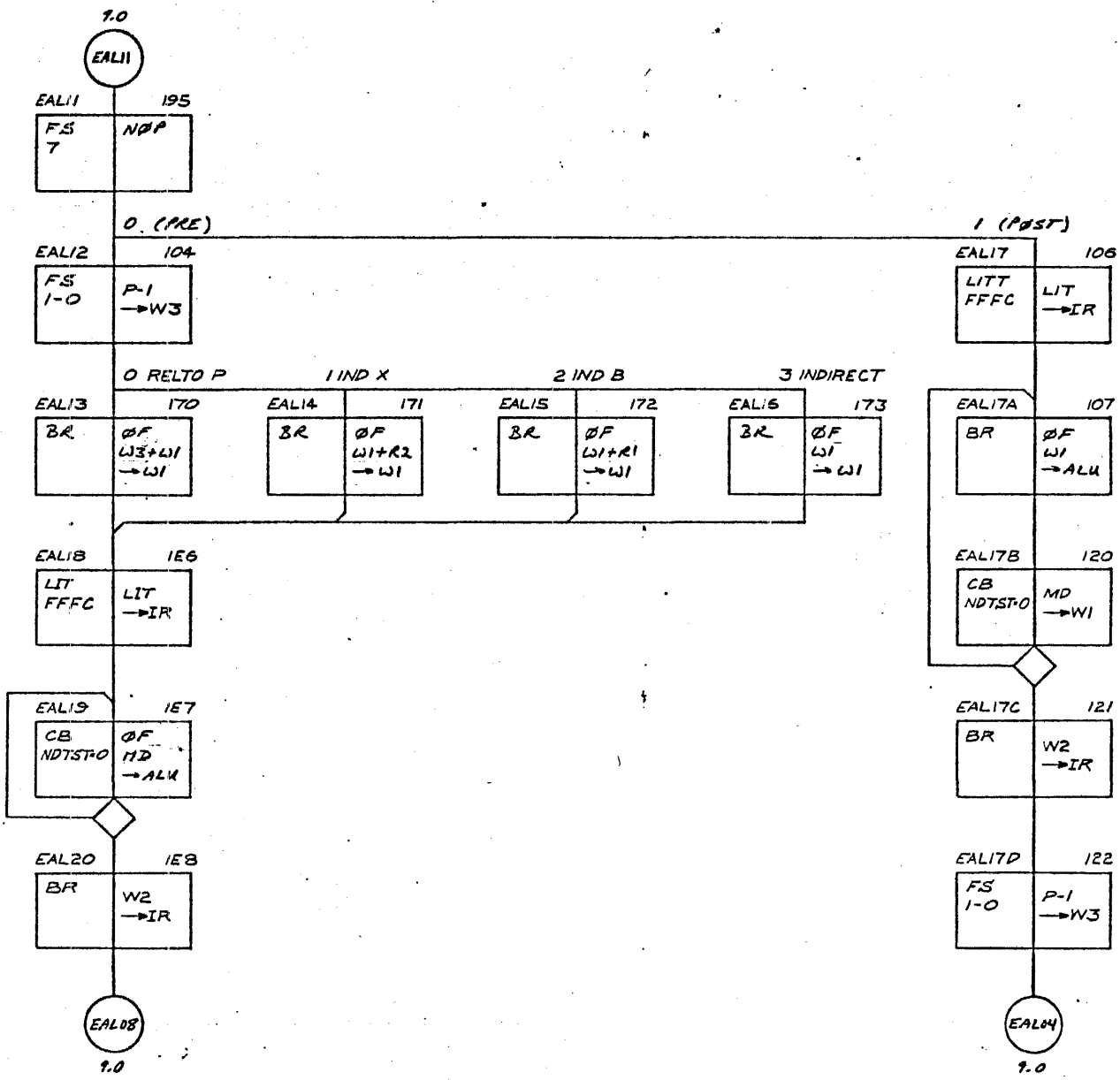

MULTIPLY ROUTINE
MUL01A
1EF
LIT FFF1
LIT →IR
MUL01
1F0
LIT 8000
R1⊕LIT →ALU
MUL02
1F1
CB QSZ=1
0 →W3
MUL02A
176
BR
MD →W1
MUL03
1F2
CB TRAP=1
MD →Q
MUL04A
123
PBR CALL
NOP
SUBR INIT0
56.0
MUL04B
124
BR
P+1 →P
MUL04
1F3
BR
SHR LOG W1,Q →W1,Q
MUL05
1F4
CB SCEMI=0 INCR IR
SHR MUL (R0*R1),Q →R0,Q EXIT→TRAMIS
MUL10
1F5
CB QBOO=1
SHR LOG W3,Q →W3,Q
MUL11
1F6
BR
R0-R1 →R0
MUL07A
12D
CB TRAP=1
W1 →Q
MUL07B
12E
BR
NOP
MUL15
1BB
BR
R0 →R0
MUL15A
1B9
BR
IF P+1 →P
MUL15B
1BD
CNTL DECODE
Q →R1
INTERRUPT
TO NXT INST.
INT 1111
53.0
MUL16
1A9
LIT FFF1
LIT →IR
MUL17
1AA
LIT 8000
R1⊕LIT →ALU
MUL18
1AB
CB QSZ=0
W1 →Q
MUL06
1AC
LIT 8000
LIT⊕W1 →ALU
MUL07
1AD
CB QSZ=0
R0 →ALU
MUL08
1AE
CB QSS=1
NOP
MUL09
1AF
PBR
NOP
T5R03
30.0
15.0
5.0
14.0
7.0
CODE IDENT NO. 21101
SIZE C
DWG NO 95F1326
REV A
SCALE
SHEET 8.0 OF

EXTENDED AND IMMEDIATES



CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE			SHEET 7.0 OF

EXTENDED AND IMMEDIATES

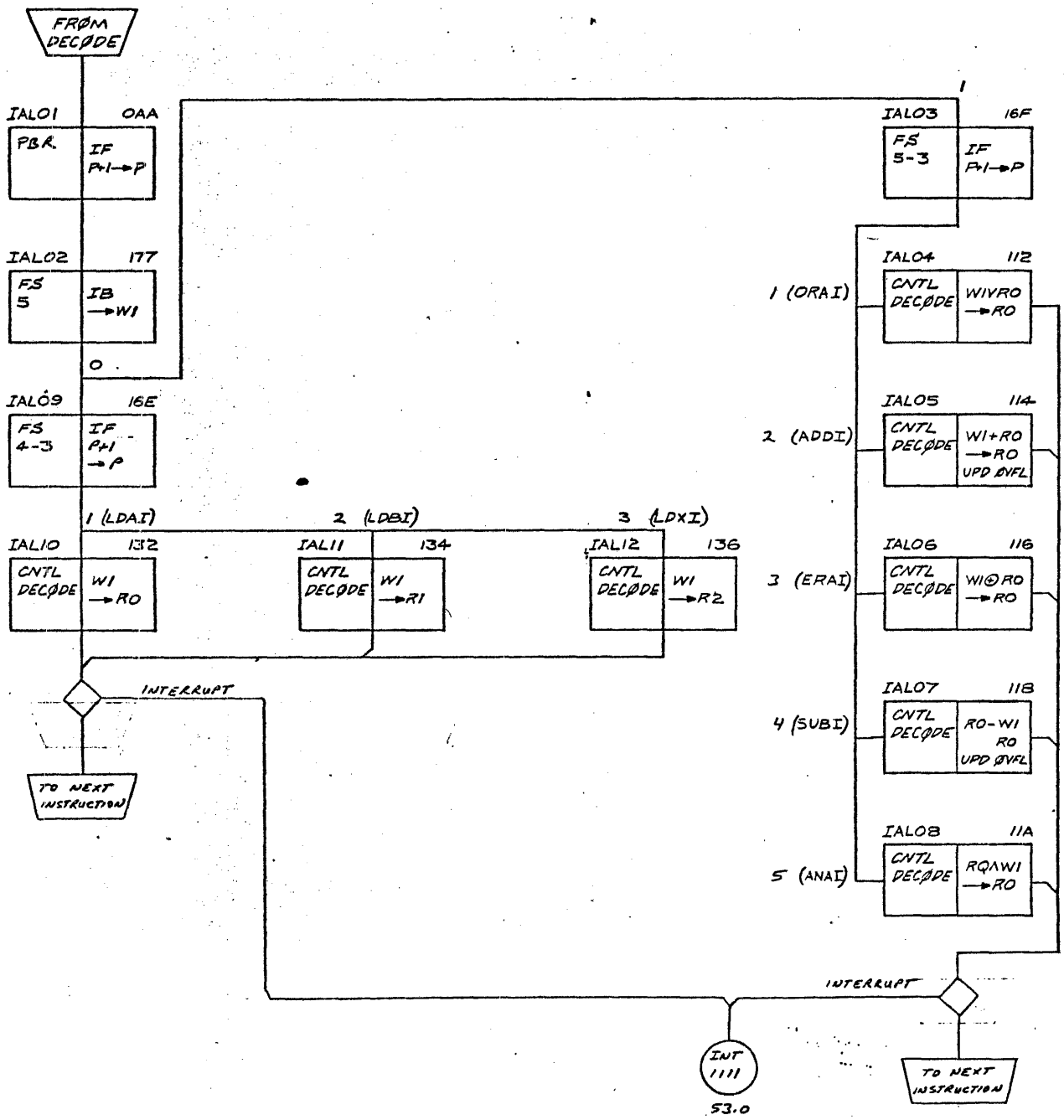


CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 10.0 OF	

4 3 2 1

EXTENDED AND IMMEDIATES

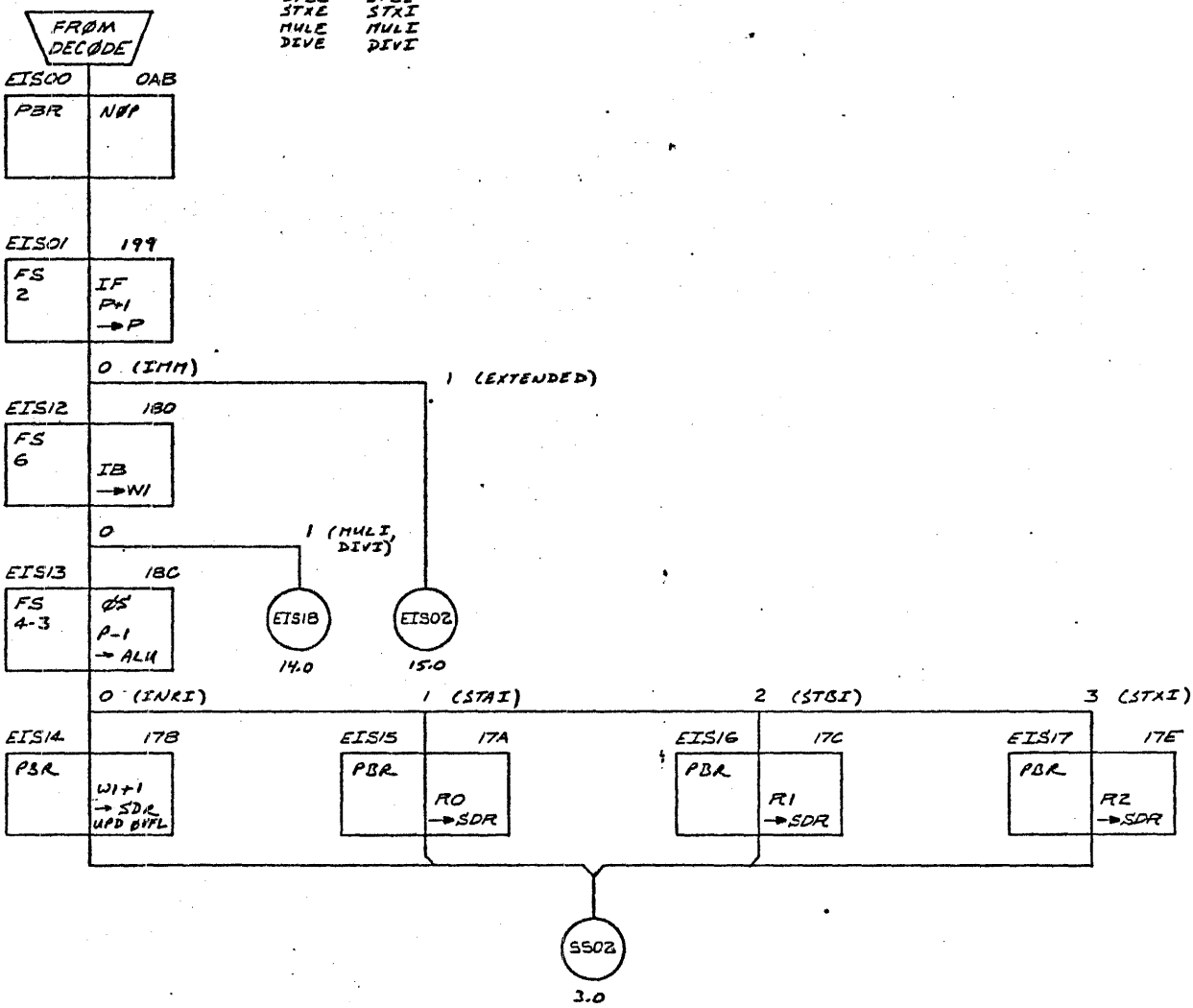
LDAI, LDBI, LDXI, ORAI, ADDI, ERAI, SUBI, ANAI



CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 11.0 OF	

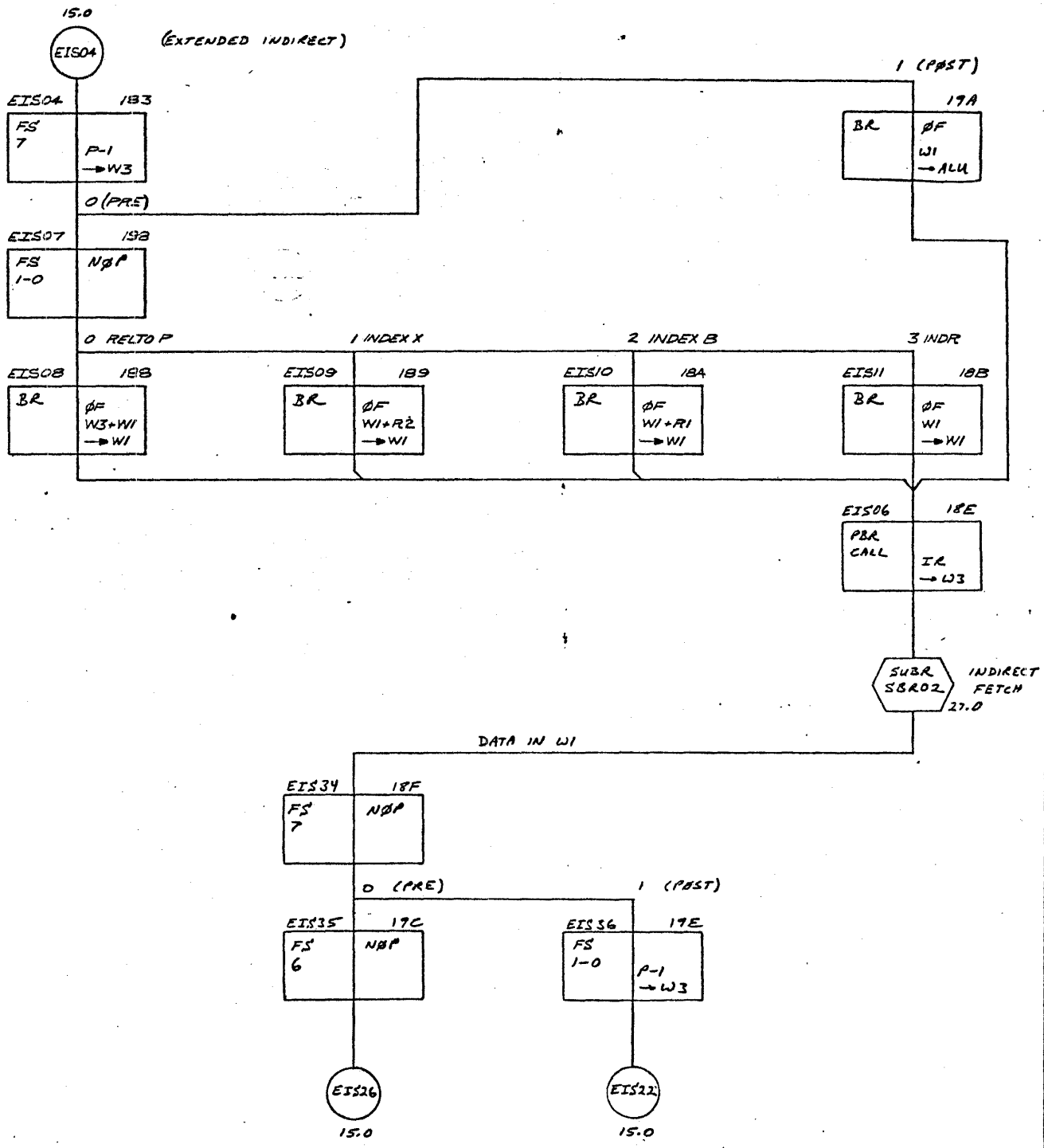
EXTENDED AND IMMEDIATES

INRE INRI
STAE STAI
STBE STBI
STXE STXI
MULE MULI
DIVE DIVI



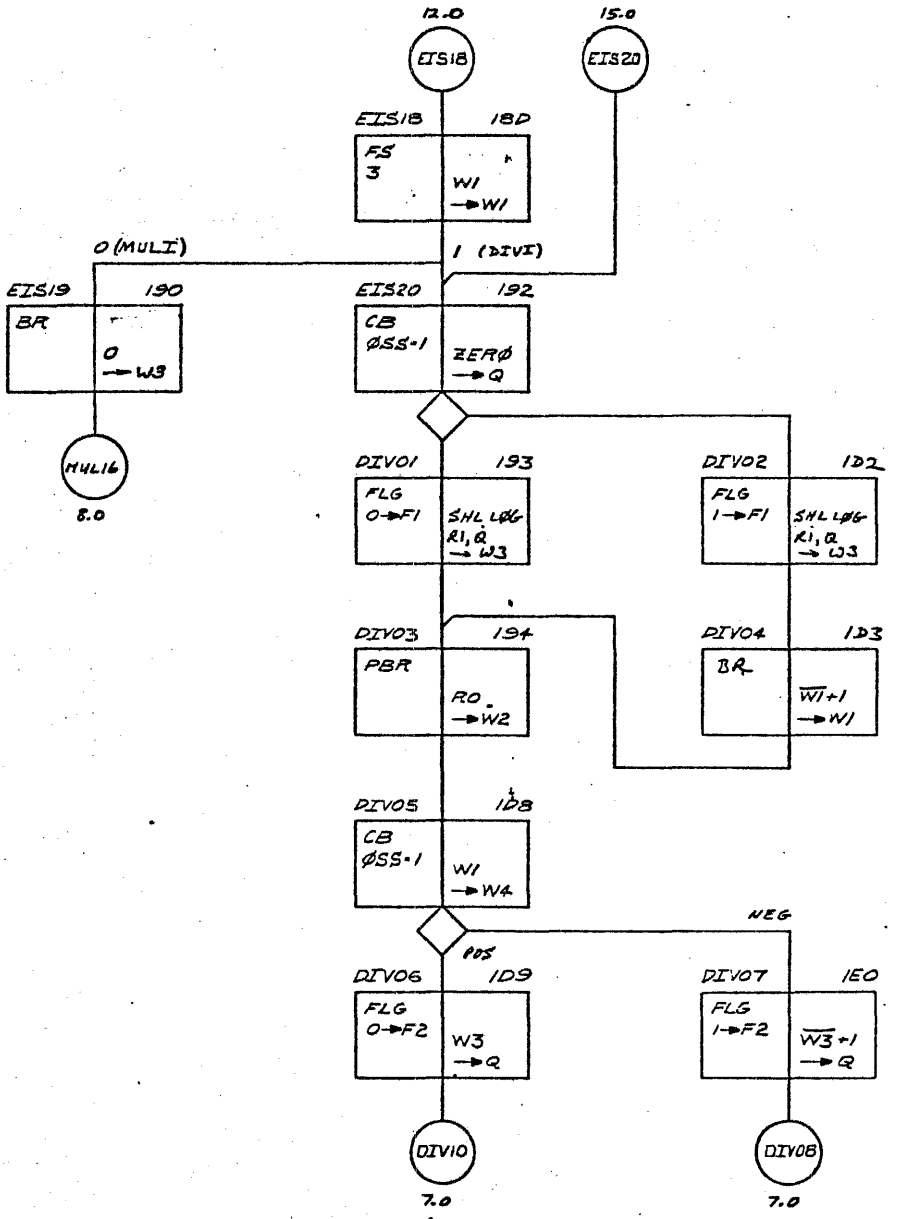
CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 12.0 OF	

EXTENDED AND IMMEDIATES

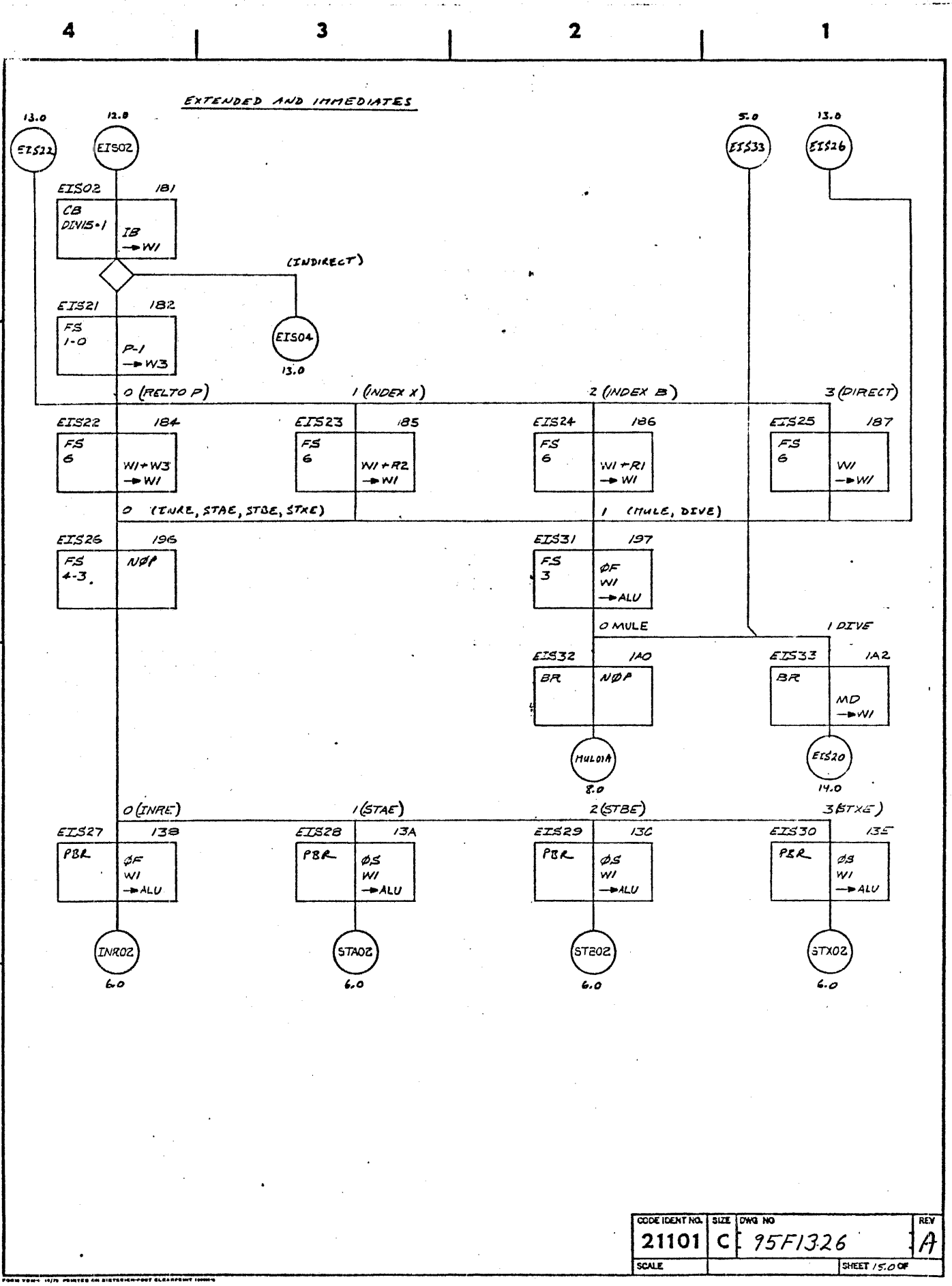


CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE			SHEET 13.0 OF

EXTENDED AND IMMEDIATES

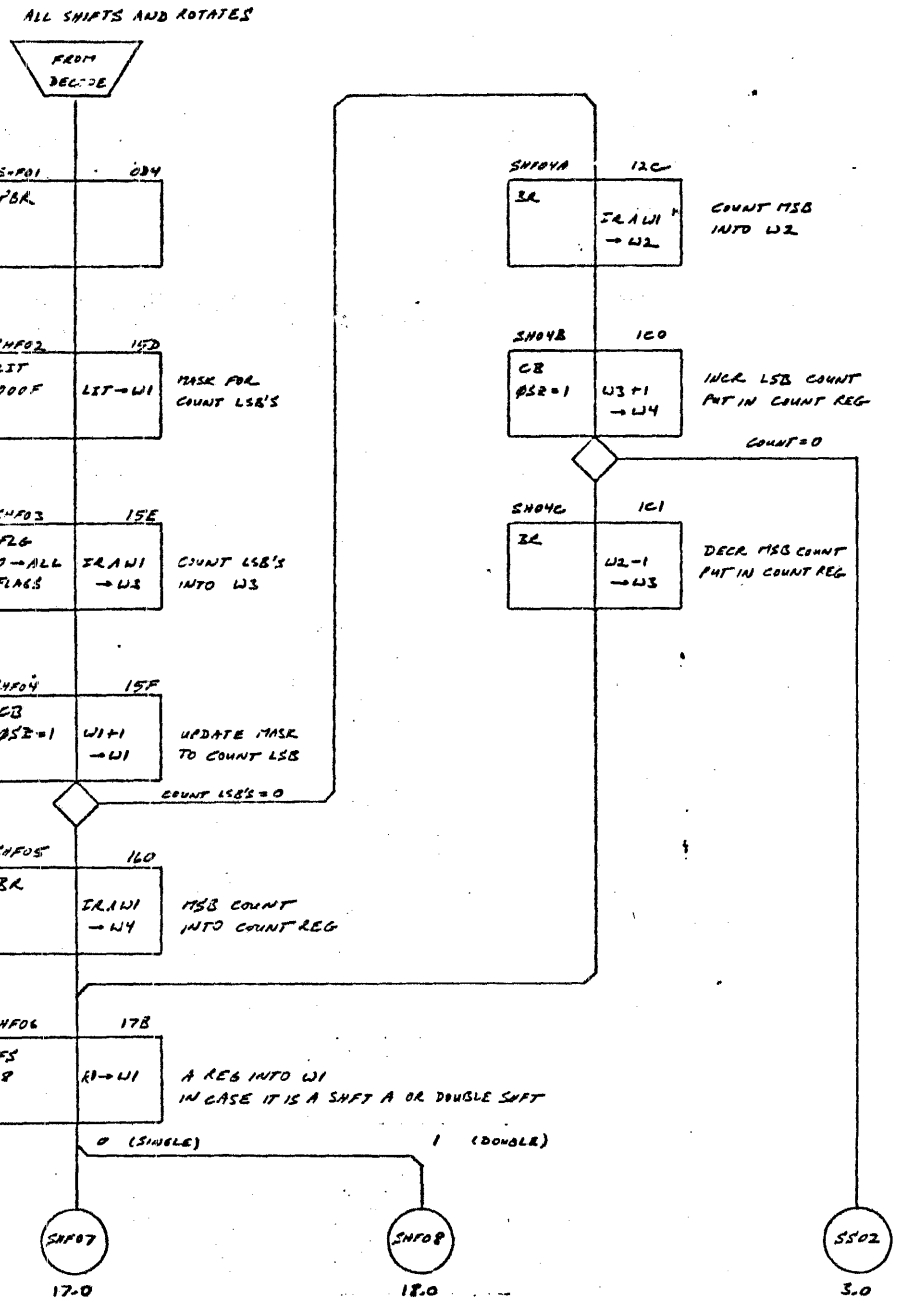


CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 14.0 OF	



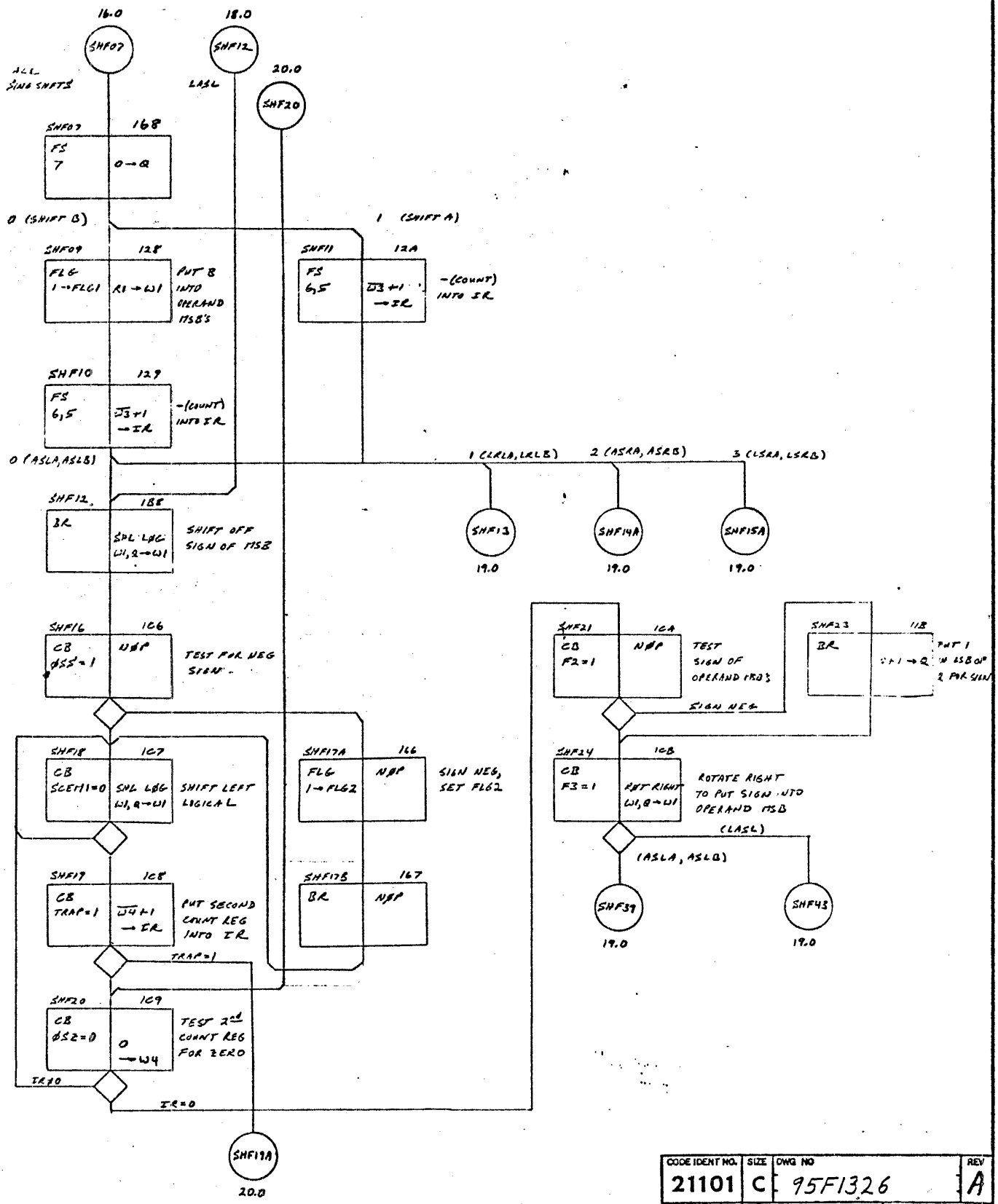
CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE			SHEET 15.0 OF

SHIFTS AND ROTATES



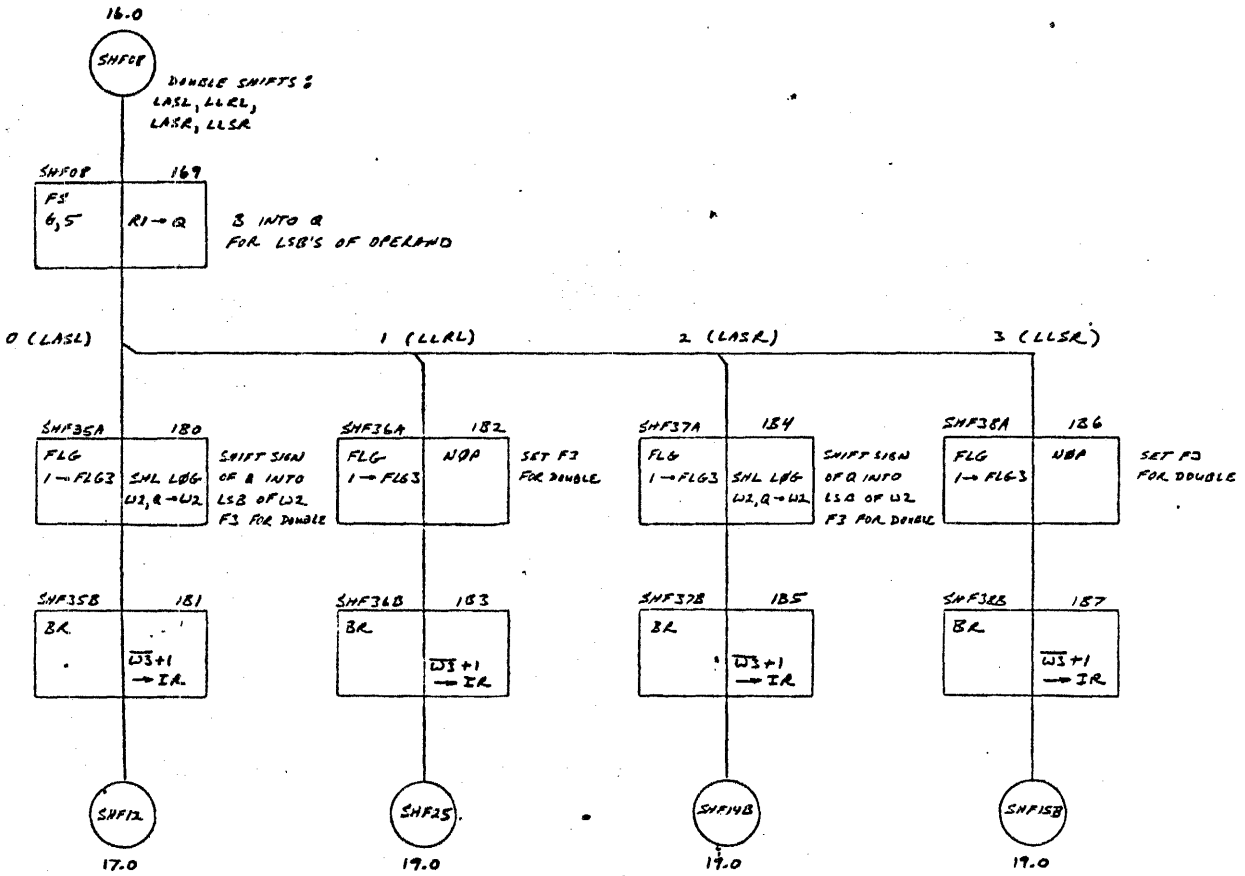
CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 16.0 OF	

SHIFTS AND ROTATES



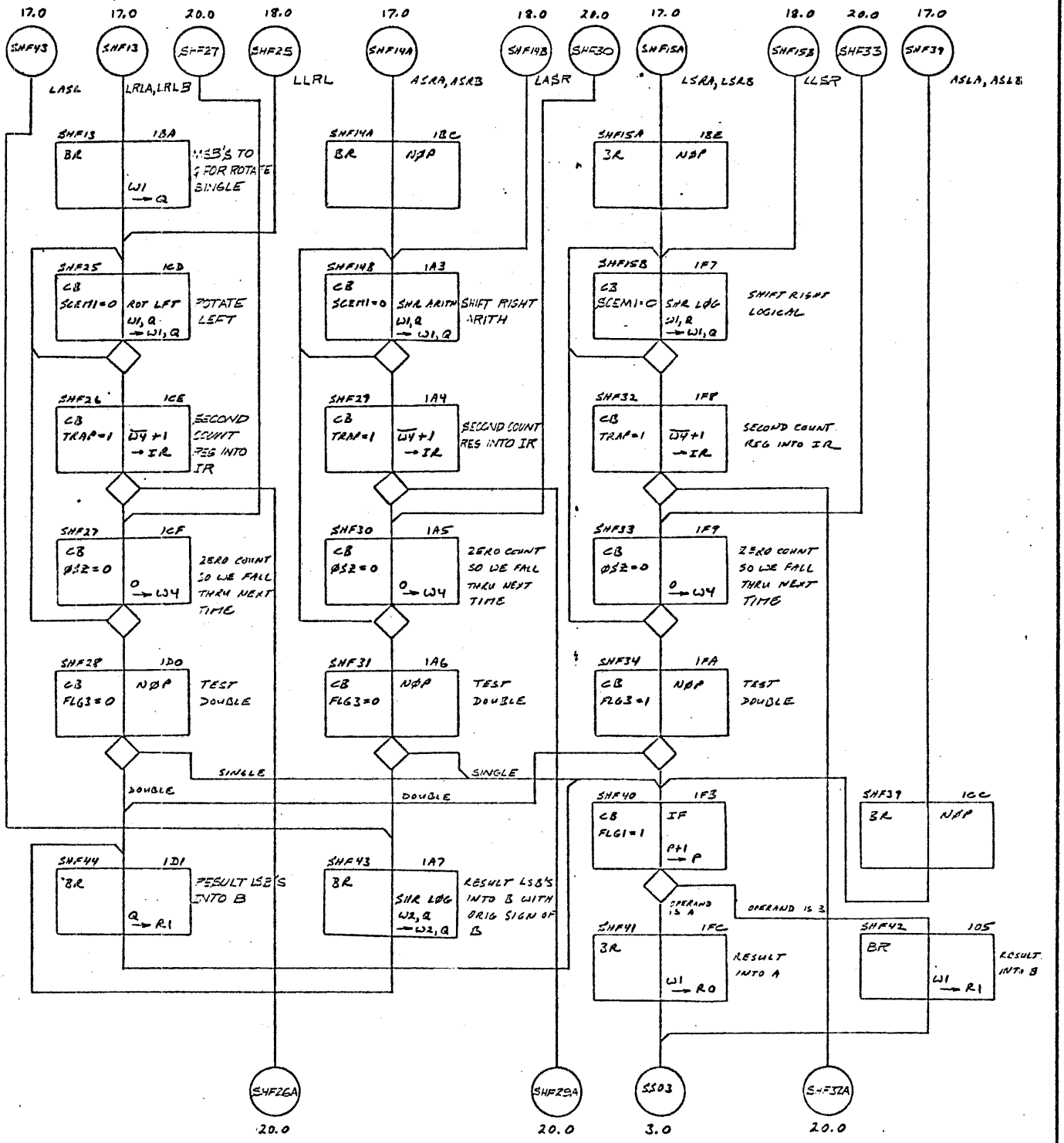
CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 17.0 OF	

SHIFTS AND ROTATES



CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 19.0 OF	

SHIFTS AND ROTATES

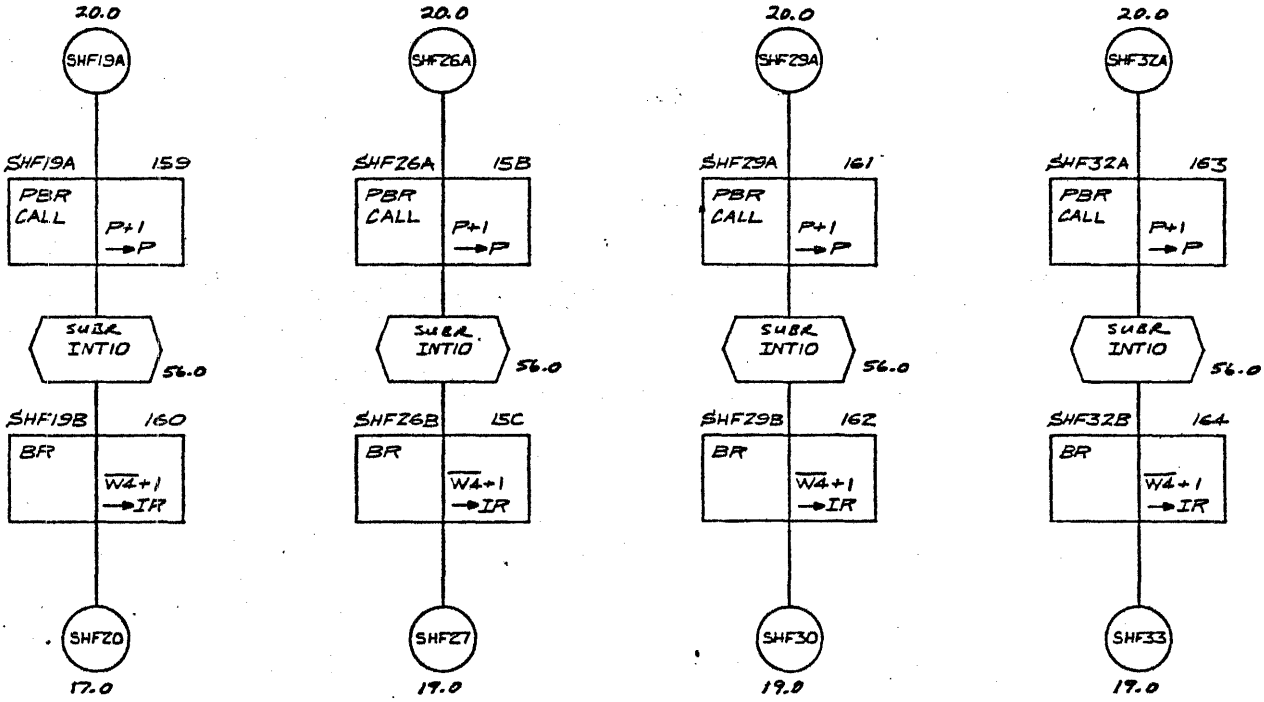


CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 17.0 OF	

4 3 2 1

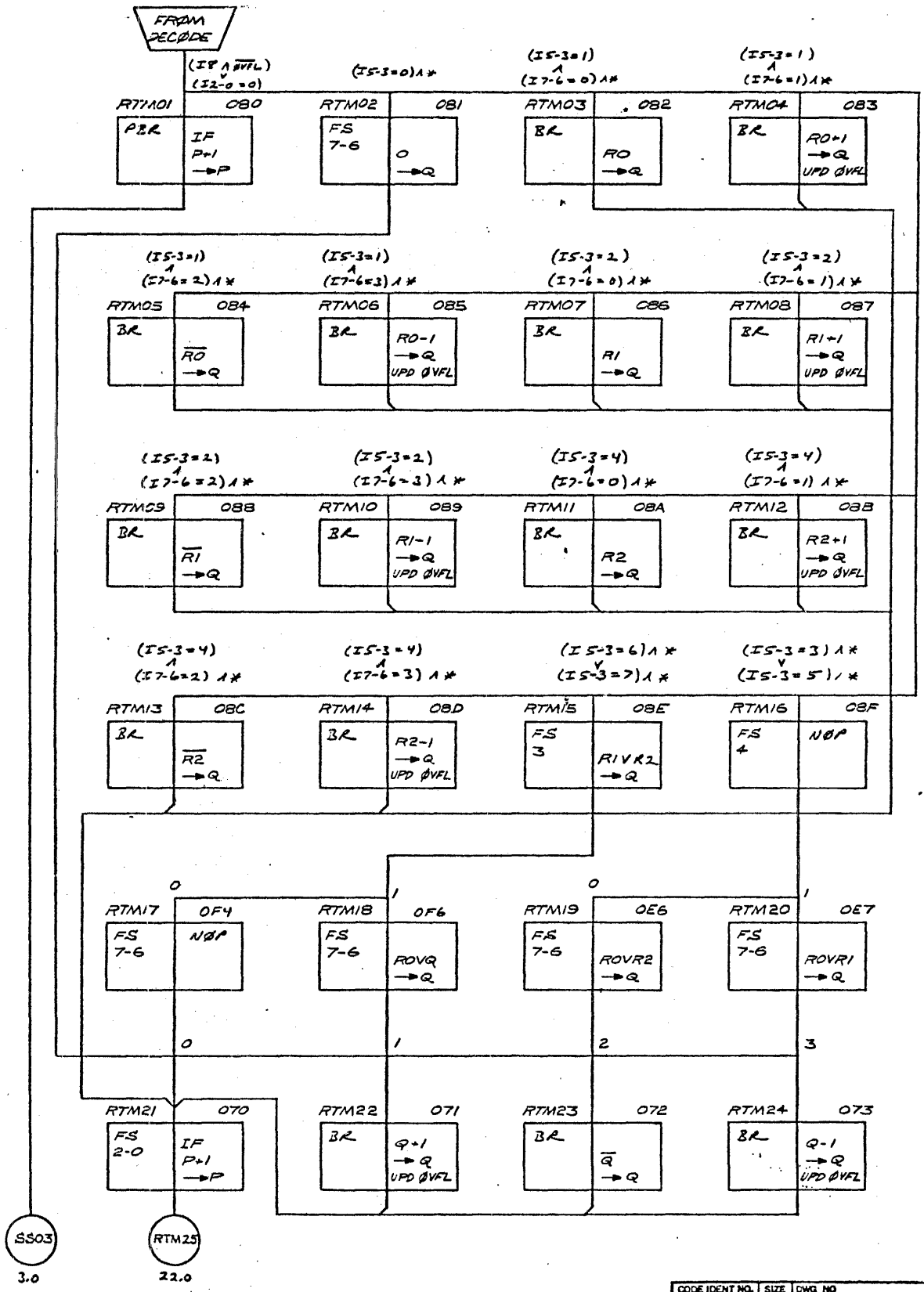
D C B A

SHIFTS AND ROTATES



CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 20.0 OF	

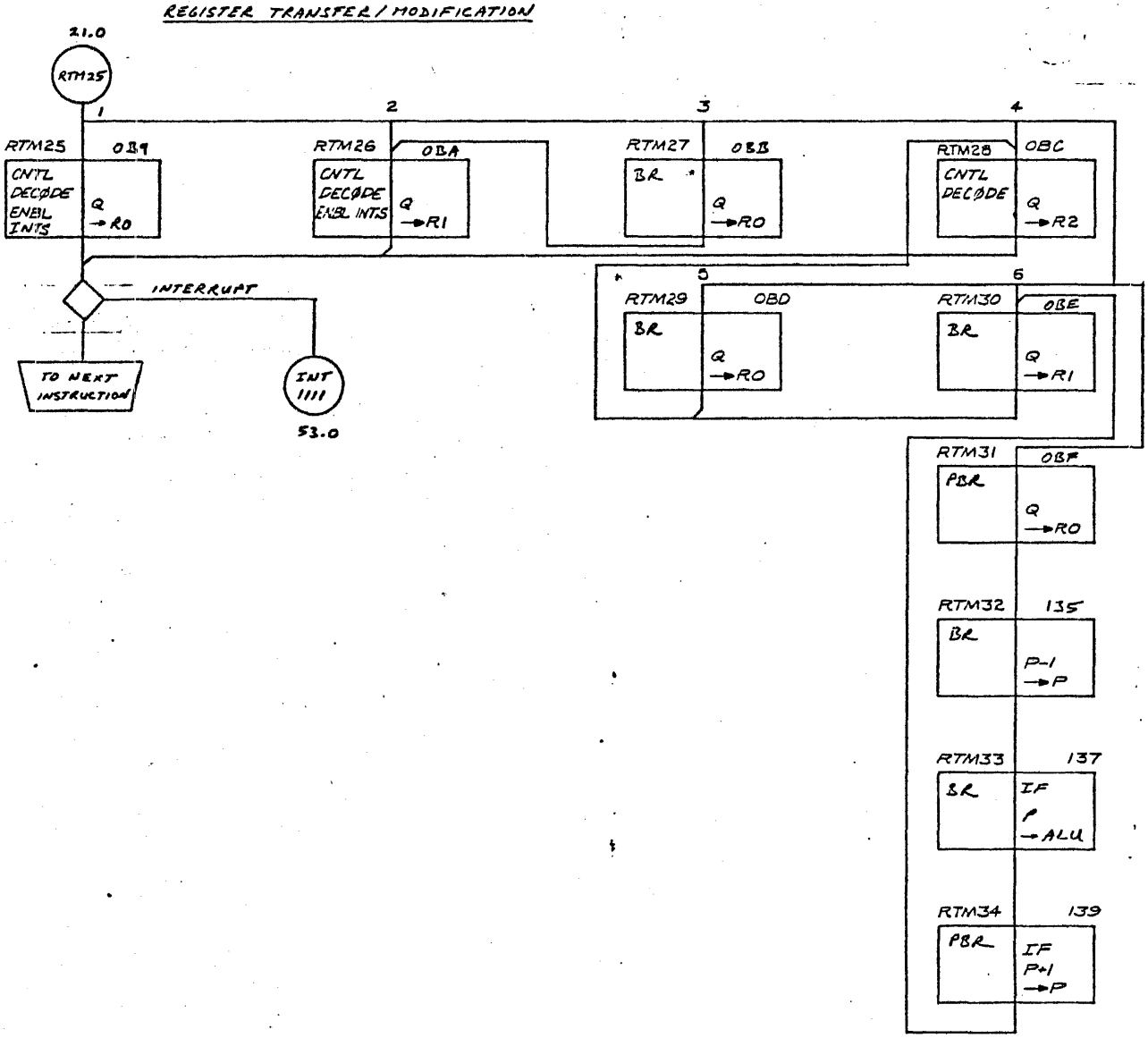
REGISTER TRANSFER / MODIFICATION



* ≙ $\overline{(I8 \wedge \overline{ØVFL})} \wedge \overline{(I2\text{-}0 = 0)}$

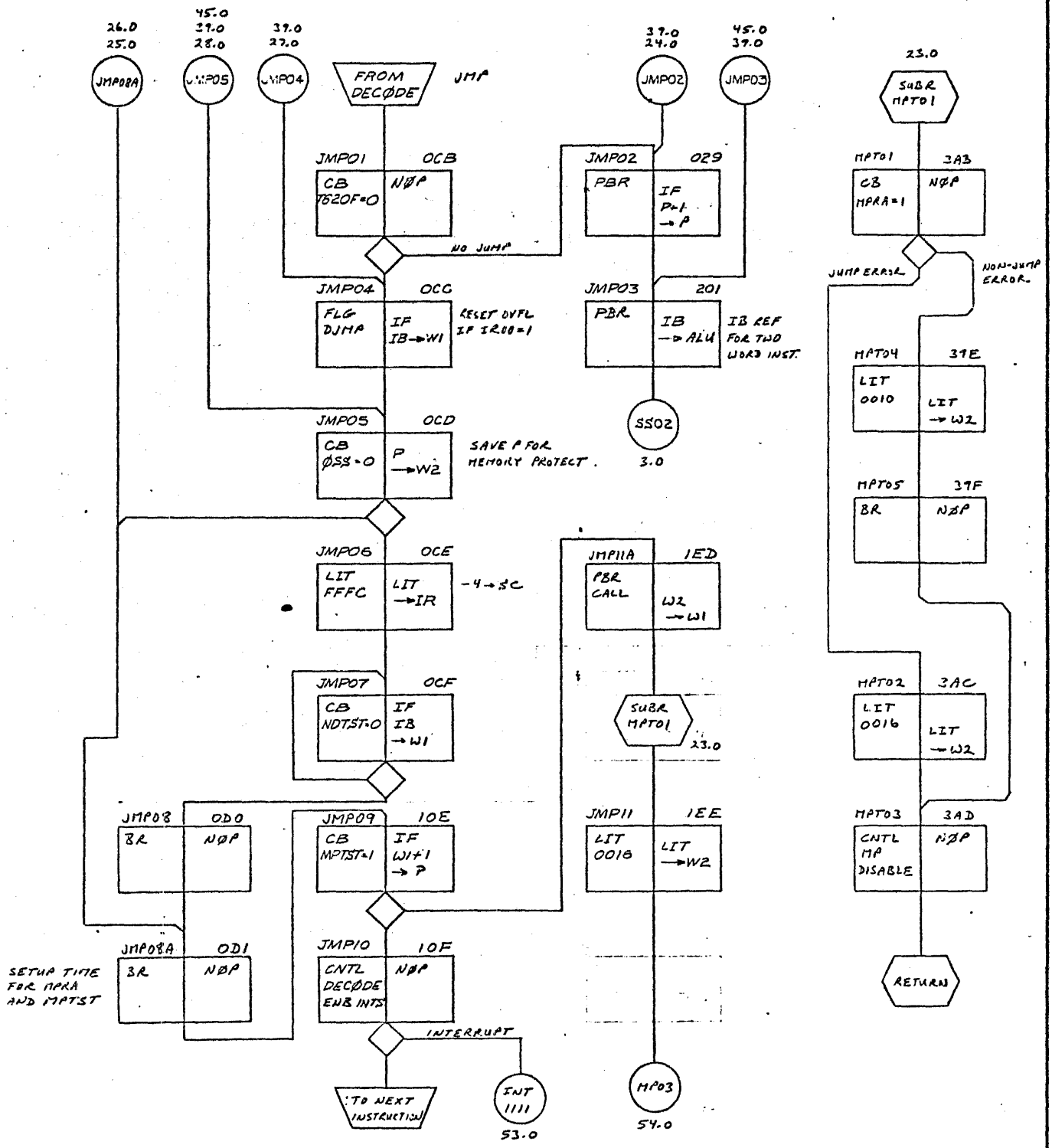
CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 21.0 OF	

