IRS-1C/1D

DIGITAL DATA PRODUCTS FORMAT FOR REVISION C FAST FORMAT PRODUCTS

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1.0 INTRODUCTION

This document describes the format for IRS–1C/1D fast format digital data products.

1.1 GENERAL FORMAT RULES

1. All field definitions strictly follow ***American National Standard Institute (ANSI***) and ***International Organization for Standardization (ISO)*** standards.

2. Only Band Sequential (BSQ) image structure is supported.

3. Image files consist of a single band of data.

4. A digital product is referred to as a volume set. Individual media (tape, CD) are referred to as volumes. A volume set may have one or more volumes, depending on image size and output media capacity.

1.2 GENERAL FORMAT DESCRIPTION

The Fast Format (Version C) volume set contains a Header File and Image Files.

1.2.1 HEADER FILE

The first file on each volume, a Read–Me–First file, contains header data. It is in American Standard Code for Information Interchange (ASCII) format, to ANSI and ISO standards. Alphanumeric fields are left justified and numeric fields are right justified. Dates are given in yyyy dd mm format (full year, month and day–of–month format). All processing options,

radiometric calibration, geometric characteristics and map projection information for the product are contained in this file. Appendix D contains a table of the entries in the Header File. The table breaks the information into 80 byte units with a carriage return as the eightieth character allowing convenient printing of the file. For this reason each 80 byte unit is referred to as a line. The table lists the field number in each record, the start and stop byte number, a FORTRAN format representation and a short text describing the field contents.

1.2.2 IMAGE FILES

Each image file contains one band of image data. There are no header records within the image file, nor are there prefix and/or suffix data in the individual image records. Image data may be blocked or unblocked. Blocking is performed to condense as much data onto the tape as possible; map-oriented full scenes otherwise would not fit onto four Computer Compatible Tapes (CCT).

1.2.3 BLOCKED RECORDS

In order to fit some products onto 6250 Bpi computer tapes (CCT), it was deemed necessary to block image data such that one record on the CCT contained several image lines. This blocking results in writing fewer End-of-Record gaps on the tape and allows more data to be written to the tape. Certain map oriented products on CCT are blocked. No blocking is done for products on 8mm Exabyte tapes,CD ROMs and Cartridges.The blocking factor used while writing in the media is indicated in the header file administrative record.

2.0 DETAILED FORMAT DESCRIPTION

2.1 HEADER FILES

The Header File contains three 1536-byte ASCII records. The first record is the Administrative Record which contains information that identifies the product, the scene and the data specifically needed to ingest the imagery from the digital media. In order to import the image data, it is necessary to read entries in the Administrative Record.

The second record is the Radiometric Record which contains the coefficients needed to convert the scene digital values into at−satellite spectral radiance.

The third record is the Geometric Record which contains the scene geodetic location information. In order to align the imagery to other data sources, it will be necessary to read entries in the Geometric Record.

The accompanying tables in Appendix D describe the format of the three records, including the number of bytes, the FORTRAN format statement and a brief description of each field in the header file. All alphanumeric fields are left justified, and all numeric fields right justified. Fields of fixed (constant) values are represented with capital letters in quotes (e.g., "PRODUCT="). Variable fields are represented with lower case letters. In both fixed and variable fields, blank spaces are indicated by the lower case"b" character.

All three records in the Header File have a carriage return every eightieth character.

2.1.1 ADMINISTRATIVE RECORD

The first field in this record contain the Product ID, a unique identifier for the product as ordered by the customer. The remainder of the initial two lines in this record describe the source of the image with pertinent sensor parameters. The next six lines are replicates of the first two without the Product ID. These are growth regions allowing for mosaic products containing up to four images and co−registered Panchromatic and multi−spectral imagery. These products are proposed and not yet implemented.

Line nine describes the type of product contained on the media i.e., size and orientation. Line ten describes the characteristics of the processing: i.e., level of geometric correction and resampler used. The remainder of the Administrative Record contains the critical fields required to import the image data to computer memory.

For unblocked data (8mm and CD−ROM), ingest of the imagery requires knowledge of the contents of fields 83 (pixels per line), 85 (Line per Band on this volume and (87) No. of lines

in output image) and 105 (Bands Present). It is necessary to count the number of non-blank entries in the Bands Present field to get the count of the number of bands. Each character (byte) in this field will have an ASCII character with the band label, usually a number. For IRS-1C the values are 2, 3, 4, 5 for LISS-3 and P for PAN . The sequence terminates in a blank.

For blocked data,fields 91 (Start Line),and either 93 (Blocking Factor) OR 95 (Record Length) and 87 (Number of lines in the output image) are also needed. Note that the (blocked) record length is equal to the blocking factor times the number of pixels per line. One may choose which parameter that best fits their system software interface. Fields 79 and 81 (Volume #/# in Set) relate to which volume number in a set and field 100 indicates Bits per Pixel. Field 73 (bytes 741-751) in Line 10 contains the level of processing that has been performed on the image.

RAW : No corrections applied
RADIOMETRIC : Radiometric corrections only
SYSTEMATIC : Radiometric and geometric corrections using spacecraft system data only.
PRECISION : Radiometric and geometric corrections using spacecraft system data and with control points used.
TERRAIN : Radiometric and geometric corrections using spacecraft system data and with control points and digital elevation model (DEM) used.

Field 75 (bytes 765-766) in Line 10 contains the resampling algorithn that has been applied to the image.

CC = Cubic convolution
NN = Nearest neighbour

Field 83 (bytes 843-847) in Line 11 contains the number of image pixels on each image line of each image band on the tape.

Field 85 (bytes 865-869) in Line 11 contains the number of image lines per band on this volume(This is the number of lines in each image file for tapes containing one or more complete image files.).

Field 87 (Bytes 871-875) contains the number of image lines for the entire band (The band may be split across multiple volumes). These are right-justified numeric fields.

Field 91 (bytes 895–899) in Line 12 identifies the first image line on this tape volume. This is "b1" unless the tape is the second or higher numbered volume of a multi–volume set (e.g. fields 79 & 81 are "b2/b2"). In this case it is the line number in the complete image of the first image line on the tape ((nominally N/2 + 1 for two–tape sets, where N is the total number of lines in the image)). This is a right–justified ASCII numeric field.

