Section 2.4

Hipparcos Catalogue: Variability Annex

2.4. Hipparcos Catalogue: Variability Annex

The variability annex has been compiled from an analysis of the (calibrated) Hipparcos epoch photometry data, described in Section 2.5. The variability annex is divided into two tabular sections (contained in Volume 11 of the printed catalogue), with three additional parts containing light curves or folded light curves (contained in Volume 12 of the printed catalogue). The criteria for including an object in the Variability Annex are described in Section 1.3.5.

The results presented in the context of the Hipparcos Catalogue publication are inevitably a compromise between the objectives of the data analysis groups to provide useful variability classification at the time of the catalogue publication, and the conflicting requirement to make the final catalogue available as rapidly as possible. Terms such as 'newly-discovered as variable by Hipparcos', assigned variability types, or inferred absence of variability, should be understood in this context.

Description of the Tabular Data

Volume 11, Section 1 is the subset of variable stars ('periodic variables') for which a period and variability amplitude has been derived on the basis of the Hipparcos data. There are also cases where the Hipparcos data were insufficient to determine a period but, when folded with the period given in the literature, confirm that period—in some cases this has provided a new determination of the reference epoch. In nearly 200 cases, mainly involving Algol-type eclipsing binaries, for which the Hipparcos observations covered the full period of the light curves inadequately, periods and reference epochs from the literature were used to fold the data. In these cases, an object may appear in the section of periodic variables even though no period is given in the main catalogue, Field H51.

Volume 11, Section 2 contains relevant information for what are referred to as 'unsolved variables', i.e. for objects which could be classified as variable on the basis of the Hipparcos data, but for which periods could not be determined from the Hipparcos data, or where Hipparcos could not confirm a periodicity given in the literature. The majority of these are small-amplitude variables ('micro-variables' without established periods are flagged 'M' in Field H52 of the main Hipparcos Catalogue, and are not included in the sections on periodic or unsolved variables). Consequently, in those cases where the Hipparcos observations have been unable to confirm a period given in the literature, an object may appear in the section of unsolved variables, even though a period may have been given in the literature (Field U18).

Both tabular sections are organised according to the Hipparcos Catalogue (HIP) identifier. A flag in the main catalogue, Field H53, takes the value '1' or '2' depending on the section where the given object is to be found.

Both sections have a similar structure, with spectral type and variability type given (generally from the literature where known), along with information on the period,

maximum and minimum magnitudes, variable star name, and other related information from the literature. For the periodic variables, information on the period and estimated values of the maximum and minimum *Hp* magnitudes from the light-curve fitting are given, while directly observed quantities are given in the case of the unsolved variables. In both cases, notes or cross-references to published light curves are given.

Within the section devoted to unsolved variables, the reference epoch and period from the literature are mainly of relevance for the semi-regular variables, where Hipparcos has been unable to confirm or update the period given in the literature—in most of these cases the information in these fields is only of historical interest, with periods given in the literature frequently being unconfirmed in the Hipparcos data.

Information entered in Fields P18–P22 and U18–U22 is largely taken from the General Catalogue of Variable Stars, 4th edition GCVS; P.N. Kholopov *et al.*, Publ. Office 'Nauka', Moscow, 1985–88) and its updates, either through the CDS (Strasbourg), or from the data base of the American Association of Variable Star Observers (AAVSO), as communicated by J. Mattei. There has not been a systematic attempt to incorporate similar published information from other sources. In a few cases, information from the recent literature has been added in these fields to support the interpretation of the Hipparcos results.

Description of the Light Curves

Field P15 in the periodic variables, and Field U15 in the unsolved variables, contains a pointer to one of the three sections of light curves contained in Volume 12. These sections provide light curves extending over the total mission duration in the case of the non-periodic variables, or folded light curves in those cases where periods are available or have been derived. A section is also devoted to objects for which light curves supplied by the AAVSO have been transformed to the same photometric system, and superimposed on the Hipparcos results (these may be periodic or non-periodic).

