

AIA/SDO FITS Keywords for Scientific Usage and Data Processing at Levels 0, 1.0, and 1.5

(This Version is for Level 0 & 1 at the start of the final AIA data release)

Keyword Nomenclature:

(Telemetry keywords are ***bold italic***; derived keywords are **bold**; & potential keywords are *italic*)
{# = Integer (~ 0-999); @ = Optional single character A-Z; & = Alpha-numeric}

LL@# Lower Left corner pixel for row (X) / column (Y) for Region of Interest (ROI) # on CCD
NAXIS@# Dimension (in pixels) along row (X) / column (Y) for ROI # on CCD
A@&&&&&& Originating from telemetry data (@: H = HDR, F = FDB, I = ISP)

(Note: The definitions of the output data levels included below have been extracted in part from the current Stanford SDO DRMS and SUMS computer database. Phil Scherrer's "JSOC Keywords used for metadata" document [current update 5/25/10] will be used to define and explain the keyword usage.)

1. **Level-0** Keywords

1.1 Basic Image Configuration Keywords and Information for **Level-0** (Some are **Level-1** as noted)

Definition of **Level-0** Metadata for the Image Header (Note: The only intended external use of this level is for JSOC-OPS quick-look viewing in near-real time.)

Metadata for Level-0, when the image comes down, consists of keywords derived directly from the image camera header data and those stored in a ground database containing the image characteristics, such as image size, date of observation, telescope, instrument, etc., plus that generated from the associated image status packet (ISP), including the status of mechanisms, the camera itself, the image stabilization system (ISS), and the guide telescope (GT). (See image status packet list in Section 1.2 below.)

Metadata for Level-0 may be updated further in the next 24 hours as the final versions of SDO roll information and Flight Dynamics System data are received.

Data Image for **Level-0**

Decompressed raw data recompressed using non-lossy compression, such as rice.

The following keywords come from science data packet image header (HDR) information (definition in Doc. AIA02019):

AHAPID = Packet APID (11b; from HDR)
AHTCS = Packet Time Code Seconds (32b; from HDR)
AHTCSS = Packet Time Code Sub Seconds (32b; from HDR)
AHTLFSN = Camera/Frame Serial Number (32b; from HDR)
AHTAPC = TAP Code (4b; from HDR)
AHBITID = Bit Select ID (4b; from HDR)
AHCPIDN = Compression parameter *n* (4b; from HDR)
AHCPIDK = Compression parameter *k* (4b; from HDR)
AHLUTID = Lookup Table ID (8b; from HDR)

The 9 keywords above will be useful in identifying and reconstructing the acquired image, as indicated below.

NAXIS	= the number of axes of the overall image,	int, (nominally = 2)	{Level-1 also}
NAXIS1	= the total number of pixels along axis 1 of overall image,	int, (nominally = 4096 for X axis)	{Level-1 also}
NAXIS2	= the total number of pixels along axis 2 of overall image,	int, (nominally = 4096 for Y axis)	{Level-1 also}
CAMERA	= the most significant 2b of AHTLFSN + 1 = [1, 2, 3, 4] and the AIA camera (telescope) number associated with the image (int)		{Level-1 also}
FSN	= the least significant 30b of AHTLFSN and is the Frame Serial Number (int)		{Level-1 also}
FID	= the Frame Definition Block (FDB) ID (int) found in the crop/de-crop tables for this image		{Level-1 also}
TLMDSNAM	= Telemetry data series name (string) with first packet of image		
IMGFPT	= the first packet time in “ISO” units constructed from AHTCS and AHTCSS .		
IMGAPID	= AHAPID ,	Image Application ID (int)	
TAPCODE	= AHTAPC ,	“Take a Picture code” (int)	
BITSELID	= AHBITID ,	Bit select id, r (int)	
COMPID	= the compression id; n, k; constructed from AHCPIDN and AHCPIDK .	(int)	
CROPID	= Crop Table ID		
LUTID	= AHLUTID ,	Lookup table id (int)	
NPACKETS		int, Number of packets in image	
NERRORS		int, Number of decompression errors	
EOIERROR		short, Last pixel error; End Of Image Error	
HEADRERR		short, Header error in image	
OVERFLOW		short, Data overflow error in image	

The following lower case keywords appear only in the JSOC Level-0 Lookdata keywords:

cparms_sg000	DRMS segment 0
image_bzero	multiplier for data values
image_bscale	offset for data values
cparms_sg001	DRMS segment 1
image_sm_bzero	multiplier for data values in small image
image_sm_bscale	offset for data values in small image

(Note: Compressed files may have extra and/or different key words.)

1.2 FITS, JSOC, and Image Statistics Keywords for **Level-0** and **Level-1**

XTENSION = “BIN TABLE”

BITPIX = “16”

BLD_VERS

ORIGIN

DATE

DATE_OBS = $T_OBS - (EXPTIME/2.0)$

= **DATE_D\$OBS** = **DATE__OBS**

T_OBS

EXPTIME

EXPSDEV

IMG_TYPE

TELESCOP = “SDO/AIA”

INSTRUME = “AIA_i”

INT_TIME = *AICFGDL4* - *AICFGDL3* (+ rollover)

Binary table extension
integer, Bits/pixel: 8, 16, 32, -32, or -64 (negative for floating point)
(HMI uses as 16 in L0)
string, JSOC build version from jsoc_version.h
string, location where file was made, e.g., “SDO/JSOC-SDP”
string, date and time of file creation in format:
yyyy-mm-ddThh:mm:ss[.sss] in UTC (FITS- and iso-standard)
string, UTC, date when image observation started
other forms of this keyword in the database or in printouts
time, UTC, middle of the exposure time (shutter open start time +
exposure time / 2.
floating point, calculated in double precision, exposure time in
seconds
float, calculated in double precision, standard deviation of the
exposure time (see Appendix 1: AIA Camera Exposure Time
Calculation for details on the 4 keywords above.)
string, shutter image type: ‘LIGHT’ or ‘DARK’
string, name of source telescope package
string, name of instrument (within telescope package) where i =
camera number = 1, 2, 3, or 4

double, interval or integration time between readout delay and

WAVELNTH = *AIAWVLEN* = AIA_IMG_WAVELENGTH

= 335 (0), 131 (1)

= 211 (2), 193 (3)

= 1600 (4), 1700 (5), 4500 (6), 171 (7)

= 304 (8), 94 (9)

WAVEUNIT = “angstrom”

WAVE_STR = string(**WAVELNTH**+’_’+*AIFILTYP*)

QUALITY

TOTVALS

DATAVALS

MISSVALS

PERCENTD

DATAMIN

DATAMAX

DATAMEDN

DATAMEAN

DATARMS

DATASKEW

DATAKURT

DATACENT

COMMENT

HISTORY

BLANK = “-32768”

CHECKSUM (e.g., = 'nhkHqek9nekGnek9')

DATASUM (e.g., = '4246760921')

END

shutter operation delay plus rollover (i.e., CCD integration duration); used to estimate dark exposures (as exptime = 0.0)

integer, wavelength of this observation in angstroms, with 2 each for camera (telescope) 1, 2, 4, and 4 each for camera 3 with mapping reference number of each wavelength

for camera 1

for camera 2

for camera 3

for camera 4

wavelength unit: angstrom

wavelength Filter Position

int, Level-0 or 1 quality word (QUALITY = 0 means OK; see Appendix 2

int, Expected number of data values (pixels)

int, Actual number of data values in image

int, Missing values: **TOTVALS** – **DATAVALS**

int, Actual number of data values in image as percent of the total:

(DATAVALS/TOTVALS) *100.0

short, minimum value from all pixels (pixel units are in “DN”)

short, maximum value from all pixels

short, median value from all pixels

float, mean value for all pixels

float, RMS deviation from the mean value of all pixels

float, Skewness from the mean value of all pixels

float, Kurtosis of all pixels

float, median value of center column of the image {Level-1 only}

Comment (optional)

