



EUROPEAN SOUTHERN OBSERVATORY

OPERATING MANUAL

No. 17 - April 1993

REMOTE CONTROL

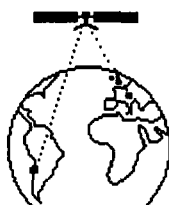
of the 3.5 m New Technology Telescope
at the European Southern Observatory

User Guide

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ESO Operating Manual No. 17

Version 1.0

April 13, 1993

Preface

The Remote Control System described in this manual was designed and implemented by Joar Brynell, Mauro Comin, Bruno Gilli and Anders Wallander. The distributed database under Unix was implemented by Andrea Balestra, Paolo Santin and their colleagues at the Trieste Observatory (OAT). The user interface is based on the Pegasus package developed by John Kerr and his colleagues at CFHT. Contributions and comments from people in the Electronics Group, from astronomers in Garching and the positive collaboration of staff from La Silla are also acknowledged.

This manual was written by Anders Wallander, with contributions from Dietrich Baade, Mauro Comin, Antonio Longinotti and Krister Wirenstrand. Dietrich Baade wrote the section about the use of MIDAS. The reader is welcome to comment and suggest any improvements of the manual (email: awalland@eso.org), or simply write comments into the copy of this manual in the RC control room.

The latest version of this document can be obtained by running L^AT_EX on tel.hq.eso.org. Files are in directory `/home1/awalland/rc_ntt/ug`, and the main file is called `user-guide.tex`. A postscript file of the latest version is also kept on rcgar.hq.eso.org in `/usr/local/rc/doc/user-guide.ps`. Examples of user interface forms are only available in paper copies, which can be requested from the Visiting Astronomer Section at the ESO headquarters (email: visas@eso.org).

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1 Introduction

The NTT remote control system allows interactive remote observing from the ESO Headquarters in Germany with the 3.5 m New Technology Telescope located at the La Silla Observatory in Chile. The term remote control implies that the astronomer interacts in real-time with the telescope and instrument. The system is based on a permanently leased 64 kbps digital satellite link, multiplexed in three channels, allowing parallel transmission of data (scientific as well as instrument and telescope parameters), video images, and voice.

The NTT remote control system was developed using state-of-the-art technologies in the areas of computers, communications and software. Due to the break-through of technologies such as UNIX workstations, TCP/IP and X11 Window Systems in the late eighties it was decided to design a new user interface based on these technologies. The effect is that the remote control user interface looks quite different from the local control user interface based on older computers and Ramtek display units. Although the look is different, the functionality is the same. Everything possible locally is also possible from the remote user end.

At the NTT, remote control is currently available for all EMMI modes including SUSI. IRSPEC is not supported.

Throughout this document the term **remote** will be used for Garching and the term **local** will be used for La Silla.

This manual describes the main features of the **remote** control system. It is intended to serve as a guide for the **remotely** observing astronomer. The main emphasis is on differences between observing at La Silla and in Garching. The EMMI & SUSI Operating Manual [1] describes in detail how to operate the instruments and is assumed to be familiar to the reader of this manual. More technical information of the **remote** control system is given in [2] and [3].

This manual first gives an overview of the system and its operation modes. Section 4 explains the philosophy behind the user interface and also gives advice how to use it in an optimal way. Observers not used to X11 and OSF/Motif should read this section carefully. Section 5 describes procedures normally carried out by the RC operator and can be skipped. Sections 6, 7 and 8 explain in some detail the user interface for telescope, instrument, and quick look. Lastly Section 9 gives an example of how a remote control session may look. This section also contains examples of user interface forms and a short description of the simulator, a powerful tool to exercise the system off-line.

In addition to this manual, meant for visiting astronomers, there is a separate documentation folder on RC operation for the RC operation team. Furthermore, copies of user guides for telescopes and instruments are kept in the remote control room (Room 241). If you need your own copy, ask the RC operator. Do not remove any document from the RC room. A full list of available documents is given at the end of this manual.

1.1 Glossary

The following abbreviations and acronyms are used in this manual.

BIMG	Blue Imaging
BLMD	Blue Medium Dispersion
Codec	Coder Decoder
DIFA	Direct Imaging Facility
DIMD	Dichroic Mode
EMMI	ESO Multimode Instrument
GUI	Graphical User Interface
LAN	Local Area Network
NTT	New Technology Telescope
OSF	Open Software Foundation
RC	Remote Control
REMD	Red Medium Dispersion
RILD	Red Imaging Low Dispersion
SUSI	Superb Seeing Imager
TCP/IP	Transmission Control Protocol/Internet Protocol de facto standard communication protocol
TCS	Telescope Control System
TDM	Time Division Multiplexing

2 Operating Modes

The present ESO policy of remote operation is as follows. The **remotely** observing astronomer is supported by a **remote** control operator. The operator is responsible for starting up and shutting down the system and assisting in case of technical failures. He normally also takes care of telescope control. For safety reasons a **local** night assistant is always present at the telescope. His tasks are similar to the operator, to prepare the telescope and assist in case of technical failures. He may also take care of some telescope functions which may be more efficiently carried out **locally**.

The policies of controlling the instrument and telescope are slightly different. All telescope functions can be controlled in parallel **locally** and **remotely**. The advantage of this approach is that the night assistant can rapidly intervene should any telescope problem occur and also that different telescope functions can be controlled **locally** and **remotely**. The disadvantage is that the **local** and **remote** user may interfere with each other when controlling the same function. It is therefore important to clearly define who is doing what and inform the other end whenever a telescope function is controlled. We call this “Gentlemen’s agreement”. The instrument can also be controlled in parallel although this is not normal. Instead the **remote** user performs the control and the **local** night assistant monitors what is happening, without any possibility of intervening. The night assistant also has access to the scientific data produced. This allows cooperation between all parties involved.

In addition to the “classical” remote observing described above the system also supports other modes of operation.

- **Team Observing.** Several collaborating astronomers could take an active part in an observation at different sites. The control could be either **local** or **remote**, but participating astronomers could actively monitor the progress and access the scientific data at multiple sites. With more participating astronomers, corrective actions and adjustments could be better, leading to higher scientific quality of the observations.
- **Service Observing.** An observation carried out **locally** by a service observer could be actively monitored by the investigating astronomer at the **remote** end in **Eaves Dropping** mode. Assessing the scientific data the astronomer may suggest corrective actions to the service observer and thereby improve the quality of his data.
- **Second level remote observing.** The system supports an extension to a second level site at the home institute of the astronomer. The second level site could actively control or monitor an observation. Second level remote observing requires, however, a 64 kbps communication link to Garching and the installation of a portable remote observing user kit. ESO has achieved successful second level remote observing during test observations [3].

3 System Overview

ESO/Garching is permanently connected to the La Silla Observatory via a dedicated 64 kbps satellite link. The link is time division multiplexed (TDM) in independent user channels. Figure 1 shows the configuration during remote control. Time division multiplexing means that each channel has a fixed bandwidth and the sum of all channels must be less than the trunk bandwidth. During remote control three channels are used; one for voice, one for video images and one for data. The remote control operator is responsible for configuring the required bandwidth of each of these channels. Although it is possible to change this at any time, it has been found that in most cases it is better to use the same bandwidth allocation throughout the night.

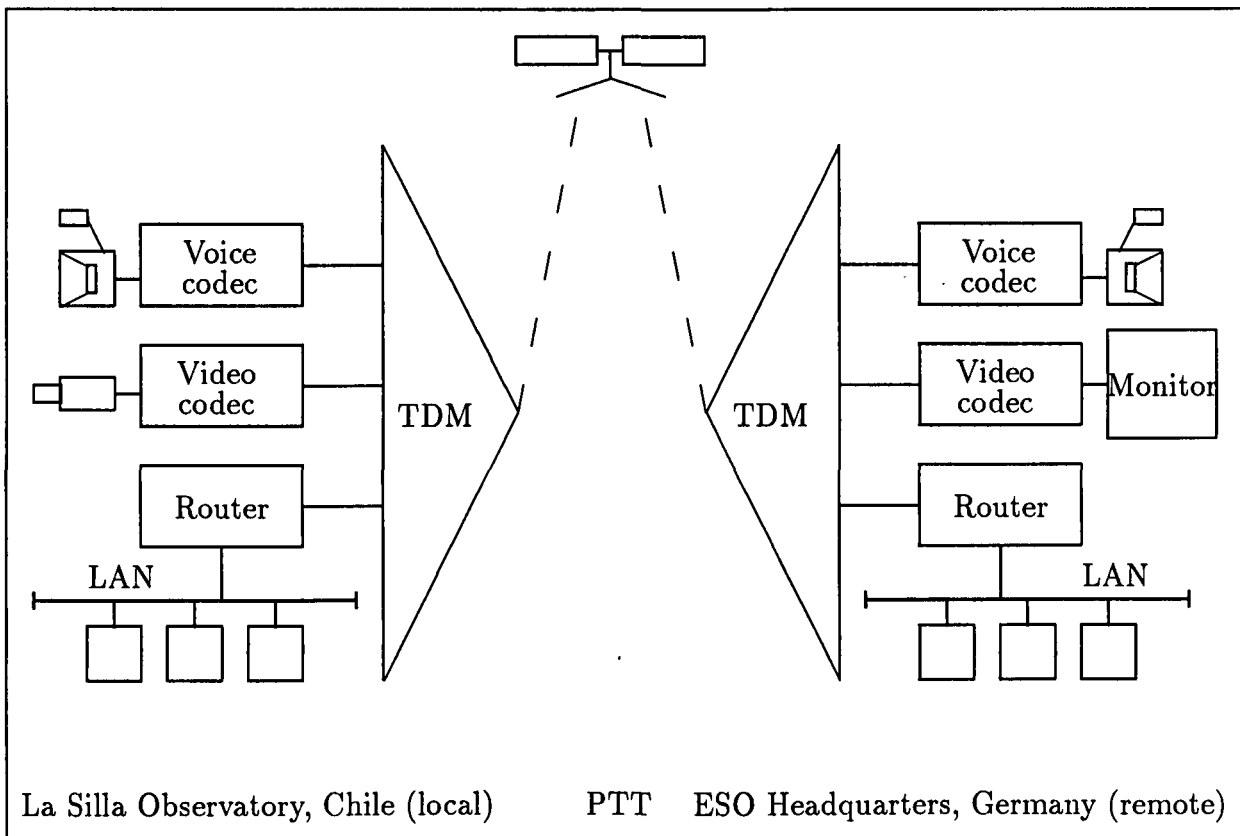


Figure 1: Communication System

3.1 Voice Channel

The voice system is based on a point-to-point channel between the local and remote control rooms. It uses microphones and loudspeakers to avoid the inconvenience of normal telephone sets or headphones. The voice codecs, responsible for signal digitizing, compressing and vice versa, are commercial products and make use of parametric encoding and advanced signal processing in order to achieve a compression ratio of 1:26, corresponding to a bandwidth of only 2.4 kbps. This bandwidth is fixed in the voice codec and the TDM channel has to be configured accordingly. The side effect of this dramatic compression is a so-called "Mickey

Mouse” effect, a distortion of the voice quality. However using the system during observations has shown that the quality is fully adequate for its purpose.

By using microphones and loudspeakers the problem of acoustic echos arises. This has been solved by only allowing one side to speak at any time (half duplex). Electronics designed in-house turn off the microphone on one side as long as someone is speaking on the other side. This is indicated with two LED’s on the voice unit. The same electronics also perform automatic gain control of the analogue voice signal before it is passed to the voice codec, and this further reduces the “Mickey Mouse” effect. The voice unit contains a volume control for the loudspeaker and an on/off switch for the microphone.

To obtain maximum voice quality, loud background noise should be avoided (do not play loud music when using the voice channel). When speaking, maintain a distance of about 10 cm from the microphone. Try to speak clearly and continuously, avoiding pauses and short sentences.

3.2 Video Image Channel

The video image system is based on a commercial slow-scan television system. Dedicated hardware for grabbing, digitizing and compressing the analogue video signal is housed in a PC. The compressed frame is transmitted over a point-to-point channel to another similar PC using the X25 protocol.

The purpose of the video image channel is to transmit images from the acquisition cameras mounted on the telescope (slit viewers and guide probe cameras). The video source (i.e. the camera) is selected from the telescope control terminal.

On start up (PC reboot), the `local` station will start up the application and wait for a connection request from the `remote` station; the `remote` station will start up the application and attempt connection to the `local` station. If the connection cannot be established or the connection is broken, the `remote` station will reattempt connection every `x` seconds until connection has succeeded. After re-connection has been established the `remote` station will reissue the last command (saved on disk) before the reboot. This strategy guarantees that after a failure (link or power) the system will come back, with the same function as before the failure, without human intervention.

The software has been customized, according to ESO specification, by the manufacturer and it allows for a wide variety of operation modes. The resolution is selectable between 720*576, 360*576 or 360*288 pixels. It is possible to operate in a single frame or in repetitive mode, i.e. slow-scan television mode. Further it is possible to save frames on the `remote` PC hard disk, to overlay the frame with computer graphics (e g orientation of field) and to perform limited image processing such as zoom and contrast adjustments. The user interface is based on windows and mouse interactions or faster accelerator keys.

