

MIKE-PLC control Manual

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I. Conceptual description.

The purpose of the project was to come up with a control system based on a Programmable Logic Controller (PLC) for replacing the electro-mechanic original control system of the instrument (we did not touch the CCDs electronics).

None of the devices included in the original control system's electronics chassis were removed from it in order to be able to reinstall it to make the instrument work in case the new control system fails. This also means that the new chassis includes connectors that match the ones used for the original system.

We also added a linear potentiometer to enable slit-position measurement and control. This potentiometer had been installed on top of the slit mechanism's motor in August 2005, with the help of Oscar Duhalde.

II. Parts / devices involved.

Hardware (PLC + interface devices):

The controller is a DirectLogic DL205 series PLC. Its parts are a D2-260 CPU, two input modules (one 32 5~15Vdc discrete inputs, used for shutter signals from the saddlebags, and one 8 channel analog input module, used for measuring focus and slit positions and instrument internal temperature), two output modules (one 8 Relay output module and one 115Vac discrete output module) and an Ethernet module (H-ECOM-100), used to communicate with the remote touchpanel. Complementary operator (user) devices are: An EZ-420 panel (24Vdc, 4x20 character display with 5 function pushbuttons, plus Up, Down, Enter and ESC pushbuttons), which is the 'Local' user interface, and a EZ-S8C-FST touch panel (24Vdc, 8 inches, with Ethernet communications capability), the 'Remote' user interface.

The electronics control box has an ON-OFF switch for turning ON/OFF the Local interface. This was added to avoid light contamination in the instrument's area produced by the panel's display.

Communications:

The communication between the PLC and the remote control unit (touch panel) goes through an ethernet crossed cable (no network involved so far). A short green crossed cable was installed between positions #22 and #44 of the hub in the switch cabinet located in the equipment room of Clay telescope. Outlet #22 is in the control room, and outlet #44 is in the NASE platform.

Serial communication between the PLC and the local panel goes through an RS485 cable (notice that both devices are in the same cabinet).

Other hardware:

Inside the electronics cabinet, there is one board where I gathered all the parts that couldn't be replaced (the R-C circuits for driving the Focus and Shutter motors and two voltage regulators, for 5Vdc and 9Vdc). The 5Vdc voltage regulator feeds the three Potentiometers used to measure Slit and Focus positions. Other non replaceable devices are the flipper controller, which is fed by 9Vdc (from the mentioned voltage regulator), and the EMCO high voltage power supply (which feeds the Th-Ar, hollow cathode lamp).

III. Signals involved.

There are very interesting issues related to input signals.

Shutter control signals coming from the DSP boards in the saddlebags (CCDs) are +5Vdc for 'open shutter' and -5Vdc for 'close shutter'. As the module we chose (it was actually the only option) has DIACs (two diodes in anti-parallel configuration) in its input circuits, either status of the signals (+5Vdc or -5Vdc) made the input to read 'ON'. This was solved installing diodes in series with the signals, so now the levels that reach the module are: Near +5Vdc for 'open' and 0Vdc for 'close'.

Focus and Slit position raw signals were a little too jumpy, so in the end I installed 25uF (25Vdc) capacitors in parallel with the incoming signals. The result is smooth control, with a tolerance of +/- 1 unit in the readings (actually 1mV). The process indicators used with the original system didn't show the mentioned jumps in their readings. I assume that they have internal stabilization or filtering circuits for solving this issue.

For being able to measure the temperature inside the instrument (currently in a temporary location), I used the last two free terminals in connector J2 (which takes / brings signals to / from the blue plate), U and T, for connecting an AD592 sensor.

Note: One of the advantages of this new control system is that no induction appeared on the analog signals, like we had when first installed MIKE (remember we had to use ferrites for filtering, and still we had jumps on the control room indicators when the Quartz lamp or the Th-Ar lamp were turned on or off).

Output signals are simple. The focus motors need 120Vac applied to one of their two 'input' leads through appropriate R-C circuits to turn one way or opposite way. The only restriction is that both 'input' leads MUST NOT be energized at the same time (the PLC program logic takes care of this restriction).

