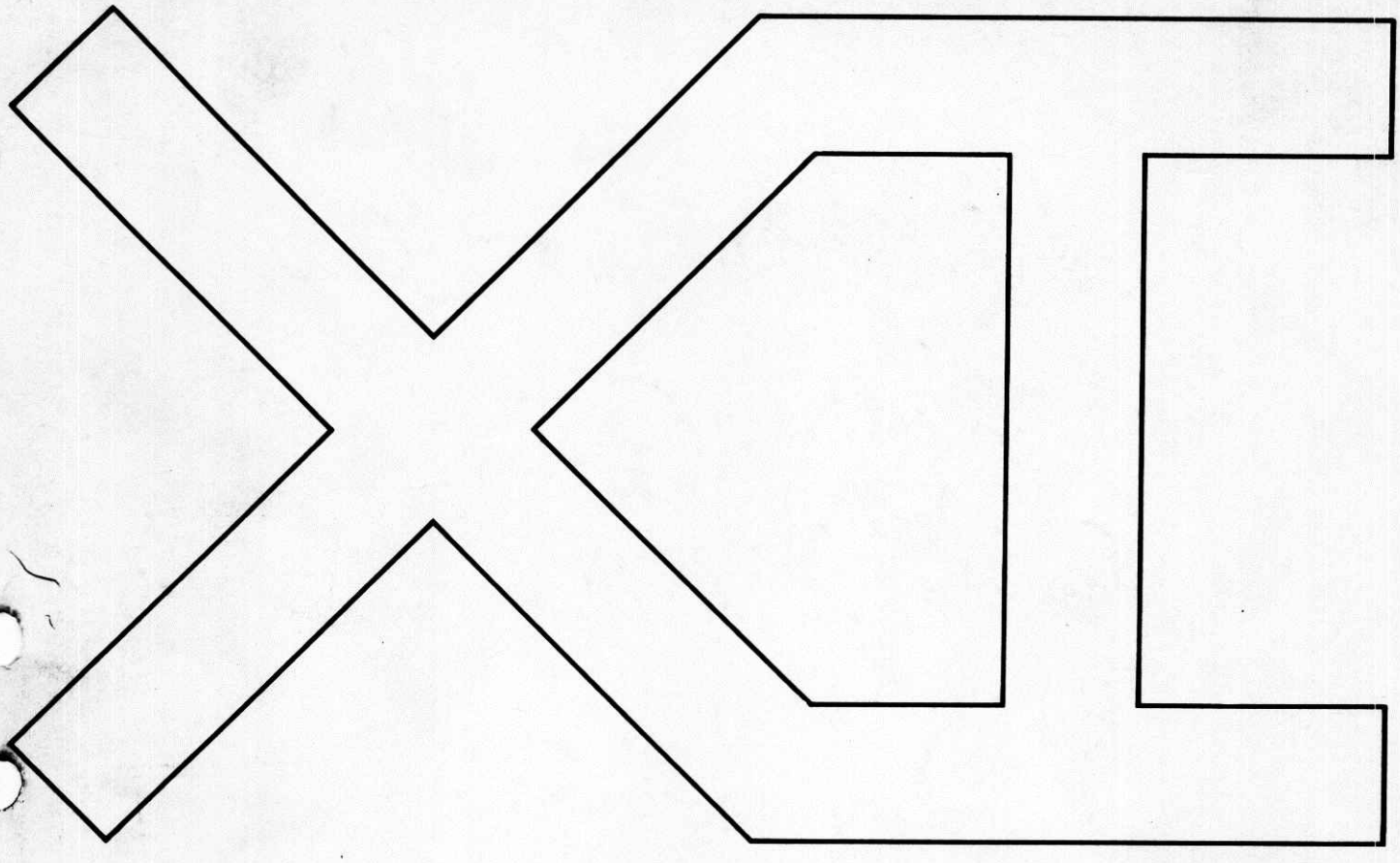

MONROBOT XI

UTILITY PROGRAMS FOR PUNCHED CARD INPUT

MO-226 ED 1-65
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The UTILITY PROGRAMS which follow are intended for use with a Monrobot XI computer installed with an IBM 24 card reader and a 26 card punch at Device 2 for program input/output.

UTILITY PROGRAMS are also available for use with computers having five or eight channel tape as the program input/output medium. While in many instances the utility programs have the same end result the coding and operating instructions are different.

The primary purpose of these Utility Programs is to enable the programmer to input or output program instructions from a variety of devices and to verify the output or reproduce additional copies.

Some Utility Programs are used for diagnostic purposes to determine the location of program instructions which may cause an error or instructions which must be changed.

Other Utility Programs are used as working tools by the programmer. All of these routines allow rapid communication with the computer for program testing purposes.

All of the following Utility Programs are contained in registers 007 through 04X and are easily relocated to other locations in memory. Each group of program cards is preceded by a title card which is used as a trailer card when reading in the card deck. Following the title card is the program card (A's card) to be placed on the IBM 24 card reader program drum. The next card contains the program relocation codes.

TABLE OF CONTENTS

GENERAL OPERATING PROCEDURE

1. Before attempting to use these Utility Programs it is necessary to be thoroughly familiar with the Monroe descriptive material on the card reader and card punch as well as the IBM 24/26 Card Punch Reference Manual (A24-0520-0).

2. These Utility Programs require an IBM 24 card reader and 26 card punch connected at the device 2 input/output box with a reader skip cable connecting the model 24 card read coupler and the model 26 card punch coupler.

3. To use the Utility Programs prepare the card reader and punch as follows:

   a) Turn power ON and touch the RELease keys to break the interlocks.

   b) See that the Off-line switches under the program drum cover are set to "COMPUTER."

   c) Set the AUTO FEED, AUTO SKIP/DUP and PRINT switches on the card punch keyboards ON.

   d) Place the proper program card on the card reader program drum and lower the star wheels onto the program card.

   e) Place the program cards to be read followed by one additional card (which will not be read) in the card reader hopper, touch FEED, FEED, and RELease keys to position the first card at the reading station.

   f) If the card punch is to be used no program card is necessary. Raise the star wheels.

   g) Place blank cards in the card punch hopper, touch the FEED key twice to position a card at the punching station.

Procedure to be Used to Record the
PROGRAM INPUT FROM PUNCHED CARDS
Instructions on the Drum of the Monrobot XI

1. Prepare the card devices for use as described in General Operating Procedure, paragraph three. It is essential that this card deck be in strict sequential order, ie, L1, L2, L3 and L4 followed by a blank card. Standard program card (all A's) is used.

2. Press the RESET button.

3. From the input/output typewriter or 16 key device connected to input device number one, enter the following:

Enter	Press LOAD Button	Enter	Press START Button
T3W5S380	"	240073W9	"
T3W6S380	"	U0059004	"
T3W7S380	"	X005T3WS	"
T3W8S380	"	T00533W5	"
T3W9s380	"	2400X3W7	"

Note: If the 16 key device is connected to input box number one, change all S380 instructions to 0000.

4. Enter 33W50000, press the LOAD and START buttons. Columns 1 through 12 only of each card will be read into the computer. Reading will stop after the 3XX card has been read. The input from device 2 and START lights will remain on. Press the RESET button. Touch the RELease key on the card reader to stack the trailer card. Remove the program card from the program drum.

After the Utility Program has been recorded on the drum the computer can read in previously prepared program cards.

5. Prepare the card devices for use as described in General Operating Procedure, paragraph 3. Use the A's program card on the card reader program drum. Advance the first card to the card read station.

6. Press the RESET button.

7. Type 33X00000, press the LOAD and START buttons. The program cards will be read into the computer.

8. Reading will stop after the last program card has been read, the input from device 2 and START lights will remain on. Press the RESET button. Touch the RELease key on the card reader to stack the trailer card.

9. If a parity error occurs reading of the cards will stop, the input from Device # 1 and parity lights on the control panel will be on. Press the backspace button under the card read bed to set the card back two columns, then touch the space bar on the card reader keyboard, and then the space bar on the typewriter. Reading will continue if the card has been punched correctly.

Note: Since the starting address for each sequence of eight registers appears on each program card it is not necessary to maintain the deck of program cards in strict sequence. During program testing it is necessary only to punch program cards for registers which have been changed and place these cards at the back of the program deck. After testing is completed the entire program can be output to a new deck of program cards for permanent use.

Relocation addresses: 3WT - 3XX

Card reader and punch at device 2.

Procedure to be Used to Record the CARD-LOAD BOOTSTRAP FOR AN OPERATIONAL SYSTEM Instructions on the Drum of the Monrobot XI

This routine is permanently recorded in storage. No card-load routine is ever required except in bootstrap form. Each time a program is to be loaded, the 3X0 load program is bootstrapped into its appropriate location. This particular bootstrap routine transfers control to the load program after the bootstrap operation is completed. This load program expects to find program cards following the bootstrap cards L1, L2, L3, and L4. The last card in the program deck should place an unconditional jump in register 3X0 to the beginning of the program which has been loaded, otherwise the computer will stop after the last program card has been read (see Step 8 in Utility Program UTC-1).

1. Prepare the card devices for use as described in General Operating Procedure, paragraph 3. The Standard Program Card (all A's) is used. It is essential that this card deck be in strict sequential order, ie, L1, L2, L3, L4, followed by the program cards for the program to be read in. The last card in the deck must be a blank card.

2. Press the RESET button.

3. From the input/output typewriter or 16 key device connected to input device number one, enter the following:

Enter	Press LOAD Button	Enter	Press START Button
T008S380	"	V009300T	"
T009S380	"	V005T3W9	"
T00SS380	"	2400X001	"
T00TS380	"	T0013401	"
T00US380	"	2400700S	"
T00VS380	"	63XXU005	"
T00WS380	"	9004X005	"
T00XS380	"	T005300U	"

Note: If the 16 key device is connected to input box number one, change all S380 instructions to 0000.

4. Enter 30080000, press the LOAD and START buttons. Columns 1 through 12 only of each card will be read into the computer. Reading will stop after the 3XX card has been read. The input from device 2 and START lights will remain on. Press the RESET button. Touch the RELease key on the card reader to stack the trailer card. Remove the program card from the program drum.