The normal mode of operation is slow-scan television mode. If a fast frame repetition rate is required, a low resolution is selected and if resolution is more critical, high resolution is selected at the cost of a slower frame repetition rate. Because video images generated by

the acquisition cameras are normally very simple, consisting of only a few small sources on a black background, the compression algorithm works very efficiently. Using a bandwidth of 12 kbps and low resolution mode, the typical frame repetition rate is one frame every 3 seconds. This makes it possible to use the video image system as feedback for interactive control, e.g. offsetting the telescope, even when the video image system is using only one fifth of the available bandwidth.

3.3 Data Channel

The data channel is based on two routers connecting the local area networks (LAN's) in Garching and La Silla. This allows transparent access between all hosts connected to ESO networks. To avoid interference from the general LAN in Garching, the remote control computers are connected on a separate LAN using a dedicated port on the router. The router also allows access restrictions to avoid interference from other users during remote control sessions. It is the task of the remote control operator to guarantee that no interference occurs.

The remote control system makes use of many computer resources distributed at both ESO sites. For direct control the following computers and terminals are involved:

- **rcgar.** The remote control computer, an HP9000/700 series Unix workstation located on the remote control LAN in Garching.
- **rcxt1, rcxt2 and rcxt3.** Three HP700RX X-terminals connected to the remote control LAN in Garching.
- **te0.** An HP1000 A900 computer supporting message communication and located on the general LAN in Garching.
- **ntt.** The NTT telescope control computer, HP1000 A900, located at NTT.
- **nti.** The NTT instrument control computer, HP1000 A990, located at NTT.
- **ws1ntt.** The NTT acquisition computer, SUN Sparc, located at NTT.
- **134.171.89.1.** The astronomical weather station including the seeing monitor, VME running OS9, located close to the Schmidt telescope.

3.4 Time Display

To assist the observer a time display unit is available. It displays Sidereal Time, Universal Time, German Time and Chilean Time. The time display unit obtains Middle European Time (MET) via a radio signal and calculates the other times based on this. It also takes into account daylight saving times in Europe and Chile as applicable.

The time display unit includes a timer. To program it press the two buttons Up and Down simultaneously. When the display clears use the Up and Down buttons to set the desired

timer. After a few seconds the time display will reappear. When the programmed time has elapsed the time display unit will ring a bell. This may be useful to “wake up” after a longer exposure.

3.5 Meteo Data from the GOES satellite

A commercial system has been installed to obtain satellite pictures of South America directly from the GOES satellite. Pictures are received every two hours, via a parabolic antenna, and stored on a hard disk of a dedicated PC. Normal operation is to play the “movie” of the last 24 hours to see the trend of cloud formations (very similar to the weather report on television). The “movie” will be automatically updated when a new picture is received. The remote control operator is an expert in using this system.

3.6 Remote Control Station

A dedicated room (No. 241) at headquarters has been allocated as the NTT remote control room. It houses the remote control station and care has been taken to make an ergonomic installation. The control console is slightly U-shaped to give the user an overview of all devices and includes only hardware necessary for user interaction. All other hardware devices have been installed in a separate computer room, and cabling has been made invisible using cable channels in the purpose-built furniture. Indirect lighting is used to avoid reflections on the monitors. Figure 2 shows the layout of the control station.

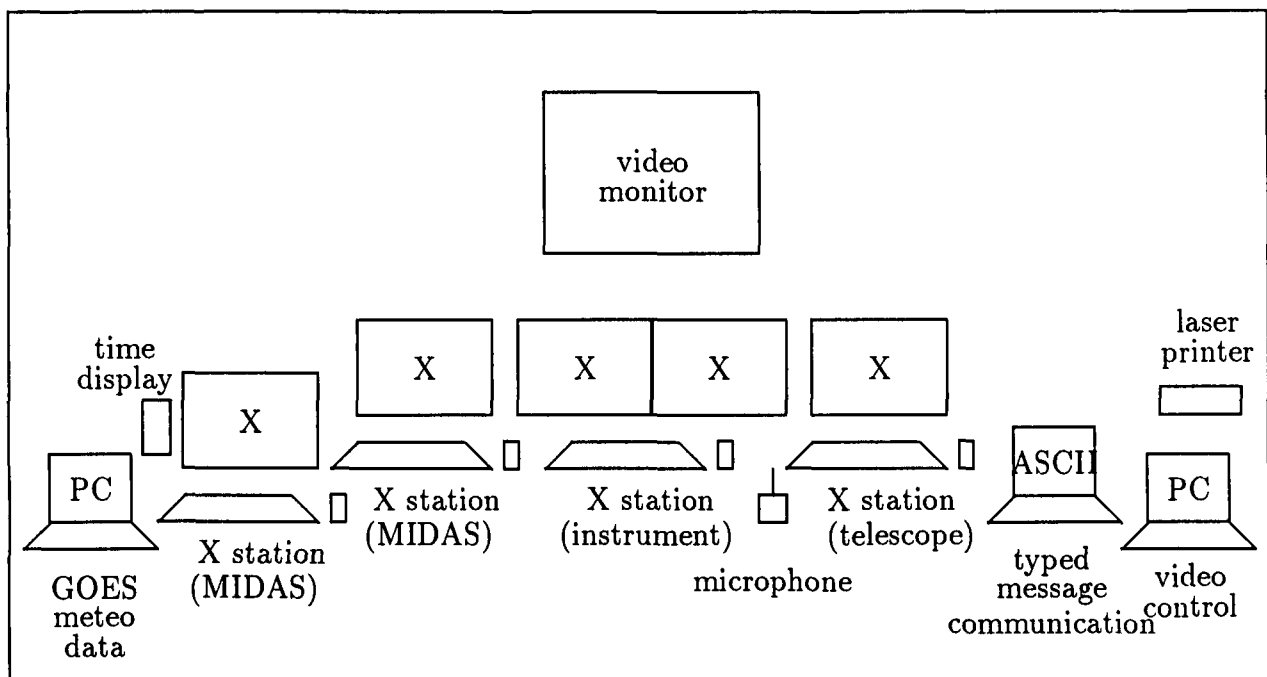


Figure 2: Remote Control Station

Four X stations are located at the center of the console. One of these X stations is allocated to telescope control, one to instrument control and two to quick-look and image processing with

MIDAS, both locally and remotely. The instrument X station has a dual screen to increase the display area. On the right side is an ASCII terminal, which is used for typed message communication with the local night assistant. This complements the voice system. A large video monitor displaying video images is installed above the X terminals. At the two ends of the station are two PCs used only occasionally. One is for the video control and the other is for receiving meteo data from the GOES satellite. The time display unit is installed beside the GOES satellite PC. A laser printer is available for making hardcopies and printouts. Lastly a movable voice unit containing a microphone and a loudspeaker implements access to the voice system. The remote control operator normally works on the right side of the console, while the Visiting Astronomer works on the left side. There is sufficient space also for a second and even a third astronomer should that be required.

4 Look & Feel of the User Interface

The following section gives an introduction to the philosophy behind the user interface running on the X stations. The general look & feel and some common features are described. The term look & feel is used to define conventions how applications appear and how the user interacts with them. Advice on how to use it for a smooth observation are given in Section 4.5. Details of the particular user interfaces for instrument, telescope and quick look are given in Sections 6, 7 and 8.

The remote control user interface is based on the Pegasus package developed at CFHT. It runs on top of X11 Window Systems and OSF/Motif and makes use of standard widgets. A widget is a graphic device capable of receiving input from the keyboard and the mouse and communicating with an application program or another widget. Anyone used to work with X11 will find the interaction with the user interface self explanatory. People not so familiar with X11 should read the following section carefully in order to understand the philosophy behind the user interface.

When you are in Garching, we suggest that you ask the introducing astronomer to get you started with the RC simulator as early as possible, so that you can try out any of the functions described in this section.

4.1 The Mouse

The three mouse buttons follow the conventions:

- **Left Button** used for selection, setting the cursor location and to pop-up partially hidden windows.
- **Central Button** used for moving and copying elements (cut & paste operations).
- **Right Button** used to push down the window and for additional user interactions (application oriented).

The user can combine mouse button press and release actions along with mouse movements to activate elements of applications and components.

- **Click** indicates pressing and releasing a mouse button without moving the pointer (e.g. operate widget, pop up window, set cursor location, select text input field, push back window).
- **Drag** indicates pressing a mouse button without releasing it and then moving the position of the pointer (e.g. move window across the screen, cut & paste operations, selection of pull-down menu item).
- **DoubleClick** indicates clicking the mouse button twice in rapid sequence (e.g. open an icon).

The keyboard focus determines which window in the workspace and which component within that window gets keyboard input. The window with the keyboard focus is highlighted by the window frame and by the pointer location and shape in case of a component within a window.

The shape of the mouse pointer provides the user with an important visual cue, indicating the functionality of the area in which the mouse pointer is currently located.

- **X pointer** indicates that the pointer is outside of any application area.
- **Arrow pointer** is used for single object activation.
- **I-beam pointer** is used for text editing to indicate the position of the cursor within a text edit field.
- **Hourglass pointer** indicates an action is in progress in the area. While the hourglass is active, all mouse button and keyboard events are ignored.

4.2 Initial Screen Layout

At login time applications will start and initial windows will appear on the screen. The exact layout will depend on the type of session (instrument control, telescope control or quick look and data reduction), each of which runs on separate terminals. Applications and windows started at login time remain active throughout the whole session. Figure 3 shows the layout and the purpose of the various areas on the initial screen.

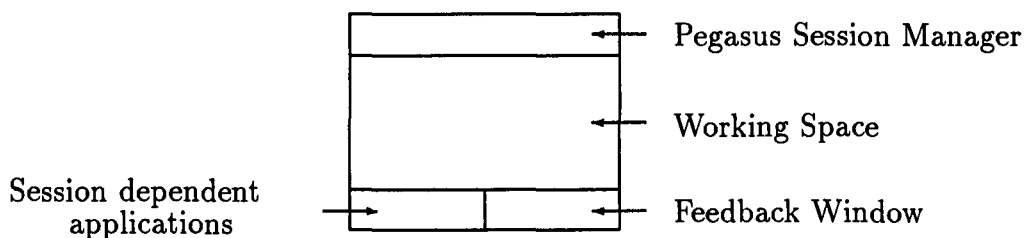


Figure 3: User Interface Screen Layout

Common for all Pegasus sessions is the Pegasus Session Manager appearing across the top of the screen. This is the root menu bar and all primary operations are initiated from here. All buttons appearing here will, when activated, cause another menu or window to appear. By positioning the cursor (no clicking) within a button a help text is displayed below the buttons. When a button has been selected (clicking the left mouse button) it will be displayed in reverse video until the application activated has been terminated. A special button is the **Adios** button which terminates the session.

For the instrument and telescope sessions a feedback window appears at the bottom right corner. This is the place where all errors, diagnostics, alarms and replies to commands appear. It is therefore important to keep an eye on it, especially after an action (e.g. start exposure) has been initiated. The feedback window does not accept any user input. It contains a scrollbar

to recall messages which have scrolled beyond the top of the window. To operate the scrollbar click on the arrow symbols in the window frame, alternatively drag along the scrollbar.

Depending on the session type other applications may also be started at login time.

4.3 Control Panels

A control panel is a window containing input, output and/or interactive widgets. Examples of panels and widgets are given in Section 9. There are three types of control panels:

- **Status Picture.** Static and dynamic status information is presented in ASCII or graphical format (output widgets). Dynamic information is periodically updated as long as the window is active. A status picture is recognized by the appearance of standard buttons (, , ,) at the bottom of the window. Only the button, which closes the window, has any effect. This is indicated by the fonts used. A status picture does not accept user input except via push buttons. A special case of a status picture is a submenu containing push buttons to call other control panels or initiate actions.
- **Input Form.** Parameters which need to be set by the user are presented using input widgets. It is typically used to define an instrument setup or telescope preset. An input form is recognized by the appearance of standard buttons (, , ,) at the bottom of the window. The buttons have the following meaning:
 - will save the data and close the window. The data will be used by the next action requiring them.
 - If any default values are applicable this button will set them accordingly.
 - will close the window without changing anything.
 - is not yet implemented.
- **Dialogue Panel.** An application asks the user for something and waits for a reply. It is typically used for confirmation purposes. For instance, when the user has clicked the button "Abort Exposure", the exposure will be aborted only after explicit confirmation in a dialogue panel.