IV. How it works (interaction between PLC and user interface devices).

Although the control tasks are performed by the PLC, which receives the input signals and sends the output (actuation) signals to the motors, shutters, lamps and flipper controller, the local interface (Operator's console, display + programmable function pushbuttons) and the Touch panel (remote interface at the control room) are the devices that 'tell' the PLC what to do.

The main user interface is the touch panel located in the control room (remote controller), as the 'blue console' was in the original system. Control is taken over by the Local interface (located on the electronics control box attached to the instrument) by pressing its F1 function pushbutton. While F1 is ON (a red LED above the pushbutton will stay ON), touch panel control functions are disabled. Remote control is only recovered by pressing pushbutton F1 again in order to make it 'go OFF' (the LED above it will turn OFF), and cannot be recovered from the control room. This is also consistent with the original control system. The slight difference here is that while on the original system you may set the mechanisms to local one by one, on the new system all the controls pass to 'Local' or 'Remote' at the same time. In other words, on the new system, you cannot have some mechanisms in 'Local' while others in 'Remote'.

While the system is under 'Local' control, the user may change screens on the touch panel, but none of the touch panel's commanding-cells will be 'listened' by the PLC until 'Local' control is disabled (remote control is reestablished).

All position measurements (Slit and the two Focus mechanisms) are 5V full scale, but the user will 'see' 2V full scale values, in order to reproduce the way they were presented on the original control system. This scaling-down (from 5V full scale to 2V full scale) is accomplished thanks to the touch panel has the capability of 'scaling'. In the case of the OP420 (local panel), the PLC's program does the scaling for it.

Safety measures.

- Initial conditions: Every time the PLC program starts, the 'Initial stage' sets all the output lines to 'Zero'. This stage is executed only once after power-up or program restart. This means that all the devices and mechanisms (motors) are set to OFF or STOP state. This avoids any movement or device going ON after an unexpected power cycle.
- Software limits were included for Slit and Focus movement ranges. These limits were originally set only for 'Manual' mode, since 'Table' and 'Go to' modes have limits for their required (wanted position) values. Same absolute software limits were added to 'Table' and 'Go to' modes lately (PLC program version V8).
- Time Outs were included for the three mentioned mechanisms on 'Table' and 'Go to' modes. Maximum time with none or minimal reading variation for Slit was set to 2 seconds, and to 1 second for each Focus. If the movement 'times out', it will be stopped by the program and the message 'Slit Stuck' (or similar for focus) will blink on the corresponding touch panel screen.
If a mechanism times out (assuming it is not mechanically stuck), you can still try moving it using the 'Manual' mode to get to the desired (requested) position.

How readings may fail.

- Motors getting stuck in one place or the signal wire getting disconnected from the corresponding PLC's analog input (this last case was tested). For these two cases, the situation from the PLC's point of view is the same; the reading stays stable even while commanding the motors to move (WATCH OUT, they can actually move). 'Slit stuck' or 'Focus stuck' message is displayed on the touch panel accordingly, while 'Table' or 'Go to' modes are disabled. But motors can still be moved using 'Manual' mode.
- No power on the measuring potentiometers (tested): The readings go down to 0.0V. I added a safety feature in PLC's program to turn OFF the motor control signals when readings are 0.0V. For 'Table' mode I still could

see some output signals going ON for a short time (something for further checking). As readings don't move, the 'Slit stuck' or 'Focus stuck' messages are displayed on the touch panel accordingly.

V. Touch panel screens.

The touch panel (remote user interface) allows the user to control and monitor the status of all the devices and mechanisms of the instrument. One of the advantages of having a touch panel is that we can have different 'screens' for different purposes. That is why we currently have 7 control screens and 3 help screens (mainly text).

Although the main screen is a little different from the rest of the screens, there is a common structure or philosophy for all of them:

