

Department of the Interior  
U.S. Geological Survey

**LANDSAT MULTISPECTRAL SCANNER (MSS)  
LEVEL 1 (L1)  
DATA FORMAT CONTROL BOOK (DFCB)**

**Version 3.0**

**August 2012**





## **Executive Summary**

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This Data Format Control Book (DFCB) presents detailed data formats of the Multispectral Scanner (MSS) output files generated by the Level 1 (L1) Product Generation System (LPGS). These L1 processing systems produce L1 output files using Level 0 Reformatted (LOR) images as input. The standard output format used to generate images from the LPGS is the Geographic Tagged Image File Format (GeoTIFF) format.

The Landsat Configuration Control Board (LCCB) maintains and controls this DFCB. Staff may update or revise this document only upon LCCB approval. Please direct comments and questions regarding this DFCB to the following:

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## Document History

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# Section 1 Introduction

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## 1.1 Purpose

This Data Format Control Book (DFCB) provides a high-level description of the Landsat Multispectral Scanner (MSS) Level 1 (L1) distribution product, output product packaging, and viewing tools. This document outlines Landsat 1-5 MSS data products. The different MSS data types include Multispectral Scanner - Processed Format (MSS-P), Multispectral Scanner - X Format (MSS-X), and Multispectral Scanner – A Format (MSS-A).

## 1.2 Scope

This DFCB describes the format and data contents of the MSS L1 output files. The output format generated by the Level 1 Product Generation System (LPGS) for distribution is the Geographic Tagged Image File Format (GeoTIFF).

The file format contained in this DFCB is applicable to the LPGS-generated product, operated at the U.S. Geological Survey (USGS) Earth Resources Observation and Science (EROS) Center.

## 1.3 Intended Users

This document is intended as a guide for L1 product recipients. It also provides detailed information on the L1 product packaging.

## 1.4 Definitions

**Level 0 Reformatted Archive (L0Ra) product** - Raw Computer Compatible (RCC) data that have been reformatted to support data production and include individual band, browse data, a Mirror Scan Correction Data (MSCD) file, a Payload Correction Data (PCD) file, and Scene Metadata.

**Level 0 Reformatted Product (L0Rp) digital image** - Spatially reformatted, demultiplexed, and unrectified interval data.

**L0Rp product** - L0Rp digital image plus radiometric, calibration, spacecraft attitude, and ephemeris data, consisting of the following files in Hierarchical Data Format (HDF):

- L0Rp digital image (one file per band)
- Internal Calibrator (IC) data - A calibration data file containing all of the calibration data received on a major frame basis subset to the product size ordered
- MSCD- Scan direction and error information subset to the product size ordered
- PCD - Information on spacecraft attitude and ephemeris, including quality indicators for the entire subinterval from which the product is derived
- Metadata - Descriptive information about the L0Rp image and names of appended files associated with the image

- Calibration Parameter File (CPF) - A formatted file containing radiometric and geometric correction parameters
- Scan Line Offsets (SLO) - Information on actual starting and ending pixel positions for valid image data on a line-by-line basis
- Geolocation table - A file containing scene corner coordinates and product-specific scene line numbers for bands
- HDF directory - A file containing all of the pointers, file size information, and data objects required to process the LORp product
- Annotation File - Contains the tic marks required for mapping scene-based u,v coordinates to projection space.

**Level 1 Radiometric Corrected (L1R) digital image** - Radiometrically corrected but not geometrically resampled

**Consensus File** - A single file created from the two original files included with the LORp product and errors corrected

**Level 1 Systematic Corrected (L1G) digital image** - Radiometrically corrected and resampled for geometric correction and registration to a geographic map projection

**L1G product** - L1 product distributed to the customer that includes, for all bands, a GeoTIFF format L1G image and associated data accommodated by the format

**Level 1 Systematic Terrain Corrected (L1Gt) product** - L1Gt Terrain Correction product that includes radiometric and geometric corrections, and uses a Digital Elevation Model (DEM) to correct parallax error due to local topographic relief. The accuracy of the terrain-corrected product depends upon the accuracy of the geometry off the spacecraft when GCPs are not used. L1Gt products are not recommended as output products for MSS data because of the likelihood for inaccurate terrain correction and subsequent precision modeling, and are often more inaccurate than the systematic product.

**Level 1 Terrain Corrected (L1T) product** - Includes radiometric, geometric, and precision correction, and uses a DEM to correct parallax error due to local topographic relief. The accuracy of the terrain-corrected product depends on the availability of Ground Control Points (GCPs), and the resolution of the best available DEM.

**Worldwide Reference System (WRS) scene** - A global-notation system for Landsat data. The WRS indexes orbits (paths) and scene centers (rows) into a global grid system. The path/row notation was originally employed to provide a standard designator for every nominal scene center and to allow straightforward referencing without using longitude and latitude coordinates.

The WRS system design is tied to orbital parameters such as inclination and mean motion; thus, swathing patterns and repeat cycles are different if these orbital parameters are different. Because Landsat 1-3 orbit on an 18-day repeat cycle, and

Landsat 4, 5, and 7 orbit on a 16 -day repeat cycle, each set completes a different number of orbits before covering the same area on the Earth. This difference in repeat cycles is the impetus for the difference in the number of paths between the WRS-1 and WRS-2.

WRS-1, used for Landsat 1-3, divides the Earth into 251 paths and 248 rows, for a total of 62,248 scenes. Each WRS-1 scene represents approximately 25 seconds of flight. WRS-2, used for Landsat 4, 5, and 7, grids the Earth into 233 paths by 248 rows. In total, the WRS-2 structure defines 57,784 scene centers, translating to approximately 24 seconds of flight.

## **1.5 Level 0 (L0) Pre-Archive Processing**

A basic knowledge of the pre-archive ground processing enables the user to understand the L1 product.

The Level 0 (L0) data format contains wideband data processed from the Landsat 1-5 spacecraft. The L0 format is the standard output format of the Landsat Archive Conversion System (LACS) and Multispectral Scanner – X Format Archive Conversion System (MACS). The LACS and MACS output conforms to the L0 format that the USGS uses. This format supports multiple data types for the MSS sensor, including Multispectral Scanner - Processed Format (MSS-P), Multispectral Scanner - X Format (MSS-X), and Multispectral Scanner - Archive Format (MSS-A).

The archived MSS data are processed through an "MSS formatter" to make the format similar to that of Landsat 7 Enhanced Thematic Mapper Plus (ETM+) and Landsat 4 / Landsat 5 Thematic Mapper (TM). This makes the data format consistent among the different MSS data types (P, X, and A), makes it compatible with the Level 1 processing systems, and makes it easier to work with for those already familiar with the ETM+ and TM L0Rp formats. Although archived MSS data have often been geometrically and/or radiometrically corrected to some degree, this reformatted product is referred to as "MSS L0Rp" because of its similarities to other L0Rp data sets (with respect to format and role as input to L1 processing).

The MSS L0Rp format consists of an HDF 4 data set composed of several files (an HDF catalog file, four image band files, and a variable number of metadata files, based on the MSS data type). It also includes a CPF .

## Section 2 Overview of the L1 Output Files

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The L1G digital image is radiometrically and geometrically corrected, and is available in GeoTIFF format. The L1T product includes radiometric, geometric, and precision correction, and uses DEM to correct parallax error due to local topographic relief. The processing level to which an image is generated is determined by the best available level for that particular scene, based on available DEM and GCPs for precision modeling. L1Gt products are not recommended as output products for MSS data because without precision GCPs, the geometric accuracy is not precise enough to apply a DEM. L1Gt is currently only used in Antarctica for L7.

The on-demand L1 products now available for download at no charge are generated using a standard set of parameters. These products are output using the best available processing level for that particular scene (L1G or L1T). The processing parameters and output product details used for all standard products are as follows:

- Pixel Size                                    60 m
- Output Format                                GeoTIFF
- Resampling Method                        Cubic Convolution (CC)
- Map Projection                              Universal Transverse Mercator (UTM)  
Polar Stereographic (PS) for Antarctica scenes
- Datum                                         World Geodetic system 1984 (WGS84)
- Image Orientation                         Map (North Up)
- Distribution                                 File Transfer Protocol (FTP) or Hypertext Transfer  
Protocol (HTTP) download

Table 2-1 through Table 2-5 detail the MSS L1 product components included with each format. The number of bands and optional data files that the user orders determines the number of components included with a specific product.