ASCII history record, one or more, usually by SSW (optional)

value signaling undefined integer data

HDU checksum updated date/time for FITS file

data unit checksum updated date/time for FITS file

{FITS required; not at end of current Level-0 files (TBD)}

1.3 Image Status Packet (ISP) Keywords [from APID 027, as of May 2008] to be included in **Level-0** and **Level-1**

ISPSNAME		ISP Series Name
ISPPKTIM		Packet time from the following two ISP keywords, Prime key value for the ISP record
<i>ATCS027</i>	= APID027_TIMECODE_SECONDS,	APID027 timecode in seconds
<i>ATCSS027</i>	= APID027_TIMECODE_SUBSECS,	APID027 timecode in subseconds, [Quality/Sanity Check time]
ISPPKTVN		Packet version number
<i>AIVNMST</i>	= AIA_VER_NUM_IMAGE_STATUS,	ISP version number
<i>AIMGOTS</i>	= AIA_IMG_OBT_TIME_SH_SEC,	seconds time tag read from OBC shutter time tag register for the shutter operation making this image
<i>ASQHDR</i>	= AIA_SEQ_HEADER,	a combination of the camera number and the frame serial number, both of which have their own keywords, as follows
<i>ASQTNUM</i>	= AIA_SEQ_TEL_NUM,	from which the camera (telescope) number that took this image, CAMERA (= <i>ASQTNUM</i> + 1), can be sanity checked
<i>ASQFSN</i>	= AIA_SEQ_FRAME_SN	from which the frame serial number of this image, AHFSN , can be sanity checked (independent of the camera number)
<i>AIAHFSN</i>	= AIA_IMG_HIST_FSN,	the FSN of the image from which the histogram data was obtained
<i>AECDELAY</i>	= AIA_IMG_AEC_DELAY,	time since image used for AEC
<i>AIAECTI</i>	= AIA_IMG_AEC_TABLE_ID,	Automatic Exposure Control (AEC) table used with image
<i>AIASEN</i>	= AIA_IMG_AS_ENCODER	aperture selection encoder reading
<i>AIFDBID</i>	= AIA_IMG_FDB_ID,	frame definition block id, [Quality/Sanity Check AIFDBID?]
<i>AIMGOTSS</i>	= AIA_IMG_OBT_TIME_SH_SS,	subseconds time tag read from OBC shutter time tag register for the shutter operation making this image
<i>AIFCPS</i>	= AIA_IMG_FC_POSITION	currently loaded target value for the focus position mechanism
<i>AIFTSWTH</i>	= AIA_IMG_FLT_TYPE_SW_TH,	filter switch threshold for 131A wavelength (exposure)
<i>AIFRMLID</i>	= AIA_IMG_FRMLIST_ID,	framelist id for this image
<i>AIFTSID</i>	= AIA_IMG_FTS_ID,	framelist timeline schedule (FTS) id for this image
<i>AIHISMXB</i>	= AIA_IMG_HIST_MAX_BIN,	bin number of maximum of standard histogram for previous image
<i>AIHIS192</i>	= AIA_IMG_HISTC_BN_192,	in this wavelength used for the current AEC
<i>AIHIS348</i>	= AIA_IMG_HISTC_BN_348,	cumulative histogram value at bin #192
		cumulative histogram value at bin #348

<i>AIHIS604</i>	= AIA_IMG_HISTC_BN_604,	cumulative histogram value at bin #604
<i>AIHIS860</i>	= AIA_IMG_HISTC_BN_860,	cumulative histogram value at bin #860
<i>AIFWEN</i>	= AIA_IMG_FW_ENCODER	filter wheel selector encoder reading (0-255) for this image
<i>AIMGSHCE</i>	= AIA_IMG_SH_CMDED_EXPOSURE	commanded exposure for image
<i>AECTYPE</i>	= AIA_IMG_AEC_TYPE,	AEC table for current wavelength (4 tables per wavelength)
<i>AECMODE</i>	= AIA_IMG_AEC_MODE,	mode of AEC (on/off)
<i>AISTATE</i>	= AIA_IMG_ISS_LOOP,	ISS on/off
<i>AIAECENF</i>	= AIA_IMG_AEC_ENA_FLAG,	AEC enable flag for this image
<i>AIFILTYP</i>	= AIA_IMG_FILTER_TYPE	filter type, “thick”, “thin” (used for 131 A only), or “open”
<i>AIMSHOBC</i>	= AIA_IMG_SH_OPEN_BOT_CENTR,	shutter timer register value for this position of this image
<i>AIMSHOBE</i>	= AIA_IMG_SH_OPEN_BOT_EDGE,	(same as above)
<i>AIMSHOTC</i>	= AIA_IMG_SH_OPEN_TOP_CENTR,	(same as above)
<i>AIMSHOTE</i>	= AIA_IMG_SH_OPEN_TOP_EDGE,	(same as above)
<i>AIMSHCBC</i>	= AIA_IMG_SH_CLOSE_BOT_CENTR,	(same as above)
<i>AIMSHCBE</i>	= AIA_IMG_SH_CLOSE_BOT_EDGE,	(same as above)
<i>AIMSHCTC</i>	= AIA_IMG_SH_CLOSE_TOP_CENTR,	(same as above)
<i>AIMSHCTE</i>	= AIA_IMG_SH_CLOSE_TOP_EDGE,	(same as above)
<i>AICFGDL1</i>	= AIA_IMG_CFG_DELAY_1,	mechanism delay 1 for this image
<i>AICFGDL2</i>	= AIA_IMG_CFG_DELAY_2,	clear table delay for this image
<i>AICFGDL3</i>	= AIA_IMG_CFG_DELAY_3,	shutter operation delay for this image
<i>AICFGDL4</i>	= AIA_IMG_CFG_DELAY_4,	readout delay for this image
<i>AIFOENFL</i>	= AIA_IMG_FOCUS_ENA_FLAG,	flag to indicate if focus table used or not
<i>AIMGFSN</i>	= AIA_IMG_FRLIST_POS,	position within framelist of this frame
<i>AIMGTYP</i>	= AIA_IMG_IMAGE_TYPE	software logic shows “dark” (0) only, {replaced by IMG_TYP }
<i>AIAWVLEN</i>	= AIA_IMG_WAVELENGTH	
<i>AIAGP1</i>	= AIA_IMG_GP1,	general purpose register word 1
<i>AIAGP2</i>	= AIA_IMG_GP2,	general purpose register word 2
<i>AIAGP3</i>	= AIA_IMG_GP3,	general purpose register word 3
<i>AIAGP4</i>	= AIA_IMG_GP4,	general purpose register word 4
<i>AIAGP5</i>	= AIA_IMG_GP5,	general purpose register word 5
<i>AIAGP6</i>	= AIA_IMG_GP6,	general purpose register word 6 (Onboard image quality flag; if not zero, set a bit in the Level-1 quality word)
<i>AIAGP7</i>	= AIA_IMG_GP7,	general purpose register word 7 (AICFGDL1 delay value in full precision)

<i>AIAGP8</i>	= AIA_IMG_GP8,	general purpose register word 8 (<i>AICFGDL2</i> delay value in full precision)
<i>AIAGP9</i>	= AIA_IMG_GP9,	general purpose register word 9 (<i>AICFGDL3</i> delay value in full precision)
<i>AIAGP10</i>	= AIA_IMG_GP10,	general purpose register word 10 (<i>AICFGDL4</i> delay value in full precision)
<i>AGT1SVY</i>	= AIA_IMG_GT1_SUNVECTOR_Y,	Guide Telescope (GT) 1 Sun vector in y direction
<i>AGT1SVZ</i>	= AIA_IMG_GT1_SUNVECTOR_Z,	Guide Telescope (GT) 1 Sun vector in z direction
<i>AGT2SVY</i>	= AIA_IMG_GT2_SUNVECTOR_Y,	Guide Telescope (GT) 2 Sun vector in y direction
<i>AGT2SVZ</i>	= AIA_IMG_GT2_SUNVECTOR_Z,	Guide Telescope (GT) 2 Sun vector in z direction
<i>AGT3SVY</i>	= AIA_IMG_GT3_SUNVECTOR_Y,	Guide Telescope (GT) 3 Sun vector in y direction
<i>AGT3SVZ</i>	= AIA_IMG_GT3_SUNVECTOR_Z,	Guide Telescope (GT) 3 Sun vector in z direction
<i>AGT4SVY</i>	= AIA_IMG_GT4_SUNVECTOR_Y,	Guide Telescope (GT) 4 Sun vector in y direction
<i>AGT4SVZ</i>	= AIA_IMG_GT4_SUNVECTOR_Z,	Guide Telescope (GT) 4 Sun vector in z direction
<i>AIMGSHEN</i>	= AIA_IMG_SH_ENCODER,	shutter selector encoder reading (0-255) for this image

2. Additional **Level-1** Keywords

More level definitions

Definition of **Level-1.0** (Note: This level is generated from Level-0 and the full disk images will be archived.)

1. Header

Metadata for Level-0 reduced to those scientific FITS keywords needed for analysis at Level-1, updating the image coordinate mapping keywords to meaningful and nearly correct values, plus other keywords needed for Level -1 and above.

2. Data

Decompressed raw data (level 0) with overscan pixels removed, dark pedestal and current, as well as flat field, corrections applied, bad pixel and cosmic-ray spike maps created and used to fix bad pixels and despike the cosmic-rays, image flipped to align with Solar North, and, finally, image rescaled to integer. The rice compressed data are stored as fits files.

Definition of **Level-1.5** (Note: This level is generate from Level-1.0.)

1. Header

Metadata for Level-1.0 updated for the applied calibrations below (that will irreversibly modify the data).

2. Data

Floating-Point Level-1.0 data images that are adjusted for plate scale, rotation, and sub-pixel registration; roll corrected; and finally rescaled to integer. The rice compressed data are stored as fits files.

Note: **Level-1** keywords include those identified as such above plus those following.