- Their top row contains 'pushbuttons' (touch sensitive cells) for changing screens. Every pushbutton is labeled according to the devices / mechanism controlled by the related screen. Top row is also slightly different from one screen to another. The idea was to stick the 'exit door' cells to the same place on all the screens. For instance, the blue focus screen doesn't need the option of going to 'Blue Focus', so that cell is not on the top row, as the 'Slit control' cell is missing on the Slit control screen, and so on.
- In their middle rows you find the control pushbuttons and the monitoring displays for the devices/mechanisms which are controlled from the particular screen.
- Their bottom row shows the status of all the devices/mechanism not controlled from that particular screen, and the internal temperature of the instrument to its right end (sensor is temporarily located behind the Red elevation adjustment 'door' or cover).
- 'Local Mode ON' message: Notice that as you cannot control bottom row devices (only monitor them), their status can only change if 'Local' control mode is used, or, in the case of shutters, if an exposure is started from MIKE's GUI. The 'Local Mode ON' message only shows up (flashing) above the bottom row when selected at the Local user interface (attached to the electronics control box, mounted on 'rear' of the instrument). No control can be carried out from the touch panel while 'Local' mode is ON. Remote control is only recovered when Local mode is left (disabled) at the Local user interface. This also makes the mentioned message disappear from touch panel's screen.

Notes:

- The system is programmed to turn off or disable all the devices or mechanisms when leaving a screen. The idea is not allowing any device to be left ON or running without user's supervision. For cases when you need to control several devices at the same time, like running a focus sequence, I have created special screens for doing it all without need of leaving it.
- A change in the status of every 'On/Off' device is always related to a change in the related text, as well as to a change of its text and/or background color. This is the case for both lamps, flip mirror and shutters.
- Notice that the main color here on Slit screen is green, on Blue focus screen is blue and on Red focus screen is red. The idea was to help the user recognize every mechanism's screen also by its colors.

Main screen.

Position values of Blue focus, Red focus and Slit are presented in bigger characters, in order to emulate the 7-segment display indicators used on the original control system. Below every of these ‘displays’ there is a ‘pushbutton’. Pressing ‘Go to Blue Focus Control’, ‘Go to Red Focus Control’ or ‘Go to Slit Control’, the program jumps to other screen related (and specifically dedicated) to the selected mechanism (detailed description of those screens below). The same way, control of the comparison lamps (and Flipper) is reached by pressing the pushbutton labeled ‘Go to Lamps + Flipper / Shutters Control’.

To the left of the top row of the screen there is a pushbutton that activates the panel’s screen saver (there is also an automatic activation of the screen saver after 30 minutes of panel inactivity). To the right, the ‘Help Screen’ pushbutton takes you to the first help screen (there are three). To the right end, there is a pushbutton for adjusting the contrast of the touch panel (notice that contrast is poor when the panel comes back from a long time off, and that it improves over time).

Figure 1 shows the Main Screen (below). All the pushbuttons on the screen are pointed out by red arrows.