Fields P1–19: Periodic Variables

Field P1: The Hipparcos Catalogue (HIP) identifier

The variability annex contains no provision for a component identifier. Even though in some cases there are double/multiple star solutions with individual photometry for two variable components, it has almost always been preferable to fix the magnitude of one component, and solve for only one variable. This means that the only difference between the 'combined photometry' and the 'component photometry' is a fixed amount of subtracted light. In the large majority of cases, the primary has been assumed to be the variable component, but for a few tens of cases, there is good evidence that the variability originates mainly in the secondary. This information has been indicated in a note to the entry in the Double and Multiple Systems Annex (Part C).

Field P2: Flag for newly-classified variable entries

A flag (*) indicates that the object has been newly-classified as variable on the basis of the Hipparcos observations and the preliminary variability analysis.

Field P3: Spectral type

The spectral type has generally been taken from the SIMBAD data base of the CDS, Strasbourg, and updated by the Hipparcos Input Catalogue Consortium in some cases. Spectral types given in the Hipparcos Input Catalogue were frequently truncated (e.g. B8+... for B8+K2Ibe; for most eclipsing variables, the type of the hotter component was generally given, even if fainter). Since Field P3 gives the full description of the spectral type, and because of the updating, there are certain inconsistencies between the HIP spectral types (given here) and those given in the Hipparcos Input Catalogue.

Field P4: 1-letter variability type

This field repeats the single-character variability identifier given in the Hipparcos Catalogue, Field H52. It is 'P' for all entries contained in the section on periodic variables, except for one entry, for which the $(V-I)$ colour was revised (see Field H52) and which is consequently indicated by 'R'.

Field P5: 6-letter variability type

The 6-letter variability type was taken, when available, from the GCVS and NSV Catalogues. Table 2.4.1 summarises the main types of variability given in these source catalogues (e.g. eruptive, pulsating, rotating, cataclysmic, and eclipsing stars). A semicolon, ':', following the variability type indicates that the type is uncertain. The type 'SR' has been used to indicate not only semi-regular pulsating stars, but also other apparently semi-regular light curves, and could also include some rotational modulation variables. Where appropriate, updated or newly-defined variability types have been entered, according to the preliminary analysis of the Hipparcos photometric data.

Table 2.4.1. Types of variability

Code	Description	Class of Variable
ACV	α^2 Canum Venaticorum type (including ACVO)	rotating
ACYG	α Cygni type	pulsating
BCEP	β Cephei type (including BCEPS)	pulsating
BY	BY Draconis type	rotating
CEP	Cepheids (including CEP(B))	pulsating
CST	constant stars (considered as variable by some observer(s))	–
CW	W Virginis type	pulsating
CWA	W Virginis type (periods > 8 days)	pulsating
CWB	W Virginis type (periods < 8 days)	pulsating
DCEP	δ Cephei type (including DCEPS)	pulsating
DSCT	δ Scuti type (including DSCTC)	pulsating
E	(E+, E/ ..)	eclipsing binary
EA	Algol type (EA+, EA/ ..)	eclipsing binary
EB	β Lyrae type (EB/ ..)	eclipsing binary
ELL	rotating ellipsoidal (ELL+.. or /..)	rotating
EW	W Ursae Majoris type (EW/ ..)	eclipsing binary
FKCOM	FK Comae Berenices type	rotating
GCAS	γ Cassiopeiae type	eruptive
I	irregular (I, IA, IB, In, InT, Is)	eruptive
IN	irregular (INA, INAT, INB, INSA, INSB, INST, INT)	eruptive
IS	irregular (ISA, ISB)	eruptive
L	slow irregular (L, LB, LC)	pulsating
M	Mira Ceti type	pulsating
N	slow novae (NB, NC)	cataclysmic
NA	fast novae	cataclysmic
NL	nova-like	cataclysmic
NR	recurrent novae	cataclysmic
PVTEL	PV Telescopii type	pulsating
RCB	R Coronae Borealis type	eruptive
RR	RR Lyrae type (RR, RRAB, RRB, RRC)	pulsating
RS	RS Canum Venaticorum type	eruptive
RV	RV Tauri type (RV, RVA, RVB)	pulsating
SARV	small-amplitude red variables	pulsating/rotating
SDOR	S Doradus type	eruptive
SPB	slowly pulsating B stars	pulsating
SR	semi-regular (SR, SRA, SRB, SRC, SRD)	pulsating
SXARI	SX Arietis type	rotating
SXPHE	SX Phœnicis type	pulsating
UV	UV Ceti type	eruptive
WR	Wolf-Rayet	eruptive
XNG	X-ray nova-like system	X-ray binary
XP	X-ray pulsar	X-ray binary
ZAND	Z Andromedae type	cataclysmic

