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VERY LARGE TELESCOPE

VLT CCD Cameras

Maintenance Manual

Software part

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1.1	13/03/96	All (see change bars)	Upgrade for FEB96 release
1.2	31/07/96	Fig.1 Fig. 2 5.1	Added new entries in configuration panel CCD engineering panel re-designed Manual pages for panels updated
1.3	25/04/97	Fig.1	Layout of configuration panel slightly changed
1.4	19/11/97	1.2 Fig.1 4.2	Scope explicitely restricted to ACE systems Layout of configuration panel slightly changed Complete self-test added

1 INTRODUCTION

The software described in this manual is intended to be used in the ESO VLT project by ESO and authorized external contractors only.

While every precaution has been taken in the development of the software and in the preparation of this documentation, ESO assumes no responsibility for errors or omissions, or for damage resulting from the use of the software or of the information contained herein.

1.1 Purpose

This document is the Software part of the CCD cameras Maintenance Manual. At the moment it is a stand-alone document. It is proposed to transform it at a later stage into a chapter of the CCD cameras Maintenance Manual, which should include system, hardware and software aspects

It is intended to provide people who want to do maintenance operations to a CCD camera with all the necessary information.

The manual assumes that the reader has some experience with astronomical CCD cameras. It is not intended to be an introduction to CCD cameras, and therefore it uses common terminology in this field (e.g. pixel, binning, readout, frame-transfer chip, etc.) without further explanations.

In addition to the **Introduction**, this manual contains the following chapters:

Configuration: it contains information about how to define configuration parameter values for CCD cameras.

Periodical maintenance: procedures to be followed to perform proper periodical maintenance of a CCD camera.

Trouble-shooting: it contains a list of already encountered problems and a description of the possible reasons and solutions.

Reference: it contains manual pages of the panels used for maintenance purposes.

The CCD control software is going to be used by several categories of users. The information related to this software package has been spread over several documents, in order to give each user an easier access only to the information he needs (see also section *Purpose* in [13] to know more).

The following table presents the complete list of documents available about the CCD software, together with a summary of the contents and the category of users who may be interested in reading them.

Document #	Title	Contents	Users
VLT-MAN-ESO-17240-0672	CCD Software - User Manual	• Software installation • Programmatic interface	• Responsible for VLT sw installation • Software developers

Document #	Title	Contents	Users
VLT-MAN-ESO-17240-0917	CCD Cameras - User Manual - Software part	CCD stand-alone	• Responsible for CCD cameras and chips tests. • Software developers
VLT-MAN-ESO-17240-0918	CCD Cameras - Maintenance Manual - Software part	• Camera configuration • Periodical maintenance • Trouble-shooting	• Responsible for camera installation. • Software developers
VLT-MAN-ESO-17240-0919	CCD Software - Device Control Libraries - User Manual	Integration of special hardware in the CCD sw (e.g. FORS shutter).	• Software developers (only if special hw used).

1.2 Scope

The present document is intended to be used for both scientific and technical CCD cameras based on the ACE controller.
For CCD cameras using the FIERA controller, refer to [16].

1.3 Applicable Documents

The following documents, of the exact issue shown, form a part of this document to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this document, the contents of this document shall be considered as a superseding requirement.

[1] VLT-PRO-ESO-10000-0228, 1.0 10/03/93 ---- VLT Software Programming Standards

[2] VLT-SPE-ESO-17212-0001, 2.0 12/04/95 ---- VLT Instrumentation Sw Specification

[3] VLT-SPE-ESO-17240-0227, 1.0 08/04/93 ---- CCD Detectors Control Software Specification

[4] VLT-SPE-ESO-17240-0385, 2.1 15/07/96 ---- INS Common Software Specification

[5] GEN-SPE-ESO-19400-0794, 1.08 15/11/96 --- ESO Data Interface Control Document

1.4 Reference Documents

The following documents contain additional information and are referenced in the text.