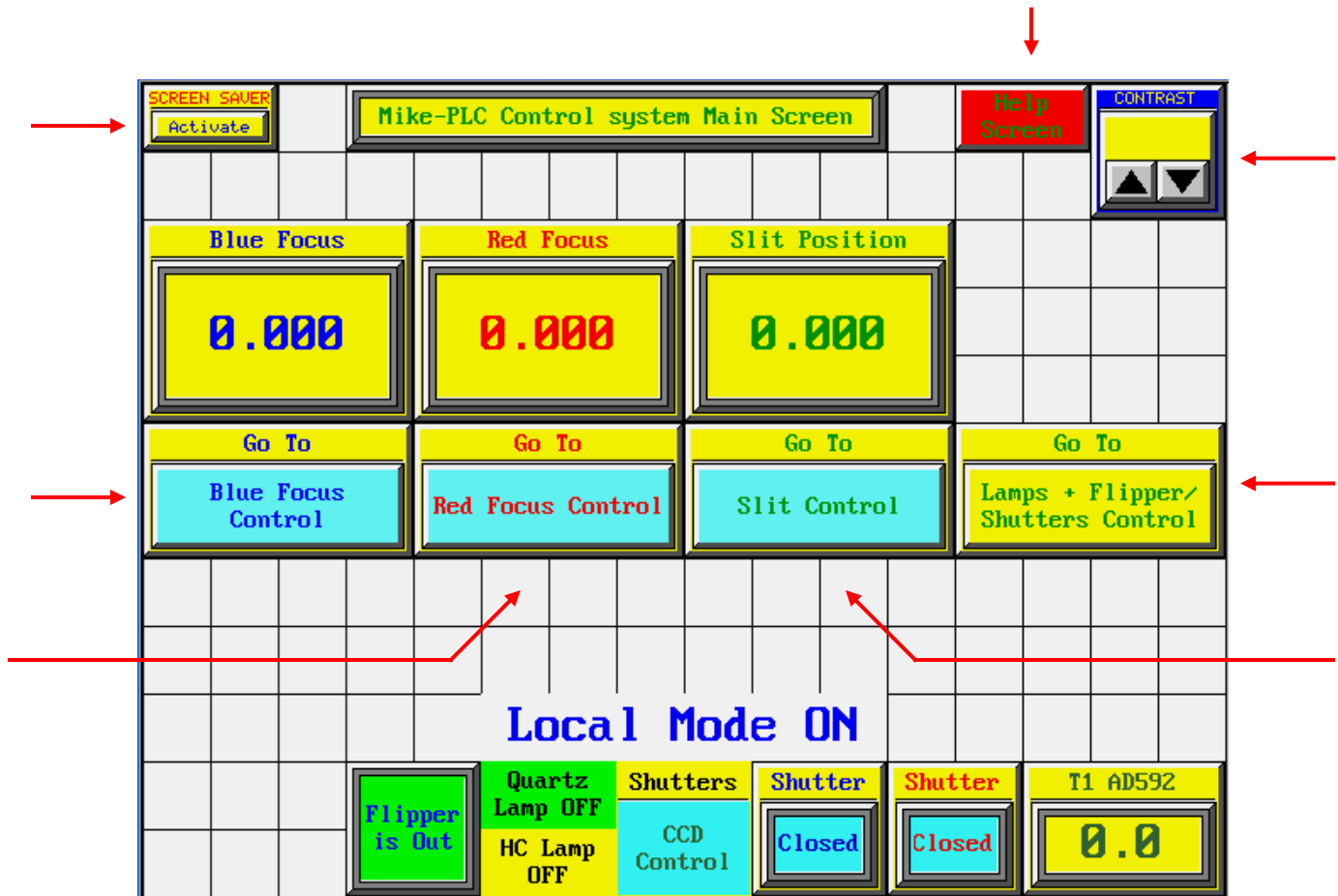


Figure 1. Main screen.

Slit control screen.

This screen controls the Slit mechanism only. Top row shows the ‘exit doors’ to the rest of the control screens (and to activate the screens saver). Bottom row shows the status of all the other devices and mechanisms of the instrument. Notice that Blue and Red Focus position values appear to the left of this row.

Control of the Slit (middle rows) works this way: To the left you have a Tri-State button that allows you to enable one out of three movement modes by pressing the cell related to each one.

- Manual mode (default):** Allows you to move the mechanism by pressing the pushbuttons to the right, labeled 'Press to Move Forward' and 'Press to Move Reverse', only one at a time. The two squares on the right end column show the current status of the PLC outputs to the motor of the mechanism (showing no movement in figure 2 below). Current position value of the Slit plate is showed in the 'Current Pos' display. The movement range is limited by software limits (0.450V and 1.500V).
- 'Steps (Table)' mode:** Allows you to move the slit plate to place one of the 22 slit positions in front of the light beam / slit viewer camera. There is a table for these positions at the end of this manual. Pressing 'Slit Sel' you are presented to a popup selector keypad where you type the number of the position required (validating / discarding by pressing enter / cancel). After selecting a position, 'Target Pos' display updates to the analog value associated to the selected position, which has become the 'target' of the system. Along with that, an automatic search process is started and only stops when the target value has been reached ('Current Pos' is within the displayed target value and a tolerance range of 2 counts, or millivolts). Notice that the right end cells will always show you when the mechanism is moving (by changing their text and color).
- 'Go to' mode:** Allows you to take the slit plate to an analog required position (within a position range between x and y V) you set by pressing the 'Type in wanted' pushbutton. A keypad will pop up for you to type the analog required value (same way described above), which makes the 'Target Pos' display to change to the entered value and the mechanism to move until it reaches the position (also within the tolerance range).

If the mechanism slows down and takes more time than expected to reach a commanded position, a timeout is triggered. This prevents the motor of the mechanism from keep moving and makes the 'Slit Stuck' message to blink. You can still try to move the plate by going into manual mode and using its related pushbuttons, or setting a different target position ('Steps' or 'Go to' modes), but the suggestion is to have the mechanism checked. In figure 2 (below), the Tri-State button is pointed out with blue arrows.