REGISTER TRANSFER / MODIFICATION



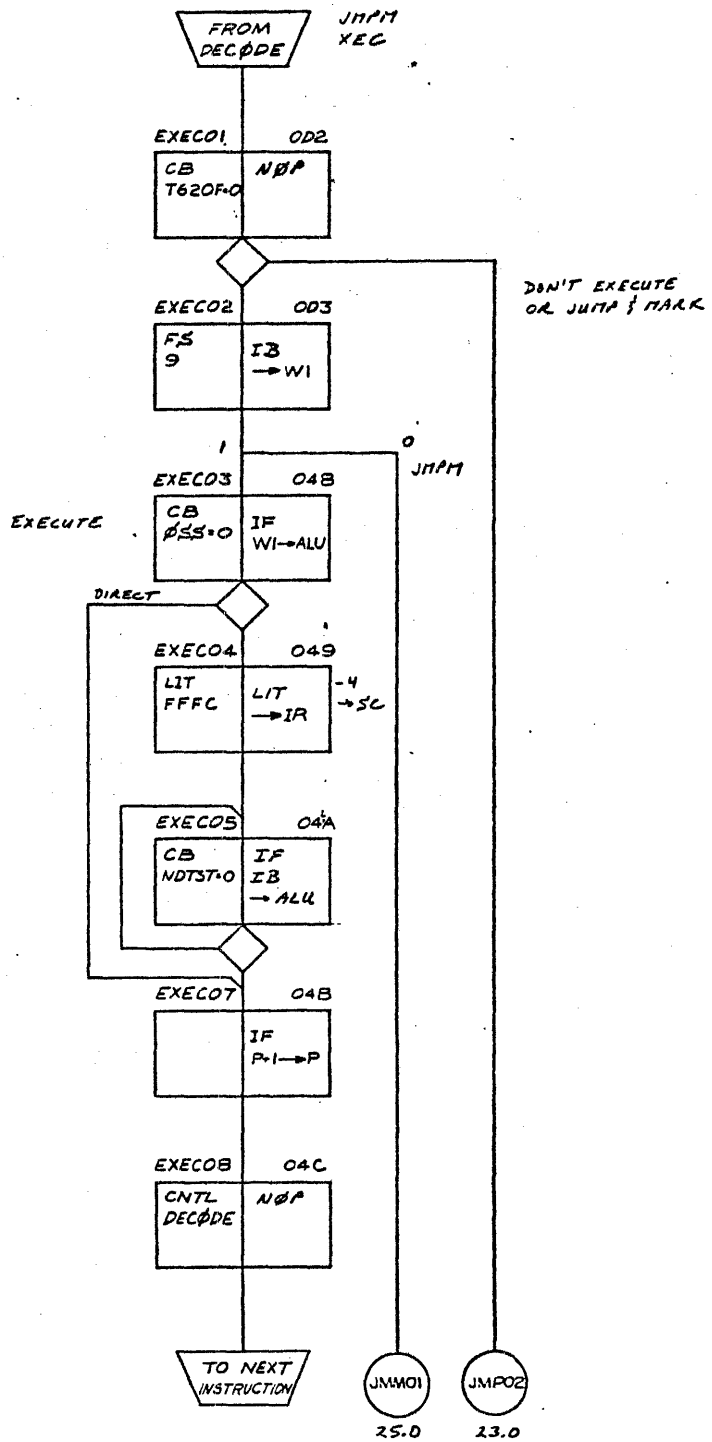
CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 22.0 OF	

CONDITIONAL JUMPS



CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 23.0 OF	

JUMP AND MARKS / EXECUTES

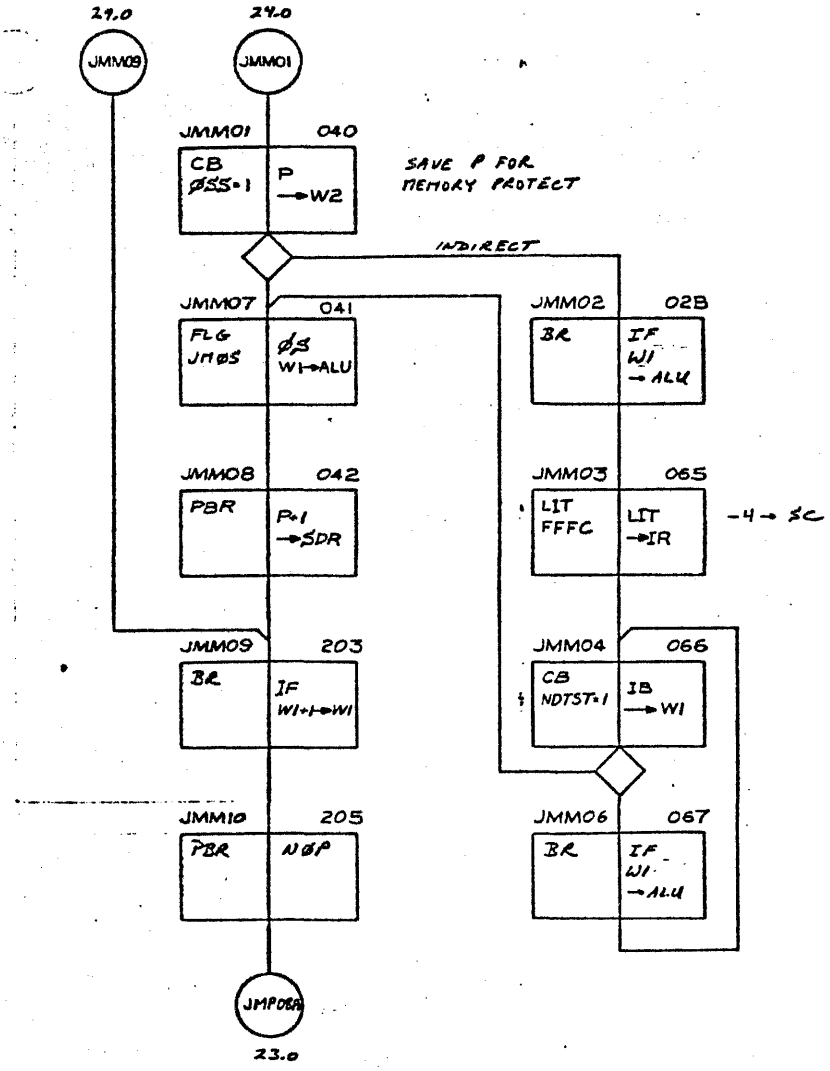


CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 24.0 OF	

P.S

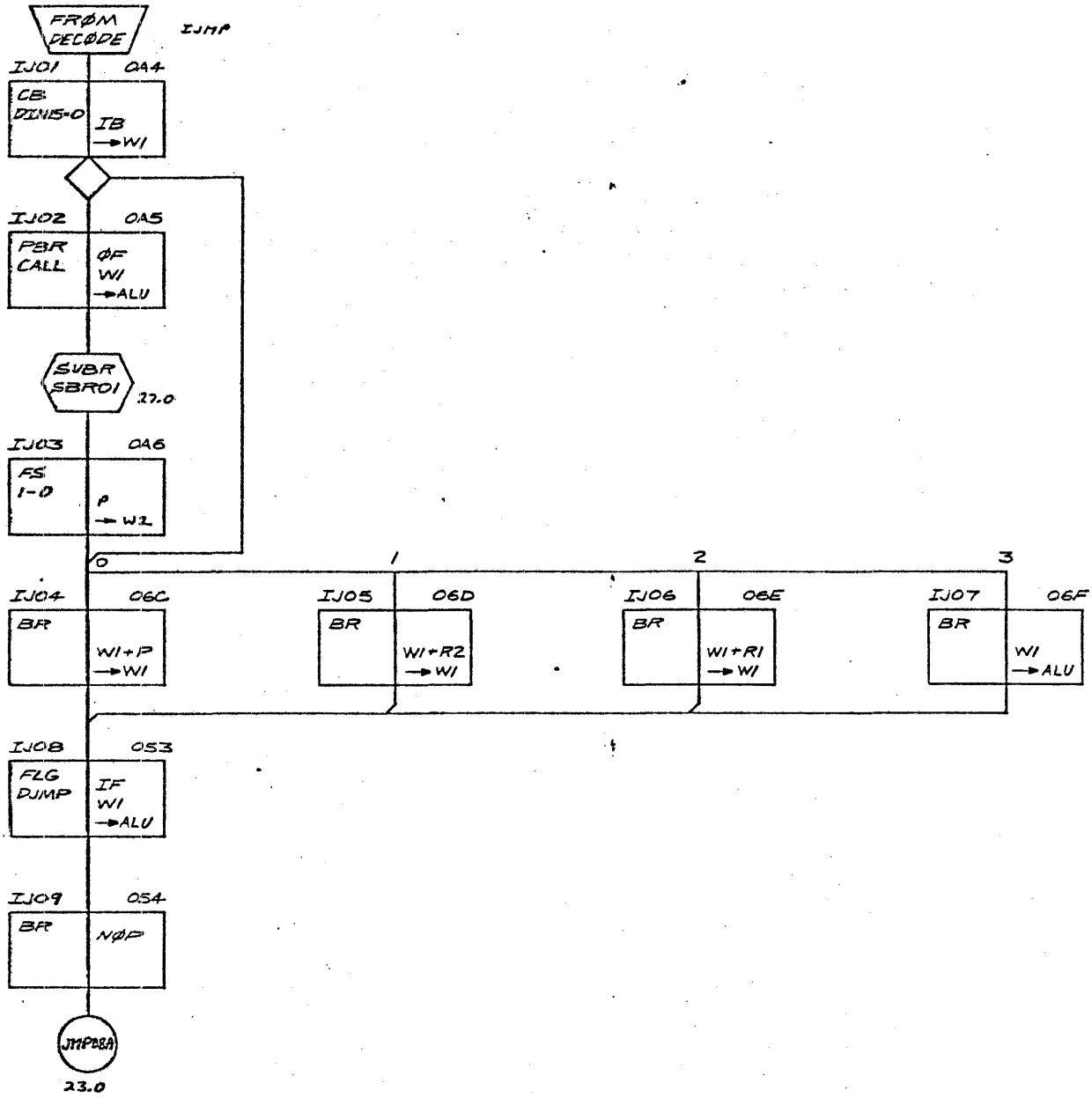
4 3 2 1

JUMP AND MARKS / EXECUTES



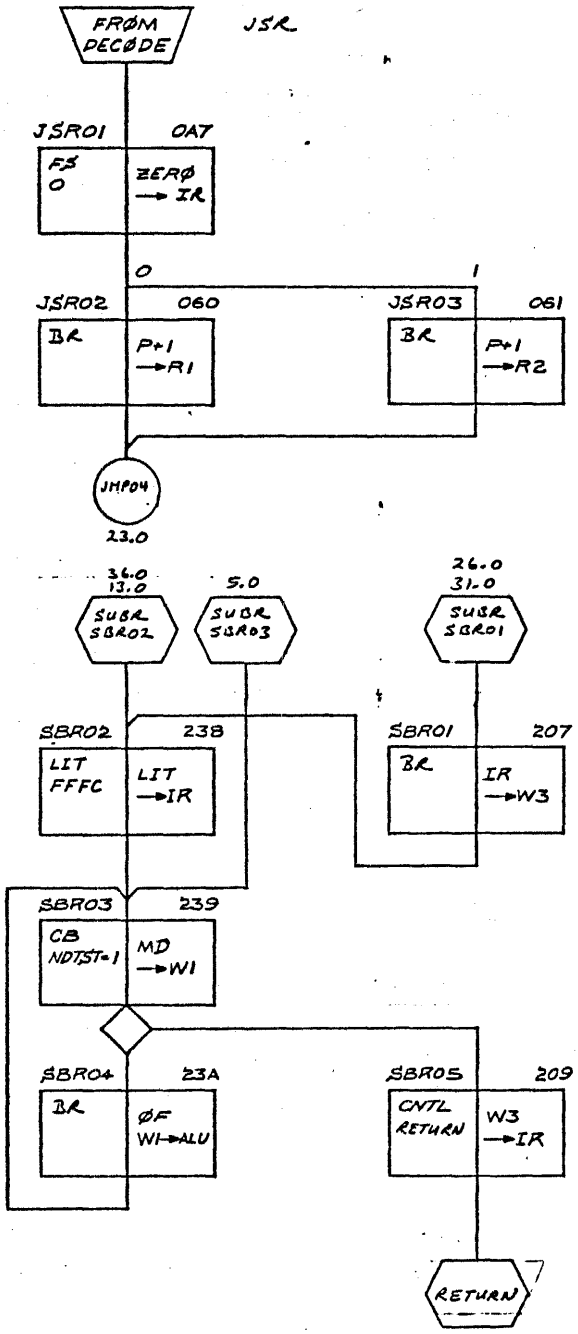
CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 25.0 OF	

INDEXED JUMP (IJMP)



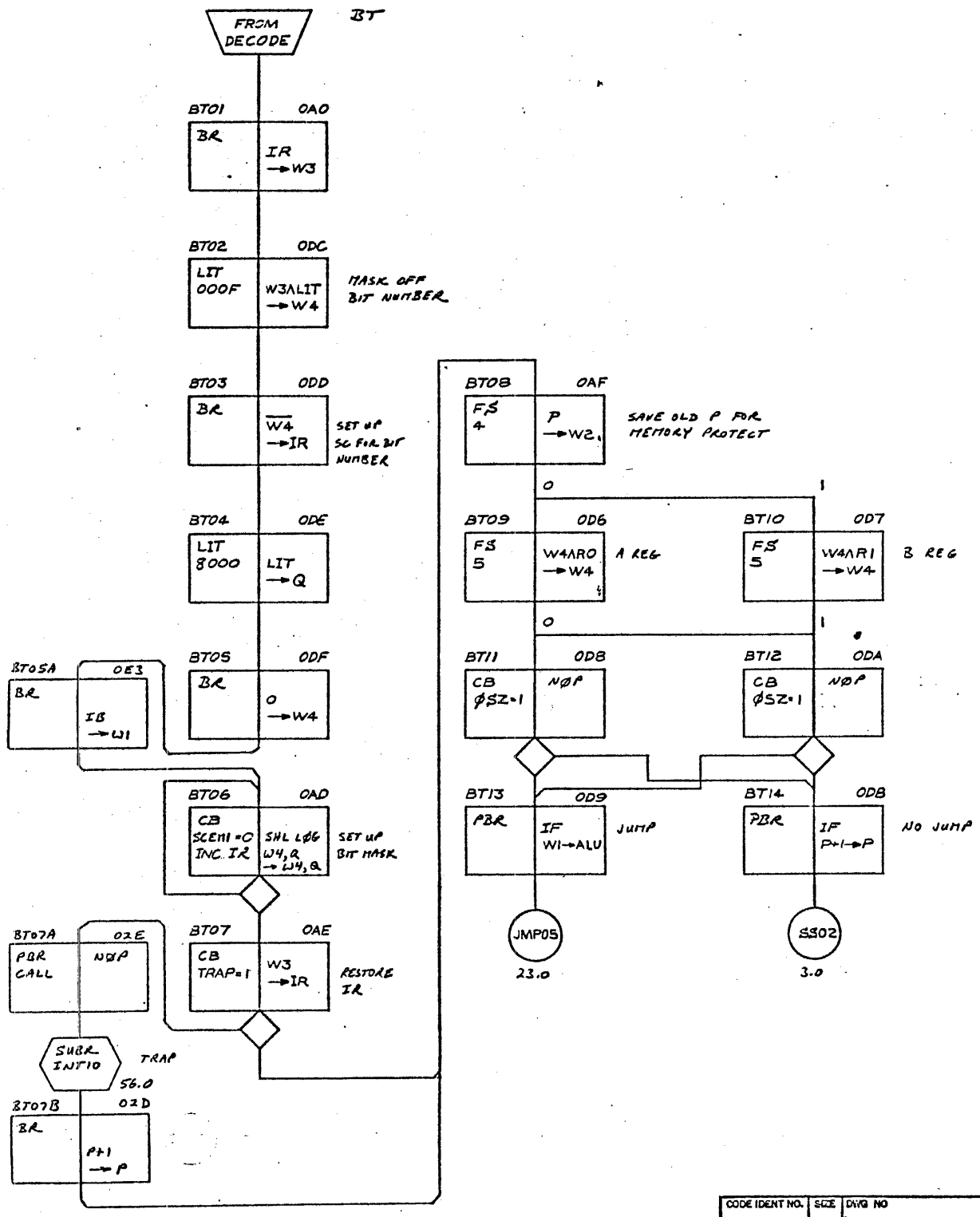
CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 26.0 OF	

JUMP AND SET RETURN (JSR)

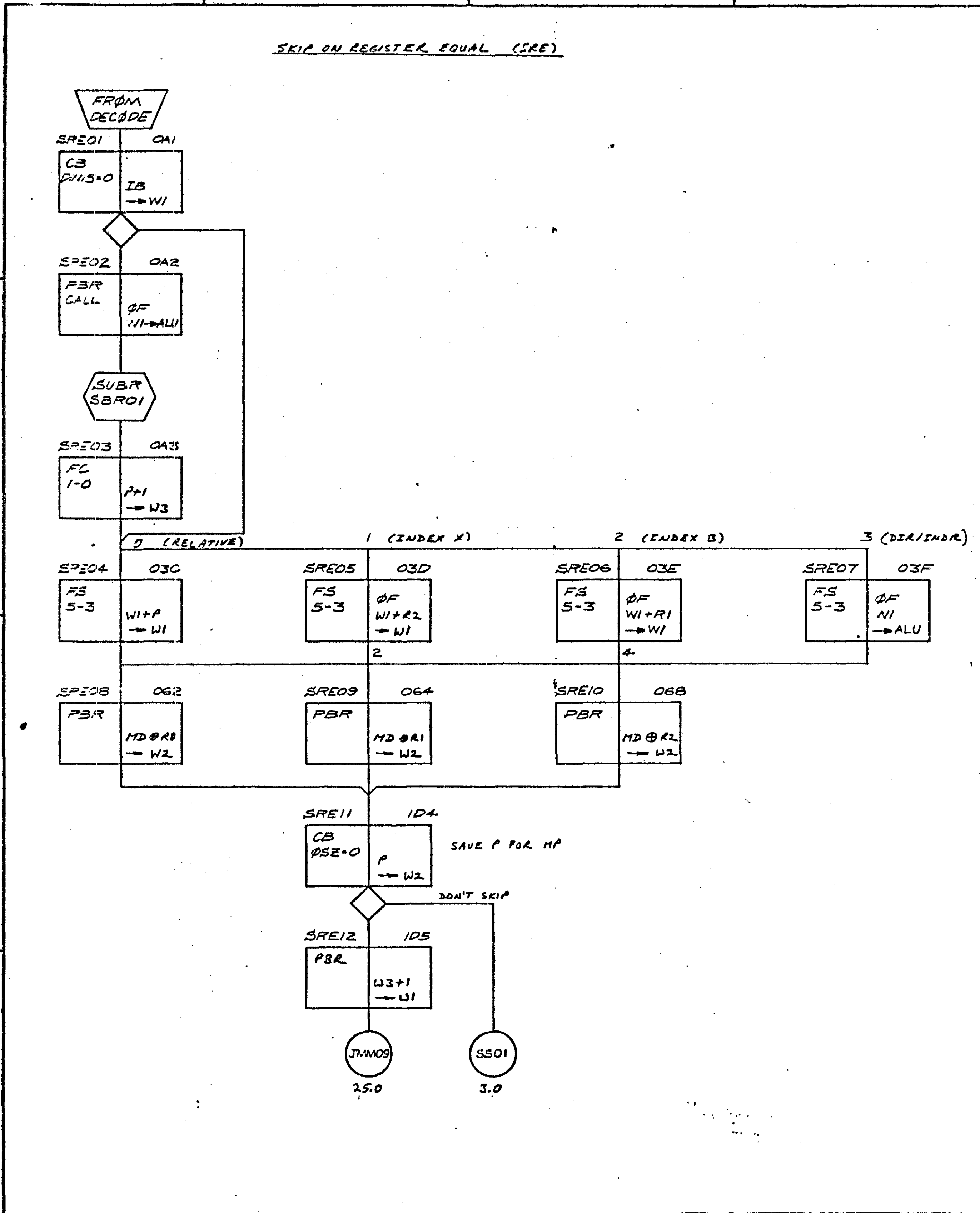


CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 22.0 OF	

BIT TEST (BT)

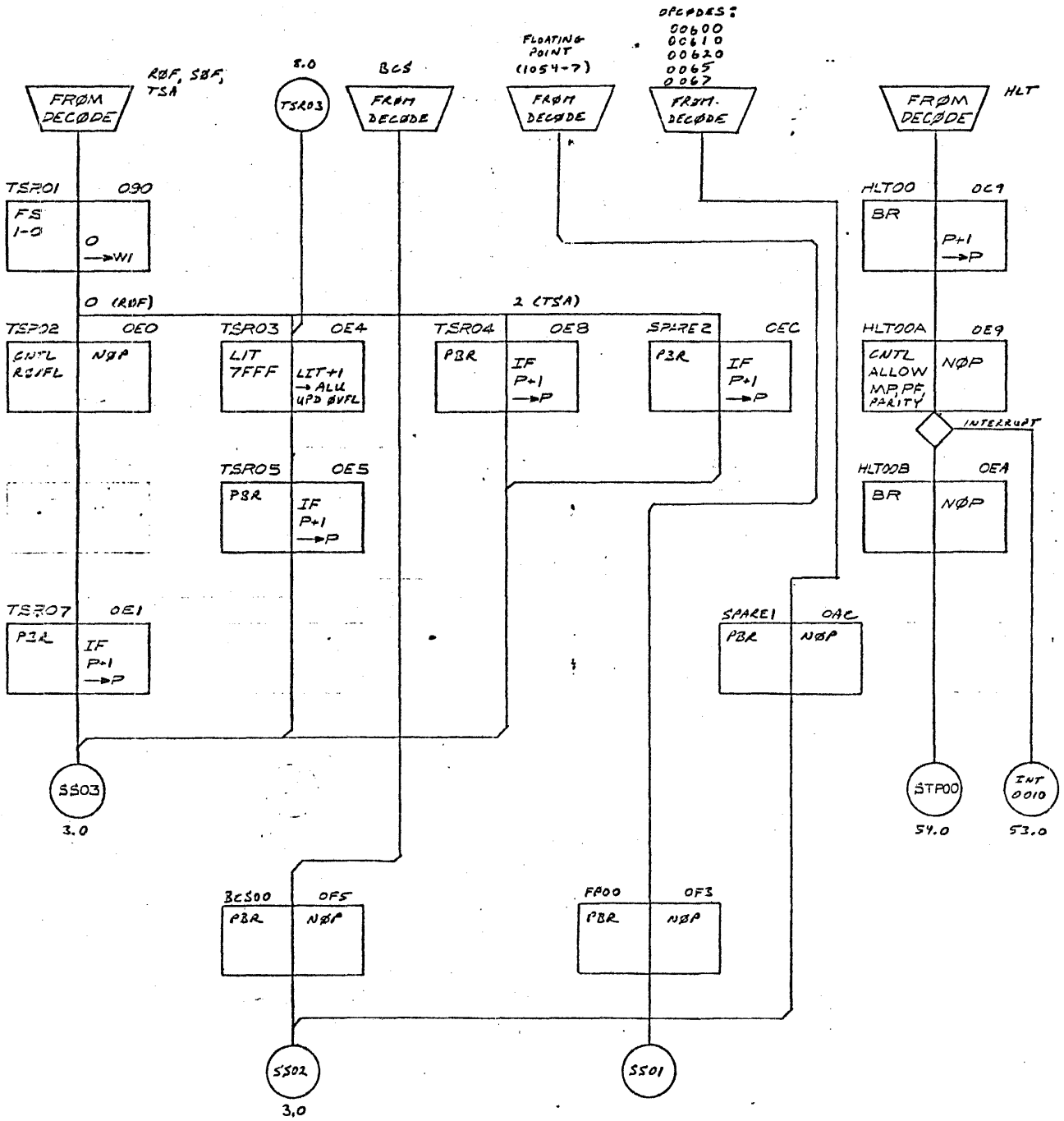


CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 28.0 OF	



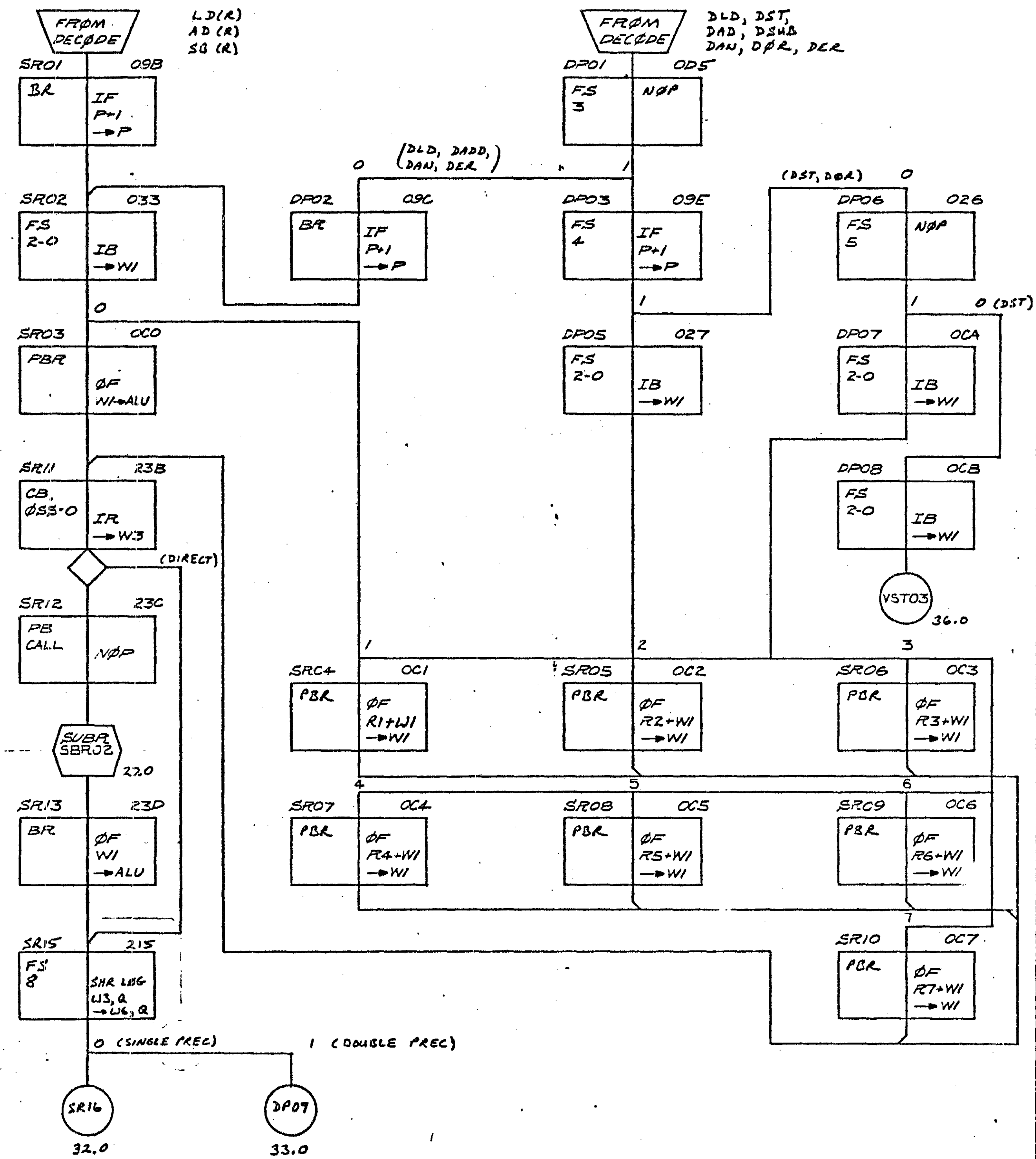
CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 29.0 OF	

CONTROL



CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE			SHEET 30.0 OF

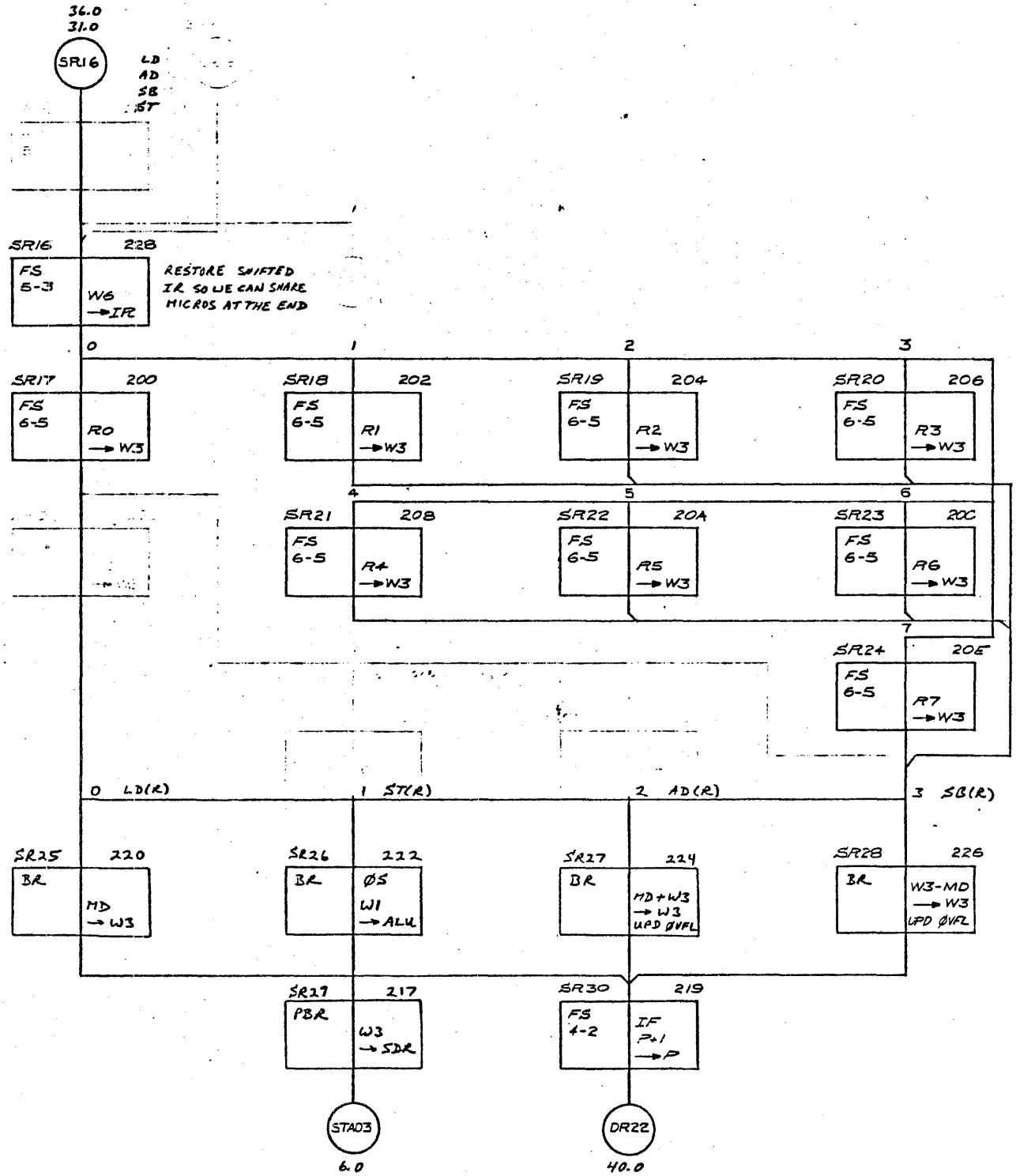
REGISTER TO MEMORY / DOUBLE PRECISION



CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 31.0 OF	

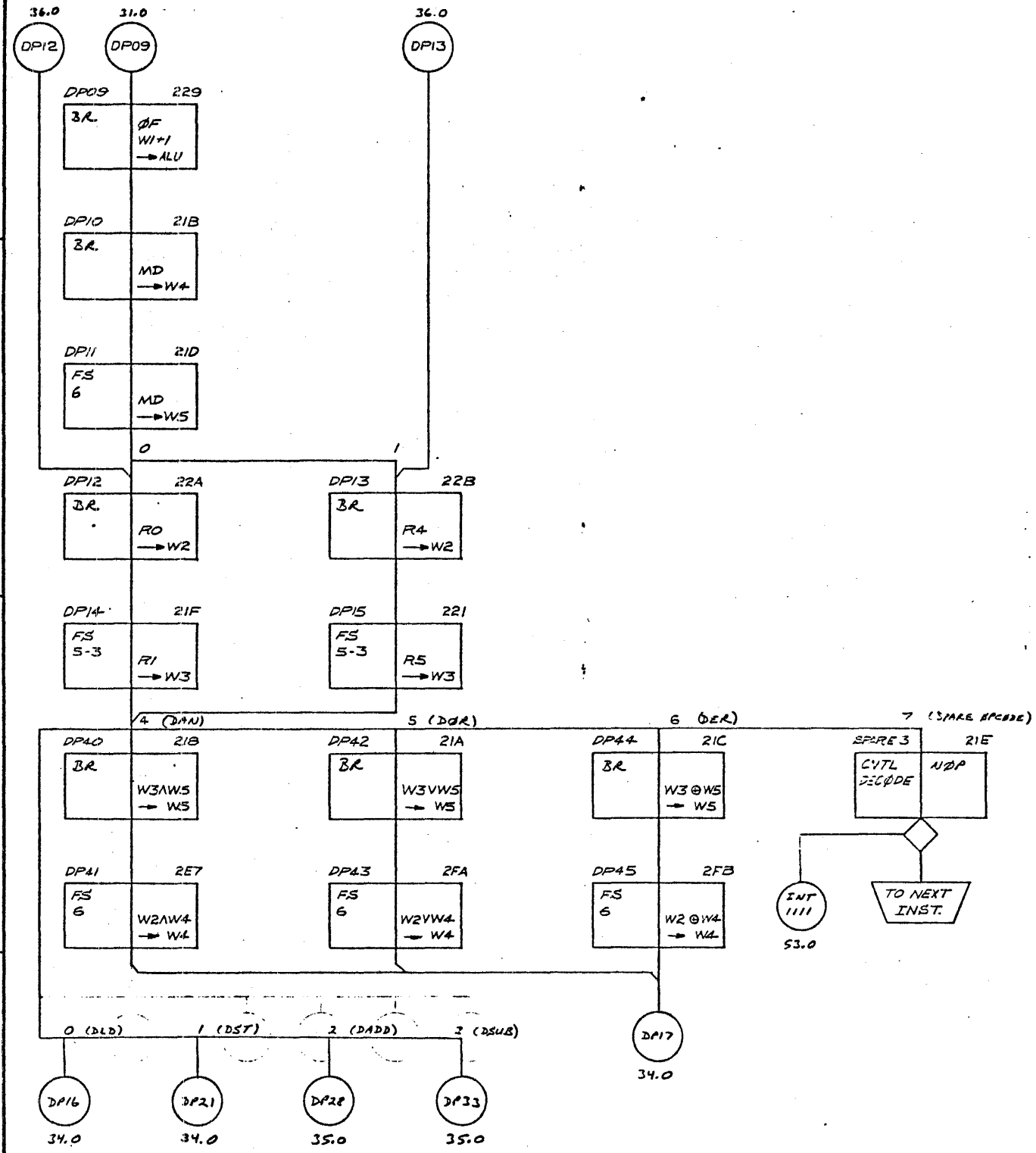
4 3 2 1

REGISTER TO MEMORY / DOUBLE PRECISION



CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE			SHEET 32.0 OF

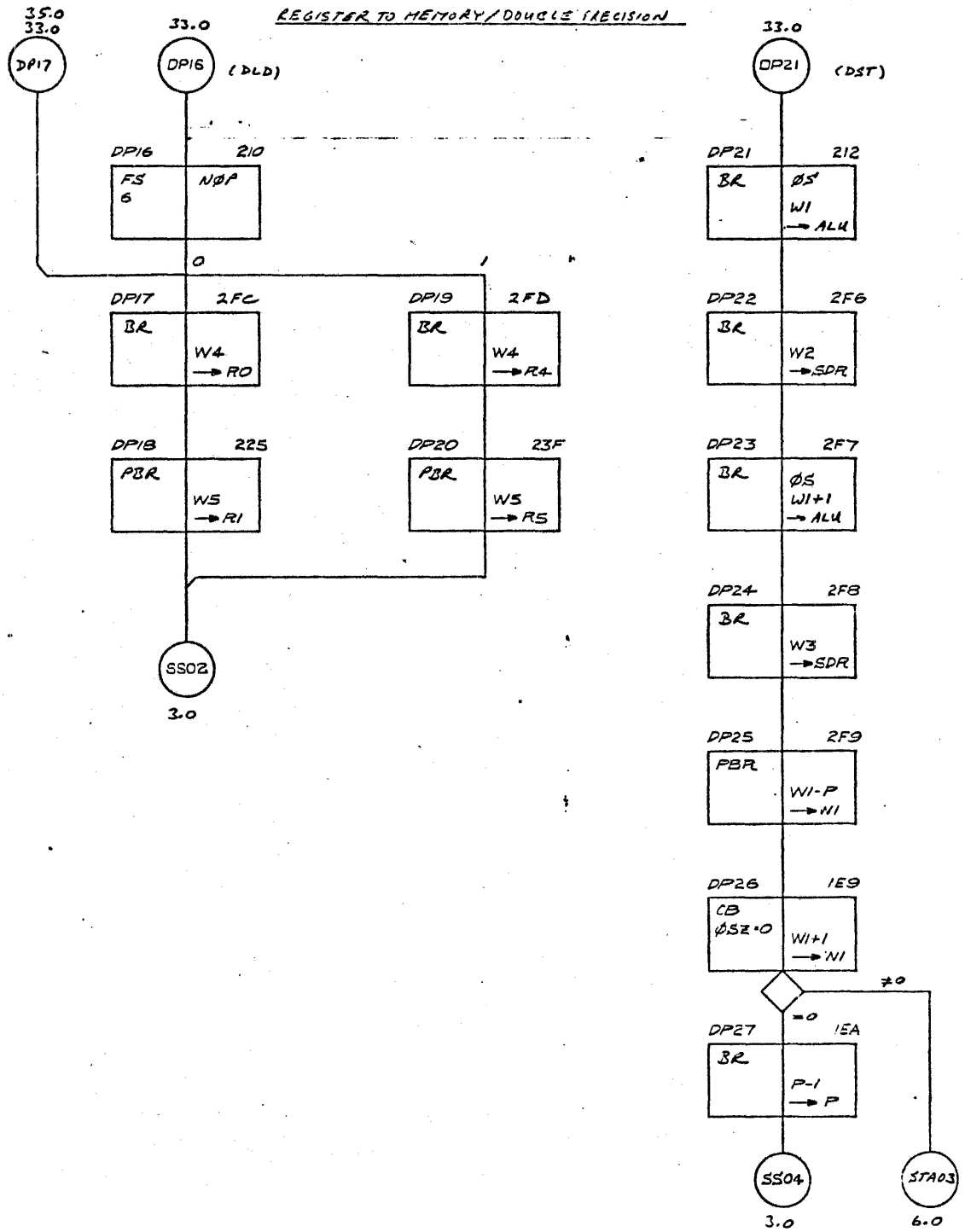
REGISTER TO MEMORY / DOUBLE PRECISION



CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE			SHEET 33.0 OF

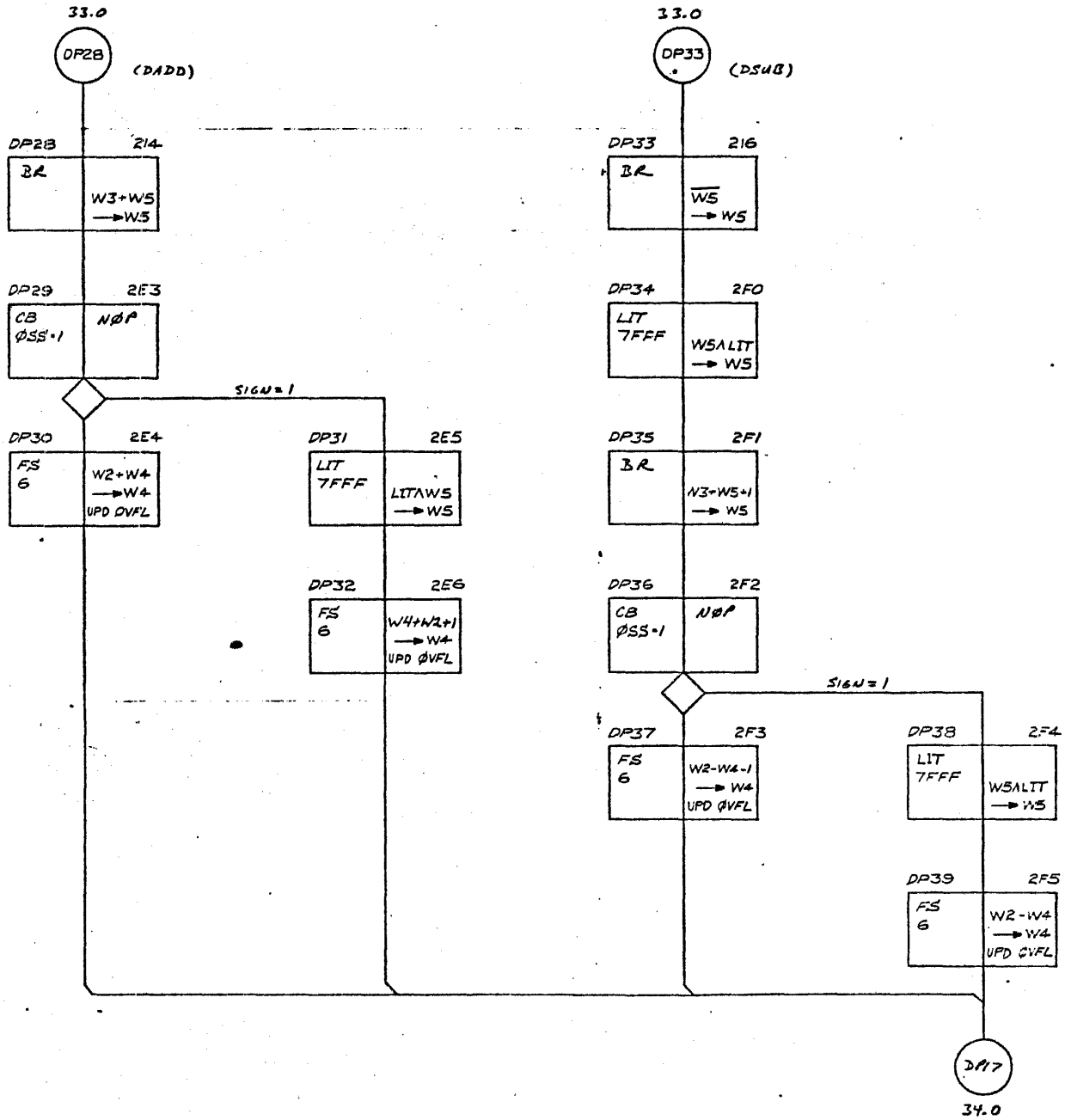
4 3 2 1

REGISTER TO MEMORY / DOUBLE PRECISION



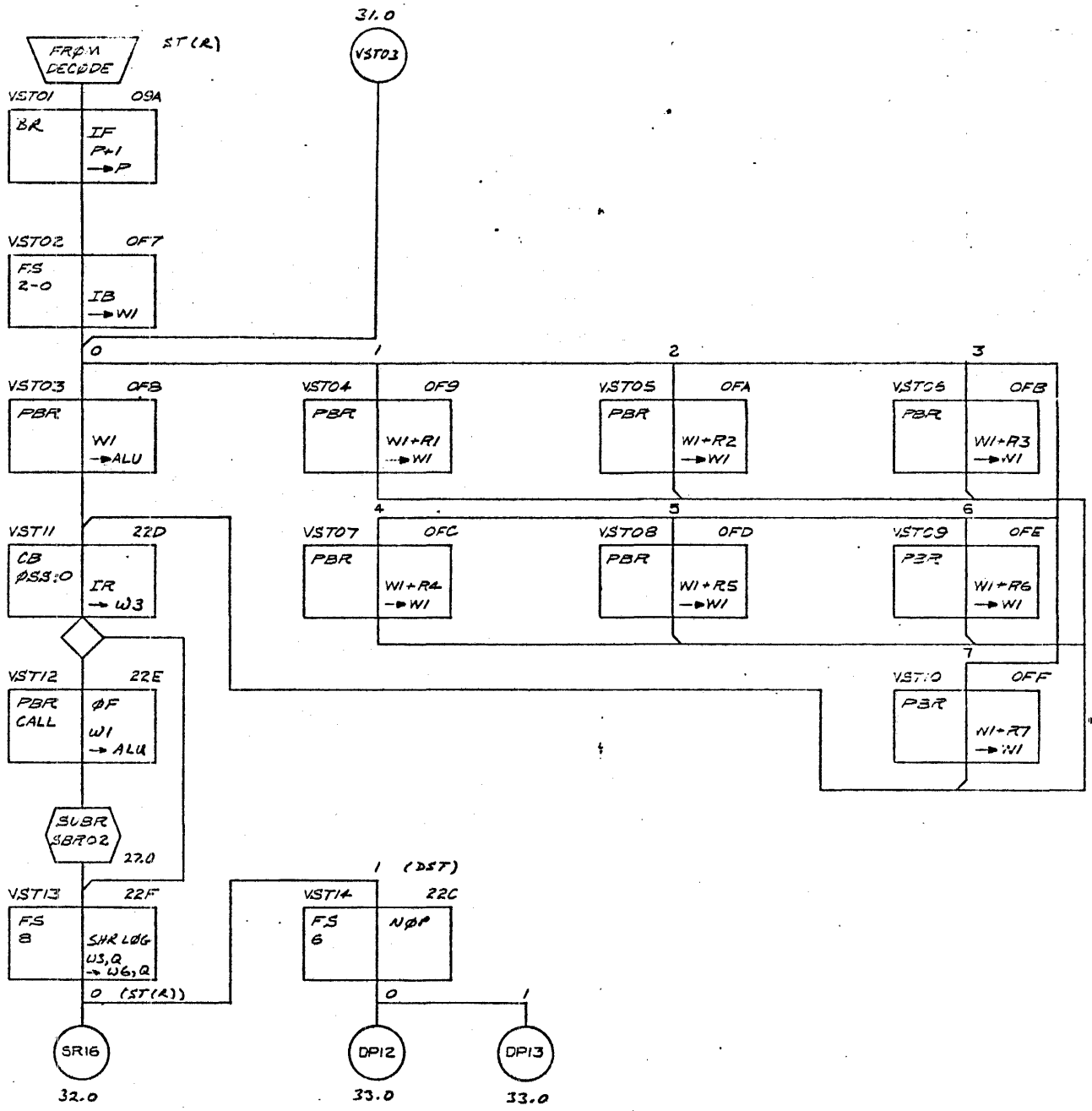
CODE IDENT NO.	SIZE	D... NO.	REV
21101	C	95F1326	A
SCALE		SHEET 34.0 OF	

