AD-401-443

TECHNICAL MEMORANDUM

(TM Series)

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General Purpose Satellite

Computer Program Descriptions

Milestone 11

5-Level Paper Tape Data Read (PT)

by

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21 February 1963

Approved

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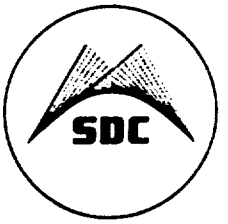
SANTA MONICA

CALIFORNIA



SUBROUTINE IDENTIFICATION

A. Title: 5-Level Paper Tape Data Read (PT). IDENT-F96, MOD 01.

B. Programmed: 8 January 1962, R. W. Holingworth, Lockheed Missiles and Space Division.

C. Revised and Documented: 3 January 1963, C. J. Zubris, System Development Corporation.

PURPOSE

PT will read and store data from six different types of 5-level paper tape*. A BCD list tape of data is optional.

USAGE

A. Calling Sequence

```
L       SLJ             4       PT
        ZRO                     T
L+1     ZRO                     AZ
        ZRO                     EL
L+2     ZRO                     SR
        ZRO                     ROLL
L+3     ZRO                     PITCH
        ZRO                     HEAD
L+4     ZRO                     PF
        ZRO                     SF
L+5     NORMAL RETURN
```

B. Input Parameters

1. T = First word address of the buffer where TIME (seconds) is to be stored.

   AZ = First word address of the buffer where AZIMUTH (radians) is to be stored.

   EL = First word address of the buffer where ELEVATION (radians) is to be stored.

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* See Appendix B for formats of 6 paper tapes and header information.

SR = First word address of the buffer where SLANT RANGE (feet) is to be stored.

ROLL = First word address of the buffer where ROLL (radians) is to be stored.

PITCH = First word address of the buffer where PITCH (radians) is to be stored.

HEAD = First word address of the buffer where HEADING (radians) is to be stored.

PF = First word address of the buffer where PRIMARY FREQUENCY is to be stored.

SF = First word address of the buffer where SECONDARY FREQUENCY is to be stored.

2. Designators for unused buffers may be filled with zeros.

3. Enter accumulator with a list indicator. This will or will not write a listable BCD tape on logical tape unit 3. If a BCD tape is not requested, Ship TLM-18 (ANGLES) and Ship MOD2 (ANSPQ-8) may or may not be modified according to A.

A = 0, write BCD list tape and correct "all" elevations for refraction. Modify Ship TLM-18 (ANGLES) data for ROLL, PITCH, Heading, and equipment. Bias Ship MOD2 (ANSPQ-8) data for equipment.

A >+0, do not write BCD list tape. Correct Ship TLM-18 (ANGLES) data for ROLL, PITCH, and HEADING, and "all" elevations for equipment bias and refraction.*

A <-0, do not write BCD list tape and do not correct ship TLM-18 (ANGLES) data for ROLL, PITCH, and HEADING. Do not correct elevations for equipment bias and refraction.

C. Output

1. Data in core.

2. Data in core and on BCD list tape.**

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* See Appendix E for formulas used in data modification.

** See Appendix A for formats of Output.

RESTRICTIONS

A. PT uses the Reference Pool and subroutines OUTPUT, RC, FLOAT, COS, SIN, TAN, ATAN1, and SUBERR.

B. All paper tapes must be punched in the correct format for each particular type of data and have at least 15 tape stop codes at the end.

C. PT reads only header information and six types of paper tape data.* Each paper tape must contain a Header and data, if any, in one of the following formats

1. Mod 2 (Verlort)
2. Ship Mod 2 (AN/SPQ-8)
3. TLM-18
4. Ship TLM-18 (ANGLES)
5. Doppler
6. Ship Doppler (PMR)

Mod 2 (Verlort) and TLM-18 formats are analogous.

D. All data tapes must have at least 15 tape stop codes at the end. Paper tape stop code = 35_8.

If a header and no data points are input, the header must be followed by at least 20 paper tape stop codes.

E. PT will read up to a maximum of 1000 Mod 2 (Verlort), Ship Mod 2 (AN/SPQ-8), TLM-18, and Ship TLM-18 (ANGLES) data points per paper tape. Doppler and Ship Doppler (PMR) tapes allow for 2000 data points per paper tape.

F. If a header is input without any data or, if no data points are accepted, a BCD list tape of header information is not written, regardless of a request for such.

G. PT is presently capable of processing data from 8 ships. The current available ship station numbers are 20_{10}, 21_{10}, 24_{10}, 25_{10},

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* See Appendix B.

26_{10}, and 30_{10}. These numbers are currently restricted to the range, 0 to 63_{10}.

H. Data modifications for BCD list tape option

1. Data from land based stations

   Elevation is corrected for refraction. The corrected elevations are left in core, whereas the apparent (input) elevation and its correction factor (determined by R.C.), are output to the BCD tape.

2. Data from sea based stations

   a. Ship TLM-18 (ANGLES)

      Azimuth and Elevation are corrected for Roll, Pitch, and Heading and equipment bias. The altered azimuth is left in core and is output to the BCD tape. The modified elevation is also corrected for refraction, and this value is left in core. The BCD tape output consists of the elevation corrected for Roll, Pitch, Heading, equipment bias, and its correction factor (determined by R.C.).

   b. Ship MOD2 (AN/SPQ-8)

      Elevation is corrected for equipment bias and then for refraction. This final value is left in core. The BCD tape output is the elevation, modified for equipment bias and its correction factor (determined by R.C.).

I. Elevation can now range between 0 and 2π radians. If an error occurs in the elevation refraction correction subroutine (R.C.), a jump to SUBERR and a halt is made. Reactivating the program will cause R.C. to process the apparent (input or modified ship) elevation and leave erroneous data in its place. COMMON will contain the correction factor that R.C. determines. If the BCD tape option (i.e., A = 0) is used, the corrected elevation is left in core, whereas apparent (input or modified ship) elevation and its corrections factor are output on the BCD list tape. If the R.C. (A > 0) option is

requested, the corrected elevations are left in core.

J. If an error occurs in the subroutines SIN, COS, or TAN during the modification of Ship TLM-18 (ANGLES) data for ROLL, PITCH, and HEADING, a jump to SUBERR is made. (Options: console scoop with no stop after printout.) Data for this point is still processed; however, it is erroneous.

K. PT halts unconditionally when

1. Format code ≠ paper tape format codes
2. Station number ≠ to station numbers in Reference Pool, i.e., those in SNO table.
3. An error in subroutine OUTPUT.
4. No header or an invalid header; see on-line printer for comments.
5. Forty frames of bad data; see on-line printer for comments.
6. Paper Tape Reader is in wrong (assembly) mode.
7. Calling sequence for the internal PT data word interpret routine* incorrect.

L. Index registers 1, 2, 3, 4, and 6 are used and preserved.

M. Cells of Reference Pool used

Symbol	Mode	Description	When or Where
MOBCD	BCD	Months in BCD	Constants, reference pool
FORMAT	Fixed, DEC	Data Type	Read in from Header
NOFMTS	Fixed, OCT	Number of formats Value = 4	Constant, reference pool
FMTCOD	Fixed, OCT	Format Codes, paper tape; Values 0,1,2,3	Constants, reference pool
FMTBCD	BCD	Format Codes Values = Mod 2 Doppler, UHF or TLM-18	Constants, reference pool
SBCD	BCD	Station Names	Constants, reference pool

* See Appendix C.