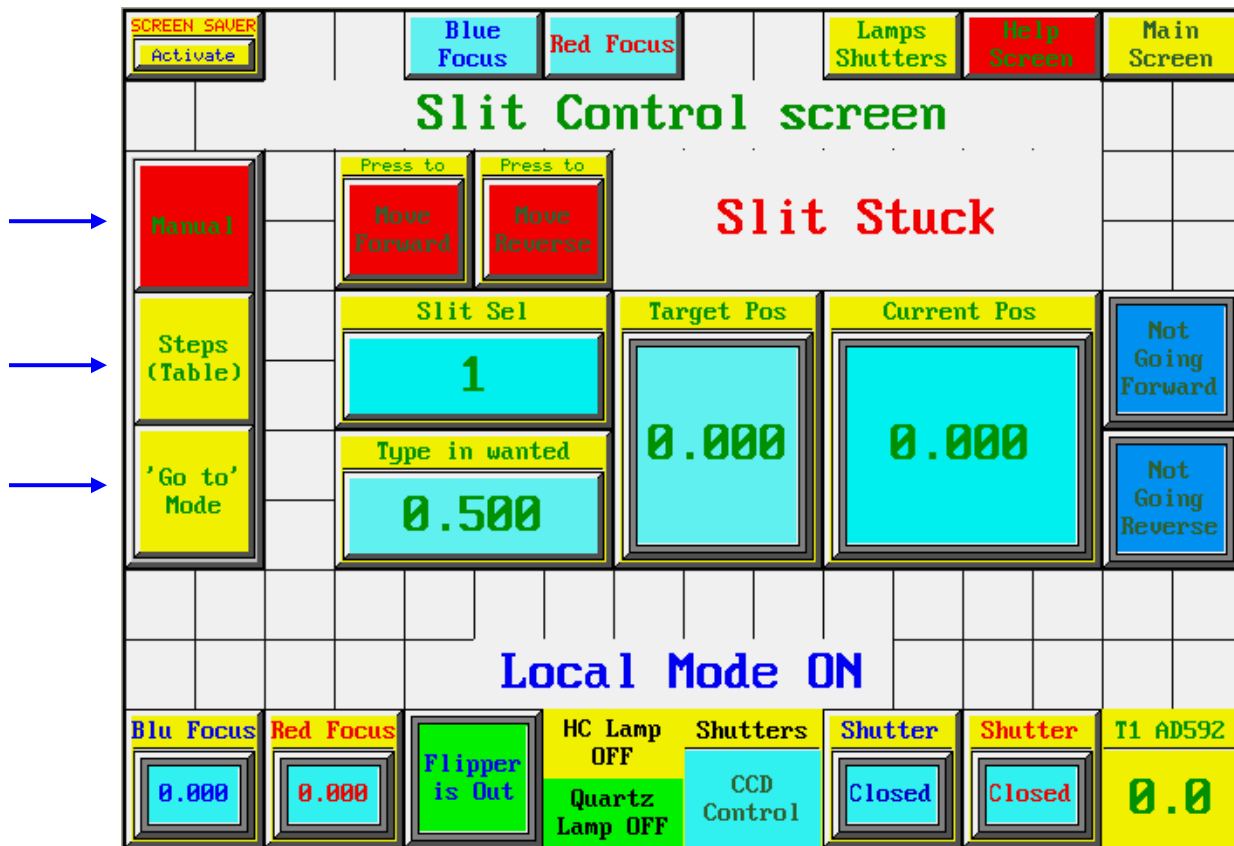


Figure 2. Slit control screen.

Blue focus control screen.

This screen is accessed by pressing the 'Blue Focus' pushbutton (AKA exit door) on the top row of any screen or the 'Go to blue Focus Control' pushbutton on the main screen. It controls the Blue Focus mechanism only. It is designed to work the same way the slit control screen does, so the description above is also valid for this one. The only differences are the movement range (software limits at 0.900V and 1.450V) and the table positions (20, detailed on the tables ahead).