Field 93 (bytes 918–919) in Line 12 contains the blocking factor used to minimize the number of CCT tapes required to accommodate the image set. This field is always "1" for 8mm tapes. (See Blocking Factor explanation under Image Files).

Field 95 (bytes 936–940) in Line 12 contains the physical tape record length. The value is right justified in an ASCII numeric field. the number of pixels (samples) per image line can be determined by dividing this field in the value in

Field 93 or by directly reading field 83 (bytes 843–847).

Field 100 (bytes 984–985) in Line 13 contains the integer number of bits per pixel that is used in the output media to represent the digital value of each individual pixel. (This value may be different from Field 102).

Field 102 (bytes 1012–1013) in Line 13 contains the integer number of bits per pixel that each individual pixel was quantized the satellite instrument. (This value may be different from field 100) IRS–1C panchromatic data is transmitted as six bit pixels, while the digital products are always produced are always produced with eight bit pixels.

Field 106 (bytes 1056–1087) in Line 14 contains the band identifiers for the image files on the tape volume. This field is composed of thirty–two– one–byte sub–fields containing from one to thirty–two of the band identifies (i.e., "234b" for full IRS–1C LISS–3 data sets or "Pb" for IRS–1C panchromatic data sets). The band identifiers are listed in the order in which the image files appear on the tape and are single character fields. So the leftmost character (byte 1056) must be non–zero. The sequence ends with trailing blanks.

Field 107 (bytes 1088–1120) in Line 14 contains a nine character product code.(e.g. STPCA02AI)

First Two character is product type e.g. ST ,GR ,QR ,TR ,G3 ,G4 ,SR etc... then single character code Projection ,Resampling ,Ellipsoid ,enhancement ,level of correction ,product format & output media.

Field 111 (bytes 1121–1182) in Line 15 contains software version number(e.g. IRS1DDPSR1V1) and scene Acqisition time is in HH:mm:SS:mmm format.

2.1.2 RADIOMETRIC RECORD

Fields 4–41 (bytes 81–689) contains the coefficients needed to convert scene digital values to at–satellite spectral radiances. The minimum detectable radiance value LMIN and the saturation radiance value LMAX for each spectral bands are provided for the operating gain.
The conversion formula for Digital Count to radiance is as follows ..

Lrad = (DN / MaxGray) * (Lmax – Lmin) + Lmin

Where

Lrad = Radiance for a given DN value
DN = Digital Count

MaxGray = 63 for PAN, 127 for WiFS and LISS–III for Raw product. 255 for corrected products of all sensors.

Lmin = Minimum radiance value for a given band
Lmax = Maximum radinace value for a given band

Here in this record Bias corresponds to Lmin and Gain corresponds to Lmax.

2.1.3 GEOM ETRIC RECORD

Line 1 contains the map projection (field 3), Earth ellipsoid (field 5) and datum (field 7) used in producing the product.

Appendix A contains the list of supported map projections and Appendix B contains the list of supported Earth ellipsoids and comments about the datum. Products are not always available in all projections and ellipsoids.

Fields 11–44 (bytes 110–504, lines two to six) contain the USGS projection parameters used to process the image in standard USGS order. The meaning of these values depends on the projection used. For information about the contents of each of the map projection fields see Appendix C.

Fields 47–88 (bytes 561–859, lines eight to eleven) contain the corresponding corner pixel locations (longitude, latitude, easting, northing) relative to the resampled pixel center for all bands on the current tape volume. Line twelve contains the same information about the scene center as well as the location of the scene center relative to the top right corner of the image on this medium. To calculate the Northing and Easting of any pixel within the image.Use the map coordinates of the image corner points and the following equations:

PE = ((NP–P)(NL–L)ULE + (P–1)(NL–L)URE + NP–P)(L–1)LLE + (P–1)(L–1)LRE)/(NP–1)(NL–1))

Pn = ((NP–P)(NL–L)ULE+(P–1)(NL–L)URN+(NP–P)(L–1)LLN+ (P–1)(L–1)LRN)/(NP–1)(NL–1))

Where
PE = Desired pixel location Easting
PN = Desired pixel location Northing
ULE – Upper left corner point Easting (Field 53)
URE – Upper right corner point Easting (Field 64)
LLE – Lower left corner point Easting (Field 86)
LRE – Lower right corner point Easting (Field 75)
ULN – Upper left corner point Northing (Field 55)
URN – Upper right corner point Northing (Field 66)
LLN – Lower left corner point Northing (Field 88)
LRN – Lower right corner point Northing (Field 77)
P – Pixel number of desired location (counted from left)
L – Line number of desired location (counted from top)
NP – Number of pixels per image line (Record 1, Field 83)
NL – Total number of lines in the output image (Record 1, Field 87)

Field 107 (bytes 969–974) in Line thirteen contains the horizontal offset of the true scene center from the nominal scene center in units of whole pixels. A negative value implies a westerly offset of the scene center from the nominal scene center in daytime scenes and an easterly offset of the scene center in nighttime scenes.

Field 109 (bytes 995–1000) in Line thirteen identifies the orientation angle of the scene. For non–polar scenes the orientation angle of the scene is relative to the scene alignment to map or grid north. For non polar map oriented scenes this field should be zero. A negative angle implies a clockwise rotation of the scene to align with map north whereas a positive angle implies a counterclockwise rotation of the scene to align with map north. To calculate the orientation angle of any image use the following equation:

ANGLE = arctan (NORTHDIFE/EASTDIFF)

Where
NORTHDIFF = URNORTH – ULNORTH
EASTDIFF = UREAST – ULEAST
URNORTH = Upper right corner point Northing (field 66)

ULNORTH = Upper left corner point Northing (field 55)
UREAST = Upper right corner point Easting (field 64)
ULEAST = Upper left corner point Easting (field 53)

Field 113 (bytes 1062–1065) in Line fourteen contains the sun elevation in degrees for the scene center location at the scene center acquisition time. This angle specifies the solar parallel of altitude on the celestial sphere as referenced from the celestial horizon of the scene center.

