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# **GMT Software and Controls FITS Keyword Dictionary**

*Release 1.2-6*

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## **INTRODUCTION**

This report provides a list of FITS header keywords used by the Data Processing Subsystem when processing telescope data and generating FITS data products.

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CHAPTER  
TWO

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ACRONYMS

## STANDARD FITS KEYWORDS

**Description:** Keywords for a basic FITS standard header. In many cases, the keywords and descriptions are taken verbatim from ‘Definition of the Flexible Image Transport System (FITS), Version 3.0’.

### 3.1 AUTHOR

**Key:** author

**Info:** Author(s) of data

**Type:** string

**HDU:** any

**Description:** The value field shall contain a character string identifying who compiled the information in the data associated with the header. This keyword is appropriate when the data originate in a published paper or are compiled from many sources. Also corresponds to IVOA ‘DataID.Creator’ Spectral Data Model.

### 3.2 BITPIX

**Key:** bitpix

**Info:** Bits per data value

**Type:** integer

**HDU:** any

**Description:** The value field shall contain an integer. The absolute value is used in computing the sizes of data structures. It shall specify the number of bits that represent a data value.

### 3.3 ‘ ‘

**Key:** blankkey

**Info:** Descriptive comment

**Type:** string

**HDU:** any

**Description:** Columns 1-8 contain ASCII blanks. This keyword has no associated value. Columns 9-80 may contain any ASCII text. Any number of card images with blank keyword fields may appear in a header. Blank field supplies comments to FITS file, useful for aesthetic purposes to provide a break between groups of related keywords in the header.

## 3.4 BLANK

**Key:** blank

**Info:** Value used for undefined array elements

**Type:** string

**HDU:** primary

**Description:** This keyword shall be used only in primary array headers or IMAGE extension headers with positive values of BITPIX (i.e., in arrays with integer data). Columns 1-8 contain the string, 'BLANK' (ASCII blanks in columns 6-8). The value field shall contain an integer that specifies the representation of array values whose physical values are undefined.

## 3.5 BSCALE

**Key:** bscale

**Info:** Linear factor in scaling equation

**Type:** float

**HDU:** any

**Description:** This keyword shall be used, along with the BZERO keyword, when the array pixel values are not the true physical values, to transform the primary data array values to the true physical values they represent, using the equation:  $\text{physical\_value} = \text{BZERO} + \text{BSCALE} * \text{array\_value}$ . The value field shall contain a floating point number representing the coefficient of the linear term in the scaling equation, the ratio of physical value to array value at zero offset. The default value for this keyword is 1.0.

## 3.6 BUNIT

**Key:** bunit

**Info:** Physical units of the array values

**Type:** string

**HDU:** any

**Description:** The value field shall contain a character string, describing the physical units in which the quantities in the array, after application of BSCALE and BZERO, are expressed. The units of all FITS header keyword values, with the exception of measurements of angles, should conform with the recommendations in the IAU Style Manual. For angular measurements given as floating point values and specified with reserved keywords, degrees are the recommended units (with the units, if specified, given as 'deg'). Corresponds to IVOA 'o\_unit'.



## 3.7 BZERO

**Key:** bzero

**Info:** Zero point in scaling equation

**Type:** float

**HDU:** any

**Description:** This keyword shall be used, along with the BSCALE keyword, when the array pixel values are not the true physical values, to transform the primary data array values to the true values using the equation:  $\text{physical\_value} = \text{BZERO} + \text{BSCALE} * \text{array\_value}$ . The value field shall contain a floating point number representing the physical value corresponding to an array value of zero. The default value for this keyword is 0.0.

## 3.8 COMMENT

**Key:** comment

**Info:** Descriptive comment

**Type:** string

**HDU:** any

**Description:** This keyword shall have no associated value; columns 9-80 may contain any ASCII text. Any number of COMMENT card images may appear in a header.

## 3.9 DATE

**Key:** date

**Info:** Date of file creation

**Type:** string

**HDU:** any

**Description:** The date on which the HDU was created, in the format specified in the FITS Standard. The old date format was 'yy/mm/dd' and may be used only for dates from 1900 through 1999. The new Y2K compliant date format is 'yyyy-mm-dd' or 'yyyy-mm-ddThh:mm:ss[.sss]'. This maps to IVOA 'obs\_creation\_date'. Also corresponds to the IVOA 'DataID.Date' Spectral Data Model.

## 3.10 DATAMAX

**Key:** datamax

**Info:** Maximum data value

**Type:** float

**HDU:** any

**Description:** The value field shall always contain a floating point number, regardless of the value of BITPIX. This number shall give the maximum valid physical value represented by the array, exclusive of any special values.

## 3.11 DATAMIN

**Key:** datamin

**Info:** Minimum data value

**Type:** float

**HDU:** any

**Description:** The value field shall always contain a floating point number, regardless of the value of BITPIX. This number shall give the minimum valid physical value represented by the array, exclusive of any special values.

## 3.12 DATE-OBS

**Key:** date\_obs

**Info:** Date of the observation

**Type:** string

**HDU:** any

**Description:** The date of the observation, in the format specified in the FITS Standard. The old date format was 'yy/mm/dd' and may be used only for dates from 1900 through 1999. The new Y2K compliant date format is 'yyyy-mm-dd' or 'yyyy-mm-ddTHH:MM:SS[.sss]'. Use instead of TIME-OBS.

## 3.13 DOBS<sub>*n*</sub>

**Key:** dobs[*n*]

**Info:** Date of the observation

**Type:** string

**HDU:** any

**Description:** Similar to DATE-OBS except primary keyword for BINTABLE vector and pixel list alike.

## 3.14 END

**Key:** end

**Info:** Marks the end of the header keywords

**Type:**

**HDU:** any

**Description:** No associated value. Marks the logical end of the header. Columns 9-80 shall be filled with ASCII blanks.

## 3.15 EXTLEVEL

**Key:** extlevel

**Info:** Hierarchical level of the extension

**Type:** integer

**HDU:** extension

**Description:** The value field shall contain an integer, specifying the level in a hierarchy of extension levels of the extension header containing it. The value shall be 1 for the highest level; levels with a higher value of this keyword shall be subordinate to levels with a lower value. If the EXTLEVEL keyword is absent, the file should be treated as if the value were 1. This keyword is used to describe an extension and should not appear in the primary header.

## 3.16 EXTEND

**Key:** extend

**Info:** Indicates whether the FITS file contain extensions

**Type:** boolean

**HDU:** primary

**Description:** T or F indicating whether the FITS file is allowed to contain conforming extensions following the primary HDU. This keyword MUST NOT appear in XtensionFrame. Contains a logical value indicating whether the FITS file is allowed to contain conforming extensions following the primary HDU. This keyword may only appear in the primary header and must not appear in an extension header. If the value field is T then there may be conforming extensions in the FITS file following the primary HDU. This keyword is only advisory, so its presence with a value T does not require that the FITS file contains extensions, nor does the absence of this keyword necessarily imply that the file does not contain extensions.

## 3.17 NEXTEND

**Key:** nextend

**Info:** The number of standard extensions [To be Deleted?]

**Type:** integer

**HDU:** primary

**Description:** Number of standard extensions. The value field shall contain an integer giving the number of standard extensions contained in the FITS file. This keyword may only be used in the primary array header. [To be Deleted?]

## 3.18 EXTNAME

**Key:** extname

**Info:** Name of the extension

**Type:** string

**HDU:** extension

**Description:** The value field shall contain a character string, to be used to distinguish among different extensions of the same type, i.e., with the same value of XTENSION, in a FITS file. This keyword is used to describe an extension and should not appear in the primary header. The extension types are: SCI (science image), ERR (error image), DQ (data quality image), SAMP (number of sample), TIME (exposure time), EVENTS (photon event list), GTI (good time interval), WHT (weight image), CTX (context image).

## 3.19 EXTVER

**Key:** extver

**Info:** Version of the extension

**Type:** integer

**HDU:** extension

**Description:** The value field shall contain an integer, to be used to distinguish among different extensions in a FITS file with the same type and name, i.e., the same values for XTENSION and EXTNAME. The values need not start with 1 for the first extension with a particular value of EXTNAME and need not be in sequence for subsequent values. If the EXTVER keyword is absent, the file should be treated as if the value were 1. This keyword is used to describe an extension and should not appear in the primary header.

## 3.20 GCOUNT

**Key:** gcount

**Info:** Group count

**Type:** integer

**HDU:** extension

**Description:** The value field shall contain an integer that shall be used in any way appropriate to define the data structure, consistent with Eq. 5.2 in the FITS Standard. This keyword originated for use in FITS Random Groups where it specifies the number of random groups present. In most other cases this keyword will have the value 1. Must have the value 1 in the IMAGE, Table, and BINTABLE standard extensions.

## 3.21 GROUPS

**Key:** groups

**Info:** Indicates random groups structure

**Type:** boolean

**HDU:** extension

**Description:** The value field shall contain the logical constant T. The value T associated with this keyword implies that random groups records are present. This is deprecated for use outside of radio interferometry.

## 3.22 HISTORY

**Key:** history

**Info:** Processing history of the data

**Type:** string

**HDU:** any

**Description:** This keyword shall have no associated value; columns 9-80 may contain any ASCII text. The text should contain a history of steps and procedures associated with the processing of the associated data. Any number of HISTORY card images may appear in a header.

## 3.23 INSTRUME

**Key:** instrume

**Info:** Name of instrument

**Type:** string

**HDU:** any

**Description:** The value field shall contain a character string identifying the instrument used to acquire the data associated with the header. Corresponds to IVOA 'instrument\_name'.

## 3.24 NAXIS

**Key:** naxis

**Info:** Number of axes

**Type:** integer

**HDU:** any

**Description:** The value field shall contain a non-negative integer no greater than 999, representing the number of axes in the associated data array. A value of zero signifies that no data follow the header in the HDU. In the context of FITS 'TABLE' or 'BINTABLE' extensions, the value of NAXIS is always 2.

## 3.25 NAXIS $n$

**Key:** naxis $n[n]$

**Info:** Size along the axis  $n$  dimension

**Type:** integer

**HDU:** any

**Description:** [NAXIS $n$ ] The value field of this indexed keyword shall contain a non-negative integer, representing the number of elements along axis  $n$  of a data array. The NAXIS $n$  must be present for all values  $n = 1, \dots, \text{NAXIS}$ , and for no other values of  $n$ . A value of zero for any of the NAXIS $n$  signifies that no data follow the header in the HDU. If NAXIS is equal to 0, there should not be any NAXIS $n$  keywords.

## 3.26 NAXIS1

**Key:** naxis1

**Info:** Size along the axis 1 dimension

**Type:** integer

**HDU:** any

**Description:** Size along the axis 1 dimension

## 3.27 NAXIS2

**Key:** naxis2

**Info:** Size along the axis 2 dimension

**Type:** integer

**HDU:** any

**Description:** Size along the axis 2 dimension

## 3.28 OBJECT

**Key:** object

**Info:** Name or type of observed object

**Type:** string

**HDU:** any

**Description:** The value field shall contain a character string giving a name or type of the object observed. Often 'TARGNAME' is used for target name, in which case 'OBJECT' can be used to specify the object category. If so, this is a list of object classes (or types) used by the SIMBAD, NED, or other IVOA vocabulary. This maps to IVOA 'target\_class' Also corresponds to the IVOA 'Target.Name' Spectral Data Model.

## 3.29 OBSERVER

**Key:** observer

**Info:** Observer who acquired the data

**Type:** string

**HDU:** any

**Description:** The value field shall contain a character string identifying who acquired the data associated with the header.

### 3.30 ORIGIN

**Key:** origin

**Info:** Organization or person responsible for the data

**Type:** string

**HDU:** any

**Description:** The value field shall contain a character string identifying the organization, institution, or person, responsible for creating the FITS file. This maps to IVOA ‘obs\_creator\_name’.

### 3.31 PCOUNT

**Key:** pcount

**Info:** Parameter Count

**Type:** integer

**HDU:** extension

**Description:** The value field shall contain an integer that shall be used in any way appropriate to define the data structure, consistent with Eq. 5.2 in the FITS Standard. This keyword was originated for use with FITS Random Groups and represented the number of parameters preceding each group. It has since been used in ‘BINTABLE’ extensions to represent the size of the data heap following the main data table. In most other cases its value will be zero. Must have value of 0 for IMAGE and TABLE extensions. In BINTABLE, the value specifies the number of bytes that follow the main data table in the supplemental data area called the heap. This keyword is also used in the random groups structure to specify the number of parameters preceding each array in a group.

### 3.32 PSCAL $n$

**Key:** pscal[ $n$ ]

**Info:** Parameter scaling factor

**Type:** float

**HDU:** extension

**Description:** [PSCAL $n$ ] This keyword is reserved for use within the FITS Random Groups structure. This keyword shall be used, along with the PZEROn keyword, when the  $n$ th FITS group parameter value is not the true physical value, to transform the group parameter value to the true physical values it represents, using the equation,  $\text{physical\_value} = \text{PZEROn} + \text{PSCALn} * \text{group\_parameter\_value}$ . The value field shall contain a floating point number representing the coefficient of the linear term, the scaling factor between true values and group parameter values at zero offset. The default value for this keyword is 1.0.

### 3.33 PTYPE $n$

**Key:** ptype[ $n$ ]

**Info:** Parameter scaling factor

**Type:** string

**HDU:** extension

**Description:** [PTYPEn] This keyword is reserved for use within the FITS Random Groups structure. The value field shall contain a character string giving the name of parameter n. If the PTYPEn keywords for more than one value of n have the same associated name in the value field, then the data value for the parameter of that name is to be obtained by adding the derived data values of the corresponding parameters. This rule provides a mechanism by which a random parameter may have more precision than the accompanying data array elements; for example, by summing two 16-bit values with the first scaled relative to the other such that the sum forms a number of up to 32-bit precision.

## 3.34 PZEROn

**Key:** pzero[n]

**Info:** Parameter scaling zero point

**Type:** float

**HDU:** extension

**Description:** [PZEROn] This keyword is reserved for use within the FITS Random Groups structure. This keyword shall be used, along with the PSCALn keyword, when the nth FITS group parameter value is not the true physical value, to transform the group parameter value to the physical value. The value field shall contain a floating point number, representing the true value corresponding to a group parameter value of zero. The default value for this keyword is 0.0. The transformation equation is as follows:  $\text{physical\_value} = \text{PZEROn} + \text{PSCALn} * \text{group\_parameter\_value}$ .

## 3.35 REFERENC

**Key:** referenc

**Info:** Bibliographic reference

**Type:** string

**HDU:** any

**Description:** The value field shall contain a character string citing a reference where the data associated with the header are published. For IVOA this is a forward link to major publications which reference the dataset. This corresponds to IVOA 'bib\_reference'.

## 3.36 SIMPLE

**Key:** simple

**Info:** Indicates whether the file conforms to the standard

**Type:** boolean

**HDU:** primary

**Description:** The SIMPLE keyword is required to be the first keyword in the primary header of all FITS files. The value field shall contain a logical constant with the value T if the file conforms to the standard. This keyword is mandatory for the primary header and is not permitted in extension headers. A value of F signifies that the file does not conform to this standard.



### 3.37 TBCOL $n$

**Key:** tbcoll[ $n$ ]

**Info:** Beginning column number

**Type:** integer

**HDU:** extension

**Description:** The value field of this indexed keyword shall contain an integer specifying the column in which field  $n$  starts in an ASCII TABLE extension. For tables, The TBCOL $n$  keywords must be present for all values  $n=1 \dots$  TFIELDS, and for no other values of  $n$ . The value contains an integer specifying the column in which field  $n$  starts. The first column of a row is numbered 1.

### 3.38 TDIM $n$

**Key:** tdim[ $n$ ]

**Info:** Dimensionality of the array

**Type:** string

**HDU:** extension

**Description:** [TDIM $n$ ] The value field of this indexed keyword shall contain a character string describing how to interpret the contents of field  $n$  as a multidimensional array, providing the number of dimensions and the length along each axis. The form of the value is not further specified by the Standard. A proposed convention is described in Appendix B.2 of the FITS Standard in which the value string has the format '(l,m,n...)' where  $l$ ,  $m$ ,  $n$ , ... are the dimensions of the array. The data are ordered such that the array index of the first dimension given ( $l$ ) is the most rapidly varying and that of the last dimension given is the least rapidly varying.

### 3.39 TDISP $n$

**Key:** tdisp[ $n$ ]

**Info:** Display format

**Type:** string

**HDU:** extension

**Description:** [TDISP $n$ ] The value field of this indexed keyword shall contain a character string describing the format recommended for the display of the contents of field  $n$ . If the table value has been scaled, the physical value shall be displayed. All elements in a field shall be displayed with a single, repeated format. For purposes of display, each byte of bit (type X) and byte (type B) arrays is treated as an unsigned integer. Arrays of type A may be terminated with a zero byte. Only the format codes in Table 8.6, discussed in section 8.3.4 of the FITS Standard, are permitted for encoding. The format codes must be specified in upper case. If the Bw.m, Ow.m, and Zw.m formats are not readily available to the reader, the Iw.m display format may be used instead, and if the ENw.d and ESw.d formats are not available, Ew.d may be used. The meaning of this keyword is not defined for fields of type P in the Standard but may be defined in conventions using such fields.

## 3.40 TELESCOP

**Key:** `telescop`

**Info:** Name of telescope

**Type:** string

**HDU:** any

**Description:** The value field shall contain a character string identifying the telescope used to acquire the data associated with the header. This can correspond to IVOA ‘facility\_name’, but another IVOA specific FITS keyword exists (‘facility’) that is more direct.

## 3.41 TFIELDS

**Key:** `tfields`

**Info:** Number of columns in the table

**Type:** integer

**HDU:** extension

**Description:** The value field shall contain a non-negative integer representing the number of fields in each row of a ‘TABLE’ or ‘BINTABLE’ extension. The maximum permissible value is 999.

## 3.42 TFORM $n$

**Key:** `tform[ $n$ ]`

**Info:** Column data format

**Type:** string

**HDU:** extension

**Description:** [TFORM $n$ ] The value field of this indexed keyword shall contain a character string describing the format in which field  $n$  is encoded in a ‘TABLE’ or ‘BINTABLE’ extension. The TFORM $n$  keywords must be present for all values  $n=1 \dots$  TFIELDS, and for no other values of  $n$ .

