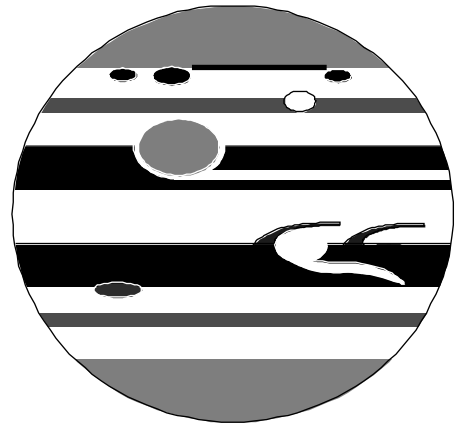


# JUPOS



Database for  
object positions on Jupiter

## **Project Documentation**

version 4

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# 1. General information on JUPOS

## What is JUPOS, and what does it accomplish?

The first statements regarding the rotation period of Jupiter were made by Cassini more than 300 years ago. With the 1878 rediscovery of the Great Red Spot a boom of Jovian positional observations set in. Not only Cassini but also observers 100 years ago estimated the time that a certain object crossed the central line of the planet's disc, the so-called Central Meridian (C.M.). From this transit time the Jovian longitude of the object can be gathered immediately.

The timing of Central Meridian transits (C.M.T.) is still a common visual method for deriving trustworthy longitudes of structures on Jupiter. Also common in former years were micrometer measurements, made directly at the eyepiece, and C.M.T. with the aid of micrometer webs. Some observers performed series of precise positional sketches while an object crossed the Central Meridian. At present, modern photographic and CCD techniques are revolutionizing planetary astronomy. High resolution images of that kind contain a lot of information on various structures in the Jovian atmosphere.

Meanwhile, the number of all these positional observations has reached an immense extent, but they are scattered to numerous places. Especially in previous times they were analyzed mostly nationally or in small local groups, if at all. It can be expected that a comprehensive analysis of old and recent positions will reveal details that have not been recognized as yet. This concerns, for example, the history of low-amplitude longitude variations of longlived Jovian objects, e.g. the Great Red Spot, and a more detailed description of systematic observational errors.

In order to collect as much as possible positions ever observed and to place them at the disposal of any interested Jupiter recorder, we have initiated the project JUPOS. This project is a continuation of the 1979 „International Jupiter Voyager Telescope Observations Programme“ (IJVTOP), which was mainly directed to Earth based observations during the Voyager encounters. Until now, we have entered about 25,000 positions of various objects of the years 1834-1912 and 1968-95 in our database. These data include 11,000 IJVTOP observations. Tens of thousands of further observations, also covering the most recent past, are still awaiting compilation. They can be found in a number of periodical or single publications, or with the recorders of the separate countries, or they are hidden unanalyzed and unpublished in drawers.

**Your cooperation is highly appreciated if you**

- have been / are an active observer of Jupiter and have made / make positional observations yourself
- have access to libraries with a good astronomical supply and can search for historical Jovian positional observations there
- know where unreduced or unpublished Jovian positions by other observers are put away and have access to these data

**You may contribute by**

- making photocopies of observational reports
  - writing down the positions on prepared JUPOS data forms
  - entering the observations directly in a computer file via the special software PC-JUPOS
- and, after finishing that, forwarding your copies, data forms or floppy disk to the JUPOS coordinator.

**Contacts**

The JUPOS coordinator:

Hans-Jörg Mettig  
c/o Astroclub Radebeul e.V.  
Auf den Ebenbergen  
D-01445 Radebeul  
Germany

is responsible for project organization and processing of positional data. Questions and comments regarding the software should be addressed to the PC-JUPOS programmer:

Grischa Hahn  
Wienerstr. 61a  
D-01219 Dresden  
Germany.

**For copyright reasons**

we ask authors who refer to JUPOS data files to name „JUPOS/IJVTOP“ as their source.

**Finances**

JUPOS hardly receives financial grants, and our resources are limited. Please understand that we cannot reimburse any of your expenses, even for copying and postal fees.

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## 2. Organizational details

### Before you start to photocopy or record data

please inform the coordinator about your intention, since it might well be possible that the observations in question have already been stored in the JUPOS database. Your note should include information on the:

- observer
- type of observations (C.M.T., ...)
- time range
- source - please more detailed (if literature: name of publication, volume, pages, author and title of contribution).

You will then be notified whether the data in question are already known or not.

### If you make photocopies

note that only complete copies, from the first to the last line of each contribution, are of interest, since information essential for recording data often hides somewhere in the text. Should the

- title of a contribution and its author
- title of the publication
- site of publication
- volume number
- page numbers

not be evident from the copies, please add them by hand on the first copied page.