Field 115 (bytes 1086–1090) contains the sun azimuth (west) in degrees for the scene center location at the scene center acquisition time. This angle specifies the vertical circle (West) on which the sun’s location is measured from the principal vertical circle of the scene center.

APPENDIX A

Map Projections

This appendix contains the map projections used in EOSAT's products. This list of map projections shows the name and the identifier used in Record 3. Field 3 of the header file.

Projection Name	Mnemonic
Universal Transverse Mercator	UTM
State Plane Coordinate System	SPCS
Albers Conical Equal Area	ACEA
Lambett's Conformal Conic	LCC
Mercator	MER
Polar Stereographic	PS
Polyconic	PC
Equidistant Conic (Type A & B)	EC
Transverse Mercator (Gauss-Krueger)	TM
Stereographic	SG
Lamberts Azimuthal Equal Area	LAEA
Azimuthal Equidistant	AE
Gnomonic	GNO
Orthographic	OG
General Vertical Near-Side Perspective	GVNP
Sinusoidal	SIN
Equirectangular (Plate Carree)	ER
Miller Cylindrical	MC
Van Der Grintern I	VDG
Oblique Mercator (Type A & B)	OM
Space Oblique Mercator	SOM

APPENDIX B

Earth Ellipsoids

This appendix contains the earth cllipsoids used in products. This list of ellipsoids shows the name and the identifier used in Record 3. Field 3 of the header file.

Ellipsoid Name	Semi-Major Axis (meters)	Semi-Minor Axis (meters)	Mncmonic
Clarke 1866	6378206.400000	G356583.800000	CLARKE_1866
Clarke 1880	6378249.145000	6356514.869550	CLARKE_1880
International 1967	63778157.500000	6356772.200000	INTERNATL_1967
International	6378388.000000	6356911.946130	INTERNATL_1909 1909
WGS 66	6378145.000000	6356759.769356	WGS_66
WGS 72	6378135.000000	6356750.519915	WGS_72
GRS 1980	6378137.000000	6356752.314140	GRS_80
Airy	6377563.396000	6356256.910000	AIRY
Modified Airy	6377340.189000	6356034.448000	MODIFIED_AIRY
Everest	6377276.345200	6356075.413300	EVEREST
Modified Everest	6377304.063000	6356103.039000	MODIFIED_EVEREST
Mercury 1960	6378166.000000	6356784.283666	MERCURY_1960
Modified Mercury 1968	6378150.000000	6356768.337303	MOD_MERC_1968
Bessel	6377397.155000	6356078.962840	BESSEL
Walbeck	6376896.000000	6355834.846700	WALBECK
Southeast Asia	6378155.000000	6356773.320500	SOUTHEAST_ASIA
Australian Natl.	6378160.000000	6356774.719000	AUSTRALIAN_NATL
Krassovsky	6378245.000000	6356863.018800	KRASSOVSKY
Hough	6378270.000000	6356794.343479	HOUGH
6370997 Sphere	6370997.000000	6370997.000000	6370997_M_SPHERE

Datums

Standard products over North America use either NAD27 or NAD 83. Other datum are available for premium products. Please inquire with NDC,NRSA Customer service**s**

Datum Name	Mncmonic
North American 1927	NAD27
North American 1983	NAD83

APPENDIX C

Fast Format Header File Record Format Tables

The following tables are a description of the three records in the Header File. Each record described below is separated by a blank typed line every eighty characters for case fo reading. A group of eighty characters can be thought of as a (printed) line. See the accompanying text for more explanation of critical entries.

Administrative Record

Line	Field	Start Byte	End Byte	Format	Description
1	1	1	12	A12	"PRODUCTbIDb="
	2	13	23	A11	Product order number in yydddnnn-cc format
	3	24	34	A11	"bLOCATIONb="
	4	35	51	A17	First scene location
					path/row/fraction/subscene in ppp/rrrffss format where ppp = Path(096), rrr = Row(051), ff=ShiftPer(20) ss = Subscene or Quadrant Number (e.g. 02)
	5	52	70	A19	"bACQUISITIONbDATEb="
	6	71	78	A8	First scene acquisition date in yyyyddmm format
	7	79	79	1X	Blank fill
	8	80	80	A1	Carriage return
2	9	81	91	A11	"SATELLITEb="
	10	92	101	A10	First scene satellite Name:L4,L5,1B,1C
	11	102	110	A9	"bSENSORb="
	12	111	120	A10	First scene sensor Name: TM, LISS1, LISS2, LISS3,PAN,WIFS
	13	121	134	A14	"bSENSORbMODEb="
	14	135	140	A6	First scene sensor Mode
	15	141	153	A13	"bLOOKbANGLEb="
	16	154	159	F6.2	First scene off-nadir angle in degrees
	17	160	160	A1	Carriage return

Line	Field	Start Byte	End Byte	Format	Description
3	18	161	183	23X	Blank fill
	19	184	194	A11	"bLOCATIONb="
	20	195	211	A17	Second scene location path/ row/fractions/subscene in ppp/rrrffss format
	21	212	230	A19	"bACQUISITIONbDATEb="
	22	231	238	A8	Second scene acquisition date in yyyyddmm format
	23	239	239	1X	Blank fill
	24	240	240	A1	Carriage return
4	25	241	251	A11	"SATELLITEb="
	26	252	261	A10	Second scene satellite Name:L4, L5, 1B, 1C
	27	262	270	A9	"bSENSORb="
	28	271	280	A10	Second scene sensor Name: TM, LISS1, LISS2, LISS3, PAN, WIFS
	29	281	294	A14	"bSENSORbMODEb="
	30	295	300	A6	Second scene sensor Mode
	31	301	313	A13	"bLOOKbANGLEb="
	32	314	319	F6.2	Second scene off-nadir angle in deg.
	33	320	320	A1	Carriage return
5	34	321	343	23X	Blankfill
	35	344	354	A11	"bLOCATIONb="
	36	355	371	A17	Third scene location path/ row/fraction/subscene in ppp/rrrffss format
	37	372	390	A19	"bACQUISITIONbDATEb="
	38	391	398	A8	Third scene acquisition date in yyyyddmm format
	39	399	399	1X	Blank fill
	40	400	400	A1	Carriage return
6	41	401	411	A11	"SATELLITEb="
	42	412	421	A10	Third scene satellite Name: L4,L5,1B,1C
	43	422	430	A9	"bSENSORb="
	44	431	440	A10	Third scene sensor Name: TM, LISS1, LISS2, LISS3, PAN, WIFS
	45	441	454	A14	"bSENSORbMODEb="