[6] VLT-MAN-ESO-17200-0642, 1.8 31/05/97 ---- VLT Common Software Installation Manual

[7] VLT-MAN-ESO-17200-0888, 1.0 17/08/95 ---- VLT Common Software Overview

[8] VLT-MAN-SBI-17210-0001, 3.4 05/05/97 ---- LCU Common Software User Manual

[9] VLT-MAN-ESO-17210-0619, 1.7 30/04/97 ---- Central Control Software User Manual

[10]VLT-MAN-ESO-17240-0816, 1.0 28/09/95 ---- CCD DCS Sw Maintenance Manual WS part

[11]VLT-MAN-ESO-17240-0932, 1.0 28/09/95 ---- CCD Stand-alone Sw Maint. Manual WS part

[12]VLT-MAN-ESO-17240-0817, 1.0 28/09/95 ---- CCD Sw Maintenance Manual LCU part

[13]VLT-MAN-ESO-17240-0672, 1.5 19/11/97 ---- CCD Sw User Manual

[14]VLT-MAN-ESO-17240-0919, 1.0 28/09/95 ---- CCD Software DCL User Manual

[15]VLT-MAN-ESO-17240-0918, 1.5 19/11/97 ---- CCD Cameras User Manual, Sw part

[16]VLT-MAN-ESO-13640-1388,1.0 13/11/97 ---- FIERA sw User Manual

1.5 Abbreviations and Acronyms

The following abbreviations and acronyms are used in this document:

ACE	Array Control Electronics
CCD	Charge-Coupled Device
CCS	Central Control Software
CPU	Central Processing Unit
DCL	Device Control Library
DCS	Detector Control Software
ESO	European Southern Observatory
FDDI	Fibre Distributed Data Interface
FIERA	Fast Imager Electronic Readout Assembly
FITS	Flexible Image Transport Format
HW	Hardware
INS	Instrumentation Software Package
I/O	Input/Output
LAN	Local Area Network
LCC	LCU Common Software
LCU	Local Control Unit
MIDAS	Munich Image Data Analysis System
N/A	Not Applicable
SCCD	Scientific CCD
SW	Software
TBC	To Be Clarified
TBD	To Be Defined
TCCD	Technical CCD
TCS	Telescope Control Software
TIM	Time Interface Module
TRS	Time Reference System
UIF	(Portable) User Interface (Toolkit)
VLT	Very Large Telescope
VME	Versa Module Eurocard
WAN	Wide Area Network
WS	Workstation

1.6 Glossary

No special definition is introduced in this manual.

1.7 Stylistic Conventions

The following styles are used:

bold in the text, for commands, file names, etc. as they have to be typed.

italic in the text, for parts that have to be substituted with the real content before typing.

`teletype` for examples.

<name> in the examples, for parts that have to be substituted with the real content before typing.

The **bold** and *italic* styles are also used to highlight words.

1.8 Naming conventions

This implementation follows the naming conventions as outlined in [2].

1.9 Problem Reporting/Change Request

The form described in [6] shall be used.

2 CONFIGURATION

Before being able to use a CCD camera, its configuration must be defined and saved. The same operation must be performed each time some change in the camera configuration takes place (e.g. a new chip or a new cryostat is mounted).

A pre-requisite to be able to configure a CCD camera is that the VLT CCD software must already have been installed and configured (see [13] section *Installation Guide*).

The configuration of a CCD camera does not require an in-depth knowledge neither of the CCD software nor of the VLT software in general, in that the CCD software provides panels to help and guide in this operation. On the other hand it requires knowledge of the characteristics of the camera to be configured.

Note: the usage of Configuration panels is restricted to off-line operations. The setting of configuration values acts on the on-line database; it is recommended not to change any configuration value during camera operations: the behavior of the running software could become unpredictable.

Type from the Workstation shell prompt:

```
$ccdConfig "gvar(maint)=1" &
```

A panel as shown in Fig.1 will appear. For details about the contents see manual page at section 5.1.
Note: the panel is rather big and contains quite some information. Depending on the load of the Workstation CPU it can take a few seconds before being displayed. Please, wait and don't panic!

The directory where files are saved/loaded from is
$INS_ROOT/SYSTEM/COMMON/CONFIGFILES
(see [13] section *Installation Guide* for the meaning of the environment variable INS_ROOT)

By pressing the button *Accept*, the values displayed are stored in the on-line database and then saved in the file $CCDNAME.dbcfg (see [13] section *Installation Guide* for the meaning of the environment variable CCDNAME).