Note: This bootstrap routine destroys the contents of registers 3W9 and 3WS. The load program has parameters 3WT-3XX. The programmer may use 007, 010-3XX. Registers 3W9-3XX may be used for working storage.

Preparation of Punched Cards Used to Record the PROGRAM INPUT FROM PUNCHED CARDS Instructions on the Drum of the Monrobot XI

1. Prepare four cards as follows:

Card 1		Card Columns
	Register	1234567890123
	3WS	2637163174 5 ¤ 1
	3WT	3437325778 2 ¤ 1
	3WU	8417783177 4 ¤ 1
	3WV	1777777787 4 ¤ 1
	3WW	3178132777 7 ¤ 1
	3WX	3577783177 2 ¤ 1L1
Card 2		
	3X0	2847811181 8 ¤ 1
	3X1	2577871378 1 ¤ 1
	3X2	2577781175 7 ¤ 1
	3X3	8437811817 7 ¤ 1
	3X4	8677714778 5 ¤ 1
	3X5	3637352778 1 ¤ 1L2
Card 3		
	3X6	8677711178 1 ¤ 1
	3X7	3577831778 1 ¤ 1
	3X8	8637823176 6 ¤ 1
	3X9	3577866177 7 ¤ 1
	3XS	2778128778 8 ¤ 1
	3XT	3578132778 5 ¤ 1L3
Card 4		
	3XU	8437827175 3 ¤ 1
	3XV	3377867177 1 ¤ 1
	3XW	1437642778 4 ¤ 1
	3XX	2456783175 8 ¤ 1L4

MONROBOT XI PROGRAM SHEET

PROGRAM

PROGRAM INPUT FROM PUNCHED CARDS

PAGE	DATE	PROGRAMMER
3X0		

REGISTER		CONTENTS	NOTES
3X0	A	U500	(3XX) Clear FA6 to 0
	B	9410	Generate an IBM zero
3X1	A	T003	Store IBM zero = 00000010
	B	9801	Divide by 2 = 00000008
3X2	A	T000	Store alpha factor
	B	13WX	X00033XS to FA4
3X3	A	2400	Read waste character from coupler
	B	S07X	Clear conversion register
3X4	A	37XU	Jump mark to read address
	B	V005	Load address = 00000ADR
3X5	A	X3WW	Add constant V005SXXX
	B	T001	Store V005T(ADR-1)
3X6	A	37XU	(3X8) Jump mark to read register
	B	9401	Generate a 1
3X7	A	X001	Add V005T(ADR-1) = V005TADR
	B	T001	Store drum store instruction
3X8	A	3401	Jump mark to store register
	B	33X6	Jump to read next card register
3X9	A	X003	(3XV) Add back constant 00000010
	B	63XX	Jump zero = end of card
3XS	A	U005	(004)(3XW) Character to FA5/ Word to FA6
	B	9008	Shift left 1 tetrad
3XT	A	X005	Add character
	B	T005	Store new conversion
3XU	A	2401	(3X4)(3X6)(3WU) Read 1 character
	B	73WT	Parity error or lozenge
3XV	A	W003	Subtract constant 00000010
	B	73X9	Jump negative if space or 1-9
3XW	A	63XS	Jump zero if an IBM zero
	B	3004	Alpha S-X; Add alpha factor; to 3XS
3XX	A	S5W0	(3X9) Eject card
	B	33X0	Jump to read next card

MONROBOT XI PROGRAM SHEET

PROGRAM

PROGRAM INPUT FROM PUNCHED CARDS

PAGE	DATE	PROGRAMMER
3W0		

REGISTER		CONTENTS	NOTES
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
3WT	A	W3WV	(3XU) Subtract constant 8000003U
	B	6002	0 = lozenge; end of address or register
3WU	A	2200	Halt, parity error
	B	33XU	Jump to re-read character
3WV	A	8000	Constant: lozenge
	B	003U	
3WW	A	V005	Virgin store instruction
	B	SXXX	
3WX	A	X000	Instruction for FA4: Add constant 00000008
	B	33XS	Jump to convert

Procedure to be Used for PROGRAM INPUT FROM TYPEWRITER

1. Read in the UTC-2 deck of program cards following steps 5 through 8 of PROGRAM INPUT FROM PUNCHED CARDS (UTC-1).

2. Press the RESET button.

3. Type 30100000. Press the LOAD and START buttons. A carriage return will occur.

4. Type the three sexadecimal character address of the first register in which the program input from the typewriter is to be stored.

5. Press the START button; a carriage return will occur.

6. Type the three sexadecimal character address of the last register to be used to store the program input from the typewriter. If an error is made while typing either address, press the RESET button, type 30100000, press the LOAD and START buttons, repeat from Step 4.

7. Press the START button; a carriage return will occur. The START light and the input from device one light on the control panel will now be on.

8. Type in the eight character program instruction which is to be stored at the starting address. If an incorrect character is typed, retype the correct information, since only the last eight characters typed will be stored.

   Note: The typewriter has keys for the digits "one" and "zero". These must be used rather than the keys for the alpha characters "O" and lower case "L".

9. When the last eight characters are the correct ones, touch the space bar on the typewriter. This will cause the computer to store the instructions in the proper register and execute a carriage return.

10. Repeat Steps 8 and 9 which will store the typed instructions in successive registers.

11. A parity error can occur if two keys are struck together by accident. If this happens, a carriage return will occur and all eight characters of that register must be typed again.

12. When instructions have been stored in the last register (given in Step 6 above) an "E" will be printed on the typewriter indicating that all registers between and including the starting and ending addresses have had instructions stored in them.

13. An error has occurred if the "E" is printed before the last register has been input or if the "E" does not print when expected. Either one register has been entered twice (in the first instance) or a register has been omitted. In order to avoid extensive repetition, it is suggested that not more than one page of coding be input within a set of parameters. (e.g., start at 050, end at 05X.)

14. After the "E" has been printed, the program will repeat from Step 4. When no further program is to be input, press the RESET button.

RELOCATION ADDRESSES: 010-029

Typewriter at Device # 1

MONROBOT XI PROGRAM SHEET

PROGRAM

Program Input From Typewriter

PAGE	DATE	PROGRAMMER
010		

REGISTER		CONTENTS	NOTES
010	A B	V025 T001	Load Constant 00000001 Store in FA 1
011	A B	V026 T002	Load Constant 00000008 Store in FA 2
012	A B	V027 T003	Load Constant 00000010 Store in FA 3
013	A B	S380 U500	(029) Carriage Return Clear FA 6 to 0
014	A B	0000 X028	Type in beginning register number. Depress start Add Constant V005T000
015	A B	T020 S380	Store modified beginning register in Reg. 020 Carriage Return
016	A B	U500 0000	Clear FA 6 to 0 Type in Ending Register number. Depress Start
017	A B	X028 X001	Add constant V005T000 Add Constant 00000001
018	A B	T000 3023	Store modified Ending Register plus 1 in FA 0 Jump to Register 023
019	A B	T005 2200	(01W) (024) Store contents of FA 6 in FA 5 Type in one character of instruction to be stored
01S	A B	7023 6020	Jump on parity to Register 023 Jump 0 to Register 020, (Space Character)
01T	A B	W003 601V	Subtract Constant 00000010 (Code Conversion) Jump to 0 to Reg. 01V
01U	A B	701X X002	Jump minus to Reg. 01X If not 0 and not minus add constant of 00000008
01V	A B	U005 9008	(01T) (01X) Interchange with FA 5 (will contain input char. Binary Shift Left 4 (previous input shifted)
01W	A B	X005 3019	Add latest character in Tetrad 0 to shifted input Jump to type in another character
01X	A B	X003 301V	(01U) Add constant 00000010 Jump to Reg. 01V

MONROBOT XI PROGRAM SHEET

PROGRAM

Program Input From Typewriter

PAGE	DATE	PROGRAMMER
020		

REGISTER		CONTENTS	NOTES
020	A B	0000 0000	(01S) Load completed Input in FA 6 [015] Store in proper register [022]
021	A B	V020 X001	Load modified storage Register Add constant 00000001
022	A B	T020 W000	Store new modified storage register Subtract modified ending register plus 1
023	A B	6029 U500	(018) (01S) Jump 0 to Register 029 If not 0 clear FA 6 to 0
024	A B	S380 3019	Carriage Return Jump to Register 019
025	A B	0000 0001	Constant
026	A B	0000 0008	Constant
027	A B	0000 0010	Constant
028	A B	V005 T000	(023) Constant
029	A B	S375 3013	Self output a typed "E" (Signal for end of input) Jump to register 013 - End of Program
	A B		
	A B		
	A B		
	A B		
	A B		
	A B		

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Procedure for off-line preparation of

PROGRAM INPUT PUNCHED CARDS

Punched cards in program input format compatible with the UTC-1 Utility Program can be produced on an IBM 26 printing card punch when not connected to the computer. This is an alternate method to the Program Input from Typewriter utility program (UTC-2).

For off-line use the key punch should be disconnected from the card punch coupler and the "Computer/Off-line" switch under the program drum cover set to the "Off-line" position. Disconnect MUST be made with power to all equipment turned off.

1. On the IBM 26 key punch prepare a card with the lozenge character (◆ , punches in 12, 4, and 8 rows) in columns 4, 13, 22, 31, 40, 49, 58, 67, and 76. This will be the master end code card.

2. Prepare a program drum card with punches as follows:

Cols	1,2,3	a one in each column
Col	4	a zero punch
Cols	5 thru 12	a one in each column
Col	13	a zero punch
Cols	14 thru 21	a one in each column
Col	22	a zero punch
Cols	23 thru 30	a one in each column
Col	31	a zero punch
Cols	32 thru 39	a one in each column
Col	40	a zero punch
Cols	41 thru 48	a one in each column
Col	49	a zero punch

Col	50 thru 57	a one in each column
Col	58	a zero punch
Cols	59 thru 66	a one in each column
Col	67	a zero punch
Cols	68 thru 75	a one in each column
Col	76	a zero punch
Col	77	a hyphen (minus sign)
Col	78,79, and 80	an ampersand (&) in each column.

3. Place the program card on the program drum and insert on the key punch.

4. Place the master end code card in front of the hopper of blank cards. Press the "FEED" key twice, then the "RELease" key to position the master end code card at the reading station.