Line	Field	Start Byte	End Byte	Format	Description
	46	455	460	A6	Third scene sensor Mode
	47	461	473	A13	"bLOOKbANGLEb="
	48	474	479	F6.2	Third scene off-nadir angle in degree
	49	480	480	A1	Carriage return
7	50	481	503	23X	Blank fill
	51	504	514	A11	"bLOCATIONb="
	52	515	531	A17	Fourth scene location path/ row/fraction/subscene in ppp/rrrffss format
	53	532	550	A19	"bACQUISITIONbDATEb="
	54	551	558	A8	Fourth scene acquisition date in yyyyddmm format
	55	559	559	1X	Blank fill
	56	560	560	A1	Carriage return
8	57	561	571	A11	"SATELLITEb="
	58	572	581	A10	Fourth scene satellite Name: L4,L5,1B,1C
	59	582	590	A9	"bSENSORb="
	60	591	600	A10	Fourth scene sensor Name: TM,LISS1,LISS2, LISS3,PAN, WIFS
	61	601	614	A14	"bSENSORbMODEb="
	62	615	620	A6	Fourth scene sensor mode
	63	621	633	A13	"bLOOKbANGLEb="
	64	634	639	F6.2	Fourth scene off-nadir angle in deg.
	65	640	640	A1	Carriage return
9	66	641	654	A14	"PRODUCTbTYPEb="
	67	655	672	A18	Product type: MAPbORIENT0dbbbbbb'. 'ORBITbORIENTEDbbbb'
	68	673	687	A15	"bPRODUCTbSIZEb="
	69	688	697	A10	Product size:'FULLbSCENE', 'SUBSCENEbb'. 'MAPbSHEETb'.,'QUADRANT'.
	70	698	719	22X	blank fill
	71	720	720	A1	Carriage return
10	72	721	740	A20	"TYPEbOFbPROCESSINGb="
	73	741	751	A11	Type of processing used: 'SYSTEMAT-ICb', 'PRECISIONbb'. 'TERRAINbbbb', 'RADIOMETRIC", 'RAWbbbbbbbb'

Line	Field	Start Byte	End Byte	Format	Description
	74	752	764	A13	"bRESAMPLINGb="
	75	765	766	A2	Resampling algorithm used: 'CC','NN'
	76	767	799	33X	blank fill
	77	800	800	A1	Carriage return
11	78	801	819	A19	'VOLUMEb#/#bINbSETb="
	79	820	821	I2	Tape volume number in tape set (for multi-volume image)
	80	822	822	A1	"/"
	81	823	824	I2	Number of volumes in tape set (for multi-volume image)
	82	825	842	A18	"bPIXELSbPERbLINEb="
	83	843	847	I5	Number of pixels per image line
	84	848	864	A17	"bLINESbPERbB/ANDb="
	85	865	869	I5	Number of lines on this volume
	86	870	870	A1	"/"
	87	871	875	I5	Number of lines in the output image
	88	876	879	4X	Blank fill
	89	880	880	A1	Carriage return
12	90	881	894	A14	"STARTbLINEb#b="
	91	895	899	I5	First image line number on this vloume (for multi-volume image)
	92	900	917	A18	"bBLOCKINGbFACTORb="
	93	918	919	I2	Tape blocking Factor
	94	920	935	A16	"bRECORDbLENGTHb="
	95	936	940	I5	Length of physical file record in bytes
	96	941	953	A13	"bPIXELbSIZEb="
	97	954	959	F6.2	Pixel size in meters
	98	960	960	A1	Carriage return
13	99	961	983	A23	"OUTPUTbBITSbPERbPIXELb="
	100	984	985	I2	Output bits per pixel
	101	986	1011	A26	"bACQUIREDbBITSbPERbPIXELb="
	102	1012	1013	I2	Acquired bits per pixel
	103	1014	1039	26X	Blank fill
	104	1040	1040	A1	Carriage return
14	105	1041	1055	A15	"BANDSbPRESENTb="
	106	1056	1087	A32	Image bands present on this volume
	107	1088	1102	A14	"PRODUCTbCODEb="
	108	1103	1111	A9	product code
	109	1112	1119	8X	Blank fill
	110	1120	1120	A1	Carrige return

Line	Field	Start Byte	End Byte	Format	Description
15	111	1121	1132	A12	"VERSION NO ="
	112	1133	1144	A12	software version
	113	1145	1152	8X	Blank fill
	114	1153	1170	A18	"ACQUISITIONbTIME ="
	115	1171	1182	A12	time in HH:MM:SS:mmm
	116	1183	1199	17X	Blank fill
	117	1200	1200	A1	Carrige return
16	118	1201	1220	A20	"GENERATINGbCOUNTRYb="
	119	1221	1232	A12	Generating Country Name
	120	1233	1235	X3	Blank Fill
	121	1236	1254	A19	"GENERATINGbAGENCYb="
	122	1255	1262	A8	Generating Agency Name
	123	1263	1279	17X	Blank Fill
	124	1280	1280	A1	Carriage Return
17	125	1281	1301	A21	"GENERATINGbFACILITYb="
	126	1302	1306	A5	Facility Name
	127	1307	1359	53X	blank fill
	128	1360	1360	A1	Carriage Return
18	129	1361	1439	79X	blank fill
	130	1440	1440	A1	Carriage return
19	131	1441	1519	79X	blank fill
	132	1520	1520	A1	Carriage return
20	133	1521	1535	15X	"REVbbbbbbbbbbbb"
	134	1536	1536	A	Format version code (A–Z). This document describes version