A user, who must configure a completely new camera, can load (button *Load*) default configuration parameters from a template (file *ccdSciTemplate.dbcfg* for scientific cameras, *ccdTecTemplate.dbcfg* for technical cameras).

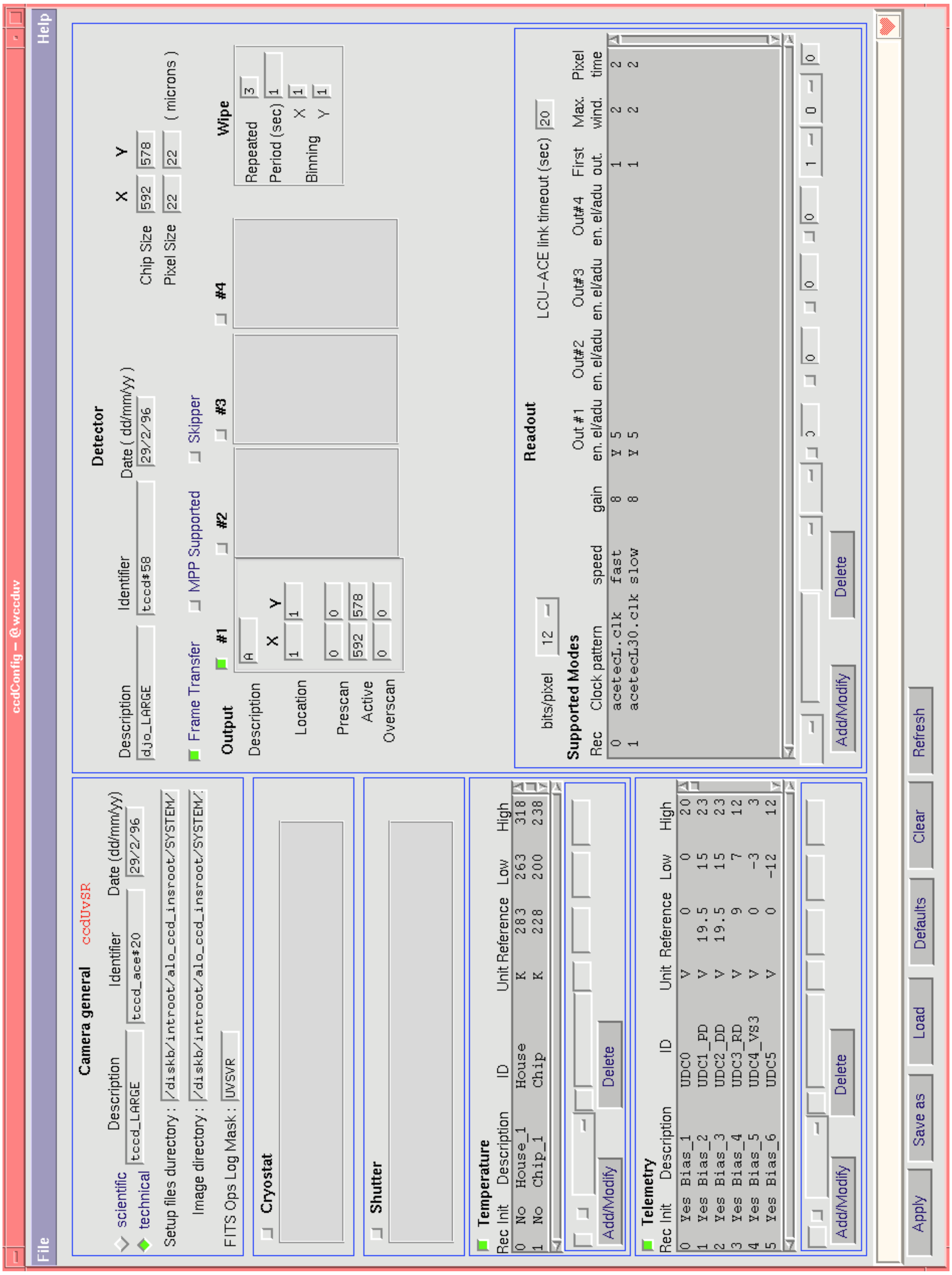

Fig.1 CCD camera configuration panel

3 PERIODICAL MAINTENANCE

This section provides a description of all operations to be done on the CCD software for periodical maintenance of the CCD stand-alone camera.