## 3.43 THEAP

**Key:** `theap`

**Info:** Offset to starting data heap address

**Type:** integer

**HDU:** extension

**Description:** The value field of this keyword shall contain an integer providing the separation, in bytes, between the start of the main data table and the start of a supplemental data area called the heap. The default value, which is also the minimum allowed value, shall be the product of the values of NAXIS1 and NAXIS2. This keyword shall not be used if the value of PCOUNT is zero. A proposed application of this keyword is presented in Appendix B.1 of the FITS Standard.

## 3.44 TNULL $n$

**Key:** tnull[ $n$ ]

**Info:** Value used to indicate undefined table element

**Type:** string

**HDU:** extension

**Description:** [TNULL $n$ ] In ASCII ‘TABLE’ extensions, the value field for this indexed keyword shall contain the character string that represents an undefined value for field  $n$ . The string is implicitly blank filled to the width of the field. In binary ‘BINTABLE’ table extensions, the value field for this indexed keyword shall contain the integer that represents an undefined value for field  $n$  of data type B, I, or J. The keyword may not be used in ‘BINTABLE’ extensions if field  $n$  is of any other data type.

## 3.45 TSCAL $n$

**Key:** tscal[ $n$ ]

**Info:** Linear data scaling factor

**Type:** float

**HDU:** extension

**Description:** [TSCAL $n$ ] This indexed keyword shall be used, along with the TZEROn keyword, when the quantity in field  $n$  does not represent a true physical quantity. The value field shall contain a floating point number representing the coefficient of the linear term in the equation,  $\text{physical\_value} = \text{TZEROn} + \text{TSCALn} * \text{field\_value}$ , which must be used to compute the true physical value of the field, or, in the case of the complex data types C and M, of the real part of the field with the imaginary part of the scaling factor set to zero. The default value for this keyword is 1.0. This keyword may not be used if the format of field  $n$  is A, L, or X.

## 3.46 TTYPE $n$

**Key:** ttype[ $n$ ]

**Info:** Column name

**Type:** string

**HDU:** extension

**Description:** [TTYPEn] The value field for this indexed keyword shall contain a character String, giving the name of field  $n$ . It is recommended that only letters, digits, and underscore (hexadecimal code 5F, ‘\_’) be used in the name. String comparisons with the values of TTYPEn keywords should not be case sensitive. The use of identical names for different fields should be avoided.

## 3.47 TUNIT $n$

**Key:** tunit[ $n$ ]

**Info:** Column units

**Type:** string

**HDU:** extension

**Description:** [TUNITn] The value field shall contain a character string describing the physical units in which the quantity in field n, after any application of TSCALn and TZEROn, is expressed. The units of all FITS header keyword values, with the exception of measurements of angles, should conform with the recommendations in the IAU Style Manual. For angular measurements given as floating point values and specified with reserved keywords, degrees are the recommended units (with the units, if specified, given as 'deg').

## 3.48 TZEROn

**Key:** tzero[n]

**Info:** Column scaling zero point

**Type:** float

**HDU:** extension

**Description:** [TZEROn] This indexed keyword shall be used, along with the TSCALn keyword, when the quantity in field n does not represent a true physical quantity. The value field shall contain a floating point number representing the true physical value corresponding to a value of zero in field n of the FITS file, or, in the case of the complex data types C and M, in the real part of the field, with the imaginary part set to zero. The default value for this keyword is 0.0. This keyword may not be used if the format of field n is A, L, or X. This indexed keyword is used with TSCALn keyword to linearly scale the values in the table field n to transform them into physical values using:  $\text{physical\_value} = \text{TZEROn} + \text{TSCALn} * \text{field\_value}$ .

## 3.49 XTENSION

**Key:** xtension

**Info:** Marks beginning of new HDU

**Type:** string

**HDU:** extension

**Description:** Required to be the first keyword of all image (XTENSION= 'IMAGE ') and table (XTENSION= 'BINTABLE' or XTENSION= 'TABLE ') extensions. The value field shall contain a character string giving the name of the extension type. This keyword is mandatory for an extension header and must not appear in the primary header. For an extension that is not a standard extension, the type name must not be the same as that of a standard extension.

## 3.50 WCSAXES

**Key:** wcsaxes

**Info:** The number of axes in the WCS description

**Type:** integer

**HDU:** all

**Description:** [integer; default: NAXIS, or larger of WCS indexes i or j]. Number of axes in the WCS description. This keyword, if present, must precede all WCS keywords except NAXIS in the HDU. The value of WCSAXES may exceed the number of pixel axes for the HDU.

### 3.51 CTYPEia

**Key:** ctype[i][a]

**Info:** Name of the coordinate axis

**Type:** string

**HDU:** all

**Description:** [CTYPEia] The value field shall contain a character string, giving the name of the coordinate represented by axis n. Any coordinate type that is not covered by the standard or an officially recognized FITS convention shall be taken to be linear. All non-linear coordinate system names must be expressed in '4-3' form: the first four characters specify the coordinate type, the fifth character is a hyphen ('-'), and the remaining three characters specify an algorithm code for computing the world coordinate value. Coordinate types with names of less than four characters are padded on the right with hyphens, and algorithm codes with less than three characters are padded on the right with blanks. Algorithm codes should be three characters.

### 3.52 CTYPE1

**Key:** ctype1

**Info:** Coordinate type for the x-axis

**Type:** string

**HDU:** all

**Description:** Coordinate type for the x-axis

### 3.53 CTYPE2

**Key:** ctype2

**Info:** Coordinate type for the y-axis

**Type:** string

**HDU:** all

**Description:** Coordinate type for the y-axis

### 3.54 iCTYPn

**Key:** [i]ctyp[n]

**Info:** Name of the coordinate axis

**Type:** string

**HDU:** extension

**Description:** [iCTYPn] Similar to CTYPEia except primary keyword for BINTABLE vector.

### 3.55 *iCTYn*

**Key:** [i]cty[n]

**Info:** Name of the coordinate axis

**Type:** string

**HDU:** extension

**Description:** [iCTYn] Alternative keyword for iCTYPn for BINTABLE vector.

### 3.56 TCTYPn

**Key:** tctyp[n]

**Info:** Name of the coordinate axis

**Type:** string

**HDU:** extension

**Description:** [TCTYPn] Similar to CTYPEia except primary keyword for pixel list.

### 3.57 TCTYna

**Key:** tcty[n][a]

**Info:** Name of the coordinate axis

**Type:** string

**HDU:** extension

**Description:** [TCTYna] Alternative keyword for TCTYPn for pixel list.

### 3.58 CUNITia

**Key:** cunit[i][a]

**Info:** Units of CRVAL and CDELTA

**Type:** string

**HDU:** primary

**Description:** [CUNITia] Physical units of CRVAL and CDELTA for axis i. Note that units should always be specified. Units for celestial coordinate systems defined in this Standard must be degrees.

### 3.59 iCUNIn

**Key:** [i]cuni[n]

**Info:** Units of CRVAL and CDELTA

**Type:** string

**HDU:** extension

**Description:** [iCUNIn] Similar to CUNITia except primary keyword for BINTABLE vector.

### 3.60 *iCUNna*

**Key:** [i]cun[n][a]

**Info:** Units of CRVAL and CDELT

**Type:** string

**HDU:** extension

**Description:** [iCUNna] Same as iCUNIn except alternative keyword for BINTABLE vector.

### 3.61 *TCUNIn*

**Key:** tcuni[n]

**Info:** Units of CRVAL and CDELT

**Type:** string

**HDU:** any

**Description:** [TCUNIn] Similar to CUNITia except primary keyword for pixel list or table.

### 3.62 *TCUNna*

**Key:** tcun[n][a]

**Info:** Units of CRVAL and CDELT

**Type:** string

**HDU:** extension

**Description:** [TCUNna] Same as iCUNIn except alternative keyword for pixel list or table.

### 3.63 *CRPIXja*

**Key:** crpix[j][a]

**Info:** Coordinate system reference pixel

**Type:** float

**HDU:** primary

**Description:** [CRPIXja] The value field shall contain a floating point number, identifying the location of a reference point along axis n, in units of the axis index. This value is based upon a counter that runs from 1 to NAXISn with an increment of 1 per pixel. The reference point value need not be that for the center of a pixel nor lie within the actual data array. Use comments to indicate the location of the index point relative to the pixel.

### 3.64 *jCRPX<sub>n</sub>*

**Key:** [j]crpx[*n*]

**Info:** Coordinate system reference pixel

**Type:** float

**HDU:** extension

**Description:** [jCRPX<sub>n</sub>] Similar to CRPIX<sub>ja</sub> except primary keyword for BINTABLE vector.

### 3.65 *jCRP<sub>n</sub>a*

**Key:** [j]crp[*n*][*a*]

**Info:** Coordinate system reference pixel

**Type:** float

**HDU:** extension

**Description:** [jCRP<sub>n</sub>a] Same as jCRPX<sub>n</sub> except alternative keyword for BINTABLE vector.

### 3.66 *TCRPX<sub>n</sub>*

**Key:** tcrpx[*n*]

**Info:** Coordinate system reference pixel

**Type:** float

**HDU:** all

**Description:** [TCRPX<sub>n</sub>] Similar to CRPIX<sub>ja</sub> except primary keyword for pixel list or table.

### 3.67 *TCRP<sub>n</sub>a*

**Key:** tcrp[*n*][*a*]

**Info:** Coordinate system reference pixel

**Type:** float

**HDU:** extension

**Description:** [TCRP<sub>n</sub>a] Same as jCRPX<sub>n</sub> except alternative keyword for pixel list or table.

### 3.68 *CRVAL<sub>i</sub>a*

**Key:** crval[*i*][*a*]

**Info:** Coordinate system value at reference pixel

**Type:** float



**HDU:** all

**Description:** [CRVALia] The value field shall contain a floating point number, giving the value of the coordinate specified by the CTYPEn keyword at the reference point CRPIXn. Units must follow the prescriptions of section 5.3 of the FITS Standard.

## 3.69 CRVAL1

**Key:** crval1

**Info:** x-coordinate value at reference pixel

**Type:** float

**HDU:** primary

**Description:** x-coordinate value at reference pixel

## 3.70 CRVAL1

**Key:** crval2

**Info:** y-coordinate value at reference pixel

**Type:** float

**HDU:** primary

**Description:** y-coordinate value at reference pixel

## 3.71 iCRVLn

**Key:** [i]crvl[n]

**Info:** Coordinate system value at reference pixel

**Type:** float

**HDU:** extension

**Description:** [iCRVLn] Similar to CRVALia except primary keyword for BINTABLE vector.

## 3.72 iCRVna

**Key:** [i]crv[n][a]

**Info:** Coordinate system value at reference pixel

**Type:** float

**HDU:** extension

**Description:** [iCRVna] Alternative keyword for iCRVLn for BINTABLE vector.

### 3.73 TCRVL*n*

**Key:** tcrvl[*n*]

**Info:** Coordinate system value at reference pixel

**Type:** float

**HDU:** any

**Description:** [TCRVL*n*] Similar to CRVALia except primary keyword for pixel list or table.

### 3.74 TCRV*na*

**Key:** tcrv[*n*][*a*]

**Info:** Coordinate system value at reference pixel

**Type:** float

**HDU:** any

**Description:** [TCRV*na*] Alternative keyword for iCRVL*n* for pixel list or table.

### 3.75 CDELT*na*

**Key:** cdelt[*n*][*a*]

**Info:** Coordinate increment along axis

**Type:** float

**HDU:** primary

**Description:** [CDELT*na*] The value field shall contain a floating point number giving the partial derivative of the coordinate specified by the CTYPEn keywords with respect to the pixel index, evaluated at the reference point CRPIX*n*, in units of the coordinate specified by the CTYPEn keyword. These units must follow the prescriptions of section 5.3 of the FITS Standard.

### 3.76 iCDLT*n*

**Key:** [i]cdlt[*n*]

**Info:** Coordinate increment along axis

**Type:** float

**HDU:** extension

**Description:** [iCDLT*n*] Similar to CDELTi except primary keyword for BINTABLE vector.

### 3.77 *iCDEna*

**Key:** [i]cde[n][a]

**Info:** Coordinate increment along axis

**Type:** float

**HDU:** extension

**Description:** [iCDEna] Alternative keyword for iCDLTn for BINTABLE vector.

### 3.78 TCDLTn

**Key:** tcdlt[n]

**Info:** Coordinate increment along axis

**Type:** float

**HDU:** any

**Description:** [TCDLTn] Similar to CDELTi except primary keyword for pixel list.

### 3.79 TCDEna

**Key:** tcde[n][a]

**Info:** Coordinate increment along axis

**Type:** float

**HDU:** any

**Description:** [TCDEna] Alternative keyword for TCDLTn for pixel list or table.

### 3.80 CROTAi

**Key:** crota[i]

**Info:** [Deprecated] Coordinate system rotation angle

**Type:** float

**HDU:** primary

**Description:** [CROTAi] This keyword is used to indicate a rotation from a standard coordinate system described by the CTYPEn to a different coordinate system in which the values in the array are actually expressed. Rules for such rotations are not further specified in the Standard; the rotation should be explained in comments. The value field shall contain a floating point number giving the rotation angle in degrees between axis n and the direction implied by the coordinate system defined by CTYPEn. Further use of this keyword is deprecated, in favor of the newer formalisms that use the CDi\_j or PCi\_j keywords to define the rotation.

### 3.81 *iCROT<sub>n</sub>*

**Key:** [i]crot[n]

**Info:** [Deprecated] Coordinate system rotation angle

**Type:** float

**HDU:** extension

**Description:** [iCROT<sub>n</sub>] Similar to CROTAi except primary keyword for BINTABLE vector.

### 3.82 *TCROT<sub>n</sub>*

**Key:** tcrot[n]

**Info:** [Deprecated] Coordinate system rotation angle

**Type:** float

**HDU:** any

**Description:** [TCROT<sub>n</sub>] Similar to CROTAi except primary keyword for pixel list or table.

### 3.83 *PCi<sub>j</sub>a*

**Key:** pc[i]\_j[a]

**Info:** Coordinate transformation coefficient

**Type:** float

**HDU:** primary

**Description:** [PCi<sub>j</sub>a] [floating point; defaults: 1.0 when i = j, 0.0 otherwise]. Linear transformation matrix between pixel axes j and intermediate coordinate axes i. The PCi<sub>j</sub> matrix must not be singular.

### 3.84 *ijPC<sub>n</sub>a*

**Key:** [i][j]pc[n][a]

**Info:** Coordinate transformation coefficient

**Type:** float

**HDU:** extension

**Description:** [ijPC<sub>n</sub>a] Similar to PCi<sub>j</sub>a except this is keyword for BINTABLE vector.

### 3.85 *TPC<sub>n</sub>\_ka*

**Key:** tpc[n]\_k[a]

**Info:** Coordinate transformation coefficient

**Type:** float

**HDU:** any

**Description:** [TPCn\_ka] Similar to PCi\_ja except this is keyword for pixel list or table.

### 3.86 TPn\_ka

**Key:** tp[n]\_[k][a]

**Info:** Coordinate transformation coefficient

**Type:** float

**HDU:** any

**Description:** [TPn\_ka] Similar to PCi\_ja except this is also keyword for pixel list or table.

### 3.87 CDi\_ja

**Key:** cd[i]\_[j][a]

**Info:** Linear transformation matrix between axes i and j

**Type:** float

**HDU:** primary

**Description:** [CDi\_ja] [floating point; defaults: 0.0, but see below]. Linear transformation matrix (with scale) between pixel axes j and intermediate coordinate axes i. This nomenclature is equivalent to PCi\_j when CDELTi is unity. The CDi\_j matrix must not be singular. Note that the CDi\_j formalism is an exclusive alternative to PCi\_j, and the CDi\_j and PCi\_j keywords must not appear together within an HDU.

### 3.88 CD1\_1

**Key:** cd1\_1

**Info:** Projection of unit vector of axis 1 of one coordinate system with respect to axis 1 of the other coordinate system

**Type:** float

**HDU:** primary

**Description:** When two coordinate axes are rotated with respect to each other, e.g. North with respect to x-axis, this keyword gives the projection of unit vector of axis 1 (e.g. N) of one system with respect to the axis 1 (e.g. x) of the other.

### 3.89 CD1\_2

**Key:** cd1\_2

**Info:** Projection of unit vector of axis 1 of one coordinate system with respect to axis 2 of the other coordinate system

**Type:** float

**HDU:** primary

**Description:** When two coordinate axes are rotated with respect to each other, e.g. North with respect to x-axis, this keyword gives the projection of unit vector of axis 1 (e.g. N) of one system with respect to the axis 2 (e.g. y) of the other.

### 3.90 CD2\_1

**Key:** cd2\_1

**Info:** Projection of unit vector of axis 2 of one coordinate system with respect to axis 1 of the other coordinate system

**Type:** float

**HDU:** primary

**Description:** When two coordinate axes are rotated with respect to each other, e.g. South with respect to x-axis, this keyword gives the projection of unit vector of axis 2 (e.g. S) of one system with respect to the axis 1 (e.g. x) of the other.

### 3.91 CD2\_2

**Key:** cd2\_2

**Info:** Projection of unit vector of axis 2 of one coordinate system with respect to axis 2 of the other coordinate system

**Type:** float

**HDU:** primary

**Description:** When two coordinate axes are rotated with respect to each other, e.g. South with respect to y-axis, this keyword gives the projection of unit vector of axis 2 (e.g. S) of one system with respect to the axis 2 (e.g. y) of the other.