Field P6: Flag indicating newly-assigned variability type

A flag (*) indicates that a previously known variable has been assigned a different variability type in Field P5 than that previously given in the literature, on the basis of the Hipparcos analysis (a flag in Field P6 therefore never coincides with a newly-discovered variable flag in Field P2). Further details are given in the notes.

Field P7–9: Magnitudes at maximum and minimum luminosities

Fields P7 and P9 provide the magnitudes at maximum and minimum luminosities. These were derived from (folded) light-curve fitting on the basis of the *Hp* photometry for approximately 90 per cent of the stars in the section of periodic variables. These cases are assigned an associated error value in Field P10. The remaining 10 per cent (where no value is given in Field P10) had these magnitudes estimated from the light curves; in these cases the estimated errors on the period (Field P12) and reference phase (Field P14) were based on general relations between periods and accuracies.

A flag (>) in Field P8 indicates that the true magnitude at minimum luminosity is likely to be larger than the value of $Hp_{\rm min}$ given in Field P9.

For large-amplitude and faint variables, the fitted light-curve generally gives a more reliable estimate of $Hp_{\rm min}$, especially when the minimum is fainter than the detection threshold (cf. the AAVSO/Hipparcos light curves). For some stars with partial observations, fitting is not possible near the minimum, although it may be clear that the true minimum is fainter than the minimum luminosity observed.

Maximum and minimum magnitudes are given to 1, 2, or 3 decimal places, depending on the accuracy estimated for these values during the light-curve fitting process. The use of three decimals is generally only appropriate for the very brightest stars. The intrinsic uncertainty of the light-curve fitting, and the variability of the levels of the minima and maxima themselves, imply that resulting variations will typically be larger than 0.005 mag. In particular, for large amplitude or faint stars, only two or even one decimal are significant if σ_A/A (see Field P10) is large.

Some subjectivity is therefore involved in assigning the number of significant decimals. Appropriate caution should be exercised in their interpretation and, in general, users should establish their own reliability criteria on the basis of the epoch photometry data. Attention is drawn to the fact that interpretation of the significance of the machine-readable data, given as an ASCII string, must be carried out by explicitly testing for the number of significant digits retained.

The values given in Field P7 and P9 are generally different from the corresponding magnitudes at maximum and minimum luminosities given in the main Hipparcos Catalogue, Fields H49–50; the former having been derived from the light-curve fitting (and thus subject to modelling uncertainties), the latter having been strictly and consistently (for all objects with Field P4 having a value of U, P or R) derived from the 5th and 95th percentiles of the magnitude distribution respectively. The corresponding Fields H49–50 in the main Hipparcos Catalogue are given uniformally to 2 decimal digits.

Field P10: Relative error on the peak-to-peak amplitude, $\log_{10}(\sigma_A/A)$

An indication of the uncertainty on the magnitudes given in Fields P7–9 is given by σ_A/A, where A is the difference between the (fitted) magnitudes at maximum and minimum luminosity ($Hp_{\max} - Hp_{\min}$) given in Fields P7–9, and σ_A is the root-sum-square of the errors on the maximum and minimum magnitudes. The field is blank in some cases (see Fields P7–9).