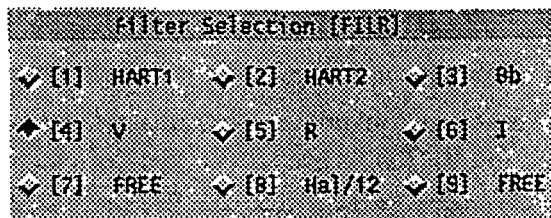
4.4 Widgets

The following input widgets are used:

- **Radio Button.** Select one option from a number of options (e.g. select a filter). Radio buttons appear as a small diamond followed by a descriptive label. If the diamond is filled (pressed, below the surface), then the option described is selected for activation (switch

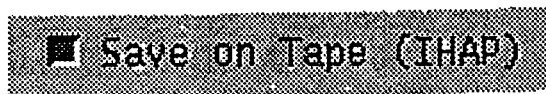
on); if the diamond is empty (unpressed, above the surface), then it is not selected for activation (switch off). The user controls the on-off switch by clicking in the diamond with the left mouse button. Radio buttons always come in sets of two or more. Only one radio button in a set can be active at any time. *The selected option takes effect only after the control panel has additionally been **Accept**'ed.*

Example:



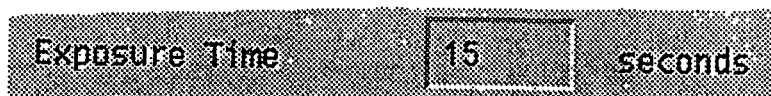
- **Toggle Button.** Toggle an option on or off (e.g. automatic data saving on tape). A toggle button is a small square followed by a text describing the option. If the square is filled (pressed, below the surface), then the option is selected for activation (switch on); if the square is empty (unpressed, above the surface), then the option is not selected for activation (switch off). The user can control the on-off switch by clicking in the square with the left mouse button. *The selected option takes effect only after the control panel has additionally been **Accept**'ed.*

Example:



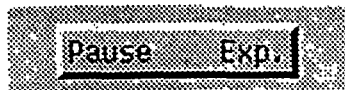
- **Text Edit.** Define a string (e.g. exposure identifier). A text edit box is a rectangular area below the surface. The user can insert information or change the information within a text edit box; that is, the user may edit it. The tab character as well as the mouse may be used to move between text edit boxes. *The entered string takes effect only after the control panel has additionally been **Accept**'ed.* Some text edit fields are subject to type and range checking. If an illegal value or type is entered (e.g. a non numerical character for exposure time) another window will pop up describing the error or a bell is given and the entered character is ignored. In some cases the entered field is replaced with a question mark and the **Accept** button is disabled. The user has to acknowledge the error and correct the field before the **Accept** button becomes available again. This mechanism normally catches most fatal typing errors in advance of an attempt to execute the command.

Example:



- **Push Button.** A push button is a rectangular area above the surface containing text, which briefly describes the action to be invoked upon selecting the button (e.g. pause exposure). *Once a push button is selected, the action is immediately taken.*

Example:



Some or all of the following pure output widgets are additionally used to compose a window:

- **Title Bar.** A title bar is a shaded rectangular region placed along the upper edge of an window (e.g. "EMMI RILD : Red Imaging Low Dispersion Setup Definitions"). A title bar is static.
- **Static Text.** A static text is an area with no visible boundaries. It contains a descriptor or label that cannot change.
- **Dynamic Text.** A dynamic text is an area with no visible boundaries. It contains a string (or number) which is related to some status (e.g. "Autoguiding ON") and is periodically updated.
- **Dynamic Raster.** A dynamic raster is a bitmap with no visible boundaries. It contains a picture which illustrates the status of some component (e.g. satellite above ocean when link is operational).

4.5 Advice to the User

There is always a trade-off between streamlining a user interface and allowing a maximum of flexibility for the user. Although a streamlined user interface may be more friendly to the user in a standard observation, it may be a constraint should the observer want to do something non-standard. Because of the flexibility and possibilities of the NTT and its instruments the design of the remote control user interface has given priority to flexibility over streamlining. No windows will pop up by themselves, and no windows will close by themselves. It means the greatest possible flexibility has been given to the user to combine the information he requires. It also means that the user may cause performance degradation, messy screens and confusion if he does not exercise discipline. It is important to take into account the advice listed below.

Most windows contain data from the local control computers. Because the complete database cannot be distributed to the remote computer, only data actually used (displayed in windows) are transmitted. It means that when a new window is requested, the local control computers have to know about the data in this window, before the data can be transmitted to the remote computer. Therefore there is a delay of a few seconds every time a window is requested or

when an input form is ed. The delay depends on the amount of data in *all* windows displayed on the screen. Accordingly, windows not needed should be ed as they are a burden for the computers.

For normal observations the user should observe the following rules of thumb for maximum performance and transparency:

- Don't iconize windows. Don't move or resize windows. All these operations will lead to a messy screen. Windows pop up in predefined places and there should be no need to move them around.
- Try to avoid too much window switching. Obviously input forms need to be requested and accepted every time some setup parameters need to be changed, but normally the main status picture(s) can be left active throughout the night.
- Try to use as few windows as possible at the same time. When observation gets going the user will find that he only needs a few windows to perform his observation. If problems or special requirements occur the user may request other windows. Many parallel windows will not only mess up the screen, they will also degrade performance.

5 RC Operating Procedures

The procedures described in this section are normally carried out by the remote control operator. However for completeness the procedures are explained below.

5.1 Start Up and Shut Down of Remote Control Session

The remote control session is normally started up at 16-17:00 Chilean time (20-21:00 Garching time during northern winter, 22-23:00 Garching time during northern summer), after the instrument setup has been completed by the Operation Group at La Silla, and the night assistant has prepared the telescope.

1. Reconfigure the TDM multiplexer to give the required bandwidth to the remote control channels.
2. Check with Operations Group or Night Assistant at La Silla that remote control can start.
3. Reboot all computers in both La Silla and Garching.
4. All RC X terminals should be logged out. Log on the dual screen terminal as user `rcemmi`. If the terminal gives a window displaying “this account has been disabled” consult the system manager. This is a security measure to prevent accidental access to EMMI/SUSI.
5. `rcemmi` starts up all common software required by other users. In particular it starts the link handler (`rlser`) and `xpool` programs (`pl***`) and makes all connections. At completion of the login procedure a program called `pllpupd` should report “Connection established with `#ntt#`” and “Connection established with `#nti#`”. If this is not the case, the `xpool` start was not successful (see section 5.3 for recovery actions).
6. After `rcemmi` has been successfully started, the right terminal can be logged on as `rcets`. If the terminal gives a window displaying “this account has been disabled” consult the system manager. This is a security measure to prevent accidental access to NTT.
7. If MIDAS is going to be used, the two left terminals should be logged on as `midashq` and `rcmidas`.
8. If EMMI or SUSI are going to be used, the programs should be terminated at La Silla (or they can be `Exit`’ed from the `rcemmi` terminal after agreement from La Silla).
9. If the night assistant or a local participating astronomer is actively taking part in the observation, a stand-alone IHAP session (user account `EMMIHAP` or `SUSIHAP`) should be started at NTT. It is important that all IHAP copies on `nti` are stopped before the stand-alone IHAP session is started. It is necessary to start the stand-alone IHAP session before EMMI or SUSI are initiated in order to access IHAP batches.

10. EMMI or SUSI should then be started (**Init**) from rcemmi. This is necessary to direct asynchronous messages to the **remote** station. The user will be prompted to define his environment, his name and project identity. The environment should normally be everything, i.e. ccd(s), instrument, adapter and telescope. The initialization procedure should give a completion message "Init OK". If this is not the case, **Exit** and initialize again.
11. It is necessary to upload some so-called pool data from the **local** control computers. These data are installation parameters which do not change during the night, e.g. calibration factors, calibration lamps and mounted filters. They are uploaded and later accessed directly on the **remote** control computer to increase performance. The upload procedure is available from the Motif root menu on the instrument control terminal. Position the cursor on the background and press left button. Drag down on the menu until pointer is on the field "Upload pool data" and release the button. There are two possibilities, minimum and maximum. Minimum will upload only the absolutely essential pool data. This takes a few minutes. Maximum will upload the complete database used on the **remote** control computer (takes about 15 minutes). Normally only the Minimum option should be used.
12. If the night assistant or a **local** participating astronomer is actively taking part in the observation a monitoring session should be started at NTI (user account OBSTMON or SUSIMON (not yet implemented)).
13. After the Operations Group has performed the EMMI instrument setup they fill in a form with setup parameters. This form is accessible by the following procedure. Open an hpterm and type "telnet nti". When the prompt RTE_A LOG ON: appears type "rcmgr/". Resize the window and type "pf /emmi/optemmi". The displayed window can be dumped to the printer by selecting "Dump Window to Printer" from the Motif root menu, pointing on the window and pressing the left mouse button. Type "ex" to log out and "exit" to close the hpterm.
14. The startup procedure is completed.

To close down the remote control session the terminals should be logged out in reverse order.

1. Terminate the instrument control program(s) by selecting **Exit EMMI** and/or **Exit SUSI**. This will cleanly close down the environment on the nti computer.
2. Log out rctcs terminal by selecting **Adios**.
3. Log out rcemmi terminal by selecting **Adios**.
4. Inform the night assistant that the remote control session has terminated and request him to close down the telescope.
5. Reconfigure the multiplexer to give bandwidth to general purpose daytime users.
6. The shutdown procedure is completed.

5.2 Switching Instrument Control between Local and Remote

There may be cases during the remote control session when it is required to switch the instrument control to `local`. For example when a problem occurs with the instrument, the operations group at La Silla may need to have control to investigate the reason. To minimize lost telescope time the procedures to switch between `local` and `remote` have been optimized and take only a few minutes to execute.

Switch control to `local`:

- Terminate the instrument control program(s) by selecting `Exit EMMI` and/or `Exit SUSI`. This will cleanly close down the environment on the nti computer. Wait for an “OBST Exit OK” message.
- Check that EMMI and/or SUSI are, in fact, not running (Section 5.4, “EMMI/SUSI Status”).
- Inform La Silla that they can take `local` control.
- If `remote` monitoring is not required, no further actions are needed. If `remote` monitoring is required, the Xpool package needs to be restarted **after** EMMI and/or SUSI have been successfully initialized `locally`. See section 5.3 how to restart Xpool.

Switch control to `remote`:

- Request La Silla to terminate the instrument control program(s) (EMMI and/or SUSI). After agreement from La Silla this can also be done from Garching by selecting `Exit EMMI` and/or `Exit SUSI`.
- Request La Silla to start a stand-alone IHAP session (user account EMMIHAP or SUSIHAP) if not already running. Wait for confirmation that it is running.
- If any installation parameter in the database (e.g. calibration factors or mounted filters) was changed during `local` control it is necessary to repeat the upload procedure described in section 5.1.
- Check that EMMI and/or SUSI are, in fact, not running (Section 5.4, “EMMI/SUSI Status”).
- Start EMMI or SUSI from the instrument terminal by selecting `Init EMMI` or `Init SUSI`. The initialization procedure should give a completion message “Init OK”.

5.3 Recovery Procedures

All the software involved in remote control has carefully been designed to automatically recover after failures (in particular link failures), if possible without human intervention. If automatic recovery is not possible, procedures are available for a fast recovery.

The Motif root menu on the instrument control terminal includes procedures to restart all involved software. The root menu is accessible by pushing the left mouse button (keep button depressed) on rcmmi terminal when the cursor is pointing on the background. A restart procedure normally has to be acknowledged (a dialog window appears where the user can cancel or proceed with the restart procedure). All restart procedures are independent: doing a restart of one software package does not interfere with any other package. Software which depends on other software will restart itself if required.

- **Xpool Restart.** Before using this procedure all forms displaying pool data (i.e. instrument and telescope parameter values) should be Cancel'ed. This procedure will kill and restart xpool in the right sequence on all involved nodes. Messages will appear in the feedback window. A successful restart is indicated by completion messages from pllpupd "Connection established with #ntt#" and "Connection established with #nti#". The complete procedure takes about 30 seconds to execute.
- **Link Handler Restart.** Will restart the link handler (rlser and chmsg) for commands and replies. The procedure takes a few seconds to execute.
- **Remote Fits Restart.** Will restart software involved in the scientific data handling (rcfits) communicating with the ntt workstation (ws1ntt). The procedure takes a few seconds to execute.
- **Link Status Restart.** Will restart the link monitor tool (earth and satellite picture in the bottom left corner). The procedure takes a few seconds to execute.
- **Meter Tools Restart.** Will restart the disk and seeing monitors in the bottom middle of the screen. The procedure takes a few seconds to execute.

5.4 Diagnostics Procedures

The Motif root menu on the instrument control terminal also includes procedures for diagnostics. These may be useful to troubleshoot any problems occurring during the observation.

- **Xpool Remote Status.** Checks the status of the xpool programs running on ntt and nti. The reply appears in the feedback window. If any of the replies include the string "No ID segment for this program", it means some program is not running and it is necessary to do an Xpool Restart (see Section 5.3).
- **Xpool Local Status.** Checks the status of the xpool programs running on rcgar. The reply appears in the feedback window. If plmgr, plrmtrsv, plrmtrcln and pllpupd are not all running, it is necessary to do an Xpool Restart (see Section 5.3).
- **Xpool Monitor.** Pops up a form showing the status of Xpool connections to remote nodes. It shows if connections are active as well as the amount of data being passed between the nodes.

- **Emmi Status.** Checks the status of all programs in the EMMI environment on nti. The reply appears in the feedback window. If any program is not running (“No ID segment for this program”), it is necessary to reinitialize EMMI from the Pegasus main menu bar. It is strongly recommended to verify if EMMI is running or terminated during switches between local and remote control (see Section 5.2).
- **Susi Status.** Same as above, but for the SUSI environment.