5. Lower the star wheels onto the program drum card.

6. Key in the three character sexadecimal address of the first register of instructions which is to appear on the card. The end code will be automatically duplicated.

   Note: The keypunch will normally be in alphabetic shift. When the digits 1 thru 9 and 0 are to be punched the "NUMeric" key must be held down, then released before an alpha character is punched.

7. Enter the eight characters to be stored at the address punched in step 6. The end code will be automatically duplicated.

8. Continue entering the instructions for succeeding registers. The end code will be automatically duplicated after each group of eight characters.

9. After the instructions have been entered for the eighth register the card will be automatically released. Repeat from step 6 by entering the starting address for the next program input card.

10. If an error is made touch the "RELease" key. The end codes will be duplicated in the card containing the error. Repeat from step 6 or hold down the "DUPlicate" key until the column preceeding the error has been duplicated.

Utility Program UTC-4

Procedure to be Used for PROGRAM OUTPUT TO PUNCHED CARDS

This Utility Routine is used to punch program instructions in cards to be compatible with the PROGRAM INPUT FROM PUNCHED CARDS (UTC-1) Utility Routine.

1. Read in the UTC-4 deck of program cards following steps 5 through 8 of PROGRAM INPUT FROM PUNCHED CARDS (UTC-1).

2. Press the RESET button.

3. Fill the hopper of the IBM 26 card punch with blank cards with the unprinted side of the cards facing front to avoid confusion with any printed material that may be on the card. Touch the FEED key twice to position the first card at the punching station. Raise the star wheels.

4. Type 30100000, press the LOAD and START buttons. A carriage return will occur.

5. Type the address of the first program register which is to be punched in cards. The address must be three sexadecimal characters.

6. Press the START button; a carriage return will occur.

7. Type the address of the last program register to be punched in cards.

8. Press the START button; a carriage return will occur.

9. The output format will have the address of the first register on the card punched in columns 1, 2 and 3 followed by a lozenge. The contents of eight registers will be punched in the remaining columns of the card. The contents of each register will be followed by a lozenge.

10. The program is terminated when the word END is typed followed by a carriage return. The RESET light will be on. If further output is required the program will repeat from step 5.

RELOCATION ADDRESSES: 010 - 035

Card Punch at device # 2.

MONROBOT XI PROGRAM SHEET

PROGRAM

PROGRAM OUTPUT TO PUNCHED CARDS

PAGE	DATE	PROGRAMMER
010		

REGISTER		CONTENTS	NOTES
010	A	S380	C/R
	B	U500	Clear Acc.
011	A	0000	Halt - type in starting address
	B	341V	Jump mark to shift 16 bits & C/R
012	A	T000	Store "0XXX 0000"
	B	U500	Clear FA 6
013	A	0000	Halt - type in ending address.
	B	341V	Jump mark to shift 16 bits & C/R
014	A	X02W	Add 0001 0000
	B	T001	Store Maximum Address plus 1
015	A	V02X	Load 0000 0012 (Correction constant for S - X)
	B	T004	Store
016	A	U500	Clear FA 6
	B	8102	Generate S (Dec. 10)
017	A	T003	Store
	B	3018	No op.
018	A	S07X	Clear FA 5
	B	S580	Feed new card
019	A	V000	Load starting address
	B	8U08	B. E. A. 4 bits
01S	A	X02W	Add 0001 0000 to indicate end of address
	B	3426	Jump mark to punch out routine
01T	A	V000	Load address
	B	S57U	Punch lozenge code at end of address
01U	A	342V	Jump mark to form initial pick up order
	B	3028	Jump
01V	A	9080	(011)(013) Bin. Sh. Left 8 bits
	B	9080	Bin. Sh. Left 8 bits
01W	A	S380	C/R
	B	3002	Jump Return
01X	A	8U08	(032) B. E. A. 4 bits
	B	X003	Add S (Dec. 10) to indicate end of word

MONROBOT XI PROGRAM SHEET

PROGRAM

PROGRAM OUTPUT TO PUNCHED CARDS

PAGE	DATE	PROGRAMMER
020		

REGISTER		CONTENTS	NOTES	
020	A	U005	(027)	Interchange (char now in FA 6-Remainder in FA 5)
	B	6024		Jump Ø to generate IBM Ø
021	A	W003		Subtract dec. value 10
	B	7023		Jump - neg. is value 1 thru 9
022	A	X004		Add 0000 0012 to correct digits S thru X
	B	3025		Jump
023	A	X003	(021)	Add back Dec. 10
	B	3025		Jump to punch out char.
024	A	9410	(020)	Generate IBM Ø
	B	3025		No op.
025	A	U005	(022)(023)	Interchange (char. now in FA 5-Remainder in FA 6)
	B	S47X		Punch char.
026	A	8U02	(01S)	B. E. A. 2 bits
	B	8U02		B. E. A. 2 bits
027	A	6002		Jump Ø to 01T or 028
	B	3020		Jump
028	A	V000	(01U)	Load address count
	B	X02W		Add 0001 0000
029	A	T000		Store
	B	W001		Subtract maximum address plus 1
02S	A	S53U		Punch lozenge code
	B	6033		Jump Ø - End of routine
02T	A	X001		Restore address count
	B	X431		Extract 0007 0000
02U	A	6018		Jump Ø to feed new card & punch address
	B	V000		Load address count
02V	A	X030	(01U)	Add V000 3032
	B	3006		Pick up new word from storage & exit to 032
02W	A	0001		Const. 014 01S 028
	B	0000		
02X	A	0000		Const. 015
	B	0012		

MONROBOT XI PROGRAM SHEET

PROGRAM

PROGRAM OUTPUT TO PUNCHED CARDS

PAGE	DATE	PROGRAMMER
030		

REGISTER		CONTENTS		NOTES
030	A	V000		Const. 02V
	B	3032		
031	A	0007		Const. 02T
	B	0000		
032	A	S07X	(02V)	Clear FA 5
	B	301X		Jump to 01X
033	A	S580	(02S)	Eject card
	B	S375		Print E
034	A	S325		Print N
	B	S334		Print D
035	A	S780		C/R & eject card
	B	3010		Jump to beginning of routine
	A			
	B			
	A			
	B			
	A			
	B			
	A			
	B			
	A			
	B			
	A			
	B			
	A			
	B			
	A			
	B			
	A			
	B			
	A			
	B			

Utility Program UTC-5

Procedure to be Used for PROGRAM OUTPUT TO TYPEWRITER (Monroe Form 92C)

This Utility Routine is used to output the contents of a series of program registers in the format required by the reproducible pin-feed coding sheet, Monroe form MO-92C.

1. Read in the UTC-5 deck of program cards following steps 5 through 8 of PROGRAM INPUT FROM PUNCHED CARDS (UTC-1).

2. Press the RESET button.

3. Attach the form alignment device to the typewriter and insert the continuous form MO-92C. Set the left margin so that the three character register address will type out in the "Register" block on the form. Then set a tab stop nine spaces from the left margin.

4. Type 30100000, press the LOAD and START buttons. A carriage return will occur.

5. Type the address of the first program register which is to be typed. The address must be three sexadecimal characters.

6. Press the START button; a carriage return will occur.

7. Type the address of the last program register to be typed and press the START button. Align the form to the A link of the first register to be typed on the printed form and touch the backspace key. The three character register address will be typed followed by the A and B link instructions for each register within and including the address parameters. If a register contains zeros the address will be typed but no zeros will be typed in the contents area on the form.

8. After the contents of the last register address have been typed the program will repeat from Step 5 if further typeout is desired. If not, press the RESET button.

RELOCATION ADDRESSES: 010-03S

Typewriter at Device # 1.

MONROBOT XI PROGRAM SHEET

PROGRAM

Program output to typewriter (Monroe Form 92C)

PAGE	DATE	PROGRAMMER
010		

REGISTER		CONTENTS	NOTES
010	A	S380	(022) Carriage return
	B	U500	Clear FA 6
011	A	0000	Halt, enter starting address /6, 0001000 to FA 4
	B	5034	Starting address to A link of FA 5, clear FA
012	A	S380	Carriage return
	B	0000	Halt, enter ending address
013	A	U005	Starting address → FA 6/Ending address → FA 5
	B	X039	Add virgin instruction V0003002
014	A	T000	Save register load instruction
	B	V005	Load ending address
015	A	5404	Ending address to A link of FA 5
	B	2200	Halt, adjust form, enter back space or carriage return
016	A	V039	Load virgin V0003002
	B	X005	Add ending address
017	A	T003	Save
	B	X004	Add one to ending address
018	A	T001	Save
	B	343S	Clear FA 5; register load instruction → FA 6
019	A	9008	(026) BSL 4
	B	3427	Type address
01S	A	3427	"
	B	3427	"
01T	A	3400	Jump mark to load register
	B	3031	Jump to test for zero register and tab
01U	A	3427	(032) Type A link of register
	B	3427	"
01V	A	3427	"
	B	3427	"
01W	A	S380	Carriage return
	B	S35W	Tab
01X	A	3427	Type B link of register
	B	3427	"

MONROBOT XI PROGRAM SHEET

PROGRAM

Program Output to Typewriter (Monroe form 92C)

PAGE	DATE	PROGRAMMER
020		

REGISTER		CONTENTS	NOTES
020	A	3427	Type B link of register
	B	3427	"
021	A	S380	(033) Carriage return
	B	V000	Load instruction
022	A	W003	Subtract ending instruction
	B	6010	Jump if zero to repeat program
023	A	X001	Add one to register load address
	B	T000	Save
024	A	X436	Extract R of ADR
	B	602W	Jump if zero to form up
025	A	S380	(02X) Carriage return
	B	V000	Load register load instruction
026	A	3019	Jump to repeat typeout
	B	0000	Fill
027	A	8U08	Binary left end around shift 4 bits
	B	U005	Char → FA 6/ Remainder → FA 5
028	A	602U	Jump to generate IBM zero
	B	W035	Subtract 10
029	A	702V	If negative character was 1-9
	B	X037	Add 18 to create alpha character
02S	A	U005	(02U) Char → FA 5/Ramainder FA → 6
	B	S27X	(02V) Output character
02T	A	3002	Jump to exit
	B	0000	Fill
02U	A	9410	(028) Generate IBM zero
	B	302S	Jump to continue
02V	A	X035	(029) Add back 10
	B	302S	Jump to continue
02W	A	V038	(024) Load constant, number of carriage returns for form up
	B	302X	No operation
02X	A	S380	(030) Carriage return (form up)
	B	6025	Jump if zero to continue