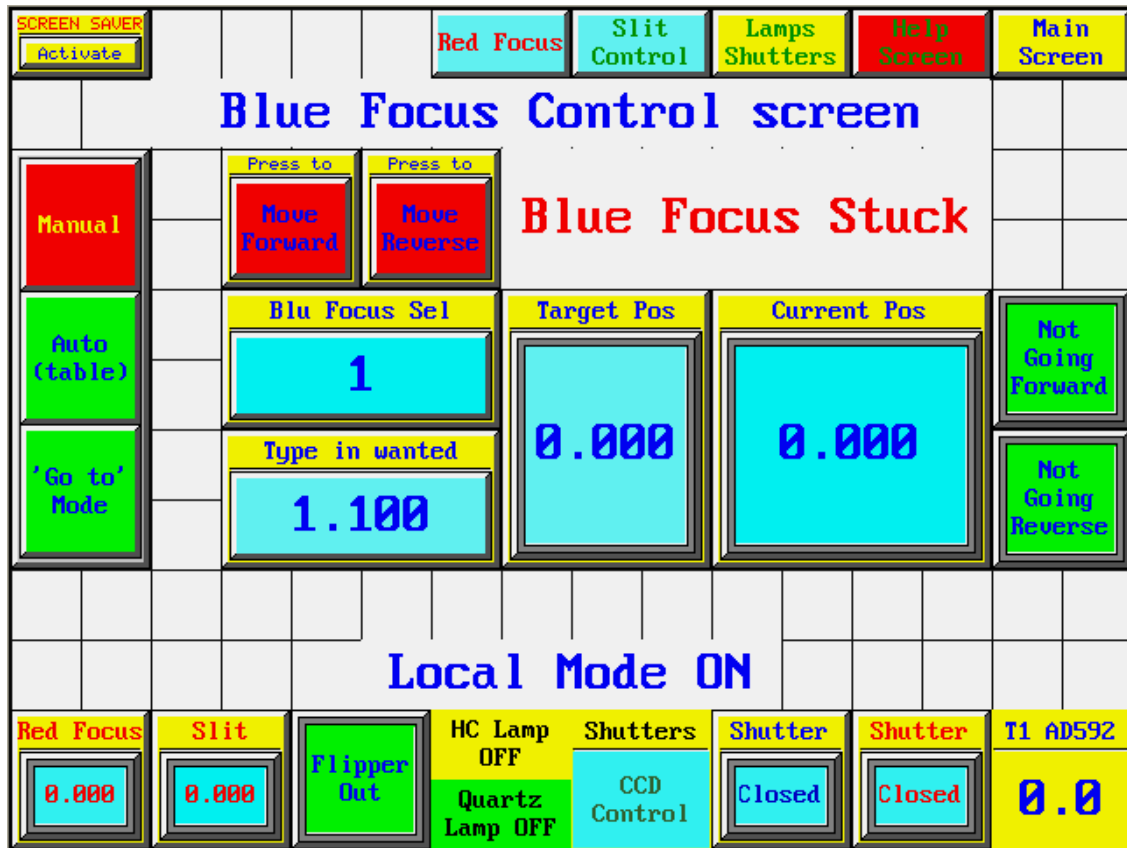


Figure 3. Blue Focus control screen.

Red focus control screen.

This screen is accessed by pressing the 'Red Focus' pushbutton (AKA exit door) on the top row of any screen or the 'Go to Red Focus Control' pushbutton on the main screen. It controls the Red Focus mechanism only. It is designed to work the same way the slit control screen and the blue focus control screen do, so the description above is also valid for this one. The only differences are the movement range (software limits at 0.800V and 1.350V) and the table positions (20, detailed on the tables ahead).