5.5 Types of Session

The normal use of the system is for active remote control of NTT and EMMI/SUSI. The system supports however also other operating modes. This is determined by the user account names. The list below summarizes the legal combinations of session types:

- **Active Remote Observing.** The instrument terminal is logged on as `rcemmi` and the telescope terminal as `rctcs`. Computer connects to NTT and NTI at La Silla.
- **Simulator.** The instrument terminal is logged on as `simemmi` and the telescope terminal as `simtcs`. Computer connects to TE0 and TE3 in Garching, simulating the NTT and NTI computers at La Silla. Used for test and training purposes.
- **Passive Remote Observing or Eaves Dropping.** The instrument terminal is logged on as `monemmi` and the telescope terminal as `montcs`. Computer connects to NTT and NTI at La Silla, but no control actions are available. Telescope and instruments are used in `local` mode by people at the telescope. The actions can be monitored from Garching. Data can be analyzed both at La Silla and in Garching.

In addition there are two user accounts available for quick-look and image processing. These are independent of the instrument and telescope control sessions.

- **MIDAS in Garching.** The terminal is logged in as `midashq`. A standard MIDAS session is started on the `rcgar` computer.
- **Midas at La Silla.** The terminal is logged in as `rcmidas`. A standard MIDAS session is started on the `ws1ntt` computer at La Silla, with display window defined in Garching.

5.6 Message Communication with NTT

Sometimes a voice connection is not the optimum way to communicate. Typed messages are often less ambiguous and may reduce misunderstandings and therefore result in a more efficient use of telescope time. To complement the voice system, a message communication system is therefore available. The ASCII terminal on the right side of the console is used for this purpose. The following procedure should be followed to establish a message communication session with NTT.

- Connect the ASCII terminal to the te0 computer. This is done by pressing the **Break** and **Return** keys and selecting Destination a900jr (or a900aw, a900al, a900mc).
- When the prompt RTE-A LOG ON : appears, type phone and **Return** key. When system prompts for password press the **Return** key (no password).
- The application program Phone is started and a connection is established with the nti computer at La Silla. The screen is divided into two parts, where messages from La Silla are displayed on the top part and messages to La Silla are typed in the bottom part (after the prompt PHONE >). In addition, labels for the softkeys F1-F8 are displayed at the very bottom of the screen.
- Provided the same procedure has been carried out on the nti computer, messages can now be exchanged.

Messages are transmitted line by line, that is when **Return** is pressed. A bell is always added to each line. The maximum length of a message (line) is 68 characters. If the message is longer, it will be truncated and a warning is given to the user. The character > should never be used within a message. If the prompt PHONE > changes, it has to be restored by typing 'PHONE >' (note capitals). Beware that the top part of the screen operates in wrap around mode. The last message always appear before the blank line, which is not necessary the last line.

The eight softkeys of the ASCII terminal have the following functions:

- **HELP** Gives some on-line help.
- **STATUS** Gives status of connection, software version etc.
- **CONNECT** Connects to a node (nodename as parameter). This command should normally not be used.
- **DISCONNECT** Disconnects from node. This command should normally not be used.
- **TEST** Executes a test sequence. Extensive help is given when this command is requested. This utility is useful to check whether the night assistant at NTT is actually receiving messages typed at the remote site.
- **LIST LOGFILE** The "conversation" is logged in a logfile. The complete file can be displayed on the terminal (to check some old messages which have scrolled off the screen). It can also be printed on a printer (filename /phone/phone.log).
- **Restore Screen** It may happen that the screen gets messed up (typically the cursor moves up to the top part of the screen). This command will clean up and restore the screen.
- **EXIT** This is the only way of terminating the Phone application. Any other method, such as pressing the **Break** key, will mess up the system and require a manual clean up.

5.7 Control of the Video Image System

The control of the video image system is performed from the video PC. The user selects a submenu (function) by positioning the cursor in the field and pressing the left mouse button. On the bottom part of the screen, each callable function appears as an icon. The active function is highlighted in red. The user may switch fast between functions by using these icons instead of going through the menus. In addition, function and control keys can be used as accelerator keys.

A detailed description of all functions is given in the Telsat Prisme Video System User Guide [4]. However the normal user will only use a small subset of these.

As described in Section 3.2, the system will, after failure, automatically re-establish connection and start the previous (or default) function. This is normally a slow scan television function with low resolution black and white images. On the PC screen, the application will enter the communication submenu (the communication icon is highlighted on the bottom part of the screen). A status display will show that images are continuously received. This mode may be stopped at any time by positioning the cursor in the stop field and clicking the mouse.

For fast operation, five different modes may be preprogrammed. These are activated by pressing the accelerator keys (Ctrl)F1, (Ctrl)F2, (Ctrl)F3, (Ctrl)F4 or the default mode (Ctrl)F10. The mode is determined by parameters such as resolution, colour/black&white, encoding method, repetition rate, superimposition of graphics etc. The normal user will not bother about these details, but just switch between some of these preprogrammed modes. The accelerator keys may be used only when the communication menu is active.

6 Instrument and Detector Control

The following section describes how the user controls and monitors the instrument and detector. Together with the quick-look and image processing terminals, this is the activity with which the observer will spend most of his time during the night.

6.1 Initial Screen Layout

After the instrument terminal has been logged in and the EMMI and/or SUSI control programs have been started (see Section 5.1) the screen will look like Figure 4.

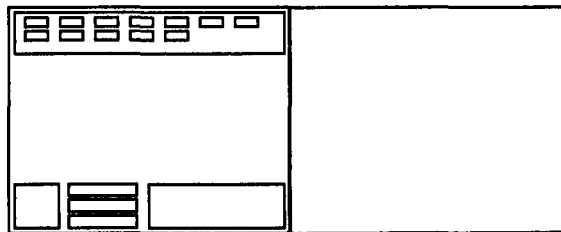


Figure 4: Initial layout of the instrument dual control screen

The applications are from the top in clockwise direction:

- Pegasus Session Manager as described in Section 4.2. It contains push buttons to initialize and terminate EMMI and SUSI, to get a submenu for a particular instrument mode, to enter suggestions and bug reports and a button to terminate the session.
- The feedback window as described in Section 4.2.
- Three meters which continuously display some important parameters.
 - Available disk space on the `remote` control computer. Any transfer of data will fail if the disk is full.
 - Available disk space on the ntt acquisition computer. *A full disk may cause data to be lost.*
 - The seeing value as measured by the seeing monitor at the Astronomical Weather Station (AWS). Note that if AWS has not been activated by the `local` operator it will return the sun elevation instead of the seeing value. Beware that the sign of the elevation is not displayed.
- Link monitoring tool. This displays the status of the communication link to La Silla and the level of its utilization (bits per second). It is a very useful tool with which to see what is going on over the communication link.

The right screen remains black after log in. This screen is used for status displays only. The mouse, and keyboard focus, can be moved between the screens.

6.2 Defining an Instrument Setup and Exposure Sequence

The first thing to do is to select the mode of EMMI (RILD, REMD, BIMG, BLMD or DIMD) or SUSI. Even though SUSI is a physically different instrument, mounted at the other Nasmyth focus of the telescope, the user interface software regards it as just another mode of EMMI. Selecting the mode will pop up a new menu panel above the Pegasus session manager. This menu panel should remain on the screen as long as this mode is being operated.

It is possible to switch instrument modes many times during the night. The switch is trivial and taken care of by the local control software automatically when starting an exposure sequence. When switching between SUSI and EMMI the telescope light beam also has to be switched between focus A and B (see Section 7). It is possible to define instrument setups and exposure sequences for one mode while integrating in another mode. Parallel operation of many modes will however cause the screen to be crowded with many windows overlapping each other. The experienced user may take advantage of these facilities, but the novice user is recommended to work only in one mode at any one time. Obviously, EMMI can physically work in only one mode at a time.

The local control software allows, for each mode, the definition of up to six instrument setups and eight exposure definitions. These can be combined into exposure sequences. A new exposure sequence may be defined while another exposure sequence is running. The purpose of this is to maximize the exposure time during the night. A single exposure is a special case of an exposure sequence. *That is, even if you want to do only one single exposure, you have to define and execute it as a sequence.*

The mode menu panel looks very similar for the different modes. All functions required to perform an observation in the selected mode are accessible from here. The mode menu panels are divided into logical areas. The top part includes buttons to define parameters, and to initiate an exposure sequence. The bottom part includes buttons for status displays and management of scientific data. The logical areas and buttons are from top left to bottom right (for many purposes, they also form a temporal sequence) :

- **Global Parameters.** Buttons for setting up common parameters applicable to all exposure and setup definitions:
 - **CCD Readout** (fast or slow readout of chip, binning factors and size of read-out (sub>window).
 - **Focussing** for through-focus exposures (number of focus position steps, focus step size and spatial offsets) and instrument focus setting method (manual or automatic). Telescope through-focus exposures are only applicable for certain instrument modes. Instrument focus may be set according to two methods. Either the user specifies the focus unit position in encoder steps (manual), or the local software calculates the position according to instrument mode, temperature and filter (automatic). Because the temperature is supplied by the TCS, the latter method requires a link to the TCS, which sometimes cannot be established.
- **Define Setup Parameters.** Six buttons are available to define six different instrument setups. The exposure definition refers to one of these six setups. This is only applicable

to EMMI. The setup parameters depend of course on the mode, but typically they include things like filters, grisms and slits. Each setup also has an identifier (any ASCII character string).

- **Define Exposure Parameters.** Eight buttons are available to define the exposure parameters for up to eight different exposures. The parameters are
 - Type of exposure (scientific, external flat field, dark, calibration, multi lamp calibration, telescope focus, instrument focus). Not all of these are applicable in all modes.
 - Duration. Exposure time in seconds.
 - Number of successive, identical integrations.
 - Identifier of the file which will hold the exposure data. To be stored in the FITS keywords (note that this is not the filename).
 - IHAP Batch. This field should normally be blank.
 - Setup Name. A reference (by name or number) to any of the six instrument setups, that can be defined for a given instrument mode. This is only applicable to EMMI.
 - Calibration lamp. A reference (by name or number) to a calibration lamp (the list of available lamps is accessible on the telescope control terminal on the “Calibration Unit” status display). This is applicable only for calibration exposures.
 - Filter. This is only applicable to SUSI (for EMMI the filter selection is part of the instrument setup definition).
- **Specials.** Some modes have some specific functions which can be set here.
 - Slitview. Sometimes the observer wants to see the field in the slitviewer before starting an exposure. This is required e.g. when the observer switches between RILD and REMD. This function moves the mirror to see field in slitviewer. It should never be used during an exposures.
 - MOS. This function gives the observer access to the punching unit to prepare starplates for Multi Object Spectroscopy.
- **SEQUENCE CONTROL.** This is explained in Section 6.3 below.
- **Status Displays.** A number of dynamic status displays are available depending on the mode. Status displays, when requested, always pop up on the right screen. Some of these are explained in the Section 6.3. Related to definitions and setups are
 - Setup Configurations. This shows the present six instrument setups. It may be useful when filling in the exposure definition and instrument setup forms.
 - Exposure Definitions. This shows the present eight exposure definitions as well as CCD readout parameters and other common setup parameters. It may be useful when filling in the exposure definition forms.
- **Management of Scientific Data.** This is explained in Section 6.4.

6.3 Executing and Monitoring an Exposure Sequence

After the astronomer has defined (via global parameters, setup parameters and exposure definitions) the exposure(s) that constitute the sequence to be carried out (remember that even a single exposure can be executed only as a sequence), he is ready to start integrating. The top rightmost area of the mode menu panel (**SEQUENCE CONTROL**) contains two buttons to do this:

- **CONFIGURE SEQUENCE**. To identify the exposures to be executed and some common parameters related to this sequence. It contains the following parameters:
 - Exposures to execute. Two numbers between 1 and 8 and defining the range of defined exposures to be executed. A special case is a single exposure when the range is one (e.g. 3 to 3).
 - Save on tape. A toggle button to flag data to be saved on tape. Data saving can be done either immediately after readout or later on user request. This is selected with two radio buttons. The mechanism is explained in Section 6.4. Default is to save data to tape immediately after readout.
- **START SEQUENCE**. To start exposing. The local control software will check for consistency of all setup parameters before starting the sequence. Any inconsistency will be displayed as an error message in the feedback window and the exposure sequence will not start. It is therefore important to keep an eye on the feedback window to check that everything is OK.

It should be noted that it is not necessary to configure the sequence each time it is started. In particular, if the astronomer works in single exposure mode using only one exposure definition, it is not necessary to reconfigure the sequence. Only if any of the parameters in the **CONFIGURE SEQUENCE** form has to be changed is there a need to recall it. Note that this still holds if the definition of the exposure(s) (e.g. name and time) or setup (e.g. filter, wavelength) have been changed.

The progress of the sequence is visible in the feedback window echoing all the actions the local control software is taking. In addition, status displays can be requested from the mode menu panel. Status displays pop up on the right screen.