Component	L1G	L1T
L1 image file (for each band)	X	X
L1 Metadata file (text [.txt] file)	X	X
GCP file (text [.txt] file)		X
3 Band Verification Browse Image (JPEG [.JPG] file)		X
Geometric Verification Statistics file (text [.txt] file)		X

**Table 2-1. GeoTIFF Product Components**

### 2.1 GeoTIFF

The file-naming convention for the GeoTIFF product is the following:

<LANDSAT\_SCENE\_ID>\_BN.XXX, where LANDSAT\_SCENE\_ID is LMSPPPRRRRYYYYDOYGSIVV, where

L	=	L = Landsat
M	=	Mission: M = Landsat MSS
S	=	Satellite: 1 = Landsat 1 2 = Landsat 2 3 = Landsat 3 4 = Landsat 4 5 = Landsat 5
PPP	=	3-Digit starting path
RRR	=	3-Digit starting row
YYYY	=	4-Digit acquisition year
DOY	=	3 Digit acquisition day of year
GSI	=	Ground Station Identifier
VV	=	2-Digit version
BN	=	Band Number: B1 = Band 1 B2 = Band 2 B3 = Band 3 B4 = Band 4 B5 = Band 5 B6 = Band 6 B7 = Band 7
XXX	=	File type: = TIF file extension for all image data = JPG file extension for the verification browse = txt file extension for GCP, VER, and MTL files

**Table 2-2. GeoTIFF Product Naming Convention**

## 2.2 L1 Image File

GeoTIFF defines a set of public domain Tagged Image File Format (TIFF) tags that describe all cartographic and geodetic information associated with GeoTIFF imagery. GeoTIFF is a means for tying a raster image to a known model space or map projection and for describing those projections. A metadata format provides geographic information to associate with the image data, but the TIFF file structure allows both the metadata and the image data to encode into the same file. The GeoTIFF file is grayscale, scan line, uncompressed, and 8-bit unsigned integers.

## 2.3 L1 Metadata (MTL) Files

The MTL file is created during product generation and contains information specific to the product ordered. Table 2-3 lists the full contents of the MTL file. This file contains all applicable image description information from the L0Rp metadata file. The new MTL file introduced with LPGS version 12.1.0 complies with LS-DIR-05 Landsat Metadata Description Document (LMDD), Version 8.0 (see References).

The legacy MTL file (not LMDD compliant) is currently bundled with the product for reference. The old MTL file (MTLold) is created during product generation after the MTL file and will be bundled as part of the product for a user transition period for a

period of time. The old MTL file will be retired at a future date. Table 2-4 lists the full contents of the old MTL file.

Vdata Name: LMSPPRRRRYYYYDDDGSIVV_MTL.txt
Vdata Class: LPGS_Metadata
Interlace Type: FULL_INTERLACE
Bytes Per Logical Record: 65535
Number of Records: One record.

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
GROUP	18	= L1_METADATA_FILE	Beginning of the first-level Object Description Language (ODL) group; it indicates the start of the L1 MTL file level group.
GROUP	18	= METADATA_FILE_INFO	Beginning of the metadata file information group.
ORIGIN	47	= "Image courtesy of the U.S. Geological Survey"	Establishes the origin of the image from the USGS.
REQUEST_ID	19	USGS products use: "NNNYMMDDSSSS_UUUUU" format where: NNNYMMDDSSSS = 13-digit Tracking, Routing, and Metrics (TRAM) order number NNN = Node indicator YY = Year MM = Month DD = Day SSSS = Sequence number for the day UUUUU = 5-digit TRAM unit number	Data producer-defined request number that uniquely identifies each product. USGS products use a unique product generation TRAM-generated request ID.
LANDSAT_SCENE_ID	21	= LMSPPRRRRYYYYDDDGSIVV where L = Landsat M = MSS S = Satellite PPP = WRS Path RRR = WRS Row YYYY = Year of Acquisition DDD = Day of Acquisition Year GSI = Ground Station Identifier VV = Version	Unique Landsat scene identifier. (Earth-imaging), orbital path/row
FILE_DATE	20	= YYYY-MM-DDTHH:MI:SSZ where YYYY = 4-digit Julian year MM = the month number of the Julian year (01-12) DD = the day of the Julian month (01-31) T = the start of time information in ODL ASCII time code format	L1 system date and time when the metadata file for the L1 product set was created.

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
		HH = hours (00-23) MI = minutes (00-59) SS = seconds (00-59) Z = Zulu time (same as GMT)	
STATION_ID	3	= "EDC"	Unique 3-letter code identifying the originating Ground Station.
PROCESSING_SOFTWARE_VERSION	20	= "SYSTEM_VERSION" where SYSTEM = LPGS, IAS VERSION = version of software	"Software name, followed by version number(s) and separated by underscores. Example: LPGS_8.2.3"
DATA_CATEGORY	11	= "NOMINAL" = "VALIDATION" = "EXCHANGE" = "TEST" or = "ENGINEERING"	"Current data category assigned to the data. Values: NOMINAL = Nominal data that exists within expected, acceptable limits. VALIDATION = Validation data obtained from an International Ground Station (IGS) in order to validate that the IGS data are of equivalent quality to those that the USGS maintains. EXCHANGE = Exchange data (between an IGS and the USGS) that require a quarantine period and have been successfully validated to be of equivalent quality to the corresponding USGS data. TEST = Test data. ENGINEERING = Engineering data that typically results from an inclination change to the spacecraft or Delta I Maneuver. Refer to LS-DIR-03 Landsat Data Management Policy."
END_GROUP	18	= METADATA_FILE_INFO	End of the metadata information group.
GROUP	16	= PRODUCT_METADATA	Beginning of the product metadata group.
DATA_TYPE	20	= "L1T" = "L1G" or = "L1GT"	Identifier to inform the user of the data type.
DATA_TYPE_LORP	20	= "MSSA_LORP" = "MSSX_LORP" or	Data type identifier string used to create the LORp product.

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
		= "MSSP_LORP"	
ELEVATION_SOURCE	7	= "GLS2000" or = "RAMP"	Digital elevation dataset used to terrain-correct the product. Values: GLS2000 = Global Land Survey 2000. RAMP = Radarsat Antarctic Mapping Project.
OUTPUT_FORMAT	7	= "GEOTIFF"	Output format of the image. Values: GEOTIFF = Geostationary Earth Orbit Tagged Image File Format.
EPHEMERIS_TYPE	10	= "DEFINITIVE" = "PREDICTIVE"	Identifier to inform the user of the orbital ephemeris type used. If the field is not present, the user should assume PREDICTIVE in all cases (L1G product only).
SPACECRAFT_ID	9	= "LANDSAT_1" = "LANDSAT_2" = "LANDSAT_3" = "LANDSAT_4" = "LANDSAT_5"	Name of the satellite platform.
SENSOR_ID	8	= "MSS"	Name of the imaging sensor. MSS = Multispectral Scanner.
WRS_PATH	3	= NNN, where NNN = the path number (001-251)	WRS-defined nominal Landsat satellite track (path). (orbital)
WRS_ROW	3	= NNN, where NNN = the row of the first full or partial scene in the product (001-248)	WRS-defined nominal Landsat satellite row, based on the latitudinal center frame of a Landsat image. (orbital)
DATE_ACQUIRED	10	= YYYY-MM-DD	Date that this scene was imaged.
SCENE_CENTER_TIME	14	= "HH:MI:SS.SSSSSSZ where HH = Hour (00-23) MI = Minutes SS.SSSSSS = Fractional seconds Z = constant (indicates ""Zulu"" time (same as GMT)).	Scene center time of the date the image was acquired.
CORNER_UL_LAT_PRODUCT	7	= -90.00000 through +90.00000 degrees. Positive (+) value indicates north latitude; negative (-) value indicates south latitude	Latitude value for the upper-left corner of the product (the L1 systems recalculate for the L1G product).

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
CORNER_UL_LON_PRODUCT	8	= -180.00000 through +180.00000 degrees. Positive (+) value indicates east longitude; negative (-) value indicates west longitude	Longitude value for the upper-left corner of the product (the L1 systems recalculate for the L1G product).
CORNER_UR_LAT_PRODUCT	7	= -90.00000 through +90.00000 degrees.	Latitude value for the upper-right corner of the product (the L1 systems recalculate for the L1G product).
CORNER_UR_LON_PRODUCT	8	= -180.00000 through +180.00000 degrees.	Longitude value for the upper-right corner of the product (the L1 systems recalculate for the L1G product).
CORNER_LL_LAT_PRODUCT	7	= -90.00000 through +90.00000 degrees.	Latitude value for the lower-left corner of the product (the L1 systems recalculate for the L1G product).
CORNER_LL_LON_PRODUCT	8	= -180.00000 through +180.00000 degrees.	Longitude value for the lower-left corner of the product (the L1 systems recalculate for the L1G product).
CORNER_LR_LAT_PRODUCT	7	= -90.00000 through +90.00000 degrees.	Latitude value for the lower- right corner of the product (the L1 systems recalculate for the L1G product).
CORNER_LR_LON_PRODUCT	8	= -180.00000 through +180.00000 degrees.	Longitude value for the lower-right corner of the product (the L1 systems recalculate for the L1G product).
CORNER_UL_PROJECTION_X_PRODUCT	14	= -132000000.000 through 132000000.000 Units are feet or meters	Projection X coordinate for the upper-left corner of the product (the L1 systems calculated, L1G only).
CORNER_UL_PROJECTION_Y_PRODUCT	14	= -132000000.000 through 132000000.000 Units are feet or meters	Projection Y coordinate for the upper-left corner of the product (L1 systems calculated, L1G only).
CORNER_UR_PROJECTION_X_PRODUCT	14	= -132000000.000 through 132000000.000 Units are feet or meters	Projection X coordinate for the upper-right corner of the product (L1 systems calculated, L1G only).
CORNER_UR_PROJECTION_Y_PRODUCT	14	= -132000000.000 through 132000000.000 Units are feet or meters	Projection Y coordinate for the upper-right corner of the product (L1 systems calculated, L1G only).
CORNER_LL_PROJECTION_X_PRODUCT	14	= -132000000.000 through 132000000.000	Projection X coordinate for the lower-left corner of the