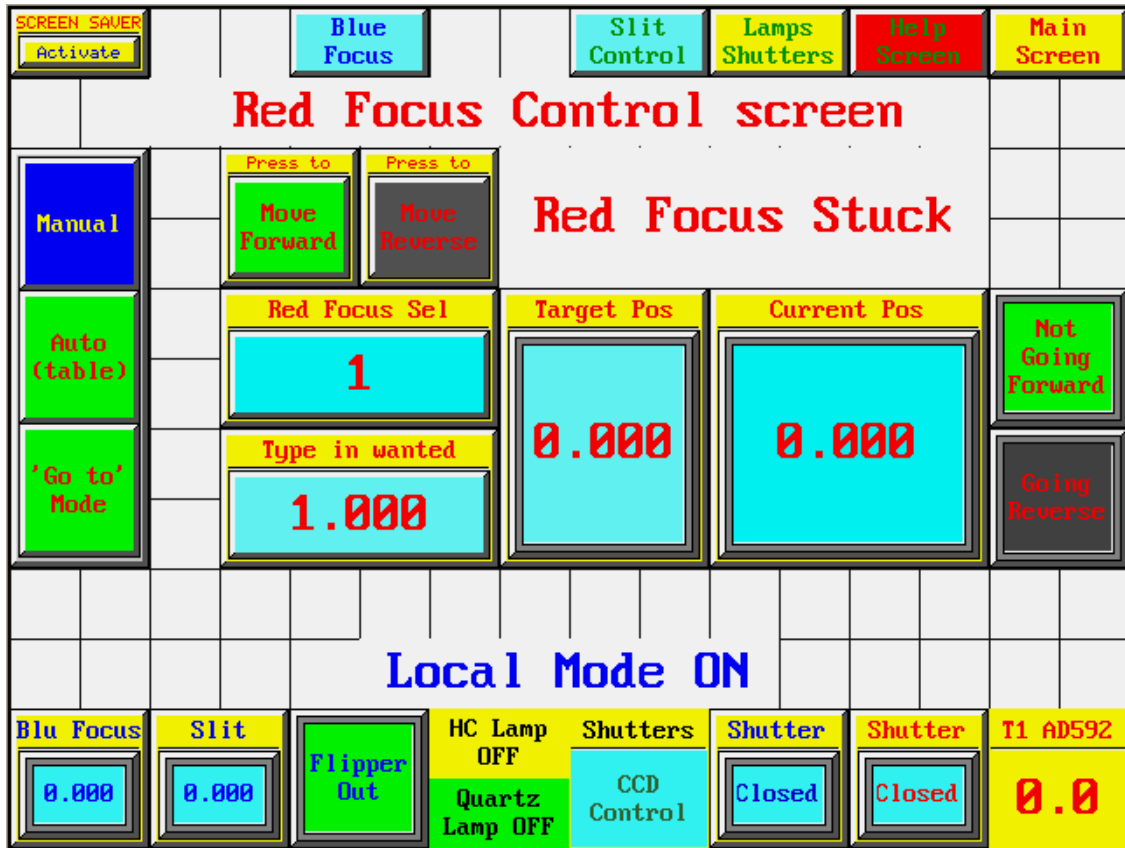


Figure 4. Red Focus control screen.

Lamps control screen.

This screen is accessed by pressing the ‘Lamps Shutters’ pushbutton (AKA exit door) on the top row of any screen or the ‘Go to Lamps + Flipper / Shutters Control’ pushbutton on the main screen. It was designed to be used by the night observer (there is a more complete one designed for the Instrument specialists and Electronics, which can be accessed from this screen by pressing the ‘Flipper / Shutters’ pushbutton on the top row). It controls the Quartz and the Th-Ar lamps. In order to avoid confusion, I decided not to give control of the Flip mirror (AKA flipper) to the observer. The flip mirror goes automatically IN every time either lamp is turned ON.

A tri-state button allows you to turn the lamps on or off. Pressing its upper cell turns off any on lamp. The Quartz lamp is turned on by pressing its middle cell. Th-Ar lamp is turned on by pressing its lower cell. Both lamps cannot be on at the same time (it is a feature of the Tri-State button).

While a lamp is on, its related tri-State button will change from yellow to red. Its related lamp symbol will change color (indicating it is on), and its related status cell (to the right end) will both change color and text (indicating it is on). All the mentioned cells will go back to their off-state colors and text when their related lamp is turned off.

