User Manual - No. XXVI

La Palma Archive User Manual

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1 INTRODUCTION

1.1 About the La Palma Observations Archive

Observations collected with telescopes of the Isaac Newton Group (ING) at the Observatorio del Roque de los Muchachos on the Spanish island of La Palma, are archived at the Royal Greenwich Observatory, Cambridge, England. The Group consists of the 1.0-m Jacobus Kapteyn Telecope (JKT), the 2.5-m Isaac Newton Telescope (INT), and the 4.2-m William Herschel Telescope (WHT). These telescopes are operated by the Royal Greenwich Observatory on behalf of the UK Particle Physics and Astronomy Research Council (PPARC) and the Nederlandse organisatie voor Wetenschappelijk Onderzoek (NWO).

The La Palma Data Archive is part of the Dutch contribution to the joint operation of the ING telescopes. It consists of a comprehensive set of computer programmes which enable efficient storage, housekeeping and management of the collected observations. A detailed description of the archive operation is given by Zuiderwijk et al. (1994, PASP, **106**, 515).

A catalogue of archived observations is kept on-line on a VAX computer at RGO (node GXVG). It contains several 10^5 entries, and holds information about the instrument, detector(s), telescope, *etc.* at the time the data was obtained. The catalogue can be searched by means of an elaborate and versatile piece of query software. An archive user wanting to retrieve data can compose a table of observations of interest, and send it as a request for data to the archive manager for granting, processing and subsequent release. There is, however, a proprietary period of one year (from the date of observation), during which data can only be released with explicit consent of the original owner, *i.e.* the principal investigator on the PATT or CAT proposal under which the observations were obtained. After the one year period the data are in the free domain.

Data are released on magnetic tape in FITS format, and can be read by a standard FITS reader. However, early INT and JKT data headers may contain some additional unusual FITS descriptors for part of the (*e.g.* instrument-specific) information; if such information has to be accessed by data-reduction software, the usage of an extended FITS reading programme ('INGFITS', which runs in the FIGARO data reduction software environment) may be usefull. Usually, however, a standard FITS reader will do.

A recipient of data from the archive is asked to acknowledge the archive in (possible) ensueing publication(s), and further may consider to send us an empty tape in return. We would appreciate receiving preprints or reprints of publications which contain La Palma Archive data.

1.2 About this manual

This manual replaces the earlier edition of the archive PRIMER (La Palma Technical Note No. 69), and *partly* superseeds the archive User's Guide (ING User Manual No. XIX). The emphasis of this user manual is completely and exclusively on queries of the observations catalogue both *on-line*, via a captive account at RGO, or *off-line*, via the archive mailserver. Additional functions of the query software, such as queries of the archive index and other modes of access, are outside the of this manual scope, and are *not* included here; they are described in the already mentioned earlier ING User Manual No. XIX (see also page 25).

This User Manual is devided into three parts. Part I, sections 2 to 6, gives an astronomical description of the archive contents. Part II, sections II to 16, has the character of a 'Primer' with a general introduction to the query software, and describes how to *on-line* query the archive catalogue via the captive account and the usage of the archive mailserver. Part III, section 17 to 28, deals with the command language employed by the query software, and includes a detailed description of individual commands and qualifiers.

Part I

Astronomical Overview

2 Catalogue contents

The La Palma Archive contains observations collected with the JKT and the INT since medio 1986; observations obtained with the WHT are routinely archived since 1991. Table 1 summarizes the more important items in the catalogue. The archive contains the raw data taken at the telescopes. Therefore, a substantial fraction (about one quarter) of the catalogue entries relate to calibration exposures; a further ten percent of observations are of astronomical standards.

Table 1: Contents of the Master Catalogue

Catalogue Item	Details	Notes
Telescope Coordinates	RA, Dec in J2000 coordinates	
Object Name ('Title')	24 ASCII characters	
Observation Type	1-byte integer number [1,255]	1
Object Type	up to 4 1-byte integers [1,255]	1
Telescope	*e.g.* INT, JKT, WHT	
Instrument	*e.g.* IDS, PFCU, ISIS	2
Detector name	*e.g.* CCD, IPCS, RCA, EEV3	3
Date and Time of Observation	UT date and UT	
Exposure time	Seconds	
Waveband information	*e.g.* U, V, O5007, H6607	2
Polarisation	*e.g.* Calcite, Polaroid	2
Sky quality, Seeing codes	added afterwards	4
Observer identification	up to 4 characters ('initials')	
Observing proposal reference	character string	
Proprietary Period	default 365 days	
Pointers to archive tapes		

Notes:
1 See section 5
2 See section 3
3 See section 4
4 See section 6

A complete list of catalogue items and derived information, and of the keywords under which that information can be accessed, is given furtheron (see section 20.2 and Table 12).

3 Instruments

Table 2 shows the common-user instrumentation for which observations are archived. A detailed description of ING instrumentation is outside the scope of this manual. For full documentation about individual instruments the reader is referred to the Observers Guide and the various Instrument Manuals. However, some knowledge about the instrumentation may be of help to an archive user not familiar with the observatory itself. Therefore, some characteristics of individual instruments will be given here.

Table 2: ING instruments with archived data

Telescope	Focus	Instrument	Description	Detector(s)
JKT	Cassegrain	FWHL	Direct Imaging, no camera optics	CCD
	Cassegrain	QUBES	Belfast Echelle Spectrograph	CCD
	Cassegrain	RBS	Richardson-Brealey Spectrograph	CCD
INT	Cassegrain	IDS	Intermediate Dispersion Spectrograph	CCD, IPCS
	Cassegrain	FOS-I	Faint Object Spectrograph	CCD
	Prime	PFCU	Imaging Camera (Prime Focus Cone Unit)	CCD
	Cassegrain	MES	Manchester Echelle Spectrograph	CCD, IPCS
	Cassegrain	QUBES	Belfast Echelle Spectrograph	CCD
WHT	Cassegrain	ISIS	Intermediate-dispersion double Spectrograph	CCD, IPCS
	Cassegrain	FOS-II	Faint Object Spectrograph	CCD
	Nasmyth	UES	Utrecht Echelle Spectrograph	CCD, IPCS
	Cassegrain	TAURUS	Fabry-Perot Imaging System	IPCS, CCD
	Cassegrain	APORT	Auxilliary Cassegrain Imaging Port	CCD
	Cassegrain	LDSS	Low Dispersion Survey Spectrograph	CCD
	Prime	PRIME	Prime Focus Imaging Camera	CCD

3.1 Imaging instruments

imaging instruments JKT, INT, WHT
filters and sets
scales for various CCDs
operational constraints.

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3.2 Spectrographs

- The Faint Object Spectrographs (FOS, on INT and WHT)

  The FOSs are fixed-format low-dispersion spectrographs of special design matched to the optical characteristics of the telescope in order to optimize throughput. The spectrum covers the whole wavelength range from 3500Å up to 10500Å . There are two spectral orders, both slightly curved, which requires precise treatment during data reduction. A set of special atmospheric standards is usually required to (flux) calibrate the red part of the spectrum. Data reduction is best done by using the Durham FOS software package, but reduction can be done using standard IRAF functions.

- The Intermediate Dispersion Spectrograph (IDS, on INT)

  This spectrograph comes with a set of 15 different gratings, which cater for low dispersion spectroscopy at 16Å resolution all the way up to 'high' dispersion spectroscopy at 0.3Å resolution, and corresponding spectral coverage. There are two cameras, on a short focus and a long focus arm, each with its own detector mounted (CCD or, previous to 1992, IPCS); it is possible to switch from one arm to the other during an observing night, but both arms cannot be used simultaneously. Data reduction for CCD observations is standard; long-slit observations taken with the IPCS may require an advanced two-dimensional package (see section 4). On rare occasions the IDS has been used in a cross-dispersed mode.

- The ISIS double spectrograph (on WHT)

  This is an intermediate dispersion spectrograph with two independent cameras, one on the blue and one on the red arm. Both cameras can be used simultaneously, thus one may find in the archive sets of two ISIS observations taken at the same time. The blue arm can be equiped with either a blue-sensitive CCD or the IPCS, the red arm always carries a CCD detector. Sometimes only one camera is used. A range of gratings is available to allow spectroscopy from low to high resolution. ISIS can also be used in spectropolarimetrical mode, for which purpose active optical elements can be inserted into the lightpath. The polarization information is available in the archive catalogue.

- The Utrecht Echelle Spectrograph (UES).

  A very stable high-dispersion echelle spectrograph resident on the Nasmyth platform of the WHT. UES requires a large detector (1000×1000 CCD) in order to have a large spectral coverage. UES has also been used with the WHT IPCS detector on very faint objects. UES data can be reduced routinely with the IRAF or FIGARO/ERIS software packages.

- The Richardson-Brealey Spectrograph (RBS on JKT).

  A very stable, off-axis spectrograph at the JKT Cassegrain focus, for low and intermediate dispersion (resolution 1Å to 10Å) spectroscopy. The grating setting on this instrument is not under computer control, and done manually.

- QUBES and MES. *TO BE COMPLETED*

3.3 Special Instruments

- TAURUS

  A two-dimensional imaging spectrograph. This instrument can be used in etalon mode, where a series of exposures is taken through a sequence of narrow-band Fabry-Perot etalon settings. The data are three dimensional, and difficult to reduce. There is a reduction package available at RGO and at Roden (The Netherlands).

  Alternatively, TAURUS can be used as imaging instrument, using a filter instead of the etalon.

- The Low Dispersion Survey Spectrograph *TO BE COMPLETED*

4 Detectors

There are two types of detectors in use at ING instruments: the Imaging Photon Counting System (IPCS) and the Charge Coupled Device (CCD). The catalogue also contains a small number of observations recorded on photographic plate, but in those cases the catalogue only serves as observing log, and the data cannot be retrieved in a standard way; these observations are flagged (see section 5) and are best ignored when searching the archive.

4.1 The IPCS detectors.

The IPCS detector is based on the principle of event centering: Incoming photons on the light-sensitive target are amplified by an image-tube intensifier; the light flashes at the output window are registered by a Vidicon or CCD detector. That signal is analyzed by hard-wired logic to determine the positions of individual photon events. The sensitivity of the IPCS is determined by the characteristics of the Image Tube phosphorus. The IPCS is sensitive up to about 7000Å, with an overall Quantum Efficiency of about 20%. In practice the IPCS is only used for observations where the signal-to-noise is limited by the detector, *i.e.* high dispersion spectroscopy on faint objects (in dark time).

A first-generation IPCS has been in use at the IDS spectrograph (INT) until about 1992. This detector made use of a Vidicon tube for event detection, and therefore required elaborate set-up procedures for alignment and minimizing of image distortion. Image size is maximum 2048×256 pixels, but for spectroscopic use a format of 2048×32 is more typical. Pixel size is usually 15μ in the dispersion direction. Calibration of this detector can be cumbersome and, in particular for longslit spectroscopy, special calibration exposures are needed. These calibration are marked in the catalogue with special codes.

A second-generation IPCS with CCD readout has been in use at the WHT instruments (ISIS and UES) since 1991. Maximum format is about 2400×3200; pixel size 12μ.

4.2 The CCD detectors

Over the years a plethora of CCD detectors have been in use at practically all ING instruments. A listing of past and current detectors was kindly provided by Dr. P. Jordan of RGO and is given in Table 5 at the end of this Part I. This table is also included in the on-line help facilty of the archive and will be kept up-to-date.

CCD detectors in the catalogue are described either by 'CCD' (on JKT and INT) or by the camera name, *e.g.* EEV3, (on WHT). It is intended that the camera name will be shown throughout, and we are in the process of amending the catalogue accordingly (see section 6).

5 Astronomical codes

The observations catalogue contains two coded items which may be called 'astronomical codes': the 'observation type' and the 'object type'.

5.1 Observation-type code

The Observation Type is a integer number encoding the kind of observation, and serves to distinguish between calibration and science exposures. The archive recognizes roughly 7 different types of observations; a summary is shown in table 3. The complete list of current observation types in use can be obtained by using the SHOW command of the query software (section 22.3).

Table 3: Observation-type codes (summary)

Type	Description
0	(still) Undefined
1 – 7	Science observations
8, 9	Corrupted and Test data
10 – 19	Astronomical (*e.g.* flux) Standards
20 – 29	Detector characteristics (BIAS, DARK, *etc.*)
30 – 39	Flatfield exposures of one kind or another
40 – 49	Arc exposures
≥ 50	Special calibrations

Occasionally, a new entry may be added to the list (for which there is ample possibility), for instance if a new instrument uses a specific kind of calibration exposure. The query software supports a function to search calibrations for a given selection of observations (CALSELECT, see section 20.4), which makes use of the observation-type code.

5.2 Object-type code

There are up to four integer-number Object Types associated with each observation, which encode a brief astronomical description of the data. At the moment we have identified some 150 astronomical categories which allow for both a very general typing (*e.g.* 'galaxy') or a more detailed (*e.g.* Seyfert I) description.

Data can be selected on object type(s), and all catalogue entries with any of the (up to) 4 types matching the specification will be found. However, the object-type codes are put into the data base by the archive manager. Given the plethora of different objects in the catalogue (there are over 10000), this is a very substantial task, requiring much effort and time. Consequently, there will always be a substantial number of observations, which which have not yet been typed. Thus, searching the catalogue on object type may not reveal all observations of a given object.

Table 4 lists some examples of object type codes; an archive user can obtain a complete list by using the SHOW command of the query software (section 22.3).

6 Catalogue Maintenance

The archive receives the observations as they are produced by the Data Acquisition System (DAS) of ING telescopes. Unfortunately, the desciption of the data with the FITS headers has not always been completely reliable, due to technical or operational difficulties encountered during an observing session. For instance, a failure of the computer link between the Telescope Control System and the DAS at the time of observation will have resulted in missing position information in the FITS descriptors, hence in the catalogue.

Problems have occurred with the description of a whole range of catalogue items, and a substantial number of observations may have one or more item undefined, or sometimes even uncorrectly defined (*e.g.* temporal information, instrument and filters names, *etc.*).

The correction of such missing or erroneous information in the catalogue is an on-going effort, and very time consuming. Archive users might, therefore, take this health warning into account (and spare a thought for the archive manager), if they stumble upon missing information when searching through the catalogue.

TO BE COMPLETED

Table 4: Sample of object types used in the La Palma Archive

Category		code	Category		code
unknown	=	1	Protostar/Protostellar Cloud	=	90
Star(-like object) of unknown type	=	2	T Tauri star	=	91
Non-stellar object of unknown type	=	3	Cocoon star	=	92
terrestrial	=	9	Herbig-Haro object	=	93
			etc.		
Solar System	=	10			
Sun	=	11	Nebula	=	100
Moon	=	12	H-II region	=	101
Planet	=	13	Compact H-II region	=	102
etc.			Supernova Remnant	=	103
			etc.		
Early Type Star (A9 or earlier)	=	20			
O type	=	21	Galactic Centre	=	110
Wolf-Rayet (spectrum) star	=	22	Halo object	=	111
Helium (spectrum) star	=	23	population II object	=	112
etc.			Galactic non-stellar	=	113
			etc.		
Late Type Star (F0 or later)	=	30			
F type	=	31	Galaxy (incl. anonymous)	=	120
G type	=	32	Elliptical	=	121
K type	=	33	cD (giant elliptical)	=	122
etc.			Lenticular (S0) Galaxy	=	123
			etc.		
main-sequence star	=	40			
giant or sub-giant	=	41	Active Galaxy	=	130
supergiant	=	42	Emission-line Galaxy	=	131
subdwarf	=	43	Seyfert I	=	132
etc.			Seyfert II	=	133
			etc.		
Variable star	=	50			
Long period (semi-regular) variable	=	51	Extragalactic star-like object	=	140
Irregular variable	=	52	BL Lac object	=	141
Mira type	=	53	Blue star-like object	=	142
etc.			*etc.*		
Eruptive variable	=	60	Quasar/QSO	=	150
Supernova	=	61	BAL QSO	=	151
Supernova Type I	=	62	OVV quasar	=	152
Supernova Type II	=	63	X-ray QSO	=	153
etc.			*etc.*		
Binary or Multiple star	=	70	(member of) (Pair or) Group of galaxies	=	160
Eclipsing Binary	=	71	Abell Cluster	=	161
Spectroscopic Binary	=	72	Supercluster	=	162
Massive X-ray Binary	=	73	High-redshift (super)cluster	=	163
etc.			*etc.*		
(member of) Star Cluster	=	80	candidate identification of γ-ray source	=	170
Open Cluster	=	81	candidate identification of X-ray source	=	171
Galactic Globular Cluster	=	82	candidate identification of UV source	=	172
Globular Cluster in other galaxy	=	83	candidate identification of IR source	=	173
etc.			*etc.*		