Symbol	Mode	Description	When or Where
SNO	OCT and DEC	Station numbers	Constants, reference pool
SHIPST (SHIPNOS)	OCT	2425303132362425 8 ship station numbers, packed.	Constant, reference pool

N. Additional Cells

Symbol	Mode	Description	When or Where
VNOSAVE	DEC	Input Vehicle number, Values 0 to 7	Read in from Header, currently not used

O. Data Buffers Needed

Data Type	Buffers Needed	Maximum Buffer Length
MOD2 (Verlort)	T, AZ, EL, and SR	1000 cells each
TLM-18	T, AZ, EL, and SR	1000 cells each
Doppler	T and EL	2000 cells each
Ship TLM-18 (ANGLES)	T, AZ, EL, ROLL, PITCH, and HEAD	1000 cells each
Ship MOD2 (AN/SPQ-8)	T, AZ, EL, and SR	1000 cells each
Ship Doppler (PMR)	T, PF, and SF	2000 cells each

P. Faults and interrupts are not considered.

Q. Sea based station data via the BCD list tape can be determined by the station code names and BCD tape formats.

TIMING

The timing is contingent upon the length of paper tape and the options requested.

STORAGE REQUIREMENTS

Program: 843 cells

PAPER TAPE DATA

A. Data* - Header

1. Month: 4 bits (fixed integer) input; stored in cell MONTH, of the Reference Pool. Output, to BCD tape, will consist of the name of the month.

2. Greenwich Day: 4 bits (fixed integer) input; stored in cell DAY of the Reference Pool. Output, to BCD tape will be the number of day.

3. Station Number: 5 bits (fixed integer) input; stored in cell ST of the Reference Pool. Station name is output to BCD tape.

4. Vehicle Number: 3 bits (fixed integer) input; stored in cell VNOSAVE of PT. The value in cell VNO, of the Reference Pool, will be output to BCD tape.

5. AMPM Indicator: 1 bit (fixed integer, 0 or 1) input; stored in cell AMPM of the Reference Pool. The contents of cell AMPM is <u>not</u> output by PT.

6. Format Designators: 3 bits (fixed integer, F_1-F_0) are input and stored in cell FORMAT of the Reference Pool.

F_1 - punched = TLM-18 data
F_0 - punched = DOPPLER data
F_1 and F_0 - not punched = MOD2 data
Format name (TLM-18, MOD2, or DOPPLER) will be output to a BCD tape.

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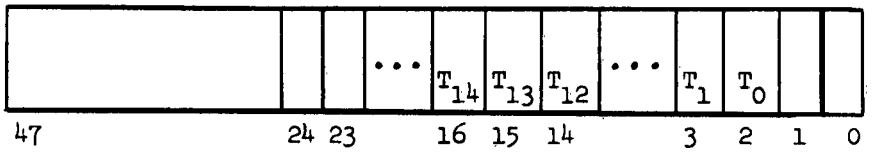
* See Appendix B for paper tape data formats.

B. Data - TLM-18

1. System Time: 15 bits, T_0 - T_{14} (fixed integer) input, stored in buffer T.

T. buffer, word format



Bit positions

Bits 1 and 0 = 0. Output to a BCD tape will consist of the values of System time and Universal Time.*

T_{15}: 1 bit input; not used.

2. Azimuth: 16 bits, A_0 - A_{15} (fixed point number, binary scaling = 15) input; stored in Buffer AZ. Azimuth in input in degrees and converted to radians (floating point) before being stored in Buffer AZ. If a BCD tape is requested, azimuth will be output in degrees.

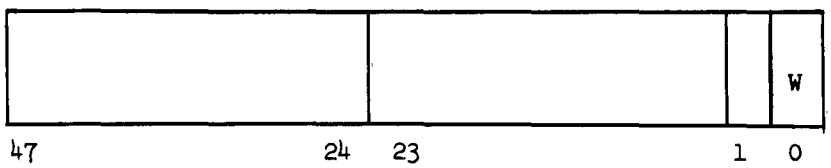
3. Elevation: 16 bits, E_0 - E_{15} (fixed point number, binary scaling = 15) input. Elevation is input in degrees and is converted to radians (floating point) prior to being stored in Buffer EL. Prior to exit, elevations in core may or may not be corrected for refraction. If the list

* For definitions of System and Universal time see Appendix A of TM-714/001/00 (MACTIM).

tape option is used, core will always contain corrected elevations.

4. Weight bit W: 1 bit input; stored in bit position 0 of SR buffer word. W is punched when radar is locked on.

SR buffer, word format



Bit positions

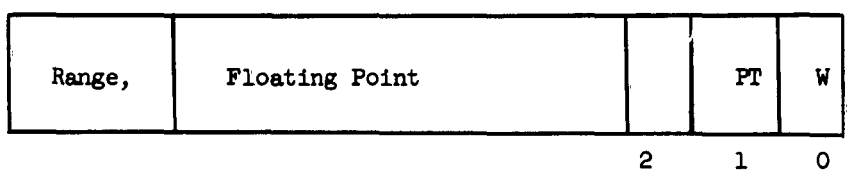
Output, to BCD tape, consists of a blank space or an "*". Radar locked on is indicated by a blank space.
(*) is defined as: Radar not locked on.

5. Blanks: 19 bits are blank in a TLM-18 data word.

C. Data MOD2 (Verlort)

1. PT: passive track indicator. When punched PT is on, 1 bit is input and stored in bit position 1 of SR buffer word. Range is not accurate if PT is on. Output to BCD tape will be a blank space or an (*).

SR buffer, word format



Bit positions

2. System time: Same as in TLM-18 data.

3. Azimuth: Same as in TLM-18 data.

4. Elevation: Same as in TLM-18 data.

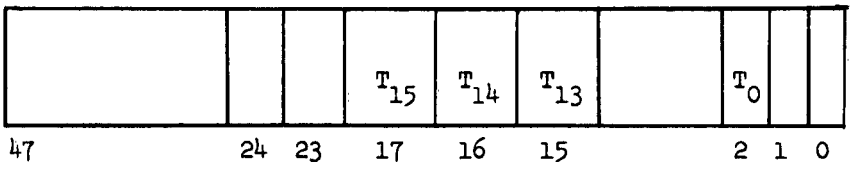
5. Range: 19 bits, R_0 - R_{18} (fixed point number, binary scaling = 9) input. Range is input in yards, converted to feet (floating point), and then stored in buffer SR. Output to BCD tape will be in kiloyards.

6. Weight bit W: Same as in TLM-18 data.

D. Data-Doppler

1. System Time: 16 bits, T_0 - T_{15} (fixed integer) input; stored in buffer T.

T. buffer, word format

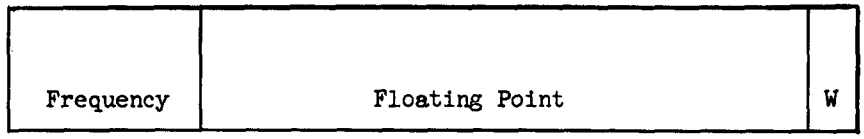


Bit positions 1 and 0 are set to zero. The values of System Time and Universal Time will be output, to a BCD tape, if such a tape is requested.

2. Frequency: 18 bits, F_0 - F_{17} (fixed integer) input, converted to floating point and then stored in buffer EL. Output, to BCD tape, is CYCLES/SEC and the frequency value.

3. Weight bit W: 1 bit input; stored in least significant bit position of frequency in buffer EL. Output to BCD tape will be in the form of a blank space or an (*).

