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_RF0	'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	Result of AEC calculation used to determine exposure time; 0: Normal, 1: Underexposure, 2: Overexposure, 3: No feedback
ORIGIN	'ISAS; NAOJ; MSSL; LM-SAL; GSFC; 'SAO	Origin of the Chief Observer

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Keyword	Value	Definition
DATA_LEV	0, 1	Data Level; running **trace_prep.pro** will change 0 to 1
ORIG_RF0	'ISAS ; NAOJ ; MSSL ; LM-SAL ; GSFC ; 'SAO	Where the level 0 file was created
VER_RF0		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 Hight 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 Sagamihara 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_SCLOCK		Spacecraft clock of most recent status request prior to arrival of exposure command
E_LCLOCK	0-16777215	Time at which exposure command processing began, local clock, converted to μs
E_SH_OPE	0-16777215	Time CCD_EXPOSE and OPENOUT signals were raised (low 24 bits), converted to μs
E_SH_CLO	0-16777215	Time CCD_EXPOSE and OPENOUT signals were lowered (low 24 bits), converted to μs

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 *unchanged* 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 *unchanged* so the user can reconstruct the original exposure time.)
E_ETIM		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

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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	49	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_SN0		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 *longitude*
SC_ATTY		Spacecraft attitude in *latitude*
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
CDELT1		Horizontal pixel size (PLATESCALE × SUMROW)
CDELT2	50	Vertical pixel size (PLATESCALE × 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 $\times$ CDELT1
FOVY		Width of field of view y-axis; equivalent to NAXIS2 $\times$ CDELT2
PLATESCL		Platescale, in units of arcseconds per pixel