Table 5: ING CCD Summary Version 04/07/94

CHIP TYPE		CAMERA NAME	OPERATING DATES	BIAS LEVEL (adu)	READ NOISE (e^-)	GAIN e/ADU	Max Counts (adu)	FORMAT Pixel size [micron]	Notes
RCA 501EX	t	RCA (PF)	Jul 85 Feb 87	1300	60	3.8	>65K	320×512 [30×30]	1
RCA 501EX	t	RCA2 [*]	Feb 87 onward	300	60	3.8	>65K		2
GEC P8603		FOS1 (INT)	May 85 May 88	150	7	1	27K	385×578 [22×22]	3
GEC P8603	c	FOS1	May 88 onward	150	8	1	>65K		4
GEC P8603		GEC1 (IDS)	Jun 84 Dec 86	140	5 12 pf	0.8	40K		5
GEC P8603		GEC1	Feb 87 Dec 87	100	7	0.8	>30K		6
GEC P8603	c	GEC3 [*]	Dec 87 Apr 92	100	7	1	>65K		7
GEC P8603		GEC2 (JKT)	Sep 85 Mar 86	100	6	1	30K		8
GEC P8607		GEC2	Jul 86 Nov 86	100	8	1.6	35K	385×578 [16×16]	9
GEC P8603		GEC2	Nov 86 Jan 88	150	9	2.2	>65K	385×578 [22×22]	10
GEC P8603	c	GEC4 [*]	Jan 88 May 89	200	6.5	1.1	>65K		11
GEC P8603	c	FOS2 (WHT)	Aug 87 May 89	200	10	2	30K		12
GEC P8603	c	GEC5 (WHT)	Jul 88 onward	150	9	1.1	40K		13
GEC P8603	c	GEC6 [*]	May 89 May 92	200	8	1	60K		14
GEC P8603	c	FOS2	May 89 onward	200	9.5	2.3	>50K		15
EEV P88225		EEV1 (ISIS)	Jul 89 Dec 89	2450	5	1.7	60K	770×1152 [22.5×22.5]	16
EEV 88231		EEV2 [*]	Dec 89 Jun 91	2630	4	1.1	60K		20
EEV 0530	M	EEV3 (ISIS)	Apr 91 onward	3850	3.5	0.8	50K	1242×1152 [22.5×22.5]	21
EEV 0520	M	EEV4 [*]	Jun 91 onward	2700	4	1	50K	770×1152 [22.5×22.5]	22
EEV 0530	M	EEV5 (INT)	Oct 91 onward	4100	4.5	0.7	>45K	1242×1152 [22.5×22.5]	23
EEV 0530	M	EEV6 (ISIS)	Oct 91 onward	3600	3.5	1.0	>50K		24
Tek TK1024	t	TEK1 (WHT)	Mar 92 Oct 92	450	5/12	2.4	>60K	1024×1024 [24×24]	25
Tek TK1024	t	TEK1 (WHT)	Nov 92 onward	2290	5	1.3	>60K	1024×1024 [24×24]	25
EEV 05-30	M	EEV7 (JKT)	Apr 92 onward	4300	4	0.76	>60K	1242×1152 [22.5×22.5]	26
EEV 0206	M	GEC7 (INT)	May 92 onward	7600	8.5	1.4	>60K	335×520 [22×22]	27

Table 5: ING CCD Summary Version 04/07/94 continued

CHIP TYPE	CAMERA NAME	OPERATING DATES	BIAS LEVEL (adu)	READ NOISE (e^-)	GAIN e/ADU	Max Counts (adu)	FORMAT Pixel size [micron]	Notes
GEC P8603 c	GEC3.1	May 92 onward	100?	7	1	>65K 100Ke	385×578 [22×22]	29
Tek TK1024 t	TEK2 (WHT)	Nov 93 onward	1125	4.5	1.2	>65K 120Ke	1024×1024 [24×24]	30
Tek TK1024 t	TEK3 (INT)	May 94 onward	800	4.5	0.7	>65K 120Ke	1024×1024 [24×24]	33
Tek TK1024 t t	TEK4 (JKT)	Jul 94 onward	500	4.7	0.8	>65K 120Ke	1024×1024 [24×24]	34

General comments:

- `[*]` with camera name, indicates usage on several instruments.
- `"c"` with chip type, refers to a dye-coating to give enhanced UV-response.
- `"M"` with chip type, refers to a 'Metachrome' phosphor coating, for UV response.
- `"t"` with chip type, refers to a thinned CCD, for enhanced peak/UV response.
- Typical digitised areas exceed the size of the imaging area; *e.g.* 1124×1124 for TEK Cameras.
- Read-noise is quoted at the STANDARD readout speed.
- ADU = analogue-digital converter units. The e^-/ADU figures are believed correct to about 10% . The figure is given for the default (standard) readout speed.
- The maximum available digitised count is always 65535 (2^{16}). This is a purely electronic limitation. In some cases measurements close to this limit have not been made; these are often indicated by, *e.g.* , '>55K'. Usually the linearity limit is constrained by the ADC range combined with the electronic gain of the system, rather than by a real limitation of the CCD (which exceeds 100000 electrons in most cases).
- The GEC CCD was originally made by GEC-Hurst Research Centre; however all devices are now made by EEV (Chelmsford, part of GEC group). We have retained the original 'GEC' camera names, for camera-heads containing small CCDs (although they are now supplied by EEV; 'GEC7' is such an example).

Further notes with individual CCDs:

1 The original RCA chip; began to deteriorate early 1987.

2 This is our last but one remaining RCA CCD.

3 This chip suffered from poor charge transfer; it was replaced in May 1988.

4 This is a high-quality coated-CCD.

5 Originally fitted to IDS Camera. A nominal preflash (pf) was routinely used. Chip electronics were reset in Oct/Nov 1984. From Oct 1986 chip performance was poor.

6 No preflash required; un-coated chip.

7 This coated chip is was destroyed by preamp-OS s/c in April 92.

8 A-grade chip originally fitted to this camera, replaced in March 1986.

9 A 3/4 scale chip; temporary spare in JKT camera.

10 A normal-sized chip; does not require preflash; replaced Jan 1988.

11 For the first month of use the gain was 2.2e/ADU; later 1.1 e/ADU. Developed a threshold fault in May 89.

12 A standard ESO-coated EEV CCD; poor blue response.

13 A standard ESO-coated EEV CCD.

14 Dye-coated EEV CCD, with negligible preflash needed. Destroyed (by GEC3 P-A fault), in May92.

15 Dye-coated EEV CCD; no preflash used. This chip has the normal coated UV/blue response. In July 89 switched to operate with the new WHT Dwingeloo CCD controller. High noise has been seen if FOS-body is not well earthed.

16 A large-format setup-grade CCD for ISIS; operates with the WHT Dwingeloo CCD controller only; replaced in Dec 89.

20 Super-grade, un-coated '88200' CCD. Gain adjusted to reduce e/ADU factor.

21 Metachrome-coated, super-grade device; used on ISIS blue arm.

22 Coated, super-grade chip.

23 Large-format, coated, super-grade chip, used on INT/IDS.

24 The default ISIS-red sensor.

25 This is a grade-1, thinned CCD. Used at first for LDSS, but available for use at any WHT focus. At the observatory, it exhibited higher noise (13e) than during tests at Cambridge (5e); In Oct 92 it was returned to Cambridge, for examination. The problem was traced to a noisy preamp. connection. The head was returned to ING in Nov 92; the preamp-gain was increased (to give minimum noise, for spectroscopic applications).

26 This super-grade sensor is similar to the EEV5 one, and is now the default on the JKT, where it has replaced the GEC head.

27 This is a GEC small-format sensor; it has been thinned and Metachrome-coated. It has lower noise, but is less uniform than the RCA2 head. For use on INT/JKT.

29 Replacement chip for GEC3; used on various instruments.

30 Duplicate of TEK1, with a larger cryostat. 5 readout speeds now introduced. Installed at WHT Prime Focus, but also for use on ISIS and UES.

33 The new Tek head (for INT), which is mechanically similar to TEK2 (larger 2.5l cryostat). Delivered to ING in May 94, with extra readout modes and speeds. Simultaneous binning with window, and a double-window mode.

Part II

The Captive Account and Mailserver

7 General aspects of archive queries

An archive user has interactive access to the Observations Catalogue, but access to the data only by request. The actual observations are stored off-line and have to be retrieved by the archive operators. A de-archiving request is subject to authorization by the archive manager, in order to safeguard (possible) proprietary rights of the original owner(s) of the data.

The program ARCQUERY allows the user to query the Observations Catalogue and to select observations of interest in a 'query table'. This software can be used interactively (on the captive account) or in batch mode (via the server). At the end of a query session, the user may make a request for the selected observations to be de-archived. Such a request, however, can only be processed if the user has provided address information: the archive (manager) requires knowledge of who, and where, the user is. In particular, a user identifies him or herself with up to 4 initials on login, and, preferably on first-time usage, may provide additional information with the 'address' facility. The database system communicates with its users via electronic mail, and an E-mail address has therefore to be provided as part of the user identification. Successful processing of a request includes the mailing of a dearchiving log to the user, and, of course, sending the data off on a FITS tape.

All files created during a query session are identified by the initials of the user. At the end of a session the tables and listings created during that session (the 'query context') may be saved for future use. At the beginning of each query session the program checks whether there are any saved results from a previous session with the given user identification (initials) and, if found, offers the option to restore them. The query context is updated after the execution of every command; recovery from accidental exit, a system crash, or a similar disaster, is therefore straightforward.

At any level of the query process HELP information is available on line; the simplest way of accessing HELP is by typing a question mark '?' at the point where the user gets lost. A more complete description of this facility is given in section 18.

A full description of ARCQUERY command, command qualifiers, keywords and keyword qualifiers is given in sections 19 to 25 of part II of this manual. The ARCQUERY command interpreter works with a minimal matching method: commands, qualifiers and keywords alike may be abbreviated to an unambiguous combination of the leading characters; upper case or lower case may be used.

An archive user can define a set of user-specific defaults and symbols, which can be modified at any time during the session either permanently or temporarily. It is possible to do this in an initialization file, which will be executed automatically when one starts ARCQUERY.

8 Access

The Observations Catalogue and query software reside on a disk at the RGO VAX node GXVG at Cambridge (UK). The software can be accessed both on-line, via the captive account ARCQUERY, and off-line via the mailserver. The GXVG node can be reached via INTERNET, SPAN, JANET and STARLINK (UK users).

In order to use the query software interactively, simply connect to GXVG, and logon as username ARCQUERY; no password is required. Only a limited number of commands of the query software can be executed from this account. Table 6 shows GXVG's network identifications.

If the connection to the given SPAN address does not succeed, then try to connect via the RLESIS server at the Rutherford Appleton Laboratory (Didcot, Oxfordshire), as follows:

- Connect to RLESIS

Table 6: The GXVG node at RGO

INTERNET	SPAN	JANET	STARLINK
131.111.69.20 GXVG.AST.CAM.AC.UK	63559	UK.AC.RGO.SRF	GXVG

- Logon as username ESIS
- (a menu appears) Select option 1
- Choose Node GXVG
- Logon as ARCQUERY

9 The Captive Account ARCQUERY

GXVG is a DEC VAX machine running under DCL. On the captive account, the user cannot execute any DCL commands; only the commands of the query software are available. However, several aspects of the archive software make use of the DCL protocol; the HELP facility, for instance, is based on the VAX HELP facility.

On entry, the user is prompted for a set of (up to 4) initials. This is an important piece of information, and will be kept in the archive database. Thus, a user may reflect a moment on the question before providing an answer.

After completion of the login procedure, a listing appears of available functions:

- **ARCQUERY**:

  To enter the catalogue query software; the subject of the remaining sections of this part III.

- **EXAMPLE_QUERY**:

  Shows an example of a simple archive query session; first-time users may browse through it to get an idea of the function of several arcquery commands.

- **ARCSHOW**:

  Shows archive catalogues available. The one of interest here is OBSCAT_LP. The other posibilities ARCINX_LP and WSRTOLD relate to searches of the packet database, or remote access to the Westerbork Radio observations archive in Dwingeloo. Actually, with current fast network links, the WSRT archive can best be accessed by directly logging on to the ARCQUERY account at the Dwingeloo site (Internet node 'nfra.nl'). Index searches and remote access to other catalogues are described in ING User Manual XIX.

- **HELP, HELPQUERY, HELPCAT**

  On-line HELP information about ARCQUERY functions. This HELP facility can also be accessed from inside the ARCQUERY programme itself.

- **EDT_INITFILE, TPU_INITFILE**

  Edit an ARCQUERY initialization file via the EDT or TPU editor. Such an initialization file is executed on entry of the ARCQUERY programme, and can be used to define user-specific symbols and default settings, which are then automatically available at the beginning of each subsequent use of the query software.

- **CALCULATE**

  This programme enables the user to carry out a large number of pocket-calculator like functions, including the conversion of units. It has its own help-facility.

- **EXIT, LOGOUT**

  To logout from the captive account, with control returned to the user's own site, or, if you entered via RLESIS (SPAN), to ESIS.

10 Interactive use of ARCQUERY software

10.1 Starting ARCQUERY

The catalogue query software is started from the captive account by typing:

`ARCQ[UERY]` , or `ARCQO`

On entry, the programme will perform the following checks:

- **Identification check**: ARCQUERY will test whether address information is known to the database for user initials as provided on login. If no information is found, a message is displayed to that effect. It is recommended to provide the information with the ADDRESS function as a matter of priority when in business. See section 12.

- **Restoration check**: Subsequently, ARCQUERY will test if a saved query context exists, left from an earlier query session by this user. If such a saved context is found, the user will be prompted for its restoration, or not.

- **Catalogue check**; Finally, but only after start-up with the `ARCQ[UERY]` command, the user will be asked what archive has to be accessed. Just answer OBSCAT_LP to this one.

  Start-up with `ARCQO` implies accessing OBSCAT_LP.

Once inside ARCQUERY the full arsenal of commands and other tools are at the user's disposal. An extensive description of ARCQUERY commands, keywords and qualifiers, and of the command language syntax, is presented in part II of this manual, to which the user is referred for full details.

10.2 Terminating ARCQUERY

The regular way of stopping ARCQUERY is by using the EXIT command (see section 25). An alternative way is to reply to any question or prompt with `CTRL/Z`. This will terminate execution in a manner similar to EXIT/SAVE. If no qualifier is given with the EXIT command, ARCQUERY will prompt for one; the SAVE qualifier saves the query context of this session.

In principle, `CTRL/Y` should not be used to stop ARCQUERY.

After termination of the ARCQUERY programme, control is returned to the captive account menu; in order to logout, do `EXIT` again, or type `LOGOUT`.

Programme execution is also terminated when the ARCQUERY prompt runs into a time-out. The time-out period is set to 30 minutes; if a reply is not given within that period, CTRL/Z is forced, followed by exit/save.

10.3 Interrupts

The process started by a number of ARCQUERY commands (*e.g.* SELECT, CALSELECT, LIST, COUNT) may be interrupted by CTRL/E or CTRL/C.

CTRL/E merely enquires the status of the process. It produces the number of records processed or selected so far. The process continues thereafter.

CTRL/C, on the other hand is a real interrupt. The user will be asked to decide what to do next. In general, the options are:

SHOW	to show the status and continue (identical to CTRL/E);
KEEP	to discontinue the process, but keep what has been done so far as the final result of the process;
ABORT	to abort the process and discard all results of it; one returns to the point where the original command was given.

A special interrupt CTRL/L may be used (it does not always work!) to discontinue/continue listing on the VDU (if a command would produce such a listing).

11 Aspects of a simple-minded ARCQUERY session

11.1 Overview

The ARCQUERY software employs about 20 primary commands, which fall in roughly six groups:

- help and preparation	HELP, DEFAULT
- selecting	SELECT, EDIT, CALSELECT
- table handling	UNION, INTERSECTION, DIFFERENCE, RENAME, DELETE
- listing	LIST, TYPE/PRINT, SPOOL, SHOW
- requesting	REQUEST, ADDRESS_INFO, MODIFY_REQUEST
- miscellaneous	SORT, COUNT, MAIL_COMMENT
- termination	EXIT

An on-line HELP (section 18) facility can be accessed at any point in a query session by simply typing a "?". For example, typing "SELECT ?" on the ARCQUERY prompt will produce that part of the HELP information pertaining to the SELECT command; alternatively, one may use "HELP SELECT" .

The ARCQuery software uses a table structure: a SELECT operation on table N, for instance, will produce a new output table N+1. The default table 0 on entry is, of course, the catalogue itself; the newly created output table becomes the default for the next operation. Similarly, table-handling commands all create new tables (which then become the default). Input and output tables can also be specified with command qualifiers, and one can flip back and forth between tables, if one so wishes. The default table can also be explicitly defined; see sections 21 and 28, and below.