### Where to record which type of observation?

Timings of Central Meridian transits you have to enter on the special C.M.T. data forms or via the PC-JUPOS menu „Record Central Meridian transits“. On the other hand, positions from

- micrometer measurements
- C.M.T. estimated with the aid of micrometer webs
- photos and CCD images
- series of precise drawings

are classed as „Measurements“ and have to be recorded on Measurements data forms or via the PC-JUPOS menu of the same name.

## JUPOS data forms

you may order from the coordinator or print out yourself in PC-JUPOS. Enter the observer's name and observational site in the header, and take a new form for each new observer. Detailed directions as to fill in the individual columns are given in chapters 3 and 4.

## The software PC-JUPOS

and its Handbook you can also order from the coordinator. Do not forget to specify the floppy disk format you use (5.25" or 3.5", DD or HD). If you have the choice we recommend 3.5" High Density disks.

How to install, start and operate PC-JUPOS, please look up in the PC-JUPOS Software Handbook [1]. The recording masks have the same structures as the corresponding data forms and have to be filled in the same way. We think it's best to complete the paper forms first and transfer data from there to the computer afterwards. This method is less stressful than direct computer recording and should effectively not take much more time, too.

Be very careful when you leave a recording mask and you are asked „Sort file ... chronologically?“. In the case that data are not in a strictly chronological order, a „Yes“ might cause a record sequence which is completely changed! If you want to continue data recording after that, but you have forgotten the last observation, you are in trouble. We recommend to switch the keyword „Permit chronological sorting“ of the „Preferences“ menu to „no“ before recording data, since such sorting will become impossible then.

C.M.T. files are stored in the PC-JUPOS subdirectory STAMMDAT, Measurements files in MESSDAT. There is a separate data file for each observer. The file name is identical with the name defined in „Record ... New“ and terminated by suffix .ZMP (for C.M.T.) or .MES (for Measurements). Copy all data files which you have processed onto a floppy disk, together with LIST\_ZMP.BEO or LIST\_MES.BEO, respectively. Additionally, please forward the data forms to the coordinator as well.

If you want to record more data of an observer of whom you already sent a file to the coordinator before, there are two ways:

1. Write the new data to another file and tell the coordinator that, e.g., SMITH\_2.ZMP is the continuation of SMITH.ZMP.
2. Write new data to the old file in such a manner that they form a continuous block which must not be interrupted by any old observation. If old and new observational times intersect, there is only one chance: You **must not** sort the file chronologically, all new observations will remain at its end then. In any case, inform the coordinator about the new block (records no. ... to ...).

### **Never send originals**

of data forms but only (legible) photocopies. Furthermore, backup your PC-JUPOS data files. It would be a pity if the result of days or even months of your work gets lost on mail transport or owing to a computer defect, with no duplicate in existence.

### **You will be notified asap**

once your post has reached the coordinator. In case you will not have heard anything from him after 6 weeks passed, inquire about it.

### **If you note an error afterwards**

send a correction, either on data form or as a PC-JUPOS printout, but **not** as a file. Do not forget to mark the previously erroneous record(s) clearly.

## 3. Recording Central Meridian transits

In the C.M.T. data forms or PC-JUPOS recording mask you have to enter information about

- the object and its latitude (cols. 1 and 2)
- the time of its C.M.T. (cols. 3 to 5)
- the deduced zenographic longitude (cols. 6 and 7)
- supplementary details (cols. 8 to 10).

### Object

Enter intensity, reference point, visibility and type of the object here:

1. character:
  - „W“ for a bright
  - „D“ dark object
2. character:
  - „P“ if the preceding end
  - „C“ centre
  - „F“ following end of the object was timed
3. character:
  - „1“ if the object was easy
  - „2“ moderate
  - „3“ difficult to see
- 4.-9. character: Morphological classification of the object. Only use the object code described in chapter 5.

### R

is the so-called region code that describes the latitude of the object. It will be explained in chapter 6.

### Date

is the date of the C.M.T. in format YYYYMMDD (YYYY .. year, MM .. month, DD .. day), measured in Universal Time.

### UT

is the estimated time of the C.M.T. in format HHMM.T (HH .. hour, MM .. minute, T .. tenth minute), measured in Universal Time. Note the prepared decimal point.



**+/-**

is the maximum error of „Date, UT“ in format M.T (M .. minute, T .. tenth minute), as estimated on the eyepiece. Note the prepared decimal point.