REGISTER TO MEMORY / DOUBLE PRECISION



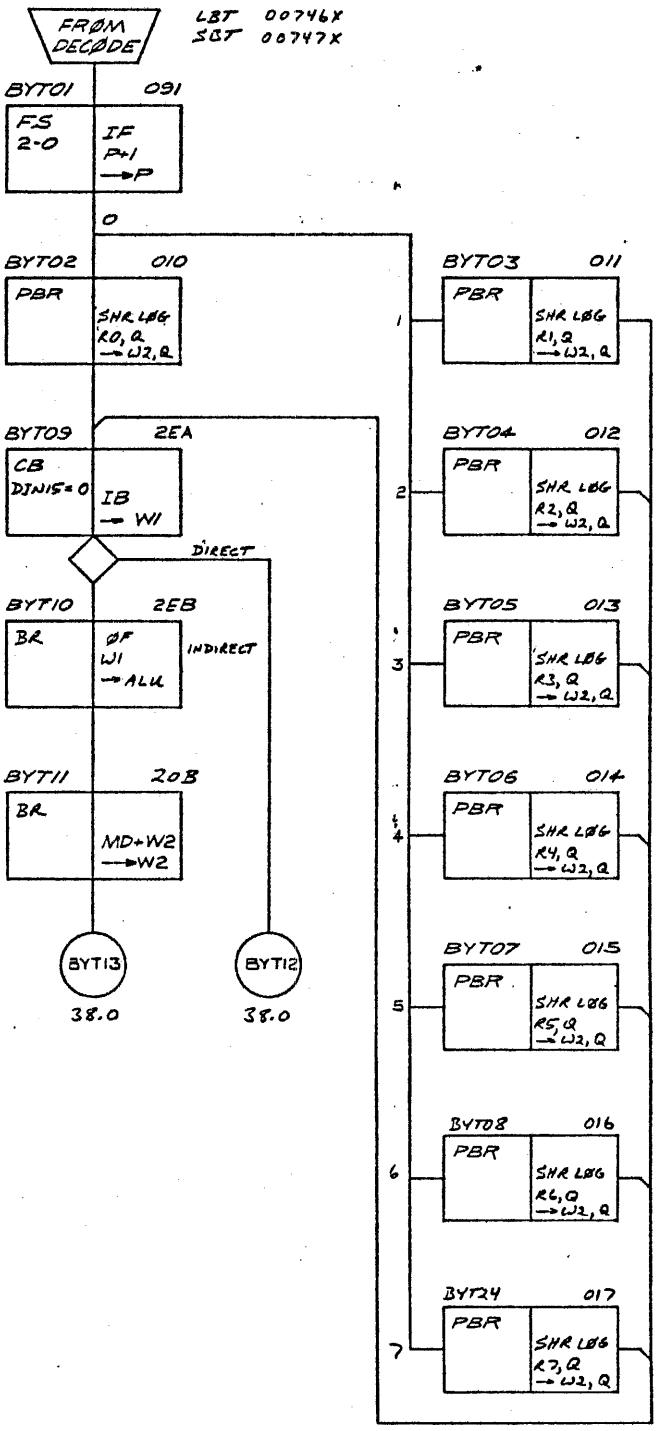
CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 5.0 OF	

REGISTER TO MEMORY / DOUBLE PRECISION



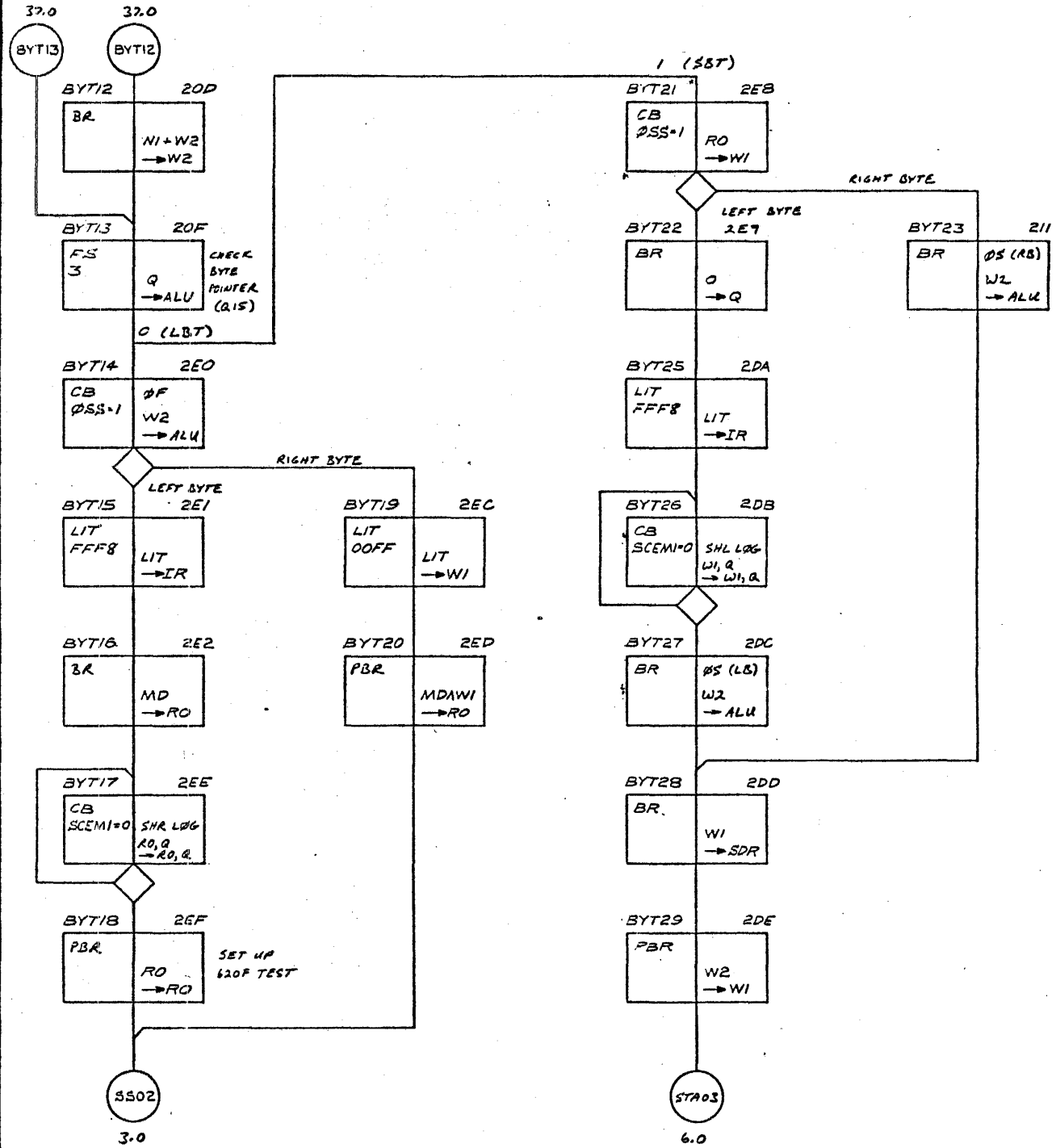
CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 36.0 OF	

BYTE ADDRESSING

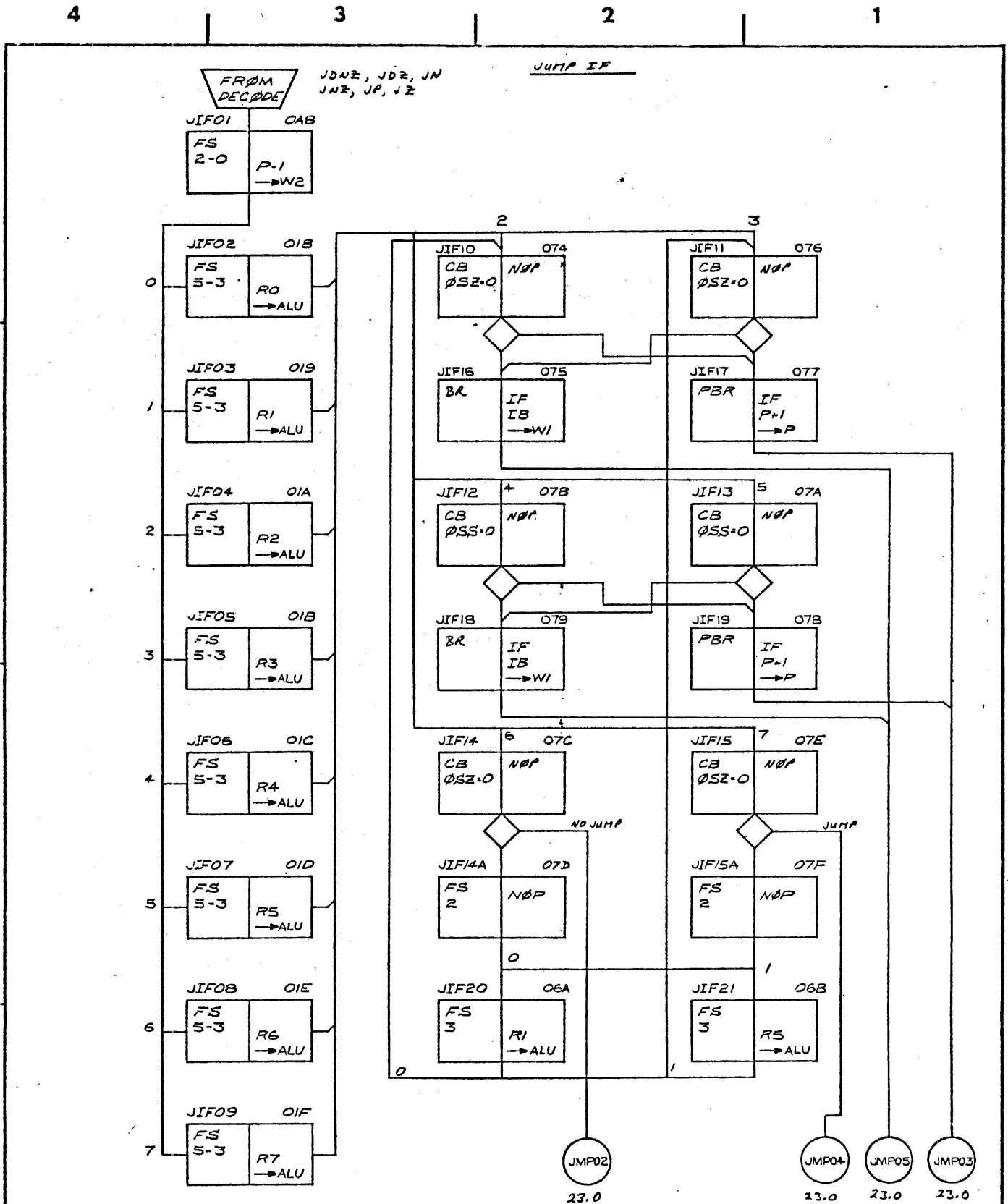


CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 32.0 OF	

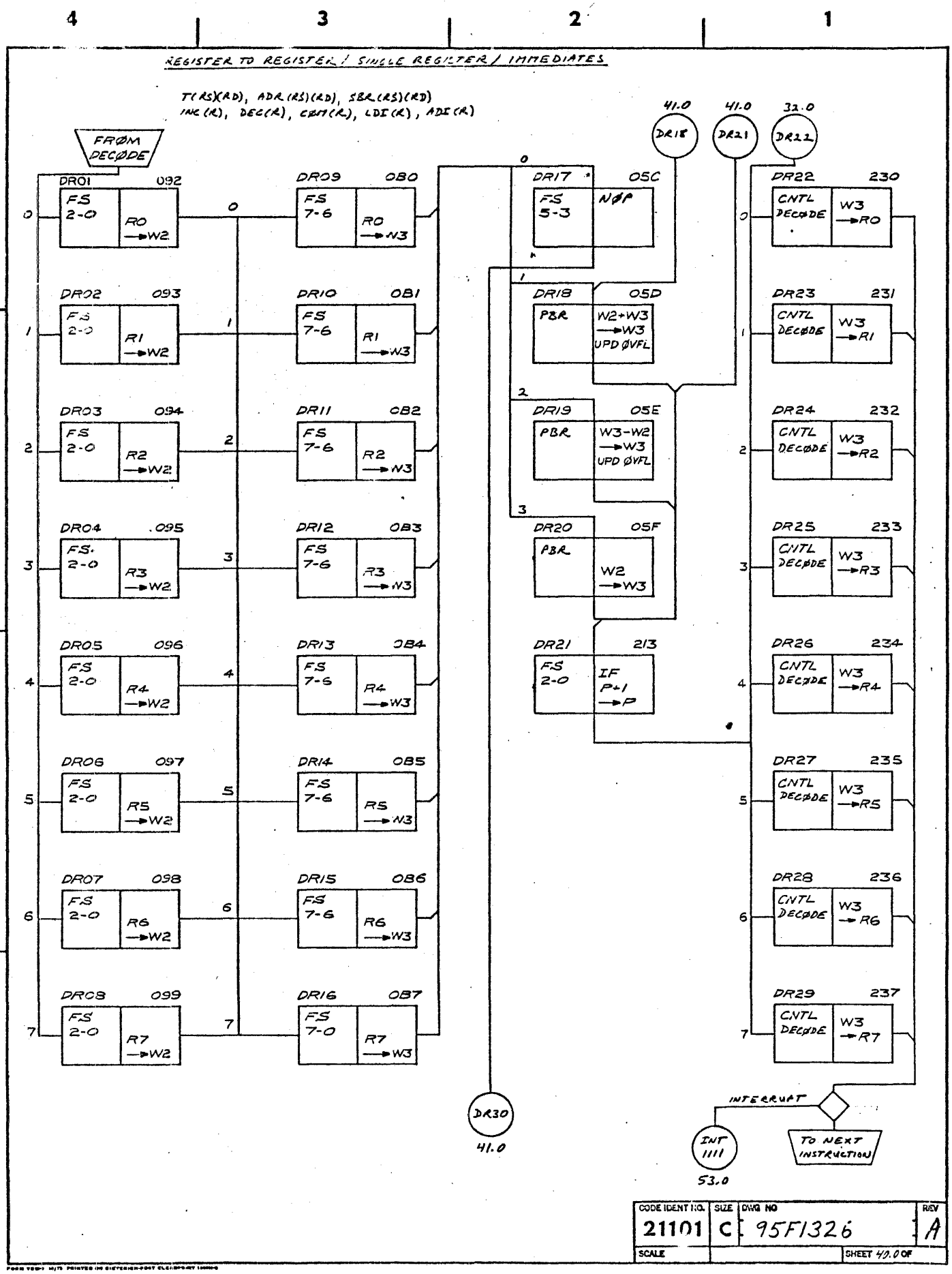
BYTE ADDRESSING



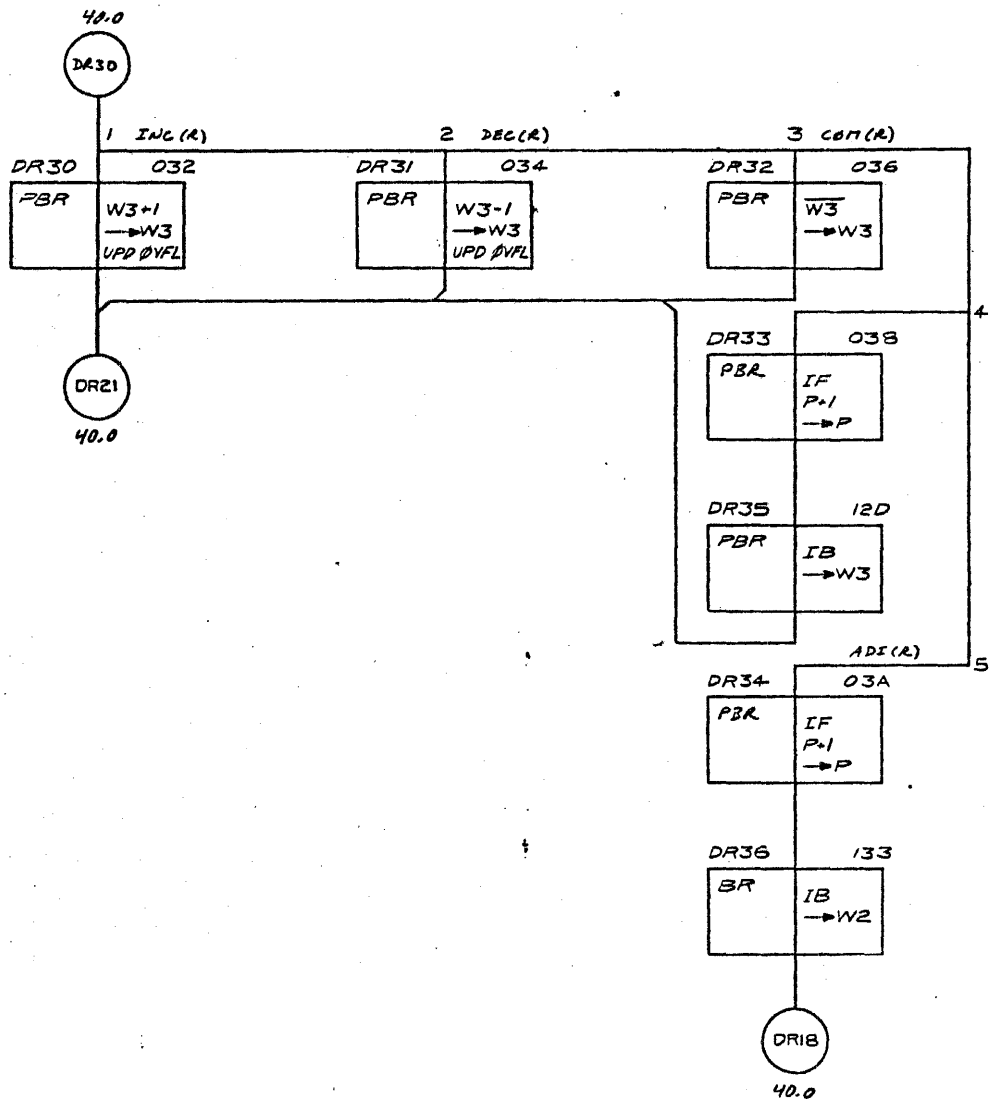
CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 38.0 OF	



CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 37.0 OF	


4
3
2
1
REGISTER TO REGISTER / SINGLE REGISTER / IMMEDIATES
T(RS)(RD), ADR(RS)(RD), SBR(RS)(RD)
INC(R), DEC(R), CBM(R), LDI(R), ADI(R)
FROM DECODE
DR01 092
FS 2-0
R0 →W2
DR02 093
FS 2-0
R1 →W2
DR03 094
FS 2-0
R2 →W2
DR04 095
FS 2-0
R3 →W2
DR05 096
FS 2-0
R4 →W2
DR06 097
FS 2-0
R5 →W2
DR07 098
FS 2-0
R6 →W2
DR08 099
FS 2-0
R7 →W2
DR09 0B0
FS 7-6
R0 →W3
DR10 0B1
FS 7-6
R1 →W3
DR11 0B2
FS 7-6
R2 →W3
DR12 0B3
FS 7-6
R3 →W3
DR13 0B4
FS 7-6
R4 →W3
DR14 0B5
FS 7-6
R5 →W3
DR15 0B6
FS 7-6
R6 →W3
DR16 0B7
FS 7-0
R7 →W3
DR17 05C
FS 5-3
NOP
DR18 05D
PBR
W2+W3 →W3 UPD OVFL
DR19 05E
PBR
W3-W2 →W3 UPD OVFL
DR20 05F
PBR
W2 →W3
DR21 213
FS 2-0
IF P+1 →P
DR30
41.0
41.0
41.0
32.0
DR18
DR21
DR22
DR22 230
CNTL DECODE
W3 →R0
DR23 231
CNTL DECODE
W3 →R1
DR24 232
CNTL DECODE
W3 →R2
DR25 233
CNTL DECODE
W3 →R3
DR26 234
CNTL DECODE
W3 →R4
DR27 235
CNTL DECODE
W3 →R5
DR28 236
CNTL DECODE
W3 →R6
DR29 237
CNTL DECODE
W3 →R7
INTERRUPT
INT 1111
53.0
TO NEXT INSTRUCTION
CODE IDENT NO. 21101
SIZE C
DWG NO 95F1326
REV A
SCALE
SHEET 49.0 OF

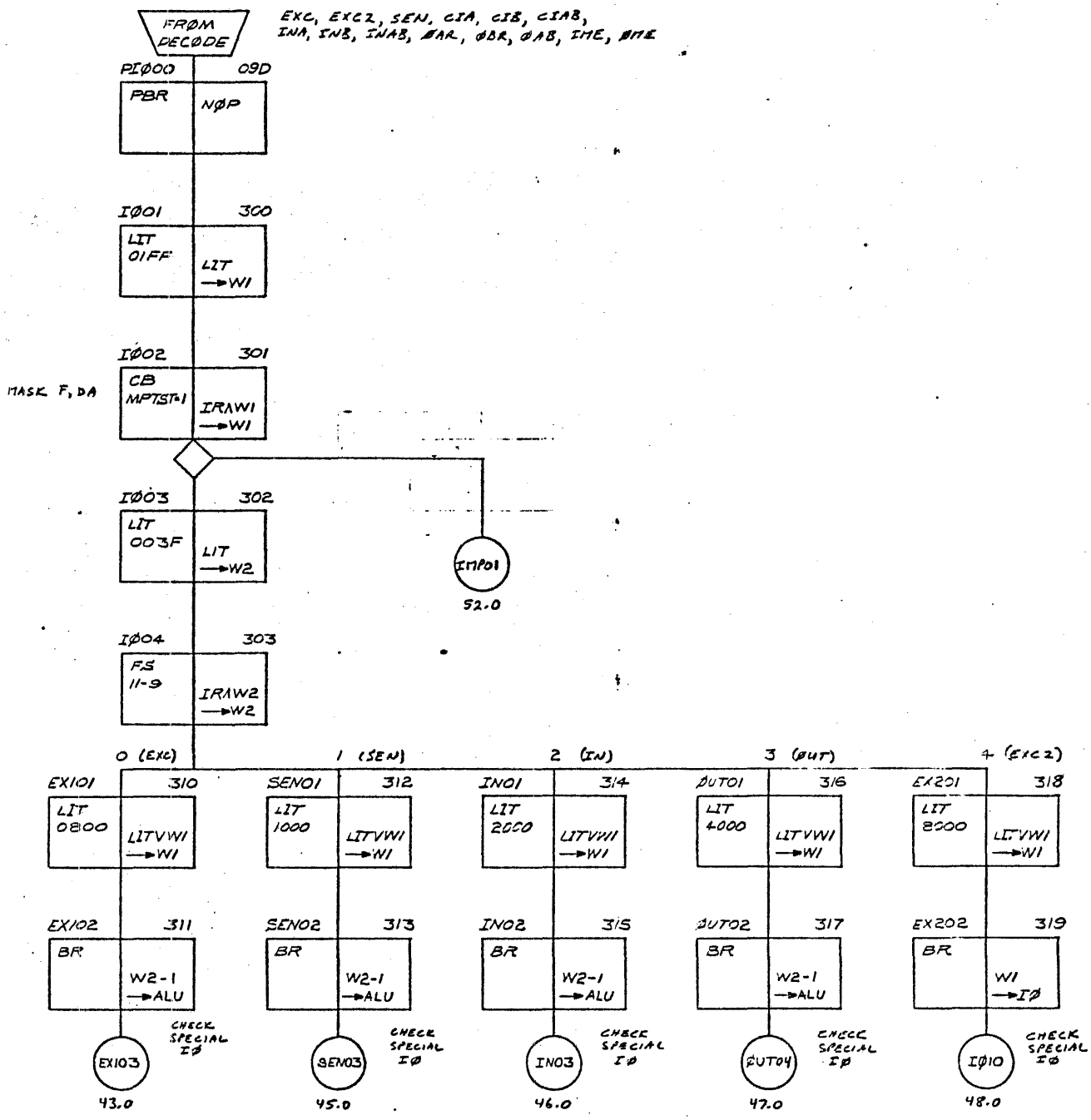
REGISTER TO REGISTER / SINGLE REGISTER / IMMEDIATES



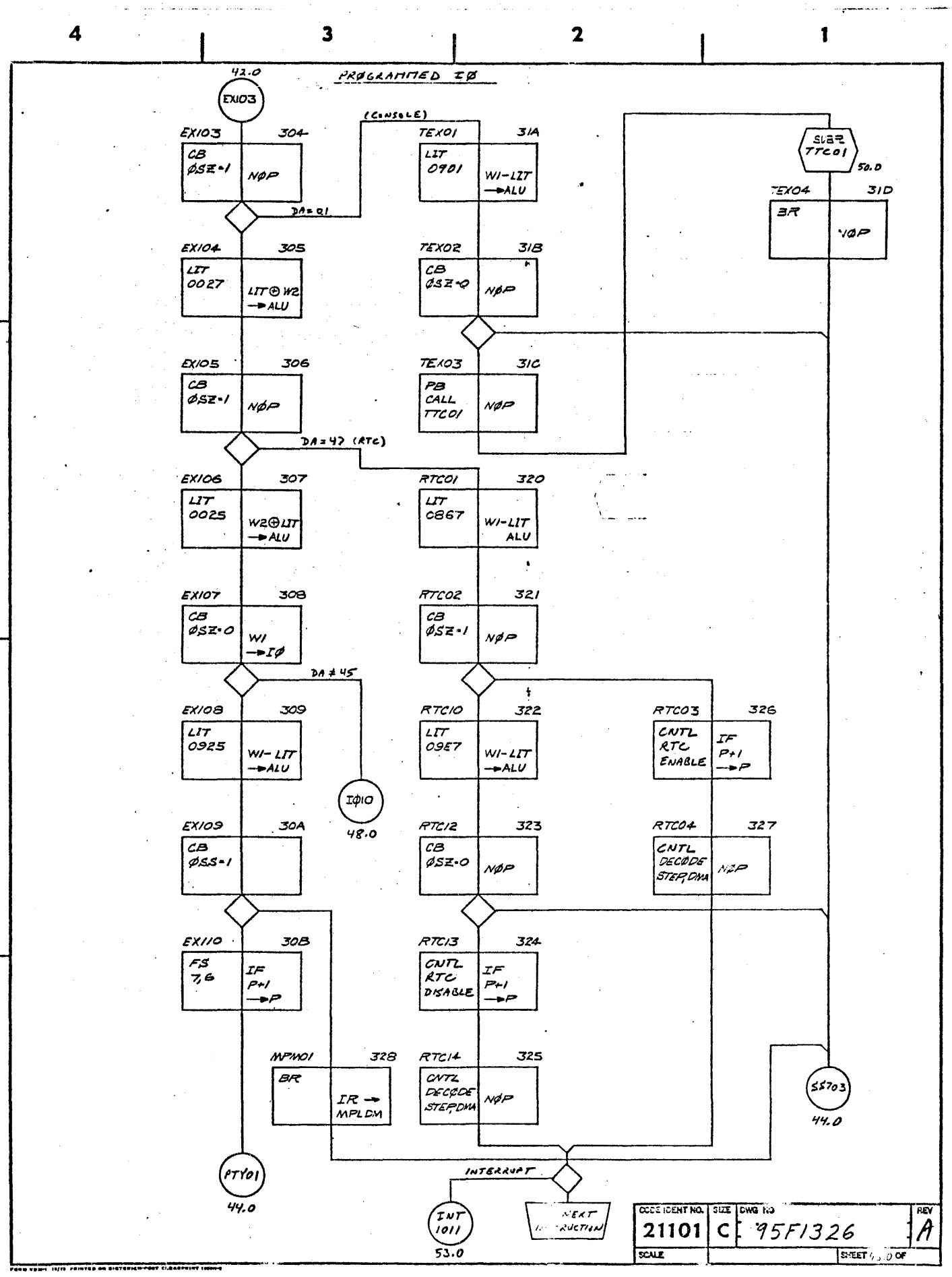
CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 41.0 OF	

4 3 2 1

PROGRAMMED IØ

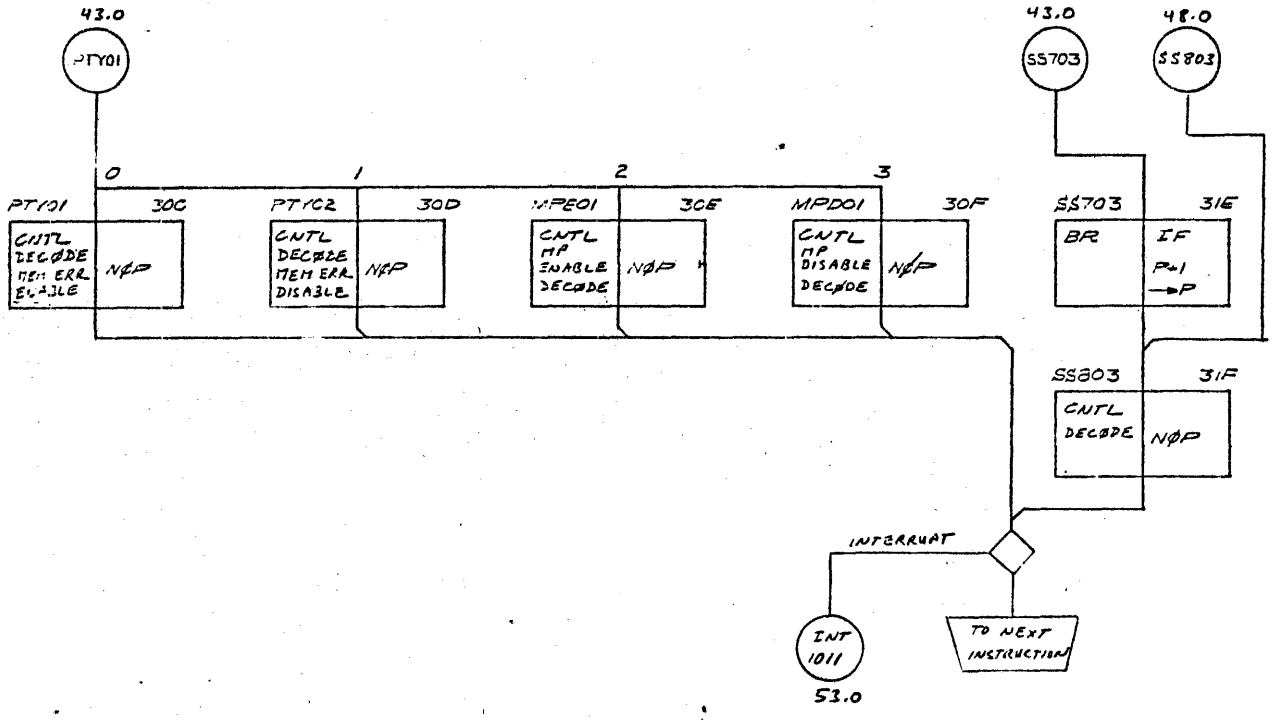


CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 42.0 OF	


PROGRAMMED IØ
42.0
EX103
EX103 304
CB ØSZ=1
NØP
DA=01
(CONSOLE)
TEX01 31A
LIT 0901
WI-LIT →ALU
SUBR TTC01
50.0
TEX04 31D
BR
NØP
EX104 305
LIT 0027
LIT ⊕ W2 →ALU
TEX02 31B
CB ØSZ=0
NØP
EX105 306
CB ØSZ=1
NØP
TEX03 31C
PB CALL TTC01
NØP
DA=47 (RTC)
EX106 307
LIT 0025
W2⊕LIT →ALU
RTC01 320
LIT 0867
WI-LIT ALU
EX107 308
CB ØSZ=0
WI →IØ
RTC02 321
CB ØSZ=1
NØP
DA≠45
EX108 309
LIT 0925
WI-LIT →ALU
IØ10
48.0
RTC10 322
LIT 09E7
WI-LIT →ALU
RTC03 326
CNTL RTC ENABLE
IF P+1 →P
EX109 30A
CB ØSS=1
RTC12 323
CB ØSZ=0
NØP
RTC04 327
CNTL DECØDE STEP DMA
NØP
EX110 30B
FS 7,6
IF P+1 →P
RTC13 324
CNTL RTC DISABLE
IF P+1 →P
INPM01 328
BR
IR → MPLDM
RTC14 325
CNTL DECØDE STEP DMA
NØP
SS703
44.0
PTY01
44.0
INTERRUPT
INT 1011
53.0
NEXT INSTRUCTION
CODE IDENT NO. 21101
SIZE C
DWG NO 95F1326
REV A
SCALE
SHEET 4.0 OF

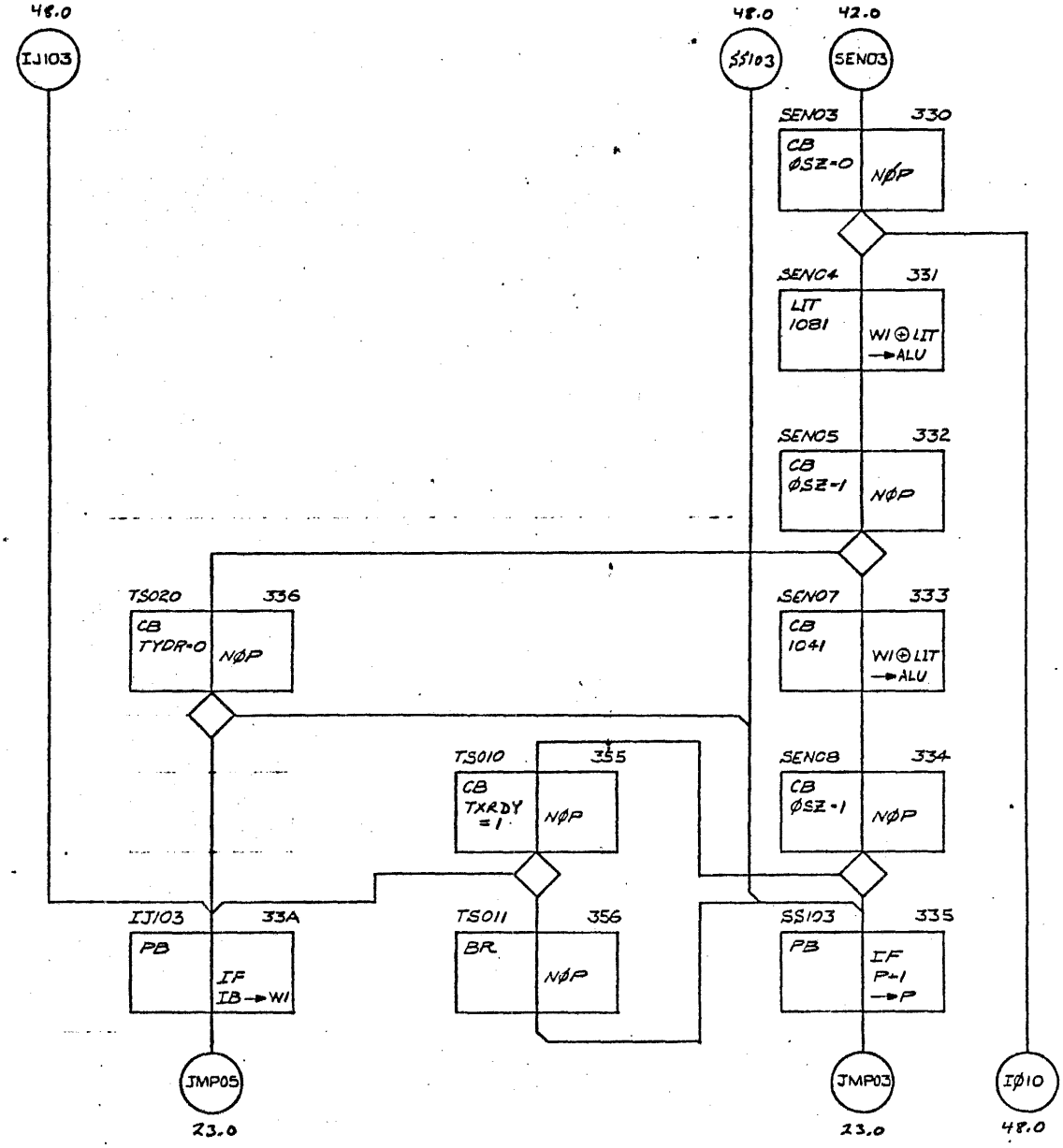
D C B A

PROGRAMMED IØ



CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE			SHEET 44.0 OF

PROGRAMMED IØ

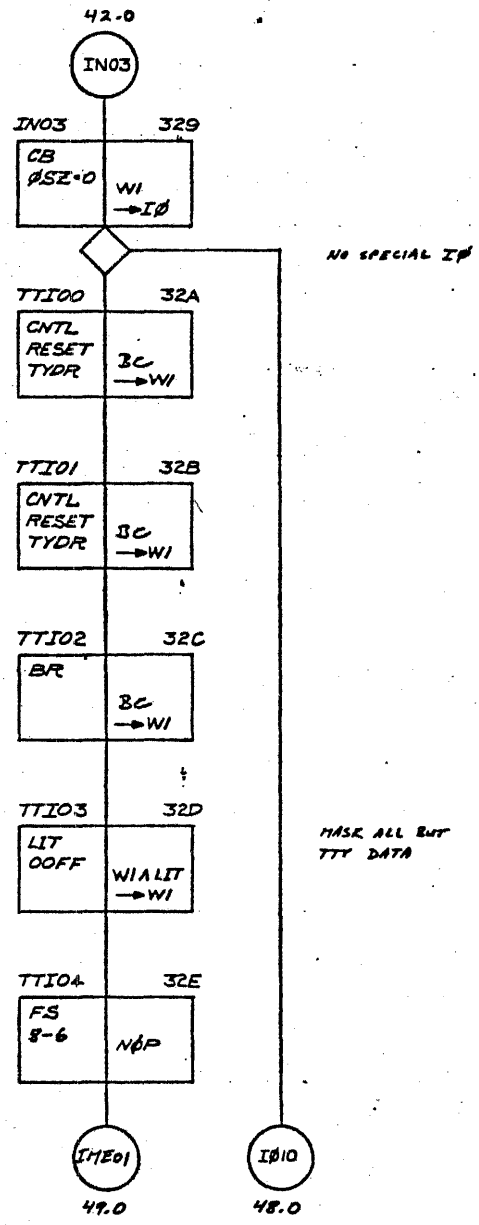


CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 45.0 OF	

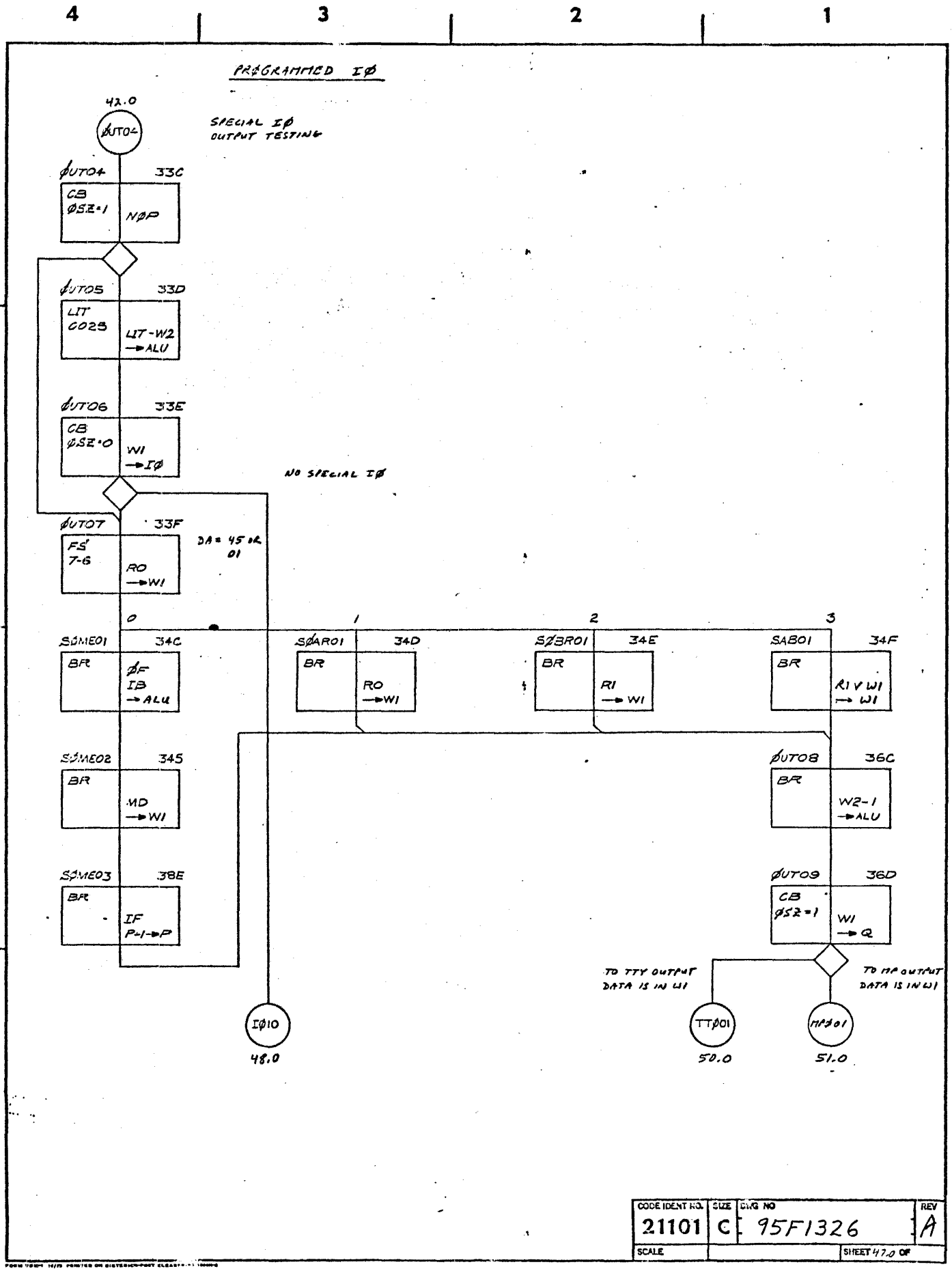
4 3 2 1

D C B A

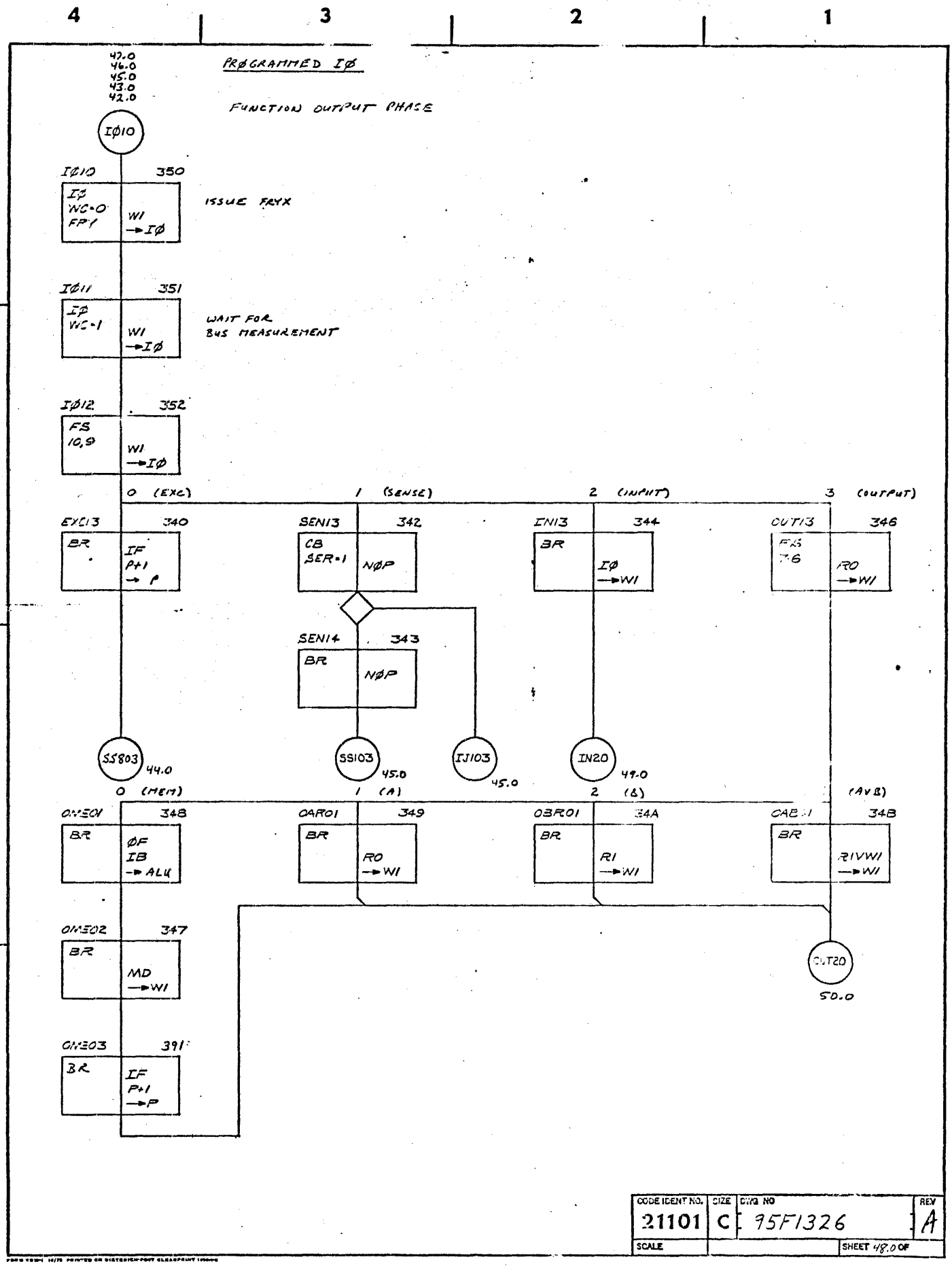
PROGRAMMED IØ



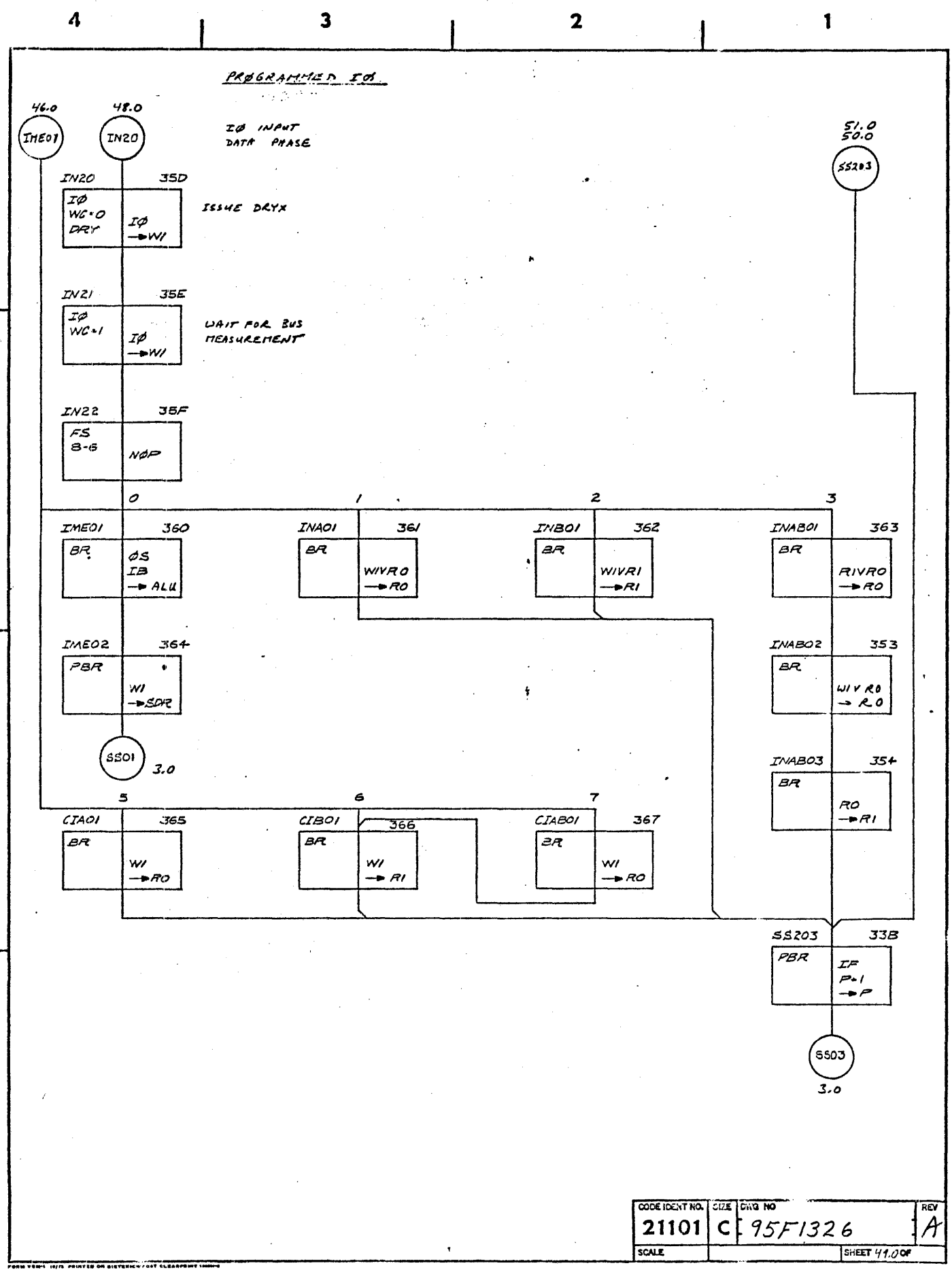
CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 46.0 OF	



CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 47.0 OF	



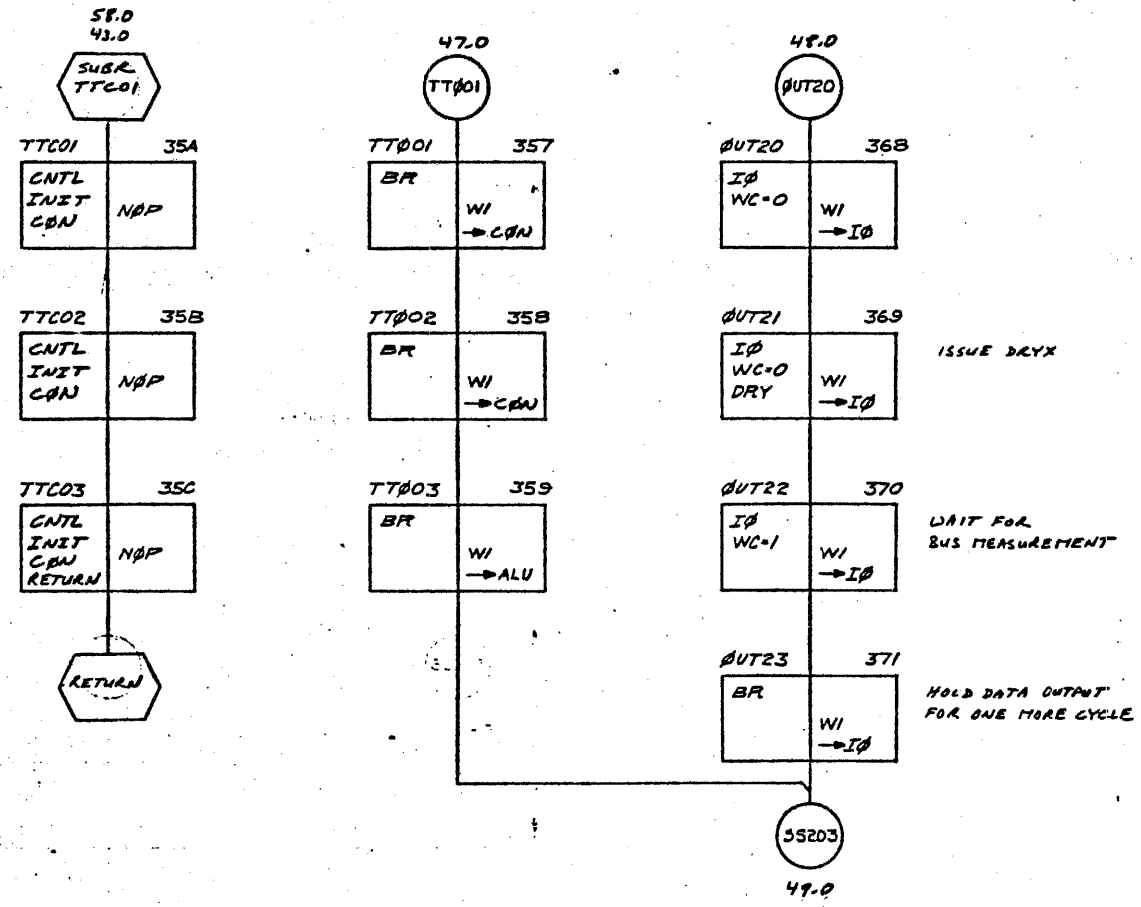
CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 48.0 OF	


4
3
2
1
PROGRAMMED IØ
46.0
IME01
48.0
IN20
IØ INPUT DATA PHASE
51.0
50.0
SS203
IN20
35D
IØ WC=0 DRIr
IØ →WI
ISSUE DRYX
IN21
35E
IØ WC=1
IØ →WI
WAIT FOR BUS MEASUREMENT
IN22
35F
FS 8-6
NØP
0
1
2
3
IME01
360
BR
ØS IB →ALU
INA01
361
BR
WIVR0 →R0
INB01
362
BR
WIVR1 →R1
INAB01
363
BR
RIVR0 →R0
IME02
364
PBR
WI →SDR
INAB02
353
BR
WIVR0 →R0
SS01
3.0
INAB03
354
BR
R0 →R1
5
6
7
CIA01
365
BR
WI →R0
CIB01
366
BR
WI →R1
CIAB01
367
BR
WI →R0
SS203
33B
PBR
IF P=1 →P
SS03
3.0
CODE IDENT NO.
21101
SIZE
C
DWG NO
95F1326
REV
A
SCALE
SHEET 41.0 OF

4 3 2 1

D C B A

PROGRAMMED I/O

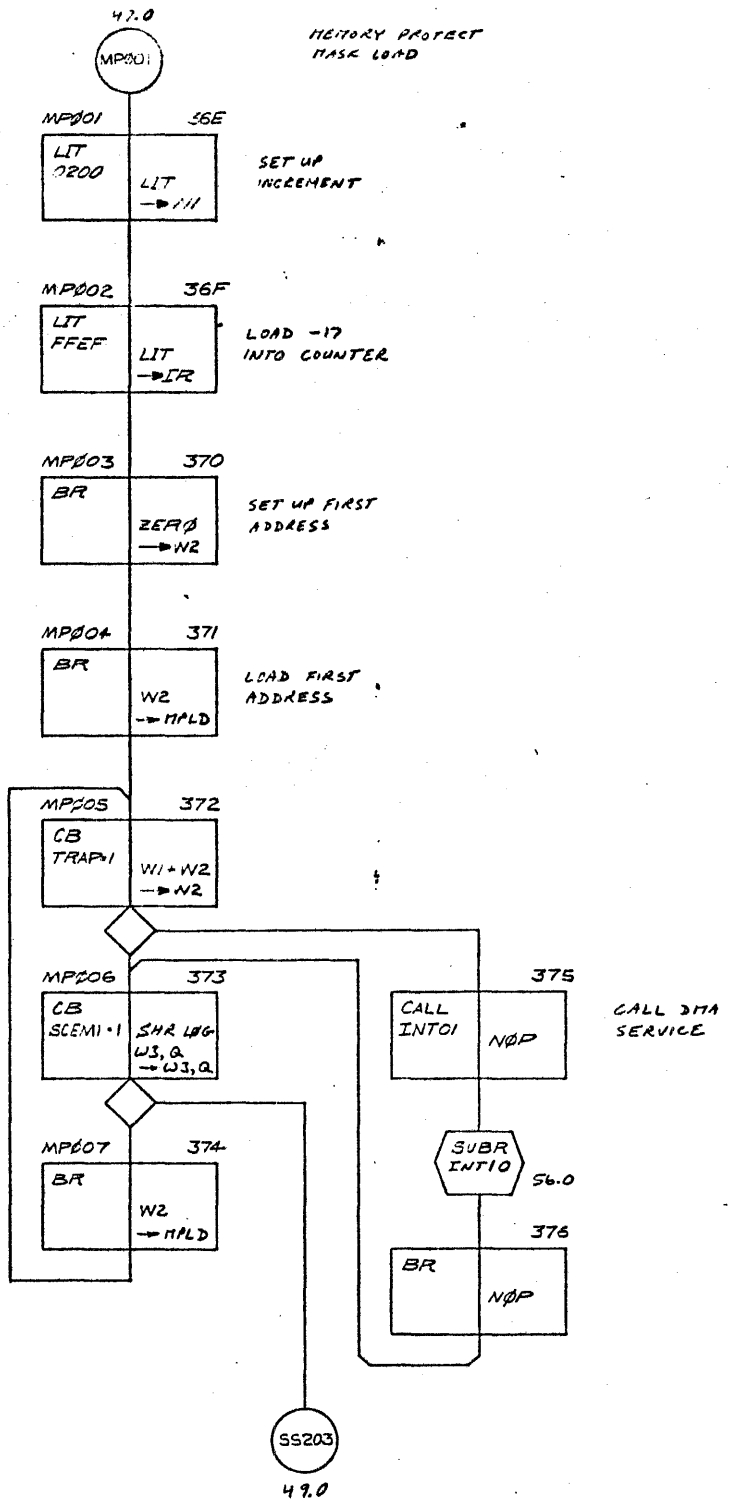


CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 50.0 OF	

4 3 2 1

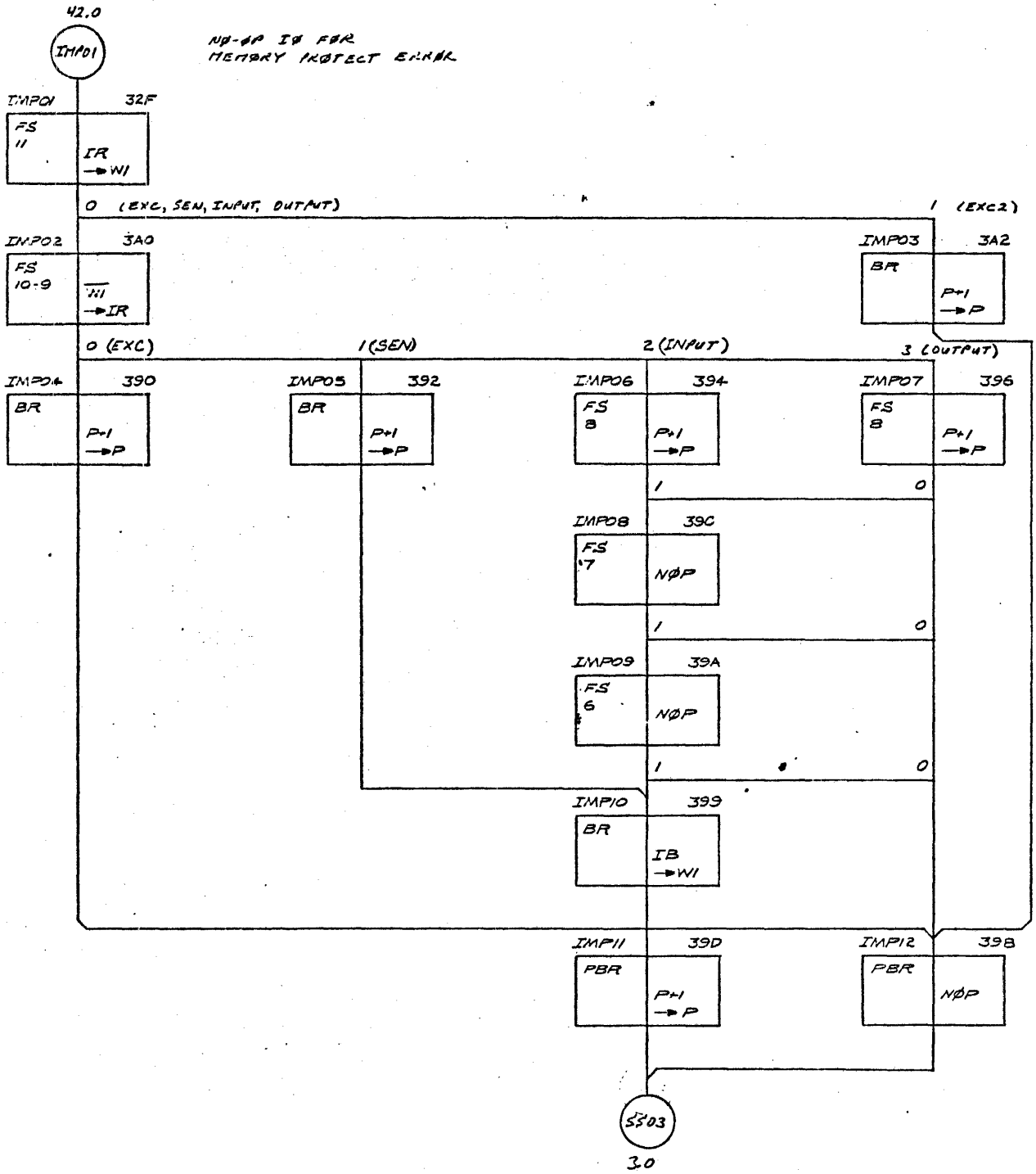
D C B A

PROGRAMMED IØ



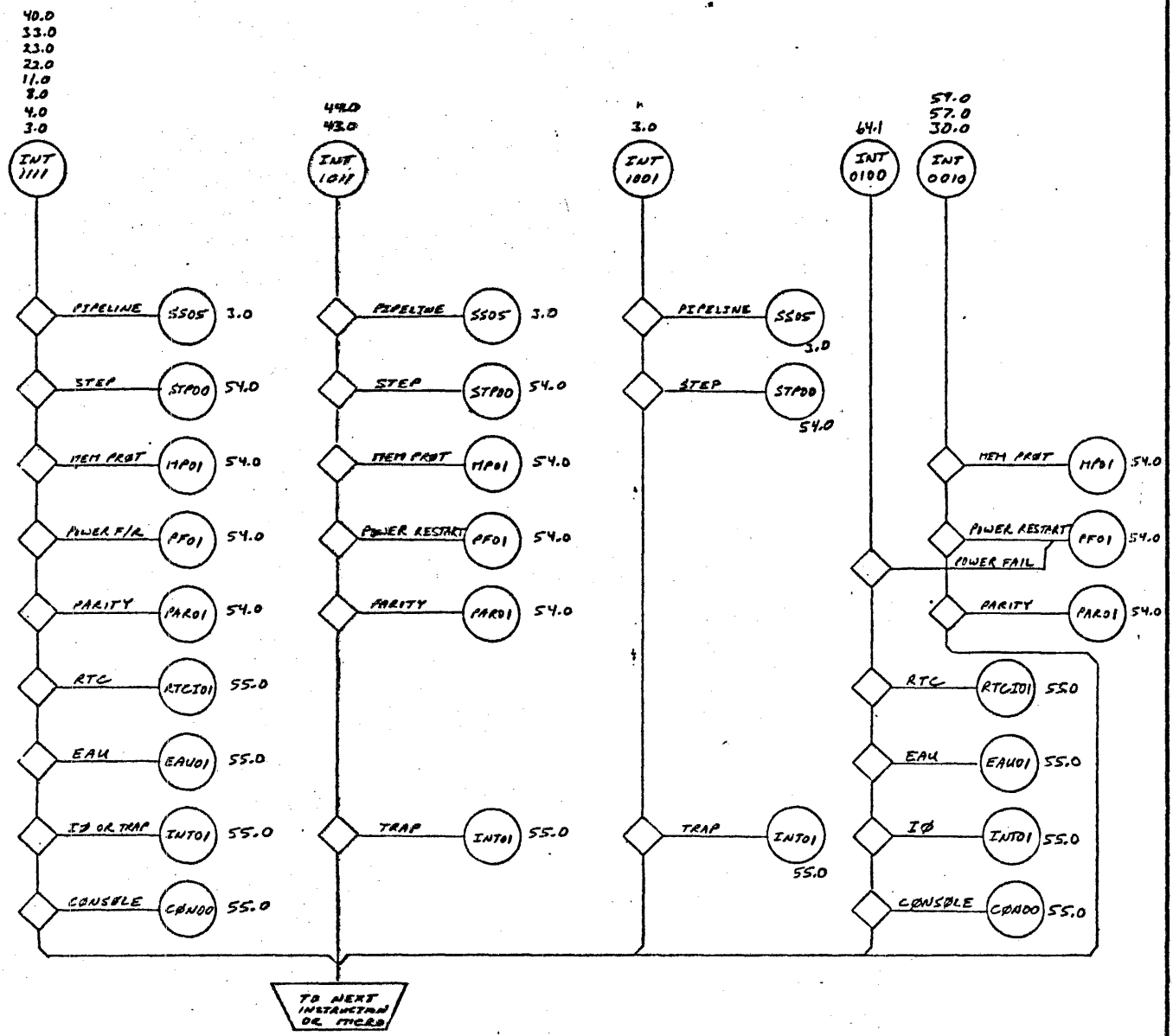
CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE			SHEET 57.0 OF

PROGRAMMED IØ



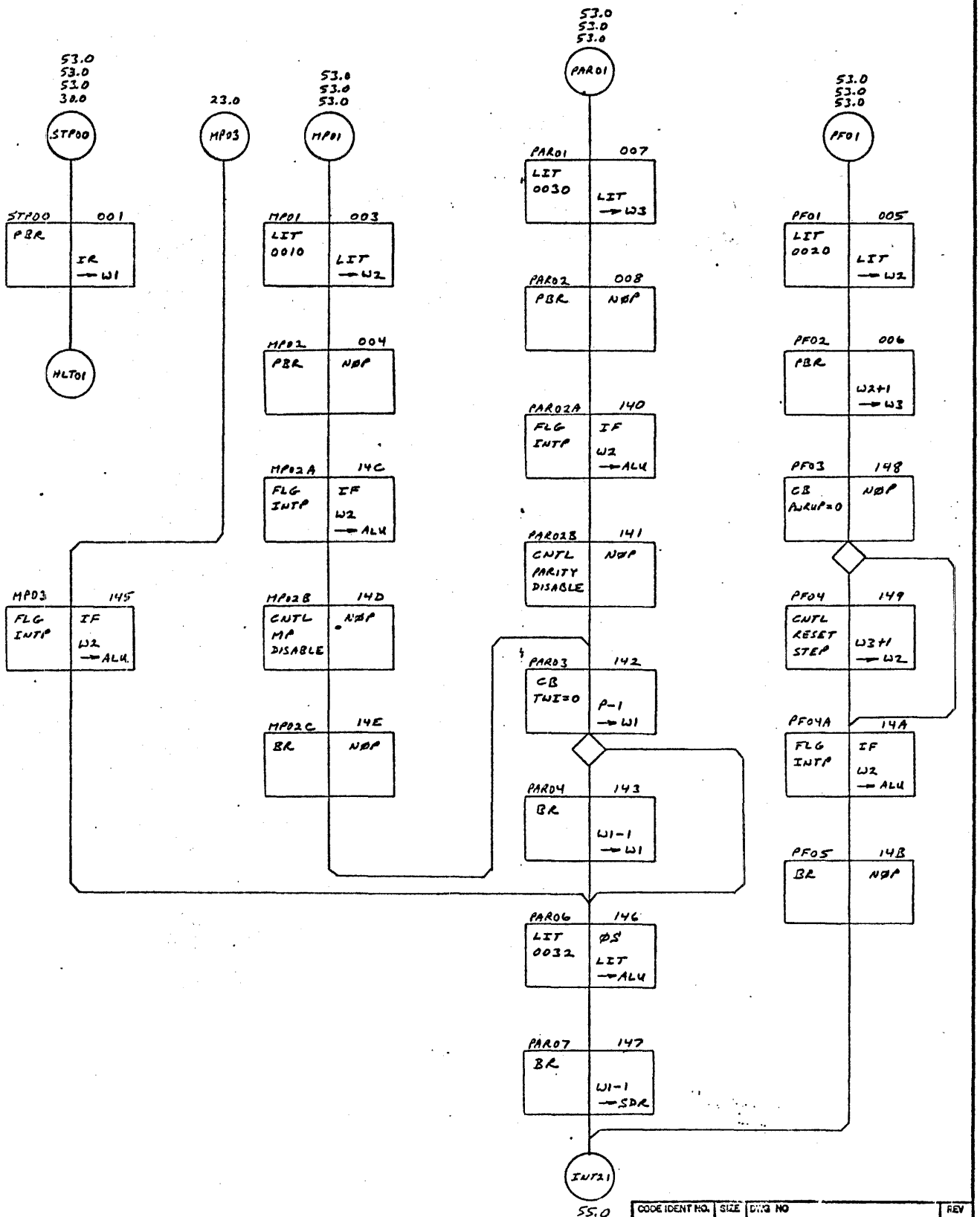
CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 52.0 OF	

INTERRUPTS

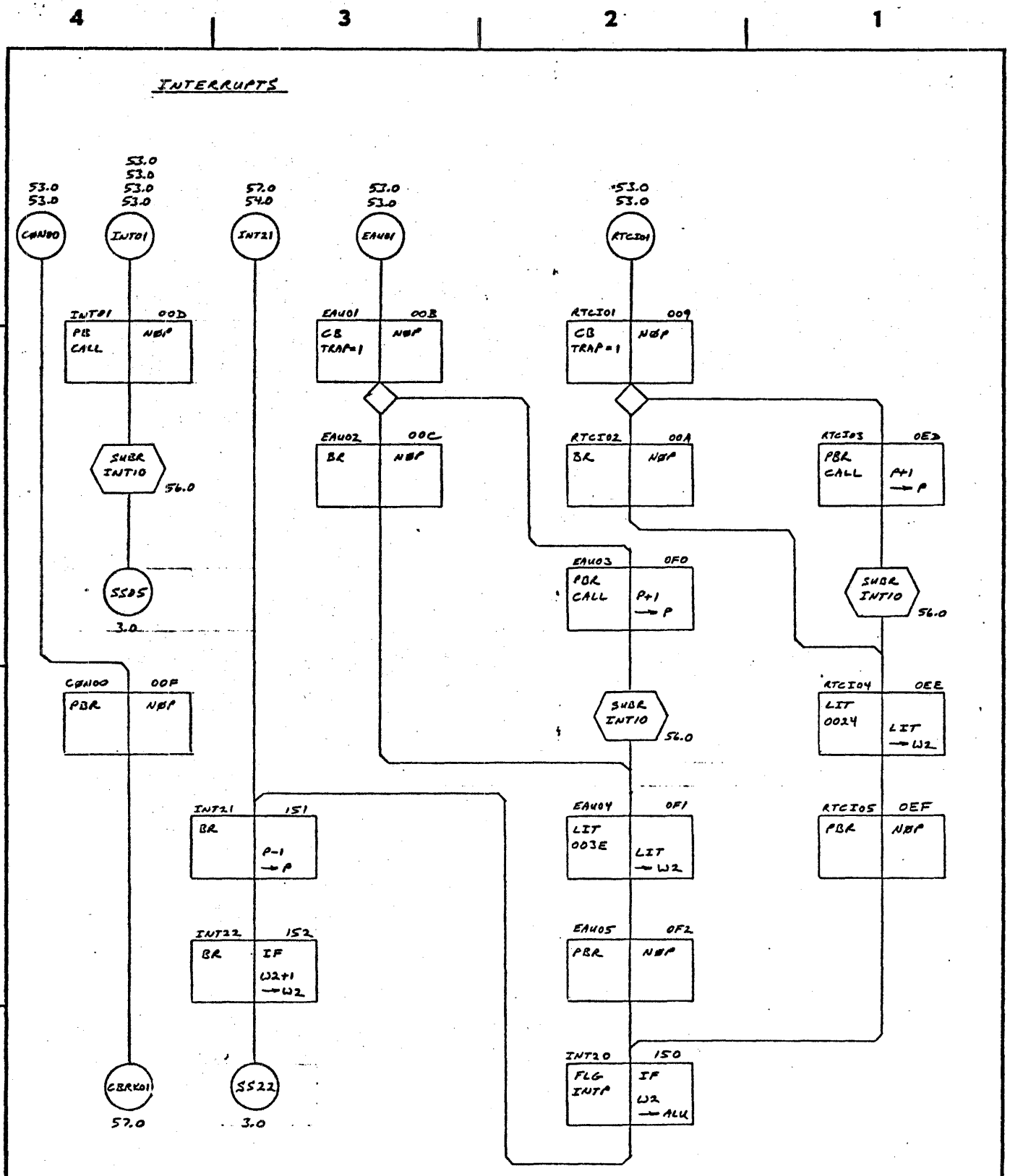


CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 53.0 OF	

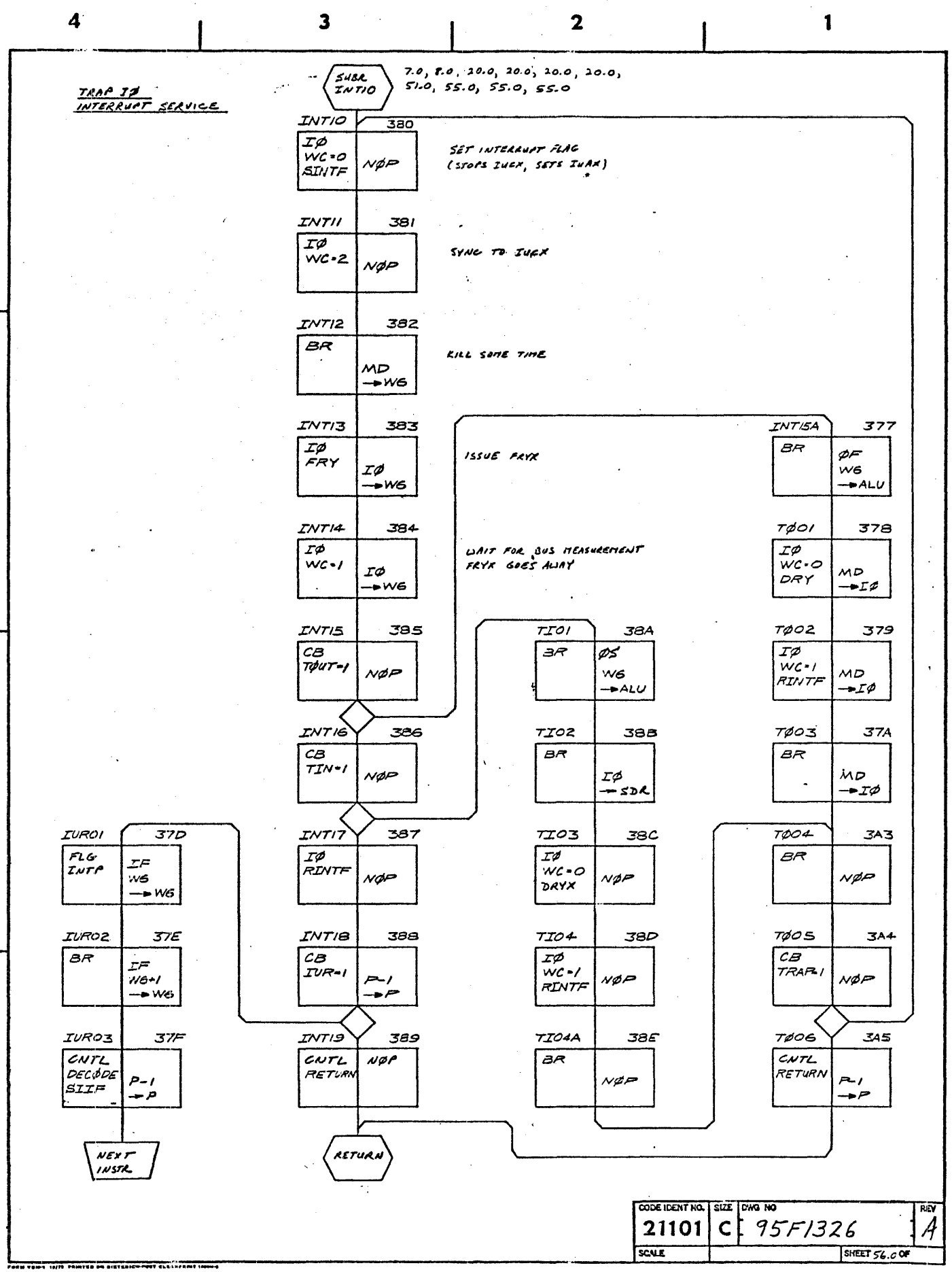
INTERRUPTS



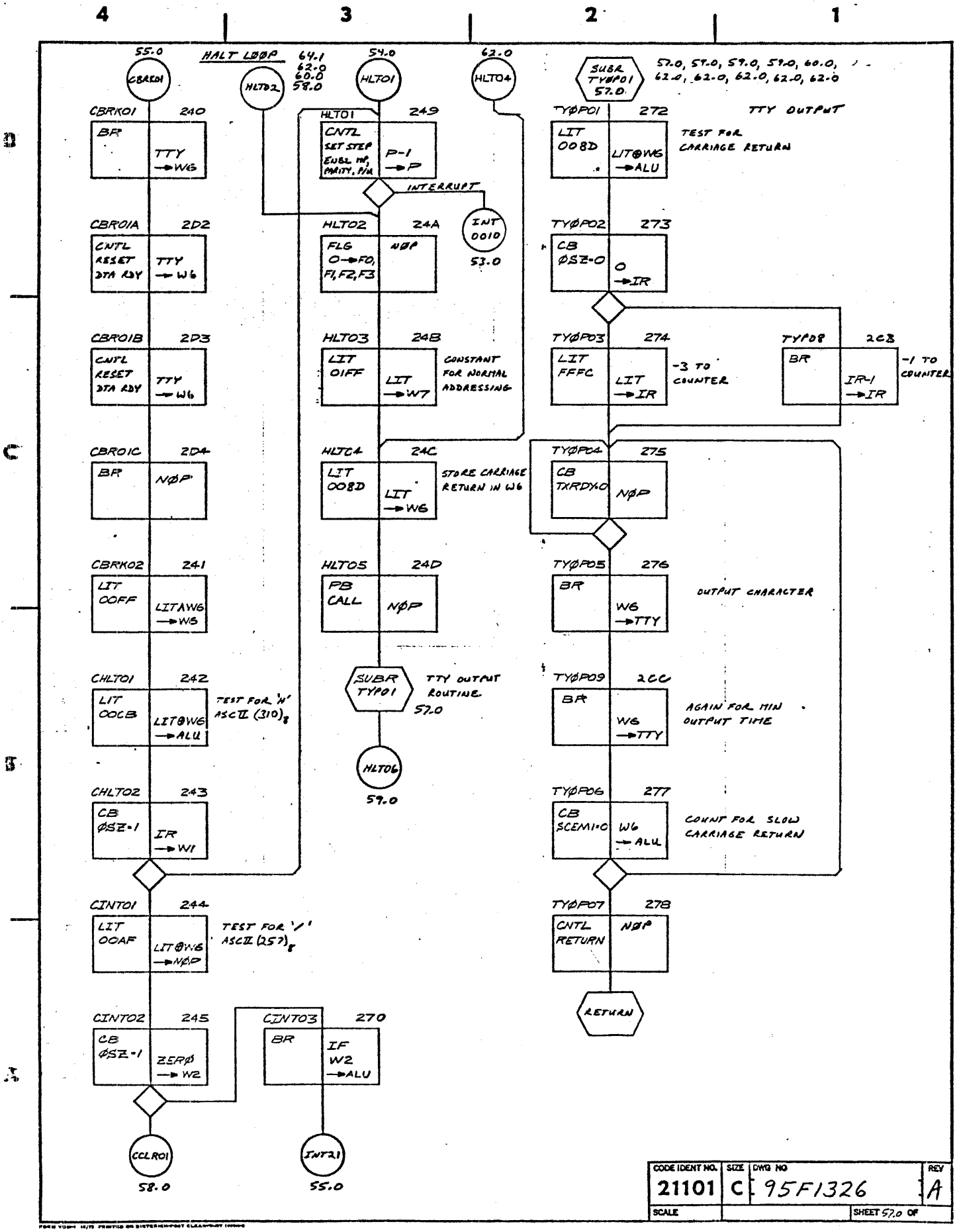
CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 54.0 OF	



CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 55.00F	

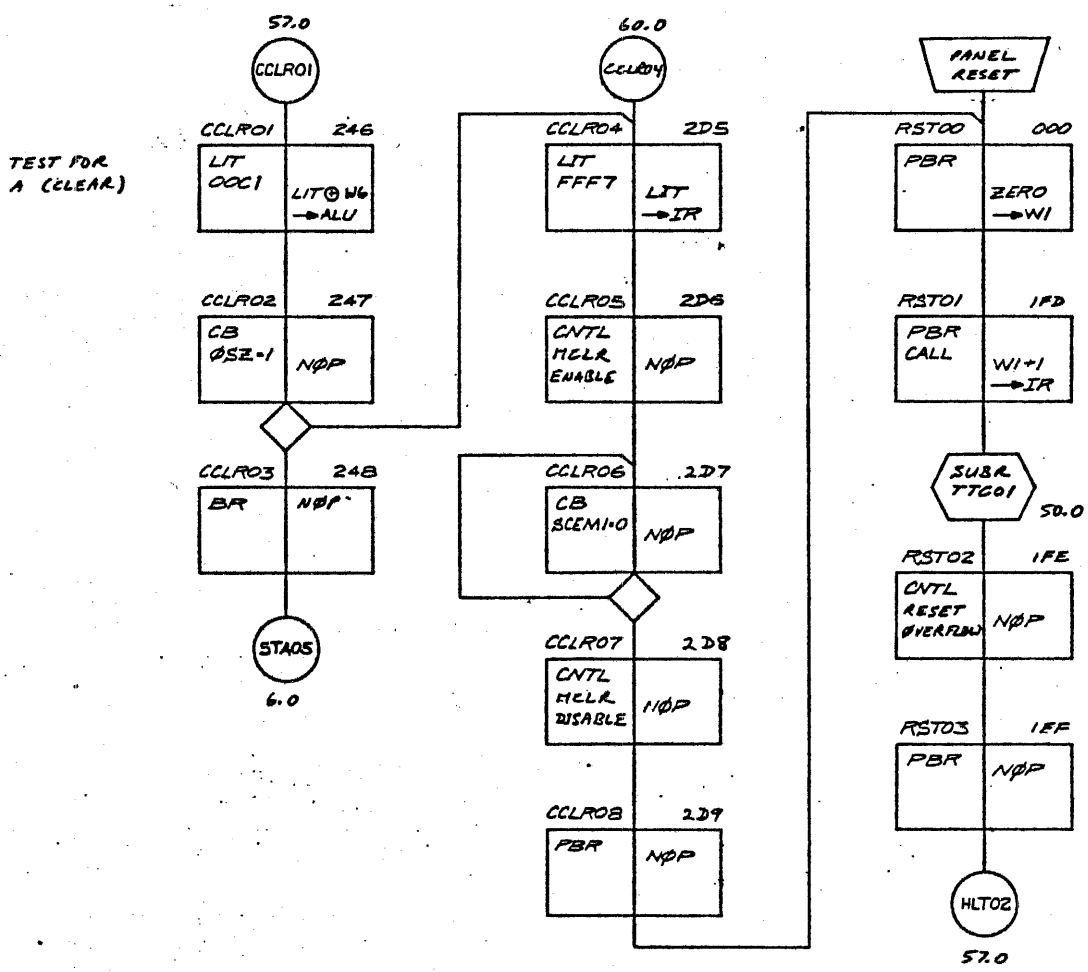


CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 56.0 OF	



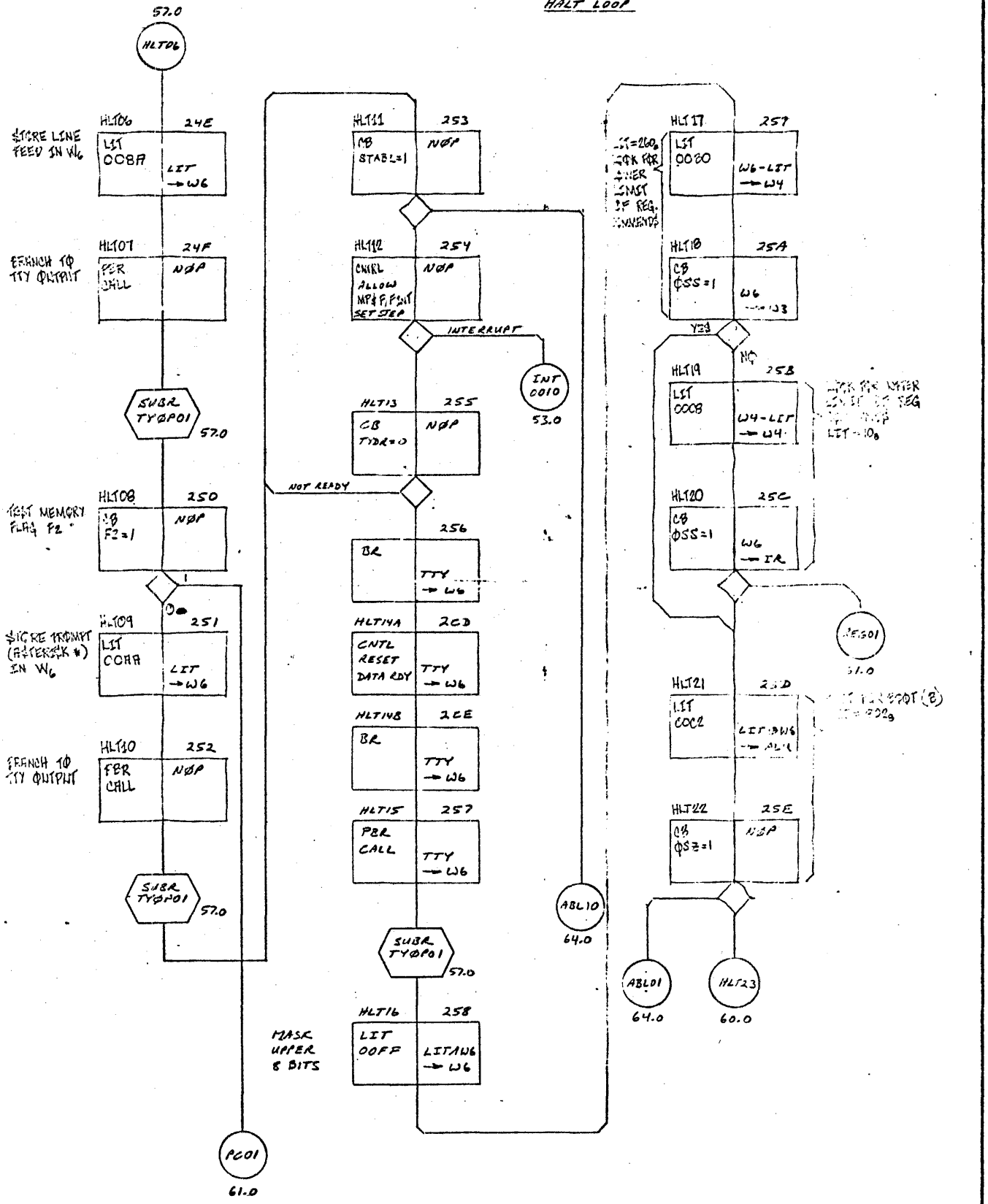
CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 57.0 OF	

HALT LOOP



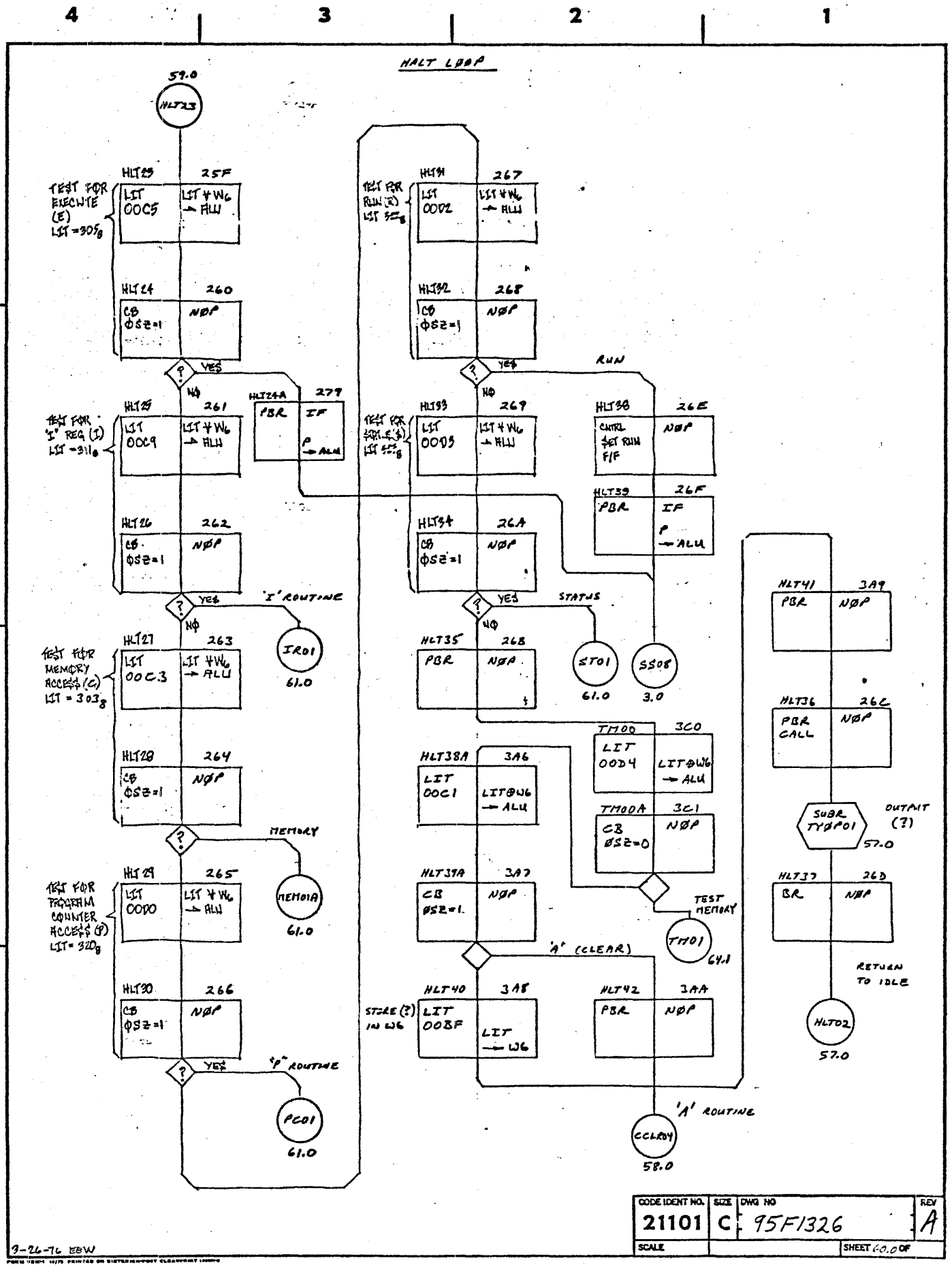
CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE			SHEET 58.0 OF

HALT LOOP



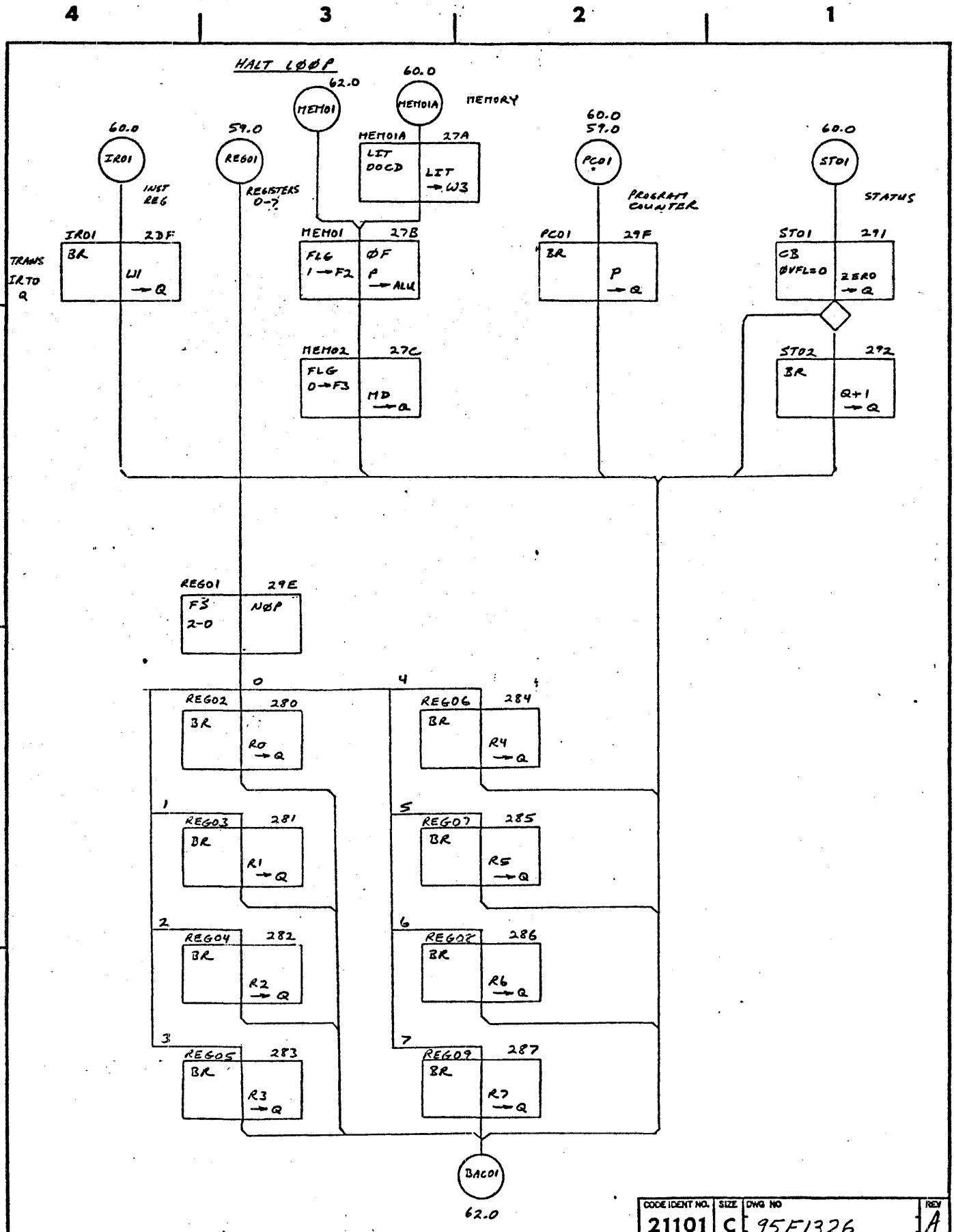
CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	9577326	A
SCALE			SHEET 57.0 OF

3-26-76 EEW

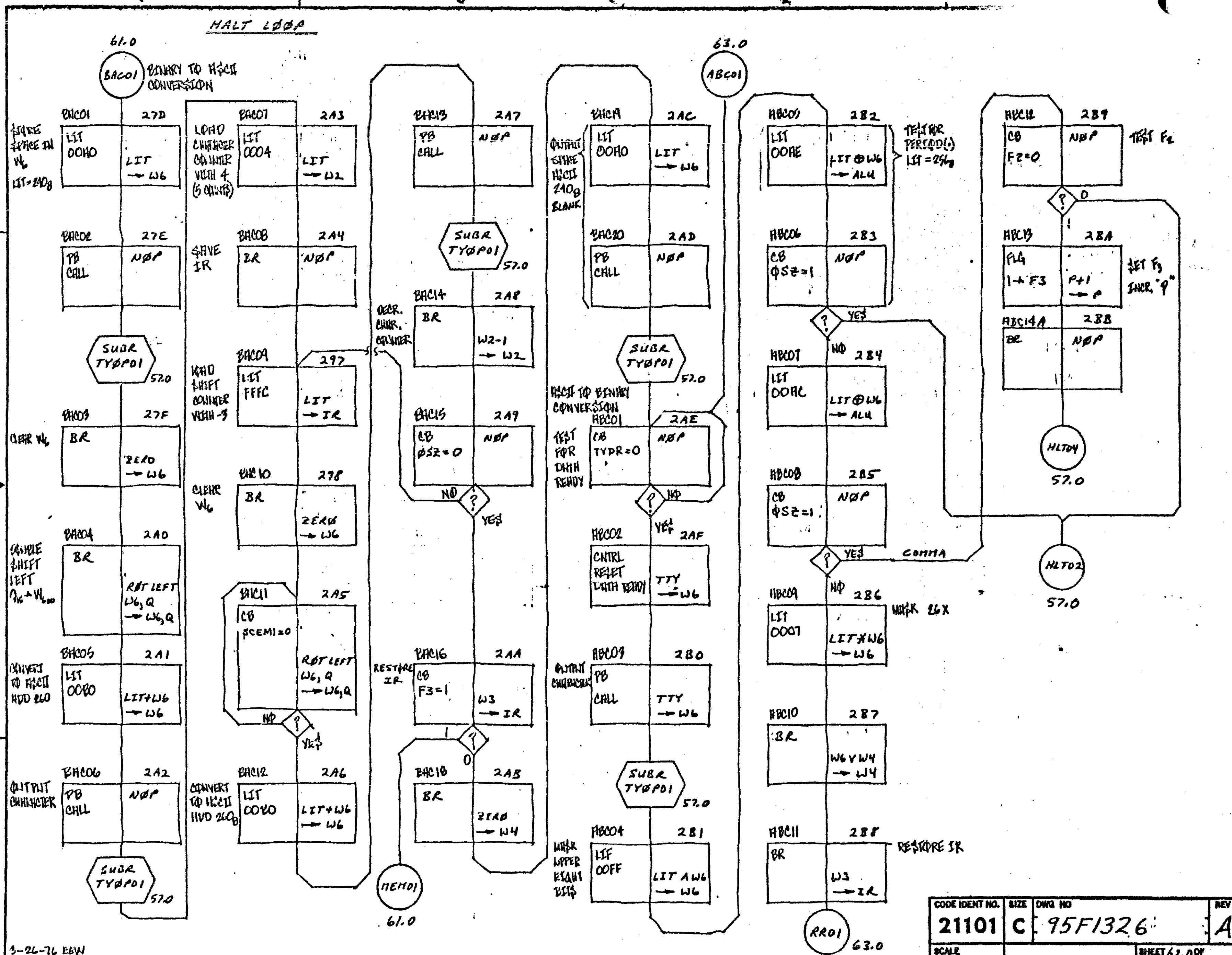


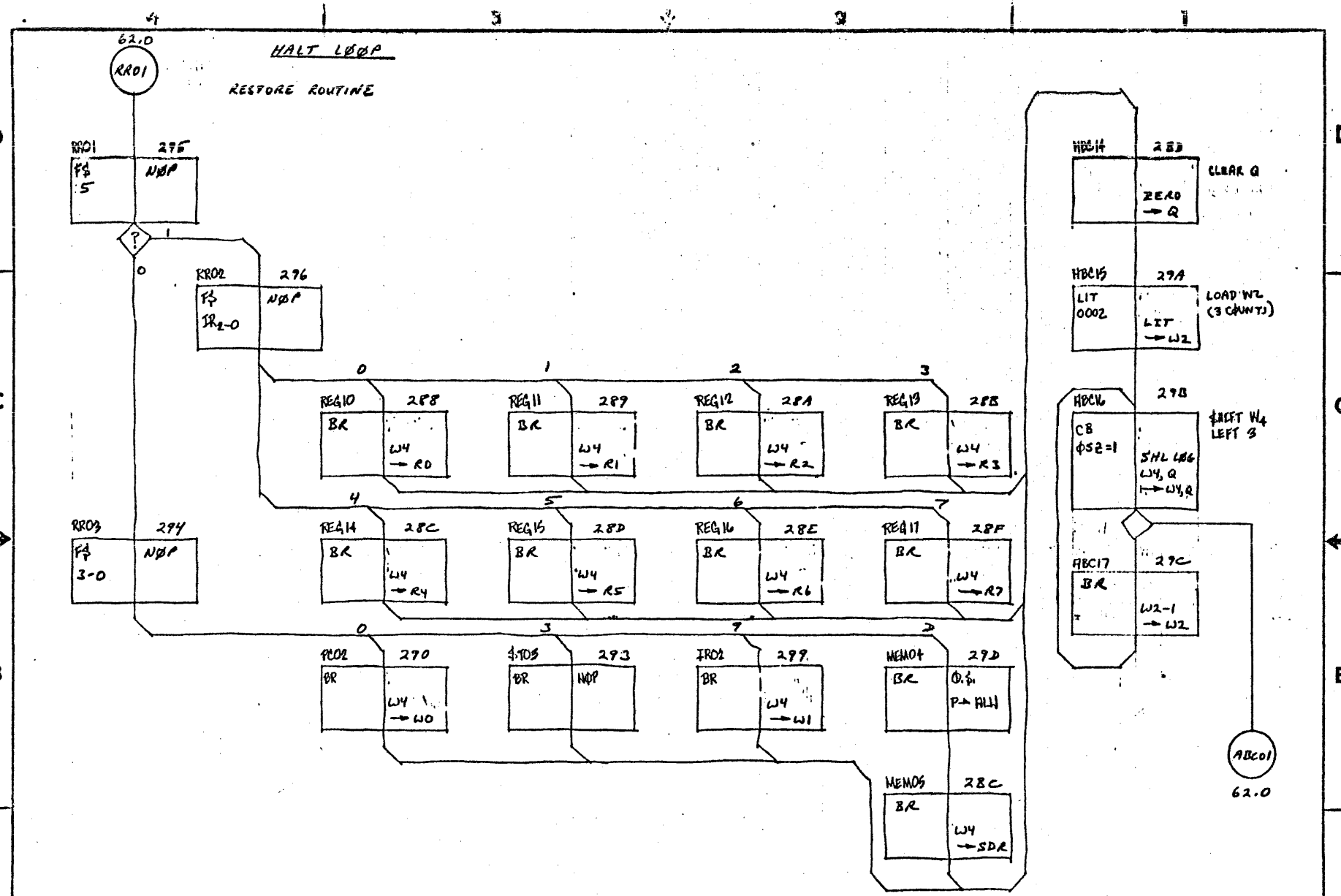
CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 60.0 OF	