MONROBOT XI PROGRAM SHEET

PROGRAM

Program Output to Typewriter (Monroe form 92C)

PAGE	DATE	PROGRAMMER
030		

REGISTER		CONTENTS	NOTES
030	A	W004	Subtract 1
	B	302X	Jump to repeat carriage return
031	A	6033	(01T) Register contains zeros, omit print
	B	S35W	Tab
032	A	301U	Jump to type A link
	B	0000	Fill
033	A	S380	(031) Carriage return
	B	3021	Jump to increment address
034	A	0001	Increment for address
	B	0000	
035	A	0000	Constant: 10
	B	000S	
036	A	000X	Extractor
	B	0000	
037	A	0000	Constant for alpha factor: 18
	B	0012	
038	A	0011	Constant for form up: 17
	B	0000	
039	A	V000	(03S) Virgin load instruction
	B	3002	
03S	A	S07X	(018) Clear FA 5
	B	3039	Jump to load new register
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		

Utility Program UTC-6

Procedure to be Used for PROGRAM CARD TO DRUM COMPARISON

This Utility Routine is used to compare the program output cards produced by the UTC-4 Utility Program with the equivalent registers on the drum. The purpose is to verify program output cards against the contents of the drum to be certain that the cards have been punched correctly. When two versions of a program exist one may be read into the computer and the other compared with it by use of this routine. Or, when a program is known to run but fails when read into the computer the comparison utility routine may help in detecting the trouble.

1. The program against which comparison is to be made must be present on the computer drum.

2. Read in the UTC-6 deck of program cards following steps 5 through 8 of PROGRAM INPUT FROM PUNCHED CARDS (UTC-1).

3. Press the RESET button.

4. Insert paper in the typewriter and touch the carriage return key, then set tab stops 6 and 17 spaces from the left margin.

5. Place the deck of program cards (followed by a trailer card) which is to be compared with the drum in the card reader and position the first card at the reading station.

6. Type 30100000, press the LOAD and START buttons.

7. If a parity error occurs reading of the program card will stop, the input from device # 1 and parity lights on the control panel will be on. Backspace the card reader two columns, touch the space bar on the card reader keyboard, and then the space bar on the typewriter. If the parity error repeats the card has been mispunched and a new card must be produced for comparison.

8. If the program card register does not match the drum register, the following will print on the typewriter:

(Register Address)	(Contents of program card)	(Contents of drum)
XXX	XXXXXXXX	XXXXXXXX
Example: 294	220073W0	240073W0

RELOCATION ADDRESSES: 010 - 03V

Typewriter at Device No. 1, Card Reader at Device No. 2

MONROBOT XI PROGRAM SHEET

PROGRAM

PROGRAM CARD TO DRUM COMPARISON

PAGE	DATE	PROGRAMMER
010		

REGISTER		CONTENTS	NOTES
010	A	S380	Carriage return
	B	U500	Clear FA 6 to 0
011	A	9410	Generate a decimal 16
	B	T003	Store subtractor
012	A	9801	Divide by 2
	B	T000	Store alpha factor
013	A	1038	X0003026 to FA 4
	B	3014	No-op
014	A	S07X	Clear FA 5 to 0
	B	3428	Jump mark to read address
015	A	U005	0 to FA 5/ ADR to FA 6
	B	X039	Add V005VXXX
016	A	T001	Store V005W(ADR-1)
	B	3017	No-op
017	A	S07X	(01S)(024) Clear FA 5 to 0
	B	3428	Jump mark to read card register
018	A	9401	Generate a 1
	B	X001	Add V005W(ADR-1)
019	A	T001	Store V005WADR
	B	3401	Jump mark to compare registers
01S	A	6017	0 = items compare; read next register
	B	V005	Load card register
01T	A	T037	Save card register
	B	V001	Load V005WADR
01U	A	W03S	Subtract 00001000
	B	T001	Store V005VADR
01V	A	9480	Left 8 bits + 80 = 05VADR80
	B	9080	Left 8 bits = VADR8000
01W	A	9008	Left 4 bits = ADR80000
	B	S07X	Clear FA 5
01X	A	3434	Jump mark to print ADR
	B	S35W	Tab

MONROBOT XI PROGRAM SHEET

PROGRAM

PROGRAM CARD TO DRUM COMPARISON

PAGE	DATE	PROGRAMMER
020		

REGISTER		CONTENTS	NOTES
020	A	V037	Load card register
	B	342X	Jump mark to print card register
021	A	S35W	Tab
	B	3401	Jump mark to load drum register
022	A	U001	Drum register to FA 1/ V005VADR to FA 6
	B	X03S	Add 00001000
023	A	U001	V005WADR to FA 1/ Drum register to FA 6
	B	342X	Jump mark to print drum register
024	A	S380	Carriage return
	B	3017	Jump to read next register
025	A	X003	(029) Add back 16
	B	602T	0 = space, end of card
026	A	U005	(02S) Character to FA 5/ Word to FA 6
	B	9008	Left shift 4 bits
027	A	X005	Add character
	B	T005	Store word
028	A	2401	(014)(017) Read 1 character
	B	702U	Negative = P.E., lozenge, or carriage return
029	A	W003	Subtract a decimal 16
	B	7025	Negative = space, or digit 1 thru 9
02S	A	6026	0 = IBM zero
	B	3004	Alpha character S thru X
02T	A	S5W0	(025) Skip card
	B	3014	Jump to read next card
02U	A	W03T	(028) Subtract 8000003U
	B	6002	0 = lozenge; end code
02V	A	W03U	Subtract 00000045
	B	6028	0 = carriage return code
02W	A	2200	Halt; parity error
	B	3028	To re-read character
02X	A	S07X	(020)(023) Clear FA 5
	B	8W08	Character to FA 5; generate a flag

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MONROBOT XI PROGRAM SHEET

PROGRAM

PROGRAM CARD TO DRUM COMPARISON

PAGE	DATE	PROGRAMMER
030		

REGISTER		CONTENTS	NOTES
030	A B	U005 W03V	(035) Word to FA 5/ Character to FA 6 Subtract S
031	A B	7032 X000	Negative = 1 thru 9 Add back 8
032	A B	X03V 6036	Add back a decimal 10 0 = IBM zero
033	A B	U005 S27X	Word to FA 6/ Character to FA 5 Print
034	A B	8U01 6002	(01X) Binary left end around shift 1 bit 0 = end of printing
035	A B	8U04 3030	Shift 3 bits Jump to print
036	A B	V003 3033	Load IBM zero code Jump to print
037	A B	( )	Saved card register
038	A B	X000 3026	Instructions for FA 4
039	A B	V005 VXXX	Instruction for FA 1
03S	A B	0000 1000	Constant
03T	A B	8000 003U	Constant: lozenge code
03U	A B	0000 0045	Constant
03V	A B	0000 000S	Constant: 10
	A B		
	A B		

Utility Program UTC-7

Procedure to be Used for PUNCHED CARD DUPLICATION

This Utility Routine can be used to duplicate a deck of program cards or data cards. All characters appearing on the card punch keyboard will be duplicated. Caution must be exercised if any column contains a character which was created by multiple punching. This column may or may not be punched correctly or may result in a parity error.

1. Read in the UTC-7 deck of programs cards following steps 5 through 8 of PROGRAM INPUT FROM PUNCHED CARDS (UTC-1).

2. Press the RESET button.

3. Fill the hopper of the IBM 26 card punch with blank cards. If program cards are to be duplicated turn the cards so that the unprinted side faces front. Touch the FEED key twice to position the first card at the punching station. Raise the star wheels.

4. Place the cards to be duplicated plus a trailer card in the IBM 24 card reader. Touch the FEED key twice, then the RELease key to position the first card at the reading station.

5. Type 30100000, press LOAD and START. The deck of cards in the card reader will be duplicated by the card punch.

6. If a parity error occurs a "P" will be typed. Backspace the card reader two columns, touch the space bar on the card reader keyboard, and then the space bar on the typewriter. If the parity error repeats the character is unique and cannot be reproduced by this program.

RELOCATION ADDRESSES: 010 - 01V

Card reader and card punch at device # 2

MONROBOT XI PROGRAM SHEET

PROGRAM

PUNCHED CARD DUPLICATION

PAGE	DATE	PROGRAMMER
010		

REGISTER		CONTENTS		NOTES
010	A	U500		Clear FA 6
	B	9410		Generate 16_{10}
011	A	T000		Save Subtractor
	B	3013		Jump to read character
012	A	S47X	(016,7,	Punch character
	B	3013	8,9)	Jump to read next character
013	A	2400	(011)	Read character from card reader
	B	T005	(01T)	Save for output
014	A	7016		Jump if parity error
	B	W01V		Subtract carriage return code
015	A	6013		Jump if zero, new card
	B	3012		Character OK, jump to punch
016	A	W01U	(014)	Subtract @ code
	B	6012		Jump if zero to punch @ character
017	A	W000		Subtract 16 for % code
	B	6012		Jump if zero to punch % code
018	A	W000		Subtract 16 for * code
	B	6012		Jump if zero to punch * code
019	A	W000		Subtract 16 for lozenge code
	B	6012		Jump if zero to punch lozenge code
01S	A	S367		Print "P", was true parity error
	B	2200		Halt, reset card reader, touch space bar
01T	A	3013		Jump to re-read character
	B	0000		Fill
01U	A	8000		Constant: @ code
	B	000U		
01V	A	0000		Constant: carriage return code
	B	0080		
	A			
	B			
	A			
	B			

Utility Program UTC-8

Procedure to be Used for REGISTER SEARCH OF MEMORY

This Utility Routine is used for diagnostic purposes to locate registers containing references to addresses, devices, or any portion of a program instruction. The program to be searched must be stored on the drum.

1. Read in the UTC-8 deck of program cards following steps 5 through 8 of PROGRAM INPUT FROM PUNCHED CARDS (UTC-1).

2. Press the RESET button.

3. Type 30100000, press the LOAD and START buttons; a carriage return will occur.

4. The words SEARCH FOR will be printed out. Type in not more than four sexadecimal characters. Press the START button. A carriage return will occur and the word MASK will be printed out. Type in not more than four sexadecimal characters to be used as an extractor mask. Press the START button. A carriage return will occur and the word START will be typed out. Type the three character sexadecimal address of the program location where searching is to begin. Press the START button.