**Long.**

is the C.M. longitude at time „Date, UT“ in format DDD.T (DDD .. full degrees, T .. tenth degree). Objects of regions J, K, L and P **must** be fit to System 1, G and M objects can be fit to it. Otherwise System 2 has to be used. Also possible are longitudes in System 3. Note the prepared decimal point.

**S**

is the number of the System (1, 2 or 3) „Long.“ relates to.

**Instr**

is the type and aperture of the observational instrument:

1. character:     - „R“ for refraktor  
                  - „S“ for reflector
- 2.-4. character: aperture in millimetres.

**Magn**

is the magnification in use while observing the C.M.T.

**O**

is the orientation of the Jovian disc in the eyepiece's visual field while observing the C.M.T. Use the following codes:

- „SR“ ... South at top, direct image (rotation from right to left)
- „NR“ ... North at top, direct image (rotation from left to right)
- „SV“ ... South at top, laterally-inverted image (rotation from left to right)
- „NV“ ... North at top, laterally-inverted image (rotation from right to left)
- „IR“ ... Jovian belts strongly inclined.

**In the case of some colums**

it might be possible that entries do not change for several lines. You can use the " repetition mark then. On data forms you do not need to order the observations chronologically.

**Should the**

- first or third character of „Object“ (i.e. its intensity or visibility)
- error estimate „+/-“
- aperture or instrument itself
- magnification
- image orientation

be unknown and impossible to reconstruct, just leave these columns or characters blank.

**JUPITER Central Meridian transits**

Observer : Smith, James

Place of observation : Xtown

Region code of version 2/3 ( ) or 4 (X)

Object	R	Date	UT	±	Long.	S	Instr	Magn	O
DC2.BAR	N1	1992 03 04	21.31.01.5		244.72		R150	140	SR
DC3.BAR	N1	" " "	22.05.52.0		264.92		"	"	"
WC2.W.O.S.-FAC	C3	" " "	22.31.01.5		280.32		"	"	1R
"	"	" 03 07	20.02.02.0		281.42		"	"	SR
WC3.S.P.O.T	72	" " "	21.14.04.0		160.21		R80	120	SR
DC2.R.S	E3	" " "	23.04.57.0		31.72		R150	140	SR
DC3.S.P.O.T	N1	" 03 09	18.39.02.0		172.02		"	"	"
WC3.S.P.O.T	B1	" 04 07	19.16.03.0		239.92		"	"	"
WC3.W.O.S.-FAC	C3	" " "	20.11.52.5		267.52		"	"	"
WC1.O.V.A.L	L1	" " "	21.52.01.5		40.21		"	"	"
DC2.R.S.H	E4	" 04 08	19.29.51.5		32.42		"	"	"

Fig. 1: A completed C.M.T. data form

## 4. Recording Measurements

In the Measurements data forms or PC-JUPOS recording mask you have to enter information about the

- object and its latitude (cols. 1 and 2)
- observation time (cols. 3 and 4)
- measured zenographic longitude and latitude (cols. 5 to 9)
- observational method (col. 10).

### Object, R, Date, UT

have the same meaning as in the case of C.M.T., although Date and UT of course relate to the observation time of the Measurement. Please consult chapter 3. Since C.M.T. estimated with the aid of micrometer webs are classed as Measurements, UT is given to the tenth minute. In the case of micrometer measurements and positions from photos and CCD images full minutes are sufficient.

### Long.

is the measured longitude in format DDD.T (DDD .. full degrees, T .. tenth degree). Objects of regions J, K, L and P **must** be fit to System 1, G and M objects can be fit to it. Otherwise System 2 has to be used. Also possible are longitudes in System 3. Note the prepared decimal point.

### +/-

is the mean error of „Long.“ in format D.T (D .. full degrees, T .. tenth degree). Note the prepared decimal point.

### S

is the number of the System (1, 2 or 3) „Long.“ relates to.

### $\beta''$

is the measured latitude in format (-)DD.T (DD .. full degrees, T .. tenth degree). Southern latitudes must be designated by a preceding minus sign. Note the prepared decimal point.

### +/-

is the mean error of  $\beta''$  in format D.T (D .. full degrees, T .. tenth degree). Note the prepared decimal point.

**Note**

Classify the method of observation here:

- „MMeasu“ ... micrometer measurement
- „MEstim“ ... C.M.T. estimated with the aid of micrometer webs
- „Drawing“ ... position from a precise series of drawings

Positions from photos and CCDs you may identify by a note of your choice.

**In the case of some colums**

it might be possible that entries do not change for several lines. You can use the " repetition mark then. On data forms you do not need to order the observations chronologically.