### 3.92 ijCDna

**Key:** [i][j]cd[n][a]

**Info:** Linear transformation matrix between axes i and j

**Type:** float

**HDU:** extension

**Description:** [ijCDna] Similar to CDi\_ja except this is keyword for BINTABLE vector.

### 3.93 TCDn\_ka

**Key:** tcd[n][k][a]

**Info:** Linear transformation matrix between axes i and j

**Type:** float

**HDU:** extension

**Description:** [TCDn\_ka] Similar to CDi\_ja except this is keyword for pixel list or table.

### 3.94 TCn\_ka

**Key:** tc[n]\_[k][a]

**Info:** Linear transformation matrix between axes i and j

**Type:** float

**HDU:** extension

**Description:** [TCn\_ka] Similar to CDi\_ja except this is also a keyword for pixel list or table.

### 3.95 PVi\_ma

**Key:** pvi[i]\_[m][a]

**Info:** Value for intermediate WCS axis i

**Type:** float

**HDU:** primary

**Description:** [PVi\_ma] [floating point]. Numeric parameter values for intermediate world coordinate axis i, where m is the parameter number. Leading zeros must not be used, and m may have only values in the range 0 through 99, and that are defined for the particular non-linear algorithm.

### 3.96 iPVn\_ma

**Key:** [0-9]pv[i]\_[n][m]

**Info:** Value for intermediate WCS axis i

**Type:** float

**HDU:** extension

**Description:** [iPVn\_ma] Similar to PVi\_ma except this is keyword for BINTABLE vector.

### 3.97 iVn\_ma

**Key:** [i]vn[n]\_[m][a]

**Info:** Value for intermediate WCS axis i

**Type:**

**HDU:** extension

**Description:** [iVn\_ma] This is equivalent to iPVn\_ma.

### 3.98 TPV*n*\_m

**Key:** tpv[n]\_[m]

**Info:** Value for intermediate WCS axis i

**Type:** float

**HDU:** any

**Description:** [TPVn\_ma] Similar to PVi\_ma except this is keyword for pixel list or table.

### 3.99 TV*n*\_ma

**Key:** tv[n]\_[m][a]

**Info:** Value for intermediate WCS axis i

**Type:** float

**HDU:** any

**Description:** [TVn\_ma] This is equivalent to TPVn\_ma.

### 3.100 iV*n*\_Xa

**Key:** [i]vx[n]\_X[a]

**Info:** Coordinate parameter array

**Type:** float

**HDU:** extension

**Description:** [iVn\_Xa] Coordinate parameter array for BINTABLE vector.

### 3.101 PSi\_*ma*

**Key:** ps[i]\_[m][a]

**Info:** Parameters for intermediate WCS axis i

**Type:** string

**HDU:** primary

**Description:** [PSi\_ma] [character]. Character-valued parameters for intermediate world coordinate axis i, where m is the parameter number. Leading zeros must not be used, and m may have only values in the range 0 through 99, and that are defined for the particular non-linear algorithm.



### 3.102 *iPSn\_ma*

**Key:** [i]ps[n]\_[m][a]

**Info:** Parameters for intermediate WCS axis i

**Type:** string

**HDU:** extension

**Description:** [iPSn\_ma] Similar to PSi\_ma except this is keyword for BINTABLE vector.

### 3.103 *iSn\_ma*

**Key:** [i]s[n]\_[m]

**Info:** Parameters for intermediate WCS axis i

**Type:** string

**HDU:** extension

**Description:** [iSn\_ma] This is equivalent to PSi\_ma

### 3.104 *TPSn\_ma*

**Key:** tps[n]\_[m][a]

**Info:** Parameters for intermediate WCS axis i

**Type:** string

**HDU:** any

**Description:** [TPSn\_ma] Similar to PSi\_ma except this is keyword for pixel list or table.

### 3.105 *TSn\_ma*

**Key:** ts[n]\_[m][a]

**Info:** Parameters for intermediate WCS axis i

**Type:** string

**HDU:** any

**Description:** [TSn\_ma] This is equivalent to TPSn\_ma

### 3.106 *CRDERi*

**Key:** crder[i]

**Info:** Random error in coordinate i

**Type:** float

**HDU:** primary

**Description:** [CRDERi] [floating point; default: 0.0]. Random error in coordinate i, which must be non-negative.

### 3.107 *iCRDna*

**Key:** [i]crd[n][a]

**Info:** Random error in coordinate i

**Type:** float

**HDU:** extension

**Description:** [iCRDna] Similar to CRDERi except this is keyword for BINTABLE vector.

### 3.108 *TCRDna*

**Key:** tcrd[n][a]

**Info:** Random error in coordinate i

**Type:** float

**HDU:** any

**Description:** [TCRDna] Similar to CRDERi except this is keyword for pixel list or table.

### 3.109 *CSYERi*

**Key:** csyer[i]

**Info:** Systematic error in coordinate i

**Type:** float

**HDU:** primary

**Description:** [CSYERi] [floating point; default: 0.0]. Systematic error in coordinate i, which must be non-negative.

### 3.110 *iCSYna*

**Key:** [i]csy[n][a]

**Info:** Systematic error in coordinate i

**Type:** float

**HDU:** extension

**Description:** [iCSYna] Similar to CSYERi except this is keyword for BINTABLE vector.

### 3.111 TCSY*na*

**Key:** tcsy[*n*][*a*]

**Info:** Systematic error in coordinate *i*

**Type:** float

**HDU:** any

**Description:** [TCSY*na*] Similar to CSYER*i* except this is keyword for pixel list or table.

### 3.112 WCST*na*

**Key:** wcst[*n*][*a*]

**Info:** WCS cross-reference target for BINTABLE vector

**Type:** string

**HDU:** extension

**Description:** [WCST*na*] WCS Cross-reference target for BINTABLE vector

### 3.113 WCSX*na*

**Key:** wcsx[*n*][*a*]

**Info:** WCS cross-reference for BINTABLE vector

**Type:** string

**HDU:** extension

**Description:** [WCSX*na*] WCS Cross-reference for BINTABLE vector

### 3.114 WCSNAME*a*

**Key:** wcsname[*a*]

**Info:** Name of the world coordinate system

**Type:** string

**HDU:** primary

**Description:** [WCSNAME*a*] [character; default for *a*: ' ' (i.e., blank, for the primary WCS, else a character A through Z that specifies the coordinate version)]. Name of the world coordinate system represented by the WCS keywords with the suffix *a*. Its primary function is to provide a means by which to specify a particular WCS if multiple versions are defined in the HDU.

### 3.115 WCSNna

**Key:** wcsn[n][a]

**Info:** Name of the world world coordinate system

**Type:** string

**HDU:** extension

**Description:** [WCSNna] Similar to WCSNAMEa except this is keyword for BINTABLE vector.

### 3.116 WCSna

**Key:** wcs[n][a]

**Info:** Name of the world world coordinate system

**Type:** string

**HDU:** any

**Description:** [WCSna] Similar to WCSNAMEa except this is keyword for pixel list or table.

### 3.117 TWCSna

**Key:** twcs[n][a]

**Info:** Name of the world coordinate system

**Type:** string

**HDU:** any

**Description:** [TWCSna] This is equivalent to WCSna.

### 3.118 RADESYSa

**Key:** radesys[a]

**Info:** Reference frame of equatorial or ecliptic coordinates

**Type:** string

**HDU:** any

**Description:** [RADESYSa] [character; default: FK4, FK5, or ICRS; see below]. Name of the reference frame of equatorial or ecliptic coordinates, whose value must be one of those specified in Table 24 of 'FITS Standard' document. The default value is FK4 if the value of EQUINOXa < 1984.0, FK5 if EQUINOXa >= 1984.0, or ICRS if EQUINOXa is not given. Note that the IAU recommends (IAU 1997) that ICRS be used as the reference celestial coordinate system, so this reference system should be used for all data products created by GMT (i.e., RADESYS = 'ICRS'). If RADESYS is 'ICRS' then the EQUINOX keyword must not be used (and note that the EPOCH keyword is already DEPRECATED).

### 3.119 RADECSYS

**Key:** radecsys

**Info:** [Deprecated] Reference frame of equatorial or ecliptic coordinates

**Type:** string

**HDU:** any

**Description:** The exact same definition as RADESYSa

### 3.120 RADEna

**Key:** rade[n][a]

**Info:** Reference frame of equatorial or ecliptic coordinates

**Type:** string

**HDU:** extension

**Description:** [RADEna] Similar to RADESYSa except this is keyword for BINTABLE vector, pixel list, or table, alike.

### 3.121 EQUINOXa

**Key:** equinox[a]

**Info:** Equinox of celestial coordinate system

**Type:** float

**HDU:** any

**Description:** [EQUINOXa] The value field shall contain a floating point number giving the equinox in years for the celestial coordinate system in which positions are expressed. The interpretation of epoch depends upon the value of RADESYSa if present: Besselian if the value is FK4 or FK4-NO-E, Julian if the value is FK5; not applicable if the value is ICRS or GAPPT.

### 3.122 EQUIna

**Key:** equi[n][a]

**Info:** Equinox of celestial coordinate system

**Type:** float

**HDU:** extension

**Description:** [EQUIna] Similar to EQUINOXa except this is keyword for BINTABLE vector, pixel list, or table, alike.

### 3.123 MJD-OBS

**Key:** mjd\_obs

**Info:** Modified Julian Date of observation

**Type:** float

**HDU:** primary

**Description:** [floating point; default: DATE-OBS if given, other- wise no default]. Modified Julian Date (JD – 2,400,000.5) of the observation, whose value corresponds (by default) to the start of the observation, unless another interpretation is explained in the comment field. No specific time system (e.g. UTC, TAI, etc.) is defined for this or any of the other time-related keywords. It is recommended that the TIMESYS keyword, as defined in Appendix B be used to specify the time system.

### 3.124 MJDOBN

**Key:** mjdob[n]

**Info:** Modified Julian Date of observation

**Type:** float

**HDU:** extension

**Description:** [MJDOBN] Similar to MJD\_OBS except this is keyword for BINTABLE vector, pixel list, or table, alike.

### 3.125 TIMESYS

**Key:** timesys

**Info:** Time system used

**Type:** string

**HDU:** any

**Description:** Time system used. Corresponds to the IVOA ‘CoordSys.TimeFrame.Name’ Spectral Data Model. Note that the IAU recommends (IAU 1991) that TT be used as the reference timescale for apparent geocentric ephemerides, so this timescale should be used for all data products created by GMT (i.e., TIMESYS = ‘TT’), unless another timescale is specifically required scientifically. In particular, UTC should NOT be used as a timescale (the one exception is the DATE keyword, which identifies the date/time when the file was created; this is explicitly required to be recorded in UTC).

### 3.126 TIMEUNIT

**Key:** timeunit

**Info:** Units of time reference

**Type:** string

**HDU:** any

**Description:** The units for reference point in time.

### 3.127 DATEREF

**Key:** dateref

**Info:** ISO-8601 time reference point

**Type:** datetime

**HDU:** any

**Description:** The reference point in time, in ISO-8601, to which all times in the HDU are relative. Format: [+/-C]CCYY-MM-DD[Thh:mm:ss[.s...]] The 'datetime' string uses a 4-digit year format or signed 5-digit year format, where [+/-C]CCYY is the year.

### 3.128 LONPOLEa

**Key:** lonpole[*a*]

**Info:** Longitude relative to celestial north pole

**Type:** float

**HDU:** any

**Description:** [LONPOLEa] [floating point; default:  $\phi_0$  if  $\delta_0 \geq \theta_0$ ,  $\phi_0 + 180$  deg otherwise]. Longitude in the native coordinate system of the celestial system's north pole. Normally,  $\phi_0$  is zero unless a non-zero value has been set for PVi 1a, which is associated with the longitude axis. This default applies for all values of  $\theta_0$ , including  $\theta_0 = 90$  deg, although the use of non-zero values of  $\theta_0$  are discouraged in that case.

### 3.129 LONPna

**Key:** lonp[*n*][*a*]

**Info:** Longitude relative to celestial north pole

**Type:** float

**HDU:** extension

**Description:** [LONPna] Similar to LONPOLEa except this is keyword for BINTABLE vector, pixel list, or table, alike.

### 3.130 LATPOLEa

**Key:** latpole[*a*]

**Info:** Latitude relative to celestial north pole

**Type:** float

**HDU:** any

**Description:** [LATPOLEa] [floating point; default: 90 deg, or no default if  $(\theta_0, \delta_0, \phi_p - \phi_0) = (0, 0, \pm 90 \text{ deg})$ ]. Latitude in the native coordinate system of the celestial system's north pole, or equivalently, the latitude in the celestial coordinate system of the native system's north pole. May be ignored or omitted in cases where LONPOLEa completely specifies the rotation to the target celestial system.

### 3.131 LATP*na*

**Key:** latp[*n*][*a*]

**Info:** Latitude relative to celestial north pole

**Type:** float

**HDU:** extension

**Description:** [LATPna] Similar to LATPOLEa except this is keyword for BINTABLE vector, pixel list, or table, alike.

### 3.132 CNAME*ia*

**Key:** cname[*i*][*a*]

**Info:** Time or spectral coordinate name/description

**Type:** string

**HDU:** any

**Description:** [CNAMEia] [character; default: ' ' (i.e. a linear, undefined axis)]. Time or spectral coordinate description which must not exceed 68 characters in length.

### 3.133 iCN*Ana*

**Key:** [0-9]cna[*i*][*n*]

**Info:** Time or spectral coordinate name/description

**Type:** string

**HDU:** extension

**Description:** [iCNAna] Similar to CNAMEia except this is keyword for BINTABLE vector.

### 3.134 TCN*Ana*

**Key:** tcna[*n*][*a*]

**Info:** Time or spectral coordinate name/description

**Type:** string

**HDU:** any

**Description:** [TCNAna] Similar to CNAMEia except this is keyword for pixel list or table.



### 3.135 RESTFRQa

**Key:** restfrq[*a*]

**Info:** Rest frequency of spectral feature of interest

**Type:** float

**HDU:** any

**Description:** [floating point; default: none]. Rest frequency of the of the spectral feature of interest. The physical unit must be Hz.

### 3.136 RESTFREQ

**Key:** restfreq

**Info:** [Deprecated] Rest frequency of spectral feature of interest

**Type:** float

**HDU:** any

**Description:** This keyword is identical to RESTFRQa.

### 3.137 RFRQna

**Key:** rfrq[*n*][*a*]

**Info:** Rest frequency of spectral feature of interest

**Type:** float

**HDU:** extension

**Description:** [RFRQna] Similar to RESTFRQa except this is keyword for BINTABLE vector and pixel list alike.

### 3.138 RESTWAVa

**Key:** restwav[*a*]

**Info:** Vacuum rest wavelength of the spectral feature of interest

**Type:** float

**HDU:** any

**Description:** [RESTWAVa] [floating point; default: none]. Vacuum rest wavelength of the spectral feature of interest. The physical unit must be m.

### 3.139 RWAVna

**Key:** rwav[*n*][*a*]

**Info:** Vacuum rest wavelength of the spectral feature of interest

**Type:** float

**HDU:** extension

**Description:** [RWAVna] Similar to RESTWAVn except this is keyword for BINTABLE vector and pixel list alike.

### 3.140 DATE-AVG

**Key:** date\_avg

**Info:** Calendar date of the mid-point of observation

**Type:** string

**HDU:** any

**Description:** [character; default: none]. Calendar date of the mid-point of the observation, expressed in the same way as the DATE-OBS keyword.

### 3.141 DAVGn

**Key:** davg[*n*]

**Info:** Calendar date of the mid-point of observation

**Type:** string

**HDU:** extension

**Description:** [DAVn] Similar to DATE-AVG except this is keyword for BINTABLE vector and pixel list alike.

### 3.142 MJD-AVG

**Key:** mjd\_avg

**Info:** MJD of the mid-point of the observation

**Type:** float

**HDU:** any

**Description:** [floating point; default: none]. Modified Julian Date (JD – 2,400,000.5) of the mid-point of the observation.

### 3.143 MJDA<sub>n</sub>

**Key:** mjda[*n*]

**Info:** MJD of the mid-point of the observation

**Type:** float

**HDU:** extension

**Description:** [MJDAn] Similar to MJD-AVG except this is keyword for BINTABLE vector and pixel list alike.

### 3.144 SPECSYSa

**Key:** specsyst[a]

**Info:** Reference frame of spectral axis coordinate

**Type:** string

**HDU:** any

**Description:** [SPECSYSa] [character; default: none]. The reference frame in use for the spectral axis coordinate(s). Valid values are given F2W in Table 27 of the 'FITS Standard' document.

### 3.145 SPECNa

**Key:** spec[n][a]

**Info:** Reference frame of spectral axis coordinate

**Type:** string

**HDU:** extension

**Description:** [SPECNa] Similar to SPECNa except this is keyword for BINTABLE vector and pixel list alike.

### 3.146 SSYSOBSa

**Key:** ssysobs[a]

**Info:** Constant spectral reference frame over the range of non-spectral WCS

**Type:**

**HDU:** any

**Description:** [SSYSOBSa] [character; default: TOPOCENT]. The spectral reference frame that is constant over the range of the non-spectral world coordinates. Valid values are given in Table 27 of the 'FITS Standard' document.

### 3.147 SOBSNa

**Key:** sobs[n][a]

**Info:** Constant spectral reference frame over the range of non-spectral WCS

**Type:** string

**HDU:** extension

**Description:** [SOBSNa] Similar to SSYSOBSa except this is keyword for BINTABLE vector and pixel list alike.

### 3.148 OBSGEO-X

**Key:** obsgeo\_x

**Info:** X-coordinate of geocentric reference frame relative to standard

**Type:** float

**HDU:** any

**Description:** [floating point; default: none]. X-coordinate (in meters) of a Cartesian triplet that specifies the location, with respect to a standard, geocentric terrestrial reference frame, where the observation took place. The coordinate must be valid at the epoch MJD-AVG or DATE-AVG.

### 3.149 OBSGXn

**Key:** obsgx[n]

**Info:** X-coordinate of geocentric reference frame relative to standard

**Type:** float

**HDU:** extension

**Description:** [OBSGXn] Similar to OBSGEO-X except this is keyword for BINTABLE vector and pixel list alike.

### 3.150 OBSGEO-Y

**Key:** obsgeo\_y

**Info:** Y-coordinate of geocentric reference frame relative to standard

**Type:** float

**HDU:** any

**Description:** [floating point; default: none]. Y-coordinate (in meters) of a Cartesian triplet that specifies the location, with respect to a standard, geocentric terrestrial reference frame, where the observation took place. The coordinate must be valid at the epoch MJD-AVG or DATE-AVG.