2.1 Level-1 Image, Scale, and Processing Keywords

The following lower case keywords appear only in the JSOC Level-1 Lookdata keywords:

cparms_sg000	DRMS segment 0
image_lev1_bzero	multiplier for data values
image_lev1_bscale	offset for data values
cparms_sg001	DRMS segment 1
bad_pixel_bzero	multiplier for data values in bad pixel list
bad_pixel_bscale	offset for data values in bad pixel list
cparms_sg002	DRMS segment 2
spikes_bzero	multiplier for data values in spikes list
spikes_bscale	offset for data values in spikes list

The following lower case keywords appear only in the JSOC Level-1.5 Lookdata keywords:

cparms_sg000	DRMS segment 0
image_lev1p5_bzero	multiplier for data values
image_lev1p5_bscale	offset for data values

T_REC	slotted form of T_OBS (Currently being implemented)
T_REC_step	T_REC step (seconds)
T_REC_epoch	epoch date
T_REC_roun	center of slot
QUALLEV0	int, Level-0 quality word in Level-0 (see Appendix 2)
QUALITY	int, Level-1 quality word (see Appendix 3)

DATAP01	In a histogram of image values: pixel value corresponding to lowest 1 percentile
DATAP10	pixel value corresponding to lowest 10 percentile
DATAP25	pixel value corresponding to lowest 25 percentile
DATAP75	pixel value corresponding to lowest 75 percentile
DATAP90	pixel value corresponding to lowest 90 percentile
DATAP95	pixel value corresponding to lowest 95 percentile
DATAP98	pixel value corresponding to lowest 98 percentile

DATAP99		pixel value corresponding to lowest 99 percentile
NSATPIX		number of saturated pixels in image (with values > 15,000)
OSCNMEAN	= nan ;not used at present by AIA	mean value of overscan rows
OSCNRMS	= nan ;not used at present by AIA	rms deviation from the mean value of overscan rows
FLAT_REC		flatfield series pointer to the calibration file containing information on the dark processed image and processed flat field image used to correct the current image.
NSPIKE		number of cosmic ray affected pixel spikes in image
LVL_NUM		level number of image
Note: The following ROI are not implemented yet:		
ROI_NWIN	= number of Windows (4b; from FDB) for number of Region Of Interest(s) (ROI) (int) (= 0, 1, 2)	
ROI_SUM	= summingMode (4b; from FDB) for summing (int): 1x1, 2x2, 4x4 (= 0, 1, 2)	
ROI_NAX1	= number of CCD Columns (from FDB and de-crop table) for width of ROI 1 in pixels (int)	
ROI_NAY1	= number of CCD Rows (from FDB and de-crop table) for height of ROI 1 in pixels (int)	
ROI_LLX1	= CCD X-variable location of lower left corner pixel of ROI 1 (int)	
ROI_LLY1	= CCD Y-variable location of lower left corner pixel of ROI 1 (int)	
ROI_NAX2	= number of CCD Columns (from FDB and de-crop table) for width of ROI 2 in pixels (int)	
ROI_NAY2	= number of CCD Rows (from FDB and de-crop table) for height of ROI 2 in pixels (int)	
ROI_LLX2	= CCD X-variable location of lower left corner pixel of ROI 2 (int)	
ROI_LLY2	= CCD Y-variable location of lower left corner pixel of ROI 2 (int)	
PIXLUNIT		string, to denote pixel value units in “DN”
DN_GAIN		DN/electron gain value in Intensity Through-Put Series
EFF_AREA		effective area value in Intensity Through-Put Series
EFF_AR_V	version # for EFF_AREA and DN_GAIN values in Intensity Through-Put Series	
TEMPCCD		temperature at CCD: CCD_HEADER X
TEMPGT		temperature at guide telescope: GT_X
TEMPMIR		temperature at secondary mirror: SEC_MIRROR
TEMPFPAD		temperature at focal plane assembly adapter: FPA_ADAPTER
KEYWDDOC	string, web pointer in FITS header for keyword doc: “www.lmsal.com/sdodocs/aiafitskeywords.doc” full document title: “www.lmsal.com/sdodocs/AIA_FITS_Keywords_AIA02840”	
RECNUM		number of records in level-1 file

Temperatures measurements at CCD, guide telescope, focal plane assembly adapter, and secondary mirror are time-averaged from the time-averaged series (mean, maximum, and variation smoothed over 300 sec). Camera attitude pointing information can be found in **MPO_REC**.

2.2 **Level-1** Coordinate Mapping Keywords

These keywords are to be populated separately for each instrument in **Level-1.0**, and above, when information becomes available following the definitions, assumptions, and guidelines in Phil Scherrer’s “JSOC Keywords used for metadata” document [current update 5/25/10 or later], which can be found on the web at http://jsoc.stanford.edu/doc/keywords/JSOC_Keywords_for_metadata. Please consider Phil’s document as another appendix to the present document, because it presents a full description of the following image coordinate mapping keywords, discussing the FITS standards, including instrument and spacecraft pointing. Below the keywords and a brief description are presented. For AIA it is assumed: 1) there is a fixed value for each telescope plate scale, **IMSCL_MP**: 2) the center of the solar disk is the origin. The spacecraft pointing keywords are now included below. Note in the following that the lower case, Italicized, letters specify mapping from array axes (j) to image axes (i).

CTYPE<i>i</i>	Text, type of image coordinate axis <i>i</i> for other Cxxxx keywords, where CTYPE1 = HPLN-TAN (SOLARX) , CTYPE2 = HPLT-TAN (SOLARY) , for longitude and latitude, respectively. (see Phil’s document for coordinate mapping descriptions).
CUNIT<i>i</i>	Physical units for position on image axis <i>I</i> , where CUNIT1 = CUNIT2 = “arcsec”
CRVAL<i>i</i>	Physical value along image axis <i>i</i> at the center of the pixel, where CRVAL1 = CRVAL2 = 0.0
CDELTA<i>i</i>	Pixel spacing per index value along image axis <i>I</i> , equal to IM_SCALE except at higher levels when the image has been rescaled (CDELTA1, CDELTA2 in x, y directions, respectively)
CRPIX<i>j</i>	Reference pixel along array axis <i>j</i> , with the center of the lower left pixel numbered 1 (not 0), i.e., location of disk center in x and y

CROTA_j		directions on image, where CRPIX1 = X0_MP + 1, CRPIX2 = Y0_MP + 1 (see X0_MP, Y0_MP below). Rotation needed for array axes to get to image axes (in degrees), where CROTA2 = SAT_ROT + INST_ROT (see below) Note: No CROTA1
CRDER_i	(TBD, to appear in MPO_REC)	Estimate of random error in coordinate <i>i</i> expressed in CUNIT_i .
CSYSER_i	(TBD, to appear in MPO_REC)	Estimate of systematic error in coordinate <i>i</i> expressed in CUNIT_i .
R_SUN		Radius of the Sun's image in pixels on the CCD detector, for the visible light (float)
MPO_REC		is the Master Pointing series record pointer to the Science reference bore sight information (See Appendix 4) and replaces SCIRFBSV , the science reference bore sight version number
INST_ROT		Master pointing CCD rotation wrt SDO Z (float, degrees)
IMSCL_MP		Master pointing image scale in arc-sec per CCD pixel (float), replacing IM_SCALE ; This value will be used for the estimate of CDELTA for AIA
X0_MP		Master pointing X0 sun center in CCD frame in pixels, start 0.0 (float) for raw image
Y0_MP		Master pointing Y0 sun center in CCD frame in pixels, start 0.0 (float) for raw image
ASD_REC		Ancillary Science Data series record pointer (string)
SAT_Y0		Position of solar center wrt the SDO -Y axis in arcsec (float)
SAT_Z0		Position of solar center wrt the SDO Z axis in arcsec (float)
SAT_ROT		Position angle of solar pole wrt the SDO X axis (float, degrees)
ACS_MODE		ACS pointing mode (ACS are strings)- ACS_AN_ACS_MODE
ACS_ECLP		ACS eclipse flag - ACS_AN_FLAG_CSS_ECLIPSE
ACS_SUNP		ACS sun presense flag - ACS_AN_FLAG_DSS_SUNPRES
ACS_SAFE		ACS safe hold flag - ACS_AN_FLAG_ACE_INSAFEHOLD
ACS_CGT		ACS ID of Controlling Guide Telescope - ACS_AN_NUM_CGT
ORB_REC		Orbit vector series record pointer (string)
DSUN_REF		Reference distance to Sun: 149,597,870,691.0 m (double)
DSUN_OBS		Distance from Sun center to SDO in m (double)
RSUN_REF		Reference radius of the Sun: 696,000,000.0 m (double)
RSUN_OBS		Apparent radius of the Sun seen by SDO (arcsec, double)

GAEX_OBS	Geocentric Inertial X position in m (double)
GAEY_OBS	Geocentric Inertial Y position in m (double)
GAEZ_OBS	Geocentric Inertial Z position in m (double)
HAEX_OBS	Heliocentric Inertial X position in m (double)
HAEY_OBS	Heliocentric Inertial Y position in m (double)
HAEZ_OBS	Heliocentric Inertial Z position in m (double)
OBS_VR	Speed of observer in radial direction in m/s (double)
OBS_VW	Speed of observer in solar-west direction in m/s (double)
OBS_VN	Speed of observer in solar-north direction in m/s (double)
CRLN_OBS	Carrington longitude of the observer in degrees (float)
CRLT_OBS	Carrington latitude of the observer in degrees (float)
CAR_ROT	Carrington rotation number of CRLN_OBS(integer)
HGLN_OBS	Stoneyhurst heliographic longitude of the observer (very small value) in degrees (float)
HGLT_OBS	Stoneyhurst heliographic latitude of the observer in degrees (float) (=CRLT_OBS)