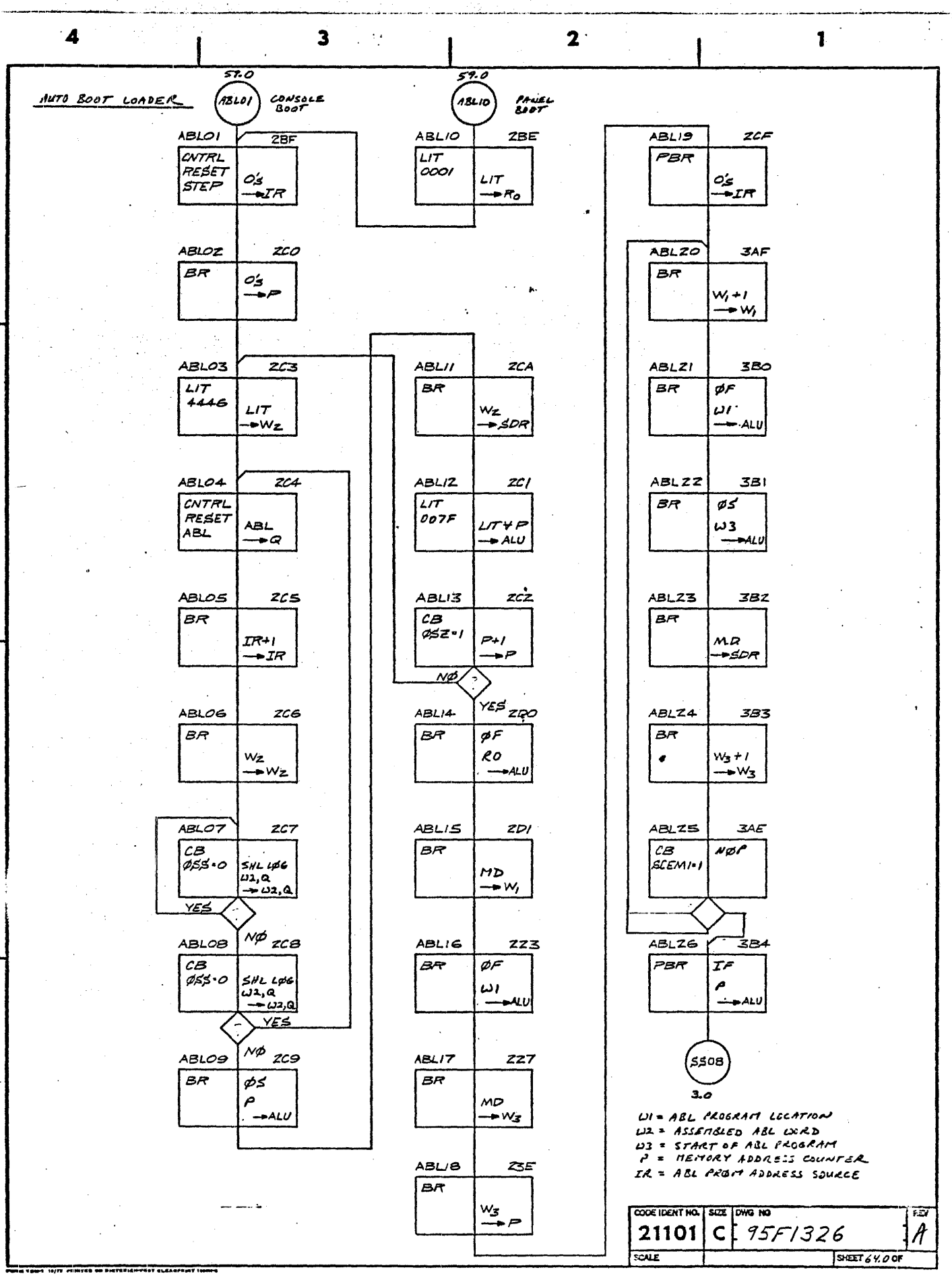
9-24-76 EBW

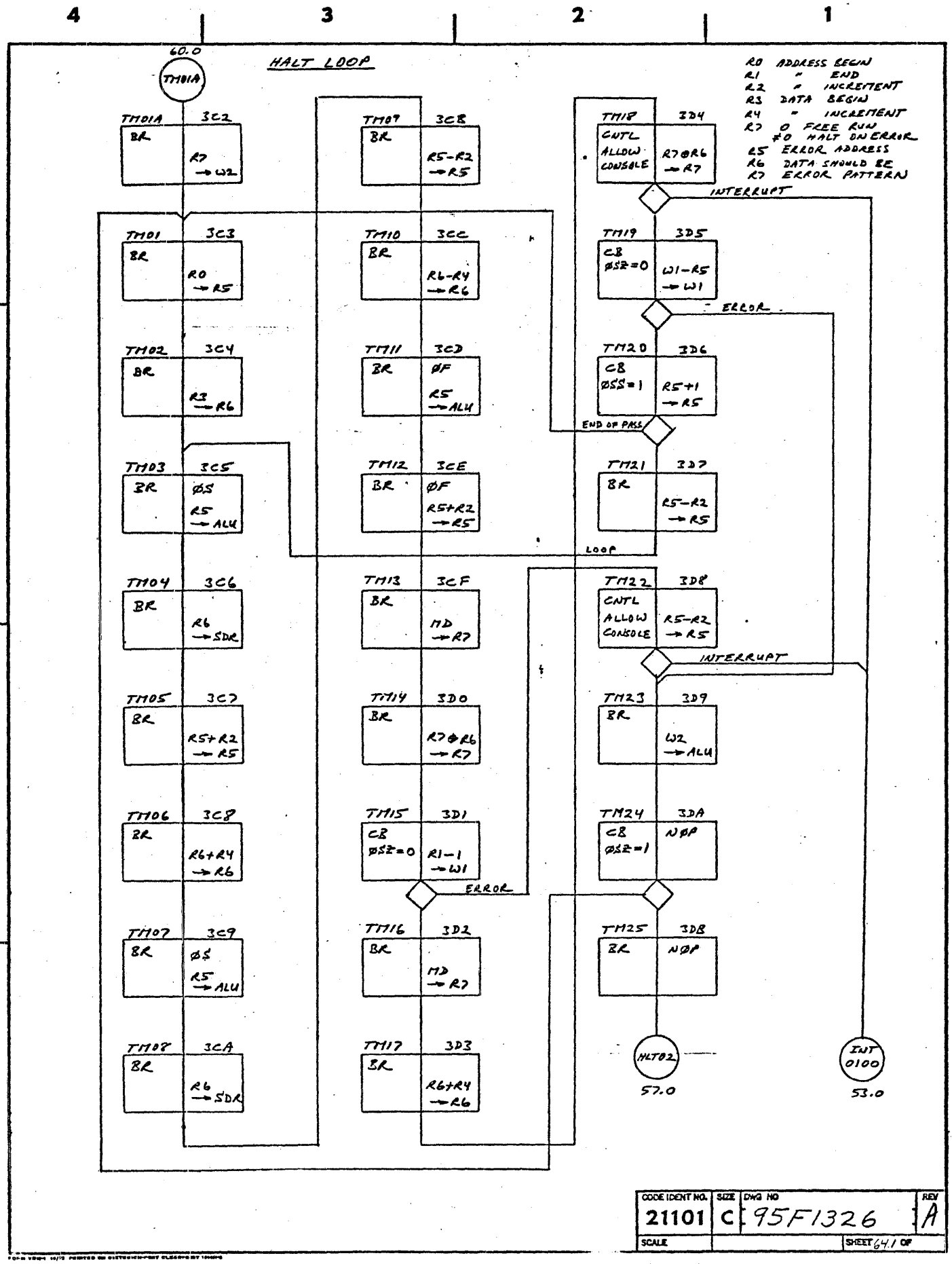


CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 61.0 OF	


HALT LOOP
61.0
BAC01
BINARY TO ASCII CONVERSION
BAC01 27D LIT 00A0 LIT → W6
STORE SPACE IN W6 LIT=240B
BAC02 27E PB CALL NOP
SUBR TYOP01 57.0
BAC03 27F BR ZERO → W6
CLEAR W6
BAC04 2A0 BR ROT LEFT W6, Q → W6, Q
SINGLE SHIFT LEFT
BAC05 2A1 LIT 00B0 LIT+W6 → W6
CONVERT TO ASCII HUD 260
BAC06 2A2 PB CALL NOP
OUTPUT CHARACTER
BAC07 2A3 LIT 0004 LIT → W2
LOAD CHARACTER COUNTER WITH 4 (5 COUNTS)
BAC08 2A4 BR NOP
SAVE IR
BAC09 297 LIT FFFC LIT → IR
LOAD SHIFT COUNTER WITH -3
BAC10 298 BR ZERO → W6
CLEAR W6
BAC11 2A5 CB SCEMI=0 ROT LEFT W6, Q → W6, Q
NO YES
BAC12 2A6 LIT 00B0 LIT+W6 → W6
CONVERT TO ASCII HUD 260B
BAC13 2A7 PB CALL NOP
DECR. CHAR. COUNTER
BAC14 2A8 BR W2-1 → W2
BAC15 2A9 CB ØSZ=0 NOP
NO YES
RESTORE IR
BAC16 2AA CB F3=1 W3 → IR
1 0
BAC18 2AB BR ZERO → W4
MEM01
61.0
63.0
ABC01
OUTPUT SPACE ASCII 240B BLANK
BAC17 2AC LIT 00A0 LIT → W6
BAC20 2AD PB CALL NOP
ASCII TO BINARY CONVERSION
TEST FOR DATA READY
ABC01 2AE CB TYPR=0 NOP
NO YES
ABC02 2AF CNTRL RESET DATA READY TTY → W6
OUTPUT CHARACTER
ABC03 2B0 PB CALL TTY → W6
MASK UPPER EIGHT BITS
ABC04 2B1 LIF 00FF LIT ∧ W6 → W6
ABC05 2B2 LIT 00AE LIT ⊕ W6 → ALU
TEST FOR PERIOD(.) LIT=256B
ABC06 2B3 CB ØSZ=1 NOP
YES NO
ABC07 2B4 LIT 00AC LIT ⊕ W6 → ALU
ABC08 2B5 CB ØSZ=1 NOP
YES COMMA NO
ABC09 2B6 LIT 0007 LIT ∗ W6 → W6
MASK 26X
ABC10 2B7 BR W6 ∨ W4 → W4
ABC11 2B8 BR W3 → IR
RESTORE IR
RR01
63.0
ABC12 2B9 CB F2=0 NOP
TEST F2
0 1
ABC13 2BA FLG 1 → F3 P+1 → P
SET F3 INCR. "P"
ABC14A 2BB BR NOP
HLT04
57.0
HLT02
57.0
3-26-76 EBW
CODE IDENT NO. 21101
SIZE C
DWG NO 95F1326
REV A
SCALE
SHEET 62.0 OF
D C B A
4 3 2 1

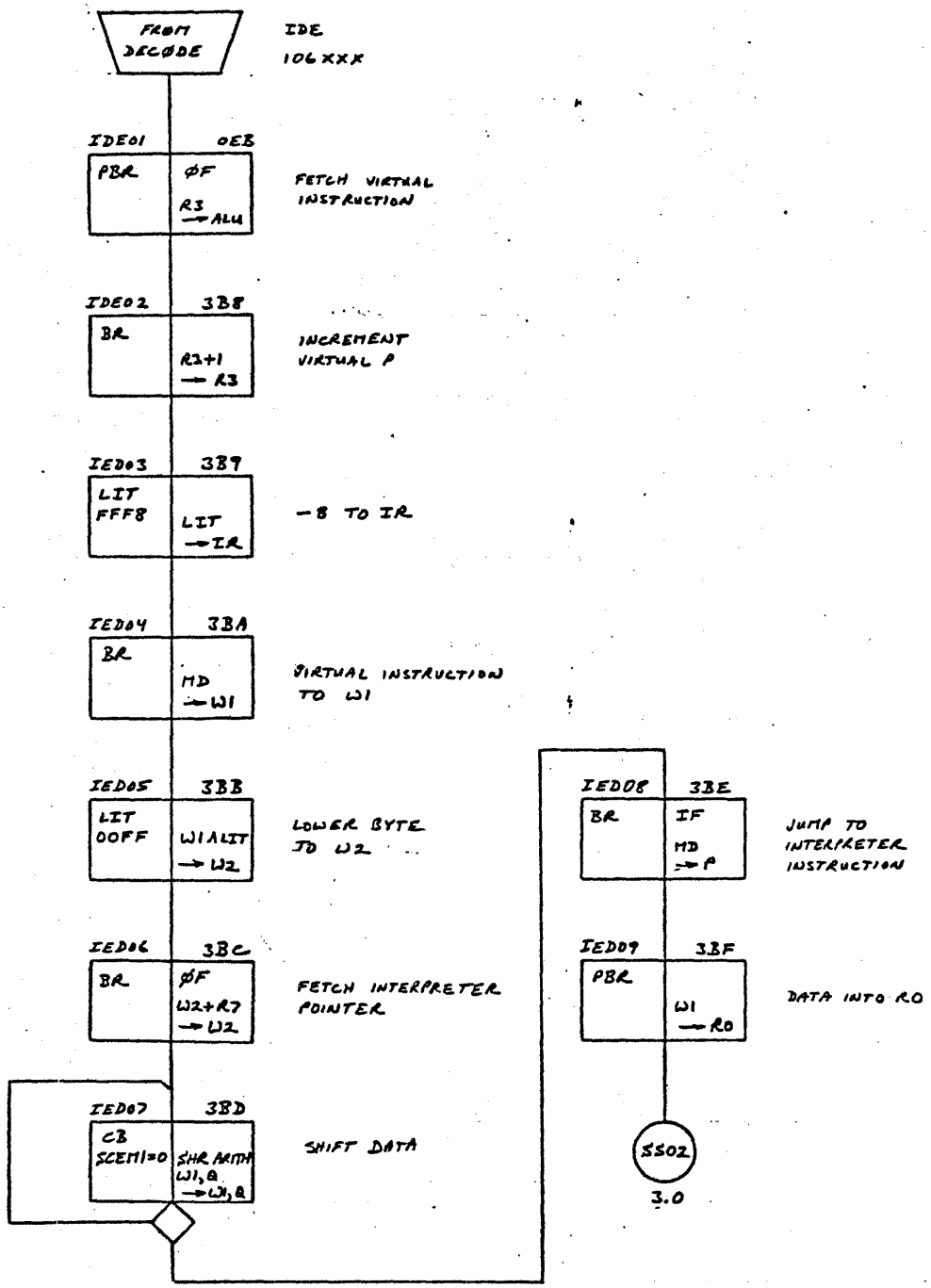

62.0
RR01
HALT LOOP
RESTORE ROUTINE
RR01 295 F$ 5 NOP
?
1
0
RR02 296 F$ IR2-0 NOP
RR03 294 F$ 3-0 NOP
0 1 2 3
REG10 288 BR W4 → R0
REG11 289 BR W4 → R1
REG12 28A BR W4 → R2
REG13 28B BR W4 → R3
4 5 6 7
REG14 28C BR W4 → R4
REG15 28D BR W4 → R5
REG16 28E BR W4 → R6
REG17 28F BR W4 → R7
0 3 7 2
PC02 270 BR W4 → W0
$TOS 293 BR NOP
IR02 299 BR W4 → W1
MEM04 29D BR 0.$4 P→ ALU
MEM05 28C BR W4 → SDR
HBC14 283 ZERO → Q
CLEAR Q
HBC15 29A LIT 0002 LIT → W2
LOAD W2 (3 COUNTS)
HBC16 29B CB φS2=1 SHL LB6 W4, Q ↦ W4, Q
SHIFT W4 LEFT 3
ABC17 29C BR W2-1 → W2
ABC01
62.0
3-26-76 EEW
CODE IDENT NO. 21101
SIZE C
DWG NO 95F1326
REV A
SCALE
SHEET 63.0 OF


4
3
2
1
AUTO BOOT LOADER
57.0
ABL01
CONSOLE BOOT
59.0
ABL10
PANEL BOOT
ABL01 2BF
CNTRL RESET STEP
0's → IR
ABL02 2C0
BR
0's → P
ABL03 2C3
LIT 4446
LIT → W2
ABL04 2C4
CNTRL RESET ABL
ABL → Q
ABL05 2C5
BR
IR+1 → IR
ABL06 2C6
BR
W2 → W2
ABL07 2C7
CB ØSS=0
SHL LØG W2,Q → W2,Q
YES
NØ
ABL08 2C8
CB ØSS=0
SHL LØG W2,Q → W2,Q
YES
NØ
ABL09 2C9
BR
ØS P → ALU
ABL10 2BE
LIT 0001
LIT → R0
ABL11 2CA
BR
W2 → SDR
ABL12 2C1
LIT 007F
LIT ∧ P → ALU
ABL13 2C2
CB ØSZ=1
P+1 → P
NØ
YES
ABL14 2D0
BR
ØF R0 → ALU
ABL15 2D1
BR
MD → W1
ABL16 2Z3
BR
ØF W1 → ALU
ABL17 2Z7
BR
MD → W3
ABL18 2ZE
BR
W3 → P
ABL19 2CF
PBR
0's → IR
ABL20 3AF
BR
W1+1 → W1
ABL21 3B0
BR
ØF W1 → ALU
ABL22 3B1
BR
ØS W3 → ALU
ABL23 3B2
BR
MDR → SDR
ABL24 3B3
BR
W3+1 → W3
ABL25 3AE
CB SCEM=1
NØP
ABL26 3B4
PBR
IF P → ALU
S508
3.0
W1 = ABL PROGRAM LOCATION
W2 = ASSEMBLED ABL WORD
W3 = START OF ABL PROGRAM
P = MEMORY ADDRESS COUNTER
IR = ABL PROM ADDRESS SOURCE
CODE IDENT NO. 21101
SIZE C
DWG NO 95F1326
REV A
SCALE
SHEET 64.0 OF



CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 64.1 OF	

PASCAL DECODER



CODE IDENT NO.	SIZE	DWG NO	REV
21101	C	95F1326	A
SCALE		SHEET 650 OF	

****
(400) FLOWCHART INDEX
****

APPENDIX B
XMIDAS LISTING

```
PAGE    1  11/09/76  PROG      VORTXII LMGEN

TIDB,XMIDAS,1,0
LD,SI
LIB
END
VSSERV A 55217   VSSMB A 55166   VSBIC A 55063   VSERR A 54455
VSFNRM A 54033   VSFNR A 53476   VSSPI A 52740   SALNUC A 51661
VSPDAL A 51537  VSGFCB A 73660  VSJPBF A 73607  VSOPBF A 73536
  VSIB A 73500  TIDSL2 A 73500  TIDBSL A 73443  TIDBER A 73406
TIDIMP A 73351   TBDIB A 73314  VSLC40 A 75000   VSTFC A 74777
 VSBFC A 74014   GOFCB A 73754   BIFCB A 73716  VSIOST A 55001
 VSIOC A 52756  VSEXEC A 55217   SSFCB A 73742   SIFCB A 73660
  BOFCB A 73766   PIFCB A 73672   LOFCB A 73704   BOFCB A 73730
 MIDAS A 12232  ($IAPI A 00647  ($LII) A 00657  ($PEDI A 20714
09:43:11  /ASSIGN,DI,SI
09:43:19  /ASSIGN,BO,PI
09:43:21  /<PMODE,1
09:43:29  /MEM,15
09:45:26  /EXEC
```

RUN 16

```
PAGE    1  11/09/76  FROG       VORTEX  MIDAS

000                                  ALOC     0
                         *           R FIELD DEFINITIONS

                 0000    R0          EQU      0
                 0001    R1          EQU      1
                 0002    R2          EQU      2
                 0003    R3          EQU      3
                 0004    R4          EQU      4
                 0005    R5          EQU      5
                 0006    R6          EQU      6
                 0007    R7          EQU      7
                 0008    W0          EQU      8
                 0008    P           EQU      8
                 0009    W1          EQU      9
                 000A    W2          EQU      10
                 000B    W3          EQU      11
                 000C    W4          EQU      12
                 000D    W5          EQU      13
                 000E    W6          EQU      14
                 000F    W7          EQU      15
```

```
                        *       D FIELD DEFINITIONS

                0010    Q       EQU     16
                0011    IF      EQU     17
                0012    OF      EQU     18
                0013    OSM     EQU     19
                0014    OSRB    EQU     20
                0015    OSLB    EQU     21
                0018    IR      EQU     24
                0019    TTY     EQU     25
                001A    IO      EQU     26
                001B    MPM     EQU     27
                001C    MPD     EQU     28
                001D    SDR     EQU     29
                001F    NOP     EQU     31
```

```
                    *            GENERAL DEFINITIONS
        000A        A      EQJ   10
        0003        B      EQU   11
        000C        C      EQU   12
        000D        D      EQJ   13
        000E        E      EQU   14
        000F        F      EQU   15
        0001        DJMP   EQU   1
        0002        JMOS   EQU   2
        0003        INIP   EQU   3
```

```
PAGE    4  11/09/76  FROG       VORTEX  MIDAS

                          *             C FIELD DEFINITIONS
              0001        OSS     EQU   1
              0002        OSZ     EQU   2
              0003        OSC     EQU   3
              0004        OVFL    EQU   4
              0005        SCEMI   EQU   5
              0006        I620F   EQU   6
              0007        NDIST   EQU   7
              0008        TXRDY   EQU   8
              0009        TYDR    EQU   9
              000A        STABL   EQU   10
              000B        DIVIS   EQU   3
              000C        DBUGV   EQU   12
              0010        FLG0    EQU   16
              0011        FLG1    EQU   17
              0012        FLG2    EQU   18
              0013        FLG3    EQU   19
              0014        MPTST   EQU   20
              0015        IWI     EQU   21
              0016        IIV     EQU   22
              0017        IOJT    EQU   23
              0018        TRAP    EQU   24
              0019        IJR     EQU   25
              001A        SER     EQU   26
              001B        PWRUP   EQU   27
              001C        EAJT    EQU   28
              001D        FLG4    EQU   29
              001E        FLG5    EQU   30
              001F        MPRA    EQU   31
```

* FORMAT DEFINITIONS

```
CN1   FORM   16(0),16(0),16,7,4,5
CN2   FORM   8(0),8(0),16(0),2(0),8,5,1,7,4,5
CN3   FORM   16(0),16(0),2(1),7,3,4,7,4,5
CN4   FORM   8(0),8(0),16(0),2(3),8,4,1,1,7,4,5
CN5   FORM   16(0),16(0),4(8),7,3,2,7,4,5
CN6   FORM   16(0),16(0),4(10),1,4,1,1,5,7,4,5
CN7   FORM   16(0),16(0),4(9),6,2,2,2,7,4,5
CN8   FORM   16(0),16(0),4(8),4(0),3,3,2,7,4,5
```

```
                    *                    MACRO DEFINITIONS

LIT     MAC
        CN1     3(P(1)),4(P(2)),5(P(3)),6(P(4))
        EMAC

CB      MAC
        CN2     5(P(1)),6(P(2)),7(P(3)),8(P(4)),9(P(5)),10(P(6))
        EMAC

FS      MAC
        CN3     4((P(1))/2),5(P(2)),6(P(3)),7(P(4)),8(P(5)),9(P(6))
        EMAC

FS0     MAC
        CN3     4((P(1))/2),5(P(2)),6(P(3)),7(P(4)),8(P(5)),9(P(6))
        EMAC

FS1     MAC
        CN3     4(((P(1)-X'100)/2)),5(P(2)),6(P(3)),7(P(4)),8(P(5)),
                C9(P(6))
        EMAC

FS2     MAC
        CN3     4(((P(1)-X'200)/2)),5(P(2)),6(P(3)),7(P(4)),8(P(5)),
                C9(P(6))
        EMAC

FS3     MAC
        CN3     4(((P(1)-X'300)/2)),5(P(2)),6(P(3)),7(P(4)),8(P(5)),
                C9(P(6))
        EMAC

PBR     MAC
        CN4     5(P(1)),6(P(2)),7(0),8(0),9(P(3)),10(P(4)),11(P(5))
        EMAC

FLG     MAC
        CN5     4(0),5(P(1)),6(P(2)),7(P(3)),8(P(4)),9(P(5))
        EMAC
```

```
FLGS    MAC
        CN8     5(P(1)),6(P(2)),7(P(3)),8(P(4)),9(P(5)),10(P(6))
        EMAC

CNTL    MAC
        CN6     4(P(1)),5(P(2)),6(P(3)),7(0),8(P(4)),9(P(5)),10(P(6)),
                C11(P(7))
        EMAC

BR      MAC
        CN2     5(P(1)),6(0),7(0),8(P(2)),9(P(3)),10(P(4))
        EMAC

CALL    MAC
        CN4     5(P(1)),6(P(2)),7(1),8(0),9(P(3)),10(P(4)),11(P(5))
        EMAC
```

```
                REIRN   MAC
                        CN6     4(0),5(0),6(1),7(0),8(0),9(P(1)),10(P(2)),11(P(3))
                        EMAC

                NDCDE   MAC
                        CN6     4(1),5(X'F),6(0),7(0),8(0),9(P(1)),10(P(2)),11(P(3))
                        EMAC
                IOW     MAC
                        CN7     4(0),5(P(1)),6(P(2)),7(P(3)),8(P(4)),9(P(5)),10(P(6))
                        EMAC

                IONW    MAC
                        CN7     4(0),5(P(1)),6(P(2)),7(0),8(P(3)),9(P(4)),10(P(5))
                        EMAC

                LITT    MAC
                        CN1     3(P(1)),4(X'42),5(X'F),6(P(2))
                        EMAC

                CBN     MAC
                        CN2     5(P(1)),6(P(2)),7(P(3)),8(X'7F),9(F),10(X'1F)
                        EMAC

                FSN     MAC
                        CN3     4((P(1))/2),5(P(2)),6(P(3)),7(X'7F),8(X'F),9(X'1F)
                        EMAC

                FSON    MAC
                        CN3     4((P(1))/2),5(P(2)),6(P(3)),7(X'7F),8(X'F),9(X'1F)
                        EMAC

                FS1N    MAC
                        CN3     4(((P(1)-X'100)/2)),5(P(2)),6(P(3)),7(X'7F),8(F),9(X'1F)
                        EMAC

                FS2N    MAC
                        CN3     4(((P(1)-X'200)/2)),5(P(2)),6(P(3)),7(X'7F),8(F),9(X'1F)
                        EMAC

                FS3N    MAC
                        CN3     4(((P(1)-X'300)/2)),5(P(2)),6(P(3)),7(X'7F),8(F),9(X'1F)
```

```
                    EMAC

PHRN    MAC
        CN4     5(P(1)),6(P(2)),7(0),8(0),9(X'7F),10(F),11(X'1F)
        EMAC

FLGN    MAC
        CN5     4(0),5(P(1)),6(P(2)),7(X'7F),8(X'F),9(X'1F)
        EMAC

CNILN   MAC
        CN6     4(P(1)),5(P(2)),6(P(3)),7(0),8(P(4)),9(X'7F),10(X'F),
                C11(X'1F)
        EMAC
```

```
BRN     MAC
        CN2     5(P(1)),6(0),7(0),8(X'7F),9(F),10(X'1F)
        EMAC

CALLN   MAC
        CN4     5(P(1)),6(P(2)),7(1),8(0),9(X'7F),10(F),11(X'1F)
        EMAC

RETRVN  MAC
        CN6     4(0),5(0),6(1),7(0),8(0),9(X'7F),10(X'F),11(X'1F)
        EMAC

NDCDEN  MAC
        CN6     4(1),5(X'0F),6(0),7(0),8(0),9(X'7F),10(X'F),11(X'1F)
        EMAC

IDWN    MAC
        CN7     4(0),5(P(1)),6(P(2)),7(P(3)),8(X'7F),9(X'F),10(X'1F)
        EMAC

IDWNV   MAC
        CN7     4(0),5(P(1)),6(P(2)),7(0),8(X'7F),9(X'F),10(X'1F)
        EMAC
```

```
                RST00   ZERO=>M1                 PBR     RST01,1,X'47,0,M1
000                                                                              FF448E09  11 11111 10100010 0100 01 11000 00 1001
                STP00   IR=>W1                  PBR     HLT01,2,X'62,0,W1
001                                                                              D248C409  11 01001 00100100 0110 00 10000 00 1001
                NA03    IR&47=>M1 FS:10-9       FS      NA04,4,6,X'7E,W7,M1
002                                                                              4A46FDE9  01 00101 00100011 011T 11 10111 10 1001
                MP01    0010=>M2                LITT    X'10,M2
003                                                                              001085EA  00 00000 00001000 0100 00 10111 10 1010
                MP02                            PBRV    MP02A,1
004                                                                              D304FFFF  11 01001 10000010 0111 11 11111 11 1111
                PF01    0020=>M2                LITT    X'20,M2
005                                                                              002085EA  00 00000 00010000 0100 00 10111 10 1010
                PF02    M2+1=>M3                PBR     PF03,1,X'17,M2,M3
006                                                                              D2042F4B  11 01001 00000010 0001 01 11101 00 1011
                PAR01   0030=>M2                LITT    X'30,M2
007                                                                              003085EA  00 00000 00011000 0100 00 10111 10 1010
                PAR02                           PBRV    PAR02A,1
008                                                                              D004FFFF  11 01000 00000010 0111 11 11111 11 1111
                RTC101  BR:TRAP=1               CBV     RTC103,TRAP,1
009                                                                              3B71FFFF  00 11101 10111000 1111 11 11111 11 1111
                RTC102                          BRV     RTC104
00A                                                                              3B80FFFF  00 11101 11000000 0111 11 11111 11 1111
                EAU01   BR:TRAP=1               CBV     EAU03,TRAP,1
00B                                                                              3C31FFFF  00 11110 00011000 1111 11 11111 11 1111
                EAU02                           BRV     EAU04
00C                                                                              3E40FFFF  00 11110 00100000 0111 11 11111 11 1111
                INT01   GO TO TRAP OR INT-IO    CALLN   INT10,3
00D                                                                              E00EFFFF  11 10000 00000111 0111 11 11111 11 1111
                SS05    P=>ALU (IF)             PBR     SS06,1,X'14,P,IF
00E                                                                              C6442911  11 00011 00100010 0001 01 00100 01 0001
                CBV00                           PBRV    CBR<01,2
00F                                                                              D008FFFF  11 01000 00000100 0111 11 11111 11 1111
                BYT02   R0=>ALU ALU,Q SR 0=>RAM15 PBR   BYT09,2,2,R0,M2
010                                                                              FA88040A  11 11101 01000100 0000 00 10000 00 1010
                BYT03   R1=>ALU ALU,Q SR 0=>RAM15 PBR   BYT09,2,2,R1,M2
011                                                                              FA88042A  11 11101 01000100 0000 00 10000 10 1010
                BYT04   R2=>ALU ALU,Q SR 0=>RAM15 PBR   BYT09,2,2,R2,M2
012                                                                              FA88044A  11 11101 01000100 0000 00 10001 00 1010
                BYT05   R3=>ALU ALU,Q SR 0=>RAM15 PBR   BYT09,2,2,R3,M2
013                                                                              FA88046A  11 11101 01000100 0000 00 10001 10 1010
```

ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE OP R A F S D
014	BYT06	R4=>ALU ALU,Q SR 0=>RAM15	PBR	BYT09,2,2,R4,W2	FA8804BA	11 11101 01000100 0000 00 10010 00 1010
015	BYT07	R5=>ALU ALU,Q SR 0=>RAM15	PBR	BYT09,2,2,R5,W2	FA8804AA	11 11101 01000100 0000 00 10010 10 1010
016	BYT08	R6=>ALU ALU,Q SR 0=>RAM15	PBR	BYT09,2,2,R6,W2	FA8804CA	11 11101 01000100 0000 00 10011 00 1010
017	BYT24	R7=>ALU ALU,Q SR 0=>RAM15	PBR	BYT09,2,2,R7,W2	FA8804EA	11 11101 01000100 0000 00 10011 10 1010
018	JIF02	R0=>ALU FS:5-3	FS	JIF10-4,1,E,X'14,R0,NOP	5C1E281F	01 01110 00001111 0001 01 00000 01 1111
019	JIF03	R1=>ALU FS:5-3	FS	JIF10-4,1,E,X'14,R1,NOP	5C1E283F	01 01110 00001111 0001 01 00000 11 1111
01A	JIF04	R2=>ALU FS:5-3	FS	JIF10-4,1,E,X'14,R2,NOP	5C1E285F	01 01110 00001111 0001 01 00001 01 1111
01B	JIF05	R3=>ALU FS:5-3	FS	JIF10-4,1,E,X'14,R3,NOP	5C1E287F	01 01110 00001111 0001 01 00001 11 1111
01C	JIF06	R4=>ALU FS:5-3	FS	JIF10-4,1,E,X'14,R4,NOP	5C1E289F	01 01110 00001111 0001 01 00010 01 1111
01D	JIF07	R5=>ALU FS:5-3	FS	JIF10-4,1,E,X'14,R5,NOP	5C1E28BF	01 01110 00001111 0001 01 00010 11 1111
01E	JIF08	R6=>ALU FS:5-3	FS	JIF10-4,1,E,X'14,R6,NOP	5C1E28DF	01 01110 00001111 0001 01 00011 01 1111
01F	JIF09	R7=>ALU FS:5-3	FS	JIF10-4,1,E,X'14,R7,NOP	5C1E28FF	01 01110 00001111 0001 01 00011 11 1111
020	NA04	P+W1=>W1 FS:15-12	FS	INR01-4,6,F,X'2F,P,W1	506F5F09	01 01000 00110111 1010 11 11100 00 1001
021	NA09	IR&W7=>W1 OPND FETCH	PBR	NA10,1,X'7D,W7,W1	CAC4F3E9	11 00101 01100010 0111 11 01111 10 1001
022	NA05	R2+W1=>W1 FS:15-12	FS	INR01-4,6,F,X'2F,R2,W1	506F5E49	01 01000 00110111 1010 11 11001 00 1001
023	NA03	IR&W7=>W1 FS:10-9	FS	NA04,4,6,X'7E,W7,W1	4846FDE9	01 00100 00100011 0111 11 10111 10 1001
024	NA06	R1+W1=>W1 FS:15-12	FS	INR01-4,6,F,X'2F,R1,W1	506F5E29	01 01000 00110111 1010 11 11000 10 1001
025	NA07	IR AND W7=>W1 DF	BR	NA07A,X'7D,W7,W1	1600F3E9	00 01011 00000000 0111 11 01111 10 1001
026	DP06	FS:5	FSOV	DP08,2,2	7222FFFF	01 11001 00010001 0111 11 11111 11 1111
	DP05	IB=>W1 FS:2-0	FS0	SR03,0,7,X'67,0,W1		

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ADR LABEL          COMMENT               MACRO        OPERAND                HEX VALUE              BINARY VALUE
                                                                                      OP                     R  A    F    B  D
027                                                                          7007CE09  01 11000 00000011 1110 01 11000 00 1001
    NA04   P+W1=>W1  OPND FETCH          PBR     NA15,1,X'2E,P,W1
028                                                                          DE445D09  11 01111 00100010 0010 11 10100 00 1001
    JMP02  P+1=>P   INST FETCH           PBR     JMP03,2,X'15,P,P
029                                                                          C0482808  11 00000 00100100 0001 01 01100 00 1000
    NA05   R2+W1=>W1 OPND FETCH          PBR     NA15,1,X'2E,R2,W1
02A                                                                          DE445C49  11 01111 00100010 0010 11 10001 00 1001
    J4H02  W1=>ALU INST FETCH            BR      J4H03,X'14,W1,IF
02B                                                                          19402931  00 01100 10100000 0001 01 00100 11 0001
    NA06   R1+W1=>W1 OPND FETCH          PBR     NA15,1,X'2E,R1,W1
02C                                                                          DE445C29  11 01111 00100010 0010 11 10000 10 1001
02E                            ORG     X'02E
    BT07A   GO TO TRAP-10                CALLN   INT10,3
02E                                                                          E00EFFFF  11 10000 00000111 0111 11 11111 11 1111
    BT07B   P+1=>P BECAUSE TRAP          BR      BT08,X'17,P,P
02F                                                                          28C02F08  00 10101 11100000 0001 01 11100 00 1000
    NA01   07FF=>W1                      LITT    X'7FF,W1
030                                                                          07FF85E9  00 00011 11111111 1100 00 10111 10 1001
    NA02   IR+W1=>W1 OPND FETCH          PBR     NA15,1,X'7D,W1,W1
031                                                                          DE44F829  11 01111 00100010 0111 11 01100 10 1001
    DR30   W3+1=>W3 UPD OVFL             PBR     DR21,2,X'11,W3,W3
032                                                                          C4C8236B  11 00010 01100100 0001 00 01101 10 1011
    SR02   IB=>W1    FS:2-0              FSO     SR03,0,7,X'67,0,W1
033                                                                          7007CE09  01 11000 00000011 1110 01 11000 00 1001
    DR31   W3-1=>W3 UPD OVFL             PBR     DR21,2,X'10,W3,W3
034                                                                          C4C8216B  11 00010 01100100 0001 00 00101 10 1011
035                            ORG     X'36
    DR32   (W3)-=>W3                     PBR     DR21,2,X'13,W3,W3
036                                                                          C4C8276B  11 00010 01100100 0001 00 11101 10 1011
038                            ORG     X'038
    DR33   P+1=>P  INST FETCH            PBR     DR35,1,X'15,P,P
038                                                                          CEC42808  11 00111 01100010 0001 01 01100 00 1000
03A                            ORG     X'03A
    DR34   P+1=>P  INST FETCH            PBR     DR36,1,X'15,P,P
03A                                                                          CCC42808  11 00110 01100010 0001 01 01100 00 1000
03C                            ORG     X'03C
    SRE04  P+W1=>W1 OPND FTCH FS:5-3     FS      SRE08-2,1,E,X'2E,P,W1
03C                                                                          5B1E5D09  01 01100 00001111 0010 11 10100 00 1001
    SRE05  R2+W1=>W1 OPND FTCH FS:5-3    FS      SRE08-2,1,E,X'2E,R2,W1
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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP / R / A / F / B / D)
03D	SRE06	R1+#1=>#1 OPND FTCH FS:5-3	FS	SRE08-2,1,E,X'2E,R1,#1	581E5C49	01 01100 00001111 0010 11 10001 00 1001
03E	SRE07	#1=>ALU OPND FETCH FS:5-3	FS	SRE08-2,1,E,X'14,#1,OF	581E5C29	01 01100 00001111 0010 11 10000 10 1001
03F	JMM01	P=>#2 BR:OSS=1	CB	JMM02,OSS,1,X'14,P,#2	581E2932	01 01100 00001111 0001 01 00100 11 0010
040	JMM07	(OS) #1=>ALU JMOS	FLGS	JMOS,0,0,X'14,#1,OS#	0AC3290A	00 00101 01100001 1001 01 00100 00 1010
041	JMM08	P+1=>SDR	PBR	JM#09,2,X'17,P,SDR	80802933	10 00000 00100000 0001 01 00100 11 0011
042			ORG	X'044	C0C82F1D	11 00000 01100100 0001 01 11100 01 1101
044	INR01	#1=>ALU UPND FETCH	PBR	IN#02,1,X'14,#1,OF	0A842932	11 01101 01000010 0001 01 00100 11 0010
045	STA01	#1=>ALU UPND STORE	PBR	STA02,1,X'14,#1,OS#	E7442933	11 10011 10100010 0001 01 00100 11 0011
046	STB01	#1=>ALU OPND STORE	PBR	STB02,1,X'14,#1,OS#	E8442933	11 10100 00100010 0001 01 00100 11 0011
047	STX01	#1=>ALU OPND STORE	PBR	STX02,1,X'14,#1,OS#	EFC42933	11 10111 11100010 0001 01 00100 11 0011
048	EXEC03	#1=>ALU IF BR:OSS=0	CB	EXEC07,OSS,0,X'14,#1,IF	12C22931	00 01001 01100001 0001 01 00100 11 0001
049	EXEC04	FFFC=>IR	LIIT	X'FFFC,IR	FFFC85F8	11 11111 11111110 0100 00 10111 11 1000
04A	EXEC05	(IF) IR => ALU	CB	EXEC05,NOTST,0,X'67,0,IF	128ECE11	00 01001 01000111 0110 01 11000 01 0001
04B	EXEC07		BR	EXEC08,X'15,P,P	13002308	00 01001 10000000 0001 01 01100 00 1000
04C	EXEC09	DECODE THE EXEC INST	CNILN	1,0,0	A800FFFF	10 10100 00000000 0111 11 11111 11 1111
04E			ORG	X'04E		
04E	NAB11	#1=>ALU (37)	PBR	MUL01A,1,X'14,#1,OF	FBC42932	11 11101 11100010 0001 01 00100 11 0010
04F	NAB12	#1=>ALU OPER FETCH	PBR	EIS33,1,X'14,#1,OF	E8842932	11 10100 01000010 0001 01 00100 11 0010
051	NAB01	07FF=>#1	ORG	X'051		
051	NAB02	IR*#1=>#1 FS:15-12	LIIT	X'7FF,#1	07FF85E9	00 00011 11111111 1100 00 10111 10 1001
			FS	IN#01-4,6,F,X'7E,#1,#1		

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ADR LABEL     COMMENT                  MACRO   OPERAND                      HEX VALUE  BINARY VALUE
                                                                                       OP                        R   A  F     B  D
052                                                                         506FF029   01 01000 00110111 1111 11 10100 10 1001
    IJ08    (IF) W1=>ALU  DJMP         FLGS    DJMP,0,0,X'14,W1,IF
053                                                                         80202931   10 00000 00010000 0001 01 00100 11 0001
    IJ09                               BRN     JMP08A
054                                                                         3440FFFF   00 11010 00100000 0111 11 11111 11 1111
058                           ORG      X'58
    NAB07A  IR => W3                   BR      NAB08,X'62,0,W3
058                                                                         1640C408   00 01011 00100000 0110 00 10000 00 1011
    NAB08   FFFB=>IR                   LITT    X'FFF3,IR
059                                                                         FFF885F8   11 11111 11111101 1100 00 10111 11 1000
    NAB09   GO TO IND. SUBR            CALLN   SBR03,2
05A                                                                         CE4AFFFF   11 00111 00100101 0111 11 11111 11 1111
    NAB10            FS:15-12          FSN     INR01-4,6,F
    NAB10            FS:15-12          FSN     INR01-4,6,F
05B                                                                         506FFFFF   01 01000 00110111 1111 11 11111 11 1111
    DR17             FS:5-3            FSN     DR30-2,1,E
05C                                                                         4C1EFFFF   01 00110 00001111 0111 11 11111 11 1111
    DR18    W2+W3=>W3 UPD OVFL         PBR     DR21,2,X'18,W2,W3
05D                                                                         C4C8314B   11 00010 01100100 0001 10 00101 00 1011
    DR19    W3-W2=>W3 UPD OVFL         PBR     DR21,2,X'28,W2,W3
05E                                                                         C4C8514B   11 00010 01100100 0010 10 00101 00 1011
    DR20    W2=>W3                     PBR     DR21,2,X'14,W2,W3
05F                                                                         C4C8294B   11 00010 01100100 0001 01 00101 00 1011
    JSR02   P+1=>R1                    BR      JMP04,X'17,P,R1
060                                                                         33002-01   00 11001 10000000 0001 01 11100 00 0001
    JSR03   P+1=>R2                    BR      JMP04,X'17,P,R2
061                                                                         33002F02   00 11001 10000000 0001 01 11100 00 0010
    SRE08   MD EOR R0=>W2              PBR     SRE11,1,X'5A,R0,W2
062                                                                         F504B40A   11 11010 10000010 0101 10 10000 00 1010
064                           ORG      X'064
    SRE09   MD EOR R1=>W2              PBR     SRE11,1,X'5A,R1,W2
064                                                                         F504B42A   11 11010 10000010 0101 10 10000 10 1010
    JMM03   FFFC=>IR                   LITT    X'FFFC,IR
065                                                                         FFFC85F8   11 11111 11111110 0100 00 10111 11 1000
    JMM09   IR=>W1    BR:NDIST=1       CB      JMM07,NDIST,1,X'67,0,W1
066                                                                         104FCE09   00 01000 00100111 1110 01 11000 00 1001
    JMM06   W1=>ALU INST FETCH         BR      JMM04,X'14,W1,IF
067                                                                         19802931   00 01100 11000000 0001 01 00100 11 0001
    SRE10   MD EOR R2=>W2              PBR     SRE11,1,X'5A,R2,W2
068                                                                         F504B44A   11 11010 10000010 0101 10 10001 00 1010
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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP R A F S D)
06A		ORG X'06A				
	JIF20	R1=>ALJ FS:3	FS0	JIF10,1,2,X'14,R1,NOP	5D12283F	01 01110 10001001 0001 01 00000 11 1111
06A	JIF21	R5=>ALJ FS:3	FS0	JIF10,1,2,X'14,R5,NOP	5D12288F	01 01110 10001001 0001 01 00010 11 1111
06B	IJ04	M1+P=>M1	BR	IJ08,X'2F,P,M1	14C05F09	00 01010 01100000 0010 11 11100 00 1001
06C	IJ05	M1+R2=>M1	BR	IJ08,X'2F,R2,M1	14C05E49	00 01010 01100000 0010 11 11001 00 1001
06D	IJ06	M1+R1=>M1	BR	IJ08,X'2F,R1,M1	14C05E29	00 01010 01100000 0010 11 11000 10 1001
06E	IJ07	M1=>M1	BR	IJ08,X'14,M1,M1	14C02929	00 01010 01100000 0001 01 00100 10 1001
06F	RTM21	P+1=>P INST FETCH FS:2-0	FS	RTM25-1,0,7,X'15,P,P	6E072808	01 10111 00000011 1001 01 01100 00 1000
070	RTM22	Q+1=>Q JPD OVFL	BR	RTM21,X'21,0,Q	1C004210	00 01110 00000000 0010 00 01000 01 0000
071	RTM23	Q(C)=>Q	BR	RTM21,X'23,0,Q	1C004610	00 01110 00000000 0010 00 11000 01 0000
072	RTM24	J-1=>Q JPD OVFL	BR	RTM21,X'20,0,Q	1C004010	00 01110 00000000 0010 00 00000 01 0000
073	JIF10	BR:OSZ=0	CBV	JIF17,OSZ,0	1DC4FFFF	00 01110 11100010 0111 11 11111 11 1111
074	JIF16	IB=>M1 INST FETCH	BR	JMP03,X'77,0,M1	3340EE09	00 11001 10100000 0111 01 11000 00 1001
075	JIF11	BR:OSZ=0	CBV	JIF16,OSZ,0	1D44FFFF	00 01110 10100010 0111 11 11111 11 1111
076	JIF17	(IF) P+1=>P	PBR	JMP03,2,X'15,P,P	C0482808	11 00000 00100100 0001 01 01100 00 1000
077	JIF12	BR:OSS=0	CBV	JIF19,OSS,0	1EC2FFFF	00 01111 01100001 0111 11 11111 11 1111
078	JIF18	IB=>M1 INST FETCH	BR	JMP03,X'77,0,M1	3340EE09	00 11001 10100000 0111 01 11000 00 1001
079	JIF13	BR:OSS=0	CBV	JIF18,OSS,0	1E42FFFF	00 01111 00100001 0111 11 11111 11 1111
07A	JIF19	P+1=>P INSTR FTCH	PBR	JMP03,2,X'15,P,P	C0482808	11 00000 00100100 0001 01 01100 00 1000
07B	JIF14	BR:OSZ=0	CBV	JMP02,OSZ,0	0A44FFFF	00 00101 00100010 0111 11 11111 11 1111
07C						