EL buffer, word format

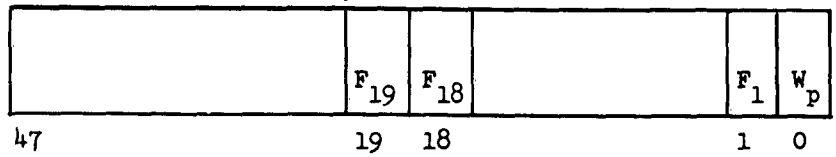


4. Blanks: 1 bit.

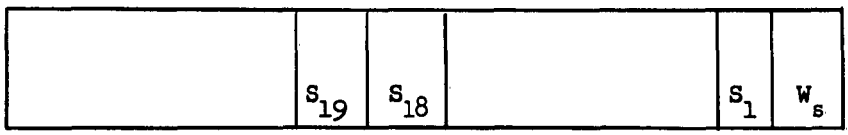
E. Data Ship Doppler

1. System Time: Same as in TLM-18 data.
2. Primary Frequency: 20 bits, F_0- F_{19}, (fixed integer) input; stored in buffer PF. Output to a BCD tape is identical to input.
3. Secondary Frequency: 20 bits, S_0 - S_{19} (fixed integer) input; stored in buffer SF. Output, to a BCD tape, is identical to input.
4. W_p: Primary weight bit. 1 bit input; stored in least significant bit position of the primary frequency. Output, to a BCD tape, is a blank space or an (*).
5. W_s: Secondary weight bit. 1 bit input; stored in least significant bit position of the secondary frequency. Output, to a BCD tape, is either a blank space or an (*). W_s and W_p are blank, i.e., = 0, when no signal is being received.

PF buffer, word format



SF buffer, word format



F. Data Ship (MOD2 - Verlort) AN/SPQ-8

1. System Time: Same as in TLM-18 data.

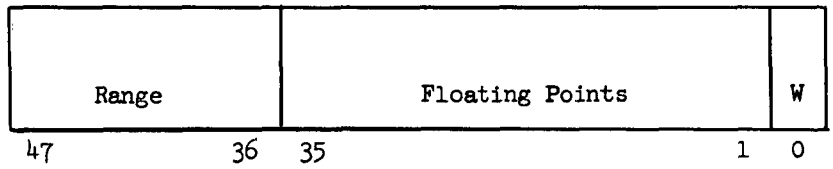
2. Azimuth: 12 bits, A_0 - A_{11} (fixed point number, binary scaling = 11) input. Azimuth is input in degrees, converted to radians (floating point), and stored in buffer AZ. Output to BCD tape is in degrees.

3. Elevation: 12 bits, E_0 - E_{11} (fixed point number, binary scaling = 11) input. Elevation is input in degrees, changed to radians (floating point), and stored in buffer EL. Prior to exit, elevations may or may not be corrected for refraction and equipment bias. Under the list tape option, elevations will always be modified. Output to a BCD tape is the apparent (input value corrected for equipment bias) elevation and its correction factor, both in degrees.

4. Range: 19 bits, R_0 - R_{18} (fixed point number, binary scaling = 10) input. Range is input in yards, converted to feet (floating point), and stored in buffer SR. Output to BCD tape is in kiloyards.

5. Weight Bit W: 1 bit input; stored in the least significant bit position of the range. Output to a BCD tape is either a blank space or an (*).

SR buffer, word format



6. Blanks: 3 bits

G. Data Ship Angles (TLM-18)

1. System Time: Same as in TLM-18 data.

2. Azimuth: 12 bits, A_0 - A_{11} (first point number, binary scaling = 11) input. Azimuth is input in degrees and converted to radians (floating point). Azimuth may or may not be modified for Heading and stored in buffer AZ. Output to a BCD tape is modified azimuth in degrees. If a BCD tape is written, core will also have modified azimuth.

3. Elevation: 12 bits, E_0 - E_{11} (fixed point number, binary scaling = 11) input. Elevation is input in degrees and converted to radians (floating point). Elevation may or may not be corrected for Roll, Pitch, Heading, refraction, and equipment bias, and stored in buffer EL. If the BCD tape option is used the corrected elevations are left in

core whereas the Output to the BCD tape will consist of the modified (i.e., corrected for Roll, Pitch, Heading, and equipment bias) elevation and its refraction correction factor, both in degrees.

4. Roll: 12 bits, R_0 - R_{11} (fixed point number, binary scaling = 11) input. Roll is input in degrees, converted to radians (floating point), and stored in buffer ROLL. This data is not output to a BCD tape.

5. Pitch: 12 bits, P_0 - P_{11} (fixed point number, binary scaling = 11) input. Pitch is input in degrees, changed to radians (floating point), and stored in buffer PITCH. This data is not output to a BCD tape.

6. Heading: 12 bits, H_0 - H_{11} (fixed point number, binary scaling = 11) input. Heading is input in degrees, converted to radians (floating point), and stored in buffer HEAD. This data is not output to a BCD tape.

7. Weight Bit W: 1 bit input; stored in least significant bit position of heading. Output to a BCD tape will either be a blank space or an (*).

HEAD buffer, word format

Heading,	Floating Points	W
47 36	35 1	0

8. Blanks: None

VALIDATION TEST

A. Procedure

A test program was written to read an unlimited amount of paper tape via the PT routine; jump key setting determined the various options.

B. Test inputs

Paper tapes in all six modes, for sea and land based stations were input.

C. Results

Paper tapes for all sea based stations (determined by station number) functioned properly. The BCD tape formats were those expected.* Spot checks verified that the input paper tape data corresponded to the BCD tape and core data.

REFERENCES

A. LMSD-447478, System Manual Subroutine Description for PT. Lockheed Missiles and Space Division, 8 January 1962, page 40.05.01.

B. FN-6872, General Description of PT, System Development Corporation, 12 September 1962.

C. TM-714/032/00, General Purpose Satellite Computer Program Descriptions, Milestone 11, Correct Apparent Elevation for Refraction (RC), 9 November 1962. (AFCPL Catalog Number 75599).

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* See Appendix A for BCD tape formats.

1. Printer comment for no or bad paper tape Header.

NO HEADER START

INSERT INTO A AS FOLLOWS

AMPM BIT, FOR PM BIT 47 = 1

TLM-18 DATA, BIT 46 = 1

DOPP DATA, BIT 45 = 1

MONTH, BIT NO. = MONTH

INSERT INTO Q AS FOLLOWS

DAY, BIT NO. = DAY

STATION NO., BITS (42-33)
RIGHT JUSTIFIED

HIT START TO CONTINUE

2. Printer comment for maximum garbage count in data.

40 FRAMES OF GARBAGE IN DATA

IF AT LEAST 40 FRAMES OF TAPE REMAIN, HIT START

IF TAPE IS NEAR END, TRANSFER TO LOCATION XXXXX*, START

3. BCD Tape (format for MOD2 and TLM-18 data)

(Station name) (Format) (Day) (Month) (Year) VEH. NO.XXX RUN NO.YYY Page XXX

SYSTEM TIME	UNIV. TIME			AZIMUTH	ELEVATION+CORR.		RANGE	RADAR	PASSIVE TRACK
SEC	HR	MIN	SEC	DEG.	DEG.	DEG.	KILOYDS	*=OFF	*=ON
XXX	XX	XXX	XXX	XXX	XXX	XXX	XXX		
:	:	:	:	:	:	:	:		
XXX	XX	XXX	XXX	XXX	XXX	XXX	XXX		

* XXX will denote numeric values and YYY will denote alpha, alpha-numeric, and numeric values.