Radiometric Record

Line	Field	Start Byte	End Byte	Format	Description
1	1	1	50	A50	"BIASESbANDbGAINSbINbTHE bBANDbORDERbASbONbTHISbTAPE"
	2	51	79	29X	Blank fill
	3	80	80	A1	Carriage Return
2	4	81	104	D24.15	Bias for first Band on this tape
	5	105	105	1X	Blank fill
	6	106	129	D24.15	Gain for first Band on this tape
	7	130	159	30X	Blank fill
	8	160	160	A1	Carriage Return
3	9	161	184	D24.15	Bias for Second Band on this tape
	10	185	185	1X	Blank fill
	11	186	209	D24.15	Gain for Second Band on this tape
	12	210	239	30X	Blank fill
	13	240	240	A1	Carriage Return
4	14	241	264	D24.15	Bias for Third Band on this tape
	15	265	265	1X	Blank fill
	16	266	289	D24.15	Gain for Third Band on this tape
	17	290	319	30X	Blank fill
	18	320	320	A1	Carriage Return
5	19	321	344	D24.15	Bias Fourth Band on this tape
	20	345	345	1X	Blank fill
	21	346	369	D24.15	Gain for Fourth Band on this tape
	22	370	399	30X	Blank fill
	23	400	400	A1	Carriage Return
6	24	401	424	D24.15	Bias for Fifth Band on this tape
	25	425	425	IX	Blank fill
	26	426	449	D24.15	Gain for Fifth Band on this tape
	27	450	479	30X	Blank fill

Line	Field	Start Byte	End Byte	Format	Description
	28	480	480	A1	Carriage Return
7	29	481	504	D24.15	Bias for Sixth Band on this tape
	30	505	505	1X	Blank fill
	31	506	529	D25.15	Gain for Sixth Band on this tape
	32	530	559	30X	Blank fill
	33	560	560	A1	Carriage Return
8	34	561	584	D24.15	Bias for Seventh Band on this tape
	35	585	585	1X	Blank fill
	36	586	609	D24.15	Gain for Seventh Band on this tape
	37	610	639	30X	Blank fill
	38	640	640	A1	Carriage Return
9	39	641	664	D24.15	Bias for Eighth Band on this tape
	40	665	665	1X	Blank fill
	41	666	689	D24.15	Gain for Eighth Band on this tape
	42	690	719	30X	Blank fill
	43	720	720	A1	Carriage Return
10	44	721	799	79X	Blank fill
	45	800	800	A1	Carriage Return
11	46	801	819	A19	"SENSOR GAIN STATE ="
	47	820	851	8*I4	bbbnbbbnbbbnbbbnbbbnbbbnbbbnbbn
	48	852	879	28X	Blank Fill
	49	880	880	A1	Carriage Return
12	50	881	959	79X	Blank fill
	51	960	960	A1	Carriage Return
13	52	961	1038	79X	Blank fill
	53	1040	1040	A1	Carriage Return
14	54	1041	1119	79X	Blank fill
	55	1120	1120	A1	Carriage Return
15	56	1121	1199	79X	Blank fill
	57	1200	1200	A1	Carriage Return
16	58	1201	1279	79X	Blank fill
	59	1280	1280	A1	Carriage Return

Line	Field	Start Byte	End Byte	Format	Description
17	60	1281	1359	79X	Blank fill
	61	1360	1360	A1	Carriage Return
18	62	1361	1439	79X	Blank fill
	63	1440	1440	A1	Carriage Return
19	64	1441	1519	79X	Blank fill
	65	1520	1520	A1	Carriage Return
20	66	1521	1535	15X	Blank fill
	67	1536	1536	A1	Carriage Return

Geometric Record

Line	Field	Start Byte	End Byte	Format	Description
1	1	1	14	A14	"GEOMETRICbDATA"
	2	15	31	A17	"bMAPbPROJECTIONb="
	3	32	35	A4	Map projection name (see Appendix A for list of mnemonies)
	4	36	47	A12	"bELLIPSOIDb="
	5	48	65	A18	Earth cllipsoid used (see Appendix B for list of mnemonies)
	6	66	73	A8	"bDATUMb="
	7	74	79	A6	Datum name (see Appendix B for list of mnemonics)
	8	80	80	A1	Carriage Return
2	9	81	108	A28	"USGSbPROJECTIONbPARAMETERSb="
	10	109	109	1X	Blank fill
	11	110	133	D24.15	USGS projection parameter #1:Semimajor axis
	12	134	134	1X	Blank fill
	13	135	158	D24.15	USGS projection parameter #2:Semiminor axis
	14	159	159	1X	Blank fill
	15	160	160	A1	Carriage Return
3	16	161	184	D24.15	USGS projection parameter #3.
	17	185	185	1X	Blank fill
	18	186	209	D24.15	USGS projection parameter #4
	19	210	210	1x	Blank fill
	20	211	234	D24.15	USGS projection parameter #5
	21	235	239	5x	Blank fill
	22	240	240	A1	Carriage Return
4	23	241	264	D24.15	USGS projectionparameter #6
	24	265	265	1x	Blank fill
	25	266	289	D24.15	USGS projection parameter #7
	26	290	290	1x	Blank fill
	27	291	314	D24.15	USGS projection parameter #8
	28	315	319	5x	Blank fill
	29	320	320	A1	Carriage Return
5	30	321	344	D24.15	USGS projection parameter #9