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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE OP R A F B D
07D	JIF14A	FS:2	FSDN	JIF20,1,1	5A91FFFF	01 01101 01001000 1111 11 11111 11 1111
07E	JIF15	BR:DSZ=0	CBN	J4P04,DSZ,0	3304FFFF	00 11001 10000010 0111 11 11111 11 1111
07F	JIF15A	FS:2	FSDN	JIF20,1,1	5A91FFFF	01 01101 01001000 1111 11 11111 11 1111
080	RTM01	P+1=>P INST FETCH	PBR	SS03,1,X'15,P,P	C9C42308	11 00100 11100010 0001 01 01100 00 1000
081	RTM02	ZERO=>0 FS:7-6	FS	RTM21,3,3,X'47,0,3	5C338E10	01 01110 00011001 1100 01 11000 01 0000
082	RTM03	R0=>3	BR	RTM21,X'14,R0,0	1C002810	00 01110 00000000 0001 01 00000 01 0000
083	RTM04	R0+1=>0 JPD OVFL	BR	RTM21,X'11,R0,0	1C002210	00 01110 00000000 0001 00 01000 01 0000
084	RTM05	R0(C)=>3	BR	RTM21,X'13,R0,0	1C002610	00 01110 00000000 0001 00 11000 01 0000
085	RTM06	R0-1=>0 JPD OVFL	BR	RTM21,X'10,R0,0	1C002010	00 01110 00000000 0001 00 00000 01 0000
086	RTM07	R1=>3	BR	RTM21,X'14,R1,0	1C002830	00 01110 00000000 0001 01 00000 11 0000
087	RTM08	R1+1=>0 JPD OVFL	BR	RTM21,X'11,R1,0	1C002230	00 01110 00000000 0001 00 01000 11 0000
088	RTM09	R1(C)=>3	BR	RTM21,X'13,R1,0	1C002630	00 01110 00000000 0001 00 11000 11 0000
089	RTM10	R1-1=>0 JPD OVFL	BR	RTM21,X'10,R1,0	1C002030	00 01110 00000000 0001 00 00000 11 0000
08A	RTM11	R2=>3	BR	RTM21,X'14,R2,0	1C002850	00 01110 00000000 0001 01 00001 01 0000
08B	RTM12	R2+1=>0 JPD OVFL	BR	RTM21,X'11,R2,0	1C002250	00 01110 00000000 0001 00 01001 01 0000
08C	RTM13	R2(C)=>3	BR	RTM21,X'13,R2,0	1C002650	00 01110 00000000 0001 00 11001 01 0000
08D	RTM14	R2-1=>0 JPD OVFL	BR	RTM21,X'10,R2,0	1C002050	00 01110 00000000 0001 00 00001 01 0000
08E	RTM15	R1 OR R2=>0 FS:3	FS	RTM17,1,2,X'3C,R1,R2	7D127822	01 11110 10001001 0011 11 00000 10 0010
08F	RTM16	FS:4	FSN	RTM19,2,1	79A1FFFF	01 11100 11010000 1111 11 11111 11 1111
	TSR01	ZERO=>W1 FS:1-0	FS	TSR02,7,C,X'47,0,W1		

ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP / R / A / F / B / D)
090	BYT01	P+1=>P INST FETCH FS:2-0	FS	BYI02,0,7,X'15,P,P	787C8E09	01 11100 00111110 0100 01 11000 00 1001
091	DR01	R0=>W2 FS:2-0	FS	DR09,0,7,X'14,R0,W2	44072B08	01 00010 00000011 1001 01 01100 00 1000
092	DR02	R1=>W2 FS:2-0	FS	DR09,0,7,X'14,R1,W2	6C07280A	01 10110 00000011 1001 01 00000 00 1010
093	DR03	R2=>W2 FS:2-0	FS	DR09,0,7,X'14,R2,W2	6C07282A	01 10110 00000011 1001 01 00000 10 1010
094	DR04	R3=>W2 FS:2-0	FS	DR09,0,7,X'14,R3,W2	6C07284A	01 10110 00000011 1001 01 00001 00 1010
095	DR05	R4=>W2 FS:2-0	FS	DR09,0,7,X'14,R4,W2	6C07286A	01 10110 00000011 1001 01 00001 10 1010
096	DR06	R5=>W2 FS:2-0	FS	DR09,0,7,X'14,R5,W2	6C07288A	01 10110 00000011 1001 01 00010 00 1010
097	DR07	R6=>W2 FS:2-0	FS	DR09,0,7,X'14,R6,W2	6C0728AA	01 10110 00000011 1001 01 00010 10 1010
098	DR08	R7=>W2 FS:2-0	FS	DR09,0,7,X'14,R7,W2	6C0728CA	01 10110 00000011 1001 01 00011 00 1010
099	VST01	(IF) P+1=>P	BR	VSI02,X'15,P,P	6C0728EA	01 10110 00000011 1001 01 00011 10 1010
09A	SR01	P+1=>P INST FETCH	BR	SR02,X'15,P,P	3DC02B08	00 11110 11100000 0001 01 01100 00 1000
09B	DP02	P+1=>P INST FETCH	BR	SR02,X'15,P,P	0CC02B08	00 00110 01100000 0001 01 01100 00 1000
09C	P1000		PBRN	1001,3	0CC02B08	00 00110 01100000 0001 01 01100 00 1000
09D	DP03	P+1=>P INST FETCH FS:4	FS0	DP06,2,1,X'15,P,P	C00CFFFF	11 00000 00000110 0111 11 11111 11 1111
09E					49A12B08	01 00100 11010000 1001 01 01100 00 1000
0A0		ORG X'0A0				
	BT01		BR	BI02,X'62,0,W3	3700C40B	00 11011 10000000 0110 00 10000 00 1011
0A1	SRE01	IB=>W1 BR:DINI5=0	CB	SRE03,DINI5,0,X'67,0,W1	28D6CE09	00 10100 01101011 0110 01 11000 00 1001
0A2	SRE02	W1=>ALU OPND FETCH	CALL	SBR01,2,X'14,W1,0F	C1CA2932	11 00000 11100101 0001 01 00100 11 0010
0A3	SRE03	P+1=>W3 FS:1-0	FS	SRE04,0,3,X'17,P,W3	4F052F0B	01 00111 10000001 1001 01 11100 00 1011
	IJ01	IB=>W1 BR:DINI5=0	CB	IJ03,DINI5,0,X'67,0,W1		

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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP / R / A / F / B / D)
0A4	IJ02	W1=>ALU OPND FETCH	CALL1	SBR01,2,X'14,W1,OF	2996CE09	00 10100 11001011 0110 01 11000 00 1001
0A5	IJ03	P=>W2 FS:1-0	FS	IJ04,0,3,X'14,P,W2	C1CA2932	11 00000 11100101 0001 01 00100 11 0010
0A6	JSR01	ZERO=>IR FS:0	FS	JSR02,0,1,X'47,0,IR	5803290A	01 01101 10000001 1001 01 00100 00 1010
0A7	JIF01	P-1=>W2 FS:2-0	FS	JIF02,0,7,X'16,P,W2	58018E18	01 01100 00000000 1100 01 11000 01 1000
0A8	EAL00	IR=>W2	PBR	EAL01,1,X'62,0,W2	46072D0A	01 00011 00000011 1001 01 10100 00 1010
0A9	IAL01	(IF) P+1=>P	PBR	IAL02,1,X'15,P,P	E444C40A	11 10010 00100010 0110 00 10000 00 1010
0AA	EIS00		PBRV	EIS01,1	DDC42B08	11 01110 11100010 0001 01 01100 00 1000
0AB	SPARE1		PBRV	SS02,1	E644FFFF	11 10011 00100010 0111 11 11111 11 1111
0AC	BT06	W4=>ALU ALU,0 SL=>W4 0=>Q00	CB	BT06,SCEM1,0,X'06,W4,W4	C4C4FFFF	11 00010 01100010 0111 11 11111 11 1111
0AD	BT07	W3=>IR B3:IRAP=1	CB	BT07A,IRAP,1,X'14,W3,IR	2B4A0D8C	00 10101 10100101 0000 01 10110 00 1100
0AE	BT08	P=>W2 FS:4	FS	BT09,2,1,X'14,P,W2	08B12978	00 00101 10111000 1001 01 00101 11 1000
0AF	DR09	R0=>W3 FS:7-6	FS	DR17,3,3,X'14,R0,W3	75A1290A	01 11010 11010000 1001 01 00100 00 1010
0B0	DR10	R1=>W3 FS:7-6	FS	DR17,3,3,X'14,R1,W3	5733280B	01 01011 10011001 1001 01 00000 00 1011
0B1	DR11	R2=>W3 FS:7-6	FS	DR17,3,3,X'14,R2,W3	5733282B	01 01011 10011001 1001 01 00000 10 1011
0B2	DR12	R3=>W3 FS:7-6	FS	DR17,3,3,X'14,R3,W3	5733284B	01 01011 10011001 1001 01 00001 00 1011
0B3	DR13	R4=>W3 FS:7-6	FS	DR17,3,3,X'14,R4,W3	5733286B	01 01011 10011001 1001 01 00001 10 1011
0B4	DR14	R5=>W3 FS:7-6	FS	DR17,3,3,X'14,R5,W3	5733288B	01 01011 10011001 1001 01 00010 00 1011
0B5	DR15	R6=>W3 FS:7-6	FS	DR17,3,3,X'14,R6,W3	573328AB	01 01011 10011001 1001 01 00010 10 1011
0B6	DR16	R7=>W3 FS:7-6	FS	DR17,3,3,X'14,R7,W3	573328CB	01 01011 10011001 1001 01 00011 00 1011
0B7					573328EB	01 01011 10011001 1001 01 00011 10 1011

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ADR LABEL           COMMENT              MACRO            OPERAND           HEX VALUE            BINARY VALUE
                                                                                      OP                        R    A    F    B    D
039                              ORG       X'089
     RIM25  Q=>R0  NORMAL DECODE         NDCDE     X'22,0,R0
039                                                                         AF804400  10 10111 11000000 0010 00 10000 00 0000
     RIM26  Q=>R1  NORMAL DECODE         NDCDE     X'22,0,R1
03A                                                                         AF804401  10 10111 11000000 0010 00 10000 00 0001
     RIM27  Q=>R0                        BR        RIM26,X'22,0,R0
03B                                                                         2E804400  00 10111 01000000 0010 00 10000 00 0000
     RIM28  Q=>R2  NORMAL DECODE         NDCDE     X'22,0,R2
03C                                                                         AF804402  10 10111 11000000 0010 00 10000 00 0010
     RIM29  Q=>R0                        BR        RIM28,X'22,0,R0
03D                                                                         2F004400  00 10111 10000000 0010 00 10000 00 0000
     RIM30  Q=>R1                        BR        RIM28,X'22,0,R1
03E                                                                         2F004401  C0 10111 10000000 0010 00 10000 00 0001
     RIM31  Q=>R0                        PBR       RIM32,1,X'22,0,R0
03F                                                                         CD444400  11 00110 10100010 0010 00 10000 00 0000
     SR03   W1=>ALU OPND FETCH           PBR       SR11,2,X'14,W1,OF
0C0                                                                         CEC82932  11 00111 01100100 0001 01 00100 11 0010
     SR04   R1+W1=>W1 OPND FETCH         PBR       SR11,2,X'2E,R1,W1
0C1                                                                         CEC85C29  11 00111 01100100 0010 11 10000 10 1001
     SR05   R2+W1=>W1 OPND FETCH         PBR       SR11,2,X'2E,R2,W1
0C2                                                                         CEC85C49  11 00111 01100100 0010 11 10001 00 1001
     SR06   R3+W1=>W1 OPND FETCH         PBR       SR11,2,X'2E,R3,W1
0C3                                                                         CEC85C69  11 00111 01100100 0010 11 10001 10 1001
     SR07   R4+W1=>W1 OPND FETCH         PBR       SR11,2,X'2E,R4,W1
0C4                                                                         CEC85[illegible]89  11 00111 01100100 0010 11 10010 00 1001
     SR08   R5+W1=>W1 OPND FETCH         PBR       SR11,2,X'2E,R5,W1
0C5                                                                         CEC85CA9  11 00111 01100100 0010 11 10010 10 1001
     SR09   R6+W1=>W1 OPND FETCH         PBR       SR11,2,X'2E,R6,W1
0C6                                                                         CEC85CC9  11 00111 01100100 0010 11 10011 00 1001
     SR10   R7+W1=>W1 OPND FETCH         PBR       SR11,2,X'2E,R7,W1
0C7                                                                         CEC85CE9  11 00111 01100100 0010 11 10011 10 1001
     DP08                                FS        VST03,0,7,X'67,0,W1
0C8                                                                         7E07CE09  01 11111 00000011 1110 01 11000 00 1001
     HLT00   P+1=>P                      BR        HLT00A,X'17,P,P
0C9                                                                         3A402F08  00 11101 00100000 0001 01 11100 00 1000
     DP07   IB=>W1      FS:2-0           FSO       SR03,0,7,X'67,0,W1
0CA                                                                         7007CE09  01 11000 00000011 1110 01 11000 00 1001
     JMP01              SR:620F TEST=0   CBN       JMP02,T620F,0
0CB                                                                         0A4CFFFF  00 00101 00100110 0111 11 11111 11 1111
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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE
						OP R A F S D
0CC	JMP04	(IF) IB=>W1 DJMP	FLGS	DJMP,0,0,X'77,0,W1	802UEE09	10 00000 00010000 0111 01 11000 00 1001
0CD	JMP05	P=>W2 BR:OSS=0	CB	JMP08A,OSS,0,X'14,P,W2	3442290A	00 11010 00100001 0001 01 00100 00 1010
0CE	JMP06	FFFC=>IR	LITT	X'FFFC,IR	FFFC85F8	11 11111 11111110 0100 00 10111 11 1000
0CF	JMP07	IB=>W1 IF BR:NOTST=0	CB	JMP07,NOTST,0,X'77,0,W1	33CEEE09	00 11001 11100111 0111 01 11000 00 1001
0D0	JMP08		BRV	JMP08A	3440FFFF	00 11010 00100000 0111 11 11111 11 1111
0D1	JMP08A		PBRV	JMP09,1	C384FFFF	11 00001 11000010 0111 11 11111 11 1111
0D2	EXEC01	BR:620F TEST=0	CBV	JMP02,T620F,0	0A4CFFFF	00 00101 00100110 0111 11 11111 11 1111
0D3	EXEC02	IB=>W1 FS:9	FS	JMP01,3,8,X'67,0,W1	5038CE09	01 01000 00011100 0110 01 11000 00 1001
0D4	SHF01		PBRV	SHF02,1	D744FFFF	11 01011 10100010 0111 11 11111 11 1111
0D5	DP01	FS:5	FSOV	DP02,1,2	6712FFFF	01 10011 10001001 0111 11 11111 11 1111
0D6	BI09	R0*W4=>W4 FS:5	FS	BI11,2,2,X'3E,R0,W4	76227C0C	01 11011 00010001 0011 11 10000 00 1100
0D7	BI10	R1*W4=>W4 FS:5	FS	BI11,2,2,X'3E,R1,W4	76227C2C	01 11011 00010001 0011 11 10000 10 1100
0D8	BI11	BR:OSZ=1	CBV	BI14,OSZ,1	36C5FFFF	00 11011 01100010 1111 11 11111 11 1111
0D9	BI13	W1=>ALU INST FETCH	PBR	JMP05,0,X'14,W1,IF	F3402931	11 11001 10100000 0001 01 00100 11 0001
0DA	BI12	BR:OSZ=1	CBV	BI13,OSZ,1	3643FFFF	00 11011 00100010 1111 11 11111 11 1111
0DB	BI14	P+1=>P INST FETCH	PBR	SS02,1,X'15,P,P	C4C42808	11 00010 01100010 0001 01 01100 00 1000
0DC	BI02	W3*000F=>W4	LIT	X'F,X'4D,W3,W4	000F986C	00 00000 00000111 1100 11 01101 10 1100
0DD	BI03	W4(C)=>IR	BR	BI04,X'15,W4,IR	37802798	00 11011 11000000 0001 00 11110 01 1000
0DE	BI04	8000=>J	LITT	X'8000,Q	800085F0	10 00000 00000000 0100 00 10111 11 0000
	BI05	ZERO=>W4	BR	BI05A,X'47,0,W4		

ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP / R / A / F / B / D)
0DF	TSR02	RESET OVERFLOW	CNTLN	0,0,0,X'E	38C08E0C	00 11100 01100000 0100 01 11000 00 1100
0E0	TSR07	(IF) P+1=>P	PBR	SS03,1,X'15,P,P	A00EFFFF	10 10000 00000111 0111 11 11111 11 1111
0E1					C9C42308	11 00100 11100010 0001 01 01100 00 1000
0E3		ORG X'E3				
0E3	BT05A	I8=>M1	BR	BT06,X'67,0,M1	2840CE09	00 10101 10100000 0110 01 11000 00 1001
0E4	TSR03	LIT+1=>ALU UPD OVFL	LIT	X'7FFF,X'40,0,NOP	7FFF801F	01 11111 11111111 1100 00 00000 01 1111
0E5	TSR05		PBR	SS03,1,X'15,P,P	C9C42308	11 00100 11100010 0001 01 01100 00 1000
0E6	RTM19	R0 OR R2=>0	FS	RTM21,3,3,X'3C,R0,R2	5C337802	01 01110 00011001 1011 11 00000 00 0010
0E7	RTM20	R0 OR R1=>0	FS	RTM21,3,3,X'3C,R0,R1	5C337801	01 01110 00011001 1011 11 00000 00 0001
0E8	TSR04	P+1=>P INST FETCH	PBR	SS03,1,X'15,P,P	C9C42308	11 00100 11100010 0001 01 01100 00 1000
0E9	HLT00A	ALLOW MP,PF	CNTLN	0,2,0,0	A100FFFF	10 10000 10000000 0111 11 11111 11 1111
0EA	HLT003	BRANCH TO HLT LOOP	BRV	STP00	0040FFFF	00 00000 00100000 0111 11 11111 11 1111
0EB	IDE01	R3=>ALU OF	PBR	IDE02,3,X'14,R3,OF	EE0C2872	11 10111 00000110 0001 01 00001 11 0010
0EC	SPARE2		PBR	SS03,1,X'15,P,P	C9C42308	11 00100 11100010 0001 01 01100 00 1000
0ED	RTC103	GO TO TRAP, P+1=>P	CALL	INT10,3,X'17,P,P	E00E2F08	11 10000 00000111 0001 01 11100 00 1000
0EE	RTC104	0024=> M2	LITT	X'24,M2	002485EA	00 00000 00010010 0100 00 10111 10 1010
0EF	RTC105		PBRN	INT20,1	D404FFFF	11 01010 00000010 0111 11 11111 11 1111
0F0	EAU03		CALLI	INT10,3,X'17,P,P	E00E2F08	11 10000 00000111 0001 01 11100 00 1000
0F1	EAU04	003E => M2	LITT	X'3E,M2	003E85EA	00 00000 00011111 0100 00 10111 10 1010
0F2	EAU05		PBRN	INT20,1	D404FFFF	11 01010 00000010 0111 11 11111 11 1111
	FP00	GO TO PAGE 9	PBRN	SS01,5		

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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP R A F B D)
0F3	RTM17	FS:7-6	FSN	RTM21,3,3	C014FFFF	11 00000 00001010 0111 11 11111 11 1111
0F4	BCS00	GO TO PAGE 5	PBRN	SS02,9	5C33FFFF	01 01110 00011001 1111 11 11111 11 1111
0F5	RTM18	R0 OR 3=>3	FS	RTM21,3,3,X'24,R0,3	C4E4FFFF	11 00010 01110010 0111 11 11111 11 1111
0F6	VST02	I3=>M1 FS:2-0	FS	VST03,0,7,X'67,0,M1	5C334810	01 01110 00011001 1010 01 00000 01 0000
0F7	VST03	M1=>ALJ	PBR	VST11,2,X'14,M1,NOP	7E07CE09	01 11111 00000011 1110 01 11000 00 1001
0F8	VST04	R1+M1=>M1	PBR	VST11,2,X'2F,R1,M1	CB48293F	11 00101 10100100 0001 01 00100 11 1111
0F9	VST05	R2+M1=>M1	PBR	VST11,2,X'2F,R2,M1	CB485E29	11 00101 10100100 0010 11 11000 10 1001
0FA	VST06	R3+M1=>M1	PBR	VST11,2,X'2F,R3,M1	CB485E49	11 00101 10100100 0010 11 11001 00 1001
0FB	VST07	R4+M1=>M1	PBR	VST11,2,X'2F,R4,M1	CB485E69	11 00101 10100100 0010 11 11001 10 1001
0FC	VST08	R5+M1=>M1	PBR	VST11,2,X'2F,R5,M1	CB485E89	11 00101 10100100 0010 11 11010 00 1001
0FD	VST09	R6+M1=>M1	PBR	VST11,2,X'2F,R6,M1	CB485EA9	11 00101 10100100 0010 11 11010 10 1001
0FE	VST10	R7+M1=>M1	PBR	VST11,2,X'2F,R7,M1	CB485EC9	11 00101 10100100 0010 11 11011 00 1001
0FF	SS01	P+1=>P INST FETCH	BR	SS02,X'15,3,P	CB485EE9	11 00101 10100100 0010 11 11011 10 1001
100	NA16	MD=>R0 NORMAL DECODE	NDCDE	X'64,0,R0	04C02308	00 00010 01100000 0001 01 01100 00 1000
101	NA17	MD=>R1 NORMAL DECODE	NDCDE	X'64,0,R1	AF80C800	10 10111 11000000 0110 01 00000 00 0000
102	NA18	MD=>R2 NORMAL DECODE	NDCDE	X'64,0,R2	AF80C801	10 10111 11000000 0110 01 00000 00 0001
103	EAL12	P-1=>M3 FS:1-0	FS1	EAL13,0,3,X'16,P,M3	AF80C802	10 10111 11000000 0110 01 00000 00 0010
104	SHF42	M1=>R1	BR	SS03,X'14,M1,R1	5C032D0B	01 01110 00000001 1001 01 10100 00 1011
105	EAL17	-4 => IR	LIIT	X'FFFC,IR	09C02921	00 00100 11100000 0001 01 00100 10 0001
106					FFFC85F8	11 11111 11111110 0100 00 10111 11 1000

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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE
						OP R A F B D
	EAL17A		BR	EAL17d,X'14,#1,OF	08002932	00 00100 00000000 0001 01 00100 11 0010
107						
	SS07	DECODE ENBL STEP,DMA	CNTLN	1,9,0,0	AC80FFFF	10 10110 01000000 0111 11 11111 11 1111
108						
	NA19	MD OR R0=>R0 NML DECODE	NDCDE	X'6A,R0,R0	AF800400	10 10111 11000000 0110 10 10000 00 0000
109						
	NA20	MD+R0=>R0 UPD OVFL NML DC	NDCDE	X'68,R0,R0	AF80D000	10 10111 11000000 0110 10 00000 00 0000
10A						
	NA21	MD EOR R0=>R0 NML DECODE	NDCDE	X'5A,R0,R0	AF808400	10 10111 11000000 0101 10 10000 00 0000
10B						
	NA22	R0-MD=>R0 UPD OVFL NML DC	NDCDE	X'78,R0,R0	AF80F000	10 10111 11000000 0111 10 00000 00 0000
10C						
	NA23	MD&R0=>R0 NORMAL DECODE	NDCDE	X'4A,R0,R0	AF809400	10 10111 11000000 0100 10 10000 00 0000
10D						
	JMP09	#1+1=>? IF BR:MPTST=1	CB	JMP11A,MPTST,1,X'15,#1,P	38692828	00 11101 10110100 1001 01 01100 10 1000
10E						
	JMP10	NORMAL DECODE	NDCDEN		AF80FFFF	10 10111 11000000 0111 11 11111 11 1111
10F						
112		ORG X'112				
	IAL04	#1 OR R0=>R0 NML DECODE	NDCDE	X'3F,#1,R0	AF807F20	10 10111 11000000 0011 11 11100 10 0000
112						
	SS02	P+1=>P INST FETCH	BR	SS03,X'15,P,P	09C03808	00 00100 11100000 0001 01 01100 00 1000
113						
	IAL05	#1+R0=>R0 UPD OVF N DECODE	NDCDE	X'18,#1,R0	AF803120	10 10111 11000000 0001 10 00100 10 0000
114						
	SS04	P=>ALU INST FETCH	BR	SS02,X'14,P,1F	04C02911	00 00010 01100000 0001 01 00100 01 0001
115						
	IAL06	#1 EOR R0=>R0 NML DCODE	NDCDE	X'3D,#1,R0	AF807820	10 10111 11000000 0011 11 01100 10 0000
116						
	SS22	P-1=>P	CNTL	1,0,0,1,X'16,P,P	A8012D08	10 10100 00000000 1001 01 10100 00 1000
117						
	IAL07	R0-#1=>R0 UPD OVF N DECODE	NDCDE	X'28,#1,R0	AF805120	10 10111 11000000 0010 10 00100 10 0000
118						
	SS06	P+1=>P INST FETCH	BR	SS07,X'15,P,P	02002808	00 00001 00000000 0001 01 01100 00 1000
119						
	IAL08	#1&R0=>R0 NML DECODE	NDCDE	X'3E,#1,R0	AF807D20	10 10111 11000000 0011 11 10100 10 0000
11A						
	SHF23	Q+1=>Q	BR	SHF24,X'33,0,Q	32C06610	00 11001 01100000 0011 00 11000 01 0000
11B						

ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE
						OP R A F B D
11C	EAL04'	W3+W1=>W1 OPND FETCH	BR	EAL08,X'2E,W3,W1	10005D69	00 01110 10000000 0010 11 10101 10 1001
11D	EAL05	R2+W1=>W1 OPND FETCH	BR	EAL08,X'2E,R2,W1	10005C49	00 01110 10000000 0010 11 10001 00 1001
11E	EAL06	R1+W1=>W1 OPND FETCH	BR	EAL08,X'2E,R1,W1	10005C29	00 01110 10000000 0010 11 10000 10 1001
11F	EAL07	W1=>ALU OPND FETCH	BR	EAL08,X'14,W1,OF	10002932	00 01110 10000000 0001 01 00100 11 0010
120	EAL17B	WD=>W1 BR:NDTST=0	CB	EAL17A,NDTST,0,X'64,0,W1	01CEC809	00 00000 11100111 0110 01 00010 00 1001
	EAL17C	W2=>IR	BR	EAL17D,X'14,W2,IR	08802958	00 00100 01000000 0001 01 00101 01 1000
121	EAL17D	P-1=>W3	FS1	EAL04,0,3,X'16,P,W3	47032008	01 00011 10000001 1001 01 10100 00 1011
122	MUL04A	GO TO TRAP-ID	CALLN	INT10,3	E00EFFFF	11 10000 00000111 0111 11 11111 11 1111
123	MUL04B	P+1=>P BECAUSE TRAP	BR	MUL04,X'17,P,P	3CC02F08	00 11110 01100000 0001 01 11100 00 1000
124	DIV10A	GO TO TRAP P+1=>P	CALLI	T10,3,X'17,P,P	E00E2F08	11 10000 00000111 0001 01 11100 00 1000
125	DIV10B	RETURN TO DIVIDE	BR	DIV11,X'14+W1,W1	36C02929	00 11011 01100000 0001 01 00100 10 1001
126	SS03	DECODE ENBL ALL INTERRUPTS WDDDEN			AF80FFFF	10 10111 11000000 0111 11 11111 11 1111
127	SHF09	R1=>W1,1=>FG1	FLG	1,3,X'14,R1,W1	80072929	10 00000 00000011 1001 01 00000 10 1001
128	SHF10	-W3=>IR	FS1	SHF12,2,6,X'12,W3,IR	6E262578	01 10111 00010011 0001 00 10101 11 1000
129	SHF11	-W3=>IR	FS1	SHF12,2,6,X'12,W3,IR	6E262578	01 10111 00010011 0001 00 10101 11 1000
12A	NA10	IR=>W2	BR	NA11,X'62,0,W2	0BC0C40A	00 00101 11100000 0110 00 10000 00 1010
12B	SHF04A	IR+W1=>W2	BR	SHF04B,X'7E,W1,W2	3000FD2A	00 11000 00000000 0111 11 10100 10 1010
12C	MUL07A	W1=>0 BR:TRAP=1	CB	MUL04A,TRAP,1,X'14,W1,0	0BF12930	00 00100 01111000 1001 01 00100 11 0000
12D	MUL07B		BRV	MUL04	3CC0FFFF	00 11110 01100000 0111 11 11111 11 1111
12E	NA11	FFF8=>IR	LITI	X'FFF8,IR		

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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP / R / A / F / B / D)
12F	NA12	MD=>ALU OF BR:NDIST=0	CB	NA12,NDIST,0,X'64,0,0F	FFF885F8	11 11111 11111101 1100 00 10111 11 1000
130	NA14	M2=>IR	BR	NA15,X'14,M2,IR	0C0EC812	00 00110 00000111 0110 01 00000 01 0010
131	IAL10	M1=>R0 NORMAL DECODE	NDCDE	X'14,M1,R0	1E402958	00 01111 00100000 0001 01 00101 01 1000
132	DR36	Id=>M2	PBR	DR18,0,X'67,0,M2	AF802920	10 10111 11000000 0001 01 00100 10 0000
133	IAL11	M1=>R1 NORMAL DECODE	NDCDE	X'14,M1,R1	D740CE0A	11 01011 10100000 0110 01 11000 00 1010
134	RT432	P-1=>P	BR	RT433,X'16,P,P	AF802921	10 10111 11000000 0001 01 00100 10 0001
135	IAL12	M1=>M2 NORMAL DECODE	NDCDE	X'14,M1,M2	0DC02D08	00 00110 11100000 0001 01 10100 00 1000
136	RT433	P=>ALU INST FETCH	BR	RT434,X'14,P,IF	AF802922	10 10111 11000000 0001 01 00100 10 0010
137	EIS27	M1=>ALU OPND FETCH	PBR	INR02,1,X'14,M1,OF	0E402911	00 00111 00100000 0001 01 00100 01 0001
138	RT434	P+1=>P INST FETCH	PBR	RT430,0,X'15,P,P	DA842932	11 01101 01000010 0001 01 00100 11 0010
139	EIS28	M1=>ALU OPND STORE	PBR	STA02,1,X'14,M1,OSW	EF802908	11 10111 11000000 0001 01 01100 00 1000
13A	DR35	IB=>M3	PBR	DR21,2,X'67,0,M3	E7442933	11 10011 10100010 0001 01 00100 11 0011
13B	EIS29	M1=>ALU OPND STORE	PBR	STB02,1,X'14,M1,OSW	C4C8CE0B	11 00010 01100100 0110 01 11000 00 1011
13C	MUL14	R1=>R1	BR	SS02,X'14,R1,R1	E8442933	11 10100 00100010 0001 01 00100 11 0011
13D	EIS30	M1=>ALU OPND STORE	PBR	STX02,1,X'14,M1,OSW	04C02821	00 00010 01100000 0001 01 00000 10 0001
13E					EFC42933	11 10111 11100010 0001 01 00100 11 0011
140		ORG X'140				
	PAR02A	(IF) M2=>ALU INTP	FLGS	INTP,0,0,X'14,M2,IF		
140	PAR023	DISABLE PARITY	CNTLN	0,0,0,6	B0602951	10 00000 00110000 0001 01 00101 01 0001
141	PAR03	P-1=>M1 BR:IWI=0	CB	PAR06,IWI,0,X'16,P,M1	A006FFFF	10 10000 00000011 0111 11 11111 11 1111
142	PAR04	M1-1=>M1	BR	PAR06,X'16,M1,M1	11AA2009	00 01000 11010101 0001 01 10100 00 1001

ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP R A F B D)
143					11802029	00 01000 11000000 0001 01 10100 10 1001
145		ORG X'145				
145	MP03	(IF) W2=>ALU INTP	FLGS	INTP,0,0,X'14,W2,IF	80602951	10 00000 00110000 0001 01 00101 01 0001
	PAR06	0052=>ALU OPRD STORE WORD	LITT	X'32,DSW	003285F3	00 00000 00011001 0100 00 10111 11 0011
146	PAR07	W1-1=>SDR	BR	INT21,X'16,W1,SDR	14402D3D	00 01010 00100000 0001 01 10100 11 1101
147	PF03	BR:PWRJP=0	CBV	PF04A,PWRUP,0	1286FFFF	00 01001 01011011 0111 11 11111 11 1111
149	PF04	W3+1=>W2 RESET STEP FF	CNTL	0,0,0,X'8,X'17,W3,W2	A0052F6A	10 10000 00000101 1001 01 11101 10 1010
	PF04A	(IF) W2=>ALU INTP	FLGS	INTP,0,0,X'14,W2,IF	80602951	10 00000 00110000 0001 01 00101 01 0001
14A	PF05		BRV	INT21	1440FFFF	00 01010 00100000 0111 11 11111 11 1111
14B	MP02A	(IF) W2=>ALU INTP	FLGS	INTP,0,0,X'14,W2,IF	80602951	10 00000 00110000 0001 01 00101 01 0001
14C	MP02B	DISABLE MEMORY PROT	CNTLN	0,0,0,4	A004FFFF	10 10000 00000010 0111 11 11111 11 1111
14D	MP02C		BRV	PAR03	1080FFFF	00 01000 01000000 0111 11 11111 11 1111
14E						
150		ORG X'150				
150	INT20	(IF) W2=>ALU INTP	FLGS	INTP,0,0,X'14,W2,IF	80602951	10 00000 00110000 0001 01 00101 01 0001
151	INT21	P+1 => P	BR	INT22,X'16,P,P	14802D08	00 01010 01000000 0001 01 10100 00 1000
152	INT22	W2+1=>W2 INST FETCH	BR	SS22,X'15,W2,W2	05C0284A	00 00010 11100000 0001 01 01101 00 1010
159		ORG X'159				
159	SHF19A	GO TO TRAP P+1=>P	CALL	INT10,3,X'17,P,P	E00E2F08	11 10000 00000111 0001 01 11100 00 1000
15A	SHF19B	RETURN TO SHIFT	BR	SHF20,X'12,W4,IR	32402598	00 11001 00100000 0001 00 10110 01 1000
15B	SHF26A	GO TO TRAP P+1=>P	CALL	INT10,3,X'17,P,P	E00E2F08	11 10000 00000111 0001 01 11100 00 1000
15C	SHF26B	RETURN TO SHIFT	BR	SHF27,X'12,W4,IR	33C02598	00 11001 11100000 0001 00 10110 01 1000
	SHF02	LSB COUNT MASK	LITT	X'000F,W1		

ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP / R A F B D)
15D	SHF03	IR+W1=>W3, CLR FLAGS	FLS	0,0,X'7E,W1,W3	000F85E9	00 00000 00000111 1100 00 10111 10 1001
15E	SHF04	W1+1=>W1	CB	SHF04A,OSZ,1,X'17,W1,W1	8000FD2B	10 00000 00000000 0111 11 10100 10 1011
15F	SHF05	IR+W1=>W4	BR	SHF06,X'7E,W1,W4	0B052F29	00 00101 10000010 1001 01 11100 10 1001
160	SHF29A	GO TO TRAP P+1=>P	CALL	INT10,3,X'17,P,P	1EC0FD2C	00 01111 01100000 0111 11 10100 10 1100
161	SHF29B	RETURN TO SHIFT	BR	SHF30,X'12,W4,IR	E00E2F08	11 10000 00000111 0001 01 11100 00 1000
162	SHF32A	GO TO TRAP P+1=>P	CALL	INT10,3,X'17,P,P	29402598	00 10100 10100000 0001 00 10110 01 1000
163	SHF32B	RETURN TO SHIFT	BR	SHF33,X'12,W4,IR	E00E2F08	11 10000 00000111 0001 01 11100 00 1000
164	EAL09	W2=>IR	BR	EAL10,X'14,W2,IR	3E402598	00 11111 00100000 0001 00 10110 01 1000
165	SHF17A	SET FLAG 2	FLGN	2,3	1D402958	00 01110 10100000 0001 01 00101 01 1000
166	SHF17B		BRN	SHF18	800BFFFF	10 00000 00000101 1111 11 11111 11 1111
167	SHF07	0=>J	FSI	SHF09,3,2,X'47,0,J	31C0FFFF	00 11000 11100000 0111 11 11111 11 1111
168	SHF08	R1=>Q	FSI	SHF35A,2,6,X'14,R1,Q	4A32dE10	01 00101 00011001 0100 01 11000 01 0000
169	INR02	0001=>W2	LITT	1,W2	6C2b2B30	01 10110 00010011 0001 01 00000 11 0000
16A	INR03		BR	INR04,X'14,W1,OSW	000185EA	00 00000 00000000 1100 00 10111 10 1010
16B	STA04	P+1=>P IF CB:OSZ=0	CB	SS03,OSZ,0,X'15,P,P	26C02933	00 10011 01100000 0001 01 00100 11 0011
16C	STA05	P-1=>P	BR	SS04,X'16,P,P	09C42B08	00 00100 11100010 0001 01 01100 00 1000
16D	IAL09	P+1=>P INST FTCH FS:5-3	FSI	IAL10-2,1,6,X'15,P,P	05402D08	00 00010 10100000 0001 01 10100 00 1000
16E	IAL03	P+1=>P INST FETCH FS:5-3	FSI	IAL04-2,1,E,X'15,P,P	4C162d08	01 00110 00001011 0001 01 01100 00 1000
16F	EAL13	W3+W1=>W1 OPND FETCH	BR	EAL18,X'2E,W3,W1	441E2d08	01 00010 00001111 0001 01 01100 00 1000
170					39805D69	00 11100 11000000 0010 11 10101 10 1001

ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP / R A F B D)
	EAL14	R2+W1=>W1 OPND FETCH	BR	EAL18,X'2E,R2,W1	39805C49	00 11100 11000000 0010 11 10001 00 1001
171	EAL15	R1+W1=>W1 OPND FETCH	BR	EAL18,X'2E,R1,W1	39809C29	00 11100 11000000 0010 11 10000 10 1001
172	EAL16	W1=>ALU OPND FETCH	BR	EAL18,X'14,W1,0F	39802932	00 11100 11000000 0001 01 00100 11 0010
173	EAL09	W2=>ALU SL=>W2	BR	EAL09,4,W2,W2	1980094A	00 01100 10100000 0000 01 00101 00 1010
174	EAL10	P+1=>P INST FETCH FS:7-4	FS1	NA16-1,2,F,X'15,P,P	402F2808	01 00000 00010111 1001 01 01100 00 1000
175	MUL02A	W0=>W1	BR	MUL06,X'64,0,W1	2800C809	00 10101 10000000 0110 01 00000 00 1001
176	IAL02	18=>W1 FS:6	FS1	IAL09,3,1,X'67,0,W1	5881CE09	01 01101 11011000 1110 01 11000 00 1001
177	EIS14	W1+1=>SDR UPD OVFL	PBR	SS02,1,X'11,W1,SDR	C4C4233D	11 00010 01100010 0001 00 01100 11 1101
178	NA15	P+1=>P IF FS:15-12	FS1	NA16-1,6,F,X'15,P,P	406F2808	01 00000 00110111 1001 01 01100 00 1000
179	EIS15	R0=>SDR	PBR	SS02,1,X'14,R0,SDR	C4C42810	11 00010 01100010 0001 01 00000 01 1101
17A	SHF06	R0=>W1	FS1	SHF07,4,1,X'14,R0,W1	5A412809	01 01101 00100000 1001 01 00000 00 1001
17B	EIS16	R1=>SDR	PBR	SS02,1,X'14,R1,SDR	C4C4283D	11 00010 01100010 0001 01 00000 11 1101
17C						
17E		ORG X'17E				
	EIS17	R2=>SDR	PBR	SS02,1,X'14,R2,SDR	C4C4285D	11 00010 01100010 0001 01 00001 01 1101
17E						
180		ORG X'180				
	EIS12	18=>W1 FS:6	FS1	EIS13,3,1,X'67,0,W1	6331CE09	01 10001 10011000 1110 01 11000 00 1001
180	EIS02	18=>W1 BR:DIN15=1	CB	EIS04,DIN15,1,X'67,0,W1	20D7CE09	00 10000 01101011 1110 01 11000 00 1001
181	EIS21	P-1=>W3 FS:1-0	FS1	EIS22,0,3,X'16,P,W3	61032D0B	01 10000 10000001 1001 01 10100 00 1011
182	EIS04	P-1=>W3 FS:7	FS1	EIS07,3,2,X'16,P,W3	66322D0B	01 10011 00011001 0001 01 10100 00 1011
183	EIS22	W3+W1=>W1 FS:6	FS1	EIS26,3,1,X'2F,W3,W1	65B15F69	01 10010 11011000 1010 11 11101 10 1001
184	EIS23	R2+W1=>W1 FS:6	FS1	EIS26,3,1,X'2F,R2,W1		

ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP R A B D)
185	EIS24	R1+M1=>M1 FS:6	FS1	EIS26,3,1,X'2F,R1,M1	65815E49	01 10010 11011000 1010 11 11001 00 1001
186	EIS25	M1=>M1 FS:6	FS1	EIS26,3,1,X'14,M1,M1	65815E29	01 10010 11011000 1010 11 11000 10 1001
187	EIS08	M3+M1=>M1 OPND FETCH	BR	EIS06,X'2E,M3,M1	65812929	01 10010 11011000 1001 01 00100 10 1001
188	EIS09	R2+M1=>M1 OPND FETCH	BR	EIS06,X'2E,R2,M1	23805969	00 10001 11000000 0010 11 10101 10 1001
189	EIS10	R1+M1=>M1 OPND FETCH	BR	EIS06,X'2E,R1,M1	23805C49	00 10001 11000000 0010 11 10001 00 1001
18A	EIS11	M1=>ALU OPND FETCH	BR	EIS06,X'14,M1,0F	23805C29	00 10001 11000000 0010 11 10000 10 1001
18B	EIS13	P-1=>ALU OPND ST FS:4-3	FS1	EIS14,1,6,X'16,P,OSW	23802932	00 10001 11000000 0001 01 00100 11 0010
18C	EIS19	M1=>M1 FS:3	FS1	EIS19,1,2,X'14,M1,M1	5E162D13	01 01111 00001011 0001 01 10100 01 0011
18D	EIS06	IR=>M3	CALLI	38802,2,X'62,0,M3	64122929	01 10010 00001001 0001 01 00100 10 1001
18E	EIS34	FS:7	FS1N	EIS35,3,2	CE0AC408	11 00111 00000101 0110 00 10000 00 1011
18F	EIS19	=>M3	BR	MUL16,X'47,0,M3	6732FFFF	01 10011 10011001 0111 11 11111 11 1111
190	EAL01	P+1=>P INST FETCH	BR	EAL02,X'15,P,P	2A408E08	00 10101 00100000 0100 01 11000 00 1011
191	EIS20	ZERO=>Q BR:OSS=1	CB	DIV02,OSS,1,X'47,0,Q	358(2308	00 11010 11000000 0001 01 01100 00 1000
192	DIV01	R1=>ALU SL=>M3 0=>FLAG1	FLG	1,1,4,R1,M3	34838E10	00 11010 01000001 1100 01 11000 01 0000
193	DIV03	R0=>M2	PBR	DIV05,1,X'14,R0,M2	80050826	10 00000 00000010 1000 01 00000 10 1011
194	EAL11	FS:7	FS1N	EAL12,3,2	F604280A	11 11011 00000010 0001 01 00000 00 1010
195	EIS26	FS:4-3	FS1N	EIS27,1,6	4132FFFF	01 00000 10011001 0111 11 11111 11 1111
196	EIS31	M1=>ALU OPND FETCH FS:3	FS1	EIS32,1,2,X'14,M1,0F	4E16FFFF	01 00111 00001011 0111 11 11111 11 1111
197	EIS07	FS:1-0	FS1N	EIS08,0,3	68122932	01 10100 00001001 0001 01 00100 11 0010
198					6203FFFF	01 10001 00000001 1111 11 11111 11 1111

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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP R A F B D)
	EIS01	P+1=>P INST FETCH FS:2	FSI	EIS12,1,1,X'15,P,P	60112808	01 10000 00001000 1001 01 01100 00 1000
199	EIS05	M1=>ALU OPND FETCH	BR	EIS06,X'14,M1,OF	23802932	00 10001 11000000 0001 01 00100 11 0010
19A	INR04	M3+M2=>SDR UPD OVFL	BR	STA03,X'68,M2,SDR	27C00150	00 10011 11100000 0110 10 00101 01 1101
19B	EIS55	FS:6	FSIN	EIS26,3,1	6581FFFF	01 10010 11011000 1111 11 11111 11 1111
19C	STA02	R0=>SDR	BR	STA03,X'14,R0,SDR	27C02810	00 10011 11100000 0001 01 00000 01 1101
19D	EIS35		FSI	EIS22,0,5,X'16,P,M5	61032D08	01 10000 10300001 1001 01 10100 00 1011
19E	STA03	M1-P=>M1	BR	STA04,X'20,P,M1	18005809	00 01101 10000000 0010 11 01100 00 1001
19F	EIS32		BRN	MUL01A	3BC0FFFF	00 11101 11100000 0111 11 11111 11 1111
1A0	STA02	R1=>SDR	BR	STA03,X'14,R1,SDR	27C02930	00 10011 11100000 0001 01 00000 11 1101
1A1	EIS33	M3=>M1	BR	EIS20,X'64,0,M1	2480C809	00 10010 01300000 0110 01 00000 00 1001
1A2	SHF143	RIGHT ARITH DOUBLE	CB	SHF143,SCE41,0,X'00,M1,M1	28CA0129	00 10100 01100101 0000 00 00100 10 1001
1A3	SHF29	-M4=>IR BR:IRAP=1	CB	SHF29A,IRAP,1,X'12,M4,IR	1871E598	00 01100 00111000 1001 00 10110 01 1000
1A4	SHF50	0=>M4	CB	SHF143,OSZ,0,X'47,0,M4	28C4BE0C	00 10100 01100010 0100 01 11000 00 1100
1A5	SHF31		CBN	SHF40,FLG3,0	3EE6FFFF	00 11111 01110011 0111 11 11111 11 1111
1A6	SHF43	RIGHT LOG DOUBLE	BR	SHF44,X'02,M2,M2	34400540	00 11010 00100000 0000 00 10101 00 1010
1A7						
1A9		ORG X'1A9				
	MUL16	X'FFF1=>IR,	LIIT	X'FFF1,IR	FFF185F8	11 11111 11111000 1100 00 10111 11 1000
1A9	MUL17	R1 XOR LIT=>ALU	LIT	X'8000,X'4E,R1,NOP	80009C3F	10 00000 00000000 0100 11 10000 11 1111
1AA	MUL18	BR:JSZ=0,M1=>J	CB	MUL07A,OSZ,0,X'14,M1,0	0B442930	00 00101 10100010 0001 01 00100 11 0000
1AB	MUL06	8000 EOR M1=>NOP	LIT	X'8000,X'4E,M1,NOP	80009C3F	10 00000 00000000 0100 11 10100 11 1111
1AC						

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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP R A F B D)
	MUL07	R0=>ALJ BR:OSZ=0	CB	MUL07A,OSZ,0,X'14,R0,NOP		
1AD					0B44281F	00 00101 10100010 0001 01 00000 01 1111
	MUL08	BR:OSS=1	CBN	MUL07A,OSS,1		
1AE					0B43FFFF	00 00101 10100001 1111 11 11111 11 1111
	MUL09		PBRN	IS803,0		
1AF					F900FFFF	11 11100 10000000 0111 11 11111 11 1111
	SHF35A	LEFT LOG DOUBLE	FLS	3,3,X'06,#2,#2		
1B0					800F004A	10 00000 00000111 1000 01 10101 00 1010
	SHF35B		BR	SHF12,X'12,#3,IR		
1B1					2E002578	00 10111 00000000 0001 00 10101 11 1000
	SHF36A		FLSN	3,3		
1B2					800FFFFF	10 00000 00000111 1111 11 11111 11 1111
	SHF36B		BR	SHF25,X'12,#3,IR		
1B3					33402578	00 11001 10100000 0001 00 10101 11 1000
	SHF37A	LEFT LOG DOUBLE	FLS	3,3,X'06,#2,#2		
1B4					800F004A	10 00000 00000111 1000 01 10101 00 1010
	SHF37B		BR	SHF14B,X'12,#3,IR		
1B5					28C02578	00 10100 01100000 0001 00 10101 11 1000
	SHF38A		FLSN	3,3		
1B6					800FFFFF	10 00000 00000111 1111 11 11111 11 1111
	SHF38B		BR	SHF15B,X'12,#3,IR		
1B7					3DC02578	00 11110 11100000 0001 00 10101 11 1000
	SHF12	LEFT LOGICAL DOUBLE	BR	SHF16,X'06,#1,#1		
1B8					31800029	00 11000 11000000 0000 01 10100 10 1001
	MUL15A	P+1=>P (IF)	BR	MUL15B,X'15,P,P		
1B9					2F402308	00 10111 10100000 0001 01 01100 00 1000
	SHF13	#1=>Q	BR	SHF25,X'14,#1,Q		
1BA					33402930	00 11001 10100000 0001 01 00100 11 0000
	MUL15	R0=>R0	BR	MUL15A,X'14,R0,R0		
1BB					2E402800	00 10111 00100000 0001 01 00000 00 0000
	SHF14A		BRN	SHF14B		
1BC					28C0FFFF	00 10100 01100000 0111 11 11111 11 1111
	MUL15B	3=>R1 DECODE	NDCDE	X'22,0,R1		
1BD					AF804401	10 10111 11000000 0010 00 10000 00 0001
	SHF15A		BRN	SHF15B		
1BE					3DC0FFFF	00 11110 11100000 0111 11 11111 11 1111
	STX02	R2=>SDR	BR	STA03,X'14,R2,SDR		
1BF					27C0285D	00 10011 11100000 0001 01 00001 01 1101
	SHF04B	#3+1=>#4	CB	SS02,OSZ,1,X'17,#3,#4		

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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP R A F B D)
1C0	SHF04C	#2-1=>#3	BR	SHF06,X'16,#2,#3	04C52F6C	00 00010 01100010 1001 01 11101 10 1100
1C1	DIV16	#2=>ALU SRD NOT=>R0	BR	DIV17,1,#2,R0	1EC02048	00 01111 01100000 0001 01 10101 00 1011
1C2	DIV17	#4+R0=>R0 BR:FLAG2=1	CB	DIV19,FLG2,1,X'2F,#4,R0	30C00340	00 11000 01100000 0000 00 01101 00 0000
1C3	DIV20	BR:FLG1=1 R0=>R0	CB	DIV21,FLG1,1,X'14,R0,R0	39255F80	00 11100 10010010 1010 11 11110 00 0000
1C4	DIV22	P+1=>P INST FETCH	BR	SS03,X'15,2,P	39632800	00 11100 10110001 1001 01 00000 00 0000
1C5	SHF16		CBN	SHF17A,OSS,1	09C02808	00 00100 11100000 0001 01 01100 00 1000
1C6	SHF18	LEFT LOG DOUBLE	CB	SHF18,SCEM1,0,X'06,#1,#1	1983FFFF	00 01100 11000001 1111 11 11111 11 1111
1C7	SHF19	-#4=>IR BR:TRAP=1	CB	SHF19A,TRAP,1,X'12,#4,IR	31CA0029	00 11000 11100101 0000 01 10100 10 1001
1C8	SHF20	0=>#4	CB	SHF18,OSZ,0,X'47,0,#4	16712598	00 01011 00111000 1001 00 10110 01 1000
1C9	SHF21		CBN	SHF23,FLG2T1	31C48E0C	00 11000 11100010 0100 01 11000 00 1100
1CA	SHF24	RIGHT ROT DOUBLE	CB	SHF43,FLG3,1,X'01,#1,#1	06E5FFFF	00 00011 01110010 1111 11 11111 11 1111
1CB	SHF39		BRN	SHF40	29E70329	00 10100 11110011 1000 00 01100 10 1001
1CC	SHF25	LEFT ROT DOUBLE	CB	SHF25,SCEM1,0,X'05,#1,#1	3EC0FFFF	00 11111 01100000 0111 11 11111 11 1111
1CD	SHF26	-#4=>IR BR:TRAP=1	CB	SHF26A,TRAP,1,X'12,#4,IR	334A0329	00 11001 10100101 0000 01 01100 10 1001
1CE	SHF27	0=>#4	CB	SHF25,OSZ,0,X'47,0,#4	16F12598	00 01011 01111000 1001 00 10110 01 1000
1CF	SHF28		CBN	SHF40,FLG3,0	33448E0C	00 11001 10100010 0100 01 11000 00 1100
1D0	SHF44	3=>R1	BR	SHF40,X'22,0,R1	3EE6FFFF	00 11111 01110011 0111 11 11111 11 1111
1D1	DIV02	R1=>ALU SL=>#3 1=>FLAG1	FLG	1,3,4,R1,#3	3EC04401	00 11111 01100000 0010 00 10000 00 0001
1D2	DIV04	#1(C)+1=>#1	BR	DIV03,X'12,#1,#1	80070828	10 00000 00000011 1000 01 00000 10 1011
1D3					25002529	00 10010 10000000 0001 00 10100 10 1001

ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE
						OP R A F B D
1D4	SRE11	P=>W2 BR:OSZ=0	CB	SS01,OSZ,0,X'14,P,W2	0004290A	00 00000 00000010 0001 01 00100 00 1010
1D5	SRE12	W3+1=>W1	PBR	J9909,2,X'17,W3,W1	C0C82F69	11 00000 01100100 0001 01 11101 10 1001
1D6	EAL02	18=>W1 BR:DIN15=1	CB	EAL11,DIN15,1,X'07,0,W1	2557CE09	00 10010 10101011 1110 01 11000 00 1001
1D7	EAL03	P-1=>W3 FS:1-0	FS1	EAL04,0,3,X'16,P,W3	47032D0B	01 00011 10000001 1001 01 10100 00 1011
1D8	DIV05	W1=>W4 BR:OSS=1	CB	DIV07,OSS,1,X'14,W1,W4	3803292C	00 11100 00000001 1001 01 00100 10 1100
1D9	DIV06	W3=>J 0=>FLAG2	FLG	2,1,X'14,W3,0	80092970	10 00000 00000100 1001 01 00101 11 0000
1DA	DIV10	W2-W1=>W1 BR:TRAP=1	CB	DIV10A,TRAP,1,X'2A,W2,W1	09715549	00 00100 10111000 1010 10 10101 00 1001
1DB	DIV11	BR:OSS=0	CBN	WJL09,OSS,0	2BC2FFFF	00 10101 11100001 0111 11 11111 11 1111
1DC	DIV12	00F0=>1R	LIIT	X'F0,1R	00F085F8	00 00000 01111000 0100 00 10111 11 1000
1DD	DIV13	W2(A)W4=>W2 DIVIDE	CB	DIV13,SCEM1,0,F,W4,W2	374A1F8A	00 11011 10100101 0000 11 11110 00 1010
1DE	DIV14	Q=>R1 BR:OSS=0	CB	DIV18,OSS,0,X'22,0,R1	38C24401	00 11100 01100001 0010 00 10000 00 0001
1DF	DIV15	1R+1=>Q	BR	DIV16,X'63,0,Q	3080C610	00 11000 01000000 0110 00 11000 01 0000
1E0	DIV07	W3(C)+1=>3 1=>FLAG2	FLG	2,3,X'12,W3,0	80082570	10 00000 00000101 1001 00 10101 11 0000
1E1	DIV08	W2(C)=>W2 BR:OSC=0	CB	DIV10,OSC,0,X'13,W2,W2	3086274A	00 11011 01000011 0001 00 11101 00 1010
1E2	DIV09	W2+1=>W2	BR	DIV10,X'17,W2,W2	36802F4A	00 11011 01000000 0001 01 11101 00 1010
1E3	DIV18	W2=>ALU SRD LOG=>R0 BIF2=0	CB	DIV20,FLG2,0,2,W2,R0	31240540	00 11000 10010010 0000 00 10101 00 0000
1E4	DIV19	R0(C)+1=>R0 BR:FLG1=1	CB	DIV22,FLG1,1,X'12,R0,R0	31632400	00 11000 10110001 1001 00 10000 00 0000
1E5	DIV21	R1(C)+1=>R1	BR	DIV22,X'12,R1,R1	31402421	00 11000 10100000 0001 00 10000 10 0001
1E6	EAL18	FFFC=>1R	LIIT	X'FFFC,1R	FFFC85F8	11 11111 11111110 0100 00 10111 11 1000
	EAL19	W0=>ALU OPND FTCH BR:NDTS=0	CB	EAL19,NDTST,0,X'64,0,0F		

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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP R A F B D)
1E7	EAL20	#2=>IR	BR	EAL08,X'14,#2,IR	39CEC812	00 11100 11100111 0110 01 00000 01 0010
1E8	DP26	#1+1=>#1 BR:OSZ=0	CB	STA03,OSZ,0,X'17,#1,#1	1D002458	00 01110 10000000 0001 01 00101 01 1000
1E9	DP27	P-1=>P	BR	SS04,X'16,P,P	27C42F29	00 10011 11100010 0001 01 11100 10 1001
1EA	SS08	P+1=>P INST FETCH	BR	SS09,X'15,P,P	05402D08	00 00010 10100000 0001 01 10100 00 1000
1EB	SS09	DECODE, NO INTERRUPTS	CNTLN	1,0,0,0	3B002B08	00 11101 10000000 0001 01 01100 00 1000
1EC	JMP11A	#2=>#1	CALLI	MPT01,3,X'14,#2,#1	A800FFFF	10 10100 00000000 0111 11 11111 11 1111
1ED	JMP11		BRN	MP03	EACE2949	11 10101 01100111 0001 01 00101 00 1001
1EE	MUL01A	X'FFF1=>IR	LIIT	X'FFF1,IR	1140FFFF	00 01000 10100000 0111 11 11111 11 1111
1EF	MUL01	R1 EOR LIT=>ALU	LIT	X'8000,X'4E,R1,NOP	FFF185F8	11 11111 11111000 1100 00 10111 11 1000
1F0	MUL02	BR:OSZ=1 ZERO=>#3	CB	MUL02A,OSZ,1,X'47,0,#3	80009C3F	10 00000 00000000 0100 11 10000 11 1111
1F1	MUL03	MD=>Q BR:TRAP=1	CB	MUL04A,TRAP,1,X'64,0,Q	10858E0B	00 01110 11000010 1100 01 11000 00 1011
1F2	MUL04	#1=>ALU SRD LOG=>#1	BR	MUL05,X'2,#1,#1	08F1CB10	00 00100 01111000 1110 01 00000 01 0000
1F3	MUL05		CB	MUL05,SCEM1,0,B,R1,R0	3D000529	00 11110 10000000 0000 00 10100 10 1001
1F4	MUL10	#3,Q SRD=> #3,Q	CB	MUL15,UBOON,1,X'02,#3,#3	3D0A1620	00 11110 10000101 0000 10 11000 10 0000
1F5	MUL11	R0-R1=>R0	BR	MUL15A,X'2D,R1,R0	2ED90568	00 10111 01101100 1000 00 10101 10 1011
1F6	SHF153	RIGHT LOG DOUBLE	CB	SHF153,SCEM1,0,X'02,#1,#1	2E405A20	00 10111 00100000 0010 11 01000 10 0000
1F7	SHF32	-#4=>IR BR:TRAP=1	CB	SHF324,TRAP,1,X'12,#4,IR	3DCA0529	00 11110 11100101 0000 00 10100 10 1001
1F8	SHF33	0=>#4	CB	SHF153,OSZ,0,X'47,0,#4	18F12598	00 01100 01111000 1001 00 10110 01 1000
1F9	SHF34		CBN	SHF44,FLG3,1	3DC48E0C	00 11110 11100010 0100 01 11000 00 1100
1FA					3467FFFF	00 11010 00110011 1111 11 11111 11 1111

ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE
						OP R A F B D
	SHF40	P+1=>P,IF	CB	SHF42,FLG1,1,X'15,P,P	01652808	00 00000 10110001 1001 01 01100 00 1000
1FB						
	SHF41	#1=>R0	BR	SS03,X'14,#1,R0	09C02920	00 00100 11100000 0001 01 00100 10 0000
1FC						
	RST01	#1+1=>IR CALL TTC	CALL	TTC01,3,X'17,#1,IR	D68E2F38	11 01011 01000111 0001 01 11100 11 1000
1FD						
	RST02	RESET OVERFLOW	CNTLN	0,0,0,X'E	A00EFFFF	10 10000 00000111 0111 11 11111 11 1111
1FE						
	RST03		PBRN	HLT02,2	D288FFFF	11 01001 01000100 0111 11 11111 11 1111
1FF						
	SR17	R0=>#3 FS:6-5	FS2	SR25,2,6,X'14,R0,#3	48262808	01 00100 00010011 0001 01 00000 00 1011
200						
	JMP03	I8=>ALU I8 REF	PBR	SS02,1,X'67,0,NOP	C4C4CE1F	11 00010 01100010 0110 01 11000 01 1111
201						
	SR18	R1=>#3 FS:6-5	FS2	SR25,2,6,X'14,R1,#3	48262828	01 00100 00010011 0001 01 00000 10 1011
202						
	JMM09	#1+1=>#1 INST FETCH	BR	JMM10,X'15,#1,#1	01402829	00 00000 10100000 0001 01 01100 10 1001
203						
	SR19	R2=>#3 FS:6-5	FS2	SR25,2,6,X'14,R2,#3	48262848	01 00100 00010011 0001 01 00001 00 1011
204						
	JMM10	WAIT FOR MP	PBRN	JMP084,0	F440FFFF	11 11010 00100000 0111 11 11111 11 1111
205						
	SR20	R3=>#3 FS:6-5	FS2	SR25,2,6,X'14,R3,#3	48262868	01 00100 00010011 0001 01 00001 10 1011
206						
	SBR01	IR=>#3	BR	SBR02,X'62,0,#3	0E00C408	00 00111 00000000 0110 00 10000 00 1011
207						
	SR21	R4=>#3 FS:6-5	FS2	SR25,2,6,X'14,R4,#3	48262888	01 00100 00010011 0001 01 00010 00 1011
209						
	SBR05	#3=>IR RETURN	REIRN	X'14,#3,IR	A0402978	10 10000 00100000 0001 01 00101 11 1000
209						
	SR22	R5=>#3 FS:6-5	FS2	SR25,2,6,X'14,R5,#3	482628A8	01 00100 00010011 0001 01 00010 10 1011
20A						
	BYT11	MD+#2=>#2	BR	BYT13,X'7A,#2,#2	03C0F54A	00 00001 11100000 0111 10 10101 00 1010
20B						
	SR23	R6=>#3 FS:6-5	FS2	SR25,2,6,X'14,R6,#3	482628C8	01 00100 00010011 0001 01 00011 00 1011
20C						
	BYT12	#1+#2=>#2	BR	BYT13,X'2F,#1,#2	03C05F2A	00 00001 11100000 0010 11 11100 10 1010
20D						
	SR24	R7=>#3 FS:6-5	FS2	SR25,2,6,X'14,R7,#3		

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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP / R / A / F / B / D)
20E	BYT13	W=>ALU FS:3	FS2	BYT14,0,8,X'22,0,NOP	482628E8	01 00100 00010011 0001 01 00011 10 1011
20F	DP16	FS:6	FS2N	DP17,3,1	7808441F	01 11100 00000100 0010 00 10000 01 1111
210	BYT23	(OSRB) W2=>ALU	BR	BYT28,X'14,W2,OSRB	7F31FFFF	01 11111 10011000 1111 11 11111 11 1111
211	DP21	W1=>ALU OPND STORE	BR	DP22,X'14,W1,OSW	37402954	00 11011 10100000 0001 01 00101 01 0100
212	DR21	P+1=>P INST FETCH FS:2-0	FS2	DR22,0,7,X'15,P,P	3D802933	00 11110 11000000 0001 01 00100 11 0011
213	DP28	W3+W5=>W5	BR	DP29,X'2F,W3,W5	4C072808	01 00110 00000011 1001 01 01100 00 1000
214	SR15	W3 SHFT RT 0 => W6	FS2	SR16,4,1,2,W3,W6	38C05F6D	00 11100 01100000 0010 11 11101 10 1101
215	DP33	W5(C)=>W5	BR	DP34,X'13,W5,W5	4A41056E	01 00101 00100000 1000 00 10101 10 1110
216	SR29	W3=>SDR	PBR	STA03,1,X'14,W3,SDR	3C0027AD	00 11110 00000000 0001 00 11110 10 1101
217	DP40	W3+W5=>W5	BR	DP41,X'3E,W3,W5	E7C4297D	11 10011 11100010 0001 01 00101 11 1101
218	SR30	P+1=>P INST FETCH FS:4-2	FS2	DR22,1,7,X'15,P,P	39C07D6D	00 11100 11100000 0011 11 10101 10 1101
219	DP42	W3 OR W5=>W5	BR	DP43,X'3F,W3,W5	4C172808	01 00110 00001011 1001 01 01100 00 1000
21A	DP10	WD=>W4	BR	DP11,X'64,0,W4	3E807F6D	00 11111 01000000 0011 11 11101 10 1101
21B	DP44	W3 EOR W5=>W5	BR	DP45,X'3D,W3,W5	0740C80C	00 00011 10100000 0110 01 00000 00 1100
21C	DP11	WD=>W5 FS:6	FS2	DP12,3,1,X'64,0,W5	3EC0796D	00 11111 01100000 0011 11 01101 10 1101
21D	SPARE3		NOOPEN		4AB1C80D	01 00101 01011000 1110 01 00000 00 1101
21E	DP14	R1=>W3 FS:5-3	FS2	DP16,1,E,X'14,R1,W3	AF80FFFF	10 10111 11000000 0111 11 11111 11 1111
21F	SR25	WD=>W3	BR	SR30,X'64,0,W3	441E282B	01 00010 00001111 0001 01 00000 10 1011
220	DP15	R5=>W3 FS:5-3	FS2	DP16,1,E,X'14,R5,W3	0640C80B	00 00011 00100000 0110 01 00000 00 1011
221					441E28AB	01 00010 00001111 0001 01 00010 10 1011

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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP R A F B D)
222	SR26	M1=>ALU OPND STORE	BR	SR29,X'14,M1,OSW	05C02933	00 00010 11100000 0001 01 00100 11 0011
223	ABL16	M1=>ALU OF	BR	ABL17,X'14,M1,OF	09C02932	00 00100 11100000 0001 01 00100 11 0010
224	SR27	M0+M3=>M3 UPD OVFL	BR	SR30,X'68,M3,M3	0640D16B	00 00011 00100000 0110 10 00101 10 1011
225	DP18	M5=>R1	PBR	SS02,1,X'14,M5,R1	C4C429A1	11 00010 01100010 0001 01 00110 10 0001
226	SR28	M3-M0=>M3 UPD OVFL	BR	SR30,X'78,M3,M3	0640F16B	00 00011 00100000 0111 10 00101 10 1011
227	ABL17	M0=>M3	BR	ABL18,X'64,0,M3	0F80C80B	00 00111 11000000 0110 01 00000 00 1011
228	SR16	M6=>IR FS:5-3	FS2	SR17,1,E,X'14,M6,IR	401E29D8	01 00000 00001111 0001 01 00111 01 1000
229	DP09	M1+1=>ALU OPND FETCH	BR	DP10,X'17,M1,OF	06C02F32	00 00011 01100000 0001 01 11100 11 0010
22A	DP12	R0=>M2	BR	DP14,X'14,R0,M2	07C0280A	00 00011 11100000 0001 01 00000 00 1010
22B	DP13	R4=>M2	BR	DP15,X'14,R4,M2	0840288A	00 00100 00100000 0001 01 00010 00 1010
22C	VST14	FS:6	FS2V	DP12,5,1	4AB1FFFF	01 00101 01011000 1111 11 11111 11 1111
22D	VST11	IR=>M3 BR:OSS=0	CB	VST15,OSS,0,X'62,0,M3	0BC2C40B	00 00101 11100001 0110 00 10000 00 1011
22E	VST12	M1=>ALU OPND FETCH	CALLI	SBR02,2,X'14,M1,OF	CE0A2932	11 00111 00001101 0001 01 00100 11 0010
22F	VST13	SHFT RIGHT(M3,3=>M6)	FS2	SR16,5,4,2,M5,M6	4A34056E	01 00101 00011010 0000 00 10101 10 1110
230	DR22	M3=>R0 NORMAL DECODE	NDCDE	X'14,M3,R0	AF802960	10 10111 11000000 0001 01 00101 10 0000
231	DR23	M3=>R1 NORMAL DECODE	NDCDE	X'14,M3,R1	AF802961	10 10111 11000000 0001 01 00101 10 0001
232	DR24	M3=>R2 NORMAL DECODE	NDCDE	X'14,M3,R2	AF802962	10 10111 11000000 0001 01 00101 10 0010
233	DR25	M3=>R3 NORMAL DECODE	NDCDE	X'14,M3,R3	AF802963	10 10111 11000000 0001 01 00101 10 0011
234	DR26	M3=>R4 NORMAL DECODE	NDCDE	X'14,M3,R4	AF802964	10 10111 11000000 0001 01 00101 10 0100
	DR27	M3=>R5 NORMAL DECODE	NDCDE	X'14,M3,R5		

ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP / R / A / F / B / D)
235	DR28	#3=>R6 NORMAL DECODE	NDCDE	X'14,#3,R6	AF802965	10 10111 11000000 0001 01 00101 10 0101
236	DR29	#3=>R7 NORMAL DECODE	NDCDE	X'14,#3,R7	AF802966	10 10111 11000000 0001 01 00101 10 0110
237	SBR02	FFFC=>IR	LIT	X'FFFC,IR	AF802967	10 10111 11000000 0001 01 00101 10 0111
238	SBR03	MD=>#1 BR:NDIST=1	CB	SBR05,NDIST,1,X'64,0,#1	FFFC85F8	11 11111 11111110 0100 00 10111 11 1000
239	SBR04	#1=>ALU OPND FETCH	BR	SBR03,X'14,#1,OF	024FC809	00 00001 00100111 1110 01 00000 00 1001
23A	SR11	IR => #3 BR:OSS=0	CB	SR15,OSS,0,X'62,0,#3	0E402932	00 00111 00100000 0001 01 00100 11 0010
233	SR12	GO TO INDIRECT SUBR	CALLN	SBR02,2	0542C40B	00 00010 10100001 0110 00 10000 00 1011
23C	SR13	(OF) #1 => ALU	BR	SR15,X'14,#1,OF	CE0AFFFF	11 00111 00000101 0111 11 11111 11 1111
23D	ABL18	#3=>P	BR	ABL19,X'14,#3,P	05402932	00 00010 10100000 0001 01 00100 11 0010
23E	DP20	#5=>R5	PBR	SS02,1,X'14,#5,R5	33C02968	00 11001 11100000 0001 01 00101 10 1000
23F	CBRK01	CSA">#6	BR	CBR01A,X'44,0,#6	C4C429A5	11 00010 01100010 0001 01 00110 10 0101
240	CBRK02	00FF&#6=>#6	LIT	X'FF,X'4D,#6,#6	3480880E	00 11010 01000000 0100 01 00000 00 1110
241	CHLI01	00C8 EOR #6=>ALU TEST H	LIT	X'C8,X'4E,#6,NOP	00FF9BCE	00 00000 01111111 1100 11 01111 00 1110
242	CHLI02	IR=>#1	CB	HLI01,2,1,X'62,0,#1	00C89DDF	00 00000 01100100 0100 11 10111 01 1111
243	CINI01	00AF EOR #6=>ALU TEST /	LIT	X'AF,X'4E,#6,NOP	1245C409	00 01001 00100010 1110 00 10000 00 1001
244	CINI02	0=>#2 BR:OSZ=1	CB	CINI05,OSZ,1,X'47,0,#2	00AF9DDF	00 00000 01010111 1100 11 10111 01 1111
245	CCLR01	X'C1 XOR #6=>ALU	LIT	X'C1,X'4E,#6,NOP	1C058E0A	00 01110 00000010 1100 01 11000 00 1010
246	CCLR02	BR:OSZ=1	CBN	CCLR04,OSZ,1	00C19DDF	00 00000 01100000 1100 11 10111 01 1111
247	CCLR05		PBRN	STA05,1	3545FFFF	00 11010 10100010 1111 11 11111 11 1111
248					D844FFFF	11 01101 10100010 0111 11 11111 11 1111

ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP … R A F B D)
249	HLT01	SET STEP,P-1=> P	CNTL	0,2,0,A,X'16,P,P	A10A2D08	10 10000 10000101 0001 01 10100 00 1000
24A	HLT02	RST ALL FLAGS	FLGN	0,0	8000FFFF	10 00000 00000000 0111 11 11111 11 1111
24B	HLT03	01FF=>R7 CONSTANT FOR NA	LIIT	X'1FF,R7	01FF85EF	00 00000 11111111 1100 00 10111 10 1111
24C	HLT04	008D=>R6	LIIT	X'8D,R6	008D85EE	00 00000 01000110 1100 00 10111 10 1110
24D	HLT05		CALLN	TYOP01,2	DC8AFFFF	11 01110 01000101 0111 11 11111 11 1111
24E	HLT06	008A=>R6	LIIT	X'8A,R6	008A85EE	00 00000 01000101 0100 00 10111 10 1110
24F	HLT07		CALLN	TYOP01,2	DC8AFFFF	11 01110 01000101 0111 11 11111 11 1111
250	HLT08	BR:FLAG2=1	CBN	PC01,FLG2,1	27E5FFFF	00 10011 11110010 1111 11 11111 11 1111
251	HLT09	00AA=>R6	LIIT	X'AA,R6	00AA85EE	00 00000 01010101 0100 00 10111 10 1110
252	HLT10		CALLN	TYOP01,2	DC8AFFFF	11 01110 01000101 0111 11 11111 11 1111
253	HLT11	BR:STABL=1	CBN	ABL10,STABL,1	2F95FFFF	00 10111 11001010 1111 11 11111 11 1111
254	HLT12	ENBL MP & PWRUP INTS	CNTLN	0,2,0,0	A100FFFF	10 10000 10000000 0111 11 11111 11 1111
255	HLT13	BR:TYDR=0	CBN	HLT11,TYDR,0	14D2FFFF	00 01010 01101001 0111 11 11111 11 1111
256	HLT14	TTY=>R6	BR	HLT14A,X'44,0,R6	3340880E	00 11001 10100000 0100 01 00000 00 1110
257	HLT15	CSR=>R6 CALL TTY OUTPUT	CALLI	TYOP01,2,X'44,0,R6	DC8A880E	11 01110 01000101 0100 01 00000 00 1110
258	HLT16	00FF*R6=>R6	LII	X'FF,X'4D,R6,R6	00FF9BCE	00 00000 01111111 1100 11 01111 00 1110
259	HLT17	R6-0080=>R4	LII	X'80,X'5D,R6,R4	00B0BBCC	00 00000 01011000 0101 11 01111 00 1100
25A	HLT18	R6=>R3 CB:OSS=1	CB	HLT21,OSS,1,X'14,R6,R3	174329CB	00 01011 10100001 1001 01 00111 00 1011
25B	HLT19	R4-0008=>R4	LII	8,X'5D,R4,R4	0008BB8C	00 00000 00000100 0101 11 01110 00 1100
	HLT20	R6=>IR BR:OSS=1	CB	REG01,OSS,1,X'14,R6,IR		

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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP / R A F B D)
25C	HLT21	#6 EOR 00C2=>ALU	LIT	X'C2,X'4E,#6,NOP	27832:D8	00 10011 11000001 1001 01 00111 01 1000
25D	HLT22	BR:OSZ=1	CBV	ABL01,OSZ,1	00C29DDF	00 00000 01100001 0100 11 10111 01 1111
25E	HLT23	00C5 EOR #6=>ALU	LIT	X'C5,X'4E,#6,NOP	2FC5FFFF	00 10111 11100010 1111 11 11111 11 1111
25F	HLT24	BR:OSZ=1	CBV	HLT24A,OSZ,1	00C59DDF	00 00000 01100010 1100 11 10111 01 1111
260	HLT25	00C9 EOR #6=>ALU	LIT	X'C9,X'4E,#6,NOP	1E45FFFF	00 01111 00100010 1111 11 11111 11 1111
261	HLT26	BR:OSZ=1	CBV	IR01,OSZ,1	00C99DDF	00 00000 01100100 1100 11 10111 01 1111
262	HLT27	X'C3 XOR #6=>ALU	LIT	X'C3,X'4E,#6,NOP	37C5FFFF	00 11011 11100010 1111 11 11111 11 1111
263	HLT28	BR:OSZ=1	CBV	NEN01A,OSZ,1	00C39DDF	00 00000 01100001 1100 11 10111 01 1111
264	HLT29	00D0 EOR #6=>ALU	LIT	X'D0,X'4E,#6,NOP	1E85FFFF	00 01111 01000010 1111 11 11111 11 1111
265	HLT30	BR:OSZ=1	CBV	PC01,OSZ,1	00D09DDF	00 00000 01101000 0100 11 10111 01 1111
266	HLT31	00D2 EOR #6=>ALU	LIT	X'D2,X'4E,#6,NOP	27C5FFFF	00 10011 11100010 1111 11 11111 11 1111
267	HLT32	BR:OSZ=1	CBV	HLT38,OSZ,1	00D29DDF	00 00000 01101001 0100 11 10111 01 1111
268	HLT33	00D3 EOR #6=>ALU	LIT	X'D3,X'4E,#6,NOP	1B85FFFF	00 01101 11000010 1111 11 11111 11 1111
269	HLT34	BR:OSZ=1	CBV	ST01,OSZ,1	00D39DDF	00 00000 01101001 1100 11 10111 01 1111
26A	HLT35		PBRN	INDO,3	2445FFFF	00 10010 00100010 1111 11 11111 11 1111
26B	HLT36		CALLN	TYDP01,2	F00CFFFF	11 11000 00000110 0111 11 11111 11 1111
26C	HLT37		BRN	HL102	DC8AFFFF	11 01110 01000101 0111 11 11111 11 1111
26D	HLT38	RST STEP	CNTLN	0,0,0,8	1280FFFF	00 01001 01000000 0111 11 11111 11 1111
26E	HLT39	(IF) P => ALU	PBR	SS08,1,X'14,P,IF	A00AFFFF	10 10000 00000101 1111 11 11111 11 1111
26F					FAC42911	11 11101 01100010 0001 01 00100 01 0001

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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP … R A F B D)
	CINT03	W2=>ALU INST FETCH	PBR	INT21,1,X'14,W2,IF		
270					04442951	11 01010 00100010 0001 01 00101 01 0001
	CCLR00	MASTER CLEAR	CNTLN	0,0,0,0		
271					A00DFFFF	10 10000 00000110 1111 11 11111 11 1111
	TYOP01	0080 EOR W6=>ALJ	LIT	X'8D,X'4E,W6,NOP		
272					008D9DDF	00 00000 01000110 1100 11 10111 01 1111
	TYOP02	0=>IR	CB	TYOP08,OSZ,0,X'47,0,IR		
273					32C48E18	00 11001 01100010 0100 01 11000 01 1000
	TYOP03	FFFC=>IR	LITT	X'FFFC,IR		
274					FFFC85F8	11 11111 11111110 0100 00 10111 11 1000
	TYOP04		CBN	TYOP04,TXRDY,0		
275					1D50FFFF	00 01110 10101000 0111 11 11111 11 1111
	TYOP05	W6=>TTY	BR	TYOP09,X'14,W6,TTY		
276					33002909	00 11001 10000000 0001 01 00111 01 1001
	TYOP06	W6=>ALJ	CB	TYOP04,SCEN1,0,X'14,W6,NOP		
277					1D4A29DF	00 01110 10100101 0001 01 00111 01 1111
	TYOP07		RETRNN			
278					A040FFFF	10 10000 00100000 0111 11 11111 11 1111
	HLT24A	P=>ALU INST FTCH	PBR	S308,1,X'14,P,IF		
279					FAC42911	11 11101 01100010 0001 01 00100 01 0001
	MEM01A	X'00CD=>W3	LITT	X'00CD,W3		
27A					00CD85EB	00 00000 01100110 1100 00 10111 10 1011
	MEM01	P=>ALU OPND FETCH 1=>FLG2	FLG	2,3,X'14,P,OF		
27B					80082912	10 00000 00000101 1001 01 00100 01 0010
	MEM02	MD=>J 0=>FLG3	FLG	3,1,X'64,0,Q		
27C					800DC810	10 00000 00000110 1110 01 00000 01 0000
	BAC01	00A0=>W6	LITT	X'A0,W6		
27D					00A085EE	00 00000 01010000 0100 00 10111 10 1110
	BAC02		CALLN	TYOP01,2		
27E					DC8AFFFF	11 01110 01000101 0111 11 11111 11 1111
	BAC03		BR	BAC04,X'47,0,W6		
27F					28008E0E	00 10100 00000000 0100 01 11000 00 1110
	REG02	R0=>J	BR	BAC01,X'14,R0,Q		
280					1F402810	00 01111 10100000 0001 01 00000 01 0000
	REG03	R1=>J	BR	BAC01,X'14,R1,Q		
281					1F402830	00 01111 10100000 0001 01 00000 11 0000
	REG04	R2=>J	BR	BAC01,X'14,R2,Q		
282					1F402850	00 01111 10100000 0001 01 00001 01 0000
	REG05	R3=>J	BR	BAC01,X'14,R3,Q		

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ADR	LABEL		COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP / R / A / F / B / D)
283	REG06	R4=>3		BR	BAC01,X'14,R4,0	1F402970	00 01111 10100000 0001 01 00001 11 0000
284	REG07	R5=>0		BR	BAC01,X'14,R5,0	1F402890	00 01111 10100000 0001 01 00010 01 0000
285	REG08	R6=>3		BR	BAC01,X'14,R6,0	1F4028B0	00 01111 10100000 0001 01 00010 11 0000
286	REG09	R7=>0		BR	BAC01,X'14,R7,0	1F4028D0	00 01111 10100000 0001 01 00011 01 0000
287	REG10	R4=>R0		BR	ABC14,X'14,R4,R0	1F4028F0	00 01111 10100000 0001 01 00011 11 0000
288	REG11	R4=>R1		BR	ABC14,X'14,R4,R1	2F402980	00 10111 10100000 0001 01 00110 00 0000
289	REG12	R4=>R2		BR	ABC14,X'14,R4,R2	2F402981	00 10111 10100000 0001 01 00110 00 0001
28A	REG13	R4=>R3		BR	ABC14,X'14,R4,R3	2F402982	00 10111 10100000 0001 01 00110 00 0010
28B	REG14	R4=>R4		BR	ABC14,X'14,R4,R4	2F402983	00 10111 10100000 0001 01 00110 00 0011
28C	REG15	R4=>R5		BR	ABC14,X'14,R4,R5	2F402984	00 10111 10100000 0001 01 00110 00 0100
28D	REG16	R4=>R6		BR	ABC14,X'14,R4,R6	2F402985	00 10111 10100000 0001 01 00110 00 0101
28E	REG17	R4=>R7		BR	ABC14,X'14,R4,R7	2F402986	00 10111 10100000 0001 01 00110 00 0110
28F	PC02	R4=>R0		BR	ABC14,X'14,R4,R0	2F402987	00 10111 10100000 0001 01 00110 00 0111
290	SI01	ZERO=>0	BR:OVFL=0	CB	BAC01,OVFL,0,X'47,0,0	2F402988	00 10111 10100000 0001 01 00110 00 1000
291	SI02	0+1=>0		BR	BAC01,X'33,0,0	1F488E10	00 01111 10100100 0100 01 11000 01 0000
292	SI03			BRV	ABC14	1F406610	00 01111 10100000 0011 00 11000 01 0000
293	RR03		FS:3-0	FS2V	PC02,0,F	2F40FFFF	00 10111 10100000 0111 11 11111 11 1111
294	RR01		FS:5	FS2V	RR03,2,2	640FFFFF	01 10010 00000111 1111 11 11111 11 1111
295	RR02		FS:2-0	FS2V	REG10,0,7	6522FFFF	01 10010 10010001 0111 11 11111 11 1111
296						6207FFFF	01 10001 00000011 1111 11 11111 11 1111

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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP R A F B D)
	BAC09		LIIT	X'FFFD,IR		
297					FFFD85F8	11 11111 11111110 1100 00 10111 11 1000
	BAC10	ZERO=>W6	BR	BAC11,X'47,0,W6		
298					29408E0E	00 10100 10100000 0100 01 11000 00 1110
	IN02	W4=>W1	BR	ABC14,X'14,W4,W1		
299					2F402989	00 10111 10100000 0001 01 00110 00 1001
	ABC15	0002=>W2	LIIT	2,W2		
29A					000285EA	00 00000 00000001 0100 00 10111 10 1010
	ABC16		CB	ABC01,OSZ,1,X'6,W4,W4		
29B					28850D8C	00 10101 11000010 1000 01 10110 00 1100
	ABC17	W2-1=>W2	BR	ABC16,X'16,W2,W2		
29C					26C02D4A	00 10011 01100000 0001 01 10101 00 1010
	MEM04	P=>ALU OPND STORE	BR	MEM05,X'14,P,OSW		
29D					2F002913	00 10111 10000000 0001 01 00100 01 0011
	REG01		FS2N	REG02,0,7		
29E					6007FFFF	01 10000 00000011 1111 11 11111 11 1111
	PC01	W0=>Q	BR	BAC01,X'14,W0,Q		
29F					1F402910	00 01111 10100000 0001 01 00100 01 0000
	BAC04		BR	BAC05,5,W6,W6		
2A0					284009CE	00 10100 00100000 0000 01 01111 00 1110
	BAC05	0080+W6=>W6	LIT	X'80,X'5C,W6,W6		
2A1					0080B9CE	00 00000 01011000 0101 11 00111 00 1110
	BAC06		CALLN	IY0P01,2		
2A2					DC8AFFFF	11 01110 01000101 0111 11 11111 11 1111
	BAC07		LIIT	5,W2		
2A3					000585EA	00 00000 00000010 1100 00 10111 10 1010
	BAC08		BRN	BAC09		
2A4					25C0FFFF	00 10010 11100000 0111 11 11111 11 1111
	BAC11	W6=>ALU ALU,Q ROT L BR:C=0	CB	BAC11,SCEM1,0,5,W6,W6		
2A5					294A09CE	00 10100 10100101 0000 01 01111 00 1110
	BAC12	0080+W6=>W6	LIT	X'80,X'5C,W6,W6		
2A6					0080B9CE	00 00000 01011000 0101 11 00111 00 1110
	BAC13		CALLN	IY0P01,2		
2A7					DC8AFFFF	11 01110 01000101 0111 11 11111 11 1111
	BAC14	W2-1=>W2	BR	BAC15,X'16,W2,W2		
2A8					2A402D4A	00 10101 00100000 0001 01 10101 00 1010
	BAC15	BR:OSZ=0	CBN	BAC09,OSZ,0		
2A9					25C4FFFF	00 10010 11100010 0111 11 11111 11 1111
	BAC16	W3=>IR BR:FLAG3=1	CB	MEM01,FLG3,1,X'14,0,IR		

ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP R A F B D)
2A9	BAC18	ZERO=>W4	BR	BAC19,X'47,0,W4	1EE72918	00 01111 01110011 1001 01 00000 01 1000
2A8	BAC19	00A0=>W6	LIIT	X'A0,W6	2B008E0C	00 10101 10000000 0100 01 11000 00 1100
2AC	BAC20		CALLN	TYDP01,2	00A085EE	00 00000 01010000 0100 00 10111 10 1110
2AD	ABC01	BR:TYDR=0	CBV	ABC01,TYDR,0	DC8AFFFF	11 01110 01000101 0111 11 11111 11 1111
2AE	ABC02		CNILI	0,0,0,9,X'44,0,W6	2B92FFFF	00 10101 11001001 0111 11 11111 11 1111
2AF	ABC03		CALLI	TYDP01,2,X'44,0,W6	A009880E	10 10000 00000100 1100 01 00000 00 1110
2B0	ABC04	00FF&W6=>W6	LII	X'FF,X'4D,W6,W6	DC8A880E	11 01110 01000101 0100 01 00000 00 1110
2B1	ABC05	00AE EOR W6=>ALU	LII	X'AE,X'4E,W6,NOP	00FF99CE	00 00000 01111111 1100 11 01111 00 1110
2B2	ABC06	BR:OSZ=1	CBV	HLT02,OSZ,1	00AE9DDF	00 00000 01010111 0100 11 10111 01 1111
2B3	ABC07	00AC EOR W6=>ALU	LII	X'AC,X'4E,W6,NOP	1285FFFF	00 01001 01000010 1111 11 11111 11 1111
2B4	ABC08	BR:OSZ=1	CBV	ABC12,OSZ,1	00AC9DDF	00 00000 01010110 0100 11 10111 01 1111
2B5	ABC09	0007&W6=>W6	LII	7,X'4D,W6,W6	2E45FFFF	00 10111 00100010 1111 11 11111 11 1111
2B6	ABC10	W6 OR W4=>W4	BR	ABC11,X'3F,W6,W4	000799CE	00 00000 00000011 1100 11 01111 00 1110
2B7	ABC11	W3=>IR	BR	RR01,X'14,W3,IR	2E007FCC	00 10111 00000000 0011 11 11111 00 1100
2B8	ABC12	BR:FLAG2=0	CBV	HLT02,FLG2,0	25402978	00 10010 10100000 0001 01 00101 11 1000
2B9	ABC13	P:1=>P 1=>F3	FLG	3,3,X'17,P,P	12A4FFFF	00 01001 01010010 0111 11 11111 11 1111
2BA	ABC14A		BRV	HLT04	800F2F08	10 00000 00001111 1001 01 11100 00 1000
2BB	MEM05	W4=>SDR	BR	ABC14,X'14,W4,SDR	1300FFFF	00 01001 10000000 0111 11 11111 11 1111
2BC	ABC14	ZERO=>J	BR	ABC15,X'47,0,0	2F402990	00 10111 10100000 0001 01 00110 01 1101
2BD					26808E10	00 10011 01000000 0100 01 11000 01 0000

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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP R A F B D)
2BE	ABL10	X'0001=>R0	LIII	X'0001,R0	0001C5E0	00 00000 00000000 1100 00 10111 10 0000
2BF	ABL01	ZERO=>IR RESET STEP	CNILI	0,0,0,X'B,X'47,0,IR	A0088E18	10 10000 00000101 1100 01 11000 01 1000
2C0	ABL02	ZERO=>P	BR	ABL03,X'47,0,P	30C08E08	00 11000 01100000 0100 01 11000 00 1000
2C1	ABL12	X'7F XOR P=>ALU	LIT	X'7F,X'4E,P,NOP	007F9D1F	00 00000 00111111 1100 11 10100 01 1111
2C2	ABL13	P+1=>P	CB	ABL14,OSZ,1,X'11,P,P	34052308	00 11010 00000010 1001 00 01100 00 1000
2C3	ABL03	X'4446=>W2	LIII	X'4446,W2	444685EA	01 00010 00100011 0100 00 10111 10 1010
2C4	ABL04	CSW=>0,RESET ABL F/F	CNTLI	0,0,0,X'C,X'44,0,0	A00C8810	10 10000 00000110 0100 01 00000 01 0000
2C5	ABL05	IR+1=>IR	BR	ABL06,X'63,0,IR	3180C618	00 11000 11000000 0110 00 11000 01 1000
2C6	ABL06	W2=>W2	BR	ABL07,X'14,W2,W2	31C0294A	00 11000 11100000 0001 01 00101 00 1010
2C7	ABL07	W2=>ALU ALU,Q SL 0=>Q0	CB	ABL07,OSS,0,X'06,W2,W2	31C20D4A	00 11000 11100001 0000 01 10101 00 1010
2C8	ABL08	W2=>ALU ALU,Q SL 0=>Q0	CB	ABL04,OSS,0,6,W2,W2	31020D4A	00 11000 10000001 0000 01 10101 00 1010
2C9	ABL09	P=>ALU OPND STORE	BR	ABL11,X'14,P,OSW	32802913	00 11001 01000000 0001 01 00100 01 0011
2CA	ABL11	W2=>SDR	BR	ABL12,X'14,W2,SDR	3040295D	00 11000 00100000 0001 01 00101 01 1101
2CB	TYOP08		BR	TYOP04,X'72,0,IR	1D40E418	00 01110 10100000 0111 00 10000 01 1000
2CC	TYOP09	W6=>TTY	BR	TYOP06,X'14,W6,TTY	1DC029D9	00 01110 11100000 0001 01 00111 01 1001
2CD	HLT14A	TTY=>W6	CNTLI	0,0,0,X'9,X'44,0,W6	A009880E	10 10000 00000100 1100 01 00000 00 1110
2CE	HLT14B	TTY=>W6	BR	HLT15,X'44,0,W6	15C0880E	00 01010 11100000 0100 01 00000 00 1110
2CF	ABL19	ZERO=>IR	PBR	ABL20,3,X'47,0,IR	EBCC8E18	11 10101 11100110 0100 01 11000 01 1000
2D0	ABL14	R0=>ALU OPND FETCH	BR	ABL15,X'14,R0,OF	34402812	00 11010 00100000 0001 01 00000 01 0010
	ABL15	MD=>W1	BR	ABL16,X'64,0,W1		

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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP R A F B D)
2D1	CBR01A	CSW=>W6 RESET DTA RDY	CNILI	0,0,0,X'9/X'44,0,W6	08C0C809	00 00100 01100000 0110 01 00000 00 1001
2D2	CBR01B	RST DVDR, CSW=>W6	CNILI	0,0,0,9,X'44,0,W6	A009880E	10 10000 00000100 1100 01 00000 00 1110
2D3	CBR01C		BRV	CBR402	A009880E	10 10000 00000100 1100 01 00000 00 1110
2D4	CCLR04	-9=>IR	LIII	X'FFF7,IR	1040FFFF	00 01000 00100000 0111 11 11111 11 1111
2D5	CCLR05	MASTER CLR ENABLE	CNILN	0,0,0,X'0D	FFF785F8	11 11111 11111011 1100 00 10111 11 1000
2D6	CCLR06		CBV	CCLR06,SCEM1,0	A00DFFFF	10 10000 00000110 1111 11 11111 11 1111
2D7	CCLR07	MASTER CLR DISABLE	CNILN	0,0,0,X'0F	35CAFFFF	00 11010 11100101 0111 11 11111 11 1111
2D8	CCLR09		PBRV	RST00,0	A00FFFFF	10 10000 00000111 1111 11 11111 11 1111
2D9	BYT25	SHIFT CNT = -8	LIII	X'FFF8,IR	C000FFFF	11 00000 00000000 0111 11 11111 11 1111
2DA	BYT26	SHFT LFT UNTIL CNT=-1	CB	BYT26,SCEM1,0,X'06,W1,W1	FFF885F8	11 11111 11111100 0100 00 10111 11 1000
2DB	BYT27	(OSLB) W2=>ALU	BR	BYT28,X'14,W2,OSLB	36CA0029	00 11011 01100101 0000 01 10100 10 1001
2DC	BYT28	W1=>SDR	BR	BYT29,X'14,W1,SDR	37402955	00 11011 10100000 0001 01 00101 01 0101
2DD	BYT29	W2=>W1 PBR:STA05	PBR	STA05,1,X'14,W2,W1	37802930	00 11011 11000000 0001 01 00100 11 1101
2DE	IR01	W1=>3	BR	BAC01,X'14,W1,0	E7C42949	11 10011 11100010 0001 01 00101 00 1001
2DF	BYT14	W2=>ALU OPND FETCH BR:OSS=1	CB	BYT19,OSS,1,X'14,W2,0F	1F402930	00 01111 10100000 0001 01 00100 11 0000
2E0	BYT15	FFF8=>IR	LIII	X'FFF8,IR	38052952	00 11101 10000001 1001 01 00101 01 0010
2E1	BYT16	MD=>R0	BR	BYT17,X'64,0,R0	FFF885F8	11 11111 11111100 0100 00 10111 11 1000
2E2	DP29	BR:OSS=1	CBV	DP31,OSS,1	3880C800	00 11101 11000000 0110 01 00000 00 0000
2E3	DP30	W2+W4=>W4 UPD OVF FS:6	FS2	DP17,3,1,X'18,W2,W4	3943FFFF	00 11100 10100001 1111 11 11111 11 1111
2E4					7F313140	01 11111 10011000 1001 10 00101 00 1100

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REV A

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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	OP			R	A	F	B	D
2E5	DP31	7FFF*W5=>W5	LIT	X'7FFF,X'4D,W5,W5	7FFF93AD	01	11111	11111111	1100	11	01110	10	1101
2E6	DP32	W2+W4+1=>W4 UPD OVF FS:6	FS2	DP17,3,1,X'19,W2,W4	7F31334C	01	11111	10011000	1001	10	01101	00	1100
2E7	DP41	W2*W4=>W4 FS:6	FS2	DP17,3,1,X'3E,W2,W4	7F317D4C	01	11111	10011000	1011	11	10101	00	1100
2E8	BYT21	R0=>W1 BR:OSS=1	CB	BYT23,OSS,1,X'14,R0,W1	04432809	00	00010	00100001	1001	01	00000	00	1001
2E9	BYT22	ZERO => Q	BR	BYT25,X'47,0,Q	36808E10	00	11011	01000000	0100	01	11000	01	0000
2EA	BYT09	13=>W1 BR:DIN15=0	CB	BYT12,DIN15,0,X'67,0,W1	0356CE09	00	00001	10101011	0110	01	11000	00	1001
2EB	BYT10	W1=>ALU OPND FETCH	BR	BYT11,X'14,W1,OF	02C02932	00	00001	01100000	0001	01	00100	11	0010
2EC	BYT19	00FF=>W1	LIIT	X'FF,W1	00FF85E9	00	00000	01111111	1100	00	10111	10	1001
2ED	BYT20	M0*W1=>R0	PBR	SS02,1,X'4A,W1,R0	C4C49520	11	00010	01100010	0100	10	10100	10	0000
2EE	BYT17	R0=>ALU ALU,U SR=>R0 B:C=0	CB	BYT17,SCEM1,0,2,R0,R0	3B8A0400	00	11101	11000101	0000	00	10000	00	0000
2EF	BYT18	R0=>R0	PBR	SS02,1,X'14,R0,R0	C4C42800	11	00010	01100010	0001	01	00000	00	0000
2F0	DP34	7FFF*W5=>W5	LIT	X'7FFF,X'4D,W5,W5	7FFF93AD	01	11111	11111111	1100	11	01110	10	1101
2F1	DP35	W3+W5+1=>W5	BR	DP36,X'2C,W3,W5	3C80596D	00	11110	01000000	0010	11	00101	10	1101
2F2	DP36	BR:OSS=1	CBN	DP39,OSS,1	3D03FFFF	00	11110	10000001	1111	11	11111	11	1111
2F3	DP37	W2-W4-1=>W4 UPD OVFL FS:6	FS2	DP17,3,1,X'38,W2,W4	7F31714C	01	11111	10011000	1011	10	00101	00	1100
2F4	DP38	7FFF*W5=>W5	LIT	X'7FFF,X'4D,W5,W5	7FFF93AD	01	11111	11111111	1100	11	01110	10	1101
2F5	DP39	W2-W4=>W4 UPD OVFL FS:6	FS2	DP17,3,1,X'29,W2,W4	7F31534C	01	11111	10011000	1010	10	01101	00	1100
2F6	DP22	W2=>SDR	BR	DP23,X'14,W2,SDR	3DC0295D	00	11110	11100000	0001	01	00101	01	1101
2F7	DP23	W1+1=>OS	BR	DP24,X'17,W1,OSW	3E002F33	00	11111	00000000	0001	01	11100	11	0011
	DP24	W3=>SDR	BR	DP25,X'14,W3,SDR									

ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP / R / A / F / B / D)
2F8	DP25	M1-P=>M1	PBR	DP26,1,X'2D,P,M1	3E40297D	00 11111 00100000 0001 01 00101 11 1101
2F9	DP43	M2 OR M4=>M4 FS:6	FS2	DP17,3,1,X'3F,M2,M4	FA445809	11 11101 00100010 0010 11 01100 00 1001
2FA	DP45	M2 EOR M4=>M4	FS2	DP17,3,1,X'3D,M2,M4	7F317F4C	01 11111 10011000 1011 11 11101 00 1100
2FB	DP17	M4=>I0	BR	DP18,X'14,M4,R0	7F31734C	01 11111 10011000 1011 11 01101 00 1100
2FC	DP19	M4=>R4	BR	DP20,X'14,M4,R4	09402980	00 00100 10100000 0001 01 00110 00 0000
2FD					0FC02984	00 00111 11100000 0001 01 00110 00 0100
300		ORG X'300				
300	I001	MASK CONSTANT = 01FF	LIIT	X'01FF,M1	01FF85E9	00 00000 11111111 1100 00 10111 10 1001
301	I002	F,DA => M1	CB	INP01,MPTST,1,X'7E,M1,M1	0BE9FD29	00 00101 11110100 1111 11 10100 10 1001
302	I003	MASK CONSTANT = 003F	LIIT	X'3F,M2	003F85EA	00 00000 00011111 1100 00 10111 10 1010
303	I004	FS:11-9, SAVE DA =>M2	FS3	EX101,4,X'E,X'7E,M2,M2	444EFD4A	01 00010 00100111 0111 11 10101 00 1010
304	EX103	BRANCH IF DA01	CBN	IEX01,OSZ,1	0685FFFF	00 00011 01000010 1111 11 11111 11 1111
305	EX104	CHECK DA47	LIT	X'27,X'4E,M2,NOP	00279D5F	00 00000 00010011 1100 11 10101 01 1111
306	EX105	BRANCH IF DA47	CBN	RTC01,OSZ,1	0805FFFF	00 00100 00000010 1111 11 11111 11 1111
307	EX106	CHECK DA45	LIT	X'25,X'4E,M2,NOP	00259D5F	00 00000 00010010 1100 11 10101 01 1111
308	EX107	BRANCH IF NOT DA45	CB	I310,OSZ,0,X'14,M1,I0	1404293A	00 01010 00000010 0001 01 00100 11 1010
309	EX108	CHECK F=0-3	LIT	X'925,X'50,M1,NOP	0925883F	00 00100 10010010 1101 11 01100 11 1111
30A	EX109	BRANCH FOR MP MASK	CBN	MP401,OSS,1	0A03FFFF	00 00101 00000001 1111 11 11111 11 1111
30B	EX110	FS:7-6,FUNCT CODE 4-7	FS3	PTY01,3,3,X'15,P,P	43332808	01 00001 10011001 1001 01 01100 00 1000
30C	PTY01	ENABL PAR, OCODE	CNTLN	1,X'8,0,7	AD87FFFF	10 10110 11000011 1111 11 11111 11 1111
	PTY02	DISABL PAR, OCODE	CNTLN	1,X'8,0,6		