4. BCD Tape (format for DOPPLER data).

(Station name) (Format) (Day) (Month) (Year) VEH. NO.XXX RUN NO.YYY Page XXX

SYSTEM TIME	UNIV. TIME			FREQUENCY	RADAR
SEC	HR	MIN	SEC	CYCLES/SEC	*=OFF
XXX	XX	XXX	XXX	XXX	
⋮	⋮	⋮	⋮	⋮	
XXX	XX	XXX	XXX	XXX	

XXX - Points

5. BCD Tape (format for Ship Angles (TLM-18) data).

(Ship, code name) (Format) (Day) (Month) (Year) VEH. NO.XXX RUN NO.YYY Page XXX

SYSTEM TIME	UNIV. TIME			AZIMUTH	ELEVATION+CORR.		WT. BIT
SEC	HR	MIN	SEC	DEG.	DEG.	DEG.	*=OFF
XXX	XX	XXX	XXX	XXX	XXX	XXX	
⋮	⋮	⋮	⋮	⋮	⋮	⋮	
XXX	XX	XXX	XXX	XXX	XXX	XXX	

XXX - Points

6. BCD Tape (format for Ship (MOD2 Verlort) AN/SPQ-8 data).

(Ship code name) (Format) (Day) (Month) (Year) VEH. NO. XXX RUN NO. YYY Page XXX

SYSTEM TIME	UNIV. TIME			AZIMUTH	ELEVATION+CORR.		RANGE	WT. BIT
SEC	HR	MIN	SEC	DEG.	DEG.	DEG.	KILOYDS	*=OFF
XXX	XX	XXX	XXX	XXX	XXX	XXX	XXX	
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
XXX	XX	XXX	XXX	XXX	XXX	XXX	XXX	

XXX - Points

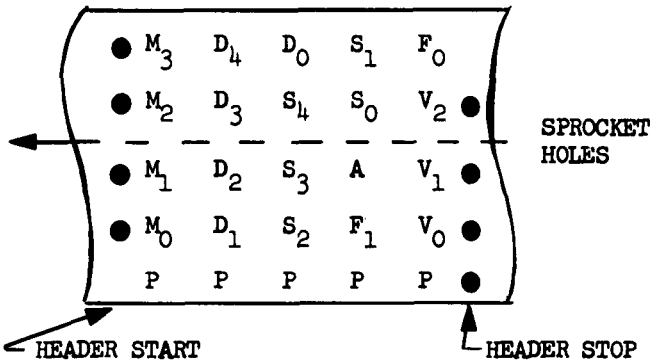
7. BCD Tape (format for Ship (PMR) DOPPLER data).

(Ship, code name)	(Format)			(Day) (Month)	(Year)	VEH. NO.XXX RUN NO.YYY	Page XXX
SYSTEM TIME	UNIV. TIME			PRIMARY FREQ.	PRI. WT. BIT	SECONDARY FREQ.	SEC. WT. BIT
SEC	HR	MIN	SEC	MICROSEC	*=OFF	MICROSEC	*=OFF
XXX	XX	XXX	XXX	XXX		XXX	
⋮	⋮	⋮	⋮	⋮		⋮	
XXX	XX	XXX	XXX	XXX		XXX	

XXX - Points

APPENDIX B

HEADER FORMAT



M_0 - M_3	- Month	M_0 = 1		M_3 = 8
D_0 - D_4	- Greenwich Day	D_0 = 1		D_4 = 16
S_0 - S_4	- Station Number	S_0 = 1		S_4 = 16
V_0 - V_2	- Vehicle Number	V_0 = 1		V_2 = 4

A - AM, PM Punch (AM - no punch, PM - punch)

F_0 - F_1 - Format (F_1 - punch: TLM-18 Data)

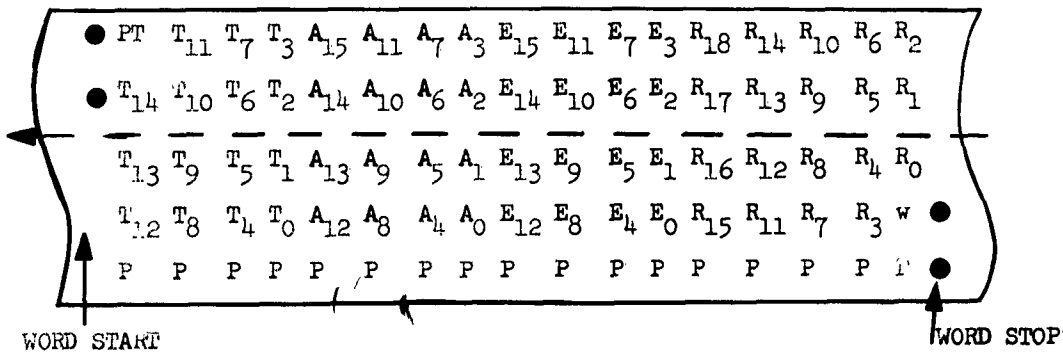
(F_0 - punch: Doppler Data)

(No punch: Mod 2 Data)

P - Parity Bit (Odd Parity)

i.e., No. of bits punched per data frame always odd.

MOD 2 (VERLORT) FORMAT



PT - Passive Track Indicator. When punched, PT is on.

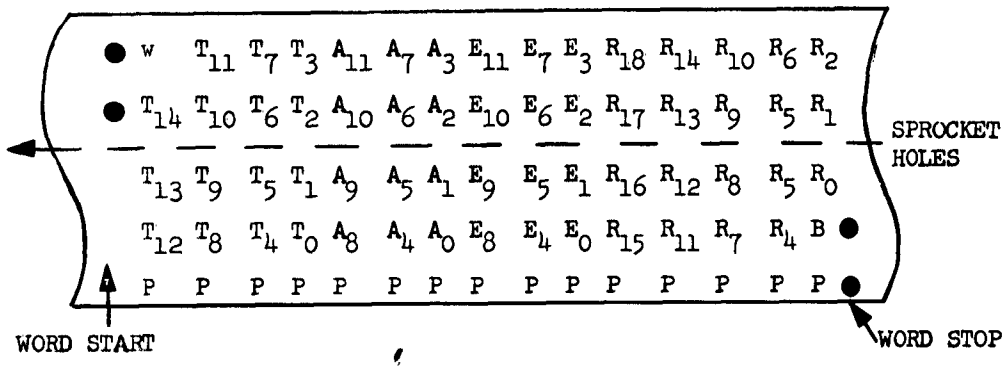
T_0 - T_{14}	- System Time	T_0 = 4 seconds	T_{14} = 65536 seconds	
A_0 - A_{15}	- Azimuth	$A_{15} = 180^\circ$	$A_0 = 180(2^{-15})^\circ$	
E_0 - E_{15}	- Elevation	$E_{15} = 180^\circ$	$E_0 = 180(2^{-15})^\circ$	
R_0 - R_{18}	- Range	R_0 = 19.53125 yards		
		$R_{18} = 5.12 \times 10^6$ yards		

W - Weight (Quality) Bit, When punched, radar is on.

P - Parity Bit (Odd Parity)

NOTE: Data is to be used only when PT is not punched and W is punched.

SHIP (MOD 2 (VERLORT), AN/SPQ-8 FORMAT)



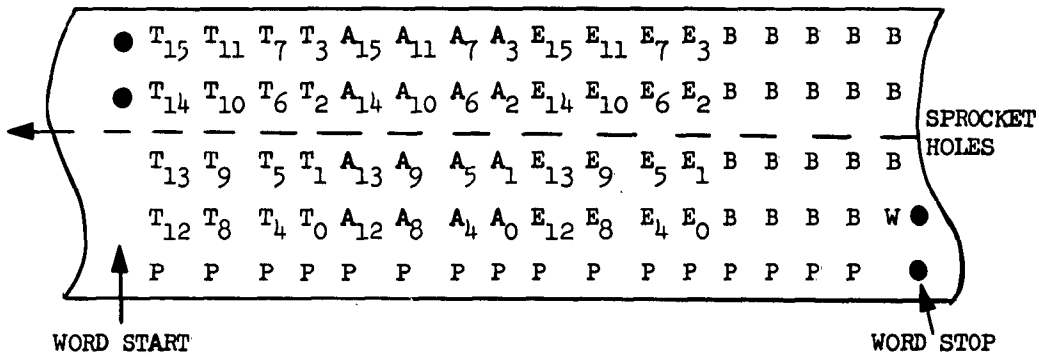
W - Weight (Quality) Bit

T_0 - T_{14}	- System Time	T_0 = 4 seconds	T_{14}	= 65536 seconds
A_0 - A_{11}	- Azimuth	A_{11} = 180°	A_0	= $180(2^{-11})°$
E_0 - E_{11}	- Elevation	E_{11} = 180°	E_0	= $180(2^{-11})°$
R_0 - R_{18}	- Range	R_{18} = 2.560×10^6 yards	R_0	= 9.765625 yards