The following non-keyword quantities can be calculated from the Level-1 keywords above (when ROI are implemented):

FOVX1 = CDELTA1 * ROI_NAX1	ROI 1 X-Axis Field of View in arcsec
FOVY1 = CDELTA2 * ROI_NAY1	ROI 1 Y-Axis Field of View in arcsec
FOVX2 = CDELTA1 * ROI_NAX2	ROI 2 X-Axis Field of View in arcsec
FOVY2 = CDELTA2 * ROI_NAY2	ROI 2 Y-Axis Field of View in arcsec

3. Approximate Lists of Keywords for Level 0 and 1 Metadata (Data File Headers)

Level 0	Level 1	Brief Description	Sample Values of Keyword	Section
XTENSION =	XTENSION		'BINTABLE'	1.2
BITPIX =	BITPIX		8	1.2
NAXIS =	NAXIS		2	1.1
NAXIS1 =	NAXIS1		4096	1.1
NAXIS2 =	NAXIS2		4096	1.1
BLD_VERS =	BLD_VERS		'V5R12X'	1.2

	LVL_NUM	1.000000	2.1
	T_REC	'2008-01-04T01:00:13Z'	2.1
	TRECSTEP	1.000000	2.1
	TRECEPOC	'1977.01.01_00:00:00_TAI'	2.1
	TRECROUN	1	2.1
ORIGIN =	ORIGIN	'SDO/JSOC-SDP'	1.2
DATE =	DATE	'2008-01-08T23:57:38'	1.2
TELESCOP =	TELESCOP	'SDO/AIA'	1.2
INSTRUME =	INSTRUME	'AIA_3'	1.2
DATE_OBS =	DATE_OBS	'2008-01-08T18:56:00.05'	1.2, App. 1
T_OBS =	T_OBS	'2008-01-08T18:56:03.05Z'	1.2, App. 1
CAMERA =	CAMERA	3	1.1 (Header)
IMG_TYPE =	IMG_TYPE	'LIGHT or DARK'	1.2
EXPTIME =	EXPTIME	5.039	1.2, App. 1
EXPSDEV =	EXPSDEV	0.019	1.2, App. 1
INT_TIME =	INT_TIME	[= <i>AICFGDL4</i> - <i>AICFGDL3</i> (+ rollover), interval time between readout delay and shutter operation delay plus rollover]	2.273438 1.2
WAVELNTH =	WAVELNTH	171	1.2
WAVEUNIT =	WAVEUNIT	'angstrom'	1.2
WAVE_STR =	WAVE_STR	'171_THIN'	1.2
FSN =	FSN	Frame Serial Number 18503066	1.1 (Header)
FID =	FID	Frame Definition Block ID 0	1.1 (Crop table)
TLMDSNAM		Telemetry data series name with first packet of image 'aia.tlm[VC04_2011_004_19_59_30]'	1.1 (Header)
IMGFPT		First packet time '2008-01-08T18:56:07.35Z'	1.1 (Header)
IMGAPID		Packet APID, "Image Application ID" 510	1.1 (Header)
TAPCODE		"Take a Picture code" 0	1.1 (Header)
BITSELID		Bit Select ID, r 0	1.1 (Header)
COMPID		Compression ID; n, k 114	1.1 (Header)
CROPID		Crop table ID 0	1.1 (Crop table)
LUTID		Lookup table id 16	1.1 (Header)
NPACKETS		Number of packets in image 11172	1.1
NERRORS		Number of decompression errors 0	1.1
EOIERROR		Last pixel error; End Of Image Error 0	1.1

HEADRERR	Header error in image	0	1.1
OVERFLOW	Data overflow error in image	0	1.1
QUALITY =	QUALLEV0 Level-0 Quality word	0	1.1, 2.1
	QUALITY Level-1 Quality word	0	1.1, 2.1
TOTVALS =	TOTVALS Expected number of data values (pixels)	16777216	1.2
DATAVALS =	DATAVALS Actual number of data values in image	16777216	1.2
MISSVALS =	MISSVALS Missing values: TOTVALS – DATAVALS	0	1.2
PERCENTD =	PERCENTD Percentage of good data	100.0	1.2
DATAMIN =	DATAMIN	81.0	1.2
DATAMAX =	DATAMAX	4100.0	1.2
DATAMEDN =	DATAMEDN	218.345670	1.2
DATAMEAN =	DATAMEAN	218.345670	1.2
DATARMS =	DATARMS	22.687300	1.2
DATASKEW =	DATASKEW	218.345670	1.2
DATAKURT =	DATAKURT	218.345670	1.2
DATACENT =	DATACENT	222.17	1.2
	DATAP01	0.00	2.1
	DATAP10	8.00	2.1
	DATAP25	21.00	2.1
	DATAP75	338.00	2.1
	DATAP90	507.00	2.1
	DATAP95	657.00	2.1
	DATAP98	917.00	2.1
	DATAP99	1151.00	2.1
	NSATPIX	0	2.1
	OSCNMEAN	nan (not applicable to aia)	2.1
	OSCNRMS	nan (not applicable to aia)	2.1
	FLAT_REC	'aia.flatfield[:#7]'	2.1
	NSIKES	2290	2.1
	CTYPE1	'HPLN-TAN'	2.2
	CUNIT1	'arcsec'	2.2
	CRVAL1	0.0	2.2
	CDELTA1	0.6	2.2

CRPIX1		2047.5	2.2
CTYPE2		'HPLT-TAN'	2.2
CUNIT2		'arcsec'	2.2
CRVAL2		0.0	2.2
CDELTA2		0.6	2.2
CRPIX2		2050.5	2.2
CROTA2		0.0	2.2
R_SUN	Radius of the Sun's visible light image in pixels	1629.015625	2.2
MPO_REC	Master Pointing series record pointer	'sdo.master_pointing[:#67]'	2.2
INST_ROT	Rotation of the camera from the SDO Z axis	0.102488	2.2
IMSCL_MP	Master pointing image scale	0.599076	2.2
X0_MP		2056.149902	2.2
Y0_MP		2014.819946	2.2
ASD_REC		'SDO.LEV0_ASD_0004[:#7383988]'	2.2
SAT_Y0		-2.903119	2.2
SAT_Z0		14.903053	2.2
SAT_ROT	Position angle of solar pole wrt the SDO Z axis	-0.000027	2.2
ACS_MODE		'SCIENCE'	2.2
ACS_ECLP		'NO'	2.2
ACS_SUNP		'YES'	2.2
ACS_SAFE		'NO'	2.2
ACS_CGT		'GT3'	2.2
ORB_REC		'sdo.fds_orbit_vectors[2011.01.06_01:00:00_utc]'	2.2
DSUN_REF	Reference distance to Sun	149597870691.0	2.2
DSUN_OBS	Distance from Sun's center to SDO	147105480081.38	2.2
RSUN_REF	Radius of the Sun in	696000000.0	2.2
RSUN_OBS	Apparent radius of the Sun seen by SDO	975.904097	2.2
GAEX_OBS		40070887.35	2.2
GAEY_OBS		9076663.22	2.2
GAEZ_OBS		-9494523.83	2.2
HAEX_OBS		-38506873400.57	2.2
HAEY_OBS		141976205012.59	2.2
HAEZ_OBS		-13457603.94	2.2
OBS_VR		1999.745637	2.2

OBS_VW	30304.776498		2.2
OBS_VN	-5670.417563		2.2
CRLN_OBS	188.945572		2.2
CRLT_OBS	-3.558670		2.2
CAR_ROT	2105		2.2
HGLN_OBS	0.000000		2.2
HGLT_OBS	-3.558670		2.2
ROI_NWIN	-2147483648	-----	2.1
ROI_SUM	-2147483648		2.1
ROI_NAX1	-2147483648		2.1
ROI_NAY1	-2147483648		2.1
ROI_NAX2	-2147483648		2.1
ROI_NAY2	-2147483648	not	2.1
ROI_LLX1	-2147483648	implemented	2.1
ROI_LLY1	-2147483648	yet	2.1
ROI_LLX2	-2147483648		2.1
ROI_LLY2	-2147483648	-----	2.1
PIXLUNIT	'DN'		2.1
DN_GAIN	17.700		2.1
EFF_AREA	2.881		2.1
EFF_AR_V	1.000		2.1
TEMPCCD	-69.000		2.1
TEMPGT	15.158		2.1
TEMPSMIR	34.815		2.1
TEMPFPAD	16.597		2.1

Currently all of the ISP keywords are in both Level-0 and Level-1:

ISPSNAME	=	ISPSNAME	ISP Series Name	aia.lev0_isp_0011	1.3 (ISP)
ISPPKTIM	=	ISPPKTIM	Packet time	'2008-01-08T18:56:01.00Z'	1.3 (ISP)
ISPPKTVN	=	ISPPKTVN	Packet version number	'001.197'	1.3 (ISP)
AIVNMST	=	AIVNMST	ISP version number	453	1.3 (ISP)
AIMGOTS	=	AIMGOTS	seconds time tag	167296647	1.3 (ISP)
ASQHDR	=	ASQHDR	[= ASQTNUM (2b) {=Camera} + ASQFSN (30b) {=FSN}]		1.3 (ISP)
ASQTNUM	=	ASQTNUM	[= Camera – 1]	2	1.3 (ISP)

ASQFSN	=	ASQFSN	[another FSN]	18503066	1.3 (ISP)
AIAHFSN	=	AIAHFSN	the FSN of the image from which the histogram data was obtained		1.3 (ISP)
AECDELAY	=	AECDELAY	time since image used for AEC	1535	1.3 (ISP)
AIAECTI	=	AIAECTI	Automatic Exposure Control (AEC) tables used with this image	0	1.3 (ISP)
AIASEN	=	AIASEN	aperture selection encoder reading	0	1.3 (ISP)
AIFDBID	=	AIFDBID	[another FDB ID]	241	1.3 (ISP)
AIMGOTSS	=	AIMGOTSS	subseconds time tag	5155	1.3 (ISP)
AIFCPS	=	AIFCPS	currently loaded target value	17	1.3 (ISP)
AIFTSWTH	=	AIFTSWTH	filter switch threshold for 131A wavelength (exposure)	0	1.3 (ISP)
AIFRMLID	=	AIFRMLID	framelist id for this image	3009	1.3 (ISP)
AIFTSID	=	AIFTSID	framelist timeline schedule (FTS) id	40962	1.3 (ISP)
AIHISMXB	=	AIHISMXB	bin number of maximum of standard histogram for previous image in this wavelength used for the current AEC	7	1.3 (ISP)
AIHIS192	=	AIHIS192	cumulative histogram value at bin #192	8385756	1.3 (ISP)
AIHIS348	=	AIHIS348	cumulative histogram value at bin #348	8388602	1.3 (ISP)
AIHIS604	=	AIHIS604	cumulative histogram value at bin #604	8388608	1.3 (ISP)
AIHIS860	=	AIHIS860	cumulative histogram value at bin #860	8388608	1.3 (ISP)
AIFWEN	=	AIFWEN	filter wheel selector encoder reading	204	1.3 (ISP)
AIMGSHCE	=	AIMGSHCE		2000	1.3 (ISP)
AECTYPE	=	AECTYPE	AEC table for current wavelength	2	1.3 (ISP)
AECMODE	=	AECMODE	mode of AEC ('OPEN' ro 'CLOSED')	'ON'	1.3 (ISP)
AISTATE	=	AISTATE	ISS ('OPEN' ro 'CLOSED')	'CLOSED'	1.3 (ISP)
AIAECENF	=	AIAECENF	AEC enable flag for this image	1	1.3 (ISP)
AIFILTYP	=	AIFILTYP		0	1.3 (ISP)
AIMSHOBC	=	AIMSHOBC	shutter timer register value	54.812000	1.3 (ISP)
AIMSHOBE	=	AIMSHOBE	shutter timer register value	68.804001	1.3 (ISP)
AIMSHOTC	=	AIMSHOTC	shutter timer register value	40.556000	1.3 (ISP)
AIMSHOTE	=	AIMSHOTE	shutter timer register value	25.544001	1.3 (ISP)
AIMSHCBC	=	AIMSHCBC	shutter timer register value	2054.919922	1.3 (ISP)
AIMSHCBE	=	AIMSHCBE	shutter timer register value	2068.808105	1.3 (ISP)
AIMSHCTC	=	AIMSHCTC	shutter timer register value	2040.812012	1.3 (ISP)
AIMSHCTE	=	AIMSHCTE	shutter timer register value	2025.884033	1.3 (ISP)
AICFGDL1	=	AICFGDL1	mechanism delay 1	0	1.3 (ISP)
AICFGDL2	=	AICFGDL2	clear table delay	137	1.3 (ISP)

AICFGDL3	=	AICFGDL3	shutter operation delay	201		1.3 (ISP)
AICDGD4	=	AICDGD4	readout delay	236		1.3 (ISP)
AIFOENFL	=	AIFOENFL	flag to indicate if focus table used or not	1		1.3 (ISP)
AIMGFSN	=	AIMGFSN	position within framelist of this frame	5		1.3 (ISP)
AIMGTYP	=	AIMGTYP	'dark'	0		1.3 (ISP)
AIAWVLEN	=	AIAWVLEN	(coded wavelength for this observation)	7		1.3 (ISP)
AIAGP1	=	AIAGP1	general purpose register word 1	0		1.3 (ISP)
AIAGP2	=	AIAGP2	general purpose register word 2	0		1.3 (ISP)
AIAGP3	=	AIAGP3	general purpose register word 3	0		1.3 (ISP)
AIAGP4	=	AIAGP4	general purpose register word 4	0		1.3 (ISP)
AIAGP5	=	AIAGP5	general purpose register word 5	0		1.3 (ISP)
AIAGP6	=	AIAGP6	gpr word 6 (Onboard Level-1 image quality flag)	0		1.3 (ISP)
AIAGP7	=	AIAGP7	gpr word 7 (AICFGDL1 delay value in full precision)	0		1.3 (ISP)
AIAGP8	=	AIAGP8	gpr word 8 (AICFGDL2 delay value in full precision)	393		1.3 (ISP)
AIAGP9	=	AIAGP9	gpr word 9 (AICFGDL3 delay value in full precision)	457		1.3 (ISP)
AIAGP10	=	AIAGP10	gpr word 10 (AICFGDL4 delay value in full precision)	748		1.3 (ISP)
AGT1SVY	=	AGT1SVY	GT 1 Sun vector in y direction	-3		1.3 (ISP)
AGT1SVZ	=	AGT1SVZ	GT 1 Sun vector in z direction	7		1.3 (ISP)
AGT2SVY	=	AGT2SVY	GT 2 Sun vector in y direction	-7		1.3 (ISP)
AGT2SVZ	=	AGT2SVZ	GT 2 Sun vector in z direction	-8		1.3 (ISP)
AGT3SVY	=	AGT3SVY	GT 3 Sun vector in y direction	-1		1.3 (ISP)
AGT3SVZ	=	AGT3SVZ	GT 3 Sun vector in z direction	-2		1.3 (ISP)
AGT4SVY	=	AGT4SVY	GT 4 Sun vector in y direction	-4		1.3 (ISP)
AGT4SVZ	=	AGT4SVZ	GT 4 Sun vector in z direction	-5		1.3 (ISP)
AIMGSHEN	=	AIMGSHEN	shutter selector encoder reading	13		1.3 (ISP)
COMMENT	=	COMMENT	Comment (optional)			1.2
HISTORY	=	HISTORY	ASCII history record, one or more (optional)			1.2
		KEYWDDOC	' https://www.lmsal.com/sdodocs/aiafitskeywords.doc '			2.1
		RECNUM		2181750		2.1
BLANK	=	BLANK		-32768		1.2 (definition)
CHECKSUM	=	CHECKSUM	(e.g., = 'nhkHqek9nekGnek9')			1.2
DATASUM	=	DATASUM	(e.g., = '4246760921')			1.2
END	=	END	End of file			1.2

Appendix 1: AIA Camera Exposure Time Calculation

Telemetry parameters required from AIA Image Status Packet:

```

AIMGOTS = AIA_IMG_OBT_TIME_SH_SEC
AIMGOTSS = AIA_IMG_OBT_TIME_SH_SS
cmdexp = double(AIMGSHCE) = AIA_IMG_SH_CMDED_EXPOSURE
shopbc = double(AIMSHOBC) = AIA_IMG_SH_OPEN_BOT_CENTR
shopbe = double(AIMSHOBE) = AIA_IMG_SH_OPEN_BOT_EDGE
shoptc = double(AIMSHOTC) = AIA_IMG_SH_OPEN_TOP_CENTR
shopte = double(AIMSHOTE) = AIA_IMG_SH_OPEN_TOP_EDGE
shclbc = double(AIMSHCBC) = AIA_IMG_SH_CLOSE_BOT_CENTR
shclbe = double(AIMSHCBE) = AIA_IMG_SH_CLOSE_BOT_EDGE
shcltc = double(AIMSHCTC) = AIA_IMG_SH_CLOSE_TOP_CENTR
shclte = double(AIMSHCTE) = AIA_IMG_SH_CLOSE_TOP_EDGE

```

AIMGSHCE is the commanded exposure (19 bits) starting from ~0.005 s (due to size of narrow shutter slit) in 0.001 s steps to 524.28 s $[(2^{19} - 1) * 10^{-3} = 524287 * 10^{-3}]$ (timings are from document AIA01259 rev H). The maximum exposure of the AIA shutter mechanism is ~268.4 s. The 24 bit shutter open and close time measurements have a resolution of 0.000004 s, starting at 0.000004 s up to ~67 s $[(2^{24} - 1) * 4 * 10^{-6} = 67108860 * 10^{-6}]$. The commanded exposure value can be used to determine the rollover value. The expected value of the commanded exposure to the nearest 0.1 sec just before each of the three possible rollover steps is 67.1 s, 134.2 s, and 201.3 s, respectively. When **AIMGSHCE** is above any of these values it has rolled over 1, 2, or 3 times, respectively, and the number of rollovers multiplied by 67.108864 s needs to be added to the respective shutter close minus open time before averaging. Please note that the programmer needs to take care near the rollover steps because the hardware and/or software may not work quite the same as in the ideal case presented here.