### 3.151 OBSGYn

**Key:** obsgy[n]

**Info:** Y-coordinate of geocentric reference frame relative to standard

**Type:** float

**HDU:** extension

**Description:** [OBSGYn] Similar to OBSGEO-Y except this is keyword for BINTABLE vector and pixel list alike.

### 3.152 OBSGEO-Z

**Key:** obsgeo\_z

**Info:** Z-coordinate of geocentric reference frame relative to standard

**Type:** float

**HDU:** any

**Description:** [floating point; default: none]. Z-coordinate (in meters) of a Cartesian triplet that specifies the location, with respect to a standard, geocentric terrestrial reference frame, where the observation took place. The coordinate must be valid at the epoch MJD-AVG or DATE-AVG.

### 3.153 OBSGZn

**Key:** obsgz[n]

**Info:** Z-coordinate of geocentric reference frame relative to standard

**Type:** float

**HDU:** extension

**Description:** [OBSGZn] Similar to OBSGEO-Z except this is keyword for BINTABLE vector and pixel list alike.

### 3.154 SSYSSRCa

**Key:** ssyssrc[a]

**Info:** Reference frame of systemic velocity of observed source

**Type:** float

**HDU:** any

**Description:** [SSYSSRCa] [character; default: none]. Reference frame for the value expressed in the ZSOURCEa keyword to document the systemic velocity of the observed source. Value must be one of those given in Table 27 in the 'FITS Standard' document except for SOURCE.

### 3.155 SSRCna

**Key:** ssrc[n][a]

**Info:** Reference frame of systemic velocity of observed source

**Type:** float

**HDU:** extension

**Description:** [SSRCna] Similar to SSYSSRCa except this is keyword for BINTABLE vector and pixel list alike.

### 3.156 VELOSYSa

**Key:** velosys[*a*]

**Info:** Relative radial velocity between observer and selected standard of rest

**Type:** float

**HDU:** any

**Description:** [VELOSYSa] [floating point; default: none]. Relative radial velocity between the observer and the selected standard of rest in the direction of the celestial reference coordinate. Units must be m/s. The CUNITia keyword is not used for this purpose since the WCS version a might not be expressed in velocity units.

### 3.157 VSYSna

**Key:** vsys[*n*][*a*]

**Info:** Relative radial velocity between observer and selected standard of rest

**Type:** float

**HDU:** extension

**Description:** [VSYSna] Similar to VELOSYSa except this is keyword for BINTABLE vector and pixel list alike.

### 3.158 ZSOURCEa

**Key:** zsource[*a*]

**Info:** Redshift of source

**Type:** float

**HDU:** any

**Description:** [ZSOURCEa] [floating point; default: none]. Radial velocity with respect to an alternative frame of rest, expressed as a unitless redshift (i.e., velocity as a fraction of the speed of light in vacuum). Used in conjunction with SSYSSRCa to document the systemic velocity of the observed source.

### 3.159 ZSOUNa

**Key:** zsou[*n*][*a*]

**Info:** Redshift of source

**Type:** float

**HDU:** extension

**Description:** [ZSOUNa] Similar to ZSOURCEa except this is keyword for BINTABLE vector and pixel list alike.

### 3.160 VELANGL*na*

**Key:** velangl[*n*][*a*]

**Info:** Space velocity vector angle of source

**Type:** float

**HDU:** any

**Description:** [VELANGL*na*] [floating point; default:+90.]. In the case of relativistic velocities (e.g., a beamed astrophysical jet) the transverse velocity component is important. This keyword may be used to express the orientation of the space velocity vector with respect to the plane of the sky. See Appendix A of reference Greisen et al. (2006) for further details.

### 3.161 VANG*na*

**Key:** vang[*n*][*a*]

**Info:** Space velocity vector angle of source

**Type:** float

**HDU:** extension

**Description:** [VANG*na*] Similar to VELANGL*a* except this is keyword for BINTABLE vector and pixel list alike.

## ADDITIONAL BASELINE FITS KEYWORDS

**Description:** Supplemental keywords for FITS headers. These keywords are not found the FITS Standard. The keywords and descriptions in some cases are derived, sometimes inherited verbatim, from the ‘Introduction to the HST Data Handbooks’, Data Handbooks from WFC3, STIS, etc., ‘ESO Data Interface Control Document (GEN-SPE-ESO-19400-0794)’, and Chandra’s ‘ASC FITS Designers’ Guide ASC-FITS-2.1.0’

### 4.1 PROPOSID

**Key:** proposid

**Info:** Proposal ID

**Type:** string

**HDU:** any

**Description:** Proposal ID. This corresponds to IVOA ‘proposal\_id’ and ‘Proposal.Identifier’ Spectral Data Model.

### 4.2 PROPTYPE

**Key:** proptype

**Info:** Proposal type

**Type:** string

**HDU:** any

**Description:** Proposal type. Type of proposal, e.g. large (multi-cycle) survey, general observer, theory, archival, etc.

### 4.3 PI\_COI

**Key:** pi\_coi

**Info:** Names of PI and CO-Is (Initials and Surname)

**Type:** string

**HDU:** any

**Description:** (PI-COI) The PI or Co-I’s initials followed by his/her surname



## 4.4 PI\_LAST

**Key:** pi\_last

**Info:** Last name of the principle investigator

**Type:** string

**HDU:** any

**Description:** Last name of the principle investigator

## 4.5 PI\_FIRST

**Key:** pi\_first

**Info:** First name of the principle investigator

**Type:** string

**HDU:** any

**Description:** First name of the principle investigator

## 4.6 PI\_MIDDL

**Key:** pi\_middl

**Info:** Middle name of the principle investigator

**Type:** string

**HDU:** any

**Description:** Middle name of the principle investigator

## 4.7 SUN\_ALT

**Key:** sun\_alt

**Info:** Altitude of the sun

**Type:** float

**HDU:** any

**Description:** Altitude of the sun above horizon

## 4.8 SUNANGLE

**Key:** sunangle

**Info:** Angle between sun and z-axis

**Type:** float

**HDU:** any

**Description:** Angle between sun and z-axis. The value field shall contain a floating point number giving the angle between the direction of the observation (e.g., the optical axis of the telescope or the position of the target) and the sun, measured in degrees.

## 4.9 MOONANGL

**Key:** moonangl

**Info:** Angle between moon and z-axis

**Type:** float

**HDU:** any

**Description:** Angle between moon and z-axis. The value field shall contain a floating point number giving the angle between the direction of the observation (e.g., the optical axis of the telescope or the position of the target) and the moon, measured in degrees.

## 4.10 REFFRAME

**Key:** refframe

**Info:** Guide star catalog version

**Type:** string

**HDU:** any

**Description:** Guide star catalog version

## 4.11 TIME-OBS

**Key:** time\_obs

**Info:** [Deprecated in favor of DATE-OBS] UT time of start of observation (hh:mm:ss)

**Type:** string

**HDU:** any

**Description:** [Deprecated in favor of DATE-OBS] UT time of start of observation (hh:mm:ss). The value field shall contain a character string that gives the time at which the observation started. This keyword is used in conjunction with the standard DATE-OBS keyword to give the starting time of the observation; the DATE-OBS keyword gives the starting calendar date, with format 'yyyy-mm-dd', and TIME-OBS gives the time within that day using the format 'hh:mm:ss.sss...'. This keyword should not be used if the time is included directly as part of the DATE-OBS keyword value with the format 'yyyy-mm-ddThh:mm:ss.sss'.

## 4.12 EXPSTART

**Key:** expstart

**Info:** [Deprecated in favor of TSTART] Exposure start time (Modified Julian Date)

**Type:** float

**HDU:** any

**Description:** [Deprecated in favor of TSTART] Exposure start time (Modified Julian Date)

## 4.13 EXPEND

**Key:** expend

**Info:** [Deprecated in favor of TSTOP] Exposure end time (Modified Julian Date)

**Type:** float

**HDU:** any

**Description:** Exposure end time (Modified Julian Date)

## 4.14 EXPTIME

**Key:** exptime

**Info:** [Deprecated in favor of XPOSURE] On-detector, open-shutter, integration time (seconds)

**Type:** float

**HDU:** any

**Description:** [Deprecated in favor of XPOSURE] Provides the integration time in seconds. The value field shall contain a floating point number giving the exposure time of the observation in units of seconds. The exact definition of 'exposure time' is mission dependent and may, for example, include corrections for shutter open and close duration, detector dead time, vignetting, or other effects. Although not a standard use, EXPTIME is commonly used to calculate the flux of a source via:  $\text{Flux} = \text{ADU} / \text{EXPTIME}$ . It is advisable to respect this usage. Under this definition, when multiple images are combined into one, EXPTIME is sometimes used with NCOMBINE to reflect the type of combining operation: if the images are summed then EXPTIME is the total open shutter integration, summed over all the sub-exposures, but with NCOMBINE=1. If N subexposures are averaged together into 1, then EXPTIME is the average exposure time, and with NCOMBINE = N. The purpose of defining NCOMBINE in this way is to facilitate the calculation of image statistics.

## 4.15 EXPFLAG

**Key:** expflag

**Info:** Exposure interrupt indicator

**Type:** string

**HDU:** any

**Description:** Exposure interrupt indicator

## 4.16 QUALCOM $n$

**Key:** qualcom[ $n$ ]

**Info:** Data quality comment  $n$

**Type:** string

**HDU:** any

**Description:** Data quality comment  $n$

## 4.17 QUALITY

**Key:** quality

**Info:** Data quality summary

**Type:** string

**HDU:** any

**Description:** Data quality summary

## 4.18 INSTITUT

**Key:** institut

**Info:** Institutions of the PI/Co-I

**Type:** string

**HDU:**

**Description:** Institutions of the PI/Co-I

## 4.19 TARGNAME

**Key:** targname

**Info:** Target name

**Type:** string

**HDU:** any

**Description:** The value field shall contain a character string giving a name for the observed object that conforms to the IAU astronomical object naming conventions. The value of this keyword is more strictly constrained than for the standard OBJECT keyword which in practice has often been used to record other ancillary information about the observation (e.g. filter, exposure time, weather conditions, target category, etc.). This keyword never specifies target category. Corresponds to IVOA ‘target\_name’.

## 4.20 TARGDESC

**Key:** targdesc

**Info:** Target description

**Type:** string

**HDU:** any

**Description:** Target description is used to describe a target more generally than its category.

## 4.21 VROT

**Key:** vrot

**Info:** Projected rotational velocity of target ( $v * \sin i$ )

**Type:** float

**HDU:** any

**Description:** Projected rotation velocity of target ( $v * \sin i$ ).

## 4.22 EBV

**Key:** ebv

**Info:** Color excess E(B-V)

**Type:** float

**HDU:** any

**Description:** Color excess E(B-V).

## 4.23 RA\_TARG

**Key:** ra\_targ

**Info:** Right ascension of the target in mean places of equinox

**Type:** float

**HDU:** any

**Description:** Right ascension of the target in mean places of equinox. The value field gives the right ascension of the observation. It may be expressed either as a floating point number in units of decimal degrees, or as a character string in 'hr:mm:ss.sss' format where the decimal point and number of fractional digits are optional. The coordinate reference frame is given by the RADECSYS keyword, and the coordinate epoch is given by the EQUINOX keyword. Example: 12.25944 or '12:15:34.00'. Also corresponds to the IVOA 'Target.Pos' Spectral Data Model.

## 4.24 DEC\_TARG

**Key:** dec\_targ

**Info:** Declination of the target in mean places of equinox

**Type:** float

**HDU:** any

**Description:** Declination of the target in mean places of equinox. The value field gives the declination of the observation. It may be expressed either as a floating point number in units of decimal degrees, or as a character string in 'dd:mm:ss.sss' format where the decimal point and number of fractional digits are optional. The coordinate reference frame is given by the RADECSYS keyword, and the coordinate epoch is given by the EQUINOX keyword. Example: -47.25944 or '-47:15:34.00'. Also corresponds to the IVOA 'Target.Pos' Spectral Data Model.

## 4.25 ECL\_LONG

**Key:** ecl\_long

**Info:** Ecliptic longitude of target (deg)

**Type:** float

**HDU:** any

**Description:** Ecliptic longitude of target (deg)

## 4.26 ECL\_LAT

**Key:** ecl\_lat

**Info:** Ecliptic latitude of target (deg)

**Type:** float

**HDU:** any

**Description:** Ecliptic latitude of target (deg)

## 4.27 GAL\_LONG

**Key:** gal\_long

**Info:** Galactic longitude of target (deg)

**Type:** float

**HDU:** any

**Description:** Galactic longitude of target (deg)

## 4.28 GAL\_LAT

**Key:** gal\_lat

**Info:** Galactic latitude of target (deg)

**Type:** float

**HDU:** any

**Description:** Galactic latitude of target (deg)

## 4.29 TEQUINOX

**Key:** tequinox

**Info:** Equinox of the target

**Type:** float

**HDU:** any

**Description:** Equinox of the target

## 4.30 RV\_HELIO

**Key:** rv\_helio

**Info:** Target heliocentric radial velocity

**Type:** float

**HDU:** any

**Description:** Target heliocentric radial velocity

## 4.31 PM\_FLAG

**Key:** pm\_flag

**Info:** Does this target have proper motion?

**Type:** boolean

**HDU:** any

**Description:** Does this target have proper motion

## 4.32 PM\_RA

**Key:** pm\_ra

**Info:** Target proper motion in RA

**Type:** float

**HDU:** any

**Description:** Target proper motion in RA

## 4.33 PM\_DEC

**Key:** pm\_dec

**Info:** Target proper motion in DEC

**Type:** float

**HDU:** any

**Description:** Target proper motion in DEC

## 4.34 PM\_EQNX

**Key:** pm\_eqnx

**Info:** Equinox of target proper motion

**Type:** string

**HDU:** any

**Description:** Equinox of target proper motion, from proposal

## 4.35 PARALLAX

**Key:** parallax

**Info:** Target parallax

**Type:** float

**HDU:** any

**Description:** Target parallax

## 4.36 GS<sub>n</sub>\_ID

**Key:** gs[*n*]<sub>id</sub>

**Info:** ID of the guide star

**Type:** float

**HDU:** any

**Description:** ID of the guide star



## 4.37 GSn\_RA

**Key:** gs[n]\_ra

**Info:** Right ascension of the guide stars in mean places of equinox

**Type:** float

**HDU:** any

**Description:** Right ascension of the guide stars in mean places of equinox

## 4.38 GSn\_DEC

**Key:** gs[n]\_dec

**Info:** Declination of the guide stars in mean places of equinox

**Type:** float

**HDU:** any

**Description:** Declination of the guide stars in mean places of equinox

## 4.39 GSn\_MAG

**Key:** gs[n]\_mag

**Info:** Guide star magnitude

**Type:** float

**HDU:** any

**Description:** Guide star magnitude

## 4.40 GSn\_FILT

**Key:** gs[n]\_filt

**Info:** Passband of guide star magnitude

**Type:** string

**HDU:** any

**Description:** Passband of guide star magnitude

## 4.41 GSn\_EQNX

**Key:** gs[n]\_eqnx

**Info:** Equinox of the guidestars

**Type:** float

**HDU:** any

**Description:** Equinox of the guidestars

## 4.42 GS1\_ID

**Key:** gs1\_id

**Info:** ID of the guide star 1

**Type:** float

**HDU:** any

**Description:** ID of the guide star 1

## 4.43 GS1\_RA

**Key:** gs1\_ra

**Info:** Right ascension of the guide star 1 in mean places of equinox

**Type:** float

**HDU:** any

**Description:** Right ascension of the guide star 1 in mean places of equinox

## 4.44 GS1\_DEC

**Key:** gs1\_dec

**Info:** Declination of the guide star 1 in mean places of equinox

**Type:** float

**HDU:** any

**Description:** Declination of the guide star 1 in mean places of equinox

## 4.45 GS1\_MAG

**Key:** gs1\_mag

**Info:** Guide star 1 magnitude

**Type:** float

**HDU:** any

**Description:** Guide star 1 magnitude

## 4.46 GS1\_FILT

**Key:** gs1\_filt

**Info:** Passband of guide star 1 magnitude

**Type:** string

**HDU:** any

**Description:** Passband of guide star 1 magnitude

## 4.47 GS1\_EQNX

**Key:** gs1\_eqnx

**Info:** Equinox of the guidestar 1

**Type:** float

**HDU:** any

**Description:** Equinox of the guidestar 1

## 4.48 GS2\_ID

**Key:** gs2\_id

**Info:** ID of the guide star 2

**Type:** float

**HDU:** any

**Description:** ID of the guide star 2

## 4.49 GS2\_RA

**Key:** gs2\_ra

**Info:** Right ascension of the guide star 2 in mean places of equinox

**Type:** float

**HDU:** any

**Description:** Right ascension of the guide star 2 in mean places of equinox

## 4.50 GS2\_DEC

**Key:** gs2\_dec

**Info:** Declination of the guide star 2 in mean places of equinox

**Type:** float

**HDU:** any

**Description:** Declination of the guide star 2 in mean places of equinox

## 4.51 GS2\_MAG

**Key:** gs2\_mag

**Info:** Guide star 2 magnitude

**Type:** float

**HDU:** any

**Description:** Guide star 2 magnitude

## 4.52 GS2\_FILT

**Key:** gs2\_filt

**Info:** Passband of guide star 2 magnitude

**Type:** string

**HDU:** any

**Description:** Passband of guide star 2 magnitude

## 4.53 GS2\_EQNX

**Key:** gs2\_eqnx

**Info:** Equinox of the guidestar 2

**Type:** float

**HDU:** any

**Description:** Equinox of the guidestar 2

## 4.54 GS3\_ID

**Key:** gs3\_id

**Info:** ID of the guide star 3

**Type:** float

**HDU:** any

**Description:** ID of the guide star 3

## 4.55 GS3\_RA

**Key:** gs3\_ra

**Info:** Right ascension of the guide star 3 in mean places of equinox

**Type:** float

**HDU:** any

**Description:** Right ascension of the guide star 3 in mean places of equinox

## 4.56 GS3\_DEC

**Key:** gs3\_dec

**Info:** Declination of the guide star 3 in mean places of equinox

**Type:** float

**HDU:** any

**Description:** Declination of the guide star 3 in mean places of equinox

## 4.57 GS3\_MAG

**Key:** gs3\_mag

**Info:** Guide star 3 magnitude

**Type:** float

**HDU:** any

**Description:** Guide star 3 magnitude

## 4.58 GS3\_FILT

**Key:** gs3\_filt

**Info:** Passband of guide star 3 magnitude

**Type:** string

**HDU:** any

**Description:** Passband of guide star 3 magnitude

## 4.59 GS3\_EQNX

**Key:** gs3\_eqnx

**Info:** Equinox of the guidestar 3

**Type:** float

**HDU:** any

**Description:** Equinox of the guidestar 3

## 4.60 GS4\_ID

**Key:** gs4\_id

**Info:** ID of the guide star 4

**Type:** float

**HDU:** any

**Description:** ID of the guide star 4

## 4.61 GS4\_RA

**Key:** gs4\_ra

**Info:** Right ascension of the guide star 4 in mean places of equinox

**Type:** float

**HDU:** any

**Description:** Right ascension of the guide star 4 in mean places of equinox

## 4.62 GS4\_DEC

**Key:** gs4\_dec

**Info:** Declination of the guide star 4 in mean places of equinox

**Type:** float

**HDU:** any

**Description:** Declination of the guide star 4 in mean places of equinox

## 4.63 GS4\_MAG

**Key:** gs4\_mag

**Info:** Guide star 4 magnitude

**Type:** float

**HDU:** any

**Description:** Guide star 4 magnitude

## 4.64 GS4\_FILT

**Key:** gs4\_filt

**Info:** Passband of guide star 4 magnitude

**Type:** string

**HDU:** any

**Description:** Passband of guide star 4 magnitude

## 4.65 GS4\_EQNX

**Key:** gs4\_eqnx

**Info:** Equinox of the guidestar 4

**Type:** float

**HDU:** any

**Description:** Equinox of the guidestar 4

## 4.66 PA\_V3

**Key:** pa\_v3

**Info:** Position angle of the V3 axis.

**Type:** float

**HDU:** any

**Description:** Position angle of the V3 axis. The V3-axis vector points toward the origin of the instrument aperture (deg), from the center of the focal plane; it is analogous to HST PA\_V3.