5. The computer will search the A and B links of every program register from the starting address through 3XX. If a reference is found, the address of the register containing the reference will be typed out. After register 3XX has been searched, the computer will print out END and halt in RESET.

6. If another search is to be made, press the START button and repeat from Step 4.

Example:

If register 29X contains program instructions which are becoming altered through an error in programming, the search for references to 29X would be done as follows:

```
SEARCH FOR 29X
MASK       3XX   (Mask for any address)
START      050   (Or the starting address of your program)
```

The address of all registers containing references to 29X will be typed out.

Example 2:

If all output to Device # 1 is to be changed to Device # 3, the location of all S27X and S3CC program instructions must be determined. Two searches will be required as follows:

```
SEARCH FOR S27X
MASK       XXXX
START       ADR where your program begins.
```

The second run would be,

```
SEARCH FOR S300
MASK       XX00
START       ADR same as above.
```

Operating Time: 3:40 to search 050 through 3XX.

RELOCATION ADDRESSES: 00T-044*

Typewriter at Device # 1.

* Four registers immediately preceeding the first program register are also required.

MONROBOT XI PROGRAM SHEET

PROGRAM

REGISTER SEARCH OF MEMORY

PAGE	DATE	PROGRAMMER
000		

REGISTER		CONTENTS	NOTES
	A B		
	A B		
	A B		
	A B		
	A B		
	A B		
	A B		
	A B		
	A B		
	A B		
	A B		
00T	A B	0000 0001	Increment for address
00U	A B	0002 0000	Increment for virgin
00V	A B	0000 0800	Extractor for maximum address
00W	A B	V008 X400	Virgin extract instruction
00X	A B	0000 03XX	Address extractor

MONROBOT XI PROGRAM SHEET

PROGRAM

REGISTER SEARCH OF MEMORY

PAGE	DATE	PROGRAMMER
010		

REGISTER		CONTENTS	NOTES
010	A	S380	Carriage Return
	B	S352	Print S
011	A	S375	E
	B	S331	A
012	A	S329	R
	B	S373	C
013	A	S338	H
	B	S340	Space
014	A	S376	F
	B	S326	O
015	A	S329	R
	B	S340	Space
016	A	U500	Clear FA 6
	B	0000	Halt, type four tetrads
017	A	T009	Save for B link search
	B	9080	Shift to
018	A	9080	A link
	B	T007	Save for A link search
019	A	S380	Carriage return
	B	S364	Print M
01S	A	S331	A
	B	S352	S
01T	A	S362	K
	B	S340	Space
01U	A	U500	Clear FA 6
	B	0000	Halt, type four tetrads
01V	A	T00S	Save B link mask
	B	9080	Shift to'
01W	A	9080	A link
	B	T008	Save A link mask
01X	A	S380	Carriage return
	B	S352	Print S

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MONROBOT XI PROGRAM SHEET

PROGRAM

REGISTER SEARCH OF MEMORY

PAGE	DATE	PROGRAMMER
020		

REGISTER		CONTENTS	NOTES
020	A	S313	Print T
	B	S331	A
021	A	S329	R
	B	S313	T
022	A	S340	Space
	B	S331	A
023	A	S334	D
	B	S329	R
024	A	S340	Space
	B	U500	Clear FA 6
025	A	0000	Halt, type three tetrads
	B	X00W	Add virgin V008X400
026	A	T028	Store in program for A link search
	B	X00U	Add 00020000
027	A	T02S	Store in program for B link search
	B	S380	Carriage return
028	A	V008	(026) Load A link mask
	B	X4T4	(033) Extract A link
029	A	W007	Subtract A link search
	B	6034	Jump if zero to print address
02S	A	V00S	(027) Load B link mask
	B	X4T4	(034) Extract B link
02T	A	W009	Subtract B link Search
	B	6034	Jump if zero to print address
02U	A	V028	(044) Load instruction
	B	X00T	Increment address
02V	A	T028	Store back
	B	X40V	Extract maximum address
02W	A	6032	Jump if zero to continue
	B	S375	Print E
02X	A	S325	N
	B	S334	D

MONROBOT XI PROGRAM SHEET

PROGRAM

REGISTER SEARCH OF MEMORY

PAGE	DATE	PROGRAMMER
030		

REGISTER		CONTENTS		NOTES
030	A	S380		Carriage return
	B	0000		Halt, end of program
031	A	3010		Jump to repeat program
	B	0000		Fill
032	A	V02S	(02W)	Load instruction
	B	X00T		Increment address
033	A	T02S		Store back
	B	3028		Jump to search next register
034	A	V028		Load instruction
	B	X40X		Extract address
035	A	S07X		Clear FA 5
	B	8U80		BSL/R 20
036	A	8U80		
	B	8U08		
037	A	3439		Print A
	B	3439		D
038	A	3439		R of register containing reference
	B	3044		Jump to increment address
039	A	8U08		BSL/R 4 bits into FA 5
	B	U005		Character → FA 5/Remainder → FA 6
03S	A	603V		Jump if zero to load constant for IBM zero
	B	W042		Subtract 10
03T	A	703W		Jump if negative, character 1 - 9
	B	X043		Add alpha factor
03U	A	303X		Jump to output
	B	0000		Fill
03V	A	V041		Load constant for IBM zero
	B	303X		Jump to output
03W	A	X042	(03T)	Add back 10
	B	303X		No operation
03X	A	U005	(03U)	Character → FA 5/Remainder → FA 6
	B	S27X		Print character

MONROBOT XI PROGRAM SHEET

PROGRAM

REGISTER SEARCH OF MEMORY

PAGE	DATE	PROGRAMMER
040		

REGISTER		CONTENTS	NOTES
040	A	3002	Jump to exit
	B	0000	Fill
041	A	0000	Constant for IBM zero
	B	0010	
042	A	0000	Constant: 10
	B	000S	
043	A	0000	Constant: alpha factor
	B	0012	
044	A	S380	(038) Carriage return
	B	302U	Jump to increment address
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		

Utility Program UTC-9

Procedure to be Used to CLEAR MEMORY

This Utility Routine is used to set to zero all registers between selected starting and ending addresses. Any portion or all of memory may be cleared. It is suggested that prior to input and testing of a new program the entire drum be cleared to prevent execution of instructions remaining from previous programs if an error in address is made. (Do not use an address higher than 3W6 to avoid removing the PROGRAM INPUT routine at 3W7 to 3XX.)

1. Read in the UTC-9 deck of program cards following steps 5 through 8 of PROGRAM INPUT FROM PUNCHED CARDS (UTC-1).

2. Press the RESET button.

3. Type 30100000, press the LOAD and START buttons.

4. A carriage return will occur. Type the three character address of the first register to be cleared, then press the START button. Then type the three character address of the last register to be cleared, press the START button. All registers between and including the starting and ending addresses will be set to zero.

5. The program is terminated when the RESET button lights.

RELOCATION ADDRESSES: 010-01V

MONROBOT XI PROGRAM SHEET

PROGRAM

CLEAR MEMORY

PAGE	DATE	PROGRAMMER
010		

REGISTER		CONTENTS	NOTES
010	A	S380	Carriage return
	B	V01T	Load virgin instruction
011	A	T001	Store in FA 1
	B	U500	Clear FA 6
012	A	0000	Halt, enter starting address
	B	T000	Save
013	A	3401	Jump mark to set FA 6 to -1, add address
	B	X01S	Add virgin instruction
014	A	1406	Store instruction in FA 4, clear FA 6
	B	S380	Carriage return
015	A	0000	Halt, enter ending address
	B	X01S	Add virgin instruction
016	A	T000	Store in FA program
	B	V01U	Load virgin instruction
017	A	T002	Store in FA program
	B	V01V	Load virgin instruction
018	A	T003	Store in FA program
	B	S07X	Clear FA 5
019	A	3000	Jump to fast access program
	B	0000	Fill
01S	A	U500	Virgin: Clear FA 6
	B	T000	Store
01T	A	U400	Virgin: Set FA 6 to - 1
	B	X000	Add
01U	A	T000	Virgin: Store
	B	W004	Subtract starting address
01V	A	6005	Virgin: Jump on zero to FA 5
	B	3000	Jump to repeat FA program
	A		
	B		
	A		
	B		

Procedure to be Used for REGISTER CROSS REFERENCE

This Utility Routine is used for diagnostic purposes to locate register containing references to a certain group of registers. The program to be cross referenced must be stored on the drum.

1. Read in the UTC-10 deck of program cards following steps 5 through 8 of PROGRAM INPUT FROM PUNCHED CARDS (UTC-1).

2. Press the RESET button.

3. On the typewriter at Device No. 1, set the Paper Guide at 5, the Left Margin at 10, and a tab stop 8 spaces from the Left Margin.

4. Type 30100000, press the LOAD and START buttons; a carriage return will occur.

5. Enter the starting address of the program to be cross referenced. Press START. A carriage return will occur.

6. Enter the ending address of the program to be cross referenced. Press START. A carriage return will occur.

7. Enter the reference starting address. Press START. A carriage return will occur.

8. Enter the reference ending address. Press START. A carriage return will occur.

9. The reference address will print followed by the address of the program in memory where reference is made to this address.

10. Upon completion of the program "E" will print. To repeat program, proceed from step 4.

Example:

Program in memory goes from 050 to 08X. We are searching for references to 060 through 068.

The program on the drum is:

```
050:  V060T066
054:  5062V068
055:  30600000
```

```
Enter  050
Enter  08X
Enter  060
Enter  068
```

The typeout would be:

```
060     050  055
062     054
066     050
068     054 E
```

RELOCATION ADDRESSES: 010-085

Typewriter at Device No. 1.