**Should the**

- first or third character of „Object“ (i.e. its intensity or visibility)
- zenographic latitude  $\beta$ "
- mean errors „+/-“

be unknown and impossible to reconstruct, just leave these colums or characters blank.

**JUPITER Measurements**

Observer : Smith, James

Place of observation : Xtown

Region code of version 2/3 | | or 4

Object	R	Date		UT	Long.	$\pm$	S	$\beta$ "	$\pm$	Note
DC2,RS	E3	1992	01	26 23,24:0	289	1:12		-23:3	1:5	MMeasu
"	"	"	02	29 22,01:0	300	1:52		-23:9	0:8	"
"	"	"	03	01 19,54:0	312	1:42		-25:4	2:1	"
"	"	"	03	07 22,35:0	305	1:82		-23:8	1:6	"
"	"	"	04	08 20,02:0	331	:	2	-24:0	:	CCD
"	"	"	05	21 20,29:0	327	:	2	-24:5	:	CCD
WC1,S,P,O,T	L2	"	"	20,45:0	90:0	2:01		:	:	MEstim
DC3,B,AR	N1	"	"	21,30:0	82:4	1:12		:	:	"
DC1,S,P,O,T	N1	"	"	21,42:0	89:5	1:72		+1:7:0	0:9	MMeasu
WC2,S,P,O,T	N2	"	"	21,55:0	69:0	2:12		+19:2	1:5	"

Fig. 2: A completed Measurements data form

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## 5. Object code

In order to classify the various kinds of objects in the Jovian atmosphere, use the following code. It is, essentially, identical to the IJVTOP nomenclature [2,4]. Note the new definition of DIST.

### Bright objects

- SPTR Small bright spot surrounded by a dark halo.
- SPOT Bright spot being not too extended or oblong.
- OVAL Large oval-shaped area, brighter than its surroundings and well defined.
- BAY Large and usually half-oval-shaped cut-out on the edge of a belt.
- NICK Small semicircle-shaped cut-out on the edge of a belt, frequently brighter than the adjoining zone.
- SECT Brighter section of a belt or zone.
- GAP Fairly extended, weakened or absent part of a belt.
- RIFT Bright line crossing a broad belt, usually at an angle of 45°..60°.
- AREA Extended bright and irregularly bordered area.
- STRK Very oblong, streak-shaped, bright object.

### Dark objects

- SDER Small dark spot surrounded by a bright halo.
- SPOT Dark spot being not too extended or oblong.
- BAR Dark oblong object.
- FEST Dark filament or festoon that passes through a zone. One end of the filament or both ends of the festoon may emerge from dark belt condensations.
- PROJ Dark projection on the edge of a belt. There are different shapes from rounded humps to tapering objects.
- SECT Darker section of a belt or zone.
- VEIL Extended dark shading in a zone or in polar regions.
- DIST Dark integral- or bridge-like structure which as a rule appears during a SEB revival.
- COL Column-like dark object in a zone, perpendicular or slightly inclined to it.
- STRK Very oblong, streak-shaped dark object.

**Use special codes for the following objects:**

- RS Great Red Spot
- RSH SEB hollow north of the Great Red Spot
- WOS-FA,-BC,-DE Longlived White Ovals FA, BC and DE
- STRD Classic STrZ disturbance
- STZB Additional band in the STZ
- STRB Additional band in the STrZ
- NTRB Additional band in the NTrZ
- NTZB Additional band in the NTZ
- SHAD Shadow of a Jovian satellite
- MOON Disc of a Jovian satellite
- IMPACT Dark structures immediately after the SL-9 comet impact

Code	Bright Objects	Code	Dark Objects
SPTR		SDER	
SPOT		SPOT	
OVAL		BAR	
BAY		FEST	
NICK		PROJ	
SECT		SECT	
GAP		VEIL	
RIFT		DIST	
AREA		COL	
STRK		STRK	

*Fig. 3: JUPOS object code*

## 6. Region code

In order to classify the latitude of an object a two-figure code has to be employed. It is explained roughly in Fig. 4 and precisely in Tab. 1. First comes a letter, second a numeral.

Compared to IJVTOP and former JUPOS versions up to no. 3 there are some modifications. They are mainly based on „The Giant Planet Jupiter“ by J.H. Rogers, the author kindly enabled us to inspect the relevant chapter before his book came out [3].

The primary criterion for the region code construction is the pattern of slow currents and fast jetstreams on Jupiter. This results in better treatment of observational data. However, the observer mostly does not know the current/jetstream of an object but only its latitudinal position relative to the belt-zone pattern. Therefore the code had to be constructed as a compromise between the demands of the analyst and possibilities of observer.