## 4.67 RA\_OFF

**Key:** ra\_off

**Info:** Telescope offset in RA from target position for observation

**Type:** float

**HDU:** any

**Description:** Telescope offset in RA from target position for observation

## 4.68 DEC\_OFF

**Key:** dec\_off

**Info:** Telescope offset in DEC from target position for observation

**Type:** float

**HDU:** any

**Description:** Telescope offset in DEC from target position for observation

## 4.69 EQNX\_OFF

**Key:** eqnx\_off

**Info:** Equinox of the offset, in case different from target equinox

**Type:** float

**HDU:** any

**Description:** Equinox of the offset, in case different from target equinox

## 4.70 POSTARG1

**Key:** postarg1

**Info:** Telescope Offset in axis 1 direction (usually x)

**Type:** float

**HDU:** any

**Description:** Telescope Offset in axis 1 direction (usually x)

## 4.71 POSTARG2

**Key:** postarg2

**Info:** Telescope Offset in axis 2 direction (usually y)

**Type:** float

**HDU:** any

**Description:** Telescope Offset in axis 2 direction (usually y)

## 4.72 XOFFSET

**Key:** xoffset

**Info:** Telescope Offset in X from target position for observation

**Type:** float

**HDU:** any

**Description:** Telescope Offset in X from target position for observation



## 4.73 YOFFSET

**Key:** yoffset

**Info:** Telescope Offset in Y from target position for observation

**Type:** float

**HDU:** any

**Description:** Telescope Offset in Y from target position for observation

## 4.74 TOTEXPT

**Key:** totexpt

**Info:** [Deprecated in favor of TELAPSE] Total exposure time

**Type:** float

**HDU:** any

**Description:** [Deprecated in favor of TELAPSE] Total exposure time

## 4.75 SCI\_CAT

**Key:** sci\_cat

**Info:** Science category (e.g. unresolved stellar pop, galaxy structure.

**Type:** string

**HDU:** any

**Description:** Science category (e.g. unresolved stellar pop, galaxy structure.

## 4.76 SCI\_KWD

**Key:** sci\_kwd

**Info:** Scientific keywords (e.g. Black Holes, Galaxy Bulges, Galaxy Formation and Evolution, etc.

**Type:** string

**HDU:** any

**Description:** Scientific keywords (e.g. Black Holes, Galaxy Bulges, Galaxy Formation and Evolution, etc.

## 4.77 UTC

**Key:** utc

**Info:** Time in seconds elapsed since midnight of start of exposure

**Type:** float

**HDU:** any

**Description:** Gives the time in seconds elapsed since midnight of the start of the exposure as known to TCS. The time on TCS is synchronized with the observatory time system via a dedicated time module. In practice, MJD-OBS, UTC, and LST, provide for a redundant consistency check mechanism in case of malfunction.

## 4.78 LST

**Key:** lst

**Info:** Local Sidereal Time, in seconds elapsed since midnight of the start of the exposure as known to the TCS.

**Type:** float

**HDU:** any

**Description:** Local Sidereal Time, in seconds elapsed since midnight of the start of the exposure as known to the TCS.

## 4.79 IRAF-TLM

**Key:** iraf\_tlm

**Info:** (IRAF-TLM) Time of last modification [To be Deleted?]

**Type:** string

**HDU:** any

**Description:** (IRAF-TLM) Time of last modification [To be Deleted?]

## 4.80 FILENAME

**Key:** filename

**Info:** Name of the originating data file

**Type:** string

**HDU:** any

**Description:** The value field shall contain a character string giving the host file name used to record the original data.

## 4.81 FILETYPE

**Key:** filetype

**Info:** Type of data found in data file (SCI, CALIB, RAW, etc.)

**Type:** string

**HDU:** any

**Description:** Type of data found in data file. The value field shall contain a character string giving the file type suffix of the host file name. The full file name typically consists of the root name (see ROOTNAME) followed by a file type suffix (e.g. SCI, CALIB, RAW, etc.). [Note: Evaluate whether to replace this keyword with HDUCLASS.]

## 4.82 ROOTNAME

**Key:** rootname

**Info:** Rootname of the observation set

**Type:** string

**HDU:** any

**Description:** Rootname of the observation set. The value field shall contain a character string giving the root of the host file name. The full file name typically consists of the root name followed by a file type suffix (see FILETYPE), separated by the period ('.') character.

## 4.83 IMAGETYP

**Key:** imagetyp

**Info:** Type of exposure identifier (e.g. EXT)

**Type:** string

**HDU:** any

**Description:** Type of exposure identifier (e.g. EXT)

## 4.84 PRIMESI

**Key:** primesi

**Info:** Instrument designated as prime [DELETE?]

**Type:** string

**HDU:** any

**Description:** Instrument designated as prime [DELETE?]

## 4.85 ORIGFILE

**Key:** origfile

**Info:** Original file name

**Type:** string

**HDU:** any

**Description:** Records the original file name, as assigned at the instrument workstation. This is an alternative file name.

## 4.86 ARCFILE

**Key:** arcfile

**Info:** Archive file name

**Type:** string

**HDU:** any

**Description:** Provides the name under which the file is stored in the archive

## 4.87 CHECKSUM

**Key:** checksum

**Info:** Exposure integrity checksum

**Type:** string

**HDU:** any

**Description:** Provides a Cyclic Redundant Check (CRC) calculation for each HDU, using the ASCII encoded 1's complement algorithm. The value field of the CHECKSUM keyword shall contain a 16 character string, left justified starting in column 12, containing the ASCII encoded complement of the checksum of the FITS HDU (Header and Data Unit). The algorithm shall be the 32-bit 1's complement checksum and the ASCII encoding that are described in the checksum proposal. The checksum is accumulated in FITS datastream order on the same HDU, identical in all respects, except that the value of the CHECKSUM keyword shall be set to the string '0000000000000000' (ASCII 0's, hex 30) before the checksum is computed.

## 4.88 CHECKVER

**Key:** checkver

**Info:** Version of checksum algorithm

**Type:**

**HDU:** any

**Description:** The value field of the CHECKVER keyword shall contain a string, unique in the first 8 characters, which distinguishes between any future alternative checksum algorithms which may be defined. The default value for a missing keyword shall be 'COMPLEMENT' which will represent the algorithm defined in the current proposal. It is recommended that this keyword be omitted from headers which implement the default ASCII encoded 32-bit 1's complement algorithm.

## 4.89 DATASUM

**Key:** datasum

**Info:** Data integrity checksum

**Type:** string

**HDU:** any

**Description:** Gives the checksum calculated for the data sections only. The value field of the DATASUM keyword shall be a character string containing the unsigned integer value of the checksum of the data records of the HDU. For dataless HDU's, this keyword may either be omitted, or the value field shall contain the string value '0', which is preferred. A missing DATASUM keyword asserts no knowledge of the checksum of the data records.

## 4.90 DATE-END

**Key:** date\_end

**Info:** Date of the end of observation

**Type:**

**HDU:** any

**Description:** The value field shall contain a character string that gives the date on which the observation ended. This keyword has the same format, and is used in conjunction with, the standard DATA-OBS keyword that gives the starting date of the observation. These 2 keywords may give either the calendar date using the 'yyyy-mm-dd' format, or may give the full date and time using the 'yyyy-mm-ddThh:mm:ss.sss' format.

## 4.91 RA\_NOM

**Key:** ra\_nom

**Info:** Nominal right ascension of the observation

**Type:**

**HDU:** any

**Description:** Nominal right ascension of the observation. The value field shall contain a floating point number giving the nominal Right Ascension of the pointing direction in units of decimal degrees. The coordinate reference frame is given by the RADECSYS keyword, and the coordinate epoch is given by the EQUINOX keyword. The precise definition of this keyword is instrument-specific, but typically the nominal direction corresponds to the direction to which the instrument was requested to point. The RA\_PNT keyword should be used to give the actual pointed direction.

## 4.92 DEC\_NOM

**Key:** dec\_nom

**Info:** Nominal declination of the observation

**Type:**

**HDU:** any

**Description:** Nominal declination of the observation. The value field shall contain a floating point number giving the nominal declination of the pointing direction in units of decimal degrees. The coordinate reference frame is given by the RADECSYS keyword, and the coordinate epoch is given by the EQUINOX keyword. The precise definition of this keyword is instrument-specific, but typically the nominal direction corresponds to the direction to which the instrument was requested to point. The DEC\_PNT keyword should be used to give the actual pointed direction.

## 4.93 INHERIT

**Key:** inherit

**Info:** Indicates whether header of primary HDU is inherited into extensions

**Type:** boolean

**HDU:** primary

**Description:** The presence of this keyword with a value = T in an extension header indicates that the keywords contained in the primary header (except the FITS Mandatory keywords, and any COMMENT, HISTORY or 'blank' keywords) are to be inherited, or logically included in that extension header.

## 4.94 PROCTIME

**Key:** proctime

**Info:** Pipeline processing time (MJD)

**Type:** float

**HDU:** any

**Description:** Pipeline processing time (MJD)

## 4.95 OBSTYPE

**Key:** obstype

**Info:** Observation type - imaging or spectroscopic

**Type:** string

**HDU:** any

**Description:** Observation type - imaging or spectroscopic

## 4.96 OBSMODE

**Key:** obsmode

**Info:** GMT Observing mode

**Type:** string

**HDU:** any

**Description:** GMT Observing mode. The value field shall contain a character string which gives the observing mode of the operation. Examples: 'SEEING-LIMITED', 'LTAO', 'NGS'

## 4.97 OPMODE

**Key:** opmode

**Info:** GMT Operating mode

**Type:** string

**HDU:** any

**Description:** GMT operating mode, e.g. queue, classical, target of opportunity, etc.

## 4.98 TOBSMODE

**Key:** tobsmode

**Info:** Telescope Observing mode

**Type:** string

**HDU:** any

**Description:** Telescope Observing mode. The value field shall contain a character string which gives the observing mode of the observation. This is used in cases where the instrument or detector can be configured to operate in different modes which significantly affect the resulting data. Examples: 'SLEW', 'RASTER', or 'POINTING'

## 4.99 SCLAMP

**Key:** slamp

**Info:** Lamp status, NONE or name of lamp which is on

**Type:** string

**HDU:** any

**Description:** Lamp status, NONE or name of lamp which is on

## 4.100 NRPTEXP

**Key:** nrptexp

**Info:** Number of repeat exposures in set: default 1

**Type:** integer

**HDU:** any

**Description:** Number of repeat exposures in set: default 1

## 4.101 SUBARRAY

**Key:** subarray

**Info:** Data from a subarray (T) or full frame (F)

**Type:** boolean

**HDU:** any

**Description:** Data from a subarray (T) or full frame (F)

## 4.102 DETECTOR

**Key:** detector

**Info:** Detector name in use

**Type:** string

**HDU:** any

**Description:** Detector name in use. The value field shall contain a character string giving the name of the detector within the instrument that was used to make the observation. Example: 'CCD1'.

## 4.103 FILTER<sub>*n*</sub>

**Key:** filter[*n*]

**Info:** Filter name selected from filter wheel

**Type:** string

**HDU:** any

**Description:** Filter name selected from filter wheel. The value field shall contain a character string which gives the name of the flux filter that was used during the observation. More than 1 filter may be listed by using the FILTER<sub>*n*</sub> indexed keyword. The value 'none' or 'NONE' indicates that no filter was used.

## 4.104 FILT\_ID

**Key:** filt\_id

**Info:** Filter ID selected from filter wheel

**Type:** string

**HDU:** any

**Description:** Filter ID selected from filter wheel



## 4.105 Camera

**Key:** camera

**Info:** Camera name or number in use

**Type:** string

**HDU:** any

**Description:** Camera name or number in use

## 4.106 APERTURE

**Key:** aperture

**Info:** Aperture name

**Type:** string

**HDU:** any

**Description:** Name of field of view aperture. The value field shall contain a character string which gives the name of the instrumental aperture through which the observation was made. This keyword is typically used in instruments which have a selection of apertures which restrict the field of view of the detector.