Line	Field	Start Byte	End Byte	Format	Description
	31	345	345	1x	Blank fill
	32	346	369	D24.15	USGS projection parameter #10
	33	370	370	1x	Blank fill
	34	371	394	D24.15	USGS projection parameter #11
	35	395	399	5x	Blank fill
	36	400	400	A1	Carriage Return
6	37	401	424	D24.15	USGS projection parameter #12
	38	425	425	1x	Blank fill
	39	426	449	D24.15	USGS projection parameter #13
	40	450	450	1x	Blank fill]
	41	451	474	D24.15	USGS projection parameter #14
	42	475	479	5x	Blank fill
	43	480	480	A1	Carriage Return
7	44	481	504	D24.15	USGS projection parameter #15
	45	505	559	55X	Blank fill
	46	560	560	A1	Carriage Return
8	47	561	564	A4	"ULb="
	48	565	565	1x	Blank fill
	49	566	578	A13	Geodetic Longitude of Upper Left corner of image. As per FIPS PUB 70, longitude will be expressed as degrees, 5 degrees, 15 minutes, 13.2 expressed as FIPSPUB minutes, seconds. Exampmle seconds west of the prime meridian will be "005153.2000W"
	50	579	579	1x	Blank fill
	51	580	591	A12	Geodetic Latitude of Upper Left cornor of image. As per FIPS latitude will be expressed as degrees, minutes, degrees, 4 minutes, 24.2334 expressed as PUB 70 Seconds Example:9 seconds north of the equator will be "090424.2334N"
	52	592	592	1x	Blank fill
	53	593	605	F13.3	Easting of Upper Left corner of image in projections units
	54	606	606	1x	Blank fill
	55	607	619	F13.3	Northing of Upper corner of image in projection units

Line	Field	Start Byte	End Byte	Format	Description
	56	620	639	20X	Blank fill
	57	640	640	A1	Carriage Return
9	58	641	644	A4	"URb="
	59	645	645	1x	Blank fill
	60	646	658	A13	Geodetic Longitude of Upper Right corner of image
	61	659	659	1x	Blank fill
	62	660	671	A12	Geodetic Latitude of Upper Right corner of image
	63	672	672	1x	Blank fill
	64	673	685	F13.3	Easting of Upper Right corner of image in projection units
	65	686	686	1x	Blank fill
	66	68 7	699	F13.3	Nothing of Upper Right corner of image in projection units
	67	700	719	20X	Blank fill
	68	720	720	A1	Carriage Return
10	69	721	724	A4	"LRb="
	70	725	725	1x	Blank fill
	71	726	738	A13	Geodetic Longitude of Lower Right corner of image
	72	739	739	1x	Blank fill
	73	740	751	A12	Geodetic Latitude of Lower Right corner of image
	74	752	752	1x	Blank fill
	75	753	765	F13.3	Easting of Lower Right corner of image in projection units
	76	766	766	1x	Blank fill
	77	767	779	F13.3	Northing of Lower Right corner of image in projection units
	78	780	799	20X	Blank fill
	79	800	800	A1	Carriage Return
11	80	801	804	A4	"LLb"
	81	805	805	1x	Blank fill
	82	806	818	A13	Geodetic Longitude of Lower corner of image
	83	819	819	1x	Blank fill
	84	820	831	A12	Geodetic Latitude of Lower corner of image
	85	832	832	1x	Blank fill
	86	833	845	F13.3	Easting of Lower Left corner of image in projection units

Line	Field	Start Byte	End Byte	Format	Description
	87	846	846	1x	Blank fill
	88	847	859	F13.3	Northing of Lower Left corner of image in projection units
	89	860	879	20X	Blank fill
	90	880	880	A1	Carriage Return
12	91	881	888	A8	"CENTERb="
	92	889	889	1x	Blank fill
	93	890	902	A13	Scene centre geodetic longitude expressed in degrees, as above. This is the true center of the full scene product image was made, and does not product image.
	94	903	903	1x	Blank fill
	95	904	915	A12	Scene center geodetic latitude expressed in degrees, minutes seconds as above. This is the true center of the full scene from which the product image was made and does not necessarily fall inside the product image.
	96	916	916	1x	Blank fill
	97	917	929	F13.3	Scene center Easting in projection units
	98	930	930	1x	Blank fill
	99	931	943	F13.3	Scene center Northing in projection units
	100	944	944	1x	Blank fill
	101	945	949	15	Scene center pixel number measured left from the product upper corner, rounded to nearest whole pixel (may be negative)
	102	950	950	1x	Blank fill
	103	951	955	15	Scene center line number measured from the product left corner upper rounded to nearest whole pixel (may be negative)
	104	956	959	4x	Blank fill
	105	960	960	A1	Carriage Return
13	106	961	968	A8	"OFFSETb="
	107	969	974	16	Horizontal offset of the true scene center inunits of whole pixels. (may be negative)

Line	Field	Start Byte	End Byte	Format	Description
	108	975	994	20A	"bORIENTATIONbANGLEb="
	109	995	1000	F6.2	Orientation angle in degrees (may be negative)
	110	1001	1039	39X	Blank fill
	111	1040	1040	A1	Carriage return
14	112	1041	1061	21A	"SUNBbELEVATIONbANGLEb="
	113	1062	1065	F4.1	Sun elevation angle in degrees at scene center
	114	1066	1085	A20	"bSUNbAZIMUTHbANGLEb="
	115	1086	1090	F5.1	Sun azimuth in degrees at scene centrer
	116	1091	1119	29X	Blank fill
	117	1120	1120	A1	Carriage Return
15	118	1121	1199	79X	Blank fill
	119	1200	1200	A1	Carriage Return
16	120	1201	1279	79X	Blank fill
	121	1280	1280	A1	Carriage Return
17	122	1281	1359	79X	Blank fill
	123	1360	1360	A1	Carriage Return
18	124	1361	1439	79X	Blank fill
	125	1440	1440	A1	Carriage Return
19	126	1441	1519	79X	Blank fill
	127	1520	1520	A1	Carriage Return
20	128	1521	1535	79X	Blank fill
	129	1536	1536	A1	Carriage Return

Mnemonics to be used in defining each ellipsoid in Fast Format File

Format – A18
Description – (See attached list of ellipsoids for correct mnemonic)

Field 6: Start Byte = 66
Box Byte = 73
Format = A8
Description = "bDATUMb="

Field 7: Start Byte = 74
Box Byte = 79
Format = A6
Description = 'NAD27b','NAD836',or blank (if no datum used)

Note :

1. For the Field No. 93, 95, 97, 99, 101 and 103 the values are for Processed Image rather than scene centre. In case of full scene product, the values will represent true scene centre.