MONROBOT XI PROGRAM SHEET

PROGRAM

REGISTER CROSS REFERENCE

PAGE	DATE	PROGRAMMER
010		

REGISTER		CONTENTS	NOTES
010	A	U500	Clear FA 6 to 0
	B	T082	Set indicator
011	A	V076	Load Constant 0000000T
	B	T083	Store in register count
012	A	V071	Load Constant 604UV003
	B	T02S	Store in program
013	A	S380	Carriage Return
	B	V072	Load Constant 6030V028
014	A	T02U	Store in program
	B	U500	Clear FA 6 to 0
015	A	0000	Halt, enter program start address
	B	9080	Binary shift left 8 bits
016	A	9080	Binary shift left 8 bits
	B	T084	Store start address
017	A	S380	Carriage Return
	B	U500	Clear FA 6 to 0
018	A	0000	Halt, enter program ending address
	B	9080	Binary shift left 8 bits
019	A	9080	Binary shift left 8 bits
	B	X077	Add Constant 00010000
01S	A	X073	Add Constant V000T003
	B	T004	Store in FA 4 (ending address plus 1)
01T	A	S380	Carriage Return
	B	U500	Clear FA 6 to 0
01U	A	0000	Halt, enter reference start address
	B	T000	Store in FA 0
01V	A	9080	Binary shift left 8 bits
	B	9080	Binary shift left 8 bits
01W	A	T001	Store in FA 1
	B	S380	Carriage Return
01X	A	U500	Clear FA 6 to 0
	B	0000	Halt, enter reference end address

MONROBOT XI PROGRAM SHEET

PROGRAM

REGISTER CROSS REFERENCE

PAGE	DATE	PROGRAMMER
020		

REGISTER		CONTENTS	NOTES
020	A B	X078 T085	Add Constant 00000001 Store end reference address plus 1
021	A B	X479 S380	Extract Constant 00000400 Carriage Return
022	A B	6024 X085	Jump on zero to register 024 Add end reference address plus 1
023	A B	T085 3024	Store in 085 No-op
024	A B	V084 X073	(022)(04T) Load address Add V000T003
025	A B	T028 X47S	Store VADRT003 in program Extract 04000000
026	A B	6028 X028	Jump on zero to load register contents Add the contents of register 028
027	A B	T028 3028	Store in program No-op
028	A B	(V000 T003)	(026) (VADR T003) Load register contents Store register contents in FA 3
029	A B	X47T W000	Extract 00000TXX (B link address) Subtract reference address
02S	A B	(604U V003)	(6066 V003) 0 = items compare Load register contents
02T	A B	X47U W001	Extract 0TXX0000 (A link address) Subtract reference address
02U	A B	(6030 V028)	(606W V028) 0 = items compare Load VADRT003
02V	A B	X077 T028	(03S)(04W) Add Constant 00010000 Store incremented instruction in program
02W	A B	W004 703T	Subtract ending constant Jump negative to continue
02X	A B	603U 0000	Jump zero to register 39U Halt, error

MONROBOT XI PROGRAM SHEET

PROGRAM

REGISTER CROSS REFERENCE

PAGE	DATE	PROGRAMMER
030		

REGISTER		CONTENTS	NOTES
030	A	V003	(02U) Load register contents
	B	9880	Binary shift right 8 bits
031	A	9880	Binary shift right 8 bits
	B	344X	Jump mark to test A link
032	A	604W	0 = command without address
	B	3033	No-op
033	A	T082	(04V) Store indicator
	B	V074	Load Constant 6066V003
034	A	T02S	Store in program
	B	V075	Load constant 606WV003
035	A	T02U	Store in program
	B	V001	Load reference address
036	A	S380	Carriage Return
	B	3459	Jump mark to print reference address
037	A	S35W	Tab
	B	3038	No-op
038	A	V028	(06T) Load VADRT003
	B	X47U	Extract ADR
039	A	3459	Jump mark to print register address
	B	S340	Space
03S	A	V028	(067)(070) Load VADRT003
	B	302V	Jump to increment
03T	A	V028	(02W) Load VADRT003
	B	3025	Jump to store and test
03U	A	V071	(02X) Load Constant 604UV003
	B	T02S	Store in program
03V	A	V072	Load Constant 6030V028
	B	T02U	Store in program
03W	A	V000	Load reference address (B link)
	B	X078	Add Constant 00000001
03X	A	T000	Store incremented reference address
	B	X479	Extract Constant 00000400

MONROBOT XI PROGRAM SHEET

PROGRAM

REGISTER CROSS REFERENCE

PAGE	DATE	PROGRAMMER
040		

REGISTER		CONTENTS	NOTES
040	A	6057	Jump zero to test for end of program
	B	X000	Add reference address
041	A	T000	Store in FA 0
	B	3042	No-op
042	A	W085	(057) Subtract end reference address plus 1
	B	6058	0 = end of program
043	A	V001	Load reference address (A link)
	B	X077	Add Constant 00010000
044	A	T001	Store in FA 1
	B	X47S	Extract Constant 04000000
045	A	6047	Jump zero to test indicator
	B	X001	Add reference address
046	A	T001	Store in FA 1
	B	3047	No-op
047	A	V082	(045) Load indicator
	B	604S	Jump zero to restore count
048	A	U500	Clear FA 6 to 0
	B	T082	Set indicator
049	A	S380	Carriage Return
	B	S380	Carriage Return
04S	A	V076	(047) Load Constant 0000000T
	B	T083	Store in count register
04T	A	3024	Jump to load register contents
	B	304U	Fill
04U	A	V003	(02S) Load register contents
	B	344X	Jump mark to test B link
04V	A	604W	0 = command without address
	B	3033	Jump to continue
04W	A	V028	(032)(04V) Load VADRT003
	B	302V	Jump to increment
04X	A	X47V	(032)(04U)(066)(06X) Extract 0000X000
	B	6002	0 = 0 command

MONROBOT XI PROGRAM SHEET

PROGRAM

REGISTER CROSS REFERENCE

PAGE	DATE	PROGRAMMER
050		

REGISTER		CONTENTS	NOTES
050	A	W07W	Subtract Constant 00002000
	B	6002	0 = 2 command
051	A	7002	Negative = 1 command
	B	W07W	Subtract Constant 00002000
052	A	7002	Negative = 3 command
	B	6002	0 = 4 command
053	A	W07X	Subtract Constant 00004000
	B	7002	Negative = 5,6, or 7 command
054	A	6002	0 = 8 command
	B	W07W	Subtract Constant 00002000
055	A	6002	0 = S command
	B	7065	Negative = 9 command
056	A	W07W	Subtract Constant 00002000
	B	3002	Jump to exit
057	A	V000	(040) Load reference address
	B	3042	Jump to subtract end reference address plus 1
058	A	S375	(042) Print E
	B	0000	Halt, end of program
059	A	U002	Address to FA 2/ Exit to FA 6
	B	S07X	Clear FA 5 to 0
05S	A	T003	Store exit
	B	V002	Load address
05T	A	9008	Binary shift left 4 bits
	B	345W	
05U	A	345W	Jump mark to print address
	B	345W	
05V	A	3003	Jump to exit
	B	305W	Fill
05W	A	8U08	Binary left end around shift 4 bits
	B	U005	Word to FA 5/ Character to FA 6
05X	A	6063	0 = zero character
	B	W080	Subtract Constant 0000000S

MONROBOT XI PROGRAM SHEET

PROGRAM

REGISTER CROSS REFERENCE

PAGE	DATE	PROGRAMMER
060		

REGISTER		CONTENTS	NOTES
060	A	7061	Negative = character 1 thru 9
	B	X081	Add alpha factor
061	A	X080	(060) Add Constant 0000000S
	B	U005	Character to FA 5/ Word to FA 6
062	A	S27X	Print character
	B	3002	Jump to exit
063	A	U005	(05X) Character to FA 5/ Word to FA 6
	B	S310	Print 0
064	A	3002	Jump to exit
	B	3065	Fill
065	A	U500	(055) Clear FA 6 to 0
	B	3002	Jump to exit
066	A	V003	Load register contents
	B	344X	Jump mark to test B link
067	A	603S	0 = command without address
	B	3068	No-op
068	A	S340	(070) Space
	B	S340	Space
069	A	U400	Set FA 6 to -1
	B	X083	Add count
06S	A	606U	0 = next line
	B	T083	Store count
06T	A	3038	Jump to print address
	B	306U	Fill
06U	A	S380	(06S) Carriage Return
	B	V076	Load Constant 0000000T
06V	A	S35W	Tab
	B	306S	Store count
06W	A	V003	Load register contents
	B	9880	Binary shift right 8 bits
06X	A	9880	Binary shift right 8 bits
	B	344X	Jump mark to test A link

MONROBOT XI PROGRAM SHEET

PROGRAM

REGISTER CROSS REFERENCE

PAGE	DATE	PROGRAMMER
070		

REGISTER		CONTENTS	NOTES
070	A B	603S 3068	0 = command without address Jump to continue
071	A B	604U V003	Constant for register 02S
072	A B	6030 V028	Constant for register 02U
073	A B	V000 T003	Constant: load and store instruction
074	A B	6066 V003	Constant for register 02S
075	A B	606W V028	Constant for register 02U
076	A B	0000 000T	Constant: count
077	A B	0001 0000	Constant: address increment
078	A B	0000 0001	Constant: reference address increment
079	A B	0000 0400	Constant: B link extractor
07S	A B	0400 0000	Constant: A link extractor
07T	A B	0000 0TXX	Constant: B link address extractor
07U	A B	0TXX 0000	Constant: A link address extractor
07V	A B	0000 X000	Constant: Command extractor
07W	A B	0000 2000	Constant to test command
07X	A B	0000 4000	Constant to test command

MONROBOT XI PROGRAM SHEET

PROGRAM

REGISTER CROSS REFERENCE

PAGE	DATE	PROGRAMMER
080		

REGISTER		CONTENTS	NOTES
080	A B	0000 000S	Constant: 10
081	A B	0000 0008	Constant: alpha factor
082	A B	( )	Indicator register
083	A B	( )	Register count
084	A B	( )	Address
085	A B	( )	End reference address plus 1
	A B		
	A B		
	A B		
	A B		
	A B		
	A B		
	A B		
	A B		
	A B		
	A B		

Utility Program UTC-11

Procedure to be Used for
OPERATIONAL PROGRAM TRACE

This Utility Routine is used for diagnostic purposes to determine the contents of the accumulator after the A link is executed and after the B link is executed for each register within a certain sequence of registers. The program to be traced must be stored on the drum.

