

A Level 0 Header Keywords

This appendix explains the 162 keywords in the XRT Level 0 FITS header.

Keyword	Value	Definition
SIMPLE	T	Conforms to FITS standard
BITPIX	8, 16, 32, -32, -64	Number of bits per pixel
NAXIS	2	Number of axes in the image
NAXIS1		Full image size in x
NAXIS2		Full image size in y
DATE	'YYYY-MM-DDThh:mm:ss.sss'	Date and time of file creation ('T' is character 'T')
DATE_RFO	'YYYY-MM-DDThh:mm:ss.sss'	Date and time of Level 0 reformatting ('T' is character 'T')
SATELLIT	0x21	Satellite number (from PDU header for images)
TELESCOPE	'SolarB'	Derived from above
INSTRUME	'XRT'; 'SOT/SP'; 'SOT/FG'	Name of the instrument; reformatter only retrieves XRT records
TIMESYS	'UTC'; 'TAI'	Time system of file header
MDP_CLK		MDP clock in units of $1/512^{th}$ seconds; same as E_SCLOCK
FILEORIG		Original filename used by level 0 reformatter
P1ROW	0 to N-1	x -coordinate of beginning, or lower left hand corner, pixel in image FOV; same as RPOS_ROW
P2ROW	0 to N-1	x -coordinate of ending, or upper right hand corner, pixel in image FOV; same as RPOS_ROW + RSIZ_ROW - 1
P1COL	0 to N-1	y -coordinate of beginning, or lower left hand corner, pixel in image FOV; same as RPOS_COL
P2COL	0 to N-1	y -coordinate of ending, or upper right hand corner, pixel in image FOV; same as RPOS_COL + RSIZ_COL - 1
TR_MODE	'TR1'; 'TR2'; 'TR3'; 'TR4'; 'FIX'	Tracking mode
IMG_MODE	1-3	Image mode (source of exposure trigger); 1: Table and manual, 2: Automatic Region Selection Patrol, 3: Flare Detection Patrol
AEC_FLG	'off' ; 'on'	Automatic Exposure Control; 1: Off, 2: On
AEC_TNUM		AEC table number; 0: Out of RB, 1: In RB
AEC_RSLT	0-3	45 Result of AEC calculation used to determine exposure time; 0: Normal, 1: Underexposure, 2: Overexposure, 3: No feedback
ORIGIN	'ISAS; NAOJ; MSSSL; LM-SAL; GSFC; 'SAO	Origin of the Chief Observer

Keyword	Value	Definition
DATA_LEV	0, 1	Data Level; running trace_prep.pro will change 0 to 1
ORIG_RFO	'ISAS ; NAOJ ; MSSL ; LM-SAL ; GSFC ; 'SAO	Where the level 0 file was created
VER_RFO		Version of Level 0 reformatter
PROG_VER	0-7	MDP observation table program version number
SEQN_VER	0-7	OT sequence table version number
PARM_VER	0-3	OT parameter table version number
PROG_NO		OT program number
SUBR_NO		OT subroutine number being executed
SEQN_NO		OT sequence table number
MAIN_CNT	0-7	OT number of times to repeat main loop
MAIN_RPT		OT current main-routine iteration
MAIN_POS		OT main-routine position
SUBR_CNT		OT sequential number of this subroutine in the main routine
SUBR_RPT		OT number of times current subroutine is repeated
SUBR_POS		OT loop count for current subroutine
SEQN_CNT		OT current sequence table repeat count
SEQN_RPT		OT sequence table repeat count
SEQN_POS		OT sequence table position
OBSTITLE		Title of observation
TARGET	'Active region' ; 'Quiet region' ; 'Coronal hole' ; 'Flare site'	Indicates the observation region. Flare site used when flare flag is set. Source of information observation planning database, or telemetry if flare flag is set.
SCI_OBJ		Up to 5 target phenomena selected from list. See Mission-Wide Keywords document, p. 26.
SCI_OBS		Target phenomena.
OBS_DEC		A few sentences describing the properties of the observation.
JOIN_SB	'ESX'; 'SX'; 'EX'; 'X'	Joint observation; E=EIS, S=SOT, X=XRT
OBS_NUM		Equal to OBS_ID
JOP_ID		Identifier of JOP
NOAA_NUM		AR Number as assigned by NOAA
OBSERVER		Name(s) of Chief Observer
PLANNER	46	Name(s) of Chief Planner
TOHBANS		Name(s) of Tohbans
DATATYPE	'SCI'; 'ENG'	Science or engineering data; darks and flats are considered engineering data
SAA	'In'; 'Out'	Indicates whether Hinode is in or out of a South Atlantic Anomaly region