The actual exposure is the average of the difference of the closing time minus the opening time for each of the four measurements positions, except when **AIMGSHCE** is less than 0.072 s, in which case the shutter mechanism is in its narrow slit mode. In the latter mode the narrow slit opening (smaller by 0.35) is utilized for one or more passes. The current operational planning calls for the shutter exposure to be about 5 s per image for each camera.

Using the above, together with Rock Bush's email of 28-Feb-08 on HMI T_OBS and EXPTIME and John Serafin's email of 20-May-08 on a rollover algorithm in C, the following algorithm has been written in IDL for calculating the AIA camera shutter exposure time

for each camera, **EXPTIME**; standard deviation, **EXPSDEV**; the shutter open start time plus the middle of the exposure time, **T_OBS**; and the date when the observation started, **DATE_OBS**.

; Computer quantities (note: all variables should be double precision and time is in seconds):

AIA_Shutter_Open_Start_Time = *AIMGOTS* + *AIMGOTSS* ;combine these in TAI

;Intermediate calculation variables:

cshclbc = shclbc + 67.108864d0 * nrollct(cmdexp, shclbc) ;correct for rollovers
 cshclbe = shclbe + 67.108864d0 * nrollct(cmdexp, shclbe)
 cshcltc = shcltc + 67.108864d0 * nrollct(cmdexp, shcltc)
 cshclte = shclte + 67.108864d0 * nrollct(cmdexp, shclte)

shebc = cshclbc - shopbc ;close time – open time
 shebe = cshclbe - shopbe
 shetc = cshcltc - shoptc
 shete = cshclte - shopte

mean = (shebc + shebe + shetc + shete)/4.0d0 ;mean and standard deviation
 exp_sd = sqrt(1/3 * ((shebc-mean) * (shebc-mean) + (shebe-mean) * (shebe-mean) + \$
 (shetc-mean) * (shetc-mean) + (shete-mean) * (shete-mean))) ;continued from previous line

if (cmdexp lt 0.072d0) then begin ;in narrow slit mode
 mean = mean * 0.35
 exp_sd = expsd * 0.35
 endif

EXPTIME = mean ;AIA_Shutter_Exposure_Time
EXPSDEV = exp_sd ;AIA_Shutter_Exposure_SD

EXPTIME_Offset = (cshclbc + shopbc + cshclbe + shopbe + cshcltc + shoptc + cshclte + \$ shopte)/8.0d0
 ;continued from previous line

T_OBS = AIA_Shutter_Open_Start_Time + EXPTIME_Offset ;(add in seconds, calculate
DATA_OBS, then convert T_OBS to UTC)

DATE_OBS = T_OBS - (EXPTIME/2.0) ;(add in seconds then convert to
UTC time)

Note: the T_OBS time is the shutter open start time plus the middle of the exposure time. As such a shutter exposure offset is the mean of all the open and close times. The EXPTIME is the shutter open time duration. DATE_OBS is the date when observation started.

```
;Rollover procedure nrollct
;for rollovers at 67.1, 134.2 and 201.3 with integers used below that are about one quarter of the
;interval away from the rollover values and thus not critical
```

Pro nrollct, cmdexp, clostim

```
If (cmdexp < 51.0) then return 0
If (cmdexp < 84.0) then if (clostim > 33.0) then return 0 else return 1
If (cmdexp < 117.0) then return 1
If (cmdexp < 151.0) then if (clostim > 33.0) then return 1 else return 2
If (cmdexp < 184.0) then return 2
If (cmdexp < 217.0) then if (clostim > 33.0) then return 2 else return 3
If (cmdexp < 251.0) then return 3
return if (clostim > 33.0) then return 3 else return 4
end
```

Appendix 2: AIA Level-0 Quality Definition

(updated by Rock Bush, 6/09/10)

QUALITY = 0 means OK.

Bit 0 is the low bit (0x01).

The first 4 bits are determined from the Img struct passed back by imgdecode

The parameter MISSVALS is from Img struct TOTVALS - DATAVALS

Bit	Meaning
---	-----
0	Overflow Flag Set
1	Header Error Flag Set
2	Compression Error in Image
3	Last Pixel Error
4	Missing Image Status Packet: (FSN != HSQFGSN) or HSQFGSN missing
5	Missing Image: (MISSVALS = TOTVALS) or NPACKETS = 0
6	Corrupt Image: (FSN = 469769216)
7	Invalid Time: (AIMGSHCE != 0) and (AIMGOTS = 0)
8	MISSVALS > 0
9	MISSVALS > 0.01*TOTVALS
10	MISSVALS > 0.05*TOTVALS
11	MISSVALS > 0.25*TOTVALS
12	
13	
14	
15	

AIA specific

16	Dark Image;	IMG_TYPE == 'DARK'
17	ISS Loop Open;	AISTATE == "OPEN"; (AISTATE != 0)

18 9.4nm Mech Error; AIAWVLEN == 9 &&
 {(AIFILTYP == 0 && AIFWEN != 269 && AIFWEN != 270
 && AIFWEN != 74 && AIFWEN != 75)}
 || (AIFILTYP == 1 && AIFWEN != 11 && AIFWEN != 12)

19 13.1nm Mech Error; AIAWVLEN == 1 &&
 {(AIFILTYP == 0 && AIFWEN != 269 && AIFWEN != 270
 && AIFWEN != 74 && AIFWEN != 75)}
 || (AIFILTYP == 1 && AIFWEN != 11 && AIFWEN != 12)

20 17.1nm Mech Error; AIAWVLEN == 7 &&
 {(AIFILTYP == 0 && AIFWEN != 203 && AIFWEN != 204)
 || (AIFILTYP == 1 && AIFWEN != 11 && AIFWEN != 12)}

21 19.3nm Mech Error; AIAWVLEN == 3 && {AIASEN != 6
 || (AIFILTYP == 0 && AIFWEN != 269 && AIFWEN != 270
 && AIFWEN != 74 && AIFWEN != 75)}
 || (AIFILTYP == 1 && AIFWEN != 11 && AIFWEN != 12)

22 21.1nm Mech Error; AIAWVLEN == 2 && {AIASEN != 24
 || (AIFILTYP == 0 && AIFWEN != 203 && AIFWEN != 204
 && AIFWEN != 74 && AIFWEN != 75)}
 || (AIFILTYP == 1 && AIFWEN != 137 && AIFWEN != 138)

23 30.4nm Mech Error; AIAWVLEN == 8 &&
 {(AIFILTYP == 0 && AIFWEN != 203 && AIFWEN != 204
 && AIFWEN != 74 && AIFWEN != 75)}
 || (AIFILTYP == 1 && AIFWEN != 137 && AIFWEN != 138)

24 33.5nm Mech Error; AIAWVLEN == 0 &&
 {(AIFILTYP == 0 && AIFWEN != 203 && AIFWEN != 204
 && AIFWEN != 74 && AIFWEN != 75)}
 || (AIFILTYP == 1 && AIFWEN != 137 && AIFWEN != 138)

25 160nm Mech Error; AIAWVLEN == 4 && AIFWEN != 269 && AIFWEN != 270

26 170nm Mech Error; AIAWVLEN == 5 && AIFWEN != 137 && AIFWEN != 138

27 450nm Mech Error; AIAWVLEN == 6 && AIFWEN != 74 && AIFWEN != 75

28 Invalid Wavelength; WAVE_STR == "UNKNOWN"

29

30

31

AIA Mechanism position definitions from Paul Boerner

WAVELEN	FILTER_TYPE	FW_ENCODER	AS_ENCODER"
1600	"Don't check"	"269 or 270"	"Don't check"
	"Don't check"	"269 or 270"	"Don't check"
	"Don't check"	"269 or 270"	"Don't check"
1700	"Don't check"	"137 or 138"	"Don't check"
	"Don't check"	"137 or 138"	"Don't check"
	"Don't check"	"137 or 138"	"Don't check"
4500	"Don't check"	"74 or 75"	"Don't check"
	"Don't check"	"74 or 75"	"Don't check"
	"Don't check"	"74 or 75"	"Don't check"
WAVELEN	FILTER_TYPE	FW_ENCODER	AS_ENCODER"
94	0	"269 or 270"	"Don't check"
	1	"11 or 12"	"Don't check"
	2 (0)	"74 or 75"	"Don't check"
131	0	"269 or 270"	"Don't check"
	1	"11 or 12"	"Don't check"
	2 (0)	"74 or 75"	"Don't check"
171	0	"203 or 204"	"Don't check"
	1	"11 or 12"	"Don't check"
304	0	"203 or 204"	"Don't check"
	1	"137 or 138"	"Don't check"

335	2 (0)	"74 or 75"	"Don't check"
	0	"203 or 204"	"Don't check"
	1	"137 or 138"	"Don't check"
	2 (0)	"74 or 75"	"Don't check"
WAVELEN	FILTER_TYPE	FW_ENCODER	AS_ENCODER"
193	0	"269 or 270"	6
	1	"11 or 12"	6
	2 (0)	"74 or 75"	6
211	0	"203 or 204"	24
	1	"137 or 138"	24
	2 (0)	"74 or 75"	24

Note: FILTER_TYPE "2" is not set correctly in the AIA flight software and is always reported as "0". The quality checks for FILTER_TYPE = 0 include both the FILTER_TYPE "0" and "2" mechanism positions.