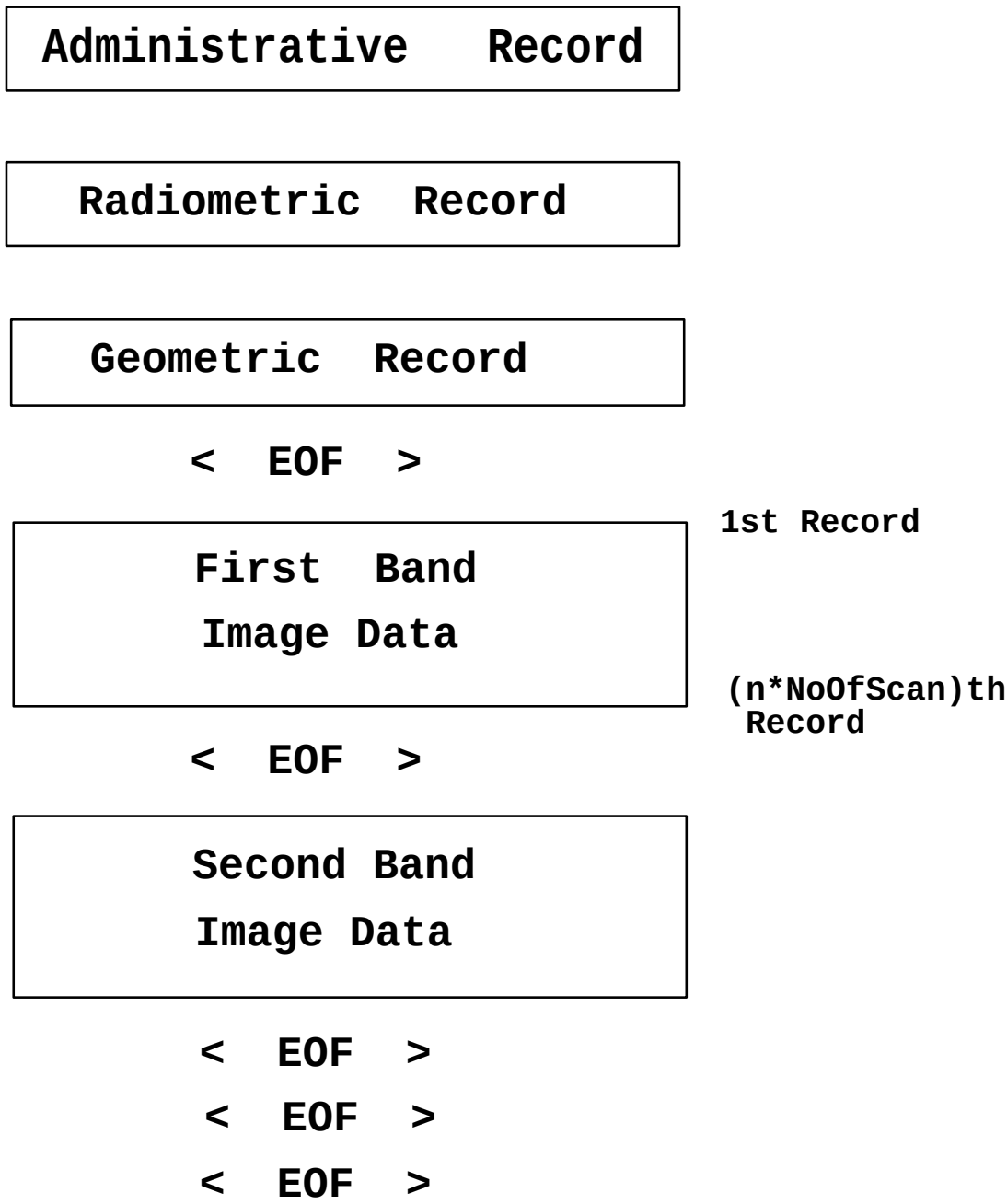
2. Fields in line number 8 to 12 representing the easting, northing co–ordinates specified as in projection units, can be read as "meters" as projection unit is always in meters.