Keyword	Value	Definition
HLZ	'In'; 'Out'	Indicates whether Hinode is in or out of High Latitude Zone region
FLFLG	'Flr'; 'Non'	Indicates if flare flag set or not
S_INSTRU	4	Instrument number
S_DAT_ID	1-3, 5-7	Type of status packet this record was created from: 0: Not used, 1: Normal status, 2: Normal and extended status, 3: Normal status and memory, 4: Not used, 5: Standard HDR only, 6: Extended status, 7: Memory
S_DAT_M	0, 1	0: Transfer to Kagoshima Space Center (KSC) and Sagamiara Satellite Operation Center (SSOC); 1: Monitor only at KSC
S_SP_SIZ	31-609	Status packet size; maximum value is 609, including header.
EC_ID	0-65535	Unique identifier, 'main ID'
EC_INDEX	0-35	Redundant to EC_EINDE; consider this keyword obsolete
EC_EINDE	0-35	Exposure Index
EC_CD_MO	0, 1	Cadence mode
EC_CD_M_	'safe' ; 'fast'	Cadence mode as name
EC_IMTYP	0, 1	Image type; 0: Normal, 1: Dark (closed shutter)
EC_IMTY_	'normal' ; 'dark'	Image type; a dark is taken with the shutter closed
EC_FW1	0-5	Filter Wheel 1 position
EC_FW1_	'Open' ; 'Al_poly' ; 'C_poly' ; 'Be_thin' ; 'Be_med' ; 'Al_med'	Filter Wheel 1 position as name
EC_FW2	0-5	Filter Wheel 2 position
EC_FW2_	'Open' ; 'Al_poly' ; 'Ti_poly' ; 'Gband' ; 'Al_thick' ; 'Be_thick'	Filter Wheel 2 position as name
EC_VL	0, 1	Visible light shutter during exposure; 0: Closed, 1: Open
EC_VL_	'closed' ; 'open'	Visible light shutter during exposure as name
E_SCLK		Spacecraft clock of most recent status request prior to arrival of exposure command
E_LCLK	0-16777215	Time at which exposure command processing began, local clock, converted to μ s
E_SH_OPE	0-16777215	Time CCD_EXPOSE and OPENOUT signals were raised (low 24 bits), converted to μ s
E_SH_CLO	0-16777215	Time CCD_EXPOSE and OPENOUT signals were lowered (low 24 bits), converted to μ s

Keyword	Value	Definition
EXCCDEX		Duration of CCD_EXPOSE in μs ; this is the correct value to use for dark exposure times
OBT_TIME		Spacecraft clock time when CCD_EXPOSE was raised; this is E_SH_OPE converted to spacecraft clock time
OBT_END		Spacecraft clock time when CCD_EXPOSE was lowered; this is E_SH_CLO converted to spacecraft clock time
E_SH_POS		Shutter encoder position
E_SH_WA		Waiting position A
E_SH_WB		Waiting position B
E_SH_WC		Waiting position C
E_SH_CW		Waiting clockwise exposure time
E_SH_CCW		Waiting counterclockwise exposure time
E_VLO	0, 1	VLS open microswitch; 0: Off (VLS not fully open), 1: On (VLS fully open)
E_VLO_	'not fully open'; 'fully open'	State of VLS
E_VLC	0, 1	VLS closed microswitch; 0: Off (VLS not fully open), 1: On (VLS fully open)
E_VLC_	'not fully open'; 'fully open'	State of VLS
E_SH_ERR	0, 1	0: No error, 1: Shutter command error
E_FW1_PO		Filter Wheel 1 course position (internal diagnostic format)
E_FW1_ST		Filter Wheel 1 status
E_FW2_PO		Filter Wheel 2 course position (internal diagnostic format)
E_FW2_ST		Filter Wheel 2 status
E_ETIM_E		Exposure time (exponent); see also E_ETIM (Though the value for E_ETIM should be normalized if the data is normalized, E_ETIM_E should remain <i>unchanged</i> so the user can reconstruct the original exposure time.)
E_ETIM_M		Exposure time (mantissa); see also E_ETIM (Though the value for E_ETIM should be normalized if the data is normalized, E_ETIM_M should remain <i>unchanged</i> so the user can reconstruct the original exposure time.)
E_ETIM	48	Exposure time in μs , derived from above two fields; this number should be normalized if the data is normalized by exposure time
EXPTIME		Requested exposure time in seconds (calculated from EC_EINDE and exposure table)
E_TTN		Rev. number of exposure table