Fits keyword and Image Status Packet (ISP) keyword translation:

ASQFSN	AIA_SEQ_FRAME_SN	int
AISTATE	AIA_IMG_ISS_LOOP	string
AIAWVLEN	AIA_IMG_WAVELENGTH	int
AIASEN	AIA_IMG_AS_ENCODER	int
AIFILTYP	AIA_IMG_FILTER_TYPE	short
AIFWEN	AIA_IMG_FW_ENCODE	int

AIAWVLEN lookup values:

Index: { 0, 1, 2, 3, 4, 5, 6, 7, 8 9 }

Wavelength: { 335, 131, 211, 193, 1600, 1700, 4500, 171, 304, 94 }

Appendix 3: HMI and AIA Level 1 Quality Definition

(updated by Rock Bush, October 19, 2010)

Bit0 is the low bit (0x01)

The parameter MISSVALS is from Img struct TOTVALS - DATAVALS

Bit	Meaning
---	-----
0	FLAT_REC == MISSING; Flatfield data not available
1	ORB_REC == MISSING; Orbit data not available
2	ASD_REC == MISSING; Ancillary Science Data not available
3	MPO_REC == MISSING; Master pointing data not available
4	RSUN_LF == MISSING or X0_LF == MISSING or Y0_LF == MISSING; HMI Limb fit not acceptable
5	
6	
7	
8	MISSVALS > 0
9	MISSVALS > 0.01*TOTVALS
10	MISSVALS > 0.05*TOTVALS
11	MISSVALS > 0.25*TOTVALS
12	ACS_MODE != 'SCIENCE'; Spacecraft not in science pointing mode
13	ACS_ECLP == 'YES'; Spacecraft eclipse flag set
14	ACS_SUNP == 'NO'; Spacecraft sun presence flag not set
15	ACS_SAFE == 'YES'; Spacecraft safemode flag set
16	IMG_TYPE == 'DARK'; Dark image
17	HWLTNSET == 'OPEN' HMI ISS loop open or AISTATE == 'OPEN'; AIA ISS loop Open
18	(FID >= 1 and FID <= 9999) HMI Calibration Image or (AIFTSID >= 0xC000) AIA Calibration Image

19 HCFTID == 17; HMI CAL mode image;
 20 (AIFCPS <= -20 or
 AIFCPS >= 100); AIA focus out of range
 21 AIAGP6 != 0; AIA register flag
 22
 23
 24
 25
 26
 27
 28
 29
 30 Quicklook image
 31 Image not available

IMG_TYPE; "Image type: LIGHT or DARK"

HMI ISS loop open; HWLTNSET == 'OPEN'; (HWLTNSET != 0)
 HWLTNSET = HMI_IMG_ISS_LOOP

AIA ISS loop open; AISTATE == 'OPEN'; (AISTATE != 0)
 AISTATE = AIA_IMG_ISS_LOOP

HMI calibration image (FID >= 1 and FID <= 9999)
 FID = Filtergram ID identical to
 HSQFGID = HMI_SEQ_FILTERGRAM_ID FID

AIA calibration image (AIFTSID >= 0xC000)
 AIFTSID = AIA_IMG_FTS_ID; active FTS ID number

AIA focus out of range (AIFCPS <= -20 or AIFCPS >= 100)
 AIFCPS = AIA_IMG_FC_POSITION; focus mechanism position

AIAGP6= AIA_IMG_GP6; AIA General Purpose Register #6

Appendix 4: SDO Master Pointing Parameter Definition File

(this jsd from Rock Bush on May 4, 2010)

#====General Series Information=====

Seriesname: sdo.master_pointing
 Author: "production"
 Owner: production
 Unitsize: 0
 Archive: 0
 Retention: 0
 Tapegroup: 0
 PrimeKeys: T_START
 DBIndex: T_START
 Description: "Master Pointing Parameters"

#====Keywords=====

#==== (0) Keywords from document: JSOC keywords used for metadata

Keyword:ORIGIN, string, constant, record, "SDO/JSOC-SDP", "%s", "none", "ORIGIN Location where file made"
 Keyword:TELESCOP, string, constant, record, "SDO", "%s", "none", "SDO spacecraft"
 Keyword:DATE, time, variable, record, DRMS_MISSING_VALUE, "0", "ISO", "Date_time of processing; ISO 8601"
 Keyword:T_START, time, variable, record, DRMS_MISSING_VALUE, "0", "ISO", "Interval start Date_time; ISO 8601"
 Keyword:T_STOP, time, variable, record, DRMS_MISSING_VALUE, "0", "ISO", "Interval stop Date_time; ISO 8601"
 Keyword:T_HKVALS, time, variable, record, DRMS_MISSING_VALUE, "0", "ISO", "Housekeeping data select Date_time; ISO 8601"
 Keyword:VERSION, int, variable, record, DRMS_MISSING_VALUE, "%d", "none", "Version"

#==== (0.1) SDO Spacecraft Inertial Reference Pointing Offset

Keyword:SC_Y_INRT_BIAS, float, variable, record, DRMS_MISSING_VALUE, "%f", "arcsec", "SDO Y Axis offset between inertial and science sun center"
 Keyword:SC_Z_INRT_BIAS, float, variable, record, DRMS_MISSING_VALUE, "%f", "arcsec", "SDO Z Axis offset between inertial and science sun center"

#===== (1) HMI Image Locations

Keyword:H_CAM1_IMSCALE, float, variable, record, DRMS_MISSING_VALUE, "%f", "arcsec", "Image scale in arcsec/pixel"
Keyword:H_CAM1_X0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD x direction"
Keyword:H_CAM1_Y0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD y direction"
Keyword:H_CAM1_INSTROT, float, variable, record, DRMS_MISSING_VALUE, "%f", "deg", "Rotation of CCD from SDO Z axis"

Keyword:H_CAM2_IMSCALE, float, variable, record, DRMS_MISSING_VALUE, "%f", "arcsec", "Image scale in arcsec/pixel"
Keyword:H_CAM2_X0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD x direction"
Keyword:H_CAM2_Y0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD y direction"
Keyword:H_CAM2_INSTROT, float, variable, record, DRMS_MISSING_VALUE, "%f", "deg", "Rotation of CCD from SDO Z axis"

#===== (2) AIA Image Locations

Keyword:A_094_IMSCALE, float, variable, record, DRMS_MISSING_VALUE, "%f", "arcsec", "Image scale in arcsec/pixel"
Keyword:A_094_X0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD x direction"
Keyword:A_094_Y0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD y direction"
Keyword:A_094_INSTROT, float, variable, record, DRMS_MISSING_VALUE, "%f", "deg", "Rotation of CCD from SDO Z axis"

Keyword:A_131_IMSCALE, float, variable, record, DRMS_MISSING_VALUE, "%f", "arcsec", "Image scale in arcsec/pixel"
Keyword:A_131_X0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD x direction"
Keyword:A_131_Y0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD y direction"
Keyword:A_131_INSTROT, float, variable, record, DRMS_MISSING_VALUE, "%f", "deg", "Rotation of CCD from SDO Z axis"

Keyword:A_171_IMSCALE, float, variable, record, DRMS_MISSING_VALUE, "%f", "arcsec", "Image scale in arcsec/pixel"
Keyword:A_171_X0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD x direction"
Keyword:A_171_Y0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD y direction"
Keyword:A_171_INSTROT, float, variable, record, DRMS_MISSING_VALUE, "%f", "deg", "Rotation of CCD from SDO Z axis"

Keyword:A_193_IMSCALE, float, variable, record, DRMS_MISSING_VALUE, "%f", "arcsec", "Image scale in arcsec/pixel"
Keyword:A_193_X0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD x direction"
Keyword:A_193_Y0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD y direction"

Keyword:A_193_INSTROT, float, variable, record, DRMS_MISSING_VALUE, "%f", "deg", "Rotation of CCD from SDO Z axis"

Keyword:A_211_IMSCALE, float, variable, record, DRMS_MISSING_VALUE, "%f", "arcsec", "Image scale in arcsec/pixel"

Keyword:A_211_X0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD x direction"

Keyword:A_211_Y0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD y direction"

Keyword:A_211_INSTROT, float, variable, record, DRMS_MISSING_VALUE, "%f", "deg", "Rotation of CCD from SDO Z axis"

Keyword:A_304_IMSCALE, float, variable, record, DRMS_MISSING_VALUE, "%f", "arcsec", "Image scale in arcsec/pixel"

Keyword:A_304_X0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD x direction"

Keyword:A_304_Y0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD y direction"