11.2 SELECTions

The SELECT command (section 20.2) acts, in principle, on all items in the observations catalogue, and on some derived quantities. A complete list of keywords used with SELECT is given in table 12; a short list of items of interest for first-time users includes:

```
- Name of the observer (up to 4 initials)               keyword: INI
- Name of the telescope                                          TEL
- Name of the instrument                                         INST
- Detector name                                                  DET
- Object name (up to 24 characters)                              OBJECT
- Object type (up to 4 code numbers)                             OBJ_TYPE
- Observation type (coded, e.g. arc/flat/object/standard)        OBS_TYPE
- RA and/or DEC, or position                                     RA, DEC, POS
- Date of observation                                            DATE
```

```
- Exposure time                                                    EXPO
- Waveband (filter) information                                    WAVEB
```

Simple selections can be as follows:

`SEL INI=EJZ` : get all observations taken by observer EJZ

`SEL DET=IPCS` : get all observations taken with the IPCS

`SEL OBJECT=3C273*` : get all objects whose name starts with 3C273

In the last example the wild card '*' can be useful, because many observers add some brief comment or clarification to the object name. If the wild card is not specified, the archive will only search for object names 3C273 strictly, and everything else is ignored. Note, however, that the use of wildcards will slow down the search. Further note that blanks in object names (and other character keywords) are ignored unless the user does explicitly specify blanks in the select command (section 26.4). Thus:

`SELECT  OBJECT=3C273` : will find 3C273, but also *e.g.* 3C 273 or 3 C 273, even 3 C 2 7 3

`SELECT  OBJECT=3C 273` : finds 3C 273 or 3 C 273, but not 3C273

During the search the SELect command may generate a listing of the selected observations (depends on the default setting, which in its turn depends on the access mode to the captive account used). Such a listing can be suppressed by giving an interrupt `<CTRL/C>` and continue with `NOLIST`, or by using `CTRL/L`, or, straight from the beginning with the `NOLIST` qualifier in the SELECT command itself:

`SEL/NOLIST`...*etc.*

If the default is set to NOLIST, then, after a select process is completed, a message appears stating the number of records selected. One may choose to list the table with `"LIST"`; alternatively, the `/LIST` qualifier may be used directly with the SELECT command itself:

`SEL/LIST`...*etc.*

11.3 Input/Output tables

If a SELECT command finds observations in the input table which satify the search specification, a new output table is created, which becomes the default input table for the next command. Thus, if the three commands shown above were to be given sequentially, the SEL INI command creates table 1 (table 0 being the catalogue), the SEL DET command then uses table 1 as input and creates table 2, and finally the SEL OBJECT command creates table 3.

If you would like to do a search again of the catalogue, you can specify the input table explicitly in the select command:

`SEL/INP=0  INI=BMW` : get data taken by BMW from the catalogue

Or, the table counter could be reset beforehand with:

`DEFAULT INPUT_TABLE=0`

before doing the SELect. Note that tables 1, 2 *etc.* can now, in principle, be overwritten with subsequent SELections. However, before an existing table is actually overwritten, the user will have to confirm it, or to define a new output table. In any case, care should be taken if one of those tables contains (part of) the final selection for a request!

The output table can also be specified at will in the select command, *e.g.* :

`SEL/INP=3/OUT=2  OBJECT=NGC4151*`

which overwrites the existing table 2. If no output table is specified, the input table name, either explicitly specified or the default, is used to define the default output table.

The table qualifiers can, for instance, be used to limit the number of scratch tables, which otherwise could easily fill up the work space of the captive account. Tables can also be DELeted; several tables can be combined in one output table with Union, DIfference, or Intersection (section 21). Thus, by intelligently using the select and table-handling functions, a user can compose a final table with observations of interest, and submit a request to de-archive those observations.

11.4 Value ranges and logical constructions

For some keywords it makes sense to do a selection on a range of values, and the command interpreter accepts interval and relational specifications:

`SEL RA = (6:10:30 to 18:05:)`	: find all objects in this RA interval
`SEL DEC = (0:: to 70::)`	: find all objects between 0 and 70 degrees declination.
`SEL DEC > 20::`	: find all objects above 20 degrees decl.
`SEL DATE >= 3MAR87`	: all observation on or after 3 March 1987

The last examples show that operators such as `>` , `>=` , `<` , `<=` , `=` and `<>` (not equal) can be used. Furthermore, the syntax interpeter understands logical constructions such as:

```
SEL   RA = (6:: to 18::)  &  DEC = (0::, to 70::)  &  EXPO > 800

SEL   (OBJECT = N*4151  &  DATE <= 3MAR89)  |  OBJECT = M81*
```

Here, the `&` stands for the logical AND operator; the `|` symbol represents the logical OR operator. For these operators one may also use the Fortran operators `.AND.` and `.OR.` , and similarly `.GT.`, `.GE.`, `.LT.`, `.LE.`, `.EQ.` and `.NE.`.

11.5 Table handling

As an example of the usage of table handling facilities, the previous example selection specification can also be made as follows:

```
SEL/INP=0/OUT=A   (OBJECT = N*4151  &  DATE <= 3MAR89)

SEL/INP=0/OUT=B    OBJECT = M81*

UNION/INP=(A,B)/OUT=1
```

The UNION command combines the two selections A and B in one tabel 1. Similarly, the INTERSECTION function serves to obtain a table of entries which occur in each of two tables, and the DIFFERENCE command will produce a table of entries which appear in only one of two tables.

If, after the union operation, the tables A and B are no longer needed, it is a good idea to delete them with:

`DELETE/INP=A` , and: `DELETE/INP=B`

You will be prompted for confirmation of the deletion.

11.6 Requests

In order to submit a request to the archive manager for the release of observations (section 23.1), just type:

`REQUEST/OUTPUT_TYPE=FITS` , or *e.g.* :

`REQUEST/INP=3B/OUTPUT_TYPE=FITS`

The latter form specifies the query table, just in case one is not sure about the default. The REQUEST command sends your request to the manager (it will be queued); you will be asked to provide any comment which might be relevant for your request; for instance, you might like to receive the data on either a DAT or EXABYTE tape. Protected data (the proprietary period is one year) will only be released with explicit consent of the original principal investigator. The command

```
SHOW REQUEST = *
```

will display the status of any outstanding request(s) of this user (queued, granted, executed or rejected). Note that an outstanding request can be cancelled by the user at any time before excution; see section 23.1 for details. The ARCQUERY software will return an E-mail message after a request has been processed.

When submitting a request for data, it may be of interest to consider the order in which the observations appear in the table; the data are de-archived in precisely that order and thus appear in that order on the FITS tape. If the table was obtained after many selections and table-handling operations, the observations can really get scrambled. Therefore, it can be a good idea to sort (section 24.1) the table before submitting the request. A sort on the keywords DATE, TIME, and possibly FITSTAPE will do nicely, *e.g.* :

```
SORT/INP=3A/OUT=4 FITSTAPE,DATE,TIME
```

11.7 Exit procedure

On `EXIT` the following actions ensue:

- All requests defined during the session are forwarded to the archive manager for authorization; request are queued.
- Print files created during the session will be submitted to the printer (default or otherwise, see section 22.2), or will be sent to the user's E-mail address. Subsequently the files are deleted.
- If `/NOSAVE` is specified, all query tables, symbols, *etc.* will be deleted.
- ARCQUERY updates some statistics of archive usage.

The qualifiers with the EXIT command of interest are:

- `/SAVE`, or `/NOSAVE`, to save the query context, or not. On the captive account, an absent `/[NO]SAVE` qualifier will result in a prompt for a decision.

  The saved query context consists of all query tables, list files and symbols that exist at the moment of termination, and of possible changes made to your user information. A saved query context can be restored at the begin of your next ARCQUERY session. Note, however, that on the captive account, the context is deleted 7 days after the last modification.

  The possibility to save the context after a session enables a user to interrupt a search at any point, and come back later, for instance after studying a (mailed) listing of the selection(s) made.

- `/[NO]MAIL`, to specify that any print files (section 22.2) must be mailed or not to the user's (current) E-mail address. If this qualifier is absent, print files will be output to the default output device; this can be E-mail, but may also be a line printer, depending from where the captive account is accessed. If you do want output via E-mail, always use the `/MAIL` qualifier on exit:

  `EXIT/MAIL/SAVE` , or: `EXIT/MAIL/NOSAVE`

  If you have registered as archive user (see section 12), ARCQUERY knows your E-mail address by default. Note that your E-mail address may be (re)defined explicitly during the session (see section 12.4).

  If you have not yet registered as user, and have not specified an electronic mail address with the ADDRESS function, ARCQUERY wil try to find a way back to you for mail output via the network path of your login. This is not always successful.

12 User Identification (ADDRESS_INFO)

On startup of the ARCQUERY software, the system will test the given initials against the archive users database. If they do not figure in the archive users list, the programme will display a message to that effect.

The 'address_info' function (section 23.2) enables the user to define user information for the archive database; the information is sent to the manager for inclusion by submitting a request. The archive requires a minimum of address information before data can be released: the archive (manager) has to know who, and where a requester is. Queries of the catalogue can be made without registration, but no data can be de-archived before the archive username is authorized by the archive manager; therefore, users are advized to submit the request during their first session. This may seem a cumbersome way of treating worried first-time users, but it is necessary in order to avoid confusion about archive users, and because the data are (partly) protected by the proprietary period of one year.

12.1 Interactive Mode

The user information may be entered interactively, on the captive account, by typing:

`ADDRESS_INFO` , or simply: `ADDRESS`

This command executes the address function in 'menu' mode: you will be prompted for the required information items. The information is split into a part concerning the user's home institute, and the user's personal information. The minimum information prompted for consists of:

- A (full) **name**; this item is compulsory.
- The user's home **institute** (compulsory; see below).
- A computer **username** (compulsory).
- A computer **host** machine name; compulsory, but may be blank (see below).
- Your **phone** extension.

(Keywords appear in **bold** script.) The tricky entry of this list is the Institute name: The archive data base contains details of a large number of institutes, entered over the years by archive users and the archive manager. At the prompt for the institute name, the user can inspect the list of institutes in the data base. If your institute is included in the list, just enter that name, and the only other items prompted for are a username, computer host (both required for communication via electronic mail), and a phone extension. If the institute does not appear in the list, the user will have to provide additional information, which is described below.

The data base contains with every institute name a 'generic' E-mail address, which may look, for instance, like the one of the Kapteyn Institute at Groningen (on INTERNET):

```
SMTP%"<user>@<host.>astro.rug.nl"
```

The address function will substitute the given username and hostname into the indicated fields; thus, users at that institute have to provide only a minimum of information. The 'SMTP' part in the above address refers to the local electronic-mail protocol used at the archive node. If the hostname is redundant, a blank hostname may be specified at the prompt: a user at node `astro.rug.nl` defines: host = " ", while a user at `kapteyn.astro.rug.nl` fills in: host = `kapteyn`.

After running through the menu, a request can be submitted automatically to the archive manager to have the information added to the user list, if wanted. Alternatively, one may choose to submit the request at a later stage (for instance after further alterations) with the command:

```
REQUEST/ADDRESS_INFO
```

When submitting the request in this way, the user is also prompted for a comment, which may serve to send any additional information or remarks to the archive manager with your request. The comment option is suppressed by using the `/NOCOMMENT` qualifier with the request function.

Note that a minimum of information is required, and that if some address items have been left undefined, a request/address cannot be done; ARCQUERY simply refuses execution. Further, if a request is not made during the current session, any address information that may have been typed in will be lost on exit unless a the query context is saved (section 25).

12.2 Command mode

The address function can also be used in command mode. Values of address items are specified with keyword(s) given with the command, *e.g.* :

`ADDRESS name="A X User"` , and:

`ADDRESS institute="GRONINGEN", username="AXU"`

If the required minimum of information is available, you will be prompted for a decision to submit the request automatically. That prompt can be suppressed by using the `/NOREQUEST` qualifier with the command:

`ADDRESS/NOREQ host=" ",phone="4638"` ,

which then must be followed explicitly by a request, if so required.

If an institute name is specified, which is not included in the database, additional information about the institute has to be defined before a request/address can be made (next subsection). A listing of the current selection of institute names in the data base is obtained with the SHOW command:

`SHOW INSTITUTE` , or `SHOW INSTITUTE=name` ,

where the second form will produce all available information of the named institute.

Information of an institute which already exists in the database, can only be changed in command mode, because it is not prompted for in menu mode, if the user specifies an existing institute name.

12.3 Defining a new Institute name

If the user's institute name is not included in the archive database, there are two options available: One can take the easy option, and choose as institute name either 'INTERNET' or 'BITNET', or the user provides full information, including a proper institute name or intelligible acronym.

The INTERNET and BITNET names are simply 'virtual institutes', with which only the user's E-mail details are communicated. The hostname to be used with INTERNET is the full Internet node specification. With BITNET the host is best specified with the SPAN node number; BITNET E-mail is routed via the RLESIS node at RAL. If you register in this way, perhaps some additional comments can be provided with the request, which could enable the archive manager to add your institute to the database.

Information required for a new institute name consists of (see also section 23.2):

- The **institute** name or acronym; in menu mode this item was already defined earlier.
- The full name of the institute; keyword=**instname**; compulsory.
- Any additional name, for instance pointing to a subdivision of a large organization; keyword=**subname**, optional.
- A (mail) **address** of the premises; compulsory.
- The **town** and/or postcodes, **country**; compulsory.

- The institute's **telephone**, **telefax** and **telex** numbers; optional.
- The institute's electronic-**mail** address; see above, compulsory. If there is a choice, the archive manager prefers an Internet address.

An example:

```
ADDRESS institute="BMO", instname="Bold Mountain Observatory"
ADDRESS/NOREQ subname="Observatorio de Nuestro Domo"
ADDRESS/NOREQ address="Mushroom Road", town="One Peak", etc.
ADDRESS/NOREQ mail="<user>@<host.>bmo.country"
REQUEST/NOCOM/ADDRESS
```

12.4 Altering existing user information (temporarilly)

Address information can be altered by simply running `ADDRESS_INFO` again in menu mode, or by explicitly (re)defining selected items in command mode. Any item can be changed; however, if the user's institute is altered, and the new name is as yet unknown, additional institute information will be required; see above.

It can sometimes be useful to redefine address information for the current ARCQUERY session only. Suppose a previously registered user logs onto the captive account from another node and account than specified in the original address information. For instance, she or he is observing and wants to query the archive to check on previous observations. The address information can be modified temporarilly, for this session only, in order to direct mail output to the user's temporary computer account.

To change the address is straightforward: one can simply change the institute specification, if the current user's site is included in the database, or one can use a 'virtual' institute name to redefine the E-mail addres. For instance, a visitor at the La Palma observatory site, can redirect ARCQUERY output to the mountain with *e.g.* :

```
ADDRESS/NOREQUEST institute="ING", host="LPVE", user="GUEST07"
```

or, alternatively, with:

```
ADDRESS/NOREQUEST institute="INTERNET", host="LPVE.ING.IAC.ES", user="GUEST07"
```

The `/NOREQUEST` qualifier serves to suppress the otherwise automatic prompt for the submission of a request. The changed address disappears when ARQUERY is terminated without save of the query context; then, on next login, the original address information applies again. If the context is saved on exit, the changes can be restored on next logon.

If you are a frequent traveller, it may be useful to define address changes as symbols in your intialization file on the captive account (see below).

The original address information can be restored from the database during an ARQUERY session, by typing:

```
ADDRESS/NOREQUEST institute=*, host=*, user=*
```

13 Search Strategies

13.1 Finding a particular object or objects

A search for a particular object is best done by searching on its sky position. There are two reasons for doing so: First, the object may appear in the catalogue under several different and perhaps abbreviated names, and secondly, the postion is an indexed catalogue item, which makes a search on it very quick. When searching only on the item object(_name), usually a wildcard has to be used, and the whole catalogue is tested, which can be much more time consuming than an indexed search.

A search on sky position is best done by either specifying a range for the catalogue items RA and DEC, or by using one of the derived keywords POSITION or BOX. For example, in order to find observations of NGC4151, at RA=12:10:32, Dec=39:24:30 (J2000 coordinates) any of the following searches could be made to obtain a first selection:

```
SEL/INP=0/OUT=1 RA = 12:08:00 to 12:13:00 , DEC = 39:00:00 to 40:00:00
SEL/INP=0/OUT=1 RA = 12:10:32 UNC 0:02:30 , DEC = 39:24:30 UNC 0.25
SEL/INP=0/OUT=1 POS = (12:10:32.0, 39:24:30, 30 arcmin)
SEL/INP=0/OUT=1 BOX = (12:10:32.0, 39:24:30, 30 arcmin, 24 arcmin)
```

By explicitly specifying the (here generous) search radius (with POS) and search box (with BOX), the defaults are overwritten. Those default sizes may also be modified (temporarilly) by using the `/RADIUS` and `/BOXSIZE` qualifiers with the select command, or (permanently) by redefining the default values themselves (and permanently, for the remainder of the session) with the DEFAULT function (sections 20.2 and 19).

Note that a selection on a precise position with `SEL RA=12:10:32, DEC=39:44:40` is unlikely to produce the desired result, or even any result, because in this case the specified values of RA and DEC must be exactly identical to those in the Observations Catalogue.