For the moment no operation is implemented nor defined.
Probably in the future a set of tests (e.g linearity) will be defined and have to be performed on a regular basis to guarantee the correct behavior of the camera.

4 TROUBLE-SHOOTING

This section provides a summary of possible failures and suggestions about reasons and how to recover.
This section will evolve in time on the base of user experience and problems reports.

4.1 Engineering Interface

A GUI panel is provided to help engineers in case of trouble. It allows to perform the most common operations needed for engineering and trouble-shooting.
The panel gives freedom to do actions at quite low level and must be used with care
It is assumed that the user knows the CCD sw and the VLT sw environment and is fully aware of the actions associated to each button and possible consequences.

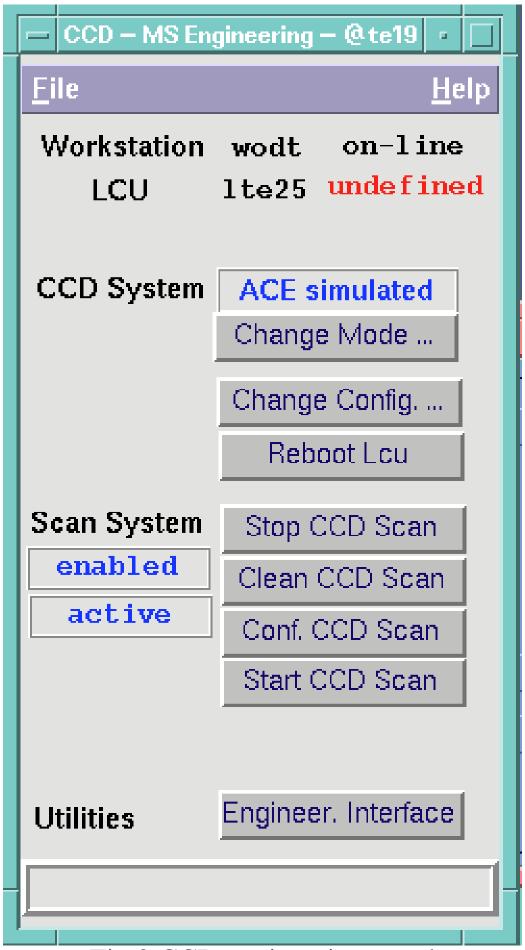

Fig.2 CCD engineering panel

Type from the Workstation shell prompt:

```
$ccdei &
```

A panel as shown in Fig.2 will appear. For more details, see section 5.1

4.2 Complete self-test

A GUI panel is provided to start and monitor a complete self-test procedure both on hw and sw and on all platforms (WS, LCU , ACE).
It is supposed to help in localising problems, typically at startup (startup fails: why ?).
The procedure has to be executed off-line. If started while the camera is online, ongoing operations will be aborted.
Type from the Workstation shell prompt:

```
$ccdVerifyGui &
```