1. On the typewriter at Device No. 1, set the Left Margin at 10 and tab stops at 17, 28, and 39.

2. Read in the UTC-11 deck of program cards following steps 5 through 8 of PROGRAM INPUT FROM PUNCHED CARDS (UTC-1).

3. Press the RESET button.

3. Type 30100000, press the LOAD and START buttons; a carriage return will occur.

4. Enter the trace starting address. Press START. A carriage return will occur.

6. Enter the trace ending address. Press START. Two carriage returns will occur.

7. The computer will type out the register address, the register contents, the contents of the accumulator after the A link is executed, and the contents of the accumulator after the B link is executed for each register within and including the parameters.

8. Upon completion of the program a carriage return will occur and the computer will halt in RESET. To repeat program, proceed from Step 5.

RELOCATION ADDRESSES: 010-09T

Typewriter at Device #1.

MONROBOT XI PROGRAM SHEET

PROGRAM

OPERATIONAL PROGRAM TRACE

PAGE	DATE	PROGRAMMER
010		

REGISTER		CONTENTS	NOTES
010	A	S380	(02X) Carriage Return
	B	U500	Clear FA 6 to 0
011	A	0000	Halt, enter starting address
	B	T096	Store starting address
012	A	S380	Carriage Return
	B	U500	Clear FA 6 to 0
013	A	0000	Halt, enter ending address
	B	X07W	Add constant 00000001
014	A	T097	Store ending address plus 1
	B	S380	Carriage Return
015	A	V002	Load the contents of FA 2
	B	T06W	Save the contents of FA 2
016	A	V005	Load the contents of FA 5
	B	T06X	Save the contents of FA 5
017	A	S380	(02X)(062) Carriage Return
	B	V096	Load starting address
018	A	W07W	Subtract Constant 00000001
	B	6046	0 = address is 001
019	A	W07W	Subtract Constant 00000001
	B	604S	0 = address is 002
01S	A	W07X	Subtract Constant 00000003
	B	604W	0 = address is 005
01T	A	W07W	Subtract Constant 00000001
	B	6052	0 = address is 006
01U	A	X080	Add back 00000006
	B	301V	No-op
01V	A	8W08	Generate a flag, binary left end around shift 4 bits
	B	9080	Binary shift left 8 bits
01W	A	9080	Binary shift left 8 bits
	B	S07X	Clear FA 5 to 0
01X	A	8U08	Binary left end around shift 4 bits
	B	3466	Jump mark to print address

MONROBOT XI PROGRAM SHEET

PROGRAM

OPERATIONAL PROGRAM TRACE

PAGE	DATE	PROGRAMMER
020		

REGISTER		CONTENTS	NOTES
020	A B	S35W V096	Tab Load address
021	A B	X081 U001	Add Constant S100V000 S100VADR to FA 1/ Contents of FA 1 to FA 6
022	A B	T06V 3401	Save the contents of FA 1 Jump mark to load register contents
023	A B	T098 V06V	Save register contents Load the contents of FA 1
024	A B	T001 V098	Store back in FA 1 Load the register contents
025	A B	3465 S35W	Jump mark to print register contents Tab
026	A B	V098 X482	Load register contents Extract 0000XXXX (B link)
027	A B	T099 V098	Save extracted B link Load register contents
028	A B	X483 9880	Extract XXXX0000 (A link) Binary shift right 8 bits
029	A B	9880 T09S	Binary shift right 8 bits Save A link
02S	A B	3430 3465	Jump mark to test A link Jump mark to print FA 6 after A link is executed
02T	A B	S35W V099	Tab Load B link
02U	A B	3430 3465	Jump mark to test B link Jump mark to print FA 6 after B link is executed
02V	A B	V096 X07W	Load address Add Constant 00000001
02W	A B	T096 W097	Store incremented address Subtract ending address plus 1
02X	A B	6010 3017	0 = end of program; jump to repeat Jump to continue

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MONROBOT XI PROGRAM SHEET

PROGRAM

OPERATIONAL PROGRAM TRACE

PAGE	DATE	PROGRAMMER
030		

REGISTER		CONTENTS	NOTES
030	A	U002	Link to FA 2/ Exit to FA 6
	B	T043	Save exit
031	A	V002	Load link
	B	W084	Subtract Constant 00006400
032	A	603T	0 = 6400 instruction
	B	V002	Load link
033	A	X485	Extract Constant 0000X400
	B	W086	Subtract Constant 00003000
034	A	6060	0 = jump command
	B	W087	Subtract Constant 00000400
035	A	6058	0 = jump mark command
	B	W088	Subtract Constant 00002U00
036	A	6056	0 = jump zero command
	B	W089	Subtract Constant 00001000
037	A	6044	0 = jump negative command
	B	V002	Load link
038	A	W08S	Subtract Constant 0000S27X
	B	609T	0 = output command S27X
039	A	V002	Load link
	B	X48T	Extract Constant 0000S300
03S	A	W08U	Subtract Constant 0000S300
	B	6063	0 = instruction output command
03T	A	V06W	(032)(064) Load the saved contents of FA 2
	B	U002	Contents of FA 2 to FA 2/ Link to FA 6
03U	A	X08V	Add Constant 64000000
	B	T03X	Store in program
03V	A	V06X	Load the saved contents of FA 5
	B	303W	No-op
03W	A	T005	Restore FA 5
	B	V070	Load the saved contents of FA 6
03X	A	(6400)	No-op
	B	(LINK)	Execute link

MONROBOT XI PROGRAM SHEET

PROGRAM

OPERATIONAL PROGRAM TRACE

PAGE	DATE	PROGRAMMER
040		

REGISTER		CONTENTS	NOTES
040	A	T070	Save the contents of FA 6 after link execution
	B	U002	Contents of FA 6 to FA 2/ Contents of FA 2 to FA 6
041	A	T06W	Save the contents of FA 2
	B	V005	Load the contents of FA 5
042	A	T06X	Save the contents of FA 5
	B	V002	Load FA 6 after link execution
043	A	6400	Saved exit
	B	3044	
044	A	V070	(037) Load the saved contents of FA 6
	B	7060	Jump negative to execute
045	A	3043	Jump to exit
	B	3046	Fill
046	A	V071	(018) Load Constant 30753072
	B	T02V	Store in program
047	A	V023	Load T097V06V
	B	X48W	Extract Constant 00000TXX
048	A	T096	Store address
	B	V07W	Load Constant 00000001
049	A	301V	Jump to print 001 as address
	B	304S	Fill
04S	A	V072	(019) Load Constant 30773073
	B	T02V	Store in program
04T	A	V015	Load V002T06W
	B	X48W	Extract Constant 00000TXX
04U	A	T096	Store address
	B	V08X	Load Constant 00000002
04V	A	301V	Jump to print 002 as address
	B	304W	Fill
04W	A	V073	(01S) Load Constant 30793074
	B	T02V	Store in program
04X	A	V016	Load V005T06X
	B	X48W	Extract Constant 00000TXX

MONROBOT XI PROGRAM SHEET

PROGRAM

OPERATIONAL PROGRAM TRACE

PAGE	DATE	PROGRAMMER
050		

REGISTER		CONTENTS	NOTES
050	A	T096	Store address
	B	V090	Load Constant 00000005
051	A	301V	Jump to print 005 as address
	B	3052	Fill
052	A	V074	(01T) Load Constant 307T3075
	B	T02V	Store in program
053	A	V03W	Load T005V070
	B	X48W	Extract Constant 00000TXX
054	A	T096	Store address
	B	V080	Load Constant 00000006
055	A	301V	Jump to print 006 as address
	B	3056	Fill
056	A	V070	(036) Load the saved contents of FA 6
	B	6060	Jump zero to execute
057	A	3043	Jump to exit
	B	3058	Fill
058	A	V002	(035) Load link
	B	W09S	Subtract A link
059	A	605V	Jump if zero to load B link
	B	V096	Load address
05S	A	X091	Add Constant 00003001
	B	9080	Binary shift left 8 bits
05T	A	9080	Binary shift left 8 bits
	B	X09S	Add A link
05U	A	T06W	Store 3ADR+1Link
	B	3060	Jump to continue
05V	A	V099	(059) Load B link
	B	9080	Binary shift left 8 bits
05W	A	9080	Binary shift left 8 bits
	B	X096	Add address
05X	A	X091	Add Constant 00003001
	B	T06W	Store LINK3ADR+1

MONROBOT XI PROGRAM SHEET

PROGRAM

OPERATIONAL PROGRAM TRACE

PAGE	DATE	PROGRAMMER
060		

REGISTER		CONTENTS	NOTES
060	A	V07V	(034)(044)(056)(05U) Load V095X07W
	B	T02V	Store in program
061	A	V002	Load link
	B	X48W	Extract Constant 00000TXX
062	A	T096	Store address
	B	3017	Jump to test address
063	A	V092	(028)(02S) Load Constant 0000S100
	B	T002	Store in FA 2
064	A	303T	Jump to test link
	B	3065	Fill
065	A	S07X	Clear FA 5 to 0
	B	8W08	Generate a flag, binary left end around shift 4 bits
066	A	6002	0 = exit
	B	U005	Word to FA 5/ Character to FA 6
067	A	606U	0 = zero character
	B	W093	Subtract Constant 0000000S
068	A	7069	Jump negative, character 1-9
	B	X094	Add alpha factor
069	A	X093	(068) Add Constant 0000000S
	B	306S	No-op
06S	A	U005	(06U) Character to FA 5/ Word to FA 6
	B	S27X	Print character
06T	A	8U08	Binary left end around shift 4 bits
	B	3066	Jump to continue
06U	A	9410	(067) Generate an IBM zero
	B	306S	Jump to continue
06V	A	( )	Saved contents of FA 1
	B		
06W	A	( )	Saved contents of FA 2
	B		
06X	A	( )	Saved contents of FA 5
	B		