Searching on object name is generally an uncertain strategy. For example, Markarian galaxies could be indicated by object names starting with MK, MRK, or MARK, but many have also an NGC or other designation. One can try *e.g.* :

```
SEL  RA=(6:: to 12::)  &  DEC=(0:: to 30::) & obje=(MK*,MRK*,MARK*)
```

to find the observations with a Markarian-like name in the given sky area, but this search will not necessarily yield all objects of your interest present in the catalogue.

Further, it is possible to use Ecliptic or Galactic coordinates as well as another Equinox. The default coordinate system (Equatorial) and equinox (J2000) can be replaced by your own favorite with the DEFAULT command, or be specified, either with SELECT command qualifiers, or by prefixing the POS and BOX keys with 'EQ', 'EC' or 'GA':

`SEL/EQ=B1950  POS = ....` *etc.* .

`SEL/COOR=GAL/EQ=1985  POS = ....` *etc.* , or: `SEL/EQ=1985 GAPOS= ....`

In order to search observations in relatively large areas one can also select by sky-cell number of the position index (see section 20.2 and table 13). Each cell covers an area of approximately 7 square degrees.

The following recipe may be useful when you know the name of your object, but forgot its position, assuming that there are indeed any data of it in the archive:

- Do: `SEL/INP=0/LIST OBJE=*name*` ;use wildcards, and the LIST qualifier.
- As soon as a record is listed, which includes the position, interrupt with: `CTRL/C`
  Save the table with: `KEEP`, or lose it with: `ABORT`.
- Do: `SEL/INP=0/OUT=1 POSI= ....` , which will find your observations.
- Similarly, you can find *e.g.* the sky cell with: `LIST .... ,GAPOS, CELL, ....` , after the interrupt and `KEEP`.

13.2 Finding a particular observing night

Catalogue items with temporal information are: Date, Time, and Exposure. Date and Time are specified in the form `DD-MM-YY` (day-month-year) and `HH:MM:SS`, where ':', '/' or '-' are acceptable delimiters; Exposure is specified in seconds. A full description of the format is given in sections 26.5 and 26.6.

The keyword DATE selects from midnight to midnight; this is often inconvenient, and therefore a derived keyword NIGHT is avalibale to select particular obeserving nights. NIGHT selects from noon to noon. Thus, the command:

```
SEL NIGHT=13-SEP-1993
```

will select data from noon 13-sep-1993 until noon 14-sep-1993. The command:

```
SEL NIGHT=13-SEP-1993 & EXPO>200
```

selects data from that night with an exposure time greater than 200 seconds.

13.3 Finding a particular Data Tape

The two keywords refering to the original D(ata)-tape, are `FITSTAPE` and `FITSFILE`. Selections can be made on these keys, but some care should be exercised when doing so. The tape and file information is NOT part of the catalogue, in the sense that it does not appear in the actual records, but is stored separately and addressed via pointers. There are safety reasons for having this setup, not least because the tape name and file number have to be stored totally secure, or, if they were in some way corrupted, the archive software would never find the data back.

Thus, if a search for a FITSTAPE is specified, what happens is that the tape information is first accessed via a pointer, and then tested. It is a very IO intensive process, which, if done for every record of the catalogue, is an *extremely* time consuming operation.

Therefore, if you wish to search for a particular tape, the best thing to do is to search on another catalogue item as well: the tape information will then only be accessed if the additional search specification(s) are satisfied. The catalogue item to use that springs to mind is the DATE (or NIGHT) of observation, not least because the date is an indexed item. A reasonably reliable strategy is to apply a window around the (approximately) know date of the observations:

```
SEL  DATE  = (<first> TO <last>) & FITSTAPE=I*nnnn
SEL  NIGHT = (<first> TO <last>) & FITSTAPE=I*nnnn
```

If you do not know the date, but for instance do know of a particular object on the tape, search on that object first (see above), and do:

```
LIST ...., DATE, FITSTAPE, [FITSFILE,]....
```

Subsequently, now knowing a date, search for the whole tape using a date window. As a final check you may list the selection thus obtained and inspect the FITSFILE item, in order to see if the whole tape was covered by the date window; some D-tapes do contain data taken over a longer period of time.

If you don't have any additional information about the tape you want to find, and only have the name to go on, then it may be better to search for it in batch mode, by using the mailserver access mode (see section **??**).

13.4 Usage of wildcards

The wildcards,'$*$' and '%', may be used in alphanumeric values to replace part of the character string by any character. The difference between '$*$' and '%' is that '$*$' can indicate a character string of any length, including zero length, while '%' stands for one character only. For example, '%%`A`' indicates all three-character strings with an A as last character, while '`*A`' may have any length, and includes '`A`' itself.

The use of wildcard(s) is particularly useful when searching on object_name: Most catalogue entries contain, apart from the, possibly abbreviated, object title, additional information, ranging from a filter name to a run number or seeing information. The wildcard can replace such additional information, and the user only needs to concentrate on the object name. For example, if you want to find observations of the object NGC205 you may try:

```
SEL OBJECT = NGC205*
```

However, better is this:

```
SEL OBJECT = (N*205 *,N*205)
```

The second formulation will also uncover N205..., but not, for instance, NGC2051. Further, the blank specified in this form is significant, and a curiosity of the software is that `N*205 *` will not uncover the plain name 'NGC205', because the blank after the 5 is not treated as part of the name in the catalogue object name field.

Wildcards can *not* be used in the values of coded catalogue items, such as Telescope or Waveband; see table 12.

13.5 Finding Calibrations

Once a user has made a selection of the astronomical observations to retrieve from the archive, the appropriate calibration data may be found with the CALSELECT command. This command will find observations of a specified 'Observation Type' (see section 5) within a specified number of days before and after (each of) the astronomical observations already selected (in the default table).

The observation type is an integer code number primarily used to separate the various calibration exposures from the astronomical observations. A short list is given in table 3; all the observation types used in the catalogue can be listed by typing:

`SHOW CODE_GROUPS=OBS_TYPE` , or: `SHOW CODE=OBS_T`

The default setting for the CALSELECT command is to search in a window of 7 days before to 7 days after the date of each astronomical observation, and on observation type $\geq$ 10, which means that all calibration exposures encountered will be collected. The command, given without further qualification uses the default setting:

```
CALSELECT
```

However, in many cases it can be better to search for specific calibrations with a more appropriate window setting, taking into account some knowledge of observing practise. For instance, observers tend to take flat-field exposures at the beginning or the end of their runs, but arcs much nearer the the actual science spectra. Instead of the single, unqualified, CALSELECT search, a sequence such as the following may be more appropriate:

`CALSELECT OBS_TYPE=(10 to 19), DAY_LIMITS=(1,1), window=4` (standards)

`CALSELECT OBS_TYPE=(20 TO 29), DAY_LIMITS=(1,1), window=3` (bias, darks)

`CALSELECT OBS_TYPE=(30 TO 39), DAY_LIMITS=(5,5), window=6` (flats)

`CALSELECT OBS_TYPE=(40 to 49), DAY_LIMITS=(1,1), window=2` (arcs)

`CALSELECT OBS_TYPE>=50, DAY=(3,3), window=5` (others)

This is a whole mouthful, and clearly an area for experimentation; it may be worth the effort to define such specific calibration-selection commands as special symbols (next section).

The `CALSELECT` command can dig out quite a number of calibrations, in particular if the search boundaries are taken generously. Searches within one day of observation is normally more than sufficient and quite likely it will even then be necessary to weed out unwanted entries, for instance because they relate to other, unwanted observations taken in the same night, or, because observations from other observers than the one who took the data, are mixed in as well. This will usually require the removal out of specific entries. A straightforward way of doing that, without the need for complex select constructions, is by using the (VAX-based) EDIT facility. First, create a list file:

`LIST/FILE` , or `LIST/FILE item, item, item, ...` , then do:

`EDIT/EDT` , or `EDIT/TPU`

which puts you in edit mode, and enables you to delete any line from the table. On output of the editor the new query table will automatically be generated.

What if CALSELECT fails to uncover any calibrations? One possibility is that you happen to work on a part of the catalogue which is not yet provided with astronomical codes (see section 6), and the only way to find calibrations is then to inspect other observations taken in the same night (or nights, by the same observer). Most calibrations can be identified by their name (FF, ARC, *etc.*), so it is generally not too difficult to find your data by selecting on such names and inside an appropriate time interval:

- Do a SELECT on the NIGHT into a scratch table.
- Do `LIST/FILE ...., object, night, initial, ......`
- Use EDIT to *delete* the observations wanted.
- Exit from the editor with 'EXCLUDE'.
- Merge the resulting scratch table and your original selection with UNION.
- Delete the scratch tables.

In the case of ARCs for spectroscopic observations it is helpful that many of these are taken at the same sky position of the actual astronomical object, so a search on position will dig them out. In particular with WHT data it is possible to find most calibrations in this way (check on exposure times; arcs and flats usually have less than 100s).

14 Usage and definition of symbols

Complex or frequently used keyword constructions or logical expressions can be abbreviated to ARCQUERY symbols. Such symbols can be used as shorthand or alternative keyword names. For example, if you define the symbol NLSEL as:

`NLSEL = "SEL/NOLIST/FILE"` ,

then the subsequent instruction:

`NSEL OBJE=N*4151*` is equivalent to: `SEL/NOLIST/FILE OBJE=N*4151*`

Carefully constructed symbols can greatly simplify a complex search. As an example, consider the search for direct images in a particular waveband, taking into account that there are several imaging instruments available. Define two symbols, *e.g.* IMAGES, and VBAND, as follows :

```
IMAGES = "INST=(FWHL,PFCU,PRIME,CASS.AUX.PORT)"
```

```
VBAND  = "(WAVEBAND=V | OBJECT=* V *)"
```

The VBAND construction takes into account that some images have no waveband information (yet; see section 6), but then may have the filter name added to the object title. With these symbols defined, the search for V-band images of some object is done with:

```
SEL/INP=0 IMAGES & VBAND & OBJECT=..... & POS=(......
```

Another example of the usages of symbols:

```
SYM1 = "posi=(12:10:32.29,39:24:29.60, 4.2 arcmin)"
SYM2 = "posi=(00:42:44.50,41:16:28.94,60.0 arcmin)"
SYM3 = "posi=(01:33:53.79,30:39:01.72,36.6 arcmin)"
SELECT/LIST (SYM1 | SYM2 | SYM3)
```

14.1 The Initialization File

The main menu of the Captive Account includes a function EDT_INITFILE, which allows you to define symbols beforehand, and have them stored in a kind of login file for ARCQUERY. Such an initialization file can be used to store symbols that you may want to use repeatedly with ARCQUERY; in fact, you can setup your own version of the command language in this way.

The initialization file is executed on startup of ARCQUERY, and all symbols defined on it are available throughout. In order to assemble or modify your initialization file, terminate ARCQUERY with `EXIT/SAVE` (if you are in it, that is), and use the `EDT` or `TPU` function, which will put you in one of the VAX editors, and, on first-time use, will create the file automatically (you have no control over its name).

Symbols defined in the initialization file have to be specified according to the DCL protocol, *i.e.* each line has to start with a dollar, ' `$`' sign. Thus, in order to define the symbol SYM1 as given above, you enter:

```
$SYM1 = "posi=(12:10:32.29,39:24:29.60, 4.2 arcmin)"
```

After processing by ARCQUERY (on startup), the symbol will be known as 'SYM1', and ARCQUERY will tell you that it has created the symbol.

You exit the editor with `EX` (or `QUIT` if you want to abort).

15 Listing

The two primary listing functions are LIST and SHOW. The LIST command serves to display specific parameters of observations in the default query table, while SHOW will tell you about values used by ARCQUERY.

15.1 LIST

With LIST in principle all catalogue keywords can be listed, but the default setting lists only: Position, Object name, Telescope, Instrument, Detector and Date. You get that listing by simply typing:

```
LIST ,
```

without further qualifications. If you want other information displayed, either change the default setting by executing `DEFAULT LIST="..."`, or by specifying the items wanted in the list command itself:

```
LIST  OBJECT, POSITION, TEL, INI, DET, DATE, EXPO
```

Note that on a VDU the linewidth is truncated at 80 characters; a too long line on the printer will be split over several pages, unless the `TRUNCATE` qualifier is given. In the previous example, for instance, you will find that the telescope field is rather wide (12 positions), and that for ING data a width of 4 would be sufficient. This can be established by qualifying the field item with `/WIDTH=n`. Further, if a listing is to be printed on the lineprinter, or output via E-mail, a list-file has to be created first with the `FILE` qualifier, *e.g.* :

```
LIST/FILE/TRUNCATE OBJECT, POSITION, TEL/WID=4, INI, DET, DATE, EXPO ,
```

followed by `PRINT` to signal that the list-file is an output file. The actual submission to the print or mail queues is done with the `SPOOL` command, or on EXIT. For more information about changing formats among other things, the reader is referred to section 22.1 and to the HELP facility, which can be entered by typing: `LIST ?` .

15.2 SHOW

The SHOW command may be used to get information about values, units or codes used by ARCQUERY. Information can be shown about: Address_info, Code_groups, Defaults, Requests, Symbols, Tables, Units, and Users. Some examples:

- `SHOW UNITS` , or `SHOW UNITS=group`
  will show all units supported, or all units of a particular group (*e.g.* distance, angle, *etc.*).
- `SHOW CODE_GROUP = WAVEBAND`
  will produce a list of waveband filter names known to the archive.
- `SHOW CODE = OBJ_TYPE`
  lists the object-type codes (section 5) used by ARCQUERY.
- `SHOW USER=EJZ`
  will produce details about archive user EJZ.

For further details, see section 22.3.

16 Using the Mailserver

16.1 Introduction

You can send an ARCQUERY session as an electronic mail message to the archive mailserver at RGO, Cambridge (UK). The mailserver runs as a detached process on the captive account and samples mail every half hour. If a message of the proper type is found, the server reads it, and assembles a command procedure to run ARCQUERY with the instruction specified in your message. Results of the query session are returned to your E-mail address.

Originally, the server was intended for remotely accessing the archive from query software installed elsewhere. In that set-up the software composes the proper server message in an interactive session with the user, and forwards it to the mailserver at RGO. This construction is at the moment only operational from the NFRA site (Dwingeloo, Netherlands). However, an experienced archive user may benefit from using the mailserver to query the archive, because there is no need to login at the archive site. Moreover, writing the message, *e.g.* with a text editor, is dead simple, but a user should be aware of some tricky aspects of server queries.

Queries via the server use a different part of the workspace allocated to the archive. In particular, an initialization file on the captive account is *not* accessible to the server (you have to define symbols with your mail message).

16.2 Access

A server message should be sent to the mailserver E-mail address:

on Internet	ARCQSERVER @ MAIL.AST.CAM.AC.UK
on SPAN	63559::ARCQSERVER
(if no joy, try:	RLESIS::GXVG::ARCQSERVER)
on JANET	ARCQSERVER @ UK.AC.RGO.SRF
on STARLINK	GXVG::ARCQSERVER

The subject **must** be specified as `[subject=]"ARCQUERY_MAILED"`; this subject name will prompt the decoding as an archive query. It is important that the subject is specified correctly, because the server also handles other kinds of messages.

16.3 Format

You may present any valid ARCQUERY instruction to the server, just as you would do with an interactive session on the Captive Account. However, your mail message must contain a few lines different from the sequence used to logon to the captive account: The message must contain a 'prompt' string, immediately followed by a login statement. The prompt string has to be (for lack of a better idea):

```
---!!!___
```

It enables the server to skip all kind of clutter put in by the E-mail postmaster(s), in particular if the message is routed via several nodes. The two lines immediately following on the prompt string must specify the login and startup of ARCQUERY, consisting of your user initials, and on the next line the catalogue name, including a restore/norestore instruction, as follows:

`ABCD`
`OBSCAT_LP/RESTORE` , or `OBSCAT_LP/NORESTORE`

The ensuing lines of the message consist of any valid ARCQUERY instruction; the last one being the EXIT instruction. Thus, a search for data of M33 can be done with the following message:

```
---!!!___
EJZ
OBSCAT_LP/NORESTORE
SELECT/INP=0/OUT=1 POSITION=(01:33:53.79,30:39:01.72,36.6 arcmin)
LIST/INP=1
EXIT/NOSAVE
```

Similarly, you may specify your address information with the ADDRESS function in command mode.

16.4 Pitfalls

The one important aspect of server queries to keep in mind is that if a command fails, either because it is invalid (spelling), or because a search command fails to turn up any observations satisfying the search specification(s), then the command is aborted and the next one is executed. Thus, a server session does *not* break on a failed command. This may lead to unwanted situations. For instance, if you did a search on the master catalogue, and the search does not yield any observation, then the default input table will still be '0' (and not '1'). If your message now contains as next instruction the LIST command, you are specifying to list the whole catalogue; not surprisingly, you will never get any reply from the server if that happens.