## 4.107 APER\_FOV

**Key:** aper\_fov

**Info:** Aperture field of view

**Type:** string

**HDU:** any

**Description:** Aperture field of view

## 4.108 FOCUS

**Key:** focus

**Info:** Instrument focus setting

**Type:** string

**HDU:** any

**Description:** Instrument focus setting

## 4.109 PROPAPER

**Key:** propaper

**Info:** Aperture specified in an observing proposal

**Type:** string

**HDU:** any

**Description:** Aperture specified in an observing proposal

## 4.110 DIRIMAGE

**Key:** dirimage

**Info:** Direct image for grism or prism exposure

**Type:** string

**HDU:** any

**Description:** Direct image for grism or prism exposure

## 4.111 NITER

**Key:** niter

**Info:** Number of exposure iterations

**Type:** integer

**HDU:** any

**Description:** Number of exposure iterations

## 4.112 NSAMP

**Key:** nsamp

**Info:** Number of MULTIACCUUM ramp samples

**Type:** integer

**HDU:** any

**Description:** Number of MULTIACCUUM ramp samples

## 4.113 NREAD

**Key:** nread

**Info:** Number of MULTIACCUUM initial and final readouts

**Type:** integer

**HDU:** any

**Description:** Number of MULTIACCUM initial and final readouts

## 4.114 READOUT

**Key:** readout

**Info:** Detector readout rate (FAST, SLOW)

**Type:** string

**HDU:** any

**Description:** Detector readout rate (FAST, SLOW)

## 4.115 SAMP\_SEQ

**Key:** samp\_seq

**Info:** MULTIACCUM exposure time sequence name

**Type:** string

**HDU:** any

**Description:** MULTIACCUM exposure time sequence name

## 4.116 SAMPZERO

**Key:** sampzero

**Info:** MULTIACCUM sample time of the zeroth read (sec)

**Type:** float

**HDU:** any

**Description:** MULTIACCUM sample time of the zeroth read (sec)

## 4.117 SUBTYPE

**Key:** subtype

**Info:** Size/type of subarray

**Type:** string

**HDU:** any

**Description:** Size/type of subarray

## 4.118 CRSPLIT

**Key:** crsplit

**Info:** Number of cosmic ray split exposures

**Type:** integer

**HDU:** any

**Description:** Number of cosmic ray split exposures

## 4.119 CENWAVE $n$

**Key:** cenwave[ $n$ ]

**Info:** Proposed central wavelength of spectrum

**Type:** integer

**HDU:** any

**Description:** Proposed central wavelength of spectrum

## 4.120 DQICORR

**Key:** dqicorr

**Info:** Flag for data quality check initialization

**Type:** string

**HDU:** any

**Description:** Flags for initializing and performing data quality checking procedures

## 4.121 BLEVCORR

**Key:** blevcorr

**Info:** Flag for subtracting bias level measured from overscan (UVIS) or reference pixels (IR)

**Type:** string

**HDU:** any

**Description:** Flag for subtract bias level measured from overscan (UVIS) or reference pixels (IR)

## 4.122 ILLMCORR

**Key:** illmcorr

**Info:** Flag for subtracting background illumination

**Type:** string

**HDU:** any

**Description:** Flag for subtracting background illumination

## 4.123 CRCORR

**Key:** crcorr

**Info:** Flag to combine observations to reject/identify cosmic rays hits

**Type:** string

**HDU:** any

**Description:** Flag to combine observations to reject/identify cosmic rays hits

## 4.124 DARKCORR

**Key:** darkcorr

**Info:** Flag to subtract dark image

**Type:** string

**HDU:** any

**Description:** Flag to subtract dark image

## 4.125 FLATCORR

**Key:** flatcorr

**Info:** Flag to apply flat field to data

**Type:** string

**HDU:** any

**Description:** Flag to apply flat field to data

## 4.126 PHOTCORR

**Key:** photcorr

**Info:** Flag to populate photometric header keywords

**Type:** string

**HDU:** any

**Description:** Flag to populate photometric header keywords

## 4.127 DRIZCORR

**Key:** drizcorr

**Info:** Flag to apply drizzle processing

**Type:** string

**HDU:** any

**Description:** Flag to apply drizzle processing

## 4.128 NLINCORR

**Key:** nlincorr

**Info:** Flag to correct for detector non-linearities

**Type:** string

**HDU:** any

**Description:** Flag to correct for detector non-linearities

## 4.129 RPTCORR

**Key:** rptcorr

**Info:** Flag to combine individual repeat observations

**Type:** string

**HDU:** any

**Description:** Flag to combine individual repeat observations

## 4.130 UNITCORR

**Key:** unitcorr

**Info:** Flag to convert to count rates (see also BUNIT)

**Type:** string

**HDU:** any

**Description:** Flag to convert to count rates (see also BUNIT)

## 4.131 ZSIGCORR

**Key:** zsigcorr

**Info:** Flag to apply zero read signal correction

**Type:** string

**HDU:** any

**Description:** Flag to apply zero read signal correction

## 4.132 ZOFFCORR

**Key:** zoffcorr

**Info:** Flag to subtract MULTIACCUM zero read

**Type:** string

**HDU:** any

**Description:** Flag to subtract MULTIACCUM zero read

## 4.133 ATODCORR

**Key:** atodcorr

**Info:** Flag to correct for analog to digital conversion errors

**Type:** string

**HDU:** any

**Description:** Flag to correct for analog to digital conversion errors

## 4.134 BIASCORR

**Key:** biascorr

**Info:** Flag to subtract bias image

**Type:** string

**HDU:** any

**Description:** Flag to subtract bias image

## 4.135 EXPSCORR

**Key:** expscorr

**Info:** Flag to process individual observations after CR-reject

**Type:** string

**HDU:** any

**Description:** Flag to process individual observations after CR-reject

## 4.136 FLSHCORR

**Key:** flshcorr

**Info:** Flag to apply post flash correction

**Type:** string

**HDU:** any

**Description:** Flag to apply post flash correction

## 4.137 SHADCORR

**Key:** shadcorr

**Info:** Flag to apply shutter shading correction

**Type:** string

**HDU:** any

**Description:** Flag to apply shutter shading correction

## 4.138 WAVECORR

**Key:** wavecorr

**Info:** Flag to use wavecal to adjust wavelength zeropoint

**Type:** string

**HDU:** any

**Description:** Flag to use wavecal to adjust wavelength zeropoint

## 4.139 X1DCORR

**Key:** x1dcorr

**Info:** Flag to perform 1-D spectral extraction

**Type:** string

**HDU:** any

**Description:** Flag to perform 1-D spectral extraction

## 4.140 BACKCORR

**Key:** backcorr

**Info:** Flag to perform background subtraction (sky and interorder)

**Type:** string



**HDU:** any

**Description:** Flag to perform background subtraction (sky and interorder)

## 4.141 HELCORR

**Key:** helcorr

**Info:** Flag to convert to heliocentric wavelengths

**Type:** string

**HDU:** any

**Description:** Flag to convert to heliocentric wavelengths

## 4.142 DISPCORR

**Key:** dispcorr

**Info:** Flag to apply 2-D dispersion solutions

**Type:** string

**HDU:** any

**Description:** Flag to apply 2-D dispersion solutions

## 4.143 FLUXCORR

**Key:** fluxcorr

**Info:** Flag to convert to absolute flux units

**Type:** string

**HDU:** any

**Description:** Flag to convert to absolute flux units

## 4.144 CTECORR

**Key:** ctecorr

**Info:** Flag to correct for CCD charge transfer inefficiency

**Type:** string

**HDU:** any

**Description:** Flag to correct for CCD charge transfer inefficiency

## 4.145 X2DCORR

**Key:** x2dcorr

**Info:** Flag to rectify 2-D spectral image

**Type:** string

**HDU:** any

**Description:** Flag to rectify 2-D spectral image

## 4.146 IMSTAT

**Key:** imstat

**Info:** Flag to calculate image statistics

**Type:** string

**HDU:** any

**Description:** Flag to calculate image statistics

## 4.147 BPIXTAB

**Key:** bpixtab

**Info:** Bad pixel table

**Type:** string

**HDU:** extension

**Description:** Bad pixel table

## 4.148 CCDTAB

**Key:** ccdtab

**Info:** Detector calibration parameters

**Type:** string

**HDU:** any

**Description:** Detector calibration parameters

## 4.149 CRREJTAB

**Key:** crrejt看

**Info:** Cosmic ray rejection parameter table

**Type:** string

**HDU:** extension

**Description:** Cosmic ray rejection parameter table

## 4.150 OSCNTAB

**Key:** oscntab

**Info:** Table containing overscan (UVIS) or reference (IR) pixel locations

**Type:** string

**HDU:** any

**Description:** Table containing overscan (UVIS) or reference (IR) pixel locations

## 4.151 CRREJTAB

**Key:** pixrejt看

**Info:** Cosmic ray rejection parameters

**Type:** string

**HDU:** any

**Description:** Cosmic ray rejection parameters

## 4.152 DARKFILE

**Key:** darkfile

**Info:** Superdark image file name

**Type:** string

**HDU:** any

**Description:** Superdark image file name

## 4.153 TDARKFIL

**Key:** tdarkfil

**Info:** Temperature dependent dark file name

**Type:** string

**HDU:** any

**Description:** Temperature dependent dark file name

## 4.154 PFLTFILE

**Key:** pfltfile

**Info:** Pixel to pixel flatfield file name

**Type:** string

**HDU:** any

**Description:** Pixel to pixel flatfield file name

## 4.155 DFLTFILE

**Key:** dfltfile

**Info:** Delta flatfield file name

**Type:** string

**HDU:** any

**Description:** Delta flatfield file name

## 4.156 LFLTFILE

**Key:** lfltfile

**Info:** Low order flat file

**Type:** string

**HDU:** any

**Description:** Low order flat file

## 4.157 TFLTFILE

**Key:** tfltfile

**Info:** Temperature dependent flat file

**Type:** string

**HDU:** any

**Description:** Temperature dependent flat file

## 4.158 FFLTFILE

**Key:** ffltfile

**Info:** Fringe correction flat file

**Type:** string

**HDU:** any

**Description:** Fringe correction flat file

## 4.159 MASKFILE

**Key:** maskfile

**Info:** Mask image file name

**Type:** string

**HDU:** any

**Description:** Mask image file name

## 4.160 NOISEFIL

**Key:** noisefil

**Info:** Detector read noise file name

**Type:** string

**HDU:** any

**Description:** Detector read noise file name

## 4.161 NLINFILE

**Key:** nlinfile

**Info:** Detector nonlinearities file

**Type:** string

**HDU:** any

**Description:** Detector nonlinearities file

## 4.162 GRAPHTAB

**Key:** graphtab

**Info:** Graph table

**Type:** string

**HDU:** any

**Description:** Graph table

## 4.163 COMPTAB

**Key:** comptab

**Info:** Components table

**Type:** string

**HDU:** any

**Description:** Components table

## 4.164 IDCTAB

**Key:** idctab

**Info:** Image distortion correction table

**Type:** string

**HDU:** any

**Description:** Image distortion correction table

## 4.165 PHOTTAB

**Key:** phottab

**Info:** Photometric throughput table

**Type:** string

**HDU:** any

**Description:** Photometric throughput table

## 4.166 APERTAB

**Key:** apertab

**Info:** Relative aperture throughput table

**Type:** string

**HDU:** any

**Description:** Relative aperture throughput table

## 4.167 DETTAB

**Key:** dettab

**Info:** Detector calibration parameters

**Type:** string

**HDU:** any

**Description:** Detector calibration parameters

## 4.168 DGEOFIELD

**Key:** dgeofile

**Info:** Distortion correction image

**Type:** string

**HDU:** any

**Description:** Distortion correction image

## 4.169 MDRIZTAB

**Key:** mdriztab

**Info:** MultiDrizzle parameter file

**Type:** string

**HDU:** any

**Description:** MultiDrizzle parameter file

## 4.170 DRIZTAB

**Key:** driztab

**Info:** Drizzle parameter file when not using MultiDrizzle

**Type:** string

**HDU:** any

**Description:** Drizzle parameter file when not using MultiDrizzle

## 4.171 ATODTAB

**Key:** atodtab

**Info:** Analog to digital correction file

**Type:** string

**HDU:** any

**Description:** Analog to digital correction file

## 4.172 BIASFILE

**Key:** biasfile

**Info:** Superbias image file name

**Type:** string

**HDU:** any

**Description:** Superbias image file name

## 4.173 FLSHFILE

**Key:** flshfile

**Info:** Post flash correction file name

**Type:** string

**HDU:** any

**Description:** Post flash correction file name

## 4.174 SHADFILE

**Key:** shadfile

**Info:** Shutter shading correction file

**Type:** string

**HDU:** any

**Description:** Shutter shading correction file

## 4.175 WAVECALF

**Key:** wavecalf

**Info:** Wavelength image file name

**Type:** string

**HDU:** any

**Description:** Wavelength image file name

## 4.176 SPTRCTAB

**Key:** sptrectab

**Info:** Spectrum trace table

**Type:** string



**HDU:** any

**Description:** Spectrum trace table

## 4.177 DISPTAB

**Key:** disptab

**Info:** Dispersion coefficient table

**Type:** string

**HDU:** any

**Description:** Dispersion coefficient table

## 4.178 LAMPTAB

**Key:** lamptab

**Info:** Template calibration lamp spectra table

**Type:** string

**HDU:** any

**Description:** Template calibration lamp spectra table

## 4.179 PCTAB

**Key:** pctab

**Info:** Photometry correction table

**Type:** string

**HDU:** any

**Description:** Photometry correction table

## 4.180 SDCTAB

**Key:** sdctab

**Info:** 2-D spatial distortion correction table

**Type:** string

**HDU:** any

**Description:** 2-D spatial distortion correction table

## 4.181 XTRACTAB

**Key:** xtractab

**Info:** Parameters for 1-D spectral extraction tab

**Type:** string

**HDU:** any

**Description:** Parameters for 1-D spectral extraction tab

## 4.182 WCPTAB

**Key:** wcptab

**Info:** Wavelength calibration parameter table

**Type:** string

**HDU:** any

**Description:** Wavelength calibration parameter table

## 4.183 MEANEXP

**Key:** meanexp

**Info:** Reference exposure time for parameters

**Type:** float

**HDU:** any

**Description:** Reference exposure time for parameters

## 4.184 SCALENSE

**Key:** scalense

**Info:** Multiplicative scale factor applied to noise

**Type:** float

**HDU:** any

**Description:** Multiplicative scale factor applied to noise

## 4.185 INITGUES

**Key:** initgues

**Info:** Initial guess method (MIN or MED)

**Type:** string

**HDU:** any

**Description:** Initial guess method (MIN or MED)

## 4.186 SKYSUB

**Key:** skysub

**Info:** Sky value subtracted (MODE or NONE)

**Type:** string

**HDU:** any

**Description:** Sky value subtracted (MODE or NONE)

## 4.187 SKYSUM

**Key:** skysum

**Info:** Sky level from the sum of all constituent images

**Type:** float

**HDU:** any

**Description:** Sky level from the sum of all constituent images

## 4.188 CRSIGMAS

**Key:** crsigmas

**Info:** Statistical rejection criteria

**Type:** string

**HDU:** any

**Description:** Statistical rejection criteria

## 4.189 CRRADIUS

**Key:** crradius

**Info:** Rejection propagation radius (pixels)

**Type:** float

**HDU:** any

**Description:** Rejection propagation radius (pixels)

## 4.190 CRTHRESH

**Key:** crthresh

**Info:** Rejection propagation threshold

**Type:** float

**HDU:** any

**Description:** TBC

## 4.191 BADINPDQ

**Key:** badinpdq

**Info:** Data quality flag bits to reject

**Type:** integer

**HDU:** any

**Description:** Data quality flag bits to reject

## 4.192 REJ\_RATE

**Key:** rej\_rate

**Info:** Rate at which pixels are affected by cosmic rays

**Type:** float

**HDU:** any

**Description:** Rate at which pixels are affected by cosmic rays

## 4.193 CRMASK

**Key:** crmask

**Info:** Flag CR-rejected pixels in input files (T/F)

**Type:** boolean

**HDU:** any

**Description:** Flag CR-rejected pixels in input files (T/F)

## 4.194 MDRIZSKY

**Key:** mdrizsky

**Info:** Sky value computed by MultiDrizzle

**Type:**

**HDU:** any

**Description:** Sky value computed by MultiDrizzle

## 4.195 PHOTMODE

**Key:** photmode

**Info:** Observation configuration mode for photometric calibration

**Type:** string

**HDU:** any

**Description:** Observation configuration mode for photometric calibration

## 4.196 PHOTFLAM

**Key:** photflam

**Info:** Inverse sensitivity, ergs/cm<sup>2</sup>/Ang/electron

**Type:** float

**HDU:** any

**Description:** Inverse sensitivity, ergs/cm<sup>2</sup>/Ang/electron

## 4.197 PHOTFNU

**Key:** photfnu

**Info:** Inverse sensitivity, Jy\*sec/electron

**Type:** float

**HDU:** any

**Description:** Inverse sensitivity, Jy\*sec/electron

## 4.198 PHOTZPT

**Key:** photzpt

**Info:** Magnitude zero point

**Type:** float

**HDU:** any

**Description:** Magnitude zero point

## 4.199 PHOTSYS

**Key:** photsys

**Info:** Photometric system

**Type:** float

**HDU:** string

**Description:** Photometric magnitude or flux system, e.g. Vega, AB, etc.

## 4.200 PHOTPLAM

**Key:** photplam

**Info:** Pivot wavelength (Angstroms)

**Type:** float

**HDU:** any

**Description:** Pivot wavelength (Angstroms)

## 4.201 PHOTBW

**Key:** photbw

**Info:** RMS bandwidth of filter plus detector (Angstroms)

**Type:** float

**HDU:** any

**Description:** RMS bandwidth of filter plus detector (Angstroms)

## 4.202 PATTERN1

**Key:** pattern1

**Info:** Primary pattern type

**Type:** string

**HDU:** any

**Description:** Primary pattern type: DITHER-BOX-MIN (4-step sampling), DITHER-LINE (2-point sampling) DITHER-LINE-3PT (3-point sampling), DITHER-BOX (4 point box sampling), GAP-LINE (2-point dithering over interchip gap) MOSAIC-LINE (full frame offset that uses single set of guide stars)

## 4.203 P1\_SHAPE

**Key:** p1\_shape

**Info:** Primary pattern shape

**Type:** string

**HDU:** any

**Description:** Primary pattern shape

## 4.204 P1\_PURPS

**Key:** p1\_purps

**Info:** Primary pattern purpose

**Type:** string

**HDU:** any

**Description:** Primary pattern purpose

## 4.205 P1\_NPTS

**Key:** p1\_npts

**Info:** Number of points in primary pattern

**Type:** integer

**HDU:** any

**Description:** Number of points in primary pattern

## 4.206 P1\_PSPAC

**Key:** p1\_pspac

**Info:** Point spacing for primary pattern (arc-sec)

**Type:** float

**HDU:** any

**Description:** Point spacing for primary pattern (arc-sec)

## 4.207 P1\_LSPAC

**Key:** p1\_lspac

**Info:** Line spacing for primary pattern (arc-sec)

**Type:** float

**HDU:** any

**Description:** Line spacing for primary pattern (arc-sec)

## 4.208 P1\_ANGLE

**Key:** p1\_angle

**Info:** Angle between sides of parallelogram pattern (deg)

**Type:** float

**HDU:** any

**Description:** Angle between sides of parallelogram pattern (deg)

## 4.209 P1\_FRAME

**Key:** p1\_frame

**Info:** Coordinate frame of primary pattern

**Type:** string

**HDU:** any

**Description:** Coordinate frame of primary pattern

## 4.210 P1\_ORINT

**Key:** p1\_orint

**Info:** Orientation of pattern to coordinate frame (deg)

**Type:** float

**HDU:** any

**Description:** Orientation of pattern to coordinate frame (deg)

## 4.211 P1\_CENTR

**Key:** p1\_centr

**Info:** Center pattern relative to pointing (yes/no)

**Type:** string

**HDU:** any

**Description:** Center pattern relative to pointing (yes/no)



## 4.212 PATTERN2

**Key:** pattern2

**Info:** Secondary pattern type

**Type:** string

**HDU:** any

**Description:** Primary pattern type: DITHER-BOX-MIN (4-step sampling), DITHER-LINE (2-point sampling), DITHER-LINE-3PT (3-point sampling), DITHER-BOX (4 point box sampling), GAP-LINE (2-point dithering over interchip gap), MOSAIC-LINE (full frame offset that uses single set of guide stars)