Keyword:A_304_INSTROT, float, variable, record, DRMS_MISSING_VALUE, "%f", "deg", "Rotation of CCD from SDO Z axis"

Keyword:A_335_IMSCALE, float, variable, record, DRMS_MISSING_VALUE, "%f", "arcsec", "Image scale in arcsec/pixel"

Keyword:A_335_X0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD x direction"

Keyword:A_335_Y0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD y direction"

Keyword:A_335_INSTROT, float, variable, record, DRMS_MISSING_VALUE, "%f", "deg", "Rotation of CCD from SDO Z axis"

Keyword:A_1600_IMSCALE, float, variable, record, DRMS_MISSING_VALUE, "%f", "arcsec", "Image scale in arcsec/pixel"

Keyword:A_1600_X0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD x direction"

Keyword:A_1600_Y0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD y direction"

Keyword:A_1600_INSTROT, float, variable, record, DRMS_MISSING_VALUE, "%f", "deg", "Rotation of CCD from SDO Z axis"

Keyword:A_1700_IMSCALE, float, variable, record, DRMS_MISSING_VALUE, "%f", "arcsec", "Image scale in arcsec/pixel"

Keyword:A_1700_X0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD x direction"

Keyword:A_1700_Y0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD y direction"

Keyword:A_1700_INSTROT, float, variable, record, DRMS_MISSING_VALUE, "%f", "deg", "Rotation of CCD from SDO Z axis"

Keyword:A_4500_IMSCALE, float, variable, record, DRMS_MISSING_VALUE, "%f", "arcsec", "Image scale in arcsec/pixel"

Keyword:A_4500_X0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD x direction"

Keyword:A_4500_Y0, float, variable, record, DRMS_MISSING_VALUE, "%f", "pixel", "Image center in CCD y direction"

Keyword:A_4500_INSTROT, float, variable, record, DRMS_MISSING_VALUE, "%f", "deg", "Rotation of CCD from SDO Z axis"

#===== (3) HMI Alignment Parameters

Keyword:HMI_FSW_AL1_POSITION, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[HAL1POS]"
 Keyword:HMI_FSW_AL2_POSITION, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[HAL2POS]"
 Keyword:HMI_AL1_STATUS, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[HAL1STAT]"
 Keyword:HMI_AL2_STATUS, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[HAL2STAT]"

Keyword:HMI_ISS_ERRGAINY, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[HIERRGNY]"
 Keyword:HMI_ISS_ERRGAINZ, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[HIERRGNZ]"
 Keyword:HMI_ISS_ERROFFY, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[HIERROFFY]"
 Keyword:HMI_ISS_ERROFFZ, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[HIERROFFZ]"

Keyword:HMI_ISS_PZTOFFA, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[HIPZTOFA]"
 Keyword:HMI_ISS_PZTOFFB, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[HIPZTOFB]"
 Keyword:HMI_ISS_PZTOFFC, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[HIPZTOFC]"

Keyword:HMI_ISS_PKT_YCOEF_A, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[HIYCOEFA]"
 Keyword:HMI_ISS_PKT_YCOEF_B, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[HIYCOEFB]"
 Keyword:HMI_ISS_PKT_YCOEF_C, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[HIYCOEFC]"
 Keyword:HMI_ISS_PKT_ZCOEF_A, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[HIZCOEFA]"
 Keyword:HMI_ISS_PKT_ZCOEF_B, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[HIZCOEFB]"
 Keyword:HMI_ISS_PKT_ZCOEF_C, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[HIZCOEFC]"

#===== (4) AIA Alignment Parameters

Keyword:AIA_IS1_ERRGAINY, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A1ERRGNY]"
 Keyword:AIA_IS1_ERRGAINZ, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A1ERRGNZ]"
 Keyword:AIA_IS1_ERROFFY, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A1ERROFFY]"
 Keyword:AIA_IS1_ERROFFZ, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A1ERROFFZ]"

Keyword:AIA_IS1_PZTGAINA, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A1PZTGNA]"
 Keyword:AIA_IS1_PZTGAINB, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A1PZTGNB]"
 Keyword:AIA_IS1_PZTGAINC, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A1PZTGNC]"

Keyword:AIA_IS1_PZTOFFA, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A1PZTOFA]"
 Keyword:AIA_IS1_PZTOFFB, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A1PZTOFB]"
 Keyword:AIA_IS1_PZTOFFC, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A1PZTOFC]"

Keyword:AIA_GT1_PKT_YCOEF_A, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT1_YCA]"
 Keyword:AIA_GT1_PKT_YCOEF_B, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT1_YCB]"
 Keyword:AIA_GT1_PKT_YCOEF_C, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT1_YCC]"
 Keyword:AIA_GT1_PKT_ZCOEF_A, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT1_ZCA]"
 Keyword:AIA_GT1_PKT_ZCOEF_B, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT1_ZCB]"
 Keyword:AIA_GT1_PKT_ZCOEF_C, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT1_ZCC]"

Keyword:AIA_IS2_ERRGAINY, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A2ERRGNY]"
 Keyword:AIA_IS2_ERRGAINZ, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A2ERRGNZ]"
 Keyword:AIA_IS2_ERROFFY, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A2ERROFY]"
 Keyword:AIA_IS2_ERROFFZ, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A2ERROFZ]"

Keyword:AIA_IS2_PZTGAINA, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A2PZTGNA]"
 Keyword:AIA_IS2_PZTGAINB, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A2PZTGNB]"
 Keyword:AIA_IS2_PZTGAINC, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A2PZTGNC]"
 Keyword:AIA_IS2_PZTOFFA, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A2PZTOFA]"
 Keyword:AIA_IS2_PZTOFFB, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A2PZTOFB]"
 Keyword:AIA_IS2_PZTOFFC, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A2PZTOFC]"

Keyword:AIA_GT2_PKT_YCOEF_A, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT2_YCA]"
 Keyword:AIA_GT2_PKT_YCOEF_B, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT2_YCB]"
 Keyword:AIA_GT2_PKT_YCOEF_C, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT2_YCC]"
 Keyword:AIA_GT2_PKT_ZCOEF_A, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT2_ZCA]"
 Keyword:AIA_GT2_PKT_ZCOEF_B, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT2_ZCB]"
 Keyword:AIA_GT2_PKT_ZCOEF_C, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT2_ZCC]"

Keyword:AIA_IS3_ERRGAINY, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A3ERRGNY]"
 Keyword:AIA_IS3_ERRGAINZ, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A3ERRGNZ]"
 Keyword:AIA_IS3_ERROFFY, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A3ERROFY]"
 Keyword:AIA_IS3_ERROFFZ, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A3ERROFZ]"

Keyword:AIA_IS3_PZTGAINA, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A3PZTGNA]"
 Keyword:AIA_IS3_PZTGAINB, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A3PZTGNB]"
 Keyword:AIA_IS3_PZTGAINC, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A3PZTGNC]"
 Keyword:AIA_IS3_PZTOFFA, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A3PZTOFA]"
 Keyword:AIA_IS3_PZTOFFB, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A3PZTOFB]"
 Keyword:AIA_IS3_PZTOFFC, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A3PZTOFC]"

Keyword:AIA_GT3_PKT_YCOEF_A, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT3_YCA]"
 Keyword:AIA_GT3_PKT_YCOEF_B, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT3_YCB]"
 Keyword:AIA_GT3_PKT_YCOEF_C, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT3_YCC]"
 Keyword:AIA_GT3_PKT_ZCOEF_A, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT3_ZCA]"
 Keyword:AIA_GT3_PKT_ZCOEF_B, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT3_ZCB]"
 Keyword:AIA_GT3_PKT_ZCOEF_C, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT3_ZCC]"

Keyword:AIA_IS4_ERRGAINY, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A4ERRGNY]"
 Keyword:AIA_IS4_ERRGAINZ, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A4ERRGNZ]"
 Keyword:AIA_IS4_ERROFFY, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A4ERROFY]"
 Keyword:AIA_IS4_ERROFFZ, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A4ERROFZ]"

Keyword:AIA_IS4_PZTGAINA, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A4PZTGNA]"
 Keyword:AIA_IS4_PZTGAINB, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A4PZTGNB]"
 Keyword:AIA_IS4_PZTGAINC, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A4PZTGNC]"
 Keyword:AIA_IS4_PZTOFFA, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A4PZTOFA]"
 Keyword:AIA_IS4_PZTOFFB, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A4PZTOFB]"
 Keyword:AIA_IS4_PZTOFFC, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[A4PZTOFC]"

Keyword:AIA_GT4_PKT_YCOEF_A, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT4_YCA]"
 Keyword:AIA_GT4_PKT_YCOEF_B, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT4_YCB]"
 Keyword:AIA_GT4_PKT_YCOEF_C, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT4_YCC]"
 Keyword:AIA_GT4_PKT_ZCOEF_A, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT4_ZCA]"
 Keyword:AIA_GT4_PKT_ZCOEF_B, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT4_ZCB]"
 Keyword:AIA_GT4_PKT_ZCOEF_C, float, variable, record, DRMS_MISSING_VALUE, "%f", "none", "[AGT4_ZCC]"