P - Parity Bit (Odd Parity)

B - Blank (No Punch)

TLM-18 FORMAT



T_0 - T_{14} - System Time (SEC)

A_0 - A_{15} - Azimuth

E_0 - E_{15} - Elevation

T_0 = 4 seconds

T_{15} = Not used

A_0 = $2^{-15}\pi$ radians

A_{15} = 180° = π radians

E_0 = $2^{-15}\pi$ radians

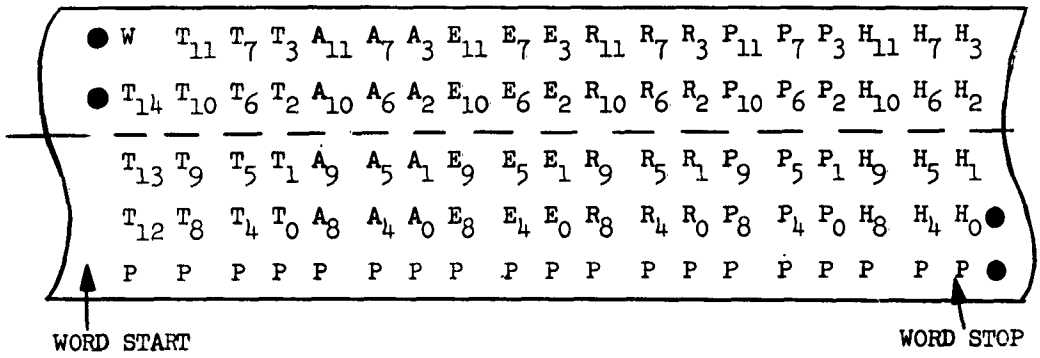
E_{15} = 180° - π radians

W - Weight Bit, Punched when radar is on.

P - Parity Bit, (Odd Parity).

B - Blank (No Punch).

SHIP ANGLES (TLM-18) FORMAT

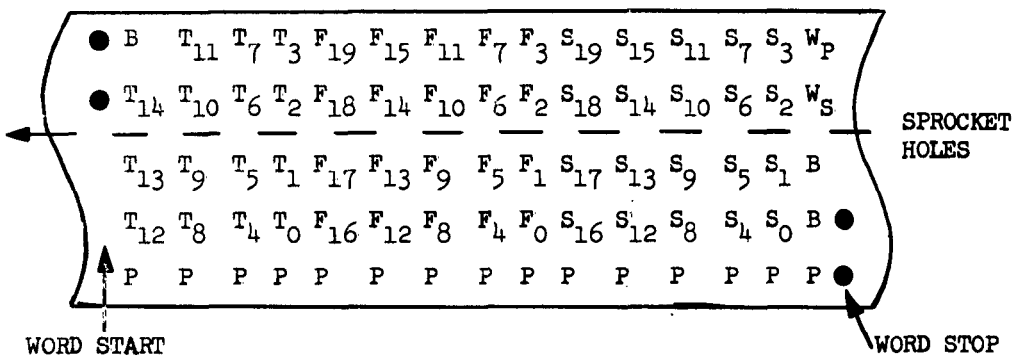


T_0 - T_{14}	- System Time	T_0 = 4 seconds		T_{14} =	65536 seconds
A_0 - A_{11}	- Azimuth	A_{11} = 180°		A_0 =	$180(2^{-11})°$
E_0 - E_{11}	- Elevation	E_{11} = 180°		E_0 =	$180(2^{-11})°$
R_0 - R_{11}	- Roll	R_{11} = 180°		R_0 =	$180(2^{-11})°$
P_0 - P_{11}	- Pitch	P_{11} = 180°		P_0 =	$180(2^{-11})°$
H_0 - H_{11}	- Heading	H_{11} = 180°		H_0 =	$180(2^{-11})°$

W - Weight Bit

P - Parity Bit (Odd Parity)

SHIP PMR DOPPLER FORMAT



B - Blank (No Punch)

T_0 - T_{14} - System Time T_0 = 4 seconds T_{14} = 65536 seconds

F_0 - F_{19} - Δt (1024 cycles) for Primary Frequency

F_0 = 1 microsecond F_{19} = 524288 μsec

S_0 - S_{19} - Δt (1024 cycles) for Secondary Frequency

S_0 = 1 microsecond S_{19} = 524288 μsec

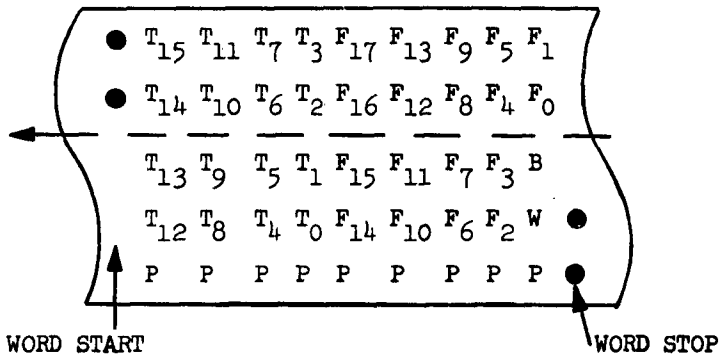
W_p - Primary Weight Bit, Punched when Primary Frequency is being received.

W_s - Secondary Weight Bit, Punched when Secondary Frequency is being received.

W_s and W_p are blank when no signal is being received.

P - Parity Bit (Odd Parity)

DOPPLER FORMAT



T_0 - T_{15} - System Time T_0 = 4 seconds T_{15} = 131072 seconds

F_0 - F_{17} - Frequency F_0 = 1 F_{17} = 131072 seconds

B - Blank (No punch)

W - Weight Bit

P - Parity Bit (Odd Parity)

APPENDIX C

Calling sequence for the interval PT data word interpret routine.

	L	SLJ	4	GIPT*
	L+1	ERROR	RETURN	
	L+2	A		B
				C
	L+3	D		E
				F
(Data)	L+4	G	H	I
	.	J		K
	.			
	.			
	.			
	L+x	NORMAL	RETURN	

where:

A = Minimum number of tape stop codes (Octal)

B = Tape stop code

C = Number of complete words to read

D = Number of frames per word (Octal)

E = Data start code

F = Data stop code

G = Number of bits required for a particular type of data (Octal)

H = Blank, data will be in fixed point format
= 1, data will be converted to floating point format

I = 0 if input data is not to be multiplied (modified) by a constant. Otherwise I = the location of the multiplier.

J = Binary scaling (Octal) if data is to be floated.