Therefore, the golden rule with instructions for the server is: *always* specify both the `INPUT_TABLE` and the `OUTPUT_TABLE`, and also other qualifiers, such as `/NOCOM`, `/NOREQ`, *etc.* . If the input table for a command is specified, and the table does not exist, the command is simply aborted with an error message. If a listing is specified with:

```
LIST/INP=..
```

and the table does not exist, no other (default) table will be listed either, and you will get in the returned message a diagnosis of the problem back, upon which you may improve your query, and resubmit it to the server.

A similar problem can occur when you follow this advise, but the actual list is so long that you still run into (quota) problems: If you do not have a good idea how long a listing will be, stagger your server query, and first submit a query with only the `SELECT/NOLIST/....` command, followed by exit. You will get a message back, stating how large your output query table is. If it is smaller then, say 1000 lines, then proceed and resubmit your query, now with the list instruction added.

16.5 Comments

You can enter comments, also with server commands. You must then qualify with the /COMMENT qualifier; all lines following the command will be put in the comment message, *until* the string CTRL/Z is encountered, which acts as termination in line mode. For instance, a comment with a request via the server can be:

```
..../OUT=3A
REQUEST/INP=3A/COMMENT/OUTPUT_TYPE=FITS
This is the first line of a comment
This is the second line of a comment
......
CTRL/Z
EXIT/MAIL/SAVE
```

16.6 Returned Output

Listings and other output generated by a server session will be returned to you via E-mail. The address ARCQUERY uses is either your address from the user data base, if it exists, or any E-mail address you may specify during the current server session. If no address is known, the server will use a return address for mail output, which it derives by retracing your original server message.

Note that you can get table listings in two different ways: the first one is by doing a select (nolist!), followed by a list, as mentioned above. The second way is to do a SELECT/FILE/NOLIST/......, followed by PRINT and EXIT/MAIL/...... In the latter case you will receive the listing as a separate message, else you will get the listing as part of your server message.

Part III

The ARCQUERY command language

17 ARCQUERY commands and qualifiers

17.1 Overview

An archive user interacts with the ARCQUERY software via a simple command language, which allows, among other things, catalogue searches to be formulated as logical expressions, relating values of several catalogue items in one command. The command syntax is the same for both on-line (the captive account) and off-line (the mailserver) access, but some defaults are set differently.

Once the program ARCQUERY has been started an extensive set of commands is available, which can be classified under roughly six categories:

- help and preparation	`HELP, DEFAULT`
- selecting	`SELECT, EDIT, CALSELECT`
- table handling	`UNION, INTERSECTION, DIFFERENCE, RENAME, DELETE`
- listing	`LIST, TYPE/PRINT, SPOOL, SHOW`
- requesting	`REQUEST, ADDRESS_INFO, MODIFY_REQUEST`
- miscellaneous	`SORT, COUNT, MAIL_COMMENT`
- termination	`EXIT`

In the following sections the individual commands are treated in the given order; a brief description of all available commands and qualifiers on the captive account is given in table 7 and table 8, which may serve as a quick reference guide for the more experienced user. A detailed description of individual command ensues in subsequent sections; however, that description is in several cases not (cannot be) exhaustive, and even more information can be found in the on-line help facility. Finally, in the last sections of this part of the Archive User Manual, some general aspects of the command language syntax and user-defined symbols are discussed.

17.2 Command Qualifiers

Many commands can be accompanied by qualifiers, some of which are general to almost all commands and some of which are specific to a few commands. All qualifiers have default values or default settings. In many cases the user can adjust the defaults to his or her needs (see section 19). A summary of functions of qualifiers is given in table 8 along with their default values, where applicable.

Most qualifiers may be negated. If a qualifier (in either positive or negative form) is used more than once with the same command, the action is determined by the last occurrence. Table 7 (right-hand pages) and table 9 show with what commands each qualifier may be used.

17.3 Keywords and key-qualifiers

Some commands make use of expressions including keywords, the keywords being items of the Observations Catalogue or parameters derived from those items (table 12).

With some keywords qualifiers may be used. Table 7 (last column) and table 10 summarize the applicability of these key-qualifiers.

Table 7: ARQUERY commands

Command	Short	Page	Function
HELPQUERY	H	38	Obtain help on the use of the program ARCQUERY.
DEFAULT	DE	38	Set/modify defaults for formats, listings search areas, *etc.*
SELECT	SE	41	Select observations from the Observations Catalogue or packets from the Archive Index, or from an earlier selection. Produce a new output table.
EDIT	ED	42	Edit a table of selected items produced in an earlier search-step. Produce a new output table.
CALSELECT	CA	42	Select calibration observations obtained within a specified time bracket before and after regular observations already selected.
UNION	U	44	Make an output table which is the union of earlier tables.
INTERSECTION	I	44	Make an output table containing the common items of earlier tables.
DIFFERENCE	DI	44	Make an output table containing items occurring in one earlier table but not in another.
RENAME	REN	44	Rename an already existing table.
DELETE	DEL	44	Delete an existing table and its associated tables.
LIST	L	45	List specified parameters of already selected observations or packets.

Table 7: ARCQUERY commands

	Qualifiers	Keyword(s)	Key-qualifiers
H			
DE		MAIL_OUT= MAXRAD= QUEUE= MAXBOX= NLINES_P= RADIUS= PAGE_WID= BOXSIZ= INPUT= EQUIN = LIST= COORD = FORMAT=	
SE	/INPUT= /FORMAT= /OUTPUT= /[NO]LIST[=] /MAXRAD= /[NO]FILE /RADIUS= /[NO]TERM /MAXBOX= /[NO]PRINT /BOXSIZ= /[NO]SPLIT /COORD= /[NO]TRUNC /EQUIN=	see Table 12	
ED	/INPUT= /[NO]TPU /OUTPUT=		
CA	/INPUT= /OUTPUT=	OBS_TYPE= DAY_LIMITS= WINDOW=	
U	/INPUT= /OUTPUT=		
I	/INPUT= /OUTPUT=		
DI	/INPUT= /OUTPUT=		
REN	/INPUT= /OUTPUT=		
DEL	/INPUT=		
L	/INPUT= /[NO]FILE /COORD= /[NO]TERM /EQUIN= /[NO]PRINT /FORMAT= /[NO]SPLIT /[NO]TRUNC	see Table 12	/[NO]DECODE /COORD= /EQUIN= /FORMAT= /DATE_FIELD= /NRVALUES= /UNIT = /WIDTH = /NRDECIMALS=

Table 7: ARCQUERY Commands (continued)

Command	Short	Page	Function
TYPE, PRINT	T P	46	Produce lists on the screen or on paper.
SPOOL	SP	46	Spool output to the printer.
SHOW	SH	46	Show various parameters of the Observations Catalogue, your query context, *etc.*
REQUEST	REQ	47	Make a request to the archive operator, *e.g.* to send you the data selected, to enter an address permanently, to restore files, etc.
ADDRESS_INFO	A	47	Enter information on your address, phone number, electronic mail address, etc.
MODIFY_REQ	MO	49	Request modification of entries in Catalogue.
SORT	SO	50	Sort tables in ascending or descending order of specified parameters.
COUNT	CO	50	Obtain statistics on the Observations Catalogue, the Archive Index, or on a selection of items out of either of them.
MAIL_COMMENT	MA	50	Send comments to the archive manager by E-mail.
EXIT	EX	51	Leave ARCQUERY with or without saving the results of the current search session.

Table 7: ARCQUERY Commands (continued)

	Qualifiers		Keyword(s)		Key-qualifiers
T P	/INPUT= /[NO]TERM /[NO]PRIN	/[NO]SPLIT /[NO]TRUNC			
SP	/[NO]COPIES= /[NO]KEEP	/QUEUE= /[NO]MAIL=			
SH	/[NO]TERMINAL /[NO]PRINTER		ADDRESS CODE_GR DEFAULT REQUESTS	SYMBOLS TABLES UNITS USERS	
REQ	/INPUT= /ADDRESS /OUTPUT_TYPE /NODENAME= /[NO]COMMENT	/RESTORE /[NO]EDIT /[NO]TPU /[UN]DELETE=			
A	/[NO]REQUEST /[NO]COMMENT /[NO]EDIT /[NO]TPU		NAME INSTITUTE USERNAME HOST PHONE_EXT INSTNAME MAIL_ADDRESS	SUBNAME ADDRESS TOWN COUNTRY TELEPHONE TELEFAX TELEX	
MO	/INPUT= /[NO]EDIT /[NO]TPU /LIST /[NO]COMMENT	/LINE_NO /LINE_WISE /COORD= /EQUINOX= /FORMAT=	see section refMOD		/COORD= /EQUINOX=
SO	/INPUT= /OUTPUT=	/ASCENDING /DESCENDING	see Table 12		/ASCENDING /DESCENDING
CO	/INPUT= /COORD= /[NO]TERMINAL /[NO]PRINTER	/EQUIN = /FORMAT=	see Table 12		/INTERVAL= /COORD= /EQUIN= /FORMAT= /NRDECIMALS= /[NO]DECODE /DATE_FIELD= /UNIT= /WIDTH=
MA	/[NO]EDIT /[NO]TPU	/[NO]SELF			
EX	/[NO]SAVE /[NO]MAIL=	/QUEUE=			

Table 8: Qualifier descriptions in alphabetical order

Qualifier	Default setting	Description
/ADDRESS_INFO		Indicates a request to permanently file your address information
/ASCENDING	/ASCENDING	Determines sorting order
/BOXSIZE=	set by DEFAULT	Dimensions of search box ($<$ MAXBOXSIZE)
/[NO]COMMENT	/COMMENT	Accompany a request issued by written comments
/COORDINATES=	set by DEFAULT	Determines the coordinate system for position selection
/[NO]COPIES=	/COPIES=1	Determines number of copies printed
/DELETE=		Allows the user to delete a request, specified by its date and time, from the request queue
/DESCENDING		Determines sorting order (mutually exclusive with ASCENDING)
/[NO]EDIT	/EDIT if /TPU /NOEDIT if /NOTPU	Determines whether an editor should be used
/EQUINOX=	set by DEFAULT	Determines the equinox
/[NO]FILE	/NOFILE	(Do not) produce a list-file
/FORMAT=	set by DEFAULT	Determines print-format for coordinates (default is hms/‘” for equatorial, decimal degrees for ecliptic and galactic)
/INPUT_TABLE=	0 or last output	Table to be operated on by command
/[NO]KEEP	/NOKEEP /KEEP if NOCOPIES	Determines whether printfile is kept after printing
/[NO]LIST[=]	/LIST with default list-string /NOLIST if remote	Determines list string
/[NO]MAIL_OUTPUT[=]	set by DEFAULT	Determines whether listings spooled will be sent as mail messages, rather than to the local printer
/MAXRADIUS=	set by DEFAULT	Maximum value for search radius (*cf.* RADIUS)
/MAXBOXSIZE=	set by DEFAULT	Maximum dimensions of search box (*cf.*BOXSIZE)
/NODENAME		Specifies node name for retrieved data in packet database.

Table 8: Qualifier descriptions in alphabetical order (continued)

Qualifier	Default setting	Description
/OUTPUT_TABLE=	input + 1	New table produced by command
/OUTPUT_TYPE =		Specifies output for dearchived data (*e.g.* FITS)
/[NO]PRINTER	/NOPRINTER	Printer as output device for listings. Note that printer and terminal can be used simultaneously.
/QUEUE	set by DEFAULT	Determines the print queue to which listings will be spooled.
/RADIUS=	set by DEFAULT	Search radius (¡ MAXRADIUS)
/[NO]REQUEST	not set in interactive mode, /REQUEST in batch	Determines whether information provided automatically results in the issue of a request to modify address-file permanently
/RESTORE		Indicates a request for restoration of data currently not on line (e.g. SOD-files or indexpackets)
/[NO]SAVE	/NOSAVE (batchmode)	Determines whether context will be saved for use in a subsequent ARCQUERY session before exiting the current session.
/[NO]SELF	/SELF	Determines whether the user's mail comments are also mailed to himself (herself). /NOSELF causes comments to be written in the log-file.
/[NO]SPLIT	/SPLIT /NOSPLIT if /TRUNC	Determines whether print-lines exceeding the page size will be split over several pages. /SPLIT and /TRUNCATE are mutually exclusive.
/[NO]TERMINAL	/TERMINAL	Terminal as output device for listings
/[NO]TPU	/NOTPU	Determines whether the TPU/EVE editor will be used instead of the VMS/EDT editor
/[NO]TRUNCATE	/NOTRUNCATE	Determines whether print-lines exceeding the page size will be truncated. /TRUNCATE and /SPLIT are mutually exclusive. /NOSPL/NOTRUNC causes line to be continued on the next one.
/UNDELETE=		Restore a deleted request onto the request queue (cf. /DELETE)

Table 9: Applicability of command qualifiers

Command / Qualifier	DEF	SEL	EDI	CAL	UNI	INT	DIF	REN	DEL	LIS	TYP	PRI	SPO	SHO	REQ	ADD	MOD	SOR	COU	MAI	EXI
/INPUT_TABLE=	D	X	X	X	X	X	X	X	X	X	X	X			X			X	X		
/OUTPUT_TABLE=		X	X	X	X	X	X	X				X						X			
/[NO]LIST[=]	D	X																			
/[NO]FILE		X								X											
/[NO]TERMINAL		X								X	X	X		X					X		
/[NO]PRINTER		X								X	X	X		X					X		
/[NO]SPLIT		X								X	X	X									
/[NO]TRUNCATE		X								X	X	X									
/[NO]EDIT															X	X				X	
/[NO]TPU		X													X	X				X	
/RADIUS=	D	X																			
/BOXSIZE=	D	X																			
/MAXRADIUS=	D	X																			
/MAXBOXSIZE=	D	X																			
/COORDINATES=	D	X								X										X	
/EQUINOX=	D	X								X										X	
/FORMAT=	D	X								X										X	
/[NO]COPIES=													X								
/[NO]KEEP													X								
/QUEUE	D												X								X
/[NO]MAIL	D												X								X
/OUTPUT_TYPE															X						
/RESTORE															X						
/ADDRESS_INFO															X						
/NODENAME=															X						
/[NO]COMMENT															X	X					
/[UN]DELETE=															X						
/[NO]REQUEST																X					
/ASCENDING																		X			
/DESCENDING																		X			
/[NO]SELF																				X	
/[NO]SAVE																					X

Note to table 9: Qualifiers marked with 'D' may be set by the DEFAULT command.

Table 10: Applicability of key-qualifiers

Command / Qualifier	DEF	LIS	SOR	COU
/[NO]DECODE		X		X
/COORDINATES=	D	X		X
/EQUINOX=	D	X		X
/FORMAT=	D	X		X
/DATE_FIELD=		X		X
/NRVALUES=		X		X
/UNIT=		X		X
/WIDTH=		X		X
/NRDECIMALS=		X		X
/INTERVAL=		X		X
/ASCENDING	D		X	
/DESCENDING	D		X	

Note to table 10: Qualifiers marked with 'D' may be set by the DEFAULT command or by a command-qualifier

18 Obtain help information: HELPQUERY (H)

This command allows the user to enter the hierarchically organized HELP facility of ARCQUERY at the top level. The first topic it will show is COMMANDS and the user can take it from there. Instead of typing `HELP` a question mark, `?`, may be used.

In order to bypass the HELP hierarchy one may specify a topic and/or qualifiers, *e.g.* :

`HELP SELECT` , or `HELP SELECT/INPUT`.

A similar thing may be done using the question mark; the difference in syntax is that the question mark must always be the last character in the string ('context-driven help'), *e.g.* :

`SEL ?` , or `SEL RA=?`

Note that the HELP facility is available at all times. If one runs into difficulties, one may always type `?` in order to obtain information about the particular topic or subtopic appropriate at that point.

The key 'PF2' (the EDT help-key,'KP2') has been predefined as '?'.

Typing `CTRL/Z` or as many carriage-returns `<CR>` as needed terminates a help session; one returns to level at which help was sollicited.

19 Set defaults: DEFAULT (DEF)

The DEFAULT command allows the user to modify the initial defaults for commonly used parameters and keywords in preparation for an ARCQUERY session (see Table 11). All parameters which may be set by this command have been assigned 'reasonable' initial values, so that many users will be able to get results without changing them. Defaults may be overridden temporarily by qualifiers, either at command level or at keyword level (see also Table 9 and Table 10).

The command can be used in three different forms:

- In order to define new default values, type:
  `DEFAULT [keyword[=value][,keyword=[value][,...]]]`
- To restore all, or a specific initial default(s), type:
  `DEFAULT *`   or: `DEFAULT keyword`
- To enter a menu mode, give:
  `DEFAULT`

Note that the syntax rules for values and value-sets apply; see section 26.3 for details. In particular, value-sets consisting of multiple values, must be enclosed in parentheses and the individual values must be separated by commas. A value containing special characters must be enclosed in quotation marks (").

Not giving the `=value` specification for a keyword, results in the keyword specified to be set to its *initial* default value. The form `DEFAULT *` restores the initial values for *all* keywords.