The chosen code should reflect the object's latitude as exact as possible. But looking through a small telescope, it is often impossible to distinguish between northern, central and southern parts of a belt or zone. In that case, take the code of the corresponding central part.

Note that belts may become invisible at times, even with larger instruments! In case of doubt, perhaps also caused by objects in high latitudes, contact the JUPOS coordinator.

Some abbreviations in Tab. 1 are additional to the basic nomenclature of belts and zones:

X(N), (C), (S)	North, central, south part or component of belt or zone X
	e.g. NEB(S) ... South part or component of NEB
	NTrZ(N) ... North part of NTrZ
Xn, s	North, south edge of belt X
	e.g. SEBn ... North edge of SEB

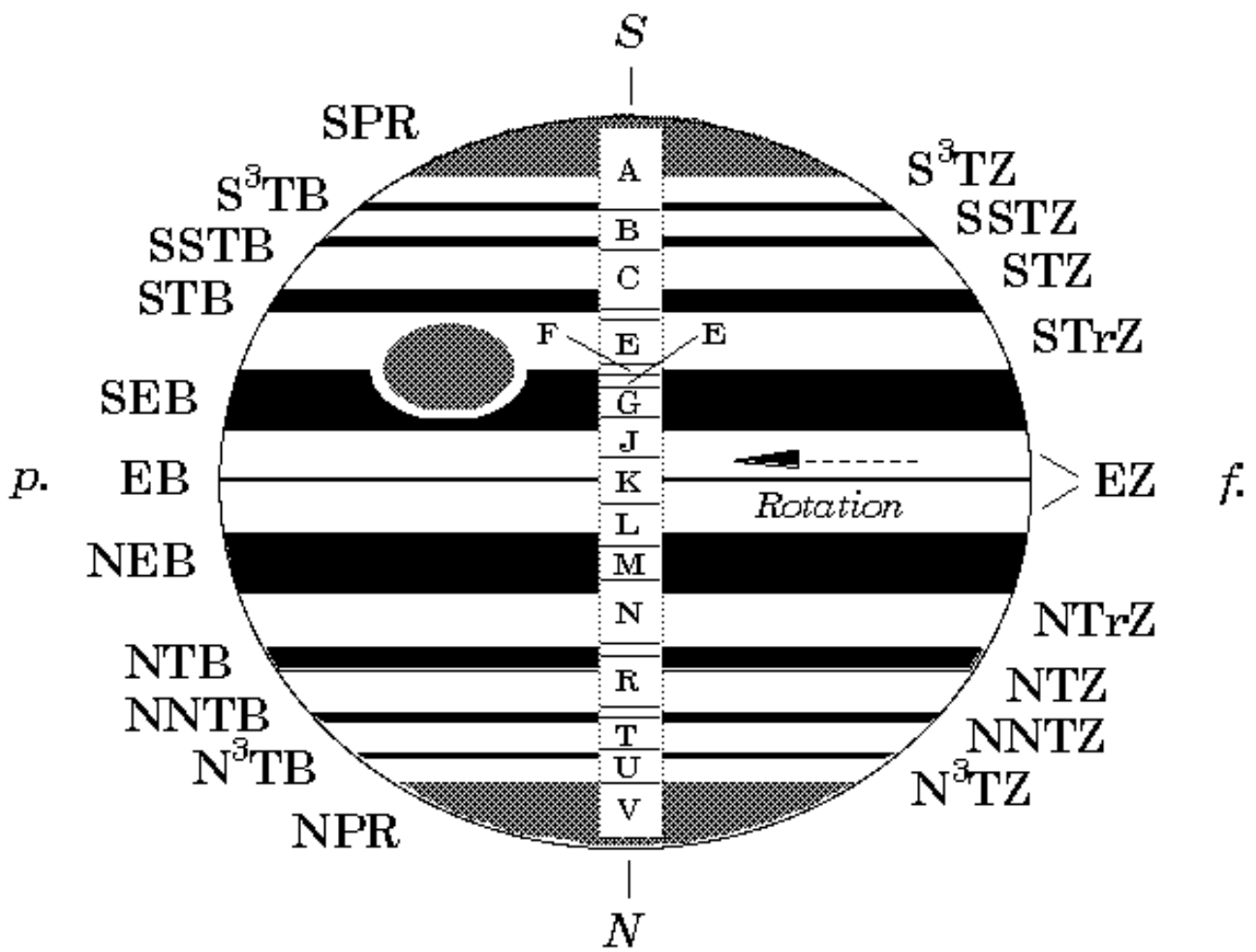


Fig. 4: Rough structure of the JUPOS region code



	1	2	3	4	5
A	SPR	S <sup>3</sup> TZ	S <sup>3</sup> TB		
B	SSTZ	SSTB <sup>*)</sup>	SSTBn		
C	STZ	STB	WOS-FA	WOS-BC	WOS-DE
D	STBn				
E	STrZ	SEB(S)	RS	RSH	
F	SEBs				
G	SEB(C)				
J	SEB(N)	EZ(S)			
K	EB	EZ(C)			
L	EZ(N)	NEB(S)			
M	NEB(C)				
N	NEB(N)	NTrZ			
P	NTBs				
R	NTB	NTZ			
S	NNTBs				
T	NNTB	NNTZ			
U	N <sup>3</sup> TB	N <sup>3</sup> TZ			
V	N <sup>4</sup> TB	N <sup>4</sup> TZ	NPR		

<sup>\*)</sup> True SSTB

Tab. 1: JUPOS region code

	Latitude $\beta''$	°/month against Sy.		Code
SPC	-90 ... -54			A
* S <sup>4</sup> TBn	-53	-129	2	
S <sup>3</sup> TC	-52 ... -45	-16 ... -2	2	A
* S <sup>3</sup> TBn	-44 ... -43	-125	2	
SSTC	-42 ... -38	-35 ... -25	2	B
SSTBn	-37 ... -36	-90 ... -80	2	B
STC	-36 ... -29	-20 ... -10	2	C
* STBs	-33 ... -32	+42	2	
STBn	-29 ... -27	-130 ... -60	2	D
STrC	-26 ... -13	-6 ... +6	2	E
SEBs	-20	+60 ... +140	2	F
SIC	-16 ... -11	-100 ... -40	2	G
SEC	-10 ... -5	-110 ... +60	1	J
CEC	-5 ... +5	+3 ... +28	1	K
NEC	+5 ... +10	-5 ... +5	1	L
NIC	+10 ... +16	-160 ... -60	2	M
* NEBn	+17 ... +18	+45	2	
NTrC	+14 ... +23	-15 ... -5	2	N
NTBs	+24	-170 ... +140	1	P
* NTBn	+31 ... +32	+69	2	
NTC	+25 ... +34	+13 ... +22	2	R
NNTBs	+35 ... +36	-95 ... -60	2	S
* NNTBn	+39 ... +40	+31	2	
NNTC	+37 ... +42	-3 ... +3	2	T
* N <sup>3</sup> TBs	+43	-68	2	
N <sup>3</sup> TC	+44 ... +47	-20 ... -10	2	U