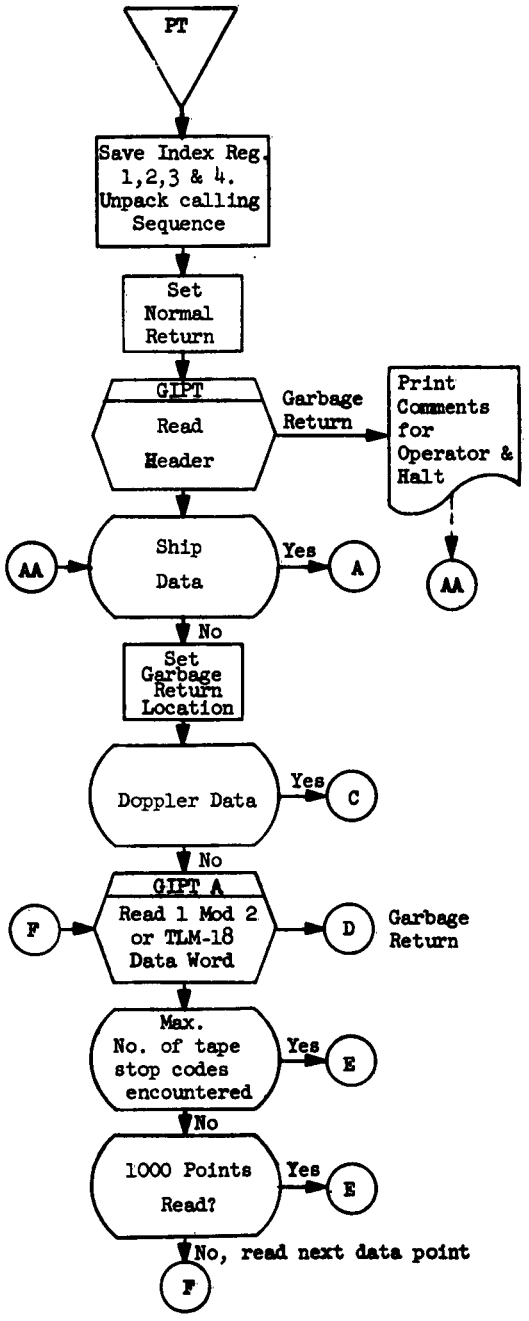
K = Storage location for data

---

* Use GIPT for Header and GIPTA for Data.

APPENDIX D

FLOW CHARTS

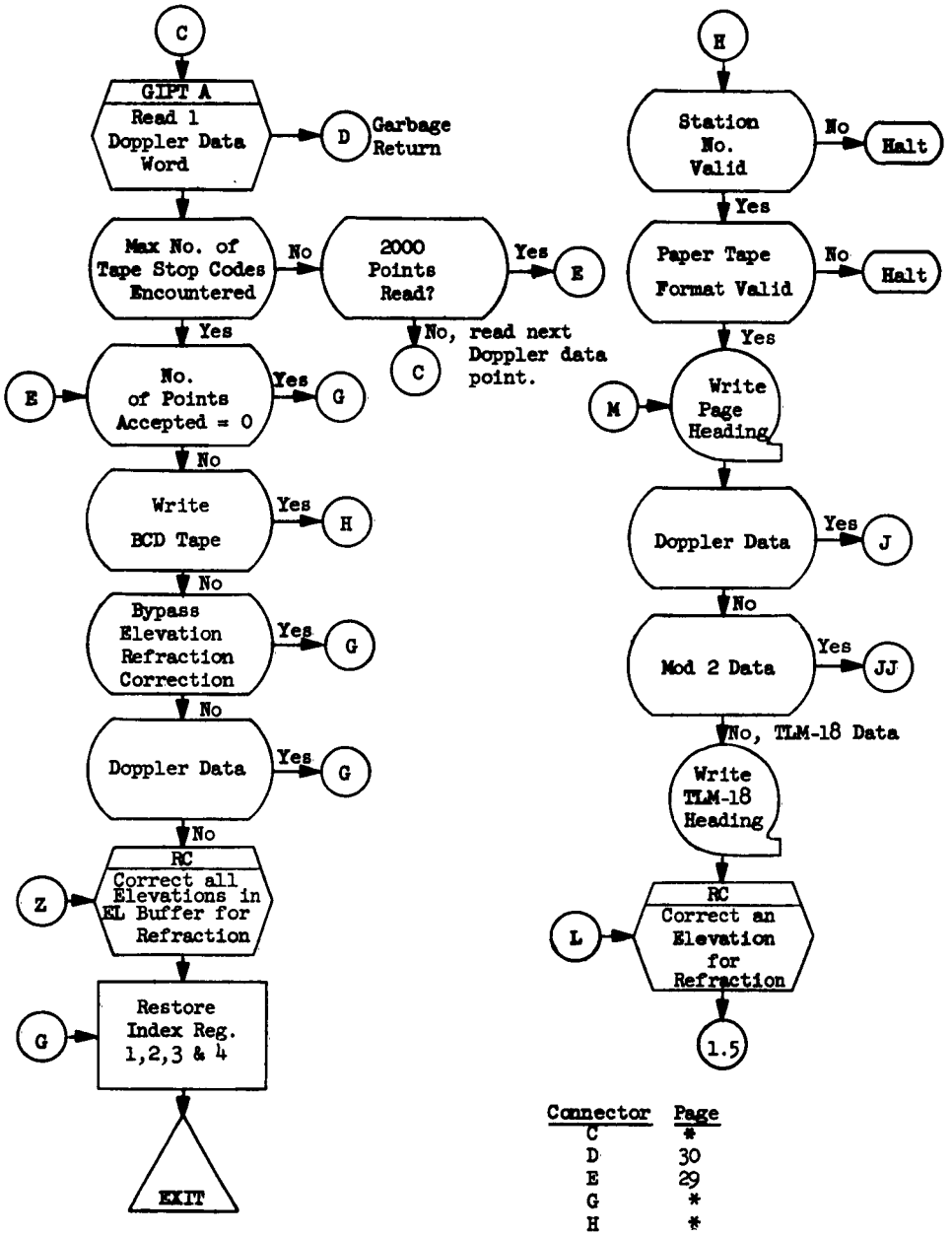


Calling Sequence

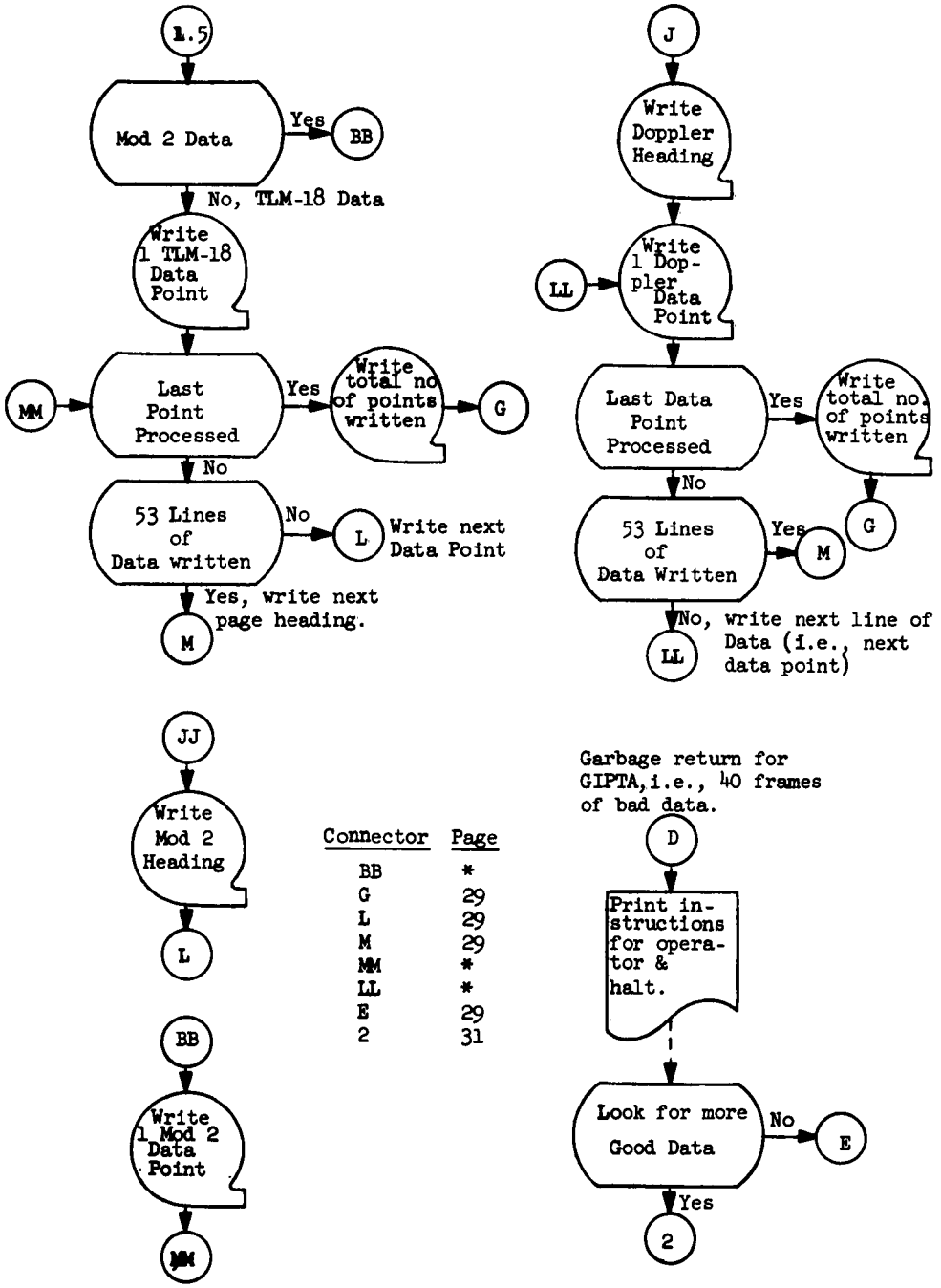
L	SLJ	4	PT
	ZRO		T
L+1	ZRO		AZ
	ZRO		EL
L+2	ZRO		SR
	ZRO		ROLL
L+3	ZRO		PITCH
	ZRO		HEAD
L+4	ZRO		PF
	ZRO		SF
L+5	NORMAL RETURN		