When using the menu mode, the current defaults will be successively shown, and may be optionally modified to a new value. Alternatively, the command `SHOW DEFAULT` (see section 22.3) can be used to show the current settings.

19.1 Default output specification

The `MAIL_OUTPUT=NO | LISTINGS | LOG_FILE | ALL` qualifier specifies whether listings and/or log files produced by ARCQUERY will be sent on termination by electronic mail. `LISTINGS` specifies

Table 11: Parameters with user defaults

Parameter	Initial value	
MAIL_OUTPUT	NO for local use,	list and log output sent
	LISTINGS for remote use	by E-mail
QUEUE	SYS$PRINT	printqueue
NLINES_PAGE	66	Nr of lines per page
PAGE_WIDTH	132	Width of printed page
INPUT_TABLE	0	Observations Catalogue
LIST	"POSITION,OBJECT,TEL/WID=4,INST/WID=4,DET/WID=4,DATE"	
FORMAT	DEFAULT	coordinate print format
MAXRADIUS	1:00:00	1 deg limit on RADIUS
MAXBOXSIZE	(2:00:00, 2:00:00)	2 deg limit on BOX
RADIUS	0:01:00	1 arcmin search radius
BOXSIZE	(0:02:00, 0:02:00)	2 arcmin search box
EQUINOX	J2000	search equinox and
COORDINATES	EQUATORIAL	coordinate system

only the listings that are produced explicitly by the user, `LOG_FILE` specifies the logfile of the session, `ALL` specifies both. `NO` indicates that no output is mailed; any existing list files will be spooled to the local print queue.

The qualifiers `QUEUE=printqueue`, `NLINES_PAGE=n` and `PAGE_WIDTH=n` refer to the line printer at the archive site (*i.e.* GXVG). They are set by the login procedure of the captive account; only change these parameters if you know exactly what you are doing. However, if the listings are to be returned to the user e-mail address, then these qualifiers can be used to change the listing format. Note that NLINES_PAGE refers to the full page length; the number of lines actually printed on a page is 5 less.

19.2 Default list formats

The command: `DEFAULT LIST="keyword[,keyword[,keyword....]]"`

(re)defines the items that will be listed by the LIST command when used without specification (see section 22.1). Qualifiers can be given with the keywords in order to specify a certain width or a number of decimals (see *e.g.* Table 11).

If the string of keywords starts with a comma it is appended to the current default list string. The total string cannot exceed 256 characters. A summary of the many possible keywords and qualifiers in the list string can be obtained with the on-line HELP facility (use: `HELP DEFAULT LIST`).

The command `DEFAULT FORMAT=DEGREES | DECIMAL | MS | DEFAULT`

specifies the list-format of coordinates. DEGREES and DECIMAL are equivalent (decimal degrees), MS implies the `hms/°'"` format, while DEFAULT implies decimal degrees for galactic and ecliptic coordinates and the MS format for equatorial ones. Note that the FORMAT default setting has no baring on the way in which position information may be *entered* by the user, in, for instance, the SELECT command.

19.3 Default table names

The command: `DEFAULT INPUT_TABLE=input-table-name`

(re)defines the default INPUT_TABLE for the next command (using an input table). The default value on entry of ARCQUERY (without RESTORE) is 0, which specifies the Observations Catalogue.

If an ARCQUERY command creates a new (output) table, the output table name can be specified with the command. If `OUTPUT_TABLE` is *not* specified explicitly, a default output table name will be generated from the input table name, either explicitly specified or the default name, according to the rules set out in section 28.

The default value of INPUT_TABLE is updated during an ARCQUERY session to be equal to the last created output table name. It is shown on the user's VDU after the execution a command. Thus, the OUTPUT_TABLE of a command becomes the default INPUT_TABLE for the next.

19.4 Defaults for position search

The parameters `RADIUS=radius` and `BOXSIZE=(width,height)` specify the default circular and rectangular areas to be searched when a position is specified. When no units are explicitly given, degrees are assumed. General rules concerning the format and units of the parameter values `radius`, `width`, `height` are given in section 26.

The parameters `MAXRADIUS=r` and `MAXBOXSIZE=(w,h)` provide safeguards against specifications of unrealistically large values of RADIUS and BOXSIZE, for instance by an incorrect use of units. If `h` is not given it defaults to `h=w`.

`COORDINATES=EQUATORIAL | GALACTIC | ECLIPTIC`, and `EQUINOX=equinox` specify the default coordinate system used for searching. Equinox may be any floating-point year number preceded optionally by B for Besselian or J for Julian. By default B is assumed for equinox < 1984.0 and J for equinox > 1984.0. Besselian coordinates are in the FK4 system, Julian ones in the FK5 system.

20 Selection of catalogue records

20.1 General procedure

A number of ARQUERY commands enable an archive user to search and select from the Observations Catalogue, and to combine different selection tables. The idea is that by intelligently using these functions of the query software, a final selection is composed of catalogue entries of interest, which then may be submitted to the archive manager as a request for the release of the data.

Although it is possible to select the observations by using only one, possibly quite complicated, SELECT command (see section 20.2) a step-by-step procedure is probably more convenient for most users. For instance, as a first step a coarse search could be made of the catalogue, followed by subsequent narrowing down of the selection. Alternatively, one might build-up a final selection by combining a number of small individual selections at particular sky positions or dates, which can be done very efficiently because of the use of catalogue indexes (section 20.2).

Each step of such a selection process will create a new output table from the input table(s). If a search is made on the Observations Catalogue, input table '0', and subsequent 'query' tables will be named '1', '2', '3', *etc.* , unless the user specifies a different name with the `/OUTPUT_TABLE` qualifier (see section 28 for table nomenclature and section 19 for the default table name conventions). If the /INPUT_TABLE qualifier is not used, selections are made from the default input table ('0', or the latest output table), which is mentioned with every ARCQUERY prompt. Non-default table names must be used when, at any point in the procedure, repeatedly selections are made from the same (input) table by different criteria. Such selections may be combined by using the UNION, INTERSECTION, and DIFFERENCE commands (see section 21).

The EDIT command (section 20.3) can be used to select in edit mode from any of the tables created. The CALSELECT command (section 20.4) serves to find, for a given selection of observations, the accompanying calibration exposures in the catalogue; this function makes use of the astronomical codes defined at the Data Acquisition stage or by the archive manager; see section 5 for details.

Once the user is satisfied with the selection a REQUEST (section 23.1) can be made to retrieve the data from the archive and to send them to the user on a FITS tape.

20.2 Select observations: SELECT (SE)

The syntax of the SELECT command (see also section 26) is similar to a logical expression in Fortran:

```
SEL[/qualifiers]  keyword.ro.value[.operator.keyword.ro.value[......]]
```

where `.ro.` stands for a relational operator, and `.operator.` stands for a logical operator. Table 15 shows the allowed operators and their order of evaluation in an expression. The relational operators are used in the keyword construction; wildcards, value-sets and value-ranges can often be used; see section 26 for details. Preceding the keyword by `NO` negates the relational operator.

Logical operators combine keyword constructions into logical expressions; the order of precedence may be altered by appropriate use of parentheses.

The versatility of the ARCQUERY command interpreter often makes it possible to formulate the same selection in different ways. For example, the selection:

```
SEL (OBJE <> (3C*,M*) & DATE >= 3MAR86) | OBJE = M81
```

is equivalent to:

```
SEL (OBJE.NE.3C*.AND.OBJE.NE.M*.AND.DATE.GE.3MAR86).OR.OBJE.EQ.M81
```

is equivalent to:

```
SEL NOOBJE= (3C*,M*), NODATE < 3MAR86 .OR.OBJE=M81
```

Blanks are allowed at any place, but are very seldom mandatory. The user is referred to tables 7 and 8 for the qualifiers applicable to the SELECT command.

Keywords

All entries of the Observations Catalogue can be used as keywords for selection. Some 'derived' keywords are allowed as well; these are quantities calculated from the actual catalogue information, but which are themselves not stored in the data base. The available catalogue keywords are listed in Table 12. Values of a number of keywords have been coded in the Observations Catalogue (see footnote 4) for the sake of compactness; these keys can be specified either with the code number or with the decoded (more meaningful) value; however, wildcards are then not allowed. The object-type code (OBJ_TYPE) and the seeing and sky-quality codes are exceptions to this rule, and can only be addressed with the code number.

Note that information about the original data tapes from which the observations were loaded does not figure in the observations catalogue, but is stored separately. Apart from the Observations Catalogue keywords, two more keys: FITS_TAPE and FITS_FILE can be used to select data. A search for a particular tape, however, is best done in combination with a DATE window, because testing of all catalogue entries for the tapename is extremely time consuming, while the usage of a date range ensures the application of the date index, which works very much quicker.

Indexes

The query software maintains indexes of two items: POSITION and DATE. Searches on those keywords are indexed searched, and therefore very fast. The position index is obtained by deviding the sky into a large number of individual cells (6450) of approximately equal size (7 square degrees), and indexing the cell numbers (table 13). Observations in cells found from the index are tested against the original search specification(s). The CELL number is a catalogue keyword, on which data can be selected. The query software decides when to use an index, based on the structure of the select string. Sometimes, if a very complex date or position specification is made, the index will not be used, and the whole catalogue is tested instead.

On entry ARCQUERY lists the items for which indexes are maintained; it is possible to have other catalogue items, apart from position and date, indexed too at some time in the future.

20.3 View and edit a selection: EDIT (ED)

In order to use this command a list-file must have been created earlier. This can be done by using the /FILE qualifier with the SELECT or LIST command; see for details under the LIST command.

The list file can be processed by either the (default) VAX/EDT editor or the TPU/EVE editor (use the `/TPU` qualifier). The following operations are recognized as legitimate usage of the editor:

- Scroll through the table only and exit editor with QUIT, creating no new file.
- Delete *lines* from the file and exit with `EX` to create a new file; ARCQUERY will prompt whether the remaining lines should be included in or exluded from the output. The output file is subsequently compared with the original query table, and a new table is created.
- add comment lines (preceded by an exclamation mark (!)) to the list file.

Do not use EDIT to make any other alterations, as ARCQUERY will detect errors when comparing the old and the new list files. Thus, the edit mode can only be used to make a selection of particular lines from a table, but not to alter individual table items.

20.4 Select calibration observations: CALSELECT (CA)

Once the user has made a selection of astronomical observations of interest, the appropriate calibration observations can be found by means of the CALSELECT command. This command makes use of the Observation Type code, to find observations of a specified type within a specified number of days before and after the selected observations of the input table. The syntax is:

```
CALSELECT[/qualifiers] [keyword.ro.value[,keyword.ro.value[,...]]]
```

Valid keywords are `DAY_LIMITS`, `WINDOW` and `OBS_TYPE`; the keywords DAY_LIMITS and WINDOW are specific to CALSELECT only. DAY_LIMITS, specifies the time window in days to be searched around the date of each observation, while WINDOW specifies the maximum number of calibrations to be selected with each observation, according to:

`DAY=(n,m)`, where `n` and `m` are the number of days before, and after, or

`DAY=n` , where `n` is a window in days, centred on the date of observation.

Similar use of WINDOW applies: `WINDOW=(n,m)` or `WINDOW=n`.

The default for DAY_LIMITS=(7,7); the default for WINDOW=(10,10). The default selection of the observation type code OBS_TYPE, is > 10, which indicates calibration observations. In practise it is often better to search more specifically for selected calibrations, and override the defaults by explicitly specifying the keywords.

If the input table for the CALSELECT command contains more than 100 entries ARCQUERY will prompt the user to confirm the action. The execution of this command can involve a lot of table handling operations and sorting, and therefore may take some time to complete.

21 Table handling

21.1 Combining tables with UNION (U)

Up to eight input tables may be combined into one new output table: UNION will select the observations which appear in either of the input tables. For example:

`UNION/INP=(a1,b1,...)[/OUT=tablename]`

The default output table name derives from the first input table name provided; in the example it would be 'A2' if the output table was not specified.

The UNION function can also be performed by the SORT command (see section 24.1)¿

21.2 Combining tables with INTERSECTION (I)

Up to eight input tables may be combined into one new output table: INTERSECTION selects the observations common to all input tables. Format is similar to the union function:

`INTERSECTION/INP=(a1,b1,...)[/OUT=tablename]`

21.3 Combining tables with DIFFERENCE (DI)

Two input tables are combined into a new output table: DIFFERENCE select the items common contained in only one of the (two) input tables, *e.g.* :

`DIFF/INP=(A1,B1)`

which results in output table A2 = A1 - B1.

21.4 Rename an existing table: RENAME (REN)

This command is used when the user decides to deviate from the default naming convention and did not specify the desired output table name by using the /OUTPUT_TABLE qualifier in one of the other commands.

`RENAME/OUT=newname[/INP=oldname]`

If the `INPUT_TABLE` qualifier is not given, the default table will be renamed; however, the Observations Catalogue cannot be renamed.

21.5 Delete an existing table: DELETE (DEL)

This command will remove an existing query table and all its associated other tables, *e.g.* LIST file(s), from the disk. It is recommended to use the DELETE function to remove, in particular, large tables if they are no longer needed, and thus free disk space of the captive account for the user's own further usage, and also for other archive users.

`DELETE/INP=tablename`

In interactive mode ARCQUERY will prompt for confirmation of the DELETE operation on a table.

22 Listing and showing information

22.1 Produce a formatted list of selections: LIST (L)

This command allows the user to list the catalogue items of a query table in a specified combination, order and format.

`LIST[/qualifiers] [list string]`

with the syntax of the list string:

`[constant,]keyword[/key-qualifiers][,[constant,]keyword [/key-qualifiers][,..]]`

A `keyword` indicates a catalogue item to be listed; all items on which the SELECT command (section 20.2) can act can be listed (except `LINE`). Generic position keywords, such as `POS`, `GAPOS`, *etc.* , are allowed in the list string. Constants may be used to make a list more readable, for example:

`LIST "RA=",RA,"DEC=",DEC,` *etc.* .

If the specified list contains more than 1000 records, ARCQUERY will prompt for confirmation. A (long) list can be interrupted with `CTRL/C`; the display on the VDU can be suppressed with `CTRL/L`, but if, for instance, the `/FILE` qualifier is used, the list file will be completed.

Some specific qualifiers for the LIST command are:

- `/FILE`, indicating whether a list file should be created; default: `/NOFILE`.
- `/SPLIT`, indicating whether lines, longer than the page width in a print file will be split over as many pages as needed; default: `/SPLIT`, unless `/TRUNCATE` is specified.
- `/TRUNCATE`, indicating that lines longer than the page width will be truncated; default `/NOTRUNCATE`.
- If both `/NOSPLIT` and `/NOTRUNCATE` are specified, lines are continued on the same page (next line) and a blank line is inserted before each item.

Table 14 specifies the default representation of the various items in the Observations Catalogue. However, the user may control the list format of every individual item by using key-qualifiers with the keywords in the list string:

- `/[NO]DECODE` to determine whether the item is listed in the coded form, in which it occurs in the Observations Catalogue, or in a decoded form.
- `/NRVALUES=` to specify the number of values to be listed, when applicable.
- `/UNIT=` to determine the units to be used.
- `/WIDTH=` to specify the total width of the list item field.
- `/NRDECIMALS=` to specify the number of decimals to be displayed.
- `/DATE_FIELD=` to specify the list format of the date, if it has to differ from the default `DD-MMM-YY` format; options are: `DAY` (of the month only), `MONTH`, `YEAR`, `WEEKDAY`, `YYDDD`, `YMD (YY/MM/DD)` and `MDY (MM/DD/YY)`.

The key qualifiers `/COORD=`, `/EQUIN=`, and `/FORMAT` have the same effect as if used as command qualifiers (see table 7).

22.2 Display list files: TYPE, PRINT and SPOOL (T, P, SP)

List files, created using the `/FILE` qualifier with the SELECT and LIST commands, may be displayed on the terminal, on a hardcopy device or output via E-mail.

Print files will automatically be spooled to the default output device when exiting ARCQUERY; for a remote login on the captive account, the file will be mailed by default to the users E-mail address. A specific print-queue may be indicated by means of the /QUEUE qualifier. The E-mail option is explicitly selected by using the /MAIL qualifier.

22.3 Show general information: SHOW (SH)

At any point in an ARCQUERY session the SHOW command may be used to obtain either specific or general information. The syntax of the command is:

`SHOW[/qualifiers] [keyword[.ro.value-set][,....],`

where the only relational operators allowed are '`=`' and '`<>`'.

The following rules apply: If `keyword` is specified as `*`, all values are shown; if `keyword` is specified without relation or value, a default will be used; and if the command is used without keywords, just: `SHOW` , the keywords DEFAULTS and TABLES will be shown.