## 4.213 P2\_SHAPE

**Key:** p2\_shape

**Info:** Secondary pattern shape

**Type:** string

**HDU:** any

**Description:** Secondary pattern shape

## 4.214 P2\_PURPS

**Key:** p2\_purps

**Info:** Secondary pattern purpose

**Type:** string

**HDU:** any

**Description:** Secondary pattern purpose

## 4.215 P2\_NPTS

**Key:** p2\_npts

**Info:** Number of points in secondary pattern

**Type:** integer

**HDU:** any

**Description:** Number of points in secondary pattern

## 4.216 P2\_PSPAC

**Key:** p2\_pspac

**Info:** Point spacing for secondary pattern (arc-sec)

**Type:** float

**HDU:** any

**Description:** Point spacing for secondary pattern (arc-sec)

## 4.217 P2\_LSPAC

**Key:** p2\_lspac

**Info:** Line spacing for secondary pattern (arc-sec)

**Type:** float

**HDU:** any

**Description:** Line spacing for secondary pattern (arc-sec)

## 4.218 P2\_ANGLE

**Key:** p2\_angle

**Info:** Angle between sides of parallelogram pattern (deg)

**Type:** float

**HDU:** any

**Description:** Angle between sides of parallelogram pattern (deg)

## 4.219 P2\_FRAME

**Key:** p2\_frame

**Info:** Coordinate frame of secondary pattern

**Type:** string

**HDU:** any

**Description:** Coordinate frame of secondary pattern

## 4.220 P2\_ORINT

**Key:** p2\_orint

**Info:** Orientation of pattern to coordinate frame (deg)

**Type:** float

**HDU:** any

**Description:** Orientation of pattern to coordinate frame (deg)

## 4.221 P2\_CENTR

**Key:** p2\_centr

**Info:** Center pattern relative to pointing (yes/no)

**Type:** string

**HDU:** any

**Description:** Center pattern relative to pointing (yes/no)

## 4.222 PATTSTEP

**Key:** pattstep

**Info:** Position number of this point in the pattern

**Type:** integer

**HDU:** any

**Description:** Position number of this point in the pattern

## 4.223 RDMODE $n$

**Key:** rdmode[ $n$ ]

**Info:** Detector amplifier readout configuration

**Type:** string

**HDU:** any

**Description:** Detector amplifier readout configuration

## 4.224 DETOFFS $n$

**Key:** detoffs[ $n$ ]

**Info:** Commanded detector bias offset

**Type:** string

**HDU:** any

**Description:** Commanded detector bias offset

## 4.225 CMDGAIN

**Key:** cmdgain

**Info:** Commanded A-to-D conversion gain of detector

**Type:** float

**HDU:** any

**Description:** Commanded A-to-D conversion gain of detector

## 4.226 DETOFSAB

**Key:** detofsab

**Info:** Commanded detector bias offset for amps A&B

**Type:** integer

**HDU:** any

**Description:** Commanded detector bias offset for amps A&B

## 4.227 DETOFSCD

**Key:** detofscd

**Info:** Commanded detector bias offset for amps C&D

**Type:** integer

**HDU:** any

**Description:** Commanded detector bias offset for amps C&D

## 4.228 DETOFST $n$

**Key:** detofst([0-9a-zA-Z])

**Info:** Commanded detector bias offset for amplifier A

**Type:** string

**HDU:** any

**Description:** Commanded detector bias offset for amplifier A

## 4.229 ATODGN $n$

**Key:** atodg[ $n$ ]

**Info:** Measured gain for amplifier  $n$

**Type:** float

**HDU:** any

**Description:** Measured gain for amplifier n

## 4.230 RDNOISE $n$

**Key:** readns([0-9a-zA-Z])

**Info:** Measured readnoise for amplifier n

**Type:** float

**HDU:** any

**Description:** Measured readnoise for amplifier n

## 4.231 BIASLEV $n$

**Key:** biaslev([0-9a-zA-Z])

**Info:** Bias level for amplifier n

**Type:** float

**HDU:** any

**Description:** Bias level for amplifier n

## 4.232 DET\_CHP

**Key:** det\_chp

**Info:** Detector chip number

**Type:** integer

**HDU:** any

**Description:** Detector chip number

## 4.233 DETTEMP $n$

**Key:** dettemp[ $n$ ]

**Info:** Detector temperature

**Type:** float

**HDU:** any

**Description:** Detector temperature

## 4.234 PRECOL $n$

**Key:** precol[ $n$ ]

**Info:** Number of unbinned prescan columns per amplifier

**Type:** integer

**HDU:** any

**Description:** Number of unbinned prescan columns per amplifier

## 4.235 POSTPIX $n$

**Key:** postpix[ $n$ ]

**Info:** Number of unbinned overscan columns per amplifier

**Type:** integer

**HDU:** any

**Description:** number of unbinned overscan columns per amplifier

## 4.236 ASN\_ID

**Key:** asn\_id

**Info:** Unique identifier assigned to association

**Type:** string

**HDU:** any

**Description:** Unique identifier assigned to association

## 4.237 ASN\_TAB

**Key:** asn\_tab

**Info:** Name of the association file

**Type:** string

**HDU:** any

**Description:** Name of the association file

## 4.238 ASN\_MTYPE

**Key:** asn\_mtype

**Info:** Role of the member in the association

**Type:** string

**HDU:** any

**Description:** Role of the member in the association

## 4.239 EXPNAME

**Key:** expname

**Info:** Exposure identifier

**Type:** string

**HDU:** extension

**Description:** Exposure identifier

## 4.240 LTV1

**Key:** ltv1

**Info:** Offset in X to subsection start

**Type:** float

**HDU:** any

**Description:** Offset in X to subsection start

## 4.241 LTV2

**Key:** ltv2

**Info:** Offset in Y to subsection start

**Type:** float

**HDU:** any

**Description:** Offset in Y to subsection start

## 4.242 LTM1\_1

**Key:** ltm1\_1

**Info:** Reciprocal of sampling rate in X

**Type:** float

**HDU:** any

**Description:** Reciprocal of sampling rate in X

## 4.243 LTM2\_2

**Key:** ltm2\_2

**Info:** Reciprocal of sampling rate in Y

**Type:** float

**HDU:** any

**Description:** Reciprocal of sampling rate in Y

## 4.244 ORIENTAT

**Key:** orientat

**Info:** Position angle of image Y-axis (degrees East of North)

**Type:** float

**HDU:** any

**Description:** Position angle of image Y-axis (degrees East of North). The value field shall contain a floating point number giving the position angle of the y axis of the detector projected on the sky, in degrees east of north. This keyword is synonymous with the CROTA2 WCS keyword.

## 4.245 PA\_APER

**Key:** pa\_aper

**Info:** Position angle of reference aperture center (deg)

**Type:** float

**HDU:** any

**Description:** Position angle of reference aperture center (deg)

## 4.246 RA\_APER

**Key:** ra\_aper

**Info:** Right ascension of aperture reference position

**Type:** float

**HDU:** any

**Description:** Right ascension of aperture reference position



## 4.247 DEC\_APER

**Key:** dec\_aper

**Info:** Declination of aperture reference position

**Type:** float

**HDU:** any

**Description:** Declination of aperture reference position

## 4.248 NCOMBINE

**Key:** ncombine

**Info:** Number of image sets combined, such as during CR rejection, or for any other purpose

**Type:** integer

**HDU:** any

**Description:** Number of image sets combined, such as during CR rejection, or for any other purpose. See EXPTIME description to note how the use of NCOMBINE may depend on EXPTIME when summing or averaging over multiple sub-exposures into one. Because there are ambiguities about what NCOMBINE may mean, to be more specific about the type of combining operation, prefer NCOMBSUM, NCOMBAVG, NCOMBMED, and promote the use of NCOMBINE that adheres to the definition given in EXPTIME when used in a science data HDU.

## 4.249 NCOMBSUM

**Key:** ncombsum

**Info:** Number of image sets combined via summing over N sub-exposures into one final exposure.

**Type:** integer

**HDU:** any

**Description:** Number of image sets combined via summing over N sub-exposures into one final exposure.

## 4.250 NCOMBAVG

**Key:** ncombavg

**Info:** Number of image sets combined via averaging over N sub-exposures into one final exposure.

**Type:** integer

**HDU:** any

**Description:** Number of image sets combined via averaging over N sub-exposures into one final exposure.

## 4.251 NCOMBMED

**Key:** ncombmed

**Info:** Number of image sets combined via median combining N sub-exposures into one final exposure.

**Type:** integer

**HDU:** any

**Description:** Number of image sets combined via median combining N sub-exposures into one final exposure.

## 4.252 CENTERAn

**Key:** centera[n]

**Info:** Subarray axis n center point in unbinned detector pix

**Type:** integer

**HDU:** any

**Description:** Subarray axis n center point in unbinned detector pix

## 4.253 SIZAXISn

**Key:** sizaxis[n]

**Info:** Subarray axis n size in unbinned detector pixels

**Type:** integer

**HDU:** any

**Description:** Subarray axis n size in unbinned detector pixels

## 4.254 BINAXISn

**Key:** binaxis[n]

**Info:** Axis n bin size in unbinned detector pixels

**Type:** integer

**HDU:** any

**Description:** Axis n bin size in unbinned detector pixels

## 4.255 SAMPNUM

**Key:** sampnum

**Info:** MULTIACCUM sample number

**Type:** integer

**HDU:** any

**Description:** MULTIACCUM sample number

## 4.256 SAMPTIME

**Key:** samptime

**Info:** Total integration time (sec)

**Type:** float

**HDU:** any

**Description:** Total integration time (sec)

## 4.257 DELTATIM

**Key:** deltatim

**Info:** Integration time of this sample (sec)

**Type:** float

**HDU:** any

**Description:** Integration time of this sample (sec)

## 4.258 ROUTTIME

**Key:** routtime

**Info:** UT time of array readout (MJD)

**Type:** Real

**HDU:** any

**Description:** UT time of array readout (MJD)

## 4.259 NGOODPIX

**Key:** ngoodpix

**Info:** Number of good pixels

**Type:** integer

**HDU:** any

**Description:** Number of good pixels

## 4.260 SDQFLAGS

**Key:** sdqflags

**Info:** Serious data quality flags

**Type:** integer

**HDU:** any

**Description:** Serious data quality flags

## 4.261 GOODMIN

**Key:** goodmin

**Info:** Minimum value of good pixels

**Type:** float

**HDU:** any

**Description:** Minimum value of good pixels

## 4.262 GOODMAX

**Key:** goodmax

**Info:** Maximum value of good pixels

**Type:** float

**HDU:** any

**Description:** Maximum value of good pixels

## 4.263 SNRMIN

**Key:** snrmin

**Info:** Minimum signal-to-noise of good pixels

**Type:** float

**HDU:** any

**Description:** Minimum signal-to-noise of good pixels

## 4.264 SNRMAX

**Key:** snrmax

**Info:** Maximum signal-to-noise of good pixels

**Type:** float

**HDU:** any

**Description:** Maximum signal-to-noise of good pixels

## 4.265 SNRMEAN

**Key:** snrmean

**Info:** Mean value of signal-to-noise of good pixels

**Type:** float

**HDU:** any

**Description:** Mean value of signal-to-noise of good pixels

## 4.266 SOFTERRS

**Key:** softerrs

**Info:** Number of soft error pixels (DQF1)

**Type:** integer

**HDU:** any

**Description:** Number of soft error pixels (DQF1)

## 4.267 MEANDARK

**Key:** meandark

**Info:** Average dark level subtracted

**Type:** float

**HDU:** any

**Description:** Average dark level subtracted

## 4.268 MEANBLEV

**Key:** meanblev

**Info:** Average bias level subtracted

**Type:** float

**HDU:** any

**Description:** Average bias level subtracted

## 4.269 MEANFLSH

**Key:** meanflsh

**Info:** Mean number of counts in post flash exposure

**Type:** float

**HDU:** any

**Description:** Mean number of counts in post flash exposure

## 4.270 OPERATOR

**Key:** operator

**Info:** Name of telescope operator

**Type:** string

**HDU:** any

**Description:** Name of telescope operator

## 4.271 FOCLENG

**Key:** focleng

**Info:** Telescope focal length [m]

**Type:** float

**HDU:** any

**Description:** Telescope focal length [m]

## 4.272 FOCSCALE

**Key:** focscale

**Info:** Telescope focal scale [arcsec/mm]

**Type:** float

**HDU:** any

**Description:** Telescope focal scale [arcsec/mm]

## 4.273 FOCVALUE

**Key:** focvalue

**Info:** Telescope M2 setting [mm]

**Type:** float

**HDU:** any

**Description:** Telescope M2 setting [mm]

## 4.274 P\_ANGBEG

**Key:** p\_angbeg

**Info:** Parallactic angle at beginning of exposure (deg)

**Type:** float

**HDU:** any

**Description:** Parallactic angle at beginning of exposure (deg)

## 4.275 P\_ANGEND

**Key:** p\_angend

**Info:** Parallactic angle at end of exposure (deg)

**Type:** float

**HDU:** any

**Description:** Parallactic angle at end of exposure (deg)

## 4.276 TRCK\_RA

**Key:** trck\_ra

**Info:** Tracking rate in RA (mas/sec)

**Type:** float

**HDU:** any

**Description:** Tracking rate in RA (mas/sec)

## 4.277 TRCK\_DEC

**Key:** trck\_dec

**Info:** Tracking rate in DEC (mas/sec)

**Type:** float

**HDU:** any

**Description:** Tracking rate in DEC (mas/sec)

## 4.278 TRCKSTAT

**Key:** trckstat

**Info:** Tracking status

**Type:** Status

**HDU:** any

**Description:** Tracking status

## 4.279 AIRMASS

**Key:** airmass

**Info:** Airmass at the center of exposure

**Type:** float

**HDU:** any

**Description:** Airmass of an exposure,  $\sec(\text{zenith angle})$ . The value field shall contain a floating point number giving the air mass during the observation by a ground based telescope. The value of the airmass is often approximated by the secant of the zenith angle and has a value of 1.0 at the zenith and increases toward the horizon. This value is assumed to correspond to the start of the observation unless another interpretation is clearly explained in the comment field.

## 4.280 AIRM\_BEG

**Key:** airm\_beg

**Info:** Airmass at start of exposure

**Type:** float

**HDU:** any

**Description:** Airmass at start of exposure,  $\sec(\text{zenith angle})$

## 4.281 AIRM\_END

**Key:** airm\_end

**Info:** Airmass at end of exposure

**Type:** float

**HDU:** any

**Description:** Airmass at end of exposure,  $\sec(\text{zenith angle})$



## 4.282 ALT\_BEG

**Key:** alt\_beg

**Info:** Telescope altitude (deg) at start of exposure

**Type:** float

**HDU:** any

**Description:** Telescope altitude (deg) at start of exposure

## 4.283 ALT\_MID

**Key:** alt\_mid

**Info:** Telescope altitude (deg) at middle of exposure

**Type:** float

**HDU:** any

**Description:** Telescope altitude (deg) at middle of exposure

## 4.284 ALT\_END

**Key:** alt\_end

**Info:** Telescope altitude (deg) at end of exposure

**Type:** float

**HDU:** any

**Description:** Telescope altitude (deg) at end of exposure

## 4.285 AZ\_BEG

**Key:** azi\_beg

**Info:** Telescope azimuth (deg) at start of exposure

**Type:** float

**HDU:** any

**Description:** Telescope azimuth (deg) at start of exposure

## 4.286 AZ\_MID

**Key:** azi\_mid

**Info:** Telescope azimuth (deg) at middle of exposure

**Type:** float

**HDU:** any

**Description:** Telescope azimuth (deg) at middle of exposure

## 4.287 AZ\_END

**Key:** azi\_end

**Info:** Telescope azimuth (deg) at end of exposure

**Type:** float

**HDU:** any

**Description:** Telescope azimuth (deg) at end of exposure

## 4.288 GEO\_ELEV

**Key:** geo\_elev

**Info:** Telescope elevation above sea level [m]

**Type:** float

**HDU:** any

**Description:** Telescope elevation above sea level [m]

## 4.289 MOONPHAS

**Key:** moonphas

**Info:** Moon phase

**Type:** float

**HDU:** any

**Description:** Moon phase

## 4.290 SEEING

**Key:** seeing

**Info:** Natural atmospheric seeing FWHM, in arcsec, measured using stars

**Type:** float

**HDU:** any

**Description:** Natural atmospheric seeing FWHM, in arcsec, measured using stars.

## 4.291 WIND\_SPD

**Key:** wind\_spd

**Info:** Average wind speed during observation [km/hr]

**Type:** float

**HDU:** any

**Description:** Average wind speed during observation [km/hr]

## 4.292 WIND\_DIR

**Key:** wind\_dir

**Info:** Average wind direction during observation [deg]

**Type:** float

**HDU:** any

**Description:** Average wind direction during observation [deg]

## 4.293 HUMIDITY

**Key:** humidity

**Info:** Average relative humidity during observation [%]

**Type:** float

**HDU:** any

**Description:** Average relative humidity during observation [%]

## 4.294 PRESSURE

**Key:** pressure

**Info:** Average atmospheric pressure during observation [mm]

**Type:** float

**HDU:** any

**Description:** Average atmospheric pressure during observation [mm]

## 4.295 AMBTEMP

**Key:** ambtemp

**Info:** Average ambient temperature during observation [C]

**Type:** float

**HDU:** any

**Description:** Average ambient temperature during observation [C]

## 4.296 DEWPOINT

**Key:** dewpoint

**Info:** Average dewpoint during observation [C]

**Type:** float

**HDU:** any

**Description:** Average dewpoint during observation [C]

## 4.297 INS\_ID

**Key:** ins\_id

**Info:** Instrument control software ID

**Type:** string

**HDU:** any

**Description:** Instrument control software ID

## 4.298 ICS\_VERS

**Key:** ics\_vers

**Info:** Instrument control software version and installation date

**Type:** string

**HDU:** any

**Description:** Instrument control software version and installation date

## 4.299 PROCVERS

**Key:** procvers

**Info:** Pipeline processing version

**Type:** string

**HDU:** any

**Description:** Pipeline processing version

## 4.300 ADC\_STAT

**Key:** adc\_stat

**Info:** ADC status

**Type:** string

**HDU:** any

**Description:** ADC status

## 4.301 ADC\_POS

**Key:** adc\_pos

**Info:** ADC position

**Type:** string

**HDU:** any

**Description:** ADC position

## 4.302 INS\_OPER

**Key:** ins\_oper

**Info:** Instrument operator

**Type:** string

**HDU:** any

**Description:** Instrument operator

## 4.303 DISP\_PA

**Key:** disp\_pa

**Info:** Disperser, grating or grism, position angle (N=0, E=90) [deg]

**Type:** string

**HDU:** any

**Description:** Disperser, grating or grism, position angle (N=0, E=90) [deg]

## 4.304 GRATING $n$

**Key:** grating[ $n$ ]

**Info:** Name of the grating

**Type:**

**HDU:** any

**Description:** The value field shall contain a character string which gives the name of the defraction grating that was used during the observation. More than 1 grating may be listed by using the GRATINGn indexed keyword. The value 'none' or 'NONE' indicates that no grating was used.