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
		Units are feet or meters	product (L1 systems calculated, L1G only).
CORNER_LL_PROJECTION_Y_PRODUCT	14	= -132000000.000 through 132000000.000 Units are feet or meters	Projection Y coordinate for the lower-left corner of the product (L1 systems calculated, L1G only).
CORNER_LR_PROJECTION_X_PRODUCT	14	= -132000000.000 through 132000000.000 Units are feet or meters	Projection X coordinate for the lower-right corner of the product (L1 systems calculated, L1G only).
CORNER_LR_PROJECTION_Y_PRODUCT	14	= -132000000.000 through 132000000.000 Units are feet or meters	Projection Y coordinate for the lower-right corner of the product (L1 systems calculated, L1G only).
REFLECTIVE_LINES	5	= NNNNN	Number of product lines for the reflective bands.
REFLECTIVE_SAMPLES	5	= NNNNN	Number of product samples for the reflective bands.
FILE_NAME_BAND_1	256	"<LANDSAT_SCENE_ID>_B1.TIF"	L1-generated external element file name for Band 1, if part of the product.
FILE_NAME_BAND_2	256	"<LANDSAT_SCENE_ID>_B2.TIF"	L1-generated external element file name for Band 2, if part of the product.
FILE_NAME_BAND_3	256	"<LANDSAT_SCENE_ID>_B3.TIF"	L1-generated external element file name for Band 3, if part of the product.
FILE_NAME_BAND_4	256	"<LANDSAT_SCENE_ID>_B4.TIF"	L1-generated external element file name for Band 4, if part of the product.
FILE_NAME_BAND_5	256	"<LANDSAT_SCENE_ID>_B5.TIF"	L1-generated external element file name for Band 5, if part of the product.
FILE_NAME_BAND_6	256	"<LANDSAT_SCENE_ID>_B6.TIF"	L1-generated external element file name for Band 6, if part of the product.
FILE_NAME_BAND_7	256	"<LANDSAT_SCENE_ID>_B7.TIF"	L1-generated external element file name for band 7, if part of the product.
GROUND_CONTROL_POINT_FILE_NAME	256	"<LANDSAT_SCENE_ID>_GCP.txt"	L1-generated external element file name for the GCP, if part of the product.
REPORT_VERIFY_FILE_NAME	256	"<LANDSAT_SCENE_ID>_VER.txt"	L1-generated external element file name where information from the scoring of geometric verification will be located.
BROWSE_VERIFY_FILE_NAME		"<LANDSAT_SCENE_ID>_VER.jpg"	L1-generated external element file name for the 3 Band Browse file (JPEG file), if part of the product.
METADATA_FILE_NAME	256	"<LANDSAT_SCENE_ID>_MTL.txt"	Name of the metadata file.

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
CPF_NAME	256	LMXCPFYYYYMMDD_YYYYMMDD .nn where L = Landsat M = MSS X = Mission 1 = Landsat 1 2 = Landsat 2 3 = Landsat 3 4 = Landsat 4 5 = Landsat 5 YYYYMMDD = effective_date_begin and effective_date_end respectively nn = version (00-99)	Archive-generated external element file name for the Image Assessment System (IAS) CPF.
END_GROUP	16	= PRODUCT_METADATA	End of the product metadata group.
GROUP	17	= IMAGE_ATTRIBUTES	Beginning of the image attributes group.
CLOUD_COVER	5	0.00-100.00, -1	"Cloud coverage (percent) assigned to a WRS scene. Values: -1 = Cloud cover not calculated or assessed."
IMAGE_QUALITY	1	0-9, -1	"Composite image quality for the bands. Values: 9 = Best. 0 = Worst. -1 = Image quality not calculated or assessed."
SUN_AZIMUTH	11	= -180.00000000 through 180.00000000 degrees. A positive value indicates angles to the east or clockwise from the north. A negative value (-) indicates angles to the west or counterclockwise from the north. Leading zeros are not required.	Sun azimuth angle in degrees for the image center location at the image center acquisition time.
SUN_ELEVATION	10	= -90.00000000 through 90.00000000 degrees. A positive value indicates a daytime scene. A negative value (-) indicates a nighttime scene. Leading zeros are not required.	Sun elevation angle in degrees for the image center location at the image center acquisition time.
GROUND_CONTROL_POINTS_MODEL	3	= 1 - 999	Number of GCPs used in the precision correction process.
GEOMETRIC_RMSE_MODEL	7	= 0.000 – 9999.999	Combined RMSE of the geometric residuals (meters) in both across-track and along-track directions measured on the

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
			GCPs used in geometric precision correction.
GEOMETRIC_RMSE_MODEL_Y	7	= 0.000 – 9999.999	Root Mean Square Error (RMSE) of the geometric residuals (meters) measured on the GCPs used in geometric precision correction.
GEOMETRIC_RMSE_MODEL_X	7	= 0.000 – 9999.999	RMSE of the geometric residuals (meters) measured on the GCPs used in geometric precision correction.
GROUND_CONTROL_POINTS_VERIFY	4	= 1 - 9999	Number of GCPs used in the verification of the terrain corrected product.
GEOMETRIC_RMSE_VERIFY	7	= 0.000 – 9999.999	RMSE of the geometric residuals (pixels) in both line and sample directions measured on the terrain-corrected product independently using GLS2000.
END_GROUP	17	= IMAGE_ATTRIBUTES	End of the image attributes group.
GROUP	16	= MIN_MAX_RADIANCE	Beginning of the min/max radiance group (L1G product only).
RADIANCE_MAXIMUM_BAND_1	6	= 0.000 – 999.999	Maximum achievable spectral radiance value for Band 1, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MAX_BAND_1.
RADIANCE_MINIMUM_BAND_1	6	= -999.999 – 999.999	Minimum achievable spectral radiance value for Band 1, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MIN_BAND_1.
RADIANCE_MAXIMUM_BAND_2	6	= 0.000 – 999.999	Maximum achievable spectral radiance value for Band 2, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
			QUANTIZE_CAL_MAX_BAND_2.
RADIANCE_MINIMUM_BAND_2	6	= -999.999 – 999.999	Minimum achievable spectral radiance value for Band 2, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MIN_BAND_2.
RADIANCE_MAXIMUM_BAND_3	6	= 0.000 – 999.999	Maximum achievable spectral radiance value for Band 3, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MAX_BAND_3.
RADIANCE_MINIMUM_BAND_3	6	= -999.999 – 999.999	Minimum achievable spectral radiance value for Band 3, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MIN_BAND_3.
RADIANCE_MAXIMUM_BAND_4	6	= 0.000 – 999.999	Maximum achievable spectral radiance value for Band 4, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MAX_BAND_4.
RADIANCE_MINIMUM_BAND_4	6	= -999.999 – 999.999	Minimum achievable spectral radiance value for Band 4, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MIN_BAND_4.
RADIANCE_MAXIMUM_BAND_5	6	= 0.000 – 999.999	Maximum achievable spectral radiance value for Band 5, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
			corresponding to QUANTIZE_CAL_MAX_BAND_5.
RADIANCE_MINIMUM_BAND_5	6	= -999.999 – 999.999	Minimum achievable spectral radiance value for Band 5, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MIN_BAND_5.
RADIANCE_MAXIMUM_BAND_6	6	= 0.000 – 999.999	Maximum achievable spectral radiance value for Band 6, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MAX_BAND_6.
RADIANCE_MINIMUM_BAND_6	6	= -999.999 – 999.999	Minimum achievable spectral radiance value for Band 6, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MIN_BAND_6.
RADIANCE_MAXIMUM_BAND_7	6	= 0.000 – 999.999	Maximum achievable spectral radiance value for Band 7, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MAX_BAND_7.
RADIANCE_MINIMUM_BAND_7	6	= -999.999 – 999.999	Minimum achievable spectral radiance value for Band 7, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QUANTIZE_CAL_MIN_BAND_7.
END_GROUP	16	= MIN_MAX_RADIANCE	End of the min/max radiance group.
GROUP	19	= MIN_MAX_PIXEL_VALUE	Beginning of the min/max pixel value group (L1G product only)

