4.4.2.6. Extension keywords

The next three keywords were originally defined for use within the header of a conforming extension, however they also *may* appear in the primary header with an analogous meaning. If these keywords are present, it is *recommended* that they have a unique combination of values in each HDU of the *FITS* file.

EXTNAME keyword. 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. Within this context, the primary array *should* be considered as equivalent to an IMAGE extension.

EXTVER keyword. 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.

EXTLEVEL keyword. 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.

The following keyword is optional, but if present it *shall* appear in the extension header immediately after the mandatory keywords. It allows to write keywords only once, and have them be shared by every extension in the file, when they would be duplicated with the same value in every extension of a multi-extension FITS file.

INHERIT keyword. The value field *shall* contain a logical value of T or F to indicate whether or not the current extension should inherit the keywords in the primary header of the FITS file.

It *should* only be used in *FITS* files that have a null primary array (e.g., with NAXIS = 0). to avoid possible confusion if array-specific keywords (e.g., BSCALE and BZERO) were to be inherited.

When an application reads an extension header with INHERIT = T, it should merge the keywords in the current extension with the primary header keywords. The exact merging mechanism is left up to the application. The mandatory primary array keywords (e.g., BITPIX, NAXIS, and NAXISn) and any COMMENT, HISTORY, and blank keywords in the primary header are *never* inherited. If the same keyword is present in both the primary header and the extension header, the value in the extension header *shall* take precedence. If INHERIT = F in an extension header, the keywords from the primary header *should* not be inherited.

An application which merely reads a FITS file is authorized by INHERIT = T to look up in the primary HDU for an expected keyword not found in the current HDU. However if the application writes out a modified file, it has to be very careful to avoid unwanted duplication of keywords, and preserve the separation of primary and extension headers, namely if an application modifies the value of an inherited keyword while processing an extension HDU, then it is recommended to write the modified value of that keyword into the extension header, leaving the value of the keyword in the primary header unchanged. The primary array keywords should only be modified when the intent is to explicitly change the value that will subsequently be inherited in the extensions.

Also if the FITS file is read in sequentially (e.g., from tape or Internet downloads), the reader would need to cache the primary header in case it turns out that a later extension in the file uses the INHERIT convention.

Appendix C: Summary of keywords

This Appendix is not part of the FITS *standard, but is included for convenient reference.*

All of the mandatory and reserved keywords that are defined in the standard, except for the reserved WCS keywords that are discussed separately in Sect. 8, are listed in Tables C.1, C.2, and C.3. An alphabetized list of these keywords and their definitions is available online: http://heasarc.gsfc.nasa.gov/docs/fcg/standard_dict.html.

Table C.1: Mandatory *FITS* keywords for the structures described in this document.

Primary HDU	Conforming extension	Image extension	ASCII table extension	Binary table extension	Random groups records
SIMPLE	XTENSION	XTENSION[1]	XTENSION[2]	XTENSION[3]	SIMPLE
BITPIX	BITPIX	BITPIX	BITPIX = 8	BITPIX = 8	BITPIX
NAXIS	NAXIS	NAXIS	NAXIS = 2	NAXIS = 2	NAXIS
NAXISn[4]	NAXISn[4]	NAXISn[4]	NAXIS1	NAXIS1	NAXIS1 = 0
END	PCOUNT	PCOUNT = 0	NAXIS2	NAXIS2	NAXISn[4]
	GCOUNT	GCOUNT = 1	PCOUNT = 0	PCOUNT	GROUPS = T
	END	END	GCOUNT = 1	GCOUNT = 1	PCOUNT
			TFIELDS	TFIELDS	GCOUNT
			TFORMn[5]	TFORMn[5]	END
			TBCOLn[5]	END	
			END		

[1]XTENSION=␣'IMAGE␣␣␣' for the image extension. [2]XTENSION=␣'TABLE␣␣␣' for the ASCII table extension. [3]XTENSION=␣'BINTABLE' for the binary table extension. [4]Runs from 1 through the value of NAXIS. [5]Runs from 1 through the value of TFIELDS.

Table C.2: Reserved *FITS* keywords for the structures described in this document.

All[1] HDUs		Array[2] HDUs	ASCII table extension	Binary table extension	Random groups records
DATE	EXTNAME	BSCALE	TSCALn	TSCALn	PTYPEn
DATE-OBS	EXTVER	BZERO	TZEROn	TZEROn	PSCALn
ORIGIN	EXTLEVEL	BUNIT	TNULLn	TNULLn	PZEROn
AUTHOR	EQUINOX	BLANK	TTYPEn	TTYPEn	
REFERENC	EPOCH[3]	DATAMAX	TUNITn	TUNITn	
COMMENT	BLOCKED[3]	DATAMIN	TDISPn	TDISPn	
HISTORY	EXTEND[4]			TDIMn	
␣␣␣␣␣␣␣␣	TELESCOP			THEAP	
OBJECT	INSTRUME				
OBSERVER					
INHERIT [5]					

[1]These keywords are further categorized in Table C.3. [2]Primary HDU, image extension, user-defined HDUs with same array structure. [3]Deprecated. [4]Only permitted in the primary HDU. [5]Only permitted in extension HDUs, immediately following the mandatory keywords.

Table C.3: General reserved *FITS* keywords described in this document.

Production	Bibliographic	Commentary	Observation
DATE	AUTHOR	COMMENT	DATE-OBS
ORIGIN	REFERENC	HISTORY	TELESCOP
BLOCKED[1]		␣␣␣␣␣␣␣␣	INSTRUME
			OBSERVER
			OBJECT
			EQUINOX
			EPOCH[1]

[1]Deprecated.

– The last paragraph of Sect. 4.1.2.3 was corrected to state that the ASCII text characters have hexadecimal values 20 through 7E, not 41 through 7E.

H.3. List of modifications to the latest FITS standard

The INHERIT keyword described in Sect. 4.4.2.6 was originally introduced as a *FITS* convention since 1995, and registered in 2007. The text of the original convention is reported at `http://fits.gsfc.nasa.gov/registry/inherit.html`. See also references and practical considerations therein.