A panel as shown in Fig.3 will appear. For more details, see section 5.1

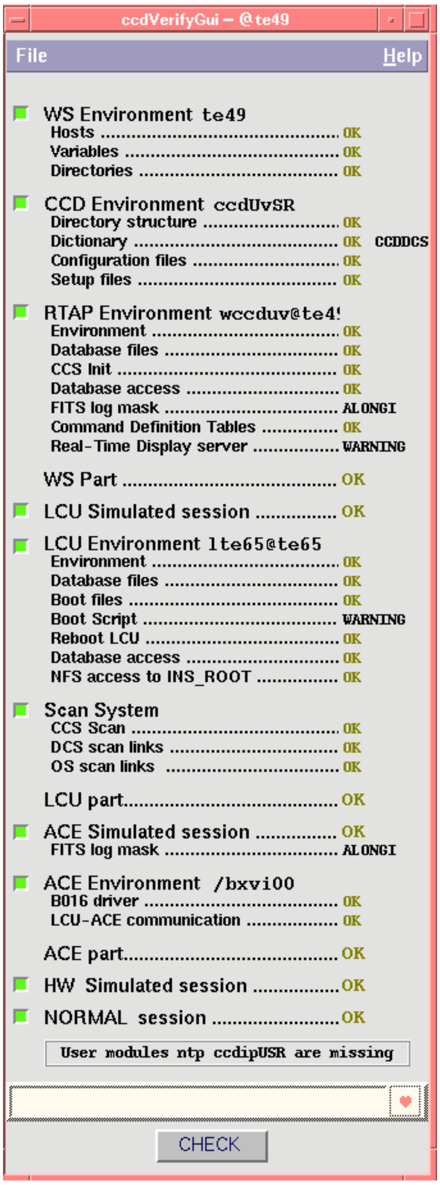

Fig.3 CCD self-test panel

4.3 Problems with Real-Time Image Display

1. **Description:** At the beginning of image transfer, the following error occurs:

   Failed in calling CCS routine *rtdInitImageEvt*.

   Reason: Real Time Display not installed or *rtdServer* not running.

   Suggestion: Try to start rtdServer (`$rtdServer &`). If it fails (*rtd* not installed), just ignore the error: simply no image display is possible with *rtd*. Images can still be saved in a FITS file.

5 REFERENCE

This chapter provides a detailed description in terms of manual pages of the CCD maintenance panels and the options available.

5.1 Panels

In this section the manual pages for the following panels are presented:

1. CCD MS Configuration panel (*ccdConfig*).
2. CCD MS Engineering Interface panel (*ccdei*).
3. CCD MS Self-test panel (*ccdVerifyGui*)

5.1.1 ccdConfig(1)

NAME

```
ccdConfig - panel for CCD camera configuration
```

MENU BAR

```
"File" menu
    Quit
        exit the application

"Help" menu
    Extended Help. Not implemented yet
```