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
QUANTIZE_CAL_MAX_BAND_1	3	= 0 - 255	Maximum possible pixel value for Band 1, if part of the product (DN).
QUANTIZE_CAL_MIN_BAND_1	1	= 0 - 1	Minimum possible pixel value for Band 1, if part of the product (DN).
QUANTIZE_CAL_MAX_BAND_2	3	= 0 - 255	Maximum possible pixel value for Band 2, if part of the product (DN).
QUANTIZE_CAL_MIN_BAND_2	1	= 0 - 1	Minimum possible pixel value for Band 2, if part of the product (DN).
QUANTIZE_CAL_MAX_BAND_3	3	= 0 - 255	Maximum possible pixel value for Band 3, if part of the product (DN).
QUANTIZE_CAL_MIN_BAND_3	1	= 0 - 1	Minimum possible pixel value for Band 3, if part of the product (DN).
QUANTIZE_CAL_MAX_BAND_4	3	= 0 - 255	Maximum possible pixel value for Band 4, if part of the product (DN).
QUANTIZE_CAL_MIN_BAND_4	1	= 0 - 1	Minimum possible pixel value for Band 4, if part of the product (DN).
QUANTIZE_CAL_MAX_BAND_5	3	= 0 - 255	Maximum possible pixel value for Band 5, if part of the product (DN).
QUANTIZE_CAL_MIN_BAND_5	1	= 0 - 1	Minimum possible pixel value for Band 5, if part of the product (DN).
QUANTIZE_CAL_MAX_BAND_6	3	= 0 - 255	Maximum possible pixel value for Band 6, if part of the product (DN).
QUANTIZE_CAL_MIN_BAND_6	1	= 0 - 1	Minimum possible pixel value for Band 6, if part of the product (DN).
QUANTIZE_CAL_MAX_BAND_7	3	= 0 - 255	Maximum possible pixel value for Band 7, if part of the product (DN).
QUANTIZE_CAL_MIN_BAND_7	1	= 0 - 1	Minimum possible pixel value for Band 7, if part of the product (DN).
END_GROUP	19	= MIN_MAX_PIXEL_VALUE	End of the min/max pixel value group.
GROUP	18	= PRODUCT_PARAMETERS	Beginning of the product parameters group (both 1R and L1G products).
CORRECTION_GAIN_BAND_1	20	= "CPF" (for CPF gains) = "INTERNAL_CALIBRATION" (for IC gains)	Correction method used by L1 in creating the image for Band 1, if part of the product.
CORRECTION_GAIN_BAND_2	20	= "CPF" (for CPF gains) = "INTERNAL_CALIBRATION" (for	Correction method used by L1 in creating the image for

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
		IC gains)	Band 2, if part of the product.
CORRECTION_GAIN_BAND_3	20	= "CPF" (for CPF gains) = "INTERNAL_CALIBRATION" (for IC gains)	Correction method used by L1 in creating the image for Band 3, if part of the product.
CORRECTION_GAIN_BAND_4	20	= "CPF" (for CPF gains) = "INTERNAL_CALIBRATION" (for IC gains)	Correction method used by L1 in creating the image for Band 4, if part of the product.
CORRECTION_GAIN_BAND_5	20	= "CPF" (for CPF gains) = "INTERNAL_CALIBRATION" (for IC gains)	Correction method used by L1 in creating the image for Band 5, if part of the product.
CORRECTION_GAIN_BAND_6	20	= "CPF" (for CPF gains) = "INTERNAL_CALIBRATION" (for IC gains)	Correction method used by L1 in creating the image for Band 6, if part of the product.
CORRECTION_GAIN_BAND_7	20	= "CPF" (for CPF gains) = "INTERNAL_CALIBRATION" (for IC gains)	Correction method used by L1 in creating the image for Band 7, if part of the product.
GAIN_BAND_1	1	= "H" (Band was acquired in high gain mode), = "L" (Band was acquired in low gain mode), or = "U" (Unknown)	Band gain state of Band 1 detected at the start of a WRS scene.
GAIN_BAND_2	1	= "H" (Band was acquired in high gain mode), = "L" (Band was acquired in low gain mode), or = "U" (Unknown)	Band gain state of Band 2 detected at the start of a WRS scene.
GAIN_BAND_3	1	= "H" (Band was acquired in high gain mode), = "L" (Band was acquired in low gain mode), or = "U" (Unknown)	Band gain state of Band 3 detected at the start of a WRS scene.
GAIN_BAND_4	1	= "H" (Band was acquired in high gain mode), = "L" (Band was acquired in low gain mode), or = "U" (Unknown)	Band gain state of Band 4 detected at the start of a WRS scene.
GAIN_BAND_5	1	= "H" (Band was acquired in high gain mode), = "L" (Band was acquired in low gain mode), or = "U" (Unknown)	Band gain state of Band 5 detected at the start of a WRS scene.
GAIN_BAND_6	1	= "H" (Band was acquired in high	Band gain state of Band 6

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
		gain mode), = "L" (Band was acquired in low gain mode), or = "U" (Unknown)	detected at the start of a WRS scene.
GAIN_BAND_7	1	= "H" (Band was acquired in high gain mode), = "L" (Band was acquired in low gain mode), or = "U" (Unknown)	Band gain state of Band 7 detected at the start of a WRS scene.
END_GROUP	18	= PRODUCT_PARAMETERS	End of the product parameters group.
GROUP	21	= RADIOMETRIC_RESCALING	Beginning of the radiometric rescaling parameters group.
RADIANCE_MULT_BAND_1	23	-999999999999999999.999 through +999999999999999999.999	Multiplicative rescaling factor used to convert calibrated digital numbers to reflectance for Band 1 (digital number-1).
RADIANCE_MULT_BAND_2	23	-999999999999999999.999 through +999999999999999999.999	Multiplicative rescaling factor used to convert calibrated digital numbers to reflectance for Band 2 (digital number-1).
RADIANCE_MULT_BAND_3	23	-999999999999999999.999 through +999999999999999999.999	Multiplicative rescaling factor used to convert calibrated digital numbers to reflectance for Band 3 (digital number-1).
RADIANCE_MULT_BAND_4	23	-999999999999999999.999 through +999999999999999999.999	Multiplicative rescaling factor used to convert calibrated digital numbers to reflectance for Band 4 (digital number-1).
RADIANCE_MULT_BAND_5	23	-999999999999999999.999 through +999999999999999999.999	Multiplicative rescaling factor used to convert calibrated digital numbers to reflectance for Band 5 (digital number-1).
RADIANCE_MULT_BAND_6	23	-999999999999999999.999 through +999999999999999999.999	Multiplicative rescaling factor used to convert calibrated digital numbers to reflectance for Band 6 (digital number-1).
RADIANCE_MULT_BAND_7	23	-999999999999999999.999 through +999999999999999999.999	Multiplicative rescaling factor used to convert calibrated digital numbers to reflectance for Band 7 (digital number-1).
RADIANCE_ADD_BAND_1	9	-9999.99999 through +9999.99999	Additive rescaling factor used to convert calibrated

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
			digital numbers to radiance units (W/(m <sup>2</sup> sr um)) for Band 1.
RADIANCE_ADD_BAND_2	9	-9999.99999 through +9999.99999	Additive rescaling factor used to convert calibrated digital numbers to radiance units (W/(m <sup>2</sup> sr um)) for Band 2.
RADIANCE_ADD_BAND_3	9	-9999.99999 through +9999.99999	Additive rescaling factor used to convert calibrated digital numbers to radiance units (W/(m <sup>2</sup> sr um)) for Band 3.
RADIANCE_ADD_BAND_4	9	-9999.99999 through +9999.99999	Additive rescaling factor used to convert calibrated digital numbers to radiance units (W/(m <sup>2</sup> sr um)) for Band 4.
RADIANCE_ADD_BAND_5	9	-9999.99999 through +9999.99999	Additive rescaling factor used to convert calibrated digital numbers to radiance units (W/(m <sup>2</sup> sr um)) for Band 5.
RADIANCE_ADD_BAND_6	9	-9999.99999 through +9999.99999	Additive rescaling factor used to convert calibrated digital numbers to radiance units (W/(m <sup>2</sup> sr um)) for Band 6.
RADIANCE_ADD_BAND_7	9	-9999.99999 through +9999.99999	Additive rescaling factor used to convert calibrated digital numbers to radiance units (W/(m <sup>2</sup> sr um)) for Band 7.
END_GROUP	21	= RADIOMETRIC_RESCALING	End of the radiometric rescaling parameters group.
GROUP	21	= PROJECTION_PARAMETERS	Beginning of the projection parameters group (L1G product only)
MAP_PROJECTION	3	= "PS" (Polar Stereographic) = "UTM" (Universal Transverse Mercator)	L1 map projection applied to this data. Used for processed archive data.
DATUM	5	= "WGS84"	Datum used in creating the image.
ELLIPSOID	5	= "WGS84"	Ellipsoid used in creating the image.
UTM_ZONE	2	= 1 to 60 or -1 to -60	Value used to indicate the zone number.
VERTICAL_LON_FROM_POLE	8	= -180.00000 through +180.00000	Vertical longitude (decimal degrees) from the pole.