Information is available about:

- ADDRESS_INFO (default $*$), the user's address information.
- CODE_GROUPS (default $*$), codes and descriptions of coded catalogue items.
- DEFAULTS (default $*$), the current (*i.e.* not initial) default values.
- REQUESTS requests made in this or any previous session (the status of a request is visible until 30 days after its processing).
- SYMBOLS the values of any user-defined symbols.
- TABLES tables created so far and by what logic (default: the current table).
- UNITS (default $*$), units supported by ARCQUERY.
- USERS, Names, addresses, *etc.* of registered archive users (see section 23.2).

23 Requesting data or action from archive operators

23.1 Make requests: REQUEST (REQ)

This command allows the user to make a request to the archive manager. The request will be stored in a queue at the archive site. The archive manager must grant every request before execution, in order to protect proprietary rights to the observations, to avoid confusion of address information of archive users, or sometimes to control the number of operator actions, for example in the case of an exceptionally large request for data. In all instances the user will be informed of the completion of a request by electronic mail, if a mail address has been provided. The result of the processing (*e.g.* a FITS tape) will be sent to the user; in the case of a small number of observations, not more than about 20, it may be possible to store the data in an anonymous FTP account (depending on available disk space), which could be accessed directly by the user.

The syntax of the command is:

`REQUEST/qualifier[/qualifier]`

The first qualifier is compulsory, because it defines the type of request:

- `/OUTPUT_TYPE=FITS` : dearchive observations listed in the (default or specified) input table onto a FITS tape, which will be mailed to the requestor.
- `/OUTPUT_TYPE=DATABASE` : dearchive observations and write requested data into a packet database a the archive site. These data can be accessed by a special set of programmes; do `HELPARC ARCDB` for details. This option may, at the moment, only be of use to local archive users.
- `/ADDRESS_INFO` : enter or modify address information (section 23.2) in the file of archive users.
- `/RESTORE` : restore data files of secondary Observations Catalogue information from tape or optical disk. This option will become active only if some secundary information with the Observations Catalogue has been stored on tape or optical disk by the archive operators (to free disk space). The request will after some time (*e.g.* a day) make that information accessible again. Note that the Observations Catalogue itself, and the indexes are always on-line.
- The `/DELETE=(date-of-request,time-of-request)` can be used to delete a request from the archive manager's request queue, as long as the request has not yet been executed. Similarly, `/UNDELETE=(d-o-r,t-o-r)` restores an delete request to the queue. `/DELETE` and `/UNDELETE` can not be used in combination with other qualifiers.

The `/COMMENT` qualifier allows the user to supply information which may be important for the archive manager or operator to know, *e.g.* a preference for a particular kind of tape (DAT or EXABYTE), or an explanation of a request including protected data, *etc.* Comments are entered very similarly to typing a VAX/VMS mail message (either in line-mode or using an editor, /EDIT or /TPU). `CTRL/Z` ends the comments in line-mode. Default is `/COMMENT/NOEDIT/NOTPU`. The prompt for comments is suppressed with `/NOCOMMENT`.

The status of a request can be queried by means of the `SHOW REQUESTS` command (see section 22.3) until 30 days after processing by the archive manager (completion or rejection).

23.2 Enter/modify address information: ADDRESS_INFO (A)

An inventory of archive users with their full names, addresses, institutes, and E-mail addresses is maintained by the archive data-base software. This information is used by the archive operator to send de-archived data to a requester, and to safeguard the rights to exclusive use of the data during the proprietary period (by the original owner/observer).

The ADDRESS_INFO function allows the user to define address items, either by using the proper keywords in command mode, or in a menu mode. The completed information is submitted to the manager with a REQUEST/ADDRESS command; it is entered into the data base only after granting of the request.

The address information is uniquely connected with the ARCQUERY user's initials provided on login. If no address is known for the user initials provided on login, a message will appear to that effect; if the address is known on login, the address information can be retrieved for inspection by the user. In that case, modification of information is possible, and can again be submitted to the archive manager for granting, if wanted. See section 12 for applications.

If a request for data will be made, a minimum of address information of the requestor is required, either from the users data base, or provided with the REQUEST/ADDRESS_INFO function in the same ARCQUERY session.

In order to enter new, or modify existing, address values with command keywords, use:

`ADDRESS_INFO[/qualifiers] [keyword[=value][,keyword=[value][,...]]]`

If a value contains special characters (such as commas), the value must be enclosed in quotation marks (").

Alternatively, one can use the interactive mode by not giving any keyword:

`ADDRESS_INFO[/qualifiers]`

A 'menu' session is entered in which the current address-item values are shown one by one. The values can be modified by entering a new value. Enclosing values in quotation marks is not necessary in this case. A null-answer (`<CR>`) will retain the old value. A blank answer (`" "`) will set the value to blank (undefined). `CTRL/Z` terminates the menu mode.

Existing information in the user data base can be recalled with: `ADDRESS_INFO keyword=*`. This command will overwrite the existing, previously defined, information.

Unless the command is accompanied by the `/NOREQUEST` qualifier, a request to the archive manager will be issued to enter the (modified) information into the archive user data base (equivalent to `REQUEST/ADDRESS`, see section 23.1. The `/NOREQUEST` option is useful to change part of the user's address temporarily for the current access of the archive only. Actually, the `/NOREQUEST` option is recommended throughout; submit a request only if the address information is completely and accurately defined.

Information can be set for a number of keywords; the address information is split in information about the user's (home) institute and the user's personal information. Note that several address items are compulsory, no data will be released, and indeed no request can be made, without that information being provided:

NAME	the full name of the user (compulsory)
INSTITUTE	the name of the user's institute (compulsory)
USERNAME	the user's computer account name (compulsory)
HOST	the system node name (may be blank)
PHONE_EXT	the user's telephone extension (if appropriate)
INSTNAME	institute name (compulsory)
SUBNAME	any additional description
ADDRESS	(required by REQUEST command)
TOWN_POSTCODE_DISTRICT	(required by REQUEST command)
COUNTRY	(required by REQUEST command)
TELEPHONE	the institute's telephone number
TELEFAX	*etc.*
TELEX	*etc.*
MAIL_ADDRESS	generic E-mail address of the institute (compulsory)

The archive data base includes a list of institutes. If the user is located at an institute already known to the archive, entered earlier by someone else, *e.g.* by the archive manager, then only the pure user information has to be provided. Only if an unknown institute name is given, the user will be prompted for further information about his institute.

The keyword `MAIL_ADDRESS` defines the generic E-mail address of the user's institute. It has the form of a normal E-mail address, but with the username replaced by the string `"<user>"` and a name `"<host>"` added to the principal node specification. ARCQUERY substitutes the given username and the host name into these fields in order to obtain the users E-mail address. Thus, users at the same institute need only to give their username and node name, where the node name may not even be necessary, and can be blank (`" "`).

It should be mentioned that the archive manager will often replace an E-mail address provided, because the archive, using the local mail facility, necessarily works with the local E-mail protocol, which may be quite different from the one at the user's site.

For convenience, two 'virtual institute' names: INTERNET and BITNET have been installed, which can be used for registration via the mailserver, or in general, if a user cannot figure out how to go about it; see section 12.

More information about the ADDRESS_INFO keywords can be found in the help facility; in particular, `HELP ADDRESS MAIL` will provide additional information about the institute mail address.

23.3 Modification of Catalogue entries: MODIFY_REQUEST (MO)

This command allows an archive user to prepare corrections to the Observations Catalogue. The value of any catalogue item can be modified. A request will be sent to the archive manager for authorization, in the same way as the REQUEST command sends requests. The modify facility is used by the archive manager for the ongoing exercise of catalogue maintenance (see section 6).

```
modify[/qualifier[/qualifier]] [keyword=newvalue[,keyword=newvalue,...]]]
```

MODIFY_REQUEST can be used in 2 modes:

- **bulk mode.** The modifications are specified directly with the command as new values for the given keyword. All observations in the input table (default, or explicitly specified) will be requested to be modified accordingly. If the `/LINE_NO` qualifier is used, only the corresponding (one) observation will be modified.
- **menu mode.** The keyword field is left empty. ARCQUERY will sequentially display each observation of the input table, and prompt for modifications. The information shown of each observation is determined by the (default) list string. Each individual observation can have (a) different modification(s) specified in this way. If `<CR>` is pressed, the observation is not modified, and the next line is displayed.

  The user can jump to another line in the table with the `/LINE_NO=n` qualifier. If the `/LINE_NO` qualifier is given with the command itself, the prompting will start at that specified line (by default it starts at the first observation).

  Exit from menu mode is done by typing `CTRL/Z`; `CTRL/C` can be used to cancel the menu mode and the request.

The `/[NO]COMMENT` qualifier can be used to specify if you want or do not want to give comments explaining your request. The comments can be given in line-mode or in editor-mode via the qualifier /EDIT or /TPU. (Similar to the MAIL_COMMENT command). Typing `CTRL/C` cancels the request in either mode. Note that on the mailserver you can only use line-mode; the last line of the comment must then consist of the string: '`CTRL/Z`'. Default is `/COMMENT/NOEDIT/NOTPU`.

Keywords

Modifications can be specified for nearly all catalogue items of an observation (see Table 12; except `CELL, BOX, NIGHT, EXPIRATION, LINE`, and, obviously, `FITS_TAPE` and `FITS_FILE`). Most modifications are made straightforwardly by specifying a new value for the keyword, *e.g.* :

```
MODIFY/INP=3A/NOCOM DATE=3-JAN-1993, INI=EJZ, INST=PRIME
```

For more details about the MODIFY function, the user is referred to the on-line HELP facility (type: `HELP MODIFY`).

24 Miscellaneous commands

24.1 Sort selections: SORT (SO)

This command sorts 1 to 8 input tables in ascending or descending order of one or more keywords. The first keyword determines the primary order.

```
SORT[/qualifiers] keyword[/ASC][/DESC][,...]
```

In order to prevent unexpected long sorts, ARCQUERY will prompt for confirmation if more than 1000 records are to be sorted.

Sorting may be done on up to 26 different Observations Catalogue keywords (see table 12). The qualifiers `/ASCENDING` (default) and `/DESCENDING` can be command qualifiers as well as keyqualifiers. In the first case they apply to all keywords, in the latter case they apply to one keyword only. The command qualifier determines the default sorting order for all keywords which are not explicitly qualified differently.

Up to eight input tables may be specified with the `/INPUT_TABLE` qualifier. They will be sorted into one output table (specified by `/OUTPUT_TABLE`, or derived from the name of the first-mentioned input table, see HELP information on ARCQUERY TABLE_NAMES or section 21). If performed on more than one input table the SORT command is almost equivalent to the UNION command (see section 21.1).

24.2 Produce simple statistics: COUNT (CO)

This command allows the user to count records in a table (the Observations Catalogue itself, or a table obtained by a selection process) in intervals of up to two specified parameters.

```
COUNT[/qualifiers] keyword[/key_qualifiers][,keyword[/key_qualifiers]
```

The output consists of header information (giving names or intervals) and details (containing the counts). Table 14 shows how various Observations Catalogue keywords will be represented by default. The qualifiers allowed with the COUNT command may be found in tables 1, 9 and 10. Many of the key-qualifiers have the same function as they have in the LIST command (see section 22.1).

The key-qualifier `/DATE_FIELD` operates in a slightly different manner. It defines the way dates will be counted, as follows:

DAY	count per day of month	(1	- 31)
MONTH	count per month	(JANUARY	- DECEMBER)
YEAR	count per year	(1950	- 2049)
WEEKDAY	count per weekday	(MONDAY	- SUNDAY)
YYDDD	count per day of year	(1 JAN	- 31 DEC) (Default)

`/DECODE` determines whether coded information in the Observations Catalogue (see section 20.2 and *e.g.* table 4) will be listed in coded or the decoded form. `/INTERVAL` and `/UNIT` define the count interval and the units of the preceding keyword and override the default interval-size.

24.3 Send mail to archive manager/operator: MAIL_COMMENT (MA)

The MAIL_COMMENT command allows the user to send comments and remarks about the archive data or the software to the archive manager. This function is very similar to the VAX MAIL utility; however, the user's name and address will be inserted automatically as the first part of the message.

The user can enter the comments in two ways:

- By typing the message directly and ending it with `CTRL/Z`.
- By editing a file via an editor (EDT or TPU/EVE), which is subsequently mailed. This mode is selected with the qualifiers `/EDIT` and `/TPU` (`/TPU` forces `/EDIT`).

Defaults are: /NOEDIT/NOTPU if /TPU is not given, or /EDIT if /TPU is given.

The qualifier `/SELF` indicates that the mail message is also sent to the user's E-mail address. If `/NOSELF` is set, the message is written into the log-file.

25 Terminate an ARCQUERY session: EXIT (EX)

In order to terminate an ARCQUERY session, type:

`EXIT[/qualifier[/qualifier[/...]]]`

The two qualifiers of interest on the captive account and mailserver are `/[NO]SAVE` and `/[NO]MAIL`. On EXIT the following actions are executed:

- All requests are sent to the archive manager.
- If the `/SAVE` qualifier is given, the session context (*i.e.* all tables and files) is saved (files are purged to their latest version); if `/NOSAVE` is specified, all tables and files will be deleted; on the captive account, if neither qualifier is provided, the user will be prompted for a decision. The LOG-file of the session is always saved. In mailserver batchmode `/NOSAVE` is the default.
- All unspooled print files are spooled (see section 22.2). Instead of being routed to the local (RGO) printer the files may be mailed to the user (default in server mode). The usage of the `/MAIL` qualifier forces E-mail output of existing print files. If a mailing fails, for instance because of network congestion, it will be retried at hourly intervals for 24 hours; after that the archive manager will be alerted.
- Statistics on archive usage are updated.
- Depending on the access-mode of the ARCQUERY session a number of other options may be carried out (see below).

If any of the above actions fails the `/SAVE` qualifier is executed automatically, so that the user can later reenter ARCQUERY, restore and try again. If ARCQUERY is terminated in an abnormal fashion, *e.g.* by time-out, `CTRL/C` or `CTRL/Z`, the `SAVE` qualifier is also forced.

Saving the context on exit allows the user to interrupt an ARCQUERY session and to continue it later, for instance after inspection of a (mailed) listing. The existence of saved files and tables will be recognized when one starts a subsequent query session. The user will then be asked to restore or not the tables and files from the previous session (see section 10.1).

NOTE: remote access to the catalogue.

The additional EXIT command qualifiers `/[NO]MASTER_SEND`, `/[NO]OUTPUT_PUT`, `/[NO]ALL`, `/[NO]RETURN_TABLE`, `/[NO]EDIT`, `/[NO]TPU` and `/IDENT=`, and also the separate command RETURN_TABLE, are not mentioned here, because they apply only to remote access of the archive via the server from ARCQUERY software installed at the user's site. This mode of access is outside the scope of this User Manual; at the moment such access can only be made from the NFRA site in Dwingeloo (the Netherlands). See the ING User Guide XIX for details.