- **Exposure Status**. The status of the present exposure (exposure number, identifier, remaining exposure time, shutter status etc.) is shown here and dynamically updated. It also includes control buttons: **pause**, **continue**, **change exposure time**, **abort exposure** and **stop sequence**. More detailed status information is available via two additional status pictures callable from here: **CCD Info** and **Exposure Info**. The exposure status picture should normally always be displayed during an observation. There is one exposure status picture for each CCD detector.
- **Function Status**. The status of the functions relevant to the mode of the instrument is shown here and dynamically updated. It includes the requested as well as the actual values. This is only applicable to EMMI.

- **DIFA Status**. Only for SUSI. The status of the M4 mirror and the SUSI filter wheel is shown. The M4 mirror is used to switch the beam between SUSI, IRSPEC and the second instrument mounted on DIFA. Controls to move the mirror are also available.

6.4 Management of Scientific Data

The original **local** acquisition system acquires scientific data into an IHAP database residing on the **nti** computer. A second acquisition system using MIDAS was added at a later stage to the **local** control system. This works in parallel using a Unix workstation, acquiring data, producing fits files on disk and automatically converting these into MIDAS **.bdf** format.

The **remote** user may also transfer the acquired data to the **remote** computer for MIDAS image processing on that node.

Thus the user must keep track of three places where data may reside and this can be very confusing. It is therefore important to understand what to do at the different places.

The official data is written on tape from IHAP (only!) and the user should always specify **Save on tape** for valuable data on the CONFIGURE SEQUENCE form. Because the saving can be a time consuming exercise for large frames, blocking the system, a mechanism was introduced in the **local** control system to postpone the saving. This is controlled by the radiobutton **automatic save after readout** on the same form. Files postponed for saving will be put in a **queue** and *must be saved explicitly by the user at a later stage*. This is controlled by the **IHAP Tape Control** button. If the user forgets to save the queued files they may be lost. For this reason it is strongly advisable not to use this mechanism, but to always set **automatic save after readout**. In fact these options are defaulted whenever the user calls the CONFIGURE SEQUENCE form.

WARNING: Due to a problem in the **local** control system, only 15 bits per pixel are delivered to IHAP and the official tape. If the user wants the most significant bit as well, he presently either needs to ask the night assistant to mount a tape on **wslnnt** or to transfer the data to Garching. This problem is expected to be solved in the near future.

During the night, the IHAP database will grow and at one point it will become full preventing observations from continuing. In fact, for large format CCD's and the standard 1700*1700 pixel² readout window, no more than 16 or 17 raw data frames can be stored in the IHAP data base. The **local** control software refuses to start any integration if there is no space in IHAP for acquired data. The user must therefore clean up (make space) in IHAP before proceeding. For this reason there is a button on the menu panel to start a **local** IHAP session. To create space, the user should execute the following IHAP commands:

- **PURGE,#x,#y**. This will delete all files with IHAP numbers between x and y. Do this for a substantial fraction of all files, at least 50 %. If possible, all files should be purged in order to speed up the **PACK**.
- **RENUMBER**

- PACK

To terminate the IHAP session type EXIT. To get on-line help type HELP in response to the IHAP prompt. Also any other IHAP command, e.g. MINMAX, *not requiring the Ramtek display or IHAP graphic terminal* may be executed here. It is good practice to clean up IHAP at the beginning of the night and one or more times during a normal observing night.

After his observing run, the observer will receive from La Silla a copy of the files written by him to the IHAP tape. Any files not saved with IHAP (or transferred to the remote site and explicitly saved to tape there) cannot be recovered and will be lost.

Note that EMMI uses one IHAP copy and SUSI another one. Thus, if an observing program requires both EMMI and SUSI, two IHAP databases must be handled. (Both will be saved to the same IHAP tape.)

For on-line data assessment and quick-look, the remote control system *does not make use of* IHAP. Instead the second local acquisition system, which is based on the ntt workstation and MIDAS is used. To access this system from the instrument control terminal the user should click **FITS File Transfer** on the mode menu panel and a new form pops up.

- **Transfer a FITS File** Ask for an explicit transfer of FITS files to the remote site. Another form will pop up, where the file name and compression algorithm to be used should be specified. Files may be queued for transfer. (Note that also MIDAS-format .bdf files can be transferred, but this take more time and is, therefore, not recommended.)
- **Abort File Transfer** Stop the transfer in progress immediately.
- **Delete Transfer Queue** Remove all files flagged for transfer from transfer queue. This will not affect the transfer in progress.
- **Delete FITS Files** Remove FITS files on the local acquisition computer. Another form will pop up, where the file name (including wildcards) should be specified. If the disk on the local acquisition computer becomes full (a meter on the bottom part of the screen continuously displays the percentage of the disk space utilized) data will not be acquired. This command may be used to clean up the disk.
- **List all FITS files** Displays all FITS files available on the local acquisition computer (wslntt).
- **Show Transfer Log** All actions involved in data transfer are logged in a file. This can be displayed with this command. Particularly useful when a transfer fails, to find out the reason.
- **List Transfer Queue** Displays all files queued for transfer.
- **Show Status** Displays status of the software. Useful to verify that a file transfer is in progress.

raw non destructive	slow non-destructive	standard non-destructive	lossy destructive	MIDAS (X-protocol)
10 min	5 min	4 min	2 min	1.5 min

Table 1: Transfer times for 2MB scientific data (1024 * 1024 pixels) using a bandwidth of 48 kbps during normal operation.

The bottom part of the form contains buttons to enable or disable automatic transfer of data immediately after readout. These are toggle switches and the selected mode will remain true until another mode is selected.

- **Off** No automatic transfer of acquired fits files. This is the default at start up.
- **Slow** Automatic transfer of all acquired fits files using unix compress. This mode will stay active until it is disabled using “Off” or any other automatic mode.
- **Standard** Same as “Slow” but using CFHT compfits compression algorithm. This mode will stay active until it is disabled using “Off” or any other automatic mode.
- **Lossy** Same as “Standard” but using a lossy compression algorithm. Data will not be reconstructed exactly as the original data. This mode will stay active until it is disabled using “Off” or any other automatic mode.

The different strategies to transfer data make use of different compression algorithms. Indicative figures of the transfer time, including compression, transfer and decompression are given in Table 1. Note also that for quick look purposes an alternative mechanism is available, using the X protocol, described in Section 8.

File transfers are carried out in background and do not affect the performance of the rest of the system. There is no danger or performance penalty to transfer files continuously during the observation.

If many files are going to be transferred at some quiet moment during the night or at the end of the observation it may be useful to use cut and paste operations with the mouse to avoid typing each file name. Use the **List all FITS files** command to cut the required filenames and paste them in the **Transfer a FITS File** form.

Due to some defects in the local software, occasionally the FITS header is not correctly acquired on wslntt. It is therefore good practice to continuously monitor the header on acquired data. This problem is expected to be solved in the near future.

During eaves dropping mode, it may be required to transfer processed files from Garching to La Silla. This can be done from a terminal emulation window, using the utility *putfitsCF*. This utility uses the standard compression algorithm and is faster than using ftp. An xterm or hpterm may be opened from the Motif root window. The utility is activated by typing `putfitsCF <filename> wslntt`

6.5 Multilamp and DIMD Exposures with EMMI

It is possible, and sometimes necessary, to make wavelength calibration exposures using more than one calibration lamp for the same frame. This is called a multilamp exposure. To define a multilamp exposure the user has to define a sequence of more than one exposure. For all exposure definitions in the sequence the exposure type should be set to **Int. Multilamp Cal.** and the **Identifier** and **Setup Name** must be the same. The `local` control software reads the exposure times for the different lamps and opens the calibration shutters in sequence in the optimal way. It should be noted that calibration lamps 1 - 12 share one shutter and cannot be combined.

It is possible to make DIMD (dichroic mode) exposures with different exposure times for the red and blue path. To define such exposures a sequence of two exposures has to be used. The **Setup Name** of these must be the same, and one should be defined for the red path the other for the blue path. The `local` control software executes these two exposures in parallel in the optimal way. It should be noted that it is not possible to do imaging in DIMD mode.

7 Telescope Control

The following section describes how the user controls and monitors the telescope and its associated devices (adapters, rotators, etc.). This is normally done by the `remote` control operator in collaboration with the `local` night assistant. The normal practice is that the night assistant takes care of the start up and shut down of the telescope and the control of the active optics system. If he has in advance been provided with finding charts, he may also identify targets for slit spectroscopy more quickly.

For safety reasons, the Remote Observer, must not operate the telescope himself. Therefore, this section, is provided for information only and can be skipped over.

7.1 Initial Screen Layout

After the telescope terminal has been logged on, the screen will look like Figure 5.

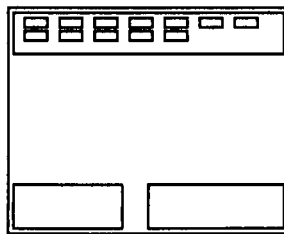


Figure 5: Initial layout of the telescope control screen

The applications are from the top in clockwise direction:

- Pegasus Session Manager as described in Section 4.2. It contains push invoke buttons to get a submenu for status displays and to control a particular part of the telescope, to enter suggestions and bug reports and a button to terminate the session.
- The feedback window as described in Section 4.2.
- A status form displaying the telescope apparent coordinates of current epoch and equinox. Coordinates are displayed for referenced and actual position. In addition the last preset coordinates are displayed in the requested epoch.

7.2 Monitoring the Status of the Telescope

Selecting the button TCS Status from the Pegasus Session Manager makes a submenu appear. Each of the push buttons on this submenu will cause a status picture with dynamic data to

pop up. For each of the two focus sides, three status pictures are available:

- **Telescope Status** This contains the common telescope status, the light path (e.g. M1 cover, M3 position), meteorological data (e.g. temperatures) and a part associated with the guide probes on the selected side.
- **Adapter Status** Detailed information about light path and autoguider status on the selected side.
- **Rotator Status** The rotator status picture mainly comprises interlock status information. Any abnormal status is flagged with a * character.
- **Calibration Unit** The status of calibration sources and shutters. This is only applicable on side B (EMMI). SUSI does not have an internal calibration unit.

In addition, four buttons are available for status information about components that are common to all observing modes:

- **Building Status** Shows position and status of building components, e.g. slit dome shutter, wind screen, flaps and M1 cover.
- **Hydraulic Plant Status** Shows status of pumps and gives temperature and pressure values.
- **Emergency Switches Status** Shows position of all emergency switches on the NTT. Any abnormal position is flagged with the * character.
- **ALT/AZ Interlock Status** Shows status of all interlocks associated with the altitude and azimuth drives. Any abnormal status is flagged with the * character.

During normal operation, the telescope status and possibly the adapter status and calibration unit should be continuously displayed, while all other status pictures should be called only if a problem is suspected.

7.3 Moving the Telescope

Selecting the button **Move Telescope** from the Pegasus Session Manager makes a submenu appear. Each of the push buttons on this submenu will cause a control action when pressed.

- **Preset to New Object** This is the direct way of moving the telescope to a new object. Another window will pop up asking for the coordinates (right ascension and declination) and epoch. After the user has **Accept**'ed the form the telescope will start to move, provided coordinates are valid. The progress of telescope movement may be monitored on the telescope status picture. When the preset is complete, a "PRSET OK" message will appear in the feedback window.

- **User Defined Catalogue** Definition and use of user defined catalogues. Another window pops up, where user defined catalogues may be created, restored and used. Each catalogue holds a maximum of 20 records (objects). This is the normal way of making telescope presets.
- **Standard Catalogue** Selection and use of standard catalogues Perth and FK5.
- **Reset wait flag** In very unusual cases, a preset command could make the local control software hang up. Using this command will cause it to restore, ready to accept a new preset.
- **Offset Step** Another window will pop up. This form allows the user to define a default offset step in right ascension and/or declination. Four push buttons allow the user to make offset steps in positive and negative direction, using the default step size, for right ascension or declination. The accumulated offset is displayed and will be reset to zero after the next preset.
- **Absolute Offset** Another window will pop up asking the user for offset steps in arc-seconds. When the values have been accepted, the telescope will start to move. At the same time the guideprobe will be moved in opposite direction trying to maintain autoguiding. Depending on initial guide probe position and offset steps requested this may be physically impossible and, therefore, fail.
- **Telescope + Rotator Status Query** A query is sent to the local control programs. The reply appears in the feedback window.
- **Automatic Probe Setting** When this is enabled the local control software will attempt to find a guide star within the valid range every time a preset is made. This is done by searching the HST guide star catalogue in STARCAT. If a candidate is found, the guide probe will be moved to the guide star. If the guide probe camera is selected as input source for the video image system, the guide star will appear somewhere in the middle close to the default position of the crosshair.
- **Manual Probe Setting** This command disables the automatic guide probe setting.
- **Rotator Offset** Another window will pop up asking the user for the rotator offset in degrees. When the value has been **Accept**'ed, the rotator will start to move.
- **Rotator Absolute Pos.** Another window will pop up asking the user for the desired absolute rotator position in degrees. When the value has been **Accept**'ed, the rotator will start to move.