APPLICATION AREA

```
Note: Entries marked with (*) have influence on the camera operations.
      They must be set to the proper value in order to get the camera
      behaving as expected.
      All other parameters have no influence on the camera behaviour;
      they are used only as information to be put in the image FITS
      header.

"Camera general"
    The name of the camera is displayed.
    "Type"
         Scientific/technical. Needed only to select the appropriate
         defaults (see button "Defaults")
    "Description"
         Name of the camera.
    "Identifier"
         ESO wide unique identification code of the camera used.
    "Date"
         Date of camera installation (format dd/mm/yy)
(*) "Setup directory"
         Directory where setup files are stored.
(*) "Image directory"
         Directory where image files are stored.
    "FITS Ops-log mask"
         Source mask appeneded to all configuration and operational logs

"Cryostat"
    The button indicates if a cryostat is mounted or not.
         For technical CCDs it is always NOT SET
    "Description"
         Name of the cryostat, including type and main characteristics.
    "Identifier"
         ESO wide unique identification code of the cryostat used.

"Shutter"
(*) The button indicates if a shutter is mounted or not
         For technical CCDs it is always NOT SET
    "Description"
         Name of the shutter, including type and main characteristics.
    "Identifier"
         ESO wide unique identification code of the shutter used.
(*) "DCL prefix"
         Prefix of the Device Control Library used (see [12]).
         Normally, for cameras using a shutter, it is ccdsha.
         Only exception until now: Fors, using ccdshf.

"Temperature"
```

```
 (*) The button indicates if temperature control exists or not
         For technical CCDs it is always SET
         For scientific CCDs it is always NOT SET (not implemented yet)
         This table has NEVER to be modified by personnel not familiar with
         the system used !!!!
         Modifications are possible through the editing session below the
         table:
            "Add"
               Enter all values in the entry fields below the table and
               then press "Add/Modify":
               "Rec"
                   Table record (0-9)
               "Init"
                   The reference value (see field "Reference") is passed
                   to the hardware (ACE) at initialisation time
               "Description"
                   It is a string consisting of <type>_<index>
                   Type can be:
                     "House"
                     "Chip"
               "ID"
                   Unique identifier of the temperature value
               "Unit"
                   It is always K (Kelvin degrees)
               "Reference"
                   Reference value
               "Low"
                   Lowest allowed value
               "High"
                   Highest allowed value
            "Modify"
               Select the row in the table to be modified, enter all
               values in the entry fields below the table (as for "Add")
               and then press "Add/Modify"
            "Delete"
               Select the row in the table to be deleted and press the
               "Delete" button

"Telemetry"
(*) The button indicates if telemetry control exists or not
         For technical and scientific CCDs it is always SET
(*) The table shows the signals currently defined.
         For technical CCDs it must contain all parameters as in the
         template (same name, value changes from system to system)
         This table has NEVER to be modified by personnel not familiar with
         the system used !!!!
         Modifications are possible through the editing session below the
         table:
            "Add"
               Enter all values in the entry fields below the table and
               then press "Add/Modify":
               "Rec"
                   Table record (0-99)
               "Init"
                   The reference value (see field "Reference") is passed
                   to the hardware (ACE) at initialisation time
               "Description"
                   It is a string consisting of <type>_<index>
                   Type can be:
                     "Bias"
                     "Clock_L"
                     "Clock_H"
               "ID"
```

```
                    Unique identifier of the telemetry value
                "Unit"
                    For technical and scientific CCDs it is always V (Volts)
                "Reference"
                    Reference value
                "Low"
                    Lowest allowed value
                "High"
                    Highest allowed value
             "Modify"
                Select the row in the table to be modified, enter all
                values in the entry fields below the table (as for "Add")
                and then press "Add/Modify"
             "Delete"
                Select the row in the table to be deleted and press the
                "Delete" button

"Detector"
    "Description"
         Name (containing characteristics) of the chip used.
    "Identifier"
         ESO wide unique identification code of the chip used.
    "Date"
         Date of chip installation (format dd/mm/yy)
(*) "chip size"
         Number of columns (X) and rows (Y).
    "pixel size"
         Size of each pixel (in micron)
(*) "frame transfer"
         Flag indicating if the chip is of frame transfer type.
         For technical CCDs always SET.
         For scientific CCDs normally NOT SET.
(*) "skipper"
         Flag indicating if the chip is of skipper type (multiple read-out
         of the same pixel possible).
         For technical CCDs always NOT SET.
         For scientific CCDs normally NOT SET.
(*) "mpp"
         Flag indicating if mpp read-out mode possible with the chip
         installed.
         For technical CCDs always NOT SET.

  "Output"
(*) The button beside the output number indicates if that output exists
    on the chip and is connected to a ADC.
         For technical CCDs #1 is always SET, #2 to #4 always NOT SET
    "Description"
         Name of the output amplifier as defined by the manufacturer.
(*) "Location"
         Pixel location (X, Y) of the output amplifier.
         Note: here and in the following we assume that the lowest left
               pixel of a chip has coordinates (1,1).
(*) "Prescan"
         Number of prescan columns and rows for each output.
         For technical CCDs is always 0
(*) "Active"
         Number of active columns and rows for each output. It indicates
         the area covered by each output which delivers real image data.
         For technical CCDs is always the same as the chip size
(*) "Overscan"
         Number of overscan columns and rows for each output.
         For technical CCDs is always 0
```

```
"Wipe"
(*) "Repeated"
     Number of times a complete chip wipe has to be done for a single WIPE
     command (normally 1, but might be not enough to clean completely the
     chip).
(*) "Period"
     Number of seconds between consecutive wipes during a periodic wipe.
(*) "Binning"
     How charges have to be binned during a wipe operation in both
     directions. Normally 1x1, but for big chips (e.g. 2000x2000) it
     might be better to define 2x2 or 4x4 to speed up the operation.
"Read-out"
(*) "Bits/pixel"
         ADC resolution.
         For technical CCDs is always 12
         For scientific CCDs is normally 16

(*) "LCU-ACE link timeout"
     Timeout in seconds over the communication link LCU-ACE. Normally
     20 sec, but for big chips a higher value might be needed.
(*)  "Supported modes"
         The table indicates the supported readout modes (maximum 10)
         For technical CCDs rec 0 is always SET, 1 to 9 always NOT SET
         "Rec"
            Record number in the table (0-9)
(*)      "Clock pattern"
            Name of the clock pattern used.
            For ACE based systems, it must correspond to the DSP file to
            be loaded into the ACE embedded sw by the CCD LCU sw.
            For small technical CCDs it is acetecS.clk
            For large technical CCDs it is acetecL.clk
         "Speed"
            Speed associated to the readout mode.
            For technical CCDs is always fast
(*)      "Gain"
            Default amplifier gain.
            For technical CCDs is normally 8
(*)      "Out#n enab."
            Outputs used for the specified readout mode
            For technical CCDs #1 is always SET, #2 to #4 always NOT SET
         "Out#n el/adu"
            Number of electrons for each digital units produced by
            the specified output
(*)      "First output"
            Index of the output generating the lowest left corner pixel of
            the image. Needed to determine the image orientation.
(*)      "Max Wind."
            Maximum number of windows allowed in this readout mode.
            For technical CCDs is always 2
(*)      "Pixel time"
            Time (in microsec) needed to digitize each pixel.
            It includes both CDS (where applicable) and conversion time
            needed by ADC devices used.
            It is used to compute the total read-out time and related
            timeouts in the sw; therefore a meaningful value has to
            be entered.
```