The majority of known and newly-discovered small-amplitude variables have A in the range 0.005 mag for the brightest to 0.05 mag. For low signal-to-noise ratio, i.e. $\sigma_A/A > 0.05$, the fraction of solutions with spurious values of amplitude and period increases rapidly, to 50 per cent or more. In contrast, for large-amplitude variables σ_A/A, if not small, may reflect the irregularity of the light-curve. Thus σ_A is less related to A than σ_P is to P, since it depends on the amplitude/noise ratio, on the regularity of the variation, on the number of modes (which may be several in the case of early-type low-amplitude variables), and on the ratio between mode amplitudes. It also depends on the degrees of freedom used to fit the light-curve. When the amplitudes are small, non-linear effects disappear and a fit with a single harmonic leads to the most stable and physical solution. The maximum number of degrees of freedom used for the folded-curve fitting depended on the character of the light curve, and the number of data points available, as well as on the intrinsic errors on the measurements relative to the amplitude of the light curve. Consequently, the determination of σ_A/A is also dependent on the adopted fitting method. In summary, $\log_{10}(\sigma_A/A)$ provides a crude classification of the variability amplitudes.

The photometric reductions were made assuming a measured or derived value of $V - I$. Because of the chromatic ageing of the instrument's optics, there may be differences between the true and the derived light-curves due to this adopted value. An incorrect value of $V - I$ may lead, for example, to a spurious linear trend of the calibrated Hipparcos photometry with time. Similarly, for variable objects where $V - I$ varies with phase, the simplistic assumption of a mean $V - I$ index at mean magnitude will contribute to an error on the magnitude and on σ_A (see Field H52 and Section 1.3.4 for further details).

Field P11: Mean period during the mission, derived from the Hipparcos data (days)

The Hipparcos Catalogue provides the variability period (Field H51) uniformally truncated to 2 decimal places for reasons of catalogue presentation and user convenience. The wide variation of variability periods and corresponding precisions means that it would strictly be more appropriate to present a variable number of decimal digits (inconvenient for the machine-readable catalogue), or express the variability period as $1/P$ or $\log(P)$ (inconvenient for visual inspection of the printed catalogue).

In the Variability Annex, a more complete description of the variability type and period is given, and a variable number of decimal digits has been adopted in order to reflect the significance of the derived period (the error being approximately proportional to the square of the period). Depending on the quality of the solution, and the stability of the period, this means that for a period below 0.1 day, some 5–6 positions following the decimal point are significant, while for a 300-day period the significance is at best a few days.

While convenient for visual inspection of the printed catalogue, a variable number of decimal digits is less tractable for the machine-readable version, where the number of trailing blanks must be specifically determined. See further comments under the description of Field P12.

Field P12: Precision on the period, $\log_{10}\sigma_P$

Field P12 provides $\log_{10}\sigma_P$ to one decimal place. As noted under the description of the period (Field P11) the use of a variable number of significant decimal digits for the period is convenient for the printed catalogue, but inconvenient for the machine-readable version, where assessment of significance would need to be based on the number of trailing blanks. $\log_{10}\sigma_P$ is almost the same as the (negative) number of significant decimals, but it is more well-defined and provides uniform relative precision on σ_P.

The number of significant decimal digits in the period (Field P11) and in the reference epoch (Field P13) are closely related through the error estimate on the period, which itself is rather unreliable. The error given on the period depends on the resulting curve-fit, and can be underestimated rather easily: the relevant factor is the derivative of the fitted curve and measurements contribute weight according to this derivative. A slightly poorer fit tends to produce locally higher derivatives due to unrealistic and uncontrolled fluctuations of the fitted curve. While acting as weights, these derivatives distort the real amount of period information contained in the data. However, what is also to be avoided is a loss of precision on the phase of the light-curve at any time during the mission, since the phase error is directly proportional to $N_{\rm cycles}\times\sigma_P$.

Field P13: Reference epoch from solution, BJD(TT)−2 440 000.0

In general, this gives the epoch of the first zero phase after JD 2 448 500. The phase of the maximum is used, except for eclipsing binaries and RV Tau variables where the zero phase is determined by the phase of the primary minimum (which can be ambiguous in the case of EW and some EA types).