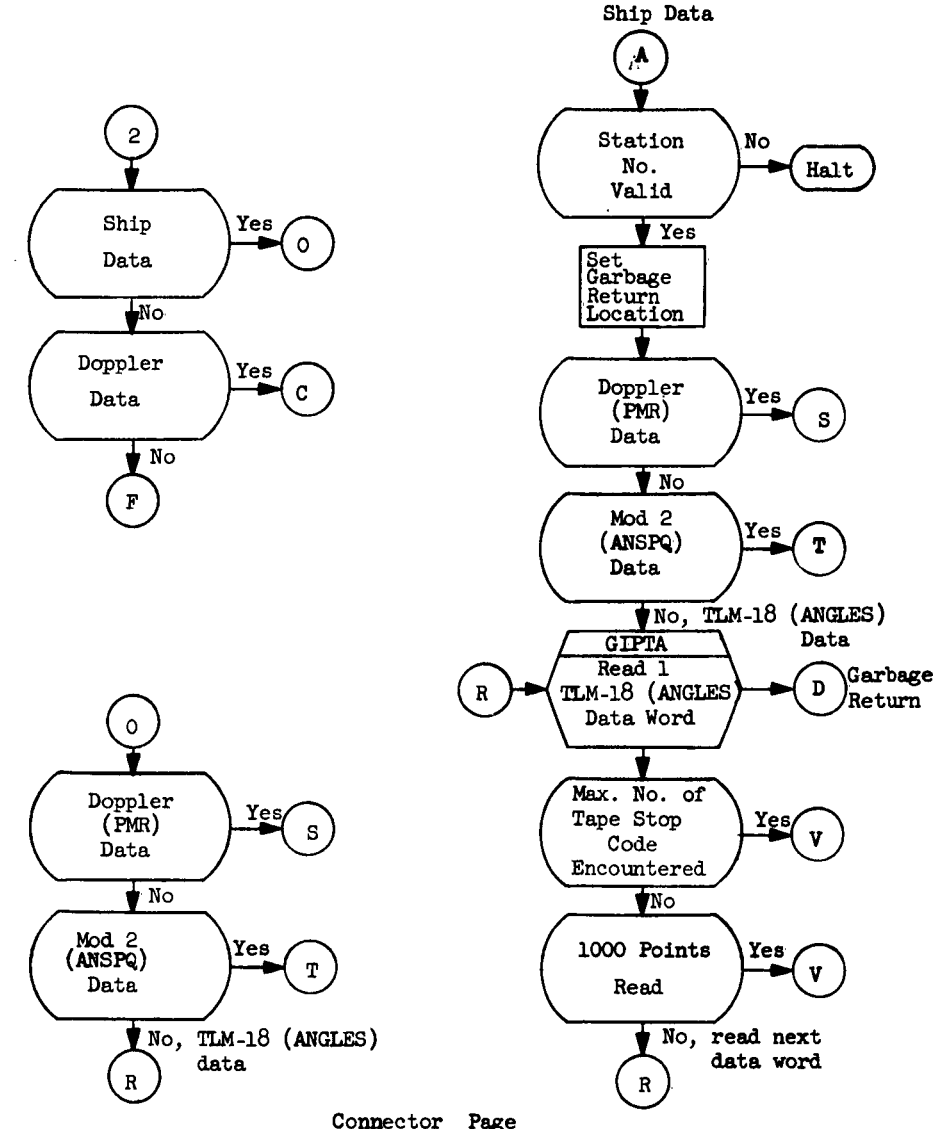
Connector	Page
AA	*
A	31
C	29
D	30
E	29
F	*