7.4 Telescope Focus Control

At the time of writing, the focussing of the telescope is being integrated with the active optics system in the local control system. The aim is to permit automatic adjustment of the telescope focus continuously during the night. Until this mechanism is 100 % working, the old focussing procedure needs to be accessible (see [1]).

Selecting the button **Focussing** from the Pegasus Session Manager causes a submenu to appear. It contains two buttons to move the M2 mirror in 'z' direction, either absolute or relative. In both cases another window appears where the user has to specify the amount in mm. When the contents of the form have been **Accept**'ed the M2 mirror will move. During the night the focus may be adjusted according to the telescope tube temperature, which is displayed on the telescope status picture. The focus form provides up-to-date information about the regression formula giving the change in focus position (in mm) with change in temperature (in degrees centigrade). Note that after the standard image analysis a telescope focussing exposure has to be made (see Section 6.2 and EMMI/SUSI Manual), because the focus offset between Antares and EMMI or SUSI are not yet accurately calibrated (e.g. as a function of temperature).

7.5 Controlling Adapter Functions

Each of the two adapters (Nasmyth focus station "A" and "B") has two guide probe units, of which usually one is utilized at a time. The four guide probe units are controlled from separate submenus called from the Pegasus Session Manager. Each of the push buttons on these submenus will cause a control action when pressed.

- **Autoguider Control.** There are six buttons to control the autoguiding: **enable**, **disable**, **start**, **stop**, **suspend** and **resume**. The autoguider must be enabled before it can be started.
- **Move Guideprobe.** Six buttons related to guide probe movements plus eight buttons to offset the probe in all directions in large or small steps.
 - **Preset Probe** To move guide probe to absolute position enter x and y coordinates in the pop up window. The probe will be moved when the pop up window is **Accept**'ed.
 - **Define Instrument** Depending on the instrument mode used, the area where the guide probe may be used without vignetting may differ. The user should here specify the instrument mode. This is particularly important when using automatic probe setting.
 - **Probe to Center** Move probe to center of field. Used to verify whether the observed field is correct. **Probe has to be moved away from center before integrating.**
 - **Probe to Park** Move probe to park position away from the center.
 - **Probe to Actual** Attempt to find a guide star within valid range using the actual telescope coordinates by searching the HST guide star catalogue in STARCAT. If a candidate is found, the guide probe will be moved to the guide star. If the guide probe camera is selected as input source for the video image system, the guide star will appear somewhere in the middle close to the default crosshair position.
 - **Probe to Reference** Attempt to find a guide star within valid range using the reference telescope coordinates from last preset by searching the HST guide star catalogue in STARCAT. This command may be executed while the telescope is

moving thereby speeding up the search for guide star as compared to the previous command. If a candidate is found, the guide probe will be moved to the guide star. If the guide probe camera is selected as input source for the video image system, the guide star will appear somewhere in the middle close to the default crosshair position.

- **Offsets** in four directions by two fixed amount, i.e. 8 buttons. Each time these buttons are pushed, the guide probe will be offset a large (2 mm) or small (0.4 mm) step. The directions correspond to the guide probe image from the video image system. Remember that the refresh rate for the video images is normally about one image every 3 seconds when using low resolution mode.
- **Camera Control.** There are eight buttons to control the behaviour of the guide probe camera.
 - **Large Box** Makes the box on the center of the crosshair large. This is useful when “catching” a guide star inside the box.
 - **Small Box**. The normal small box.
 - **Black X-Hair**
 - **White X-Hair** When using the video image system, the white crosshair should always be selected.
 - **Camera On** Guide probe camera on.
 - **Camera Off** Guide probe camera off.
 - **Set High Voltage** Adjust the high voltage. Depending on the brightness of objects the high voltage needs to be adjusted. Never use too high voltage (very bright) as this will destroy the camera. **The voltage must be turned down when doing calibration exposures.**
 - **Integration Time** Adjust integration time. This may be required to see very faint objects.
- **Move Crosshair.** One button to move crosshair to absolute position. Eight buttons to make large or small offset steps in all directions.
- In addition to the above, the second guide probe control submenu for adapter B contains additional buttons. For this probe it is possible also to use the slit viewing camera for autoguiding. This may be useful when doing spectroscopy of sufficiently bright sources or in a well populated field with EMMI.
 - **Slit View Camera** Use the slit view camera for autoguiding.
 - **Guide Probe Camera** Use the normal guide probe camera for autoguiding.
 - **Set High Voltage** Adjust high voltage for slit view camera. This also applies if the slit view camera is used only for viewing (not autoguiding). **The high voltage must be turned down when doing calibration exposures.**
 - **Integration Time** Adjust integration time for slit view camera. This also applies if the slit view camera is used only for viewing (not autoguiding).

7.6 Changing the Beam between Focus A and Focus B

The light beam from the telescope is directed to either side A (SUSI) or side B (EMMI) via the M3 mirror. To switch the beam between the sides the **Select Focus Side** button on the Pegasus Session Manager has to be used. This button causes a new window to pop up, where a semi-automatic procedure is available. The procedure includes three steps: a) stop telescope tracking and go to zenith, b) move M3, c) restart telescope ready for new preset. The whole procedure takes a few minutes to execute. In addition the telescope needs to be refocussed after a switch of focus side, either by a predefined offset [1] or a new focus exposure. In order to take full advantage of good seeing with SUSI, a focus exposure is mandatory. If the video image system is used, switching the video selection is also necessary (see Section 7.7).

7.7 Selecting the Source Signal for the Video Image System

Clicking the **Select Video** button on the Pegasus Session Manager will cause a submenu to appear with a number of push buttons. The first two select if cameras on **side A** (SUSI) or **side B** (EMMI) should be used. The next three buttons select one camera (**guide probe 1**, **guide probe 2** or **slit viewer**). The last three select one of the Ramtek displays available in the local control room. These last three buttons should never be used, but are there only for test purposes.

8 MIDAS for Remote NTT Observers

The following section describes how the observer gets access to the scientific data produced in order to determine if the observation is on track.

8.1 Introduction

Remote observers have parallel access to two different fully-fledged MIDAS sessions. One is running locally on a UNIX workstation at the NTT (the local MIDAS), the other one (the remote MIDAS), also under UNIX, on a computer in Garching; both of them have their own database. On either machine the default version will be the latest four-monthly ESO-internal release. The most recent annual release will always be available as a back-up. Therefore, the remote NTT observer does not need to learn anything specific about MIDAS. However, because of the special character of remote observing, a few hints may help the remote NTT observer to use MIDAS more efficiently.

This section is not meant to be a substitute for a MIDAS users guide or your reading of it. With very few exceptions, all MIDAS commands mentioned have up to eight, partly multiple parameters. In order to take full advantage of their functionality, the on-line HELP facility should be consulted (see below).

8.2 Set-up and resources

In the remote control room in Garching, the two MIDAS sessions are normally run on two separate X-terminals. It has proven most efficient to start the local MIDAS on the terminal closest to the screen that is used for commanding EMMI.

The terminal logged in as `rcmidas` starts up a Pegasus session. When clicking the button "NTT MIDAS Session" an automatic procedure sets up the access control for the X protocol and logs in on the `ntt` acquisition computer (`ws1ntt`). It also automatically starts a MIDAS session. If any of the MIDAS environment variables are not set as required (e.g. `MIDOPTION`), the user has to exit MIDAS, change the environment variables and restart MIDAS with the `inmidas` or `gomidas` command. MIDAS is now running on the local acquisition computer, but the display used is the `remote` screen.

The terminal logged in as `midashq` starts up a MIDAS session in a terminal emulation window.

At start-up, you should delete all files with extensions `.bdf`, and `.mt` which are no longer needed. If you want to delete them all, type `$ rm *` (you can enter also other UNIX commands in this way, i.e. you insert a `$`-sign followed by a space at the beginning of the command line).

Warning: `rm` will delete all files specified without asking for further confirmation!

The available disk space is 900 Mbytes on La Silla and 900 Mbytes in Garching. An image

with 1024×1024 pixels usually fills 4.2 Mbytes.

For convenient access to the on-line HELP type `CREATE/GUI HELP` on the local MIDAS terminal. The usage of the graphical user interface is largely self-explanatory but there is also a specific `HELP` button.

Use commands `CREATE/DISPLAY` and `CREATE/GRAPHICS` on both terminals to create windows for image display and graphics applications. (Note that the standard size of the display window is only 512×512 pixels.)

8.3 Inspecting images with MIDAS

The most important or at least time-critical task for which the observer wants to utilize MIDAS is the fast and reliable assessment of the quality of the data. Several options exist, and it is important that the observer is aware of their differences so that he can take the optimal decision.

Transfer of images to Garching: For an image of 1024×1024 pixels in FITS format, this takes between 5 (with non-destructive data compression) and 2 ('lossy' compression) minutes and, therefore, is the slowest of all possible methods. However, it is well justified if it is foreseeable that several MIDAS commands will have to be used or that the image may have to be displayed more than once before the next exposure can be taken.

The `.bdf` image files in the MIDAS-internal binary format can also be transferred from the SUN workstation at La Silla to the HP computer in Garching. But note that the performance of the compression algorithms is higher for FITS files by nearly a factor of 2.

Ideally suited for a careful inspection of the transferred image is command `VIEW/IMAGE`. It has the additional convenience of accepting input images also in FITS format so that the conversion to MIDAS format (command `INTAPE/FITS`) as a separate step becomes obsolete.

Remote display of image: Since the observer has full access to the local MIDAS with the possibility of displaying at the remote station data residing on the local database, it is possible to `LOAD` the image into an image display window opened on the remote terminal. For a window with 512×512 pixels this takes about 90 sec. The critical point of this method is that the cuts must be adequate in the first attempt because a second one will take another 90 sec.

Remote graphics: Often it can be sufficient just to plot a cross section through the image (commands `PLOT/ROW` or `PLOT/COLUMN`). If done from the local MIDAS database but on the remote terminal, the time is 10 seconds (enter `SET/GRAPHICS PMODE=1` to improve the performance). This procedure works very well for all sources which such a very selective inspection cannot miss too easily, i.e. fairly extended single objects, crowded fields, and all kinds of continuous spectra (plot one row perpendicular to the direction of dispersion).

Remote pre-analysis: The fastest but also least informative way of getting a coarse impression of the exposure level of a new image is to use command `STATISTICS/IMAGE` on the local MIDAS. Because only a few numbers have to be transferred, the penalty for the remote usage of this command is negligible.

Most methods can be accelerated in situations where analysis of a sub-image is likely to give conclusive results. With command `STATISTICS/IMAGE` such a sub-image can be specified directly, and `PLOT/IMAGE` by definition works on a sub-image. If the image display window of the local MIDAS has been defined to have only 100× 100 pixels, such a small sub-image can be `LOADed` in less than 10 seconds. For the transfer of partial images first use command `EXTRACT/IMA` in the local MIDAS.

8.4 NTT-specific MIDAS procedures

There are a number of special MIDAS procedures which are required for observations with the NTT and EMMI. A mouse-operated graphical user interface provides a convenient means to invoke them. For procedures requiring additional parameters to be entered, a small text input field will appear. In order to enter parameter values, you must point the field with the mouse *and* click the left button of the mouse (this makes an I-shaped pointer appear). In its present implementation a peculiarity of this field is that in order to delete a character, you must move the I-shaped pointer with the left-arrow key to the *left* of the character and then press either the `Delete` or `Backspace` key. Any required parameter values which cannot be defaulted are prompted for.

You can run these procedures in either MIDAS. However, cursor interaction with the image display is very slow in the local MIDAS and often is too slow, i.e. the respective commands are timed out. It is therefore recommended to transfer the files to be analysed to the remote MIDAS database. **Note** that often it is perfectly adequate to work on images that have been transferred using option `lossy`. In most cases, the loss of information is entirely irrelevant for the purposes of these procedures.

All procedures expect that the image to be analysed has already been `LOADed` into the display window. Some procedures activate a small cursor box in the image display window which is used to specify the area over which some detail is to be analysed. The cursor can be moved with the mouse. The size of the cursor box can be adjusted with the arrow keys on the keyboard. Press the left mouse button to pass a position to the calling procedure, and use the right one when you are finished and want to terminate input. Make sure that the stars you choose are well isolated and neither too bright nor too faint. All output will be directed to the respective MIDAS session window.

If for some reason the graphical user interface cannot be used, all procedures can also be run by typing: `@@ procedure_name par_1 ... par_n`. (Remember that in UNIX environments the case of characters in procedure- and filenames is significant.) Required parameter values for which no default is defined will be prompted for.

Important: Some of the procedures such as `focus`, `seeing`, and `point` have the necessary

knowledge about the image scales of modes BIMG, RILD and SUSI built in to them. They deduce the observing mode used from the first 3 characters of the filename. This implies that in order for these procedures to give reasonable results, the names of 'red' images must start with the string **red**, 'blue' images with **blue**, and SUSI images with **susi**!. Keep this in mind when using command INTAPE/FITS to convert FITS files transferred to Garching into MIDAS format.

8.4.1 focus

Interactive syntax: @@ tfocus (for through-focus exposures)

The sub-menu that can be activated through this button has two options corresponding to the two focussing methods, **wedge** exposures and **through-focus** sequences.

For wedge exposures, no parameters are needed. In the image display, you have to click the *left* image of several useful stars. The result, for EMMI mode RILD in encoder units and the telescope in millimeters, is returned as a correction to the present focus value.

The through-focus option requires two parameters to be given, the starting focus value and the step by which it has been changed in the sequence. From the old focus value before the sequence started and the focus step, you must yourself compute the focus value of the first sub-exposure: The focus sequence is carried out symmetrically about the old focus position. Through-focus sequences with *n* sub-exposures produce *n* images of every object. Click, one after the other, all images of one star; the image with the largest separation from the others must be the last one. Check the result on at least one more star.

8.4.2 seeing

Interactive syntax: @@ seeing

Click as many suitable stars as you like. The procedure will return the average full width at half-maximum (in arc seconds) of the images in both *x* and *y*.

8.4.3 point

Interactive syntax: @@ point [xslit] [yslit] [angle] [flag]

This procedure is used if a blind offset is needed in order to put an object in the slit. (In mode RILD, the slit cannot be seen via any camera, in modes BLMD and REMD the object may be too faint to be visible.) The offset is computed relative to the telescope position at which a direct image was taken just before the spectrum will be observed (with the same arm

of EMMI). The position of the target in the direct image is determined; the procedure returns the offsets in α and δ (in arcsec).

Input parameters are the desired x and y on-slit positions (in pixel numbers) of the target. The y coordinate is for all spectral formats along the slit. The x -positions of the starplates (slits) in mode RILD are listed in the optical set-up form (you will receive it from the RC operator on duty). You can check them by taking a flatfield exposure through the respective slit in imaging mode. In modes REMD and BLMD the procedure is just the same.

Further parameters are the present position angle of the rotator (defaulted to zero) and a flag indicating whether the coordinates are read directly via the cursor (C) or computed from a Gaussian fit (G). For point sources, option G is recommended which is also the default.

8.4.4 rotate

Interactive syntax: @@ rotate

This command returns the rotator position angle (in degrees) for which the slit runs parallel to the line connecting two points. It is assumed that for a rotator angle of 0° the slit is oriented north-south. This is true for mode RILD; for BLMD or REMD add or subtract 90 degrees because in these modes the slit is oriented east-west for a rotator angle of 0° .

Button rotate lets a sub-menu appear with the two options **Gauss** and **Cursor**. The latter is recommended only for extended sources whose positions cannot be determined from a Gaussian fit.

8.4.5 trace

Interactive syntax: **extract/trace** (no @@!!)

This button implements the standard MIDAS command **extract/trace**. It permits a cut through an image to be interactively extracted. Consult the on-line MIDAS **HELP** for details.

8.4.6 catalog

Interactive syntax: @@ obsrscat root

Filenames such as blue1079 very quickly become meaningless whereas the real file identification is 'hidden' in a descriptor. This command reads and lists these identifiers for all files in a given catalog (**red**, **blue** or **susi**). Alternatively, it can also first create (this option is called **reset**) a catalog of any of the three categories.

8.4.7 utils

Interactive syntax: GET/CURSOR activate cursor in image display

(Do not type '00'!)

The three-option menu offers access to three standard MIDAS commands as listed above.

9 Example of a Remote Control Session

The flexibility and possibilities of the NTT and its instruments make it very difficult to describe a typical remote control session. Many activities may be common for most RC sessions, while others may be unique to a particular type of observation. The following section gives anyway an example of how a remote control session may be carried out.

Remote control observers will normally arrive in Garching **the day before** their observations start. They should soon contact E Hoppe (Room No. 225, ext No. 473) in order to

- provide the fine details of the instrument set-up (gratings, filters, etc.) to be used. If this information is not received in time an attempt will be made to extract it from the last sheet of the application form submitted for the program.
- hand over target lists and finding charts. For spectroscopy of sources fainter than 16-17 mag. finding charts should arrive in Garching 2 weeks in advance so that they can be forwarded to the night assistant on La Silla.
- fix the time when the introduction to the system will start. The NTT remote control system includes a simulator, which allows the observer to exercise the user interface off-line. This can be done at any time and is a powerful tool to become familiarized with the user interface before start of the real observation. The observer is **strongly recommended** to use this facility.
- fix the time when the first calibration observations will start. Since Garching is six hours ahead of La Silla in the northern summer and four hours in winter, this will normally be between 8 and 12 p.m. Garching time.

The remote control operation team in Garching will forward the information received to the operations group at La Silla. Instrument set up and focussing are carried out by the operations group at La Silla during the day just the same way as for observations under local control. At the beginning of every night, the remote control operator will start up all relevant remote control software and check out the software configuration.

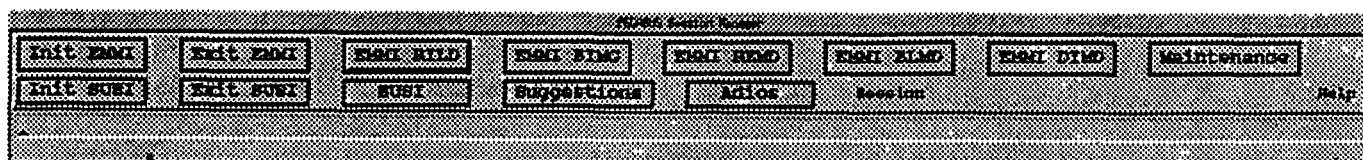


Figure 6: Pegasus Session Manager on the instrument control screen

In this example it is assumed that the observer wants to make red imaging using EMMI in RILD (Red Imaging Low Dispersion) mode. The initial screen on the instrument terminal will look like Figure 4 as described earlier. At the top of the screen is the Pegasus Session Manager displayed (Figure 6). The observer selects EMMI RILD by clicking the corresponding button.

The EMMI RILD main menu panel pops up (Figure 7) on top of the Pegasus Session Manager. This menu panel should normally be displayed as long as EMMI RILD is used. It contains all functions required to carry out an EMMI RILD observation.

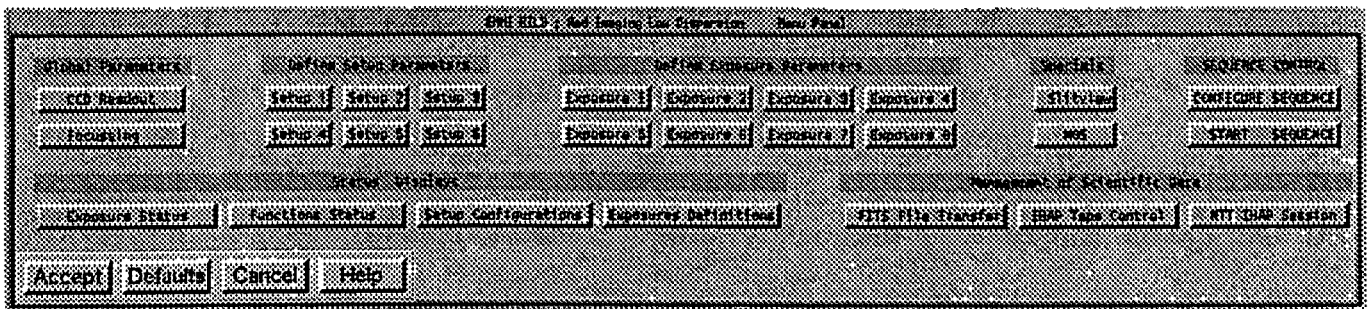


Figure 7: EMMI RILD main menu bar

It is a good practice to make as much disk space available for data as possible before start of the real observation.

The first thing to do is to delete any old files in local IHAP. An IHAP session may be started in a terminal emulation window by clicking **NTT IHAP Session** on the EMMI RILD menu panel. After the IHAP prompt appears, the user should execute the three IHAP commands **PURGE**, **RENUMBER** and **PACK**. The user can check that IHAP is empty with the command **DLIST,AL** before **EXITing** the IHAP session. Remember that there is one IHAP copy for EMMI and one IHAP copy for SUSI. Thus if SUSI is going to be used as well, the procedure has to be repeated from the SUSI menu panel.

The second thing to do is to make sure there is enough free disk space on the local acquisition computer. The available disk space is displayed on one of the meters at the bottom of the instrument control terminal. If this figure is greater than 40 %, it is recommended to clean up the disk. The easiest and fastest way of doing this is from the quick-look and image processing terminal logged in as `rcmidas`. On an xterm window execute the unix commands `rm *mt` and `rm *bdf`. Alternatively the same commands may be executed form within MIDAS. Type `$rm *mt` and `$rm *bdf` in response to the MIDAS prompt (note the "\$" sign). Note that the meter is updated only every 60 seconds so that it may take some time before the recovered disk space is shown.

If the observer intends to transfer data to the remote computer, disk space must also be

available there. Another meter at the bottom of the instrument control terminal displays the available disk space. To clean up the disk, the observer should follow the same procedure as just described for the local acquisition computer, but on the terminal logged in as midashq.

The observer should now do a number of test integrations (dark, flatfield, calibrations, etc.) in order to check the instrument set-up and to find the optimal exposure times for calibration frames. (The examples given below for the taking of science frames apply in an analogous fashion to calibration exposures). It is also advisable to check with the night assistant that he has received the list of objects and all finding charts. This is of particular importance for spectroscopy of faint objects, where identification of objects could be a problem.

When everything is working normally the real calibration exposures can start. The night assistant should be dismissed for the rest of the afternoon, but a clear agreement should first be reached as to when the scientific observations (including any sky flats) will begin and, in case of poor weather, where the night assistant can be reached. Also, it should be ensured that the telescope dome is opened well in advance of the astronomical observations.

The time in the afternoon is important for the exercising of operating procedures, the establishment of communication patterns with La Silla, and the testing of the performance of the instrumentation. Any efforts of these kinds in the afternoon will pay off during the night.

When at the agreed-upon time all parties are back to their respective terminals, scientific observations can begin.

The NTT active optics system is controlled by the night assistant. He is instructed to do a full image analysis (10 minutes) shortly after sunset. The observer may decide to shift these measurements to later in the night if they conflict with the acquisition of twilight sky flat fields, but in general it is advisable to monitor the mirror settings at least once per night.

After the telescope has been focussed (see the EMMI & SUSI operating manual on how to do it), the observer is ready for the first scientific target. In this example we assume the observer wants to take two images in EMMI RILD with two different filters. Note that all setup definition procedures described below can be carried out in advance well before sunset, for instance in parallel to the calibration exposures.

The observer needs to specify the detector setup, the instrument setup and the exposure definition. First he sets up the detector by clicking CCD Readout in the EMMI RILD menu panel. A new form pops up (Figure 8) showing the detector parameters. In this example the observer selects slow readout mode, no binning (binning factors 1,1) and no window readout. Because "No Window Readout" is selected the X and Y coordinates have no effect as stated in the text. To save the setup the observer clicks Accept and the form disappears.

RED CCD Readout Parameters

Readout Mode : ☒ Slow ☐ Fast

Binning Factors: X Y

☒ NO Window Readout

☐ Window Readout as defined below

Xleft	<input type="text" value="1"/>	Xright	<input type="text" value="2080"/>	1 - 320
Ybottom	<input type="text" value="401"/>	Ytop	<input type="text" value="2060"/>	1 - 510

Figure 8: Red CCD readout parameters

Next he defines the instrument setup by clicking **Setup 1** in the EMMI RILD menu panel. A new form pops up (Figure 9) showing all the possible EMMI functions for RILD. In this example the observer calls the setup "Vfilter" and selects the V filter. All other functions should be FREE or blank because no spectra are to be taken. In this example the observer decides to use automatic instrument focussing. The local control software calculates and moves the focus position according to the temperature at the start of the exposure. If the observer wants to set himself the focus position he must disable automatic focussing. This is done from the focussing form available in the EMMI RILD menu panel by clicking **Focussing**. To save the setup the observer clicks **Accept** and the form disappears. He repeats the operation for **Setup 2**, but instead selects the R filter.

EMMI RILD : Red Imaging Low Dispersion Setup Definitions

Setup 1 Name: **Vfilter**

Atmospheric Dispersion [ADCS+ADCC] : NOT AVAILABLE

Standard/Size [STAP] : (1) FREE (2) 2"x6" (3) 1.5" (4) 1.0" (5) 5.0"

Filter Selection [FILR]			Grism Selection [GRIS]		
(1) HART1	(2) HART2	(3) 0b	(1) gr1s 1	(2) gr1s 2	(3) FREE
(4) V	(5) R	(6) I	(4) gr1s 4	(5) gr1s 6	(6) CD1
(7) FREE	(8) Ha1/2	(9) FREE	(7) CD2	(8) FOCW	(9) FREE

Manual Focus Position [FOCR] : **8280** [6300-10100] encoder value

Autofocussing is ENABLED (above value will be overwritten).

Formula : focus = 9249 + 3 * temp + filter offset

Accept **Defaults** **Cancel** **Help**

Figure 9: EMMI RILD setup form

The observer then sets up the exposure parameters by clicking **Exposure 1** in the EMMI RILD menu panel. A new form pops up (Figure 10) showing the exposure parameters. In this example the observer selects one scientific exposure of 15 seconds, with the identifier "myVtest" and a reference to the first setup. This reference can either be a number (1) or a string (Vfilter). The other two fields, IHAP Batch and Calibration Lamp, are left blank. To save the setup the observer clicks **Accept**, and the form disappears. He repeats the operation for **Exposure 2** in the EMMI RILD menu panel, but selects a different exposure time and a different instrument setup.

Exposure Definition

Exposure Definition Number : 1 Mode : RILD

Exposure Type

- Scientific
- Ext. Flat Field
- Dark
- Int. Calibration
- Int. Multilamp Cal.
- Telescope Focussing
- Instrument Focussing

Exposure Time 15 seconds

No. of Integrations 1

Identifier myVtest

IHAP Batch

EMMI Setup Vfilter [name or #]

Calibration Lamp [name or #]

Accept Defaults Cancel Help

Figure 10: EMMI RILD exposure parameters

The user may check the exposure definitions and the instrument setups by clicking **Exposure Definitions** and/or **Setup Configurations** in the EMMI RILD menu panel. These will show the complete set of present setups including eight exposure definitions and six instrument setups as well as detector setup. Because these status pictures contain a lot of data their display will slow down the system. They should therefore be used with care and closed as soon as they are no longer needed.

After the setups have been defined the observer needs to configure the sequence of exposures. This is done by clicking **CONFIGURE SEQUENCE** in the EMMI RILD menu panel, and a new form pops up (Figure 11). In this example the observer wants to execute a sequence of two exposures from number 1 to number 2. He wants to save the data immediately on tape. This is the default, which is automatically returned to every time the **CONFIGURE SEQUENCE** button is clicked. To save the setup the observer clicks **Accept**, and the form disappears. This completes the setup and the system is now ready to start integration.

RED Exposure - Sequence Control

Exposures to execute [1-8] :

☒ Save on Tape (IHAP)

policy when saving ☐ automatic save after readout

☒ queue file for later saving

Accept **Defaults** **Cancel** **Help**

Figure 11: Configure exposure sequence

The RC operator presets the telescope from the telescope control terminal. This can of course be done in parallel with the instrument setups. In this example, using EMMI in imaging mode, there is no need for checking the field before starting the exposure (NTT pointing is better than 2 arcsec rms), provided the observer was equipped with good enough coordinates. When the telescope is pointing the target, the RC operator, or the night assistant, finds a suitable guide star and starts autoguiding. During this procedure the video image system is used to display the selected guide probe camera image on the large video screen.

When the telescope is ready, the observer starts the exposure sequence by clicking **START SEQUENCE** in the EMMI RILD menu panel. In this example it is assumed the observer does not want to transfer the data automatically, but will use the quick look facilities with the local MIDAS, before deciding to transfer the data or not. The activity of the local control software is reflected in the feedback window (Figure 12). If something is not working correctly, e.g. inconsistent setup or IHAP database full, a corresponding error message will be displayed here. It is therefore important to keep an eye on the feedback window, especially when starting an exposure sequence.

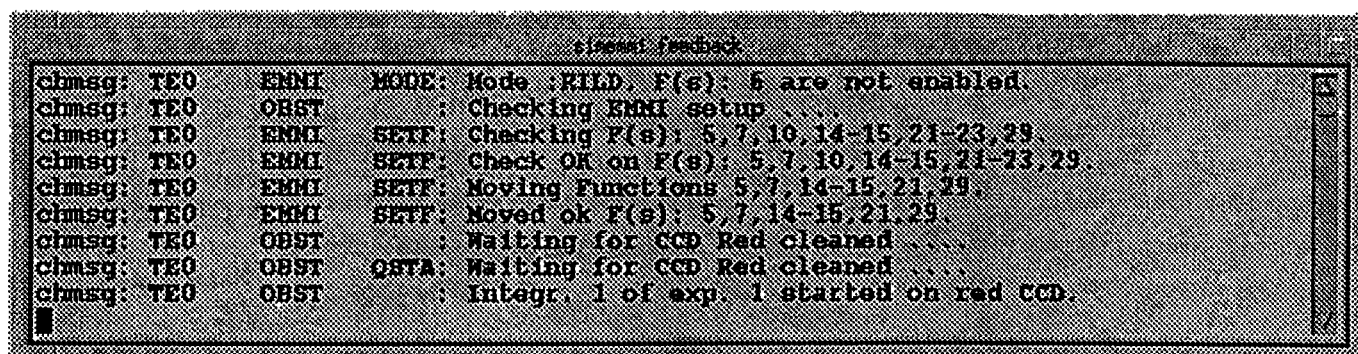


Figure 12: Feedback window

The observer has also a few status displays available to monitor the progress of the exposure sequence. To monitor the status of the exposure the observer clicks **Exposure status** in the EMMI RILD menu panel. A status picture pops up showing the progress of the exposure (Figure 13). The picture illustrates the CCD status with two icons, an observing eye when the CCD is active and a shutter viewing a galaxy when the shutter is opened. The remaining exposure time is also indicated with large fonts. The status picture includes controls to abort, pause and change the exposure time. More detailed information is also available via two other status pictures callable from here. The exposure status form is normally displayed all night long.

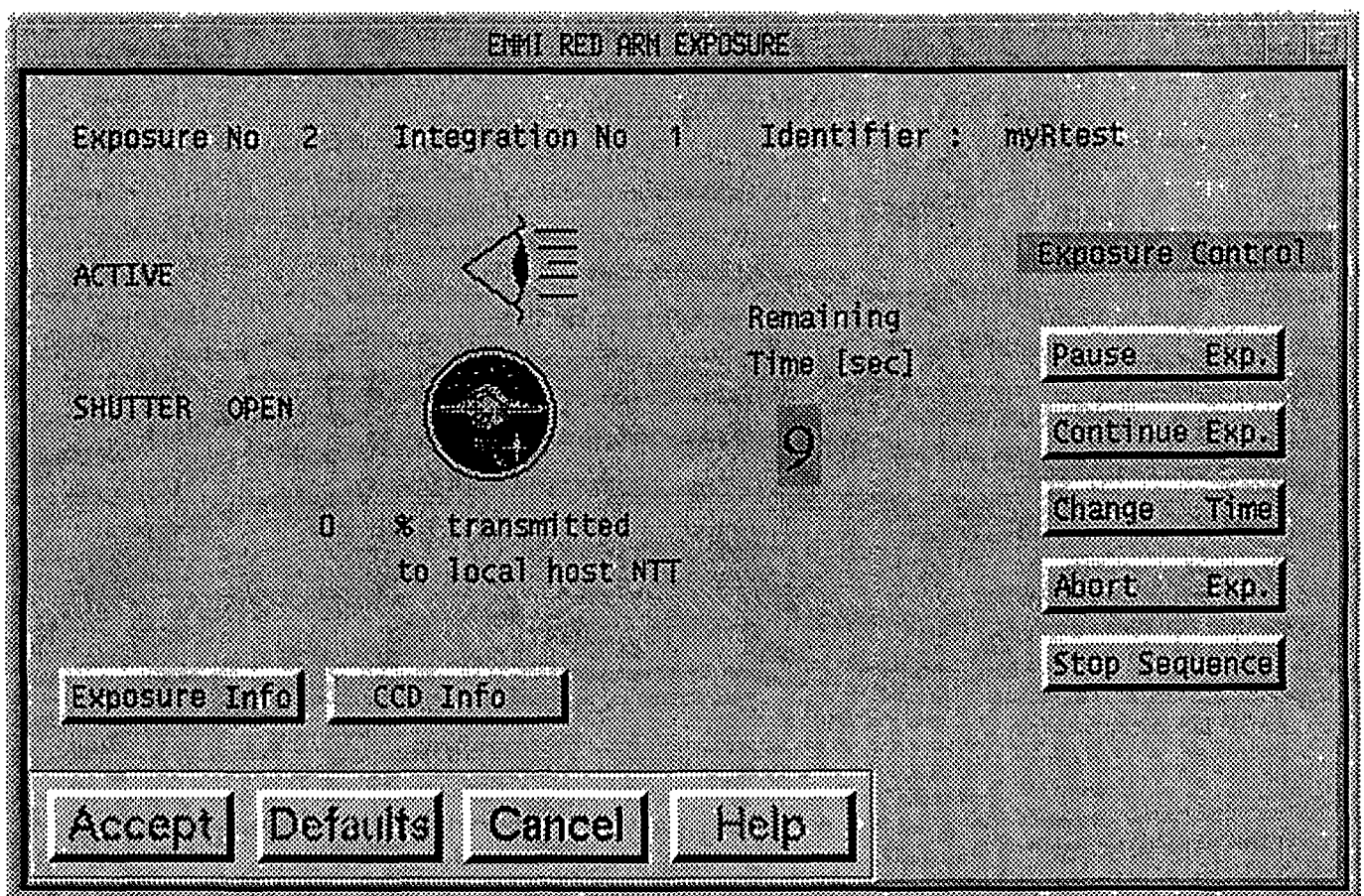


Figure 13: Exposure status

If required, the status of the instrument may also be monitored by clicking **Functions status** in the EMMI RILD menu panel. This status picture shows the setup values as well as the actual values for all instrument functions of the present mode.

When the integration is completed, this will be indicated by a change of the exposure status picture as well as in the feedback window. The local acquisition computer sends a message to the feedback window "New file <filename> ready". The local acquisition computer automatically converts this fits file to a MIDAS (.bdf) file and this takes another few seconds. When the .bdf file is ready, it may be displayed on the quick-look terminal logged in as `rcmidas`. The observer first opens a display window by executing the MIDAS command `create/display` (he should have done so already in the afternoon) and then loads the image with the command `load <filename>`. It is advisable to first set reasonable cut levels before loading the image. Even better is to use the MIDAS procedure `loadn`, which automatically determines the cuts, by giving the MIDAS command `@@ loadn <filename>`. It takes approximately 90 seconds to display the full image in a standard MIDAS display window of 512*512 pixels (note that the full CCD image will often be larger in one or two coordinates so that the SCALE parameter of command `LOAD/IMAGE` should be used).

The observer may now take corrective actions or go to the next target. He may decide he wants to transfer the data in background to perform more image processing on the remote node, at the same time as the observation continues with new targets and exposures. To perform an explicit transfer he clicks **FITS File Transfer** and a new form pops up (Figure 14).

By clicking **Transfer a FITS File** another form pops up, where the observer enters the filename and specifies a compression algorithm. It is recommended to always use the compression strategy "Standard". The initiation and completion of a file transfer is indicated by corresponding messages in the feedback window. The FITS File Transfer form also contains other control and status functions. For example, the observer may check that the transfer is really taking place by clicking **Show Status**, which causes some status information to appear in the feedback window. If a file transfer fails (e.g. an incorrect filename was entered) it may be useful to get more detailed information about the error by clicking **Show Transfer Log**.

If the observer decides he wants to transfer all produced data immediately when they become available he clicks **Standard**. This will toggle a flag and from now on every new fits file will be automatically transferred using the compression strategy "cfht compfits". To disable this flag, the observer has to click **Off**.

Data transferred to the remote node are delivered as fits (*.mt) files. To perform image processing on the remote node the observer starts a MIDAS session on the terminal logged in as `midashq`. (this has normally already been done at start-up). A terminal emulation window pops up and a MIDAS session is started. The transferred fits file has to be converted to MIDAS (*.bdf) format before processing. This is done by the MIDAS command `intape/fits <file.spec> <file.id> <device>` (e.g. `intape/fits 23 red red`).

All MIDAS procedures described in the EMMI & SUSI Operating Manual are also available to the remote observer, in local as well as remote MIDAS sessions. They may be executed

either by clicking the appropriate button on the MIDAS GUI, or by typing the procedure name in response to the MIDAS prompt.

Finally the observer might want to save the produced data either to an off-line computer at ESO, or if network links are available to his home institute, or to a tape. The remote observing computer has a DAT unit connected and data may be saved on a DAT (digital audio tape). If any other tape format is required the data first have to be transferred (ftp) to the general computers at ESO.

FITS File Transfer

Controls

Transfer a FITS File

Abort File Transfer

Delete Transfer Queue

Delete FITS Files

Status

List all FITS files

Show Transfer Log

List Transfer Queue

Show Status

Automatic FITS file transfer controls

When new scientific data files are produced at NTT they may automatically be transferred to Garching. Click **Off** if this is not required.

Slow if unix Compress algorithm is required.

Standard if CFHT Compfits is required.

Lossy if fast, but destructive, is required.

The selected policy remains active until next choice.

Off

Slow

Standard

Lossy

Accept

Defaults

Cancel

Help

Figure 14: FITS file transfer control form

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10 References

The ESO library is situated only a few meters from the remote control room and is accessible at any time for the visiting astronomer. In addition the following manuals and information are available in the remote control room.

References

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- [15] MIDAS User Guide Vol A+B.
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- [17] STARCAT User Guide
- [18] STARCAT List of On-line Catalogs