The reference epoch is usually given to (a maximum of) 3 decimals (i.e, to a maximum precision of 86 s); providing four decimal places is not justified except in one or two exceptional cases. In the printed and machine-readable catalogues, the number of trailing decimals is related to the precision on the reference epoch (Field P14), typically given to a precision of 0.01 times the period (with extremes from 0.1 for semi-regular variables to 0.002 for some Algol-like eclipsing binaries) with a minimum resolution of 1 day.

Field P14: Flag indicating precision on the reference epoch

If the proposed light-curve is reasonably well-behaved, the precision on the reference epoch, σ_ϕ, lies typically in the range 0–1 days. Since the precision of the reference epoch is itself rather inaccurate, this field contains an integer (in the range 0–5) indicating the significance of the reference epoch given in Field P13. The field gives $1-\log_{10}\sigma_\phi$, i.e. 0 for an accuracy of order 10 days, 1 for an accuracy of order 1 day, 2 for 0.1 day, 3 for 0.01 day, 4 for 0.001 day, and 5 for 0.0001 day. The field is blank if Field P13 is blank.

If Field P10 is blank the precision on the reference epoch was estimated on the basis of the period and type of light curve, rather than from the fitted light curve.

One purpose of providing the error on the reference epoch is to allow observers to evaluate the errors on the extrapolated Hipparcos light-curves before and after the mission. The traditional way of determining the reference epoch of a pulsating variable is from the phase of the maximum—often poorly defined. The phase of the folded light-curve is not necessarily determined precisely, and depends on several parameters, namely the level of regularity, the amplitude, and the shape of the light-curve (e.g. the number of harmonics used to describe it).

Field P15: Variability annex flag

A flag indicates that a light curve, or folded light curve, compiled from the Hipparcos *Hp* data, is provided in the corresponding variability annex (Volume 12). The flag is identical to that given in Field H54, and has the following meaning:

A : light curve, folded at the period given in Field P11;
B : light curve, fitted to the data derived and transformed from the data base of the AAVSO (American Association of Variable Star Observers);
C : light curve (not folded).

Most entries classified as a periodic variable have a folded light curve in Part A. Entries indicated with 'B', which takes precedence in this field, also have a curve in Part A if they are periodic (see also Field H54). A few very long-period variables are contained within the section of non-folded light curves (Part C).

Flag 'B' corresponds to large-amplitude variable stars which have been observed systematically by ground-based observers during the Hipparcos mission. In these cases, a combination of the Hipparcos and AAVSO data have allowed a more complete light curve to be derived, including refined estimates of the maximum or minimum magnitudes during the mission. Note that an entry for which the flag 'B' is set may also be contained in the section on folded light curves if it is periodic. The folded light curve, if available, is included at the relevant place according to its HIP running number.

Field P16: Flag indicating note

A flag indicates that a note is associated with the entry drawing attention, for example, to a discrepant period, amplitude, or variability type. The flag is also used to indicate that another solution is also possible, e.g. eclipsing or pulsating with period differing by a factor two, or any special feature of the light-curve. Notes on the variability are compiled with the literature references at the end of the variability annexes (Volume 11). The note flag has the same content and meaning as the flag used for the main Hipparcos Catalogue, Field H70 (where further details are given), thus:

D : double and multiple systems note only (Volume 10);
G : general note only (Volumes 5–9);
P : photometric (including variability) notes only (Volume 11);
W : 'D' + 'P' only;
X : 'G' + 'D' only;
Y : 'G' + 'P' only;
Z : 'G' + 'D' + 'P'.

Field P17: Variable star name

The variable star name has been taken from the literature if the star was already known to be variable. Names have been assigned under the auspices of the IAU by N.N. Samus and colleagues (Moscow) to Hipparcos stars with unambiguous status as newly-discovered variables.