Keyword	Value	Definition
EXPMPAS	'single'; 'multi'	Single or multipass exposure
E_FW1_P	'Open'; 'Al_poly'; 'C_poly'; 'Be_thin'; 'Be_med'; 'Al_med'	Filter Wheel 1 position
E_FW2_P	Al_poly'; 'Ti_poly'; 'Gband'; 'Al.thick'; 'Be.thick'	Filter Wheel 2 position
CCD_TEMP		CCD temperature; $t_c = -95.853 + 0.55376t_{raw} + 5.9941 \cdot 10^{-5}t_{raw}^2$
CCD_TMPC		CCD temperature, derived from CCD_TEMP
CCD_READ	0, 1	CCD readout port; 0: right, 1: left
READPORT	'L'; 'R'	CCD readout port
CHIP_SUM	1, 2, 4, 8	On-chip pixel summation for CCD; 1: 1×1, 2: 2×2, 3: 4×4, 4: 8×8
CAL_INFO	0, 1	CCD image type; 0: Calibration image, 1: Observation image
CALIMAGE	'CAL' ; 'OBS'	CCD readout port (from CAL_INFO)
POS_COL		CCD column number of start of image (original value multiplied by 8 to get number of pixels)
POS_ROW		CCD row number of start of image (original value multiplied by 8 to get number of pixels)
ROI_H_SI		ROI horizontal size; 1: 64, 2: 128, 3: 192, 4: 256, 6: 384, 8: 512, 12: 768, 16: 1024, 24: 1540, 32: 2048; (original value multiplied by 64 to get number of pixels)
SIZ_COL		Horizontal size of ROI, derived from above; value is 0 if ROI_H_SIZE is reserved
ROI_V_SI		ROI vertical size; 1: 64, 2: 128, 3: 192, 4: 256, 6: 384, 8: 512, 12: 768, 16: 1024, 24: 1540, 32: 2048; (original value multiplied by 64 to get number of pixels)
SIZ_ROW		Vertical size of ROI, derived from above; value is 0 if ROI_V_SIZE is reserved
RECTIFY		Status of rectification to put solar south-east corner at the start of the CCD image
RPOS_COL		The rectified coordinate, equivalent to POS_COL, as though the image had been read out with this coordinate. If READPORT=R, RPOS_COL=POS_COL; otherwise RPOS_CPOS_COL.
RPOS_ROW		Rectified POS_ROW. Always the same as POS_ROW.
RSIZ_COL		Rectified SIZ_COL. Always the same as SIZ_COL.

Keyword	Value	Definition
RSIZ_ROW		Rectified SIZ_ROW. Always the same as SIZ_ROW.
EFFPORT		Rectified readout port
FOC_POS	-2500 to 2500	Focus position
BITCOMP1		Compression table keyword
IMGCOMP1		Compression table keyword
QTABLE1		Compression table keyword
BITC_VER	2	Bit compression lookup table version
ACHF_VER	76	AC Huffman table version
DCHF_VER	15	DC Huffman table version
QTAB_VER	0-7	Quantization table version
PCK_SNO		Data packet keyword
PCK_SN1		Data packet keyword
NUM_PCKS		Data packet keyword
HKTSYNC		True if fields derived from housekeeping data have been updated. (That is, they are not missing from the database.) Default is false.
DATE_OBS	'YYYY-MM-DDThh:mm:ss.sss'	UTC time when exposure began ('T' is character 'T')
TIME-OBS	'hh:mm:ss.sss'	Same value as DATE_OBS, but in a different format
CTIME	'DOW MON DD hh:mm:ss YYYY'	Example: 'Mon Mar 19 00:02:11 2007'; Same value as DATE_OBS, but in a different format
DATE_END	'YYYY-MM-DDThh:mm:ss.sss'	UTC time when exposure began ('T' is character 'T')
CRPIX1		Column number of Sun center pixel (sometimes negative)
CRPIX2		Row number of Sun center pixel (sometimes negative)
SC_ATTX		Spacecraft attitude in <i>longitude</i>
SC_ATTY		Spacecraft attitude in <i>latitude</i>
CRVAL1	0.0	Number of arcseconds of the center of the sun from the reference position in the azimuthal direction (E-W); positive is to Solar West
CRVAL2	0.0	Number of arcseconds of the center of the sun from the reference position in the elevation direction (N-S); positive is to Solar North
CDELTA1		Horizontal pixel size (PLATESCALE \times SUMROW)
CDELTA2	50	Vertical pixel size (PLATESCALE \times SUMCOL)
CUNIT1		Horizontal units
CUNIT2		Vertical Units
CTYPE1		Type of units (label) of horizontal axis

Keyword	Value	Definition
CTYPE2		Type of units (label) of vertical axis
SAT_ROT		Difference between Solar north and y -axis of the satellite
INST_ROT		Difference between spacecraft y -axis and image y -axis
CROTA1		Angle between x -axis of image (same as x -axis of CCD) and E-W axis of heliocentric coordinates ($SAT_ROT + INST_ROT$)
CROTA2		Angle between y -axis of image and N-S axis of heliocentric coordinates ($SAT_ROT + INST_ROT$); CROTA1 and CROTA2 are identical for XRT
XCEN		X -coordinate of center of field of view
YCEN		Y -coordinate of center of field of view
XSCALE		Same as PLATESCL
YSCALE		Same as PLATESCL
FOVX		Width of field of view x -axis; equivalent to $NAXIS1 \times CDELTA1$
FOVY		Width of field of view y -axis; equivalent to $NAXIS2 \times CDELTA2$
PLATESCL		Platescale, in units of arcseconds per pixel