*implies item is on this page

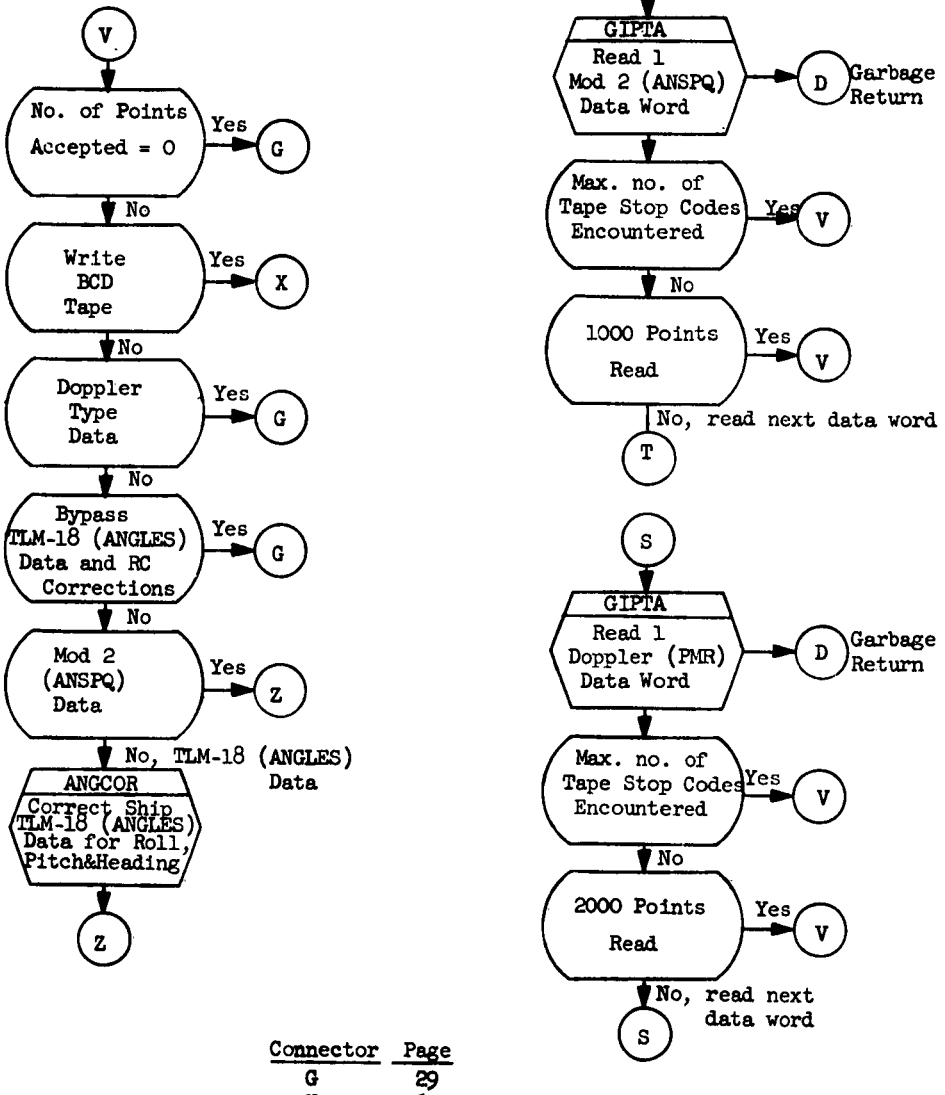


Connector	Page
C	*
D	30
E	29
G	*
H	*
J	30
JJ	30
1.5	30

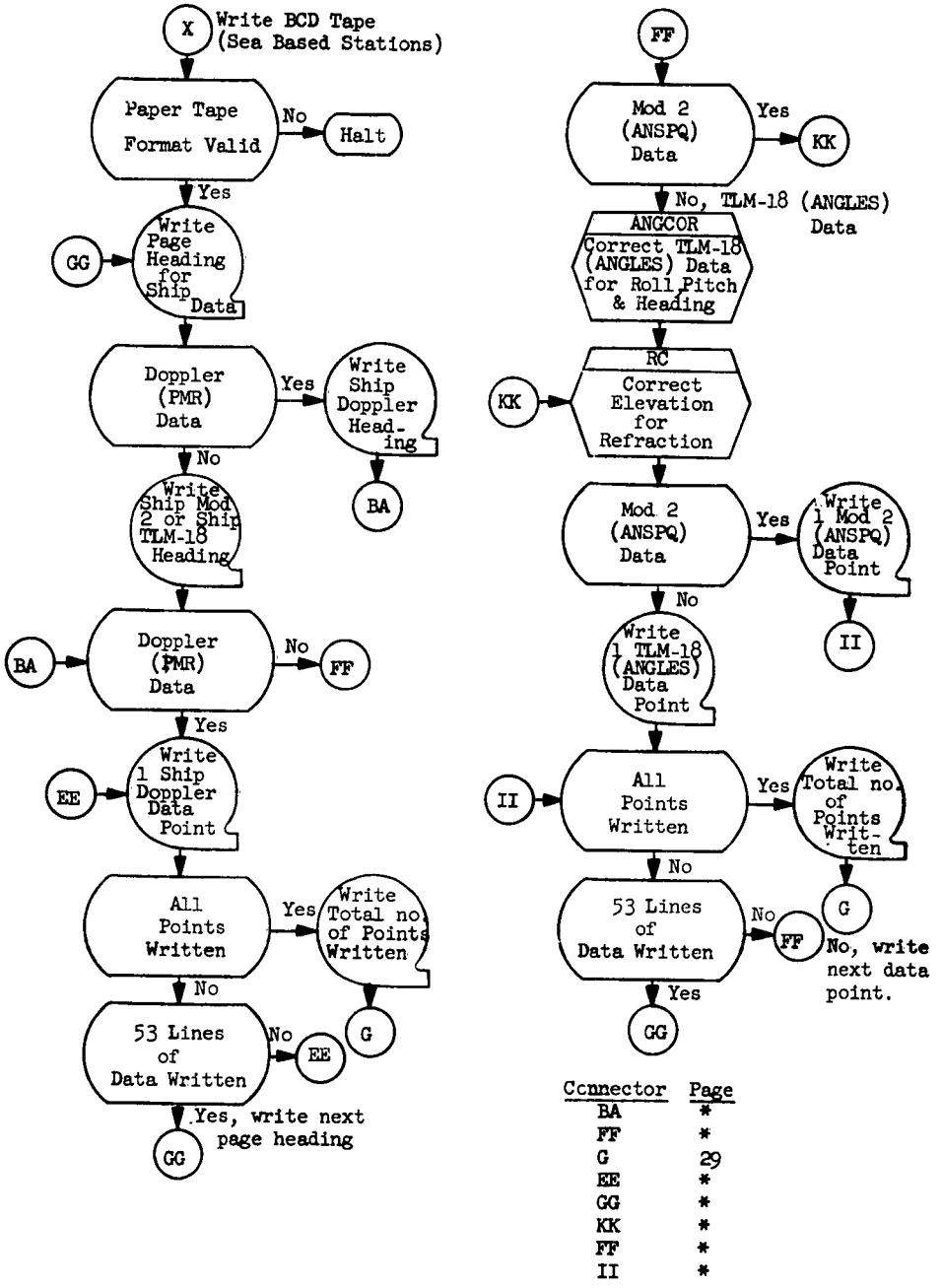

1.5
Mod 2 Data
Yes
BB
No, TLM-18 Data
Write 1 TLM-18 Data Point
MM
Last Point Processed
Yes
Write total no of points written
G
No
53 Lines of Data written
No
L
Write next Data Point
Yes, write next page heading.
M
J
Write Doppler Heading
LL
Write 1 Dop-pler Data Point
Last Data Point Processed
Yes
Write total no. of points written
No
53 Lines of Data Written
Yes
M
G
No, write next line of Data (i.e., next data point)
LL
JJ
Write Mod 2 Heading
L
BB
Write 1 Mod 2 Data Point
MM
Connector Page
BB *
G 29
L 29
M 29
MM *
LL *
E 29
2 31
Garbage return for GIPTA, i.e., 40 frames of bad data.
D
Print instructions for operator & halt.
Look for more Good Data
No
E
Yes
2



Connector	Page
C	29
F	28
O	*
R	*
S	32
T	32
V	32
D	30



Connector	Page
G	29
X	33
Z	29
D	30
V	*
T	*
S	*



Connector	Page
BA	*
FF	*
G	29
EE	*
GG	*
KK	*
FF	*
II	*

APPENDIX E

Formulas for Ship TLM-18 (ANGLES) and Ship MOD2 (AN/SPQ-8) modifications, i.e., only if the accumulator is greater than or equal to 0 upon entrance to PT.

Ship TLM-18 (ANGLES) data modification:

Let initial Azimuth = θ

Let initial Elevation = φ

Let initial Heading = α

Let initial Roll = β

Let initial Pitch = γ

Modified azimuth $\mu = \theta + \alpha$ if $\theta + \alpha < 2\pi$

$= \theta + \alpha - 2\pi$ otherwise

Modified elevation e = φ - ANGBIAS

+ arctan $([\cos(\alpha-\mu)] \gamma \pi/2 + [\sin(\alpha-\mu)] \tan \beta \pi/2)$

where: ANGBIAS = an equipment bias = 0.3926990817_{10} radians

Ship MOD2 (AN/SPQ-8) data modifications:

Elevation = φ - ANGBIAS

Constants used:

TAG	MODE	VALUE
TWOPI	DEC	6.2831854 radians
HALFPI	DEC	1.5707963 radians
ANGBIAS	DEC	0.3926990817 radians

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System Development Corporation,
Santa Monica, California
GENERAL PURPOSE SATELLITE COMPUTER
PROGRAM DESCRIPTION MILESTONE 11
5-LEVEL PAPER DATA READ (PT)
Scientific rept., TM-714/031/00, by
C. J. Zubris. 21 February 1963. 34p.
(Contract AF 19(628)-1648, Space Systems
Division Program, Space Systems Division,
AFSC)

Unclassified report

DESCRIPTORS: Programming
(Computers). Satellite Networks

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Reports that PT (5-Level Paper Tape
Data Read) will read and store data
from six different types of 5-level
paper tapes.

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