The general Hipparcos and Tycho Catalogue publication policy has been to preserve full identity between the printed and machine-readable versions—and thus to use exclusively ASCII coding. Nevertheless, the use of Greek letters for the variable star names in the printed catalogue (Field P17 and U17) has been adopted as being more appropriate, with the phonetic equivalent being used in the machine-readable version.

The following table lists the adopted equivalence:

α	alf	ι	iot	ρ	rho
β	bet	κ	kap	σ	sig
γ	gam	λ	lam	τ	tau
δ	del	μ	mu.	υ	ups
ϵ	eps	ν	nu.	ϕ	phi
ζ	zet	ξ	ksi	χ	chi
η	eta	o	omi	ψ	psi
θ	the	π	pi.	ω	ome

Note that, as in SIMBAD, a dot is added to mu, nu, and pi, in order to make three letters; this is intended to ease distinction between, e.g. the variable star MU Cep and the Greek-letter name μ Cep. [SIMBAD also supports the conventions χ = 'khi', θ = 'tet'.]

In addition, an underscore is used in the machine-readable version to tie the two parts of the variable star name, in order to facilitate reading in of Fields P17 and U17 using standard text editors. Thus, β Lyr in the printed catalogue is represented as 'bet_Lyr' in the machine-readable catalogue.

Field P18: Period (days), taken from the literature

Field P19: Reference epoch from literature, Julian Date

Due to the range of reference epochs found in the literature, this field gives the complete Julian Date of the reference epoch. Note that the time scale used in the literature for the Julian Date specification (e.g. UTC, TT, with or without barycentric correction) is frequently omitted in the literature and is not specified here.

Field P20: Magnitude at maximum luminosity, taken from the literature

Field P21: Magnitude at minimum luminosity, taken from the literature

Field P22: Photometric band for the minimum and maximum magnitudes taken from the literature, given in Fields P20–21

The letters U, B, V, K, I, R refer to the Johnson broad-band system passbands, or closely related passbands. P refers to photographic magnitude, Y and b for the Strømgren y and b bands.

Field P23: Flag (R) indicating that references are given to the literature

References are included, with the notes, at the end of the variability annexes (Volume 11). See the main catalogue, Field H70, for further details of the relationship between this field and the note flag (Field P16).

Fields U1–19: Unsolved Variables

Field U1 ≡ Field P1: The Hipparcos Catalogue (HIP) identifier

Field U2 ≡ Field P2: Flag for newly-classified variable entries. Details as for Field P2.

Field U3 ≡ Field P3: Spectral type (details as for Field P3)

Field U4 ≡ Field P4: 1-letter variability type (details as for Field P4, with 21 entries indicated by 'R')

Field U5 ≡ Field P5: 6-letter variability type (details as for Field P5)

Field U6 ≡ Field P6: Flag indicating newly-assigned variability type (details as for Field P6)

Fields U7–9 ≡ Field P7–9: Magnitudes at maximum and minimum luminosities

Fields U7 and U9 provide the magnitudes at maximum and minimum luminosities observed during the mission, derived from the 5th and 95th percentiles. In certain cases, the AAVSO data may provide more relevant values for the magnitudes at maximum and minimum luminosities; where available, these are included in the notes.

These magnitudes are given to 1, 2, or 3 decimal places, depending on the accuracy estimated for these values (see Fields P7–P9 for further details).

Note that Fields U7 and U9, and the corresponding magnitudes at maximum and minimum luminosity given in the main Hipparcos Catalogue, Fields H49–50, are the same for the unsolved variables (unlike the case for the periodic variables, Fields P7 and P9), both having been derived strictly and consistently, for all objects with inferred variability larger than 0.03 mag, from the 5th and 95th percentiles of the magnitude distribution.

For small-amplitude variables, and multi-periodic or spotted stars, the percentile values could in principal have been corrected for the photon and reduction noise, although such a procedure would be subject to some uncertainties in the case of, e.g. irregular variables or Be stars. Such corrections have therefore not been made.