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
TRUE_SCALE_LAT	7	= -90.00000 through +90.00000	Latitude of true scale in a map projection.
FALSE_EASTING	9	= -200000000 through +200000000	Value added to all "x" values in the rectangular coordinates for a map projection. Frequently assigned to eliminate negative numbers. Expressed in the unit of measure identified in Planar Coordinate Unit.
FALSE_NORTHING	9	= -200000000 through +200000000	Value added to all "y" values in the rectangular coordinates for a map projection. Frequently assigned to eliminate negative numbers. Expressed in the unit of measure identified in Planar Coordinate Unit.
GRID_CELL_SIZE_REFLECTIVE	5	= 0.00 – 120.00	Grid cell size used in creating the image for the reflective band.
ORIENTATION	10	= "NORTH_UP"	Orientation used in creating the image.
RESAMPLING_OPTION	28	= "CUBIC_CONVOLUTION"	Resampling option used in creating the image
MAP_PROJECTION_L0RA	3	= "PS" (Polar Stereographic) = "UTM" (Universal Transverse Mercator) = "HOM" (Hotine Oblique Mercator) = "SOM" (Space Oblique Mercator) = "NA" (Not applicable)	L0Ra map projection selectively applied to HDTs based on geographic location. Used for processed archive data.
END_GROUP	21	= PROJECTION_PARAMETERS	End of projection parameters group.
END_GROUP	16	L1_METADATA_FILE	End of the Level 1 Metadata file parameters.
END			Required standalone parameter signifying the file end.

**Table 2-3. MSS Level 1 Metadata Contents**

Vdata Name: LMSPPRRRRYYYYDDDGSIVV_MTLold.txt
Vdata Class: LPGS_Metadata
Interlace Type: FULL_INTERLACE
Bytes Per Logical Record: 65535
Number of Records: One record.

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
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Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
GROUP	18	= L1_METADATA_FILE	Beginning of the first-level Object Description Language (ODL) group; it indicates the start of the L1 metadata file level group.
GROUP	18	= METADATA_FILE_INFO	Beginning of the metadata file information group.
ORIGIN	47	= "Image courtesy of the U.S. Geological Survey"	Establishes the origin of the image from the USGS.
REQUEST_ID	20	USGS products use: "NNNYMMDDSSSS_UUUUU" format where: NNNYMMDDSSSS = 13-digit TRAM order number NNN = Node indicator YY = Year MM = Month DD = Day SSSS = Sequence number for the day UUUUU = 5-digit TRAM unit number	Data producer-defined request number that uniquely identifies each product. USGS products use a unique product generation TRAM-generated request ID.
PRODUCT_CREATION_TIME	20	= YYYY-MM-DDTHH:MI:SSZ where YYYY = 4-digit Julian year MM = the month number of the Julian year (01-12) DD = the day of the Julian month (01-31) T = the start of time information in ODL American Standard Code for Information Interchange (ASCII) time code format HH = hours (00-23) MI = minutes (00-59) SS = seconds (00-59) Z = Zulu time (same as GMT)	L1 system date and time when the metadata file for the L1 product set was created. For ease of human readability, this date and time is presented in ODL ASCII format. Time is expressed as Universal Time Coordinated (UTC) (also known as Greenwich Mean Time (GMT)).  Insertion of additional characters T and Z is required to meet ODL ASCII format.
STATION_ID	3	= "EDC"	Unique 3-letter code identifying the originating Ground Station.
LANDSATM_XBAND	1	Where M = Landsat Mission (1-5, or 7) and, = "0", "1", "2", or "3" ("0" = unknown)	Landsat M (L1-5 or 7) X-band used to downlink data to the Landsat Ground System (LGS).
GROUND_STATION	3	= "NNN"	Ground Station that received the data.
LPS_PROCESSOR_NUMBER	1	= 0 through 9	Landsat 7 Processing System (LPS) processor number (MSS is always 1).
DATEHOUR_CONTACT_PERIOD	7	= "YYDOYHH"	Date and hour of the contact period.
SUBINTERVAL_NUMBER	2	= "00"-"99"	Subinterval number within

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
			the contact period.
END_GROUP	18	= METADATA_FILE_INFO	End of the metadata information group.
GROUP	16	= PRODUCT_METADATA	Beginning of the product metadata group.
PRODUCT_TYPE	3	= "L1G" = "L1Gt" = "L1T"	Identifier to inform the user of the product type.
ELEVATION_SOURCE	7	= "NED" = "SRTM1" = "SRTM3" = "GTOPO30" = "GLS1975" = "GLS1990" = "GLS2000"	Identifies the digital elevation data set used to terrain correct the product.
PROCESSING_SOFTWARE	15	= "SYSTEM_VERSION" where SYSTEM =LPGS	Processing system software version. Examples: "LPGS_4.3"
EPHEMERIS_TYPE	10	= "DEFINITIVE" = "PREDICTIVE"	Identifier to inform the user of the orbital ephemeris type used. If the field is not present, the user should assume PREDICTIVE in all cases (L1G product only).
SPACECRAFT_ID	8	= "Landsat1" = "Landsat2" = "Landsat3" = "Landsat4" = "Landsat5"	Name of the satellite platform.
SENSOR_ID	4	= "MSS"	Name of the imaging sensor.
ACQUISITION_DATE	10	= YYYY-MM-DD	Date the image was acquired.
SCENE_CENTER_SCAN_TIME	17	= HH:MM:SS.FFFFFFFZ format, where HH – Hour (00–23) MM = Minute (00–59) SS = Seconds (00–59) FFFFFFF = Fractional Second code format Z = Zulu time (same as GMT)	Time of day the center of the scene contact was captured.
WRS_PATH	3	= NNN, where NNN = the path number (001-251)	WRS path value for the product.
STARTING_ROW	3	= NNN, where NNN = the row of the first full or partial scene in the product (001-248)	Starting WRS row.
ENDING_ROW	3	= NNN, where NNN = the row of the last full or partial scene in the product (001-248)	Ending WRS row.

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
BAND_COMBINATION	6	= "NNNNNNN", where = e.g. ,"1234---" or "---4567" for bands present	L1-generated indicator of the bands present for the product ordered. The band numbers present are dependent upon the satellite associated with the data.
PRODUCT_UL_CORNER_LAT	11	= -90.0000000 through +90.0000000 degrees (with 7-digit precision) Positive (+) value indicates north latitude; negative (-) value indicates south latitude	Latitude value for the upper-left corner of the product (the L1 systems recalculate for the L1G product).
PRODUCT_UL_CORNER_LON	12	= -180.0000000 through +180.0000000 degrees (with 7-digit precision) Positive (+) value indicates east longitude; negative (-) value indicates west longitude	Longitude value for the upper-left corner of the product (the L1 systems recalculate for the L1G product).
PRODUCT_UR_CORNER_LAT	11	= -90.0000000 through +90.0000000 degrees (with 7-digit precision)	Latitude value for the upper-right corner of the product (the L1 systems recalculate for the L1G product).
PRODUCT_UR_CORNER_LON	12	= -180.0000000 through +180.0000000 degrees (with 7-digit precision)	Longitude value for the upper-right corner of the product (the L1 systems recalculate for the L1G product).
PRODUCT_LL_CORNER_LAT	11	= -90.0000000 through +90.0000000 degrees (with 7-digit precision)	Latitude value for the lower-left corner of the product (the L1 systems recalculate for the L1G product).
PRODUCT_LL_CORNER_LON	12	= -180.0000000 through +180.0000000 degrees (with 7-digit precision)	Longitude value for the lower-left corner of the product (the L1 systems recalculate for the L1G product).
PRODUCT_LR_CORNER_LAT	11	= -90.0000000 through +90.0000000 degrees (with 7-digit precision)	Latitude value for the lower- right corner of the product (the L1 systems recalculate for the L1G product).
PRODUCT_LR_CORNER_LON	12	= -180.0000000 through +180.0000000 degrees (with 7-digit precision)	Longitude value for the lower-right corner of the product (the L1 systems recalculate for the L1G product).
PRODUCT_UL_CORNER_MAPX	14	= -132000000.000 through 132000000.000 Units are feet or meters	Projection X coordinate for the upper-left corner of the product (the L1 systems calculated, L1G only).
PRODUCT_UL_CORNER_MAPY	14	= -132000000.000 through	Projection Y coordinate for