3. For different valid map projection parameters see the attached sheet at the end of this document.

APPENDIX – D

Fast Format Layout

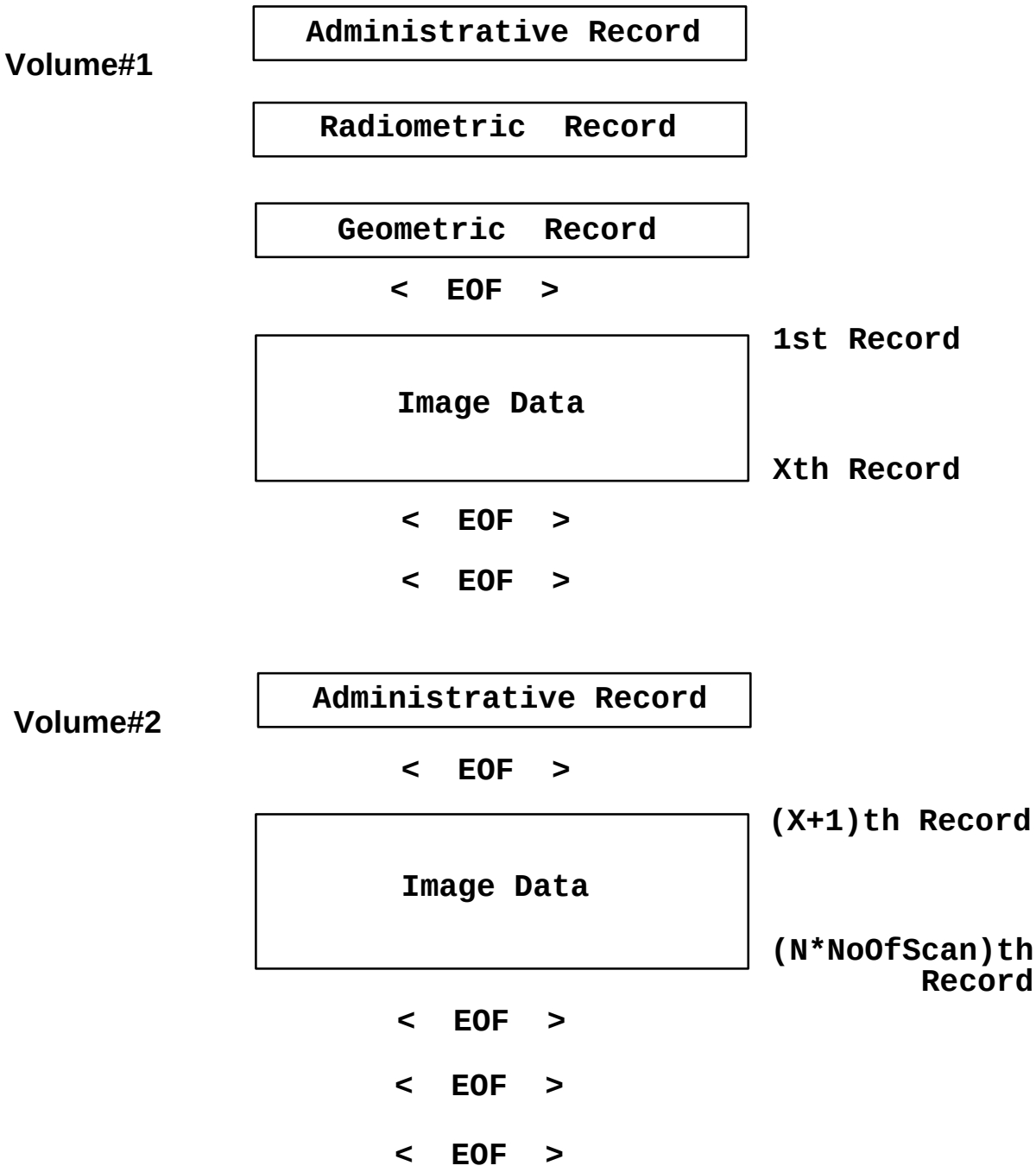
Single Volume Case



Note : If more than one bands are present , then image data is in BSQ format with <EOF> mark after each band image data. Same is valid for multi–volume case also.

Fast Format Layout

Multivolume case :



APPENDIX −E

USGS Projection Parameters

Fast Format Revision C Supports 17 USGS projection parameters. For all projections except State Plane , USGS parameters 1 and 2 are semi major and minor axes of the requested earth ellipsoid.

* Not every parameter will be used by the designated projection.

* If a parameter is not used the field for the parameter will be initialized to Zero.

* All latitude and longitude fields will be specified Decimal Degree (floating point)

* All other fields will be specified as double precision floating point values.

Please note that all co−ordinates for State Plane System contained in the Fast Format are in map metres (not in feet).

C1(U) Universal Transverse Mercator (UTM)

Parameter 3*	UTM Zone number (Optional)

C2(A) Albers Conical Equal Area (ACEA)

Parameter 3	Latitude of first Standard Parallel
Parameter 4	Latitude of second Standard Parallel
Parameter 5	Longitude of central meridian
Parameter 6	Latitude of projection's Origin
Parameter 7	False Easting (in metres)
Parameter 8	False Northing (in metres)

C3(L) Lamberts Conformal Conic (LCC)

Parameter 3	Latitude of first Standard Parallel
Parameter 4	Latitude of second Standard Parallel
Parameter 5	Longitude of central meridian
Parameter 6	Latitude of projection's Origin
Parameter 7	False Easting (in metres)
Parameter 8	False Northing (in metres)

C4(M) Mercator (Mer)

Parameter 5	Longitude of central meridian
Parameter 7	False Easting (in metres)
Parameter 8	False Northing (in metres)

C5(D) Polar Stereographic (PS)

Parameter 5	Longitude directed straight down below pole of map
Parameter 6	Latitude of true scale
Parameter 7	False Easting (in metres)
Parameter 8	False Northing (in metres)

C6(P) Polyconic (POL)

Parameter 5	Longitude of central meridian
Parameter 6	Latitude of projection's Origin
Parameter 7	False Easting (in metres)
Parameter 8	False Northing (in metres)

C7(T) Tranverse Mercator (TM)

Parameter 3	Scale Factor at central meridian
Parameter 5	Longitude of central meridian
Parameter 6	Latitude of projections's origin
Parameter 7	False Easting (in metres)
Parameter 8	False Northing (in metres)

C8(H) Stereographic (SG)

Parameter 5	Longitude of central meridian
Parameter 6	Latitude of centre of projection
Parameter 7	False Easting (in metres)
Parameter 8	False Northing (in metres)

C9(Z) Lamberts Azimuthal Equal Area (LAEA)

Parameter 5	Longitude of central meridian
Parameter 6	Latitude of centre of projection
Parameter 7	False Easting (in metres)
Parameter 8	False Northing (in metres)

C10(E) Azimuthal Equidistant (AE)

Parameter 5	Longitude of central meridian
Parameter 6	Latitude of centre of projection
Parameter 7	False Easting (in metres)
Parameter 8	False Northing (in metres)

C11(G) Gnomonic (GNO)

Parameter 5	Longitude of central meridian
Parameter 6	Latitude of centre of projection
Parameter 7	False Easting (in metres)
Parameter 8	False Northing (in metres)

C12(R) Orthographic (OG)

Parameter 5	Longitude of central meridian
Parameter 6	Latitude of centre of projection
Parameter 7	False Easting (in metres)
Parameter 8	False Northing (in metres)

C13(N) General Vertical Near−Side Perspective (GVNP)

Parameter 3	Height of perspective point above sphere
Parameter 5	Longitude of centre of projection
Parameter 6	Latitude of centre of projection
Parameter 7	False Easting (in metres)
Parameter 8	False Northing (in metres)

C14(I) Sinusoidal (SIN)

Parameter 5	Longitude of central meridian
Parameter 7	False Easting (in metres)
Parameter 8	False Northing (in metres)

C15(C) Miller Cylinderical (MC)

Parameter 5	Longitude of central meridian
Parameter 7	False Easting (in metres)
Parameter 8	False Northing (in metres)

C16(V) Van Der Grinten (VDG)

Parameter 5	Longitude of central meridian
Parameter 7	False Easting (in metres)
Parameter 8	False Northing (in metres)

C17(S) Space Oblique Mercator (SOM)

Parameter 4	Angle of azimuth east of north for central line of projection
Parameter 9	Longitude of the ascending Node
Parameter 11	Longitude of descending Node