## 4.305 DISP\_NAM

**Key:** disp\_nam

**Info:** Name of disperser, grating or grism

**Type:** string

**HDU:** any

**Description:** Name of disperser, grating or grism

## 4.306 DISP\_ID

**Key:** disp\_id

**Info:** ID of disperser, grating, or grism.

**Type:** string

**HDU:** any

**Description:** Grating ID

## 4.307 DISPERS

**Key:** dispers

**Info:** Grating or grism dispersion (Angstrom/mm)

**Type:** float

**HDU:** any

**Description:** Grating or grism dispersion (Angstrom/mm)

## 4.308 DISP\_WAV

**Key:** disp\_wav

**Info:** Disperser, grating or grism, central wavelength (Angstrom)

**Type:** string

**HDU:** any

**Description:** Disperser, grating or grism, central wavelength (Angstrom)

## 4.309 DISPAXIS

**Key:** dispaxis

**Info:** Dispersion axis: 1=<math>\lambda</math>D; axis 1, 2 <math>\lambda</math>D; axis 2, none

**Type:** string

**HDU:** any

**Description:** Dispersion axis: 1 = axis 2, 2 = axis 2, none

## 4.310 LAMP\_ID

**Key:** lamp\_id

**Info:** Lamp ID

**Type:** string

**HDU:** any

**Description:** Lamp ID

## 4.311 LAMP\_VOL

**Key:** lamp\_vol

**Info:** Lamp voltage status

**Type:** float

**HDU:** any

**Description:** Lamp voltage status

## 4.312 INS\_MODE

**Key:** ins\_mode

**Info:** Instrument mode used

**Type:** string

**HDU:** any

**Description:** Instrument mode used

## 4.313 INS\_TEMP

**Key:** ins\_temp

**Info:** Instrument temperature (C)

**Type:** float

**HDU:** any

**Description:** Instrument temperature (C)

## 4.314 INS\_OPTP

**Key:** ins\_optp

**Info:** Instrument optical pathway name

**Type:** string

**HDU:** any

**Description:** Instrument optical pathway name

## 4.315 OPT\_ELEM

**Key:** opt\_elem

**Info:** Optical element in use

**Type:** string

**HDU:** any

**Description:** Optical element in use, e.g. disperser name

## 4.316 SLIT\_WID

**Key:** slit\_wid

**Info:** Slit width [arcsec]

**Type:** float

**HDU:** any

**Description:** Slit width [arcsec]

## 4.317 SLIT\_LEN

**Key:** slit\_len

**Info:** Slit length [arcsec]

**Type:** float

**HDU:** any

**Description:** Slit length [arcsec]



## 4.318 SLIT\_PA

**Key:** slit\_pa

**Info:** Slit position angle [deg]

**Type:** float

**HDU:** any

**Description:** Slit position angle [deg]

## 4.319 SLIT\_RA

**Key:** slit\_ra

**Info:** Slit right ascension [deg]

**Type:** float

**HDU:** any

**Description:** Slit right ascension [deg]

## 4.320 SLIT\_DEC

**Key:** slit\_dec

**Info:** Slit declination [deg]

**Type:** float

**HDU:** any

**Description:** Slit declination [deg]

## 4.321 SPORDER

**Key:** sporder

**Info:** Spectral order

**Type:** integer

**HDU:** any

**Description:** Spectral order

## 4.322 PLATESC*n*

**Key:** platesc[*n*]

**Info:** Detector plate scale [arcsec]

**Type:**

**HDU:** any

**Description:** Detector plate scale [arcsec]. Corresponds to IVOA 's\_pixel\_scale'.

## 4.323 GUIDSTA1

**Key:** guidsta1

**Info:** Telescope autoguider 1 status

**Type:** string

**HDU:** any

**Description:** Telescope autoguider 1 status

## 4.324 GUID\_RA1

**Key:** guid\_ra1

**Info:** Telescope autoguider 1 right ascension

**Type:** float

**HDU:** any

**Description:** Telescope autoguider 1 right ascension

## 4.325 GUID\_DC1

**Key:** guid\_dc1

**Info:** Telescope autoguider 1 declination

**Type:** float

**HDU:** any

**Description:** Telescope autoguider 1 declination

## 4.326 GUIDSTA2

**Key:** guidsta2

**Info:** Telescope autoguider 2 status

**Type:** string

**HDU:** any

**Description:** Telescope autoguider 2 status

## 4.327 GUID\_RA2

**Key:** guid\_ra2

**Info:** Telescope autoguider 2 right ascension

**Type:** float

**HDU:** any

**Description:** Telescope autoguider 2 right ascension

## 4.328 GUID\_DC2

**Key:** guid\_dc2

**Info:** Telescope autoguider 2 declination

**Type:** float

**HDU:** any

**Description:** Telescope autoguider 2 declination

## 4.329 GUIDSTA3

**Key:** guidsta3

**Info:** Telescope autoguider 3 status

**Type:** string

**HDU:** any

**Description:** Telescope autoguider 3 status

## 4.330 GUID\_RA3

**Key:** guid\_ra3

**Info:** Telescope autoguider 3 right ascension

**Type:** float

**HDU:** any

**Description:** Telescope autoguider 3 right ascension

## 4.331 GUID\_DC3

**Key:** guid\_dc3

**Info:** Telescope autoguider 3 declination

**Type:** float

**HDU:** any

**Description:** Telescope autoguider 3 declination

## 4.332 PHAS\_STA

**Key:** phas\_sta

**Info:** Telescope phasing camera status

**Type:** string

**HDU:** any

**Description:** Telescope phasing camera status

## 4.333 PHAS\_RA

**Key:** phas\_ra

**Info:** Telescope phasing camera right ascension

**Type:** float

**HDU:** any

**Description:** Telescope phasing camera right ascension

## 4.334 PHAS\_DEC

**Key:** phas\_dec

**Info:** Telescope phasing camera declination

**Type:** float

**HDU:** any

**Description:** Telescope phasing camera declination

## 4.335 OBS\_PID

**Key:** obs\_pid

**Info:** Program ID corresponding to observing block

**Type:** string

**HDU:** any

**Description:** Program ID corresponding to Observing block

## 4.336 OBS\_ID

**Key:** obs\_id

**Info:** Unique observation ID

**Type:** string

**HDU:** any

**Description:** This value field shall contain a character string which uniquely identifies the dataset contained in the FITS file. This is typically a sequence number that can contain a mixture of numerical and character values. In the case where multiple data products are available for an observation (e.g. with different calibration levels), the obs\_id value will be the same for each product of the observation. This is equivalent to the dataset name for many archives where dataset name could have many files associated with them. This keyword corresponds to IVOA 'obs\_id'.

## 4.337 OBS\_NAME

**Key:** obs\_name

**Info:** Observing block name

**Type:** string

**HDU:** any

**Description:** Observing block name

## 4.338 OBS\_GRP

**Key:** obs\_grp

**Info:** Observing block group (linked blocks)

**Type:** string

**HDU:** any

**Description:** Observing block group (linked blocks)

## 4.339 OBS\_SEQN

**Key:** obs\_seqn

**Info:** Sequence number in observing block template

**Type:** integer

**HDU:** any

**Description:** Sequence number in an observing block template

## 4.340 OBSET\_ID

**Key:** obset\_id

**Info:** Observation set ID

**Type:** string

**HDU:** any

**Description:** Observation set ID, corresponds to IVOA 'obs\_creator\_did'.

## 4.341 TPL\_ID

**Key:** tpl\_id

**Info:** Observing template ID

**Type:** float

**HDU:** any

**Description:** Observing template ID

## 4.342 TPL\_name

**Key:** tpl\_name

**Info:** Observing template name

**Type:** string

**HDU:** any

**Description:** Observing template name

## 4.343 TPL\_SEQN

**Key:** tpl\_seqn

**Info:** Template sequence number within block

**Type:** integer

**HDU:** any

**Description:** Template sequence number within block

## 4.344 TPL\_NEXP

**Key:** tpl\_nexp

**Info:** Number of exposures within sequence template

**Type:** integer

**HDU:** any

**Description:** Number of exposures within sequence template

## 4.345 TPL\_EXPN

**Key:** tpl\_expn

**Info:** Exposure number within template

**Type:** integer

**HDU:** any

**Description:** Exposure number within template

## 4.346 DPR\_CATG

**Key:** dpr\_catg

**Info:** Data product file, data product category

**Type:** string

**HDU:** any

**Description:** Data product file, data product category [TBC]

## 4.347 DPR\_TYPE

**Key:** dpr\_type

**Info:** Data product file, observation type

**Type:** string

**HDU:** any

**Description:** Data product file, Observation type [TBC]

## 4.348 DPR\_TECH

**Key:** dpr\_tech

**Info:** Data product file, observation technique

**Type:** string

**HDU:** any

**Description:** Gives the technique used for the observation and can take on more than one value. The values should be separated with commas, from general to specific. [TBC]

## 4.349 TITLE

**Key:** title

**Info:** Title for the observation or data

**Type:** string

**HDU:** any

**Description:** The value field shall contain a character string giving a title that is suitable for display purposes, e.g., for annotation on images or plots of the data contained in the HDU. Also corresponds to IVOA ‘DataID.Title’ Spectral Data Model.

## 4.350 TLMIN $n$

**Key:** tlm $n$ [ $n$ ]

**Info:** Minimum legal values for a column

**Type:** float

**HDU:** extension

**Description:** [TLMIN $n$ ] Minimum legal values for a column. Minimum legal values for a column. The value field of this indexed keyword shall contain a floating point number specifying the lower bound of the legal range of physical values that may be represented in column  $n$  of the table. The column may contain values that are less than this legal minimum value but the interpretation of such values is not defined here. The value of this keyword is typically used as the minimum value when constructing a histogram of the values in the column. This keyword may only be used in ‘TABLE’ or ‘BINTABLE’ extensions.

## 4.351 TLMAX $n$

**Key:** tlmax[ $n$ ]

**Info:** Maximum legal values for a column

**Type:** float

**HDU:** extension

**Description:** [TLMAX $n$ ] Maximum legal values for a column. Maximum legal values for a column. The value field of this indexed keyword shall contain a floating point number specifying the upper bound of the legal range of physical values that may be represented in column  $n$  of the table. The column may contain values that are greater than this legal maximum value but the interpretation of such values is not defined here. The value of this keyword is typically used as the maximum value when constructing a histogram of the values in the column. This keyword may only be used in ‘TABLE’ or ‘BINTABLE’ extensions.

## 4.352 PIXVALUE

**Key:** pixvalue

**Info:** Value of all the pixels in an uniform image

**Type:** float



**HDU:** any

**Description:** When all pixels in an image are of a single value, that value is stored as PIXVALUE and the HDU has no binary data section. The use of PIXVALUE is not allowed for a SCI extension.

## 4.353 TDESC*n*

**Key:** tdesc[*n*]

**Info:** Column description

**Type:** string

**HDU:** extension

**Description:** [TDESC*n*] The value field of this indexed keyword contains a character string that describes the content of the table column.

## 4.354 TSORTKEY

**Key:** tsortkey

**Info:** Defines the sort order of a table

**Type:** string

**HDU:** any

**Description:** The value field shall contain a character string that defines the order in which the rows in the current FITS ASCII or binary table extension have been sorted. The character string lists the name (as given by the TTYPE*n* keyword) of the primary sort column, optionally followed by the names of any secondary sort column(s). The presence of this keyword indicates that the rows in the table have been sorted first by the values in the primary sort column; any rows that have the same value in the primary column have been further sorted by the values in the secondary sort column and so on for all the specified columns. If more than one column is specified by TSORTKEY then the names must be separated by a comma. One or more spaces are also allowed between the comma and the following column name. By default, columns are sorted in ascending order, but a minus sign may precede the column name to indicate that the rows are sorted in descending order. This keyword may only be used in 'TABLE' or 'BINTABLE' extensions. Example: TSORTKEY = 'TIME, RA, DEC'.

## 4.355 USE\_DATE

**Key:** use\_date

**Info:** Use this file for obs taken on or after this date

**Type:** string

**HDU:** all

**Description:** Use this file for observations taken on or after the date specified in the value field. This is used e.g. in instrument or calibration reference tables.

## 4.356 CONFIGUR

**Key:** configure

**Info:** Version of checksum algorithm

**Type:**

**HDU:** any

**Description:** The value field shall contain a character string that uniquely defines the configuration state, or version, of the software processing system that generated the data contained in the HDU. This keyword differs from the CREATOR keyword in that it give the name and version of the overall processing system and not just the name and version of a single program.

## 4.357 CONTINE

**Key:** continue

**Info:** Denotes the CONTINUE long string keyword convention

**Type:**

**HDU:** any

**Description:** The CONTINUE keyword, when followed by spaces in columns 9 and 10 of the card image and a character string enclosed in single quotes starting in column 11 or higher, indicates that the quoted string should be treated as a continuation of the character string value in the previous header keyword. To conform to this convention, the character string value on the previous keyword must end with the ampersand character ('&'), but the ampersand is not part of the value string and should be deleted before concatenating the strings together. The character string value may be continued on any number of consecutive CONTINUE keywords, thus effectively allowing arbitrarily long strings to be written as keyword values.

## 4.358 CREATOR

**Key:** creator

**Info:** The name of the software task that created the file

**Type:**

**HDU:** any

**Description:** The value field shall contain a character string giving the name, and optionally, the version of the program that originally created the current FITS HDU. Example: 'TASKNAME V1.2.3'

## 4.359 DATAMODE

**Key:** datamode

**Info:** Pre-processor data mode

**Type:**

**HDU:** any

**Description:** The value field shall contain a character string which identifies the configuration or mode of the pre-processing software that operated on the raw instrumental data to generate the data that is recorded in the FITS file. Example: some X-ray satellite data may be recorded in 'BRIGHT', 'FAINT', or 'FAST' data mode.

## 4.360 RA\_PNT

**Key:** ra\_pnt

**Info:** Right ascension of the pointed direction of the instrument

**Type:**

**HDU:** any

**Description:** Right ascension of the pointed direction of the instrument. The value field shall contain a floating point number giving the Right Ascension of the pointing direction in units of decimal degrees. The coordinate reference frame is given by the RADECSYS keyword, and the coordinate epoch is given by the EQUINOX keyword. The precise definition of this keyword is instrument-specific, but typically the pointed direction corresponds to the optical axis of the instrument. This keyword gives a mean value in cases where the pointing axis was not fixed during the entire observation.

## 4.361 DEC\_PNT

**Key:** dec\_pnt

**Info:** Declination of the pointed direction of the instrument

**Type:**

**HDU:** any

**Description:** Declination of the pointed direction of the instrument. The value field shall contain a floating point number giving the declination of the pointing direction in units of decimal degrees. The coordinate reference frame is given by the RADECSYS keyword, and the coordinate epoch is given by the EQUINOX keyword. The precise definition of this keyword is instrument-specific, but typically the pointed direction corresponds to the optical axis of the instrument. This keyword gives a mean value in cases where the pointing axis was not fixed during the entire observation.

## 4.362 HDUCLASS

**Key:** hduclass

**Info:** General identifier for the classification of the data

**Type:**

**HDU:** any

**Description:** The value field shall contain a character string that identifies the domain to which the associated HDUCLASn keywords apply. This keyword typically identifies the institution or project that has defined the allowed set of values for the associated hierarchical HDUCLASn keywords.

## 4.363 HDUCLAS*n*

**Key:** hduclas[*n*]

**Info:** Hierarchical classification of the data

**Type:**

**HDU:** any

**Description:** The value field shall contain a character string that identifies the domain to which the associated HDUCLAS*n* keywords apply. This keyword typically identifies the institution or project that has defined the allowed set of values for the associated hierarchical HDUCLAS*n* keywords.

## 4.364 HDUDOC

**Key:** hdudoc

**Info:** Reference to document describing the data format

**Type:**

**HDU:** any

**Description:** The value field shall contain a character string that gives a reference to a document that describes the allowed values that may be assigned to the HDUCLAS*n* data classification keywords.

## 4.365 HDUVERS

**Key:** hduvers

**Info:**

**Type:**

**HDU:** any

**Description:** The value field shall contain a character string that gives the specific version of the document referenced by HDUDOC.

## 4.366 LATITUDE

**Key:** latitude

**Info:** Geographic latitude of the observation

**Type:**

**HDU:** any

**Description:** The value field shall contain a floating point number giving the geographic latitude from which the observation was made in units of degrees.

## 4.367 SATURATE

**Key:** saturate

**Info:** Data value at which saturation occurs

**Type:**

**HDU:** any

**Description:** The value field shall contain an integer giving the data value at which the detector becomes saturated. This keyword value may differ from the maximum value implied by the BITPIX in that more bits may be allocated in the FITS pixel values than the detector can accommodate.

## 4.368 TDBIN $n$

**Key:** tdbin[ $n$ ]

**Info:** Default histogram bin size for the column

**Type:**

**HDU:** any

**Description:** Default histogram bin size for the column. The value field of this indexed keyword shall contain a floating point number specifying the suggested bin size when producing a histogram of the values in column  $n$ . This keyword is typically used in conjunction the TLMIN $n$  and TLMAX $n$  keywords when constructing a histogram of the values in column  $n$ , such that the histogram ranges from TLMIN $n$  to TLMAX $n$  with the histogram bin size given by TDBIN $n$ . This keyword may only be used in 'TABLE' or 'BINTABLE' extensions.

## 4.369 TDMAX $n$

**Key:** tdmx[ $n$ ]

**Info:** Maximum physical value in the column

**Type:**

**HDU:** any

**Description:** The value field of this indexed keyword shall contain a floating point number specifying the maximum valid physical value represented in column  $n$  of the table, exclusive of any special values. This keyword may only be used in 'TABLE' or 'BINTABLE' extensions and is analogous to the DATAMAX keyword used for FITS images.

## 4.370 TDMIN $n$

**Key:** tdmn[ $n$ ]

**Info:** Minimum physical value in the column

**Type:**

**HDU:** any

**Description:** The value field of this indexed keyword shall contain a floating point number specifying the minimum valid physical value represented in column n of the table, exclusive of any special values. This keyword may only be used in 'TABLE' or 'BINTABLE' extensions and is analogous to the DATAMIN keyword used for FITS images.

## 4.371 MIRRORCONF

**Key:** mirrorconf

**Info:** Telescope mirror configuration [TBD]

**Type:** string

**HDU:** any

**Description:** Telescope mirror configuration [TBD]

**REFERENCES**

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