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
		132000000.000 Units are feet or meters	the upper-left corner of the product (L1 systems calculated, L1G only).
PRODUCT_UR_CORNER_MAPX	14	= -132000000.000 through 132000000.000 Units are feet or meters	Projection X coordinate for the upper-right corner of the product (L1 systems calculated, L1G only).
PRODUCT_UR_CORNER_MAPY	14	= -132000000.000 through 132000000.000 Units are feet or meters	Projection Y coordinate for the upper-right corner of the product (L1 systems calculated, L1G only).
PRODUCT_LL_CORNER_MAPX	14	= -132000000.000 through 132000000.000 Units are feet or meters	Projection X coordinate for the lower-left corner of the product (L1 systems calculated, L1G only).
PRODUCT_LL_CORNER_MAPY	14	= -132000000.000 through 132000000.000 Units are feet or meters	Projection Y coordinate for the lower-left corner of the product (L1 systems calculated, L1G only).
PRODUCT_LR_CORNER_MAPX	14	= -132000000.000 through 132000000.000 Units are feet or meters	Projection X coordinate for the lower-right corner of the product (L1 systems calculated, L1G only).
PRODUCT_LR_CORNER_MAPY	14	= -132000000.000 through 132000000.000 Units are feet or meters	Projection Y coordinate for the lower-right corner of the product (L1 systems calculated, L1G only).
PRODUCT_SAMPLES_REF	4	= NNNN	Product samples for the reflective bands.
PRODUCT_LINES_REF	4	= NNNN	Product lines for the reflective bands.
BAND1_FILE_NAME	29	"<LANDSAT_SCENE_ID>_B1.TIF"	L1-generated external element file name for Band 1, if part of the product.
BAND2_FILE_NAME	29	"<LANDSAT_SCENE_ID>_B2.TIF"	L1-generated external element file name for Band 2, if part of the product.
BAND3_FILE_NAME	29	"<LANDSAT_SCENE_ID>_B3.TIF"	L1-generated external element file name for Band 3, if part of the product.
BAND4_FILE_NAME	29	"<LANDSAT_SCENE_ID>_B4.TIF"	L1-generated external element file name for Band 4, if part of the product.
BAND5_FILE_NAME	29	""<LANDSAT_SCENE_ID>_B5.TIF"	L1-generated external element file name for Band 5, if part of the product.
BAND6_FILE_NAME	29	"<LANDSAT_SCENE_ID>_B6.TIF"	L1-generated external element file name for Band 6, if part of the product.
BAND7_FILE_NAME	29	"<LANDSAT_SCENE_ID>_B7.TIF"	L1-generated external element file name for band 7, if part of the product.
GCP_FILE_NAME	29	"<LANDSAT_SCENE_ID>_ .txt"	L1-generated external

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
			element file name for the GCP, if part of the product.
VER_REPORT_FILE_NAME	29	"<LANDSAT_SCENE_ID>_VER.txt"	L1-generated external element file name where information from the scoring of geometric verification will be located.
VER_BROWSE_FILE_NAME		"<LANDSAT_SCENE_ID>_VER.jpg"	L1-generated external element file name for the 3 Band Browse file (JPEG file), if part of the product.
METADATA_L1_FILE_NAME	29	"<LANDSAT_SCENE_ID>_MTLold.txt"	L1-generated external element file name for L1 metadata .
CPF_FILE_NAME	25	LMXCPFYYYYMMDD_YYYYMMDD.nn where L = Landsat M = MSS X = Mission 1 = Landsat 1 2 = Landsat 2 3 = Landsat 3 4 = Landsat 4 5 = Landsat 5 YYYYMMDD = effective_date_begin and effective_date_end respectively nn = version (00-99)	Archive-generated external element file name for the Image Assessment System (IAS) CPF.
END_GROUP	16	= PRODUCT_METADATA	End of the product metadata group.
GROUP	16	= MIN_MAX_RADIANCE	Beginning of the min/max radiance group (L1G product only).
LMAX_BAND1	7	= NNN.NNN	Maximum achievable spectral radiance value for Band 1, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QCALMAX_BAND1.
LMIN_BAND1	7	= -NNN.NNN to NNN.NNN	Minimum achievable spectral radiance value for Band 1, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QCALMIN_BAND1.
LMAX_BAND2	7	= NNN.NNN	Maximum achievable spectral radiance value for Band 2, if part of the product (w/(m <sup>2</sup> sr

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
			micron)). In addition, the spectral radiance corresponding to QCALMAX_BAND2.
LMIN_BAND2	7	= -NNN.NNN to NNN.NNN	Minimum achievable spectral radiance value for Band 2, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QCALMIN_BAND2.
LMAX_BAND3	7	= NNN.NNN	Maximum achievable spectral radiance value for Band 3, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QCALMAX_BAND3.
LMIN_BAND3	7	= -NNN.NNN to NNN.NNN	Minimum achievable spectral radiance value for Band 3, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QCALMIN_BAND3.
LMAX_BAND4	7	= NNN.NNN	Maximum achievable spectral radiance value for Band 4, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QCALMAX_BAND4.
LMIN_BAND4	7	= -NNN.NNN to NNN.NNN	Minimum achievable spectral radiance value for Band 4, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QCALMIN_BAND4.
LMAX_BAND5	7	= NNN.NNN	Maximum achievable spectral radiance value for Band 5, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QCALMAX_BAND5.
LMIN_BAND5	7	= -NNN.NNN to NNN.NNN	Minimum achievable

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
			spectral radiance value for Band 5, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QCALMIN_BAND5.
LMAX_BAND6	7	= NNN.NNN	Maximum achievable spectral radiance value for Band 6, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QCALMIN_BAND6.
LMIN_BAND6	7	= -NNN.NNN to NNN.NNN	Minimum achievable spectral radiance value for Band 6, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QCALMAX_BAND6.
LMAX_BAND7	7	= NNN.NNN	Maximum achievable spectral radiance value for Band 7, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QCALMAX_BAND7.
LMIN_BAND7	7	= -NNN.NNN to NNN.NNN	Minimum achievable spectral radiance value for Band 7, if part of the product (w/(m <sup>2</sup> sr micron)). In addition, the spectral radiance corresponding to QCALMIN_BAND7.
END_GROUP	16	= MIN_MAX_RADIANCE	End of the min/max radiance group.
GROUP	19	= MIN_MAX_PIXEL_VALUE	Beginning of the min/max pixel value group (L1G product only).
QCALMAX_BAND1	5	= NNN.N	Maximum possible pixel value for Band 1, if part of the product (DN).
QCALMIN_BAND1	5	= NNN.N	Minimum possible pixel value for Band 1, if part of the product (DN).
QCALMAX_BAND2	5	= NNN.N	Maximum possible pixel value for Band 2, if part of the product (DN).

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
QCALMIN_BAND2	5	= NNN.N	Minimum possible pixel value for Band 2, if part of the product (DN).
QCALMAX_BAND3	5	= NNN.N	Maximum possible pixel value for Band 3, if part of the product (DN).
QCALMIN_BAND3	5	= NNN.N	Minimum possible pixel value for Band 3, if part of the product (DN).
QCALMAX_BAND4	5	= NNN.N	Maximum possible pixel value for Band 4, if part of the product (DN).
QCALMIN_BAND4	5	= NNN.N	Minimum possible pixel value for Band 4, if part of the product (DN).
QCALMAX_BAND5	5	= NNN.N	Maximum possible pixel value for Band 5, if part of the product (DN).
QCALMIN_BAND5	5	= NNN.N	Minimum possible pixel value for Band 5, if part of the product (DN).
QCALMAX_BAND6	5	= NNN.N	Maximum possible pixel value for Band 6, if part of the product (DN).
QCALMIN_BAND6	5	= NNN.N	Minimum possible pixel value for Band 6, if part of the product (DN).
QCALMAX_BAND7	5	= NNN.N	Maximum possible pixel value for Band 7, if part of the product (DN).
QCALMIN_BAND7	5	= NNN.N	Minimum possible pixel value for Band 7, if part of the product (DN).
END_GROUP	19	= MIN_MAX_PIXEL_VALUE	End of the min/max pixel value group.
GROUP	18	= PRODUCT_PARAMETERS	Beginning of the product parameters group (both 1R and L1G products).
CORRECTION_METHOD_GAIN_BAND1	3	= "CPF" (for CPF gains) = "IC" (for IC gains)	Correction method used by L1 in creating the image for Band 1, if part of the product.
CORRECTION_METHOD_GAIN_BAND2	3	= "CPF" (for CPF gains) = "IC" (for IC gains)	Correction method used by L1 in creating the image for Band 2, if part of the product.
CORRECTION_METHOD_GAIN_BAND3	3	= "CPF" (for CPF gains) = "IC" (for IC gains)	Correction method used by L1 in creating the image for Band 3, if part of the product.
CORRECTION_METHOD_GAIN_BAND4	3	= "CPF" (for CPF gains) = "IC" (for IC gains)	Correction method used by L1 in creating the image for Band 4, if part of the

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
			product.
CORRECTION_METHOD_GAIN_BAND5	3	= "CPF" (for CPF gains) = "IC" (for IC gains)	Correction method used by L1 in creating the image for Band 5, if part of the product.
CORRECTION_METHOD_GAIN_BAND6	3	= "CPF" (for CPF gains) = "IC" (for IC gains)	Correction method used by L1 in creating the image for Band 6, if part of the product.
CORRECTION_METHOD_GAIN_BAND7	3	= "CPF" (for CPF gains) = "IC" (for IC gains)	Correction method used by L1 in creating the image for Band 7, if part of the product.
CORRECTION_METHOD_BIAS	3	= "CPF" (for CPF gains) = "IC" (for IC gains)	Correction method used by L1 in creating the image.
SUN_AZIMUTH	12	= -180.0000000 through 180.0000000 degrees (with 7-digit precision) A positive value indicates angles to the east or clockwise from the north. A negative value (-) indicates angles to the west or counterclockwise from the north. Leading zeros are not required.	Sun azimuth angle in degrees for the image center location at the image center acquisition time.
SUN_ELEVATION	11	= -90.0000000 through 90.0000000 degrees (with 7-digit precision). A positive value indicates a daytime scene. A negative value (-) indicates a nighttime scene. Leading zeros are not required.	Sun elevation angle in degrees for the image center location at the image center acquisition time.
OUTPUT_FORMAT	10	= "FORMAT_VERSION", where FORMAT = GEOTIFF, VERSION = output format version	The output format and output format version of the image. Examples: "GEOTIFF" NOTE: no version included for GEOTIFF.
END_GROUP	18	= PRODUCT_PARAMETERS	End of the product parameters group.
GROUP	19	= CORRECTIONS_APPLIED	Beginning of the corrections applied group.
STRIPING_BAND1	20	= "NONE" = "BAND_AVERAGE" = "REFERENCE_DETECTOR"	Indicator of the type of striping correction applied for the Band 1 image, if part of the product.
STRIPING_BAND2	20	= "NONE" = "BAND_AVERAGE" = "REFERENCE_DETECTOR"	Indicator of the type of striping correction applied for the Band 2 image, if part of the product.
STRIPING_BAND3	20	= "NONE" = "BAND_AVERAGE" = "REFERENCE_DETECTOR"	Indicator of the type of striping correction applied for the Band 3 image, if part of the product.