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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP / R / A / F / B / D)
30D	MPE01	ENABL MP, DCODE	CNTLN	1,X'8,0,5	AD86FFFF	10 10110 11000011 0111 11 11111 11 1111
30E	MPD01	DISABL MP, DCODE	CNTLN	1,X'8,0,4	AD85FFFF	10 10110 11000010 1111 11 11111 11 1111
30F					AD84FFFF	10 10110 11000010 0111 11 11111 11 1111
310	EX101	CONTROL BIT FOR EXC	LIT	X'800,X'4C,#1,#1	08009929	00 00100 00000000 0100 11 00100 10 1001
	EX102	DEC FOR DA01 TEST	BR	EX103,X'16,#2,NOP	0100205F	00 00000 10000000 0001 01 10101 01 1111
311	SEN01	CONTROL BIT FOR SEN	LIT	X'1000,X'4C,#1,#1	10009929	00 01000 00000000 0100 11 00100 10 1001
312	SEN02	DEC FOR DA01 TEST	BR	SEN03,X'16,#2,NOP	0C00205F	00 00110 00000000 0001 01 10101 01 1111
313	IN01	CONTROL BIT FOR INPUT	LIT	X'2000,X'4C,#1,#1	20009929	00 10000 00000000 0100 11 00100 10 1001
314	IN02	DEC FOR DA01 TEST	BR	IN03,X'16,#2,NOP	0A40205F	00 00101 00100000 0001 01 10101 01 1111
315	OUT01	CONTROL BIT FOR OTPUT	LIT	X'4000,X'4C,#1,#1	40009929	01 00000 00000000 0100 11 00100 10 1001
316	OUT02	DEC FOR DA01 TEST	BR	OUT04,X'16,#2,NOP	0F00205F	00 00111 10000000 0001 01 10101 01 1111
317	EX201	CONTROL BIT FOR EXC2	LIT	X'8000,X'4C,#1,#1	80009929	10 00000 00000000 0100 11 00100 10 1001
318	EX202	NO SPECIAL IO	BR	IO10,X'14,#1,IO	1400293A	00 01010 00000000 0001 01 00100 11 1010
319	TEX01	CHECK EXC 4,01	LIT	X'901,X'5D,#1,NOP	0901883F	00 00100 10000000 1101 11 01100 11 1111
31A	TEX02	IF NOT, NOP	CBV	SS703,US2,0	0784FFFF	00 00011 11000010 0111 11 11111 11 1111
31B	TEX03	ELSE INIT TTY	CALLN	TTC01,3	D68EFFFF	11 01011 01000111 0111 11 11111 11 1111
31C	TEX04	GO FETCH, THEN DECODE	BR	SS803,X'15,P,P	07C02808	00 00011 11100000 0001 01 01100 00 1000
31D	SS703	P+1 => P ,IF	BR	SS803,X'15,P,P	07C02808	00 00011 11100000 0001 01 01100 00 1000
31E	SS803	DCODE	CNTLN	1,X'8,0,0	AD80FFFF	10 10110 11000000 0111 11 11111 11 1111
31F	RIC01	CHECK EXC 1,47	LIT	X'0867,X'5D,#1,NOP	0867883F	00 00100 00110011 1101 11 01100 11 1111
320						

ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP R A F B D)
	RIC02	IF YES, ENABLE RIC	CBV	RIC03,OSZ,1		
321					0985FFFF	00 00100 11000010 1111 11 11111 11 1111
	RIC10	CHECK EXC 7,47	LIT	X'09E7,X'5D,M1,NOP		
322					09E7DB3F	00 00100 11110011 1101 11 01100 11 1111
	RIC12	IF NOT, NOP	CBV	SS703,OSZ,0		
323					0784FFFF	00 00011 11000010 0111 11 11111 11 1111
	RIC13	DISABLE RIC,IF	CNTLI	0,0,0,2,X'15,P,P		
324					A0022D08	10 10000 00000001 0001 01 01100 00 1000
	RIC14	DECODE	CNTLN	1,X'D,0,0		
325					AD80FFFF	10 10110 11000000 0111 11 11111 11 1111
	RIC03	ENABLE RIC,IF	CNTLI	0,0,0,3,X'15,P,P		
326					A0052308	10 10000 00000001 1001 01 01100 00 1000
	RIC04	DECODE	CNTLN	1,X'D,0,0		
327					AD80FFFF	10 10110 11000000 0111 11 11111 11 1111
	MPM01	SELECT MP MASK	BR	SS703,X'62,0,MPM		
328					0780C41B	00 00011 11000000 0110 00 10000 01 1011
	IN03	BRANCH IF NOT DA01	CB	IO10,OSZ,0,X'14,M1,IO		
329					1404293A	00 01010 00000010 0001 01 00100 11 1010
	TII00	INPUT CS4,RESET TORY	CNTLI	0,0,0,9,X'44,X'F,M1		
32A					A00989E9	10 10000 00000100 1100 01 00111 10 1001
	TII01	INPUT CS4,RESET TORY	CNTLI	0,0,0,9,X'44,X'F,M1		
32B					A00989E9	10 10000 00000100 1100 01 00111 10 1001
	TII02	INPUT CS4	BR	II103,X'44,X'F,M1		
32C					0B4089E9	00 00101 10100000 0100 01 00111 10 1001
	TII03	M1 AND LIT => M1	LIT	X'00FF,X'4D,M1,M1		
32D					00FF9B29	00 00000 01111111 1100 11 01100 10 1001
	TII04	FS:8-68TYPE OF INST	FS3N	IME01,3,7		
32E					5837FFFF	01 01100 00011011 1111 11 11111 11 1111
	IMP01	IR=>M1 FS:11	FS3	IMP02,3,2,X'62,0,M1		
32F					6852C409	01 10100 00101001 0110 00 10000 00 1001
	SEN03	BRANCH IF DA NOT 01	CBV	IO10,OSZ,0		
330					1404FFFF	00 01010 00000010 0111 11 11111 11 1111
	SEN04	M1 XOR LIT => ALU	LIT	X'1081,X'4E,M1,NOP		
331					10819D3F	00 01000 01000000 1100 11 10100 11 1111
	SEN05	BR:OSZ=1	CBV	TS020,OSZ,1		
332					0D85FFFF	00 00110 11000010 1111 11 11111 11 1111
	SEN07	M1 EX-OR LIT (X'1041)	LIT	X'1041,X'4E,M1,NOP		
333					10419D3F	00 01000 00100000 1100 11 10100 11 1111
	SEN08	BR:OSZ=1	CBV	TS010,OSZ,1		

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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP / R A F B D)
334	SS103	P+1 => P ,IF NO JMP	PBR	JMP03,2,X'15,P,P	1545FFFF	00 01010 10100010 1111 11 11111 11 1111
335	IS020	BR:IYDR=0	CBN	SS103,IYDR,0	C0482808	11 00000 00100100 0001 01 01100 00 1000
336	IJ103	(IF) IB => W1	PBR	JMP05,0,X'77,0,W1	0D52FFFF	00 00110 10101001 0111 11 11111 11 1111
337					F340EE09	11 11001 10100000 0111 01 11000 00 1001
338		ORG X'338				
338	SS203	DO FETCH,THEN DECODE	PBR	SS03,1,X'15,P,P	C9C42808	11 00100 11100010 0001 01 01100 00 1000
339	OUT04	CHECK DA01	CBN	OUT07,OSZ,1	0FC5FFFF	00 00111 11100010 1111 11 11111 11 1111
33C	OUT05	CHECK DA45	LIT	X'25,X'50,#2,NOP	0025B85F	00 00000 00010010 1101 11 01101 01 1111
33D	OUT06	BRANCH IF NOT SPECIAL	CB	IO10,OSZ,0,X'14,W1,IO	1404293A	00 01010 00000010 0001 01 00100 11 1010
33E	OUT07	FS:7-6 IO REG OUTPUT	FS3	SOME01,3,3,X'14,R0,W1	53332809	01 01001 10011001 1001 01 00000 00 1001
33F	EXC13	P+1 => P, IF	BR	SS803,X'15,P,P	07C02808	00 00011 11100000 0001 01 01100 00 1000
340	RAY01		CNTLN	0,0,0,0	A000FFFF	10 10000 00000000 0111 11 11111 11 1111
341	SEN13	DO IJUMP IF SENSE	CBN	IJ103,SER,1	0DF5FFFF	00 00110 11111010 1111 11 11111 11 1111
342	SEN14	REFILL PIPELINE	PBR	JMP03,2,X'15,P,P	C0482808	11 00000 00100100 0001 01 01100 00 1000
343	IN13	START IO DATA IN	BR	IN20,X'46,0,W1	17408C09	00 01011 10100000 0100 01 10000 00 1001
344	SOME02	WD => W1	BR	SOME03,X'64,0,W1	24C0C809	00 10010 01100000 0110 01 00000 00 1001
345	OUT13	FS:7-6 OUTPUT TYPE	FS3	OME01,3,3,X'14,R0,W1	52332809	01 01001 00011001 1001 01 00000 00 1001
346	OME02	WD => W1	BR	OME03,X'64,0,W1	2440C809	00 10010 00100000 0110 01 00000 00 1001
347	OME01	FETCH DATA	BR	OME02,X'67,0,OF	11C0CE12	00 01000 11100000 0110 01 11000 01 0010
348	OAR01	R0 TO W1	BR	OUI20,X'14,R0,W1	1A002809	00 01101 00000000 0001 01 00000 00 1001
349	OBR01	R1 TO W1	BR	OUI20,X'14,R1,W1		

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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP R A F B D)
348	DAB01	R0 OR R1 TO #1	BR	OJI20,X'3F,R1,#1	1A002829	00 01101 00000000 0001 01 00000 10 1001
349	SOME01	FETCH OUTPUT #ORD	BR	SO4E02,X'67,0,OF	1A007E29	00 01101 00000000 0011 11 11000 10 1001
34C	SOAR01	R0 TO #1	BR	OJI08,X'14,R0,#1	1140CE12	00 01000 10100000 0110 01 11000 01 0010
34D	SO8R01	R1 TO #1	BR	OJI08,X'14,R1,#1	18002809	00 01101 10000000 0001 01 00000 00 1001
34E	8AB01	R0 OR R1 TO #1	BR	OJI08,X'3F,R1,#1	18002829	00 01101 10000000 0001 01 00000 10 1001
34F	IO10	ISSUE FRYX	IONM	0,1,X'14,#1,IO	18007E29	00 01101 10000000 0011 11 11000 10 1001
350	IO11	WAIT FOR BUS	IOM	0,0,1,X'14,#1,IO	9004293A	10 01000 00000010 0001 01 00100 11 1010
351	IO12	FS:10-9 ON INST TYPE	FS3	EXC13,4,6,X'14,#1,IO	9001293A	10 01000 00000000 1001 01 00100 11 1010
352	INAB02	#1 OR R0 => R0	BR	INA303,X'3F,#1,R0	5046293A	01 01000 00100011 0001 01 00100 11 1010
353	INAB03	R0 TO R1	BR	SS203,X'14,R0,R1	15007F20	00 01010 10000000 0011 11 11100 10 0000
354	TS010	BR:IXRDY=1	CBN	IJ103,IXRDY,1	0EC02801	00 00111 01100000 0001 01 00000 00 0001
355	TS011	GO FETCH NEXT INST	BRN	SS103	0DD1FFFF	00 00110 11101000 1111 11 11111 11 1111
356	TI001	#1 TO ITY	BR	IT302,X'14,#1,ITY	0D40FFFF	00 00110 10100000 0111 11 11111 11 1111
357	TI002	#1 TO ITY	BR	IT303,X'14,#1,ITY	16002939	00 01011 00000000 0001 01 00100 11 1001
358	TI003	HOLD #1 ONE CYCLE	BR	SS203,X'14,#1,NOP	16402939	00 01011 00100000 0001 01 00100 11 1001
359	TIC01	INIT ITY SUBR	CNTLN	0,0,0,8	0EC0293F	00 00111 01100000 0001 01 00100 11 1111
35A	TIC02		CNTLN	0,0,0,8	A008FFFF	10 10000 00000100 0111 11 11111 11 1111
35B	TIC03	RETURN	CNTLN	0,0,1,8	A008FFFF	10 10000 00000100 0111 11 11111 11 1111
35C	IN20	ISSUE DRYX, IO => #1	IONM	0,2,X'46,0,#1	A048FFFF	10 10000 00100100 0111 11 11111 11 1111
35D					90088C09	10 01000 00000100 0100 01 10000 00 1001

ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE OP R A F B D
35E	IN21	WAIT FOR BUS	IO4	0,0,1,X'46,0,W1	90018C09	10 01000 00000000 1100 01 10000 00 1001
35F	IN22	FS:8-6 TYPE OF INPUT	FSSN	IWE01,3,7	5837FFFF	01 01100 00011011 1111 11 11111 11 1111
360	IWE01	STR DATA IN MEM	BR	IWE02,X'67,0,OSW	1900CE13	00 01100 10000000 0110 01 11000 01 0011
361	INA01	W1 OR R0 => R0	BR	SS203,X'3F,W1,R0	0EC07F20	00 00111 01100000 0011 11 11100 10 0000
362	IN801	W1 OR R1 => R1	BR	SS203,X'3F,W1,R1	0EC07F21	00 00111 01100000 0011 11 11100 10 0001
363	INAB01	R1 OR R0 => R0	BR	INAB02,X'3F,R1,R0	14C07E20	00 01010 01100000 0011 11 11000 10 0000
364	IWE02	W1 => SDR PBR:SS01	PBR	SS01,1,X'14,W1,SDR	C0042930	11 00000 00000010 0001 01 00100 11 1101
365	CIA01	W1 TO R0	BR	SS203,X'14,W1,R0	0EC02920	00 00111 01100000 0001 01 00100 10 0000
	CIB01	W1 TO R1	BR	SS203,X'14,W1,R1		
366	CIAB01	W1 TO R0	BR	CIB01,X'14,W1,R0	0EC02921	00 00111 01100000 0001 01 00100 10 0001
367	OUT20	W1 TO IO BUS	IOXW	0,0,X'14,W1,IO	19802920	00 01100 11000000 0001 01 00100 10 0000
368	OUT21	ISSUE DRVX	IOXW	0,2,X'14,W1,IO	9000293A	10 01000 00000000 0001 01 00100 11 1010
369	OUT22	WAIT FOR BUS	IO4	0,0,1,X'14,W1,IO	9008293A	10 01000 00000100 0001 01 00100 11 1010
36A	OUT23	HOLD IO DATA	BR	SS203,X'14,W1,IO	9001293A	10 01000 00000000 1001 01 00100 11 1010
36B	OUT08	CHECK DA01 OR DA45	BR	OUT09,X'16,W2,NOP	0EC0293A	00 00111 01100000 0001 01 00100 11 1010
36C	OUT09	BRANCH IF DA01	CB	TTJ01,OSZ,1,X'14,W1,0	18402D5F	00 01101 10100000 0001 01 10101 01 1111
36D	MP001	LIT TO W1 FOR INCR	LITT	X'200,W1	15C52930	00 01010 11100010 1001 01 00100 11 0000
36E	MP002	NEG 17 TO SHIFT COUNT	LITT	X'FFEF,IR	020085E9	00 00001 00000000 0100 00 10111 10 1001
36F	MP003	ZERO TO W2	BR	MPJ04,X'47,0,W2	FFEF85F8	11 11111 11110111 1100 00 10111 11 1000
370	MPJ04	LOAD FIRST ADDR	BR	MPJ05,X'14,W2,MPD	1C408E0A	00 01110 00100000 0100 01 11000 00 1010

ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP / R A F B D)
371	MPJ05	INC ADDR, CHECK TRAP	CB	MPJ08,TRAP,1,X'2F,#1,#2	1C80295C	00 01110 01000000 0001 01 00101 01 1100
372	MPJ06	SHIFT RIGHT,OB UPDATE	CB	SS203,SCEM1,1,X'02,#3,#3	10715F2A	00 01110 10111000 1010 11 11100 10 1010
373	MPJ07	#2 TO MPD, LOOP	BR	MPJ05,X'14,#2,MPD	0EC3056B	00 00111 01100101 1000 00 10101 10 1011
374	MPJ08	START DMA SERVICE	CALLN	INIJ01,5	1C80295C	00 01110 01000000 0001 01 00101 01 1100
375	MPJ09	CONTINUE MP UPDATE	BRN	MPJ06	C34EFFFF	11 00001 10100111 0111 11 11111 11 1111
376	INI15A	(OF) #6 => ALU	BR	IJJ01,X'14,#6,OF	1CC0FFFF	00 01110 01100000 0111 11 11111 11 1111
377	IJJ01	DRYX, MD => IO	IONM	0,2,X'64,0,IO	1E0029D2	00 01111 00000000 0001 01 00111 01 0010
378	IJJ02	RESET INT FLAG	IOM	1,0,1,X'64,0,IO	9008C81A	10 01000 00000100 0110 01 00000 01 1010
379	IJJ03	HOLD DATA EXTRA CYCLE	BR	IJJ04,X'64,0,IO	9011C81A	10 01000 00001000 1110 01 00000 01 1010
37A					28C0C81A	00 10100 01100000 0110 01 00000 01 1010
37D		ORG X'37D				
37D	IUR01	(IF) #6=>ALU INTP	FLGS	INTP,0,0,X'14,#6,IF	806029D1	10 00000 00110000 0001 01 00111 01 0001
37E	IUR02	INST FETCH #6+1=ADDR	BR	IUR03,X'15,#6,#6	1FC028CE	00 01111 11100000 0001 01 01111 00 1110
37F	IUR03	DECR P, DECODE	CNTLI		A8012D08	10 10100 00000000 1001 01 10100 00 1000
380	INI10	SET INTERRUPT FLAG	IONMN	2,0	9020FFFF	10 01000 00010000 0111 11 11111 11 1111
381	INI11	SYNC IO INCX	IOMN	0,0,2	9002FFFF	10 01000 00000001 0111 11 11111 11 1111
382	INI12	DUMMY MD REFERENCE	BR	INI13,X'64,0,#6	20C0C80E	00 10000 01100000 0110 01 00000 00 1110
383	INI13	ISSUE FRYX	IONM	0,1,X'46,0,#6	90048C0E	10 01000 00000010 0100 01 10000 00 1110
384	INI14	WAIT FOR BUS	IOM	0,0,1,X'46,0,#6	90018C0E	10 01000 00000000 1100 01 10000 00 1110
385	INI15		CBN	INI15A,IOUI,1	1DEFFFFF	00 01110 11110111 1111 11 11111 11 1111
	INI16	CHECK FOR TRAP-IN	CBN	IIJ1,IIN,1		

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ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP R A F B D)
386	INT17	RESET INTERRUPT FLAG	IONMN	1,0	22A0FFFF	00 10001 01010110 1111 11 11111 11 1111
387	INT18	BR;IUR=1 P-1=>P	CB	IUR01,IUR,1,X'16,P,P	9010FFFF	10 01000 00001000 0111 11 11111 11 1111
389	INT19	SUBR RETURN, BAD REQ	RETRNN		1F732D08	00 01111 10111001 1001 01 10100 00 1000
389	TI01	(OSW) #6=> ALU	BR	TI02,X'14,#6,OSW	A040FFFF	10 10000 00100000 0111 11 11111 11 1111
38A	TI02	IO => SDR	BR	TI03,X'4b,0,SDR	22C029D5	00 10001 01100000 0001 01 00111 01 0011
38B	TI03	SET DRY	IONMN	0,2	23008C1D	00 10001 10000000 0100 01 10000 01 1101
38C	TI04	WAIT FOR BUS,RINIF	IONN	1,0,1	9009FFFF	10 01000 00000100 0111 11 11111 11 1111
38D	TI04A	GO TO NEXT TEST	BRN	TI04	9011FFFF	10 01000 00001000 1111 11 11111 11 1111
38E					28C0FFFF	00 10100 01100000 0111 11 11111 11 1111
390			ORG	X'390		
390	IMP04	P+1=>P	BR	IMP12,X'17,P,P	26002F08	00 10011 00000000 0001 01 11100 00 1000
391	04E03	P+1 => P (IF)	BR	OUT20,X'15,P,P	1A002808	00 01101 00000000 0001 01 01100 00 1000
392	IMP05	P+1=>P	BR	IMP10,X'17,P,P	26402F08	00 10011 00100000 0001 01 11100 00 1000
393	SOME03	P+1 => P (IF)	BR	OUT08,X'15,P,P	18002808	00 01101 10000000 0001 01 01100 00 1000
394	IMP06	P+1=>P FS:8	FS3	IMP12,3,4,X'17,P,P	66342F08	01 10011 00011010 0001 01 11100 00 1000
396			ORG	X'396		
396	IMP07	P+1=>P FS:8	FS3	IMP12,3,4,X'17,P,P	66342F08	01 10011 00011010 0001 01 11100 00 1000
398			ORG	X'398		
398	IMP12	BR TO SS03	PBRN	SS03,1	C9C4FFFF	11 00100 11100010 0111 11 11111 11 1111
399	IMP10	I8 =>W1	BR	IMP11,X'67,0,W1	2740CE09	00 10011 10100000 0110 01 11000 00 1001
39A	IMP09	FS:6	FS3N	IMP12,3,1	6631FFFF	01 10011 00011000 1111 11 11111 11 1111
39C			ORG	X'39C		

ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE (OP R A F B D)
39C	IMP08	FS:7	FS3N	IMP12,3,2	6632FFFF	01 10011 00011001 0111 11 11111 11 1111
39D	IMP11	P+1=>P	PBR	SS03,1,X'17,P,P	C9C42F08	11 00100 11100010 0001 01 11100 00 1000
	MPT04	X'0010=>M2	LIIT	X'0010,M2	001085EA	00 00000 00001000 0100 00 10111 10 1010
39E	MPT05		BRN	MPT03	2840FFFF	00 10101 10100000 0111 11 11111 11 1111
39F	IMP02	M1-=>IR FS:10-9	FS3	IMP04,4,6,X'13,M1,IR	64462738	01 10010 00100011 0001 00 11100 11 1000
3A0						
3A2		ORG X'3A2				
3A2	IMP03	P+1=>P	BR	IMP12,X'17,P,P	26002F08	00 10011 00000000 0001 01 11100 00 1000
	T004	CONTINUE	BRN	T005	2900FFFF	00 10100 10000000 0111 11 11111 11 1111
3A3	T005	CHECK FOR MORE TRAPS	CBN	INT10,TRAP,1	2031FFFF	00 10000 00011000 1111 11 11111 11 1111
3A4	T006	P-1 => P ,RETURN	RETRN	X'16,P,P	A0402D08	10 10000 00100000 0001 01 10100 00 1000
3A5	HLT39A	X'C1 XOR M6=>ALU	LIT	X'C1,X'4E,M6,NOP	00C19DDF	00 00000 01100000 1100 11 10111 01 1111
3A6	HLT39A		CBN	HLT42,OSZ,1	2A85FFFF	00 10101 01000010 1111 11 11111 11 1111
3A7	HLT40		LIIT	X'008F,M6	008F85EE	00 00000 01011111 1100 00 10111 10 1110
3A8	HLT41		PBRN	HLT36,2	DB08FFFF	11 01101 10000100 0111 11 11111 11 1111
3A9	HLT42		PBRN	CCLR04,2	F548FFFF	11 11010 10100100 0111 11 11111 11 1111
3AA	MPT01	BR:MPRA=1 MPT ENTER	CBN	MPT04,MPRA,1	27BFFFFF	00 10011 11011111 1111 11 11111 11 1111
3AB	MPT02	X'0016=>M2	LIIT	X'0016,M2	001685EA	00 00000 00001011 0100 00 10111 10 1010
3AC	MPT03	MP DISABL MPT RETURN	CNTLN	0,0,1,4	A044FFFF	10 10000 00100010 0111 11 11111 11 1111
3AD	ABL25	BR SCEM1=1	CBN	ABL26,SCEM1,1	2D08FFFF	00 10110 10000101 1111 11 11111 11 1111
3AE	ABL20	M1+1=>M1	BR	ABL21,X'17,M1,M1	2C002F29	00 10110 00000000 0001 01 11100 10 1001
3AF						

ADR	LABEL	COMMENT	MACRO	*OPERAND	HEX VALUE	BINARY VALUE (OP / R A F B D)
	ABL21	#1=>ALU OPND FETCH	BR	ABL22,X'14,#1,OF	2C402932	00 10110 00100000 0001 01 00100 11 0010
380	ABL22	#1=>ALU OPND STORE	BR	ABL23,X'14,#3,OSW	2C802973	00 10110 01000000 0001 01 00101 11 0011
381	ABL23	MD=>SDR	BR	ABL24,X'64,0,SDR	2CC0C81D	00 10110 01100000 0110 01 00000 01 1101
382	ABL24	#3+1=>#3	BR	ABL25,X'17,#3,#3	28802F6B	00 10101 11000000 0001 01 11101 10 1011
383	ABL25	P=>ALU INST FTCH	PBR	SS08,1,X'14,P,IF	FAC42911	11 11101 01100010 0001 01 00100 01 0001
384		ORG X'388				
385	IDE02	R3+1=>R3	BR	IDE03,X'17,R3,R3	2E402E63	00 10111 00100000 0001 01 11001 10 0011
	IDE03	-8 SHIFT COUNT=>IR	LIT	X'FFF8,IR	FFF885F8	11 11111 11111100 0100 00 10111 11 1000
386	IDE04	MD=>#1	BR	IDE05,X'64,0,#1	2EC0C809	00 10111 01100000 0110 01 00000 00 1001
	IDE05	X'00FF AND #1=>#2	LIT	X'00FF,X'4D,#1,#2	00FF982A	00 00000 01111111 1100 11 01100 10 1010
387	IDE06	R7+#2=>#2 OF	BR	IDE07,X'2E,R7,#2	2F405CEA	00 10111 10100000 0010 11 10011 10 1010
388	IDE07	BR:SCEM1=0 ASR #1	CB	IDE07,SCEM1,0,X'00,#1,#1	2F4A0129	00 10111 10100101 0000 00 00100 10 1001
389	IDE08	MD=>P IF	BR	IDE09,X'66,0,P	2FC0CC08	00 10111 11100000 0110 01 10000 00 1000
38A	IDE09	#1=>R0	PBR	SS02,1,X'14,#1,R0	C4C42920	11 00010 01100010 0001 01 00100 10 0000
38B	TM00		LIT	X'0004,X'4E,#6,NOP	0004904F	00 00000 01101010 0100 11 10111 01 1111
38C	TM00A		CBN	HLT38A,OSZ,0	2984FFFF	00 10100 11000010 0111 11 11111 11 1111
38D	TM01A		BR	TM01,X'14,R7,#2	30C029EA	00 11000 01100000 0001 01 00011 10 1010
38E	TM01		BR	TM02,X'14,R0,R5	31002805	00 11000 10000000 0001 01 00000 00 0101
38F	TM02		BR	TM03,X'14,R3,R6	31402866	00 11000 10100000 0001 01 00001 10 0110
3C0	TM03		BR	TM04,X'14,R5,OSW	31802883	00 11000 11000000 0001 01 00010 11 0011
3C1						
3C2						
3C3						
3C4						
3C5						

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ADR LABEL              COMMENT          MACRO        OPERAND              HEX VALUE            BINARY VALUE
                                                                                     OP                    R  A    F    B  D
     TM04                               BR      TM05,X'14,R6,SDR
3C6                                                                       31C028DD   00 11000 11100000 0001 01 00011 01 1101
     TM05                               BR      TM06,X'2F,R2,R5
3C7                                                                       32005E45   00 11001 00000000 0010 11 11001 00 0101
     TM06                               BR      TM07,X'2F,R4,R6
3C8                                                                       32405E86   00 11001 00100000 0010 11 11010 00 0110
     TM07                               BR      TM08,X'14,R5,OSW
3C9                                                                       328028B3   00 11001 01000000 0001 01 00010 11 0011
     TM08                               BR      TM09,X'14,R6,SDR
3CA                                                                       32C028DD   00 11001 01100000 0001 01 00011 01 1101
     TM09                               BR      TM10,X'2D,R2,R5
3CB                                                                       33005A45   00 11001 10000000 0010 11 01001 00 0101
     TM10                               BR      TM11,X'2D,R4,R6
3CC                                                                       33405A86   00 11001 10100000 0010 11 01010 00 0110
     TM11                               BR      TM12,X'14,R5,OF
3CD                                                                       338028B2   00 11001 11000000 0001 01 00010 11 0010
     TM12                               BR      TM13,X'2E,R2,R5
3CE                                                                       33C05C45   00 11001 11100000 0010 11 10001 00 0101
     TM13                               BR      TM14,X'64,0,R7
3CF                                                                       3400C807   00 11010 00000000 0110 01 00000 00 0111
     TM14                               BR      TM15,X'3D,R6,R7
3D0                                                                       34407AC7   00 11010 00100000 0011 11 01011 00 0111
     TM15                               CB      TM22,DSZ,0,X'16,R1,R1
3D1                                                                       36042C29   00 11011 00000010 0001 01 10000 10 1001
     TM16                               BR      TM17,X'64,0,R7
3D2                                                                       34C0C807   00 11010 01100000 0110 01 00000 00 0111
     TM17                               BR      TM18,X'2F,R4,R6
3D3                                                                       35005E86   00 11010 10000000 0010 11 11010 00 0110
     TM18                               CNTL1   0,4,0,0,X'3D,R6,R7
3D4                                                                       A2007AC7   10 10001 00000000 0011 11 01011 00 0111
     TM19                               CB      TM23,DSZ,0,X'2D,R5,R1
3D5                                                                       36445AA9   00 11011 00100010 0010 11 01010 10 1001
     TM20                               CB      TM01,DSS,1,X'17,R5,R5
3D6                                                                       30C32EA5   00 11000 01100001 1001 01 11010 10 0101
     TM21                               BR      TM03,X'2D,R2,R5
3D7                                                                       31405A45   00 11000 10100000 0010 11 01001 00 0101
     TM22                               CNTL1   0,4,0,0,X'2D,R2,R5
3D8                                                                       A2005A45   10 10001 00000000 0010 11 01001 00 0101
     TM23                               BR      TM24,X'14,R2,NOP
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REV A

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95F1320

SH B-62OF

REV A

ADR	LABEL	COMMENT	MACRO	OPERAND	HEX VALUE	BINARY VALUE
						OP R A F S D
3D9					3680295F	00 11011 01000000 0001 01 00101 01 1111
	TM24		CBN	TM01,JSZ,1		
3DA					30C5FFFF	00 11000 01100010 1111 11 11111 11 1111
	TM25		PBRN	HLT02,2		
3D3					D288FFFF	11 01001 01000100 0111 11 11111 11 1111
		END				

SYMBOLS

000A	A	02AE	ABC01	02AF	ABC02	02B0	ABC03	02B1	ABC04
02B2	ABC05	02B3	ABC06	02B4	ABC07	02B5	ABC08	02B6	ABC09
02B7	ABC10	02B8	ABC11	02B9	ABC12	02BA	ABC13	02BD	ABC14
02B3	ABC14A	02BA	ABC15	02B8	ABC16	02BC	ABC17	02BF	ABL01
02C0	ABL02	02C3	ABL03	02C4	ABL04	02C5	ABL05	02C6	ABL06
02C7	ABL07	02C8	ABL08	02C9	ABL09	02BE	ABL10	02CA	ABL11
02C1	ABL12	02C2	ABL13	02D0	ABL14	02D1	ABL15	0223	ABL16
0227	ABL17	023E	ABL18	02CF	ABL19	03AF	ABL20	0330	ABL21
0331	ABL22	0332	ABL23	0333	ABL24	03AE	ABL25	0334	ABL26
0003	B	027D	BAC01	027E	BAC02	027F	BAC03	02A0	BAC04
02A1	BAC05	02A2	BAC06	02A3	BAC07	02A4	BAC08	0297	BAC09
0298	BAC10	02A5	BAC11	02A6	BAC12	02A7	BAC13	02A8	BAC14
02A9	BAC15	02AA	BAC16	02AB	BAC18	02AC	BAC19	02AD	BAC20
00F5	BC500	00A0	BIT01	000C	BIT02	00DD	BIT03	00DE	BIT04
00DF	BIT05	00E3	BIT05A	00AD	BIT06	00AE	BIT07	002E	BIT07A
002F	BIT07B	00AF	BIT08	00D6	BIT09	00D7	BIT10	00D8	BIT11
00DA	BIT12	00D9	BIT13	00DB	BIT14	0091	BYT01	0010	BYT02
0011	BYT03	0012	BYT04	0013	BYT05	0014	BYT06	0015	BYT07
0016	BYT08	02EA	BYT09	02E8	BYT10	02D8	BYT11	02DD	BYT12
02DF	BYT13	02E0	BYT14	02E1	BYT15	02E2	BYT16	02EE	BYT17
02EF	BYT18	02EC	BYT19	02ED	BYT20	02E8	BYT21	02E9	BYT22
0211	BYT23	0017	BYT24	02DA	BYT25	02D8	BYT26	02DC	BYT27
02DD	BYT28	02DE	BYT29	000C	C	0202	CBR01A	0203	CBR01B
02D4	CBR01C	0240	CBR401	0241	CBR402	0271	CCLR00	0246	CCLR01
0247	CCLR02	0248	CCLR03	0235	CCLR04	0206	CCLR05	02D7	CCLR06
02D8	CCLR07	02D9	CCLR08	0242	CHLT01	0243	CHLT02	0365	CIA01
0367	CIAB01	0366	CIB01	0244	CINT01	0245	CINT02	0270	CINT03
000F	CON00	000D	D	000B	DIV15	0193	DIV01	01D2	DIV02
0194	DIV03	01D3	DIV04	01D8	DIV05	01D9	DIV06	01E0	DIV07
01E1	DIV08	01E2	DIV09	01DA	DIV10	0125	DIV10A	0126	DIV10B
01D3	DIV11	01DC	DIV12	01DD	DIV13	01DE	DIV14	01DF	DIV15
01C2	DIV16	01C3	DIV17	01E3	DIV18	01E4	DIV19	01C4	DIV20

01E5	DIV21	01C5	DIV22	0001	DJMP	00D5	DP01	009C	DP02		
009E	DP03	0027	DP05	0026	DP06	00CA	DP07	00C8	DP08		
0229	DP09	0219	DP10	0210	DP11	022A	DP12	0228	DP13		
021F	DP14	0221	DP15	0210	DP16	02FC	DP17	0225	DP18		
02FD	DP19	023F	DP20	0212	DP21	02F6	DP22	02F7	DP23		
02F8	DP24	02F9	DP25	01E9	DP26	01EA	DP27	0214	DP28		
02E3	DP29	02E4	DP30	02E5	DP31	02E6	DP32	0216	DP33		
02F0	DP34	02F1	DP35	02F2	DP36	02F3	DP37	02F4	DP38		
02F5	DP39	0218	DP40	02E7	DP41	021A	DP42	02FA	DP43		
021C	DP44	02FB	DP45	0092	DR01	0093	DR02	0094	DR03		
0095	DR04	0096	DR05	0097	DR06	0098	DR07	0099	DR08		
0030	DR09	0031	DR10	0032	DR11	0086	DR12	0034	DR13		
0035	DR14	0036	DR15	0037	DR16	005C	DR17	0053	DR18		
005E	DR19	005F	DR20	0213	DR21	0230	DR22	0231	DR23		
0232	DR24	0233	DR25	0234	DR26	0235	DR27	0236	DR28		
0237	DR29	0032	DR30	0034	DR31	0036	DR32	0038	DR33		
003A	DR34	0133	DR35	0135	DR36	000E	E	00A9	EAL00		
0191	EAL01	01D6	EAL02	01D7	EAL03	011C	EAL04	011D	EAL05		
011E	EAL06	011F	EAL07	0174	EAL08	0165	EAL09	0175	EAL10		
0195	EAL11	0104	EAL12	0170	EAL13	0171	EAL14	0172	EAL15		
0173	EAL16	0106	EAL17	0107	EAL17A	0120	EAL17B	0121	EAL17C		
0122	EAL17D	01E6	EAL18	01E7	EAL19	01E8	EAL20	0008	EAJ01		
000C	EAJ02	00F0	EAJ03	00F1	EAJ04	00F2	EAJ05	001C	EAJT		
00A3	EIS00	0199	EIS01	0181	EIS02	0183	EIS04	019A	EIS05		
018E	EIS06	0198	EIS07	0188	EIS08	0189	EIS09	018A	EIS10		
0188	EIS11	0190	EIS12	018C	EIS13	0178	EIS14	017A	EIS15		
017C	EIS16	017E	EIS17	0180	EIS18	0190	EIS19	0192	EIS20		
0192	EIS21	0194	EIS22	0185	EIS23	0186	EIS24	0187	EIS25		
0196	EIS26	0138	EIS27	013A	EIS28	013C	EIS29	013E	EIS30		
0197	EIS31	01A0	EIS32	01A2	EIS33	018F	EIS34	019C	EIS35		
019E	EIS36	0310	EX101	0311	EX102	0304	EX103	0305	EX104		
0306	EX105	0307	EX106	0308	EX107	0309	EX108	030A	EX109		
0303	EX110	0318	EX201	0319	EX202	0340	EXC13	0032	EXEC01		
0033	EXEC02	0048	EXEC03	0049	EXEC04	004A	EXEC05	0043	EXEC07		
004C	EXEC08	000F	F	0010	FLG0	0011	FLG1	0012	FLG2		
0013	FLG3	0014	FLG4	001E	FLG5	00F3	FP00	00C9	HLT00		
00E9	HLT00A	00EA	HLT00B	0249	HLT01	024A	HLT02	0248	HLT03		
024C	HLT04	024D	HLT05	024E	HLT06	024F	HLT07	0250	HLT08		
0251	HLT09	0252	HLT10	0253	HLT11	0254	HLT12	0255	HLT13		
0256	HLT14	02CD	HLT14A	02CE	HLT14B	0257	HLT15	0258	HLT16		
0259	HLT17	025A	HLT18	025B	HLT19	025C	HLT20	025D	HLT21		
025E	HLT22	025F	HLT23	0260	HLT24	0279	HLT24A	0261	HLT25		

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0262	HLT26	0263	HLT27	0264	HLT28	0265	HLT29	0266	HLT30
0267	HLT31	0268	HLT32	0269	HLT33	026A	HLT34	026B	HLT35
026C	HLT36	026D	HLT37	026E	HLT38	03A6	HLT38A	026F	HLT39
03A7	HLT39A	03A8	HLT40	03A9	HLT41	03AA	HLT42	00AA	IAL01
0177	IAL02	016F	IAL03	0112	IAL04	0114	IAL05	0116	IAL06
0118	IAL07	011A	IAL08	016E	IAL09	0132	IAL10	0134	IAL11
0136	IAL12	00E3	IDE01	0388	IDE02	0389	IDE03	038A	IDE04
0388	IDE05	038C	IDE06	038D	IDE07	038E	IDE08	038F	IDE09
0011	IF	00A4	IJ01	00A5	IJ02	00A6	IJ03	006C	IJ04
006D	IJ05	006E	IJ06	006F	IJ07	0053	IJ08	0054	IJ09
0357	IJ103	0360	IME01	0364	IME02	032F	IMP01	03A0	IMP02
03A2	IMP03	0390	IMP04	0392	IMP05	0394	IMP06	0396	IMP07
039C	IMP08	039A	IMP09	0399	IMP10	039D	IMP11	0398	IMP12
0314	IN01	0315	IN02	0329	IN03	0344	IN13	035D	IN20
035E	IN21	035F	IN22	0361	INA01	0363	INAB01	0353	INAB02
0354	INAB03	0362	INB01	0044	INR01	016A	INR02	0163	INR03
0193	INR04	000D	INT01	0380	INI10	0381	INI11	0382	INI12
0383	INI13	0384	INI14	0385	INI15	0377	INI15A	0386	INI16
0387	INI17	0388	INI18	0389	INI19	0150	INI20	0151	INI21
0152	INI22	0005	INIP	001A	IO	0300	IO01	0301	IO02
0302	IO03	0303	IO04	0350	IO10	0351	IO11	0352	IO12
0018	IR	020F	IR01	0299	IR02	0019	IJR	037D	IUR01
037E	IUR02	037F	IUR03	00A8	JIF01	0018	JIF02	0019	JIF03
001A	JIF04	0018	JIF05	001C	JIF06	0010	JIF07	001E	JIF08
001F	JIF09	0074	JIF10	0076	JIF11	0078	JIF12	007A	JIF13
007C	JIF14	007D	JIF14A	007E	JIF15	007F	JIF15A	0075	JIF16
0077	JIF17	0079	JIF18	007B	JIF19	006A	JIF20	0068	JIE21
0040	JMM01	0023	JMM02	0065	JMM03	0066	JMM04	0067	JMM06
0041	JMM07	0042	JMM08	0203	JMM09	0205	JMM10	0002	JMUS
00C3	JMP01	0029	JMP02	0201	JMP03	00CC	JMP04	00CD	JMP05
00CE	JMP06	00CF	JMP07	00D0	JMP08	00D1	JMP08A	010E	JMP09
010F	JMP10	01EE	JMP11	01ED	JMP11A	00A7	JSR01	0060	JSR02
0061	JSR03	0278	MEM01	027A	MEM01A	027C	MEM02	0293	MEM04
023C	MEM05	0003	MP01	0004	MP02	014C	MP02A	014D	MP023
014E	MP02C	0145	MP03	001C	MPD	030F	MPD01	030E	MPE01
0013	MPM	0328	MPM01	036E	MPJ01	036F	MPJ02	0370	MPJ03
0371	MPJ04	0372	MPJ05	0373	MPJ06	0374	MPJ07	0375	MPJ08
0376	MPJ09	001F	MPRA	03AB	MPT01	03AC	MPT02	03AD	MPT03
039E	MPT04	039F	MPT05	0014	MPTST	01F0	MUL01	01EF	MUL01A
01F1	MUL02	017B	MUL02A	01F2	MUL03	01F3	MUL04	0123	MUL04A
0124	MUL04B	01F4	MUL05	01AC	MUL06	01AD	MUL07	012D	MUL07A
012E	MUL07B	01AE	MUL08	01AF	MUL09	01F5	MUL10	01F6	MUL11

015D MUL14	0188 MUL15	0189 MUL15A	018D MUL15B	0149 MUL16			
01AA MUL17	01AB MUL18	0030 NA01	0031 NA02	0002 NA03			
0028 NA04	002A NA05	002C NA06	0021 NA09	0128 NA10			
012F NA11	0130 NA12	0131 NA14	0179 NA15	0101 NA16			
0102 NA17	0103 NA18	0109 NA19	010A NA20	0108 NA21			
010C NA22	010D NA23	0051 NAB01	0052 NAB02	0023 NAB03			
0020 NAB04	0022 NAB05	0024 NAB06	0025 NAB07	0058 NAB07A			
0059 NAB08	005A NAB09	005B NAB10	004E NAB11	004F NAB12			
0007 NOTST	001F NOP	0348 OA301	0349 OAR01	034A OBR01			
0012 OF	0348 OME01	0347 OME02	0391 OME03	0005 OSC			
0015 OSL3	0014 OSR3	0001 OSS	0013 OSW	0002 OSZ			
0316 OUT01	0317 OUT02	033C OUT04	0330 OUT05	033E OUT06			
033F OUT07	036C OUT08	036D OUT09	0346 OUT13	0368 OUT20			
0369 OUT21	036A OUT22	0368 OUT23	0004 OVFL	0008 P			
0007 PAR01	0008 PAR02	0140 PAR02A	0141 PAR02B	0142 PAR03			
0143 PAR04	0146 PAR06	0147 PAR07	029F PC01	0290 PC02			
0005 PF01	0006 PF02	0148 PF03	0149 PF04	014A PF04A			
014B PF05	009D PIO00	030C PIY01	0300 PIY02	0013 PWRUP			
0010 Q	000C QBOON	0000 R0	0001 R1	0002 R2			
0003 R3	0004 R4	0005 R5	0006 R6	0007 R7			
0341 RAY01	027E REG01	0280 REG02	0281 REG03	0282 REG04			
0283 REG05	0284 REG06	0285 REG07	0286 REG08	0287 REG09			
0288 REG10	0289 REG11	028A REG12	028B REG13	028C REG14			
028D REG15	028E REG16	028F REG17	0295 RR01	0296 RR02			
0294 RR03	0000 RST00	01FD RST01	01FE RST02	01FF RST03			
0320 RTC01	0321 RTC02	0326 RTC03	0327 RTC04	0322 RTC10			
0323 RTC12	0324 RTC13	0325 RTC14	0009 RTCI01	000A RTCI02			
00ED RTCI03	00EE RTCI04	00EF RTCI05	0080 RTM01	0081 RTM02			
0082 RTM03	0083 RTM04	0084 RTM05	0085 RTM06	0086 RTM07			
0087 RTM08	0088 RTM09	0089 RTM10	008A RTM11	008B RTM12			
008C RTM13	008D RTM14	008E RTM15	008F RTM16	00F4 RTM17			
00F6 RTM18	00E6 RTM19	00E7 RTM20	0070 RTM21	0071 RTM22			
0072 RTM23	0073 RTM24	0099 RTM25	008A RTM26	008B RTM27			
008C RTM28	008D RTM29	008E RTM30	008F RTM31	0135 RTM32			
0137 RTM33	0139 RTM34	034F SA801	0207 SBR01	0238 SBR02			
0239 SBR03	023A SBR04	0209 SBR05	0005 SCEM1	0010 SDR			
0312 SEN01	0313 SEN02	0330 SEN03	0331 SEN04	0332 SEN05			
0333 SEN07	0334 SEN08	0342 SEN13	0343 SEN14	001A SER			
0024 SHF01	015D SHF02	015E SHF03	015F SHF04	012C SHF04A			
01C0 SHF04B	01C1 SHF04C	0160 SHF05	017B SHF06	0168 SHF07			
0169 SHF08	0128 SHF09	0129 SHF10	012A SHF11	0138 SHF12			
013A SHF13	018C SHF14A	01A3 SHF14B	01BE SHF15A	01F7 SHF15B			

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01C6	SHF16	0166	SHF17A	0167	SHF17B	01C7	SHF18	01C8	SHF19
0159	SHF19A	015A	SHF19B	01C9	SHF20	01CA	SHF21	0118	SHF23
01C8	SHF24	01CD	SHF25	01CE	SHF26	0158	SHF26A	015C	SHF26B
01CF	SHF27	01D0	SHF28	01A4	SHF29	0161	SHF29A	0162	SHF29B
01A5	SHF30	01A6	SHF31	01F8	SHF32	0163	SHF32A	0164	SHF32B
01F9	SHF33	01FA	SHF34	0180	SHF35A	0181	SHF35B	0132	SHF36A
0133	SHF36B	0184	SHF37A	0185	SHF37B	0186	SHF38A	0137	SHF38B
01CC	SHF39	01FB	SHF40	01FC	SHF41	0105	SHF42	01A7	SHF43
01D1	SHF44	034D	SDAR01	034E	SDAR01	034C	SDME01	0345	SDME02
0395	SDME03	00AC	SPARE1	00EC	SPARE2	021E	SPARE3	0093	SR01
0033	SR02	00C0	SR03	00C1	SR04	00C2	SR05	00C3	SR06
00C4	SR07	00C5	SR08	00C6	SR09	00C7	SR10	0233	SR11
023C	SR12	0230	SR13	0215	SR15	0228	SR16	0200	SR17
0202	SR18	0204	SR19	0206	SR20	0208	SR21	020A	SR22
020C	SR23	020E	SR24	0220	SR25	0222	SR26	0224	SR27
022B	SR28	0217	SR29	0219	SR30	00A1	SRE01	00A2	SRE02
00A3	SRE03	003C	SRE04	003D	SRE05	003E	SRE06	003F	SRE07
0062	SRE08	0064	SRE09	0068	SRE10	01D4	SRE11	01D5	SRE12
0100	SS01	0113	SS02	0127	SS03	0115	SS04	000E	SS05
0119	SS06	0108	SS07	01EB	SS08	01EC	SS09	0335	SS103
0338	SS203	0117	SS22	031E	SS703	031F	SS803	0291	ST01
0292	ST02	0293	ST03	0045	STA01	019D	STA02	019F	STA03
016C	STA04	016D	STA05	000A	STA8L	0046	STB01	0141	STB02
0001	STP00	0047	STX01	013F	STX02	000B	T520F	031A	TEX01
031B	TEX02	031C	TEX03	031D	TEX04	038A	TI01	0398	TI02
039C	TI03	038D	TI04	038E	TI04A	0016	TIN	03C0	TM00
03C1	TM00A	03C3	TM01	03C2	TM01A	03C4	TM02	03C5	TM03
03C6	TM04	03C7	TM05	03C8	TM06	03C9	TM07	03CA	TM08
03CB	TM09	03CC	TM10	03CD	TM11	03CE	TM12	03CF	TM13
03D0	TM14	03D1	TM15	03D2	TM16	03D3	TM17	03D4	TM18
03D5	TM19	03D6	TM20	03D7	TM21	03D8	TM22	03D9	TM23
03DA	TM24	03DB	TM25	0378	TO01	0379	TO02	037A	TO03
03A3	TO04	03A4	TO05	03A5	TO06	0017	TOU1	0018	TRAP
0355	TS010	0356	TS011	0336	TS020	0090	TSR01	00E0	TSR02
00E4	TSR03	00E8	TSR04	00E5	TSR05	00E1	TSR07	033A	TTC01
0353	TTC02	035C	TTC03	032A	TTI00	0328	TTI01	032C	TTI02
032D	TTI03	032E	TTI04	0357	TTJ01	0358	TTJ02	0359	TTJ03
0019	TTY	0015	TWI	0008	TXRDY	0009	TYDR	0272	TYDP01
0273	TYDP02	0274	TYDP03	0275	TYDP04	027B	TYDP05	0277	TYDP06
0278	TYDP07	02CB	TYDP08	02CC	TYDP09	009A	VSI01	00F7	VSI02
00F8	VSI03	00F9	VSI04	00FA	VSI05	00FB	VSI06	00FC	VSI07
00FD	VSI08	00FE	VSI09	00FF	VSI10	022D	VSI11	022E	VSI12

```
022F VSI13  0220 VSI14  0008 #0     0009 #1     000A #2
000B #3     000C #4     000D #5     000E #6     000F #7
  0 ERRORS ASSEMBLY COMPLETE
 08:49:54  /PFILE,SS,,SS
 08:49:58  /MEM,10
 08:50:02  /CONC
```