ACTION BUTTONS

```
Note: Buttons "Apply", "Save as", "Load", "Defaults", "Clear" are
      enabled only if the variable gvar(maint) is set to 1
```

```
"Apply"
    write all current values in the on-line database and in the file
    $INS_ROOT/SYSTEM/COMMON/CONFIGFILES/$CCDNAME.dbcfg

"Save as"
    write all current values in the on-line database. A file selection box
    allows to select the file where these values must be saved in the
    directory $INS_ROOT/SYSTEM/COMMON/CONFIGFILES

"Load"
    A file selection box allows to select the file where values must be
    retrieved from (directory $INS_ROOT/SYSTEM/COMMON/CONFIGFILES). The
    values are then stored in the on-line database.

"Defaults"
    Set default values. The selection of camera type in the
    "Camera general" section (scientific/technical) determines which
    set of default values have to be considered.

"Clear"
    remove the content of all input fields.

"Refresh"
    read values from the on-line database and display them.



- - - - - -
Last change:  19/11/97-14:17
```

5.1.2 ccdei(1)

NAME

```
ccdei - panel for CCD engineering operations
```

MENU BAR

```
"File" menu
    Quit
        exit the application

"Help" menu
    Extended Help. Not implemented yet
```

APPLICATION AREA

```
"Workstation"
    On the same line are shown:
    - WS Environment name
    - Operational state of CCD sw Ws part

"LCU"
    On the same line are shown:
    - LCU Environment name
    - Operational state of CCD sw LCU part

"CCD System"
    The current operational mode is shown on the same line
    "Change mode ..."
         Pop-up the CCD panel which allows to change the operational mode
         (ccdOpMode).
    "Change Config ..."
         Pop-up the CCD panel which allows to change the camera
         configuration (ccdConfig)
    "Reboot Lcu"
         Reboot remotely the CCD LCU. It takes a few minutes

"Scan System"
    The current status of the part of scan system used by the CCD system
    is shown (enabled/disabled and active/not active).
    If something does not work, the following buttons should be pushed
    in the same order as presented from top to bottom:
    "Stop CCD Scan"
         Stop the scanning of database values from the CCD LCU.
    "Clean CCD Scan"
         Clean the list of CCD attributes to be scanned.
    "Conf. CCD Scan"
         Inform the Scan System of the attributes to be scanned for the
         CCD application.
    "Start CCD Scan"
         Start the scanning of database values from the CCD LCU.

"Utilities"
    "Engineer. Interface"
         Start VLT ccsei utility
```

SEE ALSO

```
ccsei, lccei, ccdConfig, ccdOpMode
```

```
- - - - - -
Last change:  05/05/97-17:38
```

5.1.3 ccdVerifyGui(1)

NAME

```
ccdVerifyGui - Panel to start and monitor a CCD camera self-test
```

APPLICATION AREA

```
It contains only output widgets, indicating the status of each step
performed (RUNNING, OK, ERROR, WARNING)

An output file is generated under /tmp/ccdVerify_<CCDNAME>.log
```

ACTION BUTTONS

```
"Check"
    Start the self-test procedure. All environments and connections
    are verified
```

SEE ALSO

```
ccdVerify
```

```
- - - - - -
Last change:  19/11/97-14:17
```