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
STRIPING_BAND4	20	= "NONE" = "BAND_AVERAGE" = "REFERENCE_DETECTOR"	Indicator of the type of striping correction applied for the Band 4 image, if part of the product.
STRIPING_BAND5	20	= "NONE" = "BAND_AVERAGE" = "REFERENCE_DETECTOR"	Indicator of the type of striping correction applied for the Band 5 image, if part of the product.
STRIPING_BAND6	20	= "NONE" = "BAND_AVERAGE" = "REFERENCE_DETECTOR"	Indicator of the type of striping correction applied for the Band 6 image, if part of the product.
STRIPING_BAND7	20	= "NONE" = "BAND_AVERAGE" = "REFERENCE_DETECTOR"	Indicator of the type of striping correction applied for the Band 7 image, if part of the product.
BANDING	1	= "Y" or "N"	Indicator of whether the image was corrected for banding.
COHERENT_NOISE	1	= "Y" or "N"	Indicator of whether the image was corrected for coherent noise.
MEMORY_EFFECT	1	= "Y" or "N"	Indicator of whether the image was corrected for memory effect.
SCAN_CORRELATED_SHIFT	1	= "Y" or "N"	Indicator of whether the image was corrected for scan correlated shift.
INOPERABLE_DETECTORS	1	= "Y" or "N"	Indicator of whether the image was corrected for inoperable detectors.
DROPPED_LINES	1	= "Y" or "N"	Indicator of whether the image was corrected for dropped lines.
END_GROUP	19	= CORRECTIONS_APPLIED	End of the corrections applied group.
GROUP	21	= PROJECTION_PARAMETERS	Beginning of the projection parameters group (L1G product only).
REFERENCE_DATUM	5	= "WGS84"	Datum used in creating the image.
REFERENCE_ELLIPSOID	5	= "WGS84"	Ellipsoid used in creating the image.
GRID_CELL_SIZE_REF	6	= 10.00 through 60.000 meters, in	Grid cell size used in creating the image for Visible and Near Infrared / Short Wavelength Infrared (VNIR / SWIR) bands, if part of the product.
ORIENTATION	3	= "NUP" (North Up)	Orientation used in creating the image.
RESAMPLING_OPTION	3	= "NN" (Nearest Neighbor)	Resampling option used in

Parameter Name	Size*	Value, Format, Range, and Units	Parameter Description/Remarks
		= "CC" (Cubic Convolution)	creating the image.
MAP_PROJECTION	4	= "PS" (Polar Stereographic) = "UTM" (Universal Transverse Mercator)	Map projection used in creating the image.
END_GROUP	21	= PROJECTION_PARAMETERS	End of projection parameters group.
<b>Projection parameters data (not a Level 1 metadata parameter)</b>			<b>The following parameters are included only with products that select a map projection of PS</b>
GROUP	13	PS_PARAMETERS	Beginning of the PS parameters group.
VERTICAL_LONGITUDE_FROM_POLE	12	= -180.0 to +180.0	Vertical longitude from the pole.
LATITUDE_OF_TRUE_SCALE	11	= -90.0 to +90.0	Latitude of the true scale.
FALSE_EASTING	18	= $-1.0 \times 10^8$ to $+1.0 \times 10^8$	False easting.
FALSE_NORTHING	18	= $-1.0 \times 10^8$ to $+1.0 \times 10^8$	False northing.
FALSE_EASTING_NORTHING_UNITS	6	= meters or feet	Units for false easting and northing for PS projection.
END_GROUP	13	PS_PARAMETERS	End of the PS parameters group.
<b>Projection parameters data (not a Level 1 metadata parameter)</b>			<b>The following parameters are included only with products that select a map projection of UTM.</b>
GROUP	14	UTM_PARAMETERS	Beginning of the UTM parameters group.
ZONE_NUMBER	3	= 1 to 60 or -1 to -60	Value used to indicate the zone number.
END_GROUP	13	UTM_PARAMETERS	End of the UTM parameters group.
GROUP	16	GEOMETRIC_VERIFY	Beginning of the Geometric Verification Statistics.
UL_QUAD_RMSE	5	= NN.NN	Upper-left quadrant RMSE of the GCP correlation residuals.
UR_QUAD_RMSE	5	= NN.NN	Upper-right quadrant RMSE of the GCP correlation residuals.
LR_QUAD_RMSE	5	= NN.NN	Lower-right quadrant RMSE of the GCP correlation residuals.
LL_QUAD_RMSE	5	= NN.NN	Lower-left quadrant RMSE of the GCP correlation residuals.
SCENE_RMSE	5	= NN.NN	Total scene RMSE of the GCP correlation residuals.
END_GROUP	16	GEOMETRIC_VERIFY	End of the Geometric Verification Statistics.

<b>Parameter Name</b>	<b>Size*</b>	<b>Value, Format, Range, and Units</b>	<b>Parameter Description/Remarks</b>
END_GROUP	16	L1_METADATA_FILE	End of the Level 1 Metadata file parameters.
END			
*ASCII bytes			

***Table 2-4. Legacy MSS Level 1 Metadata Contents***

## **2.4 Ground Control Points (GCP) File**

The GCP file included with an L1T product is written in ASCII format and contains a header followed by records, one on each line. Each record corresponds to a single GCP. Each record has eight column headings and looks similar to Table 2-5.

```

Example GCP Output File
=====
Wed. Jan. 20, 2010          LANDSAT 3          Time: 15:31
                          Image Assessment System
                          GCP Residual Report
-----
WOID: L102784             Path/Row: 003 / 054

LOR Reference Image: L31AAA1179056020201_HDF.100202126
Acquisition Date: Feb 24, 1979

Band Number: 7

GeoCover date for each WRS-2 path/row used:
Path Row Date
003 054 2001-03-07
003 055 2001-03-07
004 053 2001-03-14
004 054 2001-03-14

Point_ID      Latitude Longitude Height      Across   Along   Residual Residual
              (deg)      (deg)      (meters) Residual Residual In y     in x
              (deg)      (deg)      (meters) (meters) (meters) (meters) (meters)

0030540010    9.129373 -66.121990 144.657    0.000    0.000    19.057   -39.892
0030540018    9.091815 -66.383349 136.842    0.000    0.000   163.511  -49.191
0030540027    8.802283 -65.888716 135.720    0.000    0.000    20.713   110.596
0030540037    9.013381 -65.993965 126.111    0.000    0.000  -55.552    48.047
0030540038    9.135688 -65.950259 170.401    0.000    0.000   -0.777    34.012
0030540044    9.197323 -66.160217 116.346    0.000    0.000   81.440  -13.813
0030540048    9.053876 -65.878156 119.748    0.000    0.000  -71.034    82.169
0030540049    9.170300 -65.892726 143.408    0.000    0.000  -21.226    52.298
0030540053    9.111896 -66.009506 135.544    0.000    0.000  -21.883    46.452
0030540060    9.249209 -66.051034 141.822    0.000    0.000   84.762  -27.073
0030540068    8.873761 -65.897993 155.437    0.000    0.000  -54.253    88.424
0030540070    9.173863 -66.052569 162.474    0.000    0.000    1.582    2.554
0030540076    8.965733 -65.988122 139.572    0.000    0.000  -47.569    55.096
0030540079    8.823417 -65.889425 147.749    0.000    0.000    7.657    99.631
0030540087    8.932454 -66.145365 121.355    0.000    0.000  -13.303  -17.969
0030540090    8.751917 -65.882877 143.082    0.000    0.000   42.900    72.001
0030540092    9.168104 -65.685411   84.687    0.000    0.000  -12.884   102.017
0030540096    9.034415 -65.871458 136.406    0.000    0.000  -71.557    73.916
0030540100    9.183675 -66.109375 133.445    0.000    0.000   32.663  -49.319
0030540103    9.000062 -65.897357 126.825    0.000    0.000  -54.396   106.185

```

**Table 2-5. Example GCP Output File**

## Section 3 L1 Output File Format

---

### 3.1 GeoTIFF File Formats

#### 3.1.1 L1 Image File

The description of an image in GeoTIFF requires tags and keys, as described at <http://www.remotesensing.org/geotiff/spec/geotiffhome.html> (URL also noted in References). The L1 Image Files include these tags and keys, which TIFF readers automatically detect and read. The following subsections describe the tags and keys.