MONROBOT XI PROGRAM SHEET

PROGRAM

OPERATIONAL PROGRAM TRACE

PAGE	DATE	PROGRAMMER
070		

REGISTER		CONTENTS	NOTES
070	A B	( )	Saved contents of FA 6
071	A B	3075 3072	Constant: address = 001
072	A B	3077 3073	Constant: address = 002
073	A B	3079 3074	Constant: address = 005
074	A B	307T 3075	Constant: address = 006
075	A B	V07V T02V	Load V096X07W Store in program
076	A B	V08X 302W	Load constant 00000002 Jump to store as address
077	A B	V07V T02V	Load V096X07W Store in program
078	A B	V07X 302W	Load Constant 00000003 Jump to store as address
079	A B	V07V T02V	Load V096X07W Store in program
07S	A B	V080 302W	Load Constant 00000006 Jump to store as address
07T	A B	V07V T02V	Load V096X07W Store in program
07U	A B	V095 302W	Load Constant 00000007 Jump to store as address
07V	A B	V096 X07W	Load address Add Constant 00000001
07W	A B	0000 0001	Constant: address increment
07X	A B	0000 0003	Constant: address 003

MONROBOT XI PROGRAM SHEET

PROGRAM

OPERATIONAL PROGRAM TRACE

PAGE	DATE	PROGRAMMER
080		

REGISTER		CONTENTS	NOTES
080	A B	0000 0006	Constant: address 006
081	A B	S100 V000	Constant: load register contents
082	A B	0000 XXXX	Constant: extract B link
083	A B	XXXX 0000	Constant: extract A link
084	A B	0000 6400	Constant: no-op command
085	A B	0000 X400	Constant: extractor
086	A B	0000 3000	Constant: jump command
087	A B	0000 0400	Constant: extract or jump mark command
088	A B	0000 2U00	Constant: jump zero command
089	A B	0000 1000	Constant: jump negative command
08S	A B	0000 S27X	Constant: output command
08T	A B	0000 XX00	Constant: extractor for instruction output command
08U	A B	0000 S300	Constant: instruction output command
08V	A B	6400 0000	Constant: execute link
08W	A B	0000 0TXX	Constant: address 002
08X	A B	0000 0002	Constant: address 005

MONROBOT XI PROGRAM SHEET

PROGRAM

OPERATIONAL PROGRAM TRACE

PAGE	DATE	PROGRAMMER
090		

REGISTER		CONTENTS	NOTES
090	A B	0000 0005	Constant: address 005
091	A B	0000 3001	Constant: jump
092	A B	0000 S100	Constant: no-op
093	A B	0000 000S	Constant: 10
094	A B	0000 0008	Constant: alpha factor
095	A B	0000 0007	Constant: address 007
096	A B	( )	Address
097	A B	( )	Ending address plus 1
098	A B	( )	Register contents
099	A B	( )	Extracted B link
09S	A B	( )	Extracted A link
09T	A B	T06X 3063	(038) Store zero as the contents of FA 5 Jump to continue
	A B		
	A B		
	A B		
	A B		

Procedure to be Used for UTILITY PROGRAM RELOCATION

It is often convenient to have a Utility Program available at addresses other than within 007 to 04X. For this purpose, a relocation code card is included for each of the Utility Programs. After relocation, the program output to punched cards utility routine can be used to output a deck of program cards for the relocated program.

1. Read in the UTC-10 deck of program cards following steps 5 through 8 of PROGRAM INPUT FROM PUNCHED CARDS (UTC-1). In the same manner also read in the program cards for the Utility Program which is to be relocated.

2. Place the relocation code card followed by a trailer card in the card reader, touch FEED, FEED, and RELEASE buttons. Raise the star wheels from the program drum.

3. Type 30600000, press the LOAD and START buttons. A carriage return will occur.

4. Type the three character sexadecimal address of the first register in memory to be relocated. This is the first of the relocation addresses. Press the START button.

5. Type the address of the last register in memory to be relocated, the second relocation address given. Press the START button.

6. Type in the address of the register where relocation is to begin. Press the START button.

7. The computer will type out the ending address of the program being relocated. It will then relocate the program in memory without altering the original program.

8. After relocation is completed, the word END will be typed out. If the relocation address given in Step 6 would cause overlap of the original and relocated programs, the computer will type E ADR. Repeat steps 4, 5, and 6.

9. If the program is to be relocated to several addresses, repeat from Step 2, changing the address in Step 6.

10. A relocation code card is provided for the UT-13 Utility Routine and it can also be relocated.

RELOCATION ADDRESSES: 058-096*

Typewriter at Device #1, Card Reader at Device #2.

*Three registers immediately preceeding the first program register are also required.

Procedure to be Used to PRODUCE RELOCATION CODE CARD

The Relocation Program (UTC-12) can be used by the programmer to relocate subroutines or programs of his own writing. This will require a relocation code card containing a relocation code digit for each register in the program to be relocated.

The relocation code digit required for each register is selected as follows:

a. A zero (0) if neither the A or B link of the register requires address relocation.

b. A one (1) if only the A link of the register requires address relocation.

c. A two (2) if only the B link of the register requires address relocation.

d. A three (3) if both the A and B links of the register requires address relocation.

The relocation card can be produced on an off-line card punch. Additional relocation cards can be used if the program to be relocated requires more than 80 registers (one card).

If the relocation program reads too many or too few columns from the relocation code card some codes have been omitted or duplicated. A new relocation code card must be produced. The column number minus one on the program card indicator will give the last column read from the relocation code card.

Test the relocated program by actual operation. Use the Program Output to Typewriter (UTC-5) to locate errors if the program fails to operate.

MONROBOT XI PROGRAM SHEET

PROGRAM

PROGRAM RELOCATION

PAGE	DATE	PROGRAMMER
050		

REGISTER		CONTENTS	NOTES
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
05S	A	S100	Virgin load instruction
	B	V000	
05T	A	V004	Virgin store instruction
	B	T000	
05U	A	U005	Print instruction for FA 1
	B	S27X	
05V	A	S375	(06T) Print E
	B	S340	Space
05W	A	S331	Print A
	B	S334	D
05X	A	S329	R
	B	S380	Carriage return

MONROBOT XI PROGRAM SHEET

PROGRAM

PROGRAM RELOCATION

PAGE	DATE	PROGRAMMER
060		

REGISTER		CONTENTS	NOTES
060	A B	S380 U500	(086) Carriage return Clear FA 6
061	A B	0000 T057	Halt, type starting address Save
062	A B	X05S T073	Add virgin load instruction Storein program
063	A B	S380 U500	Carriage return Clear FA 6
064	A B	0000 W057	Halt, type in ending address Subtract starting address
065	A B	T059 S380	Save number of registers - 1 Carriage return
066	A B	U500 0000	Clear FA 6 Halt, type new starting address
067	A B	T058 X05T	Save Add virgin store instruction
068	A B	T07W S380	Store in program Carriage return
069	A B	V058 W057	Load new starting address Subtract present starting address
06S	A B	706U W059	Jump if negative to continue Subtract number of registers
06T	A B	W093 705V	Subtract 1 Jump if negative to error routine
06U	A B	V05U T001	(06S) Load print instruction Store
06V	A B	V058 X059	Load new starting address Add number of registers
06W	A B	5094 8U08	Shift to A link of FA 5, clear FA 6 BSL 4
06X	A B	U005 348T	Address → FA 6/Zero → FA 5 Print A

MONROBOT XI PROGRAM SHEET

PROGRAM

PROGRAM RELOCATION

PAGE	DATE	PROGRAMMER
070		

REGISTER		CONTENTS		NOTES
070	A	348T		Print D
	B	348T		Print R of ending register
071	A	V058		Load new starting address
	B	W057		Subtract present starting address
072	A	T000		Save difference
	B	5094		Shift to A link of FA 5, clear FA 6
073	A	0000	(062)	No operation
	B	005S	(080)	Load register to be relocated (084)
074	A	T004		Save
	B	3076		Jump to read relocation code
075	A	S367	(076)	Print P Parity error
	B	2200		Halt, reset tape
076	A	2400	(074)	Input relocation code character
	B	7075	(078)	Jump if parity error (079)
077	A	T001		Save character
	B	W096		Subtract tape feed code
078	A	6076		Jump if zero to read next character
	B	V001		Load character
079	A	W095		Subtract carriage return
	B	6076		Jump if zero to read next character
07S	A	V001		Load character, is relocation character
	B	9080		
07T	A	9080		Shift to high order
	B	9080		
07U	A	9020		
	B	7089		Jump if negative to correct B link address
07V	A	9001	(08S)	BSL 1
	B	7087		Jump if negative to correct A link address
07W	A	V004	(068)	Load corrected register
	B	T060	(081)	Store in new location (088)
07X	A	V073		Load instruction
	B	X093		Increment address

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PROGRAM

PROGRAM RELOCATION

PAGE	DATE	PROGRAMMER
080		

REGISTER		CONTENTS	NOTES	
080	A	T073		Store incremented instruction
	B	V07W		Load instruction
081	A	X093		Increment address
	B	T07W		Store incremented instruction
082	A	V059		Load register address
	B	W093		Subtract ending address
083	A	T059		Save
	B	7085		Jump if negative to exit
084	A	3073		Jump to repeat register relocation
	B	0000		Fill
085	A	S375	(083)	Print E
	B	S325		N
086	A	S334		D
	B	3060		Jump to repeat program
087	A	U004	(07V)	Load register
	B	X005		Correct A link address
088	A	U004		Save register
	B	307W		Jump to store corrected register
089	A	U004	(07U)	Load register
	B	X000		Correct B link address
08S	A	U004		Save instruction
	B	307V		Jump to store corrected register
08T	A	8U08		Shift character to FA 5
	B	U005		Character → FA 6/Remainder → FA 5
08U	A	608W		Jump if zero to IBM zero
	B	W090		Subtract 10
08V	A	708X		Jump if negative, character 1-9
	B	X091		Add 2
08W	A	X092	(08U)	Add 16 for alpha factor
	B	3001		Jump to print
08X	A	X090	(08V)	Add back 10
	B	3001		Jump to print

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PROGRAM

PROGRAM RELOCATION

PAGE	DATE	PROGRAMMER
090		

REGISTER		CONTENTS	NOTES
090	A	0000	Constant: 10
	B	000S	
091	A	0000	Constant: 2
	B	0002	
092	A	0000	Constant: IBM zero
	B	0010	
093	A	0000	Constant: 1
	B	0001	
094	A	0001	Constant: address increment
	B	0000	
095	A	0000	Constant: carriage return
	B	0080	
096	A	0000	Constant: tape feed
	B	003X	
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		
	A		
	B		