Field U10 ≢ Field P10: Median value of *Hp* (as given in the main Hipparcos Catalogue, Field H44)

Field U11 ≢ Field P11: Intrinsic variability amplitude, *A*

The intrinsic variability amplitude has been derived from the observed scatter, *s*, as given in Field H46, by correcting for reduction and photon noise—thus Field U11 is not precisely the same as Field H46. (The difference between raw and corrected scatter is negligible for large-amplitude variables but very significant for micro-variables.)

Field U12 ≢ Field P12: Standard error of A, σ_A

Field U13: Blank for unsolved variables

Field U14: Blank for unsolved variables

Field U15 ≡ Field P15: Variability annex flag

A flag indicates that a light curve, compiled from the Hipparcos *Hp* data, is provided in the corresponding variability annex (Volume 12). The flag is identical to that given in Field H54, and has the following meaning:

B : light curve, fitted to the data derived and transformed from the data base of the AAVSO (American Association of Variable Star Observers);

C : light curve (not folded).

[Flag 'A', which may appear in Field H54 of the main catalogue (indicating that a folded light curve is provided in Volume 12) is not relevant for unsolved variables.]

Field U16 ≡ Field P16: Flag indicating that a note is associated with the entry (see Field P16 for further details)

Field U17 ≡ Field P17: Variable star name (details as for Field P17)

Field U18 ≡ Field P18: Period (days), taken from the literature

Field U19 ≡ Field P19: Reference epoch from literature, Julian Date

The combination of unsolved variables with a meaningful reference epoch is rarely relevant, but applies to a few semi-regular variables where a period is not apparent from the Hipparcos data, and where Field U19 takes the reference epoch obtained from the literature.

Field U20 ≡ Field P20: Magnitude at maximum luminosity, taken from the literature

Field U21 ≡ Field P21: Magnitude at minimum luminosity, taken from the literature

Field U22 ≡ Field P22: Photometric band for the magnitudes given in Fields U20–21

Field U23 ≡ Field P23: Flag (R) indicating that references are given to the literature (see Field P23 for further details)

Table 2.4.2. Machine-readable Variability Annex

Field	Bytes	Format	Description
P1/U1	1– 7	I6,X	Identifier (HIP)
P2/U2	8– 9	A1,X	Flag if new variable
P3/U3	10– 22	A12,X	Spectral type
P4/U4	23– 24	A1,X	Variability type (1-letter)
P5/U5	25– 31	A6,X	Variability type (6-letter)
P6/U6	32– 33	A1,X	Flag if newly classified by Hipparcos
P7	34– 40	F6.3,X	Magnitude at max from curve fitting
U7	„	„	Magnitude at max from percentiles
P8/U8	41– 42	A1,X	Limit flag (>)
P9	43– 49	F6.3,X	Magnitude at min from curve fitting
U9	„	„	Magnitude at min from percentiles
P10	50– 56	2X,F4.1,X	$\log_{10}(\sigma_A/A)$
U10	„	F6.3,X	Median Hp (mag)
P11	57– 69	F12.7,X	Mean period (days)
U11	„	7X,F5.3,X	Intrinsic variability amplitude, A (mag)
P12	70– 76	2X,F4.1,X	$\log_{10}\sigma_P$
U12	„	F6.3,X	σ_A
P13	77– 86	F9.4,X	Epoch from solution (days)
U13	„	10X	Blank for unsolved variables
P14	87– 88	I1,X	Precision flag
U14	„	2X	Blank for unsolved variables
P15/U15	89– 90	A1,X	Annex flag
P16/U16	91– 92	A1,X	Note flag
P17/U17	93–105	A12,X	Variable star name[1]
P18/U18	106–116	F10.5,X	Period from literature (days)
P19/U19	117–127	F10.2,X	Epoch from literature (Julian Date)
P20/U20	128–133	F5.2,X	Magnitude at max from literature
P21/U21	134–139	F5.2,X	Magnitude at min from literature
P22/U22	140–141	A1,X	Photometric band
P23/U23	142	A1	Reference flag

[1] a different representation is used for the printed catalogue (see description of Field P17 for details)