Each Earth image band in the requested product is contained in a separate file, as is the optionally available DEM data file. The data are laid out in a scan line sequential format in descending detector order (e.g., Detector 16 followed by Detector 15 and so forth for the 30-meter bands). The L1G image is radiometrically corrected and resampled for geometric correction and registration to geographic map projections. The L1T image is radiometrically, geometrically, and precision corrected, and uses DEM to correct parallax error due to local topographic relief.

##### 3.1.1.1 GeoTIFF Tags

TIFF tags convey metadata information about the image. The tags describe the image with information the TIFF reader needs to control the appearance of the image on the user's screen. The TIFF tags are in the same file as the TIFF image.

A complete description of the raster data requires georeferencing of the data, which uses tags. Landsat TM L1 production systems use the transformation raster and model space tie points and scaling parameters. ModelTiepointTag and ModelPixelScaleTag are used for this purpose.

##### ModelTiepointTag

Tag = 33922  
Type = DOUBLE  
N = 6\*K, K = number of tiepoints  
Alias: GeoreferenceTag  
Owner: Intergraph

The ModelTiepointTag stores the raster-to-model tiepoint pairs in the order.

ModelTiepointTag = (... , I, J, K, X, Y, Z...),

where (I, J, K) is the point at location (I, J) in raster space with pixel-value K, and (X, Y, Z) is a vector in model space.

The raster image is georeferenced by specifying its location, size, and orientation in the model coordinate space. Because the relationship between the raster space and the model space often is an exact, affine transformation, the relationship can be defined

using one set of tiepoints and the ModelPixelScaleTag, which gives the vertical and horizontal raster grid cell size.

### **ModelPixelScaleTag**

Tag = 33550  
Type = DOUBLE  
N = 3  
Owner: SoftDesk

The ModelPixelScaleTag is used to specify the size of raster pixel spacing in the model space units, when the raster space can be embedded in the model space coordinate system without rotation, and consists of the following three values:

ModelPixelScaleTag = (ScaleX, ScaleY, ScaleZ)

where ScaleX and ScaleY give the horizontal and vertical spacing of raster pixels, and ScaleZ maps the pixel value of a DEM into the correct Z-scale. ScaleZ is not used for L1G data because it is only systematically corrected and not corrected for elevation.

A single tiepoint in the ModelTiepointTag, together with the ModelPixelScaleTag, completely determines the relationship between raster and model space.

#### **3.1.1.2 GeoTIFF Keys**

In addition to tags, the description of a projection in GeoTIFF requires using keys. Table 3-1 lists the keys necessary to define the projections supported by the L1 production systems, and their possible values.

Valid Keys	Possible Values	Meaning
<b>UTM</b>		
GTMModelTypeGeoKey	1	ModelTypeProjected (Projection Coordinate System)
GTRasterTypeGeoKey	1	RasterPixellsArea
	2	RasterPixellsPoint
GTCitationGeoKey	(ASCII, 17)	ASCII reference to public documentation
GeogLinearUnitsGeoKey	9001	Linear_Meter
	9002	Linear_Foot
GeogAngularUnitsGeoKey	9102	Angular_Degree
ProjectedCSTypeGeoKey	20000 - 32760	EPSG Projection System Codes
	32767	User-defined
<b>PS</b>		
ProjCoordTransGeoKey	15	CT_PolarStereographic
GTMModelTypeGeoKey	1	ModelTypeProjected (Projection Coordinate System)
GTRasterTypeGeoKey	1	RasterPixellsArea
	2	RasterPixellsPoint
GTCitationGeoKey	(ASCII, 17)	ASCII reference to public documentation
GeographicTypeGeoKey	4326	GCS_WGS_84
GeogLinearUnitsGeoKey	9001	Linear_Meter
	9002	Linear_Foot
GeogAngularUnitsGeoKey	9102	Angular_Degree
ProjectedCSTypeGeoKey	20000 - 32760	EPSG Projection System Codes
	32767	User-defined
ProjectionGeoKey	10000 - 19999	EPSG/POSC Projection Codes
	32767	User-defined
ProjLinearUnitsGeoKey	9001	Linear_Meter
	9002	Linear_Foot
ProjStraightVertPoleLongGeoKey		Value in units of GeogAngularUnits
ProjNatOriginLatGeoKey		Value in units of GeogAngularUnits
ProjFalseNorthingGeoKey		Value entered in units of ProjLinearUnits
ProjFalseEastingGeoKey		Value entered in units of ProjLinearUnits

**Table 3-1. GeoTIFF Keys**

### 3.1.2 MTL File

Please see 2.1.2 for L1 Metadata File details.

### 3.1.3 GCP File

Please see 2.1.4 for GCP File details.

## **Section 4 Product Packaging**

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L1 products are available for distribution via FTP or HTTP download. The following subsections provide information on each distribution method for the available L1 product formats.

### **4.1 Electronic Transfer**

Products available via electronic transfer also include the L1 volume descriptor (read-me file) with the same filenames as listed. When data are packaged and ready for distribution, they are stored in directories on the FTP server for retrieval.

The LPGS will GZip (compression) all Standard products for distribution. Each individual file within the scene will be GZipped.

## Section 5 Software Tools

---

### 5.1 ODL Parser

The University of Colorado's Laboratory for Atmospheric and Space Physics (LASP) originally implemented the ODL parser (Version 1.0) incorporated into the SDP Toolkit. The Jet Propulsion Laboratory (JPL) enhanced the ODL parser in building their Planetary Data System. IAS modified this enhanced version, which is available at <http://pds.nasa.gov/tools/>. LPGS uses this IAS-modified version.

The IAS-modified version should be particularly useful to those operating in a non-HDF-EOS environment. The software stands alone and reads the LORp or L1 metadata external elements and the CPF.

## Appendix A Projection Parameters

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This appendix contains the map projection parameters used in the L1 output products and the USGS projection parameters (Table A-2).

Project Name	Mnemonic
Polar Stereographic	PS
Universal Transverse Mercator	UTM

**Table A-1. L1 Output Product Projection Parameters**

Projection Name Mnemonic	Array Element							
	1	2	3	4	5	6	7	8
PS	SMajor	SMinor			LongPol	TrueScale	FE	FN
UTM	Lon/Z	Lat/Z						

**Table A-2. USGS Projection Parameters – Projection Transformation Package  
Projection Parameters (Elements 1-8)**

Projection Name Mnemonic	Array Element						
	9	10	11	12	13	14	15
PS							
UTM							

**Table A-3. USGS Projection Parameters - Projection Transformation Package  
Projection Parameters (Elements 9-15)**

Where	Lon/Z	=	Longitude of any point in the UTM zone or zero
	Lat/Z	=	Latitude of any point in the UTM zone or zero
	SMajor	=	Semi-major axis of the ellipsoid. If zero, Clarke 1866 in meters is assumed.
	SMinor	=	Eccentricity squared of the ellipsoid if less than zero. If zero, a spherical form is assumed, or if greater than zero, the semi-major axis of the ellipsoid.
	Sphere	=	Radius of the reference sphere. If zero, 6370997 meters is used.
	Stdpar	=	Latitude of the standard parallel
	Stdpr1	=	Latitude of the first standard parallel
	Stdpr2	=	Latitude of the second standard parallel
	CentMer	=	Longitude of the central meridian
	OriginLat	=	Latitude of the projection origin
	FE	=	False easting in the same units as the semi-major axis
	FN	=	False northing in the same units as the semi-major axis
	LongPol	=	Longitude below the pole of the map
	TrueScale	=	Latitude of the true scale
	Factor	=	Scale factor at the central meridian (TM) or center of projection (Oblique Mercator Type A (OMA)/ Oblique Mercator Type B (OMB))
	CentLon	=	Longitude of the center of projection
	CenterLat	=	Latitude of the center of projection
	Height	=	Height of the perspective point
	Long1	=	Longitude of the first point on the center line
	Long2	=	Longitude of the second point on the center line
	Lat1	=	Latitude of the first point on the center line
	Lat2	=	Latitude of the second point on the center line
	AziAng	=	Azimuth angle east of north of the center line
	AzmthPt	=	Longitude of point on the central meridian where azimuth occurs
	Satnum	=	Landsat satellite number
	Path	=	Landsat path number (use WRS-1 for Landsat 1, 2, and 3, and WRS-2 for Landsat 4, 5, or 7)
	Shapem	=	Oval shape parameter m
	Shapen	=	Oval shape parameter n
	Angle	=	Oval rotation angle

**Table A-4. USGS Projection Parameters Key**

NOTE: All array elements with blank fields are set to zero. All angles (latitudes, longitudes, azimuths, etc.) are entered in a degrees / minutes / seconds (DDDMMMSSS.SS) format.

## References

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Please see [https://landsat.usgs.gov/tools\\_acronyms\\_ALL.php](https://landsat.usgs.gov/tools_acronyms_ALL.php) for a list of acronyms.

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GeoTIFF Specification. Revision 1.0.  
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