The ESO HIERARCH Keyword Conventions

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To avoid possible misinterpretations and naming conflicts for keywords describing data acquisition parameters, ESO (the European Organization for Astronomical Research in the Southern Hemisphere) developed a hierarchical keyword convention for this purpose. Under this convention, the FITS keyword name (bytes 1 through 8 of the keyword record) is HIERARCH, and byte 9 contains a space character. Since the HIERARCH keyword does not have the '= ' value indicator in bytes 9 and 10 of the keyword record, it is in the same class as the COMMENT and HISTORY keywords that do not have a formal value. Thus, FITS readers that do not support the HIERARCH convention, as described in more detail below, should simply interpret bytes 9 through 80 of the keyword record as containing commentary text.

Under the HIERARCH keyword convention, bytes 10 through 80 of the keyword record contain a series of ASCII strings, or tokens, that serve to hierarchically classify the keyword, followed by an equals sign ("=") which is in turn followed by the keyword value field. An optional comment field may follow the value field, separated by a slash ("/") character. The value and comment fields conform to the rules for free-format keywords, as defined in the FITS Standard document.

The HIERARCH keyword structure is illustrated below:

```
HIERARCH token_1 token_2 ...  token_n = value / comment
```

The first token following the HIERARCH keyword name is the 'name space' token, which defines the top level domain of the following tokens. The name space token has the value "ESO" for all the hierarchical keywords defined within that organization; a different unique domain name should be defined by any other organizations that uses this convention. (Currently, it appears that ESO is the only organization that uses this convention).

The other tokens following the name space token and preceding the equals sign character define the hierarchical classification of the keyword. Any number of levels are allowed (as long as they all fit within the 80-character keyword record), but in practice, ESO keywords generally have 3 hierarchical levels which specify the general category, the subsystem, and the parameter name, respectively. For example, in the following keyword:

```
HIERARCH ESO TEL FOCU SCALE = 1.489 / (deg/m) Focus length  = 5.36"/mm
```

the domain = ESO, the category = TEL, the subsystem = FOCU, and the parameter name = SCALE.

Under the ESO implementation of this convention, each token string that precedes the equals sign must only contain characters that are legal in formal FITS keywords, i.e., the uppercase letters A through Z, the digits 0 through 9, and the hyphen and underscore characters. The tokens may, however, be longer than the 8 character limit of formal FITS keywords.

In some circumstances it may be convenient to map the hierarchical keywords into program variable names by concatenating the hierarchical tokens together, separating them with the full stop character ("."). For example, the hierarchical keyword shown above corresponds to the variable name ESO.TEL.FOCU.SCALE while the following keyword,

```
HIERARCH ESO INS OPTI-3 ID = 'ESO#427 ' / Optical element identifier
```

corresponds to the variable ESO.INS.OPTI-3.ID. The reverse translation is applied when converting such variables into FITS HIERARCH keywords,

This hierarchical structure provides a convenient and clear way to separate information concerning different subsystems. The definition of FITS keywords used by ESO for data acquisition can be found in the Data Interface Control Document (http://archive.eso.org/dicb). This document also gives a full definition of the hierarchical keywords in the ESO name space.