* N <sup>4</sup> TBs	+48	-94	2	
N <sup>4</sup> TC	+49 ... +55	-2 ... +4	2	V
* N <sup>5</sup> TBs	+56 ... +57	-59	2	
NPC	+58 ... +90		2	V

Tab. 2: Currents and jetstreams in the Jovian atmosphere, their zenographic latitudes (in degrees), typical drifts (in degrees per month) and attached JUPOS region codes. Currents are terminated by a „C“, jetstreams occur on belt edges. Currents marked by an asterisk were only observed by the Voyager spacecrafts as yet. According to [3], some details from [5].

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## 7. Universal Time, time figures in the literature

JUPOS exclusively uses Universal Time. This restriction may cause problems: especially in older literature observing times are related to different time scales, or one scale has different names. In the following we provide some facts that should be taken into account before entering positional observations on data forms or at the keyboard.

Some 100 years ago the now-familiar zone times like Greenwich Time, Central European Time or Pacific Standard Time were introduced. They are local mean times at geographic longitudes  $0^\circ$ ,  $15^\circ$ ,  $30^\circ$  etc. and differ by full hours. Additionally there were and are countries using national times that have offsets of further 15 or 30 minutes.

The zone time of the geographic zero meridian, the Greenwich Mean Time, is identical to Universal Time (UT). Other abbreviations for it, especially used in former times, are Gr.M.T., G.M.T., in German M.Z.Gr. and W.Z.

In order to obtain UT from Central European Time, e.g., one hour must be subtracted, and to Pacific Standard Time eight hours must be added. The individual differences between zone times and UT you find in any better atlas. Although it seems unlikely that special national times appear in the modern astronomical literature, this cannot be excluded in the case of old contributions.

In this context the Daylight Saving Time has to be mentioned, too. The Central European Daylight Saving Time, e.g., is one hour later than Central European Time: to get from there to UT, you must subtract two hours. - Unfortunately, some observers are rather careless in this respect!

The zone times were introduced at different dates, e.g., in 1883 in the U.S.A. and Britain, 1893 in Germany and Italy, 1895 in Sweden and even later in France and Russia. Before that, back to the 18th century, it was common to note observing times in local mean time of the observational location. Each observatory, each observer had its/his own local mean time defined by coordinates of the location or of a close town. However, transformation into UT is simple: Multiply the geographic longitude of the location, measured in degrees and a possible minus sign ignored, by 4 and add the result as minutes to the local mean time (for locations west of Greenwich) or subtract it (for easterly locations).

In former years M.T. was a common abbreviation for mean time. Beware that a „G.“ in „G. Mean Time“ actually means Greenwich! Furthermore, we recommend to check printed coordinates or differences from Greenwich time, since typographical errors were quite common.

**Until 1925** the astronomical day started **at noon**. So you must add 12 hours to obtain the time in the modern sense. If you read, e.g., that a C.M.T. took

place on 1910 January 3, 17.23 Gr.M.T., it actually happened on January 4, 05.23 UT. On no account forget the transition of date (even month and year) while crossing 0 or 24 o'clock which might happen at any time transformation!

In case you are checking old Russian sources, you must bear in mind that the Julian calendar was valid there til 1918. In 1900, e.g., the Julian calendar lagged the Gregorian one (introduced in most other European countries already in the 17th and 18th century) by 13 days.

In very old literature, of the first half of the 19th century or so, sidereal time is given. In this and any other tricky cases, proceed as stated in the appropriate „problem handling routine“ explained in the following chapter.

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## 8. Problems in data recording, and what to do

The most important problems, especially at literature inquiries, relate to the observing times. Hence, some remarks regarding this topic are necessary.

Even a few minutes of time offset act deadly on the quality of a C.M.T. estimation. On the other hand, the time of a Measurement, which has to be noted on JUPOS data forms and entered in PC-JUPOS recording masks, is much less critical. These techniques only demand that the object is not too far from the C.M. (max.  $30^{\circ}$ .. $40^{\circ}$ ), and Jovian objects do not significantly change their positions in the proper rotational system during a period of two hours or so. A Measurement time and object position can also be an arithmetic mean of several observations made within that period.

If an observation lacks precise timing, it is not necessarily worthless. In case that the bounds of time in question are narrow enough, you can reconstruct it by the given object longitude. As to C.M.T. there will often be several solutions and you have to decide on the most probable one. Measurement times, of course, can only be approximately restored. If the observation is a historical one and handed down in one source only, even an offset by 10 or 20 hours (one or two Jupiter rotations) might be negligible. However, you should perform such a reconstruction as seldom as possible. Provided a complete record of the same object and same observer one or two Jovian rotations away will be found later, it is not clear whether this is the same as the reconstructed observation, or not. The JUPOS data base, of course, has just to be kept clear of too many observations as the opposite is valid!

In the following you find a list of problems you might encounter while entering data in data forms or at PC, plus what to do about it.

### ***C.M.T. and Measurements***

#### **1. It is unclear whether the object was bright or dark.**

Somewhere in the present or another contribution by the same author you will surely see what he is talking about. In case you really cannot find it out, leave the first character of „Object“ blank.

#### **2. There is no reference whether the centre or p. or f. end of the object is meant.**

P. and f. ends are taken only of extended objects like the GRS. Unless otherwise stated, assume that the object's centre was observed.

**3. No statement about the the object's visibility is given.**

Keep the third character of „Object“ blank.

**4. An object cannot be clearly classified as to the object code.**

Do it anyway: use the category where it fits best.

**5. It is unclear whether a bright spot is one of the three longlived White Ovals in the STB.**

Describe it as a bright spot in region C1 or C2.

**6. The appropriate region code is hard to decide.**

Send photocopies of the observations in question to the coordinator.

**7. Neither date nor time are given.**

The positional observation is worthless.

**8. Only the date but not the time of observation is given.**

In the case of C.M.T. prior to 1897 send a photocopy. Otherwise enter the observation on the data form and leave „UT“ blank.

Do not forget to note down the observational location, also its coordinates or Greenwich local mean time difference, if known.

**9. An observation is reported in sidereal time.**

Send a photocopy.

**10. The observation time is not UT but a local mean time different from Greenwich's.**

C.M.T. for which neither the observational location, nor its coordinates or time difference to UT are given (and you cannot reconstruct any of these data by other papers) are worthless. Measurements which have the same lack enter in the data form as usual, but fill out columns „Date“ and „UT“ with local mean time. Do not forget to state clearly that these times refer to an unknown local time!

In case the geographic longitude of the location or its time difference to UT is stated, local times can be easily transformed into UT as described in chapter 7. If only the location's name is known, an atlas or geographical encyclopedia helps. In good atlases coordinate tables as precise as to 1 minute of arc are given, resulting in a maximum time error of 4 seconds. If you measure a map, be aware that the observational site's longitude has to be determined accurate to 5 minutes of arc when processing C.M.T.

If you are lacking a good atlas or geographical encyclopedia or you cannot fulfill the required precision, write to the JUPOS coordinator. He will then try to find out the exact coordinates and time differences.

You also may complete the data forms with local mean time. But do not forget to mark clearly on each data form that (or which) times are not UT then! Furthermore, note down the observational location and, if known, its coordinates and local mean time difference in each form's header. An additional information where you got coordinates and time difference from would be very desirable.

**11. Only the object's zenographic longitude is given, but not the time of observation.**

See problem 8.

**12. The estimated maximum error of the zenographic longitude is unknown.**

Leave „+/-“ blank.

**13. The rotational system a longitude refers to is not described.**

System 1 is used for latitudes close to the Jovian equator, i.e. SEB(N), EZ and NEB(S), more rarely also for the fast NTBs jetstream. If no explicit note is given, the longitude will most probably relate to System 2.

**14. Residence and observational location are not the same, or they change in the course of time.**

If feasible, always enter the current observational location. When it changes, indicate that the observer is identical to a former one. A remark like „previously Xtown“ is sufficient. When entering the address in PC-JUPOS (via „Record C.M.T. / Measurements ... New“) it is your decision which way is best.

***Only C.M.T., including timings with the aid of micrometer webs***

**15. Only the C.M.T. time but not the corresponding zenographic longitude is given.**

Keep „Long.“ blank. If you use PC-JUPOS, the software will calculate the longitude automatically while entering data. Ensure that time and date are in fact UT!

**16. There is a contradiction between C.M.T. time and longitude.**

In case the C.M.T. was observed before 1897 that is no wonder, since System 1 and 2 were only introduced at that time. In earlier years other systems were in use. Send a photocopy of the observational report then. On the other hand, please check whether

- the rotational system is right,
- the time is actually given as UT
- the 12 hour difference between old (i.e., prior to 1925) and modern counting of the astronomical day has been taken into account
- you have not overlooked a possible transition of day, month or even year when transforming the original observing time into UT,
- the used C.M. really relates to the geometrically illuminated part of Jupiter, and furthermore has not been calculated for Ephemeris Time (ET) or TDT.

If you have not found any error yet, mark the observation by an „err“ on the right margin of the data form, or exclude it from recording in PC-JUPOS at all. Do not be afraid of sending a form full of „err“'s to the coordinator! The observer in question and its publishing house will then be looked at with particular care in the future.

In case there are only a few irregularities with the same observer, typographical errors could account for them. You might check on this by using the ephemerides module of PC-JUPOS. Do data fit when you turn the day from 21 to 12, e.g., or could the longitude perhaps had been 23° instead of 33°? Please note any likely (!) modification of original values on the back of the form.

**17. The applied instrument is unknown or incompletely reported.**

In case that only its type is given, simply write „R“ or „S“. Otherwise leave the whole column „Instr“ blank.

**18. The applied magnification is unknown.**

Keep „Magn“ blank.



**19. The image orientation is not reported.**

Keep „O“ blank.

*Only micrometer measurements and measurements of photos and CCD images.*

**20. The latitude is not given zenographically, or is expressed in another form.**

Zenocentric latitudes  $\beta$  you can convert into zenographic values  $\beta''$  as follows:

$$\tan \beta'' = 1.144 * \tan \beta$$

Note that in old literature also a third manner of expressing latitudes occurs which is an „in-between“ of zenographic and -centric figures. Sometimes the spherical distance of an object to a Jovian pole is given. It is possible to calculate the zenographic latitude from that value, too.

In case of need leave the column  $\beta''$  blank.

**21. The mean error of the zenographic longitude or latitude is not reported.**

Leave „+/-“ blank.

## 9. References

- [1] Hahn, G.; Mettig, H.-J.: PC-JUPOS Software Handbook (1995)
- [2] Kowalec, Ch.: Nomenklatur der Objekte und Regionen auf Jupiter. MfP **4**, 39 ff. (1979)
- [3] Rogers, J.H.: The Giant Planet Jupiter. Cambridge University Press, 43 ff. (1995)
- [4] Roth, G.D.: Taschenbuch für Planetenbeobachter. Sterne und Weltraum Dr. Vehrenberg GmbH München, 3. Auflage, 178 ff. (1987)
- [5] Gehrels, T. (ed.): Jupiter. The University of Arizona Press, Tucson, 564 ff. (1976)