Table 12: Observations Catalogue keywords for use in SELECT command

Keyword	Description	Note
RA	right acsension	
DEC	declination	
CE[LL_NO]	celestial (equatorial) cells in range 1-6450	1
GALO[NGITUDE]	galactic longitude	
GALA[TITUDE]	galactic latitude	
ECLO[NGITUDE]	ecliptic longitude	
ECLA[TITUDE]	ecliptic latitude	
PO[SITION]	celestial position for search in circular area (long,lat,radius) in default coordinate system	2
BOX	celestial position for search in rectangular area (long,lat,width,height) in default coordinate system	2
EQP[OSITION]	equivalent to POS/EQ	2
EQB[OX]	equivalent to BOX/EQ	2
ECP[OSITION]	equivalent to POS/EC	2
ECB[OX]	equivalent to BOX/EC	2
GAP[OSITION]	equivalent to POS/GA	2
GAB[OX]	equivalent to BOX/GA	2
OBSE[RVATORY]	observatory	4
TE[LESCOPE]	telescope	4
INS[TRUMENT]	instrument	4
DET[ECTOR]	detector	4
PH[OTO_SYSTEM]	photometric system	4
WAVEB[AND]	photometric wavelength band (filters)	4
PO[LARISATION]	polarisation	4
OBJE[CT_NAME]	object identifier; spaces specified in object_name are considered significant, spaces in the names of the Observations Catalogue are not!	3
OBJ_[TYPE]	object type code in range 1-255	5
OBS_[TYPE]	type of observation	6
INI[TIALS]	observers	3
DA[TE]	observing date	
TI[ME]	observing time	
N[IGHT]	observing night	2
EXPO[SURE]	duration of observation	
Z[ENITH_DIST]	zenith distance	
WAVEL[ENGTH]	any wavelength in the band	
ST[-WAVELENG]	the lower boundary of the band	
EN[D-WAVELENG]	upper boundary of the band	
SE[EING]	seeing code	7
SK[Y_QUALITY]	sky quality code	7
PA[TT_NO]	PATT-allocation number	3
PR[OPRIETARY]	length of proprietary period; default 365	
EXPI[RATION]	the expiration date of the proprietary period (date of observation plus proprietary period)	2
RED[UCED]=YES / NO / [*]	reduction status; default: any	
LI[NE_NO]	line number of catalogue items in current table	2

Notes:
1 see Table 13
2 quantity derived from other catalogue item(s)
3 wildcard(s) (* and %) are allowed
4 wildcard(s) NOT allowed
5 see Table 4
6 see Table 3
7 see Table **??**

Table 13: Sky-cell centres of the Position Index

$\alpha = \alpha_0 + j \times \Delta\alpha,\ j = 0,\dots(n-1)$				$\delta \geq 0^\circ$			$\mid \delta \mid$	$\delta \leq 0^\circ$		
α_0		$\Delta\alpha$	n	zone	Cells			Cells		zone
180.00000	+ j ×	360.0000	1	00	0	0	+90.0000	6449	6449	64
22.50000	+ j ×	45.0000	8	01	1	8	+87.1875	6441	6448	63
11.25000	+ j ×	22.5000	16	02	9	24	+84.3750	6425	6440	62
5.62500	+ j ×	11.2500	32	03	25	56	+81.5625	6393	6424	61
5.62500	+ j ×	11.2500	32	04	57	88	+78.7500	6361	6392	60
2.81250	+ j ×	5.6250	64	05	89	152	+75.9375	6297	6360	59
2.81250	+ j ×	5.6250	64	06	153	216	+73.1250	6233	6296	58
2.81250	+ j ×	5.6250	64	07	217	280	+70.3125	6169	6232	57
2.81250	+ j ×	5.6250	64	08	281	344	+67.5000	6105	6168	56
2.81250	+ j ×	5.6250	64	09	345	408	+64.6875	6041	6104	55
2.81250	+ j ×	5.6250	64	10	409	472	+61.8750	5977	6040	54
1.40625	+ j ×	2.8125	128	11	472	600	+59.0625	5841	5976	53
1.40625	+ j ×	2.8125	128	12	601	728	+56.2500	5721	5840	52
1.40625	+ j ×	2.8125	128	13	729	856	+53.4375	5593	5720	51
1.40625	+ j ×	2.8125	128	14	857	984	+50.6250	5465	5592	50
1.40625	+ j ×	2.8125	128	15	985	1112	+47.8125	5337	5464	49
1.40625	+ j ×	2.8125	128	16	1113	1240	+45.0000	5209	5336	48
1.40625	+ j ×	2.8125	128	17	1241	1368	+42.1875	5081	5208	47
1.40625	+ j ×	2.8125	128	18	1369	1496	+39.3750	4953	5080	46
1.40625	+ j ×	2.8125	128	19	1497	1624	+36.5625	4825	4952	45
1.40625	+ j ×	2.8125	128	20	1625	1752	+33.7500	4697	4824	44
1.40625	+ j ×	2.8125	128	21	1753	1880	+30.9375	4569	4696	43
1.40625	+ j ×	2.8125	128	22	1881	2008	+28.1250	4441	4568	42
1.40625	+ j ×	2.8125	128	23	2009	2136	+25.3125	4313	4440	41
1.40625	+ j ×	2.8125	128	24	2137	2264	+22.5000	4185	4312	40
1.40625	+ j ×	2.8125	128	25	2265	2392	+19.6875	4057	4184	39
1.40625	+ j ×	2.8125	128	26	2393	2520	+16.8750	3929	4056	38
1.40625	+ j ×	2.8125	128	27	2521	2648	+14.0625	3801	3928	37
1.40625	+ j ×	2.8125	128	28	2649	2776	+11.2500	3673	3800	36
1.40625	+ j ×	2.8125	128	29	2777	2904	+08.4375	3545	3672	35
1.40625	+ j ×	2.8125	128	30	2905	3032	+05.6250	3417	3544	34
1.40625	+ j ×	2.8125	128	31	3033	3160	+02.8125	3289	3416	33
1.40625	+ j ×	2.8125	128	32	3161	3288	00.0000	3161	3288	32

The height $\Delta\delta$ of the declination zones is $2^\circ\!.8125$.

Table 14: Default representation of keyword values in (COUNT) lists

Keyword	Decode	values	Width	decimals	unit/format	interval
OBSERVATORY	yes		6			
TELESCOPE	yes		6			
INSTRUMENT	yes		6			
DETECTOR	yes		6			
PHOTO_SYSTEM	yes		6			
WAVEBAND	yes		6			
POLARISATION	yes		6			
LONGITUDE			11	1	MS	15 DEG
			9	5	DECIMAL	
LATITUDE			11	1	MS	15 DEG
			9	5	DECIMAL	
RA			11	1	MS	1 HR
			9	5	DECIMAL	
DECLINATION			11	1	MS	15 DEG
			9	5	DECIMAL	
ECLONGITUDE			9	5	DECIMAL	15 DEG
			11	1	MS	
ECLATITUDE			9	5	DECIMAL	15 DEG
			11	1	MS	
GALONGITUDE			9	5	DECIMAL	15 DEG
			11	1	MS	
GALATITUDE			9	5	DECIMAL	15 DEG
			11	1	MS	
ZENITH_DIST			6	0	DEG	1 DEG
CELL_NO			6			1
OBJ_TYPE	no	4	6			
OBS_TYPE	no		6			
DATE			9		YYDDD	
EXPIRATION			9		YYDDD	
PROPRIETARY			6		DAYS	365 DAYS
TIME			10	0	HMS	1 HR
			7	4	HR	
EXPOSURE			6	0	SEC	1 HR
			10	0	HMS	
SKY_QUALITY	no		6			
SEEING	no		6			
REDUCED			6			

The table is not complete with respect to the LIST command. Use Help for more information.

26 Syntax rules

26.1 Unambiguous abbreviations, use of upper and lower case

The execution of the ARCQUERY programme is controlled by user-provided commands (either from a VDU or with a mailserver file), consisting of a command name, keyword names and qualifier names. Typing any unambiguous abbreviation of a name is allowed. Often the first two letters are sufficient. An ambiguous or invalid choice results in a repeated prompt when on the captive account; in server mode, the command will be ignored and the next instruction will be processed.

User defined symbols (section 27) may not be abbreviated unless they have been defined explicitely with an $*$ at the position of abbreviation (DCL-fashion).

Both upper and lower case may be used when typing commands, qualifiers, character strings, *etc.* Where necessary lower case is automatically converted to upper case.

26.2 Logical relations

Under several commands logical relations can or must be specified of the form:

`keyword.ro.value[,keyword.ro.value[,.....]]` , or

`keyword.ro.value[.operator.keyword.ro.value[......]]`

Here `.ro.` stands for a *relational operator*, and `.operator.` stands for a *logical operator*. Arithmetic operators are not allowed.

The six relational operators: `=`, `>`, `>=`, `<`, `<=` or `<>` (not equal), and their FORTRAN-like equivalents, can be used in the construction. In some cases only `=` and `<>` are allowed, *e.g.* when there are only two or three values to choose from. Values specified with the operators `=` and `<>` can be single values, or may be a set of multiple values or a range of values (see section 26.3). A wildcard ($*$), indicating 'any' or 'all', is allowed as a value with `=` and `<>` (see section 26.4).

Logical operators: `.AND.`, `.OR.`, `.EQV.`, `.NEQV.` `(.XOR)` and `.NOT.`, where `.AND.` may be replaced by '`&`' and `.OR.` by '`|`', can be used to combine keyword constructions into logical expressions. Table 15 lists the allowed operators and their order of evaluation in an expression. Parentheses can be used to alter the order of precedence. A comma in front of a keyword in the string stands for a (logical) AND and may be replaced by `.AND.`.

Table 15: Operators and their precedence

Relational	Precedence	Logical	Precedence
`.EQ.` or `=`	1	`.NOT.`	2
`.GT.` or `>`	1	`.AND.` or `&` or `,`	3
`.GE.` or `>=`	1	`.OR.` or `|`	4
`.LT.` or `<`	1	`.EQV.`	5
`.LE.` or `<=`	1	`.NEQV.` or `.XOR.`	5
`.NE.` or `<>`	1		

26.3 Units, values, value-sets and value-ranges

With many numeric values (*e.g.* wavelengths) units may be specified. The specified units will be converted into the ones used internally as long as they belong to the same group of units. If no units are specified they are assumed to be equal to the units in which the parameter is expressed internally. The units allowed may be shown interactively by means of the SHOW UNITS command (see section 22.3). In a value-range (see below) units can only be given after the last value of the range (*e.g.* `10 TO 100 ANG`).

In many places, usually with the operators `=` and `<>`, are allowed not only single values but also value-sets and value-ranges.

Value-sets are strings of values, separated by commas and enclosed in parentheses. Blanks are allowed in value-sets, but not within numeric values; blanks are not delimiters. Within value-sets a comma is equivalent to the logical `.OR.` when used with the `=` operator, and equivalent to `.AND.` when used with `<>`.

Value-ranges can be specified in two ways:

either with :	`value1 TO value2 [BY value3]`
or with	`value4 UNC value5 [BY value3]`

where `value1` and `value2` are the limits of the range in the first expression and `value4` is the centre and `value5` the deviation from the centre in the second (`value2` must be `> value1`, `value3` and `value5` must be `> 0`). In both cases `value3` is an optional step value. The blanks before and after the words TO, BY and UNC are mandatory. Meaningless ranges are not allowed, and the user will be told. One can often use the help facility to find what is allowed by entering a question mark.

Value ranges may be part of value sets. Frequently used, complicated, value sets and -ranges may be predefined by a symbol; section 27.

26.4 Use of wildcards and blanks

A wildcard ('∗') may be used in many places to indicate 'any' or 'all' for numeric values. In alphanumeric values the wildcards ('∗' or '%') may be used to replace part of the character string by any character. The difference between '∗' and '%' is that '∗' can indicate a character string of any length, including zero length, while '%' stands for one character only. For example, '%%A' indicates all three-character strings with an A as last character, while '∗A' may have any length, and includes 'A' itself.

Wildcards may not be used in values of code items (table 12).

Blanks are not considered as delimiters. In many places they are ignored, in numeric values they are not allowed. Blanks in alphanumeric values specified by the user are considered significant, blanks in alphanumeric strings stored in the Observations Catalogue are not. Thus, specifying a blank in an alphanumeric string will find a match only if that blank is also present in the catalogue item considered, whereas an alphanumeric string without blanks will match a catalogue item even if the catalogue item does have a blank or blanks in it.

26.5 Specification of dates

Dates or a range of dates may be specified in many different ways:

1. *relative* with respect to today's date: by a positive or a negative number of days with respect to today, or by using the words `Y[ESTERDAY]`, `TOD[AY]` or `TOM[ORROW]`.
2. *absolute* in the form `DD-MM-YY` (day-month-year), where '`-`', '`/`' and '`:`' are acceptable delimiters (bearing in mind that '`-`' used as a minus sign takes precedence over its use as a delimiter), while no delimiter is required when the month is specified by name (see below). If a part of

the date is omitted, that part is assumed to be equal to the corresponding part in today's date: `/3` is treated as MM=3 (DD and YY are the same as today's), but `-3` is treated as a relative date (3 days before today). In principle, wildcards ($*$) are allowed in any part of the date specification string.

`MM` can be given numerically or by name. In the latter case an unambiguous set of first letters must be typed as a minimum (ja, f, mar, ap, may, jun, jul, au, s, o, n, d); no delimiters are required in this case.

YY may be given with or without the century part; if $0 \leq YY < 50$, the year specification is read as YY=2000+YY; if 50<=YY<100, then YY=1900+YY.

26.6 Specification of time

Time is specified in the form `HH:MM:SS`, where '`-`', '`/`' and '`:`' are acceptable delimiters. If any part of the time is omitted it is assumed to be equal to zero. HH is allowed to exceed 24, MM and SS may exceed 60, fraction are allowed in any part of the time specification. Time intervals (ranges) bracketing midnight can be specified unambiguously. Units (HR, MIN, SEC) may be specified if one does not like typing colons. The default unit is HR when delimiters are used, otherwise it is SEC. Some examples:

`::3600` = `:60` = `1:` = `1::` = `1 HR` = `60 MIN` = `3600 SEC` = `3600`

`23: TO 1:` is equivalent to : `23: TO 23:59:59, 0: TO 1:`

In order to facilitate the specification of observations of an entire night, the special keyword NIGHT has been introduced, which allows specification of (observing) nights, rather than a DATE range (see Table 12).

For example:	`NIGHT=1MAR87`
is equivalent to:	`DATE=1MAR87 & TIME>12:00 .OR. DATE=2MAR87 & TIME<=12:00`
or:	`NIGHT=1MAR87 TO 4MAR87`
is equivalent to:	`DATE=1MAR87 & TIME>12:00 | DATE=(2MAR87 TO 4MAR87)`
	`| DATE=5MAR87 & TIME<=12:00`

Thus, an observing night may be specified by its start date only.

26.7 Specification of position

Right ascension (as well as ecliptic and galactic longitude) may be specified as `HH:MM:SS.sss` or as `DD.dddd` (decimal degrees), declination (and ecliptical and galactic latitude) as `DD:MM:SS.sss` or as `DD.dddd`. If no unit is given, RA is assumed to be specified in hours, minutes, seconds and DEC in degrees, arcminutes, arcseconds. The hours, minutes and seconds (degrees, arcminutes, arcseconds) parts may contain a decimal point. Right ascension (longitude) intervals bracketing 24 hrs (360 degrees) may be specified unambiguously. (Arc)minutes and (arc)seconds are allowed to exceed 60. Some examples:

for RA: `10:30:00` = `10.5:` = `157.5` ; for DEC: `10:30:00` = `10.5:` = `10.5`

`RA = 345 TO 15 DEG` is equivalent to `RA = 23: TO 1:`, and also to `RA = 23 TO 24, 0 TO 1.`

Units (HR, MIN, SEC, DEG, ARCMIN, ARCSEC, RAD, etc.) may be used instead of colons.

Note that the generic position keywords POS (EQPOS, GAPOS, ECPOS) and BOX (EQBOX, GABOX, ECBOX) may be used to specify a position in any coordinate system with a search radius or a search rectangle (see also section 19 and section 20.2). If a BOX is specified in a SELECT command, the units of the given box width depend on the coordinate system. However, the default unit for (maximum) radius and for the (maximum) height of a box is always degrees.

The default list format of positions may be set by the command DEFAULT (see section 19) or by the qualifier /FORMAT (see Tables QU and KEY). The initial value of format is MS (hms/° ' ") for equatorial coordinates and DEG (decimal degrees) for ecliptic and galactic coordinates.

27 User-defined symbols

Symbols can be used as alternative keyword names or as shorthand for frequently used keyword constructions and logical expressions. A symbol can be defined at any ARCQUERY prompt. For example, define at the ARCQUERY prompt the symbol ABC:

`ABC = "SELECT/NOLIST/FILE"`

Then, the subsequent instruction:

`ABC OBJECT=N*4151*` is equivalent to: `SELECT/NOLIST/FILE OBJECT=N*4151*`

At any ARQUERY prompt a symbol may be given as answer, if it makes sense, that is. If a symbol is used as a value of a keyword it must be entered between apostrophes (DCL fashion).

The use of symbols can greatly simplify complex ARCQUERY command structures, because many symbols can occur in the same line. In section 14 some examples are presented in more detail. However, it should be kept in mind that the ARCQUERY command parser simply substitutes the symbol value at the position where it occurs in a string. Thus, the syntax of the command, after substitution, must obey the syntax rules given in section 26. Further, the length of the command after substitution cannot exceed 512 characters.

Symbols may be preceded by `NO` to negate their values. Symbol names cannot be abbreviated, unless the symbol was defined with the VAX/VMS wildcard (∗) in its name (DCL fashion), *e.g.* after `AB*C = ...`, `AB` will have the same effect or value as `ABC`. Note, however, that a symbol name will always first be tried as an (abbreviated) keyword name; thus, a symbol name identical to a keyword name is useless.

On the captive account, symbols may also be predefined in the User Initialization File (see section 14.1).

28 Table names

The query software uses a table structure: a search of the Observations Catalogue copies selected records, in similar format, into an output 'query table', which itself becomes the input table for the next operation.

Most ARCQUERY commands operate on an input table and many produce an output table. In a simple (interactive) query session the user does not need to worry about table names because by default a simple numerical sequence will be used (see below). In more complicated sessions, however, the user can and indeed may have to specify input and/or output table names through the usage of the qualifiers /INPUT_TABLE and /OUTPUT_TABLE (see *e.g.* section 20.2 and section 21). An existing table can also be renamed (see section 21.4).

The following rules apply to the nomenclature of query tables:

- A table name is an alphanumeric string of up to 8 characters.
- The default original input table is '0', *i.e.* the Observations Catalogue.
- The specification `OUTPUT_TABLE = 0` is invalid.
- The default input table is the output table of the previous operation (producing a new query table); the default input table name is always shown before the ARCQUERY prompt.

- The default output table derives from the input table name as follows: names ending with a number will have that number incremented by 1, while names ending with a character will have the next character substituted. Examples:

input table	default output table
0	1
3	4
A1	A2
1A	1B
2Z	2AA