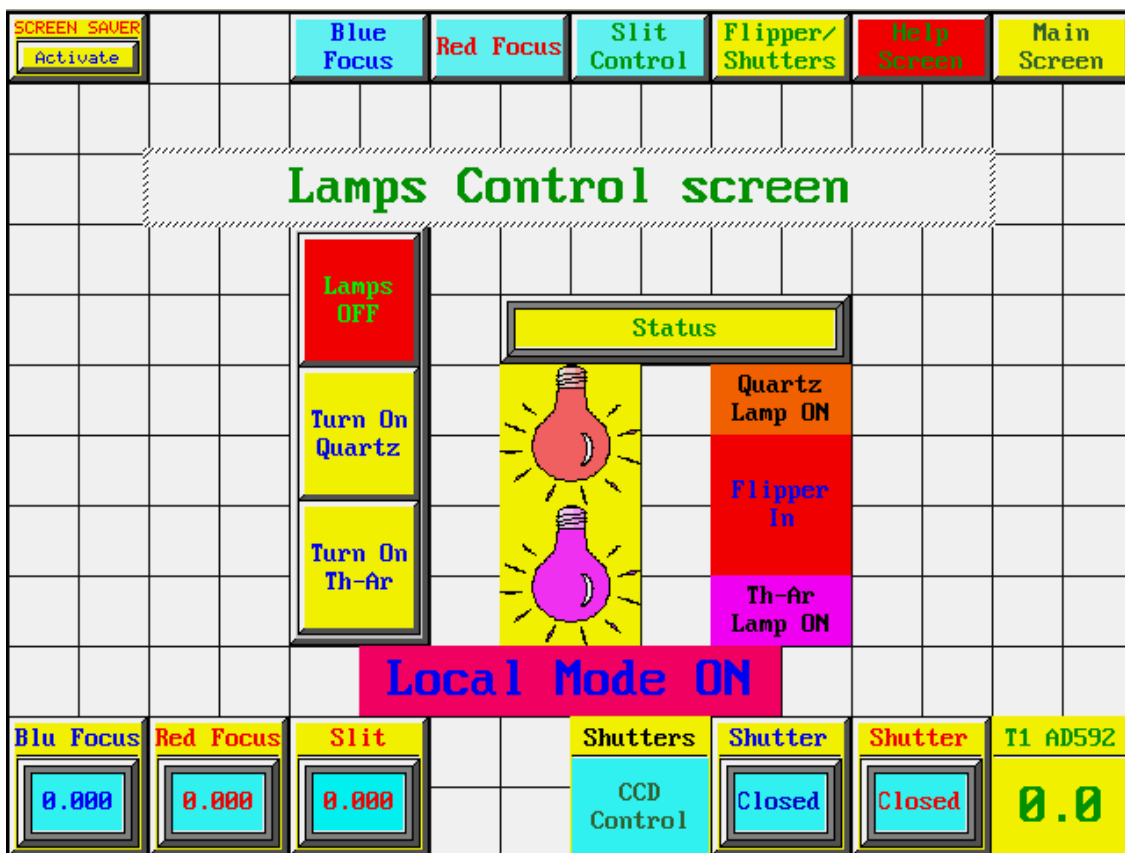


Figure 5. Lamps control screen.

Shutters / Flipper control screen.

This screen is accessed by pressing the 'Flipper / Shutters' pushbutton on the top row of the Lamps control screen. It was designed to be used by the Instrument specialists and Electronics. Besides allowing control of the Quartz and the Th-Ar lamps, it allows control of the Shutters and the Flip mirror (independent from lamps control).

Lamps control works the same way described for 'Lamps control screen'. Notice that both lamps cannot be on at the same time and that the flip mirror will still go automatically IN every time either lamp is turned ON.

Flipper control is to the right. You can take the flipper IN / OUT by pressing the 'Flipper Go In' pushbutton (its label will change to 'Flipper Go Out' while the flipper is IN. It is a toggle switch), but only while both lamps are off. Below the pushbutton you will see the current position of the flip mirror. Both pushbutton and status cells will be GREEN when the mirror is OUT, and will be RED when the mirror is IN.

Shutters control is on the center of the screen. By default, the shutters are controlled by the signals coming from their related CCD saddlebags (indicated as 'CCD Control' on the 'Status' cell. In order to take over the control of them, you have to press the 'Mode - Go Manual Control' toggle button. Once under manual control, you will be able to open / close the blue / red shutters individually by pressing the 'Press to open' toggle buttons accordingly (their labels change to 'Press to close' when shutters are open).

Don't forget to reestablish 'CCD control' of the shutters if you are taking images. Anyway, the default condition (CCD control) will be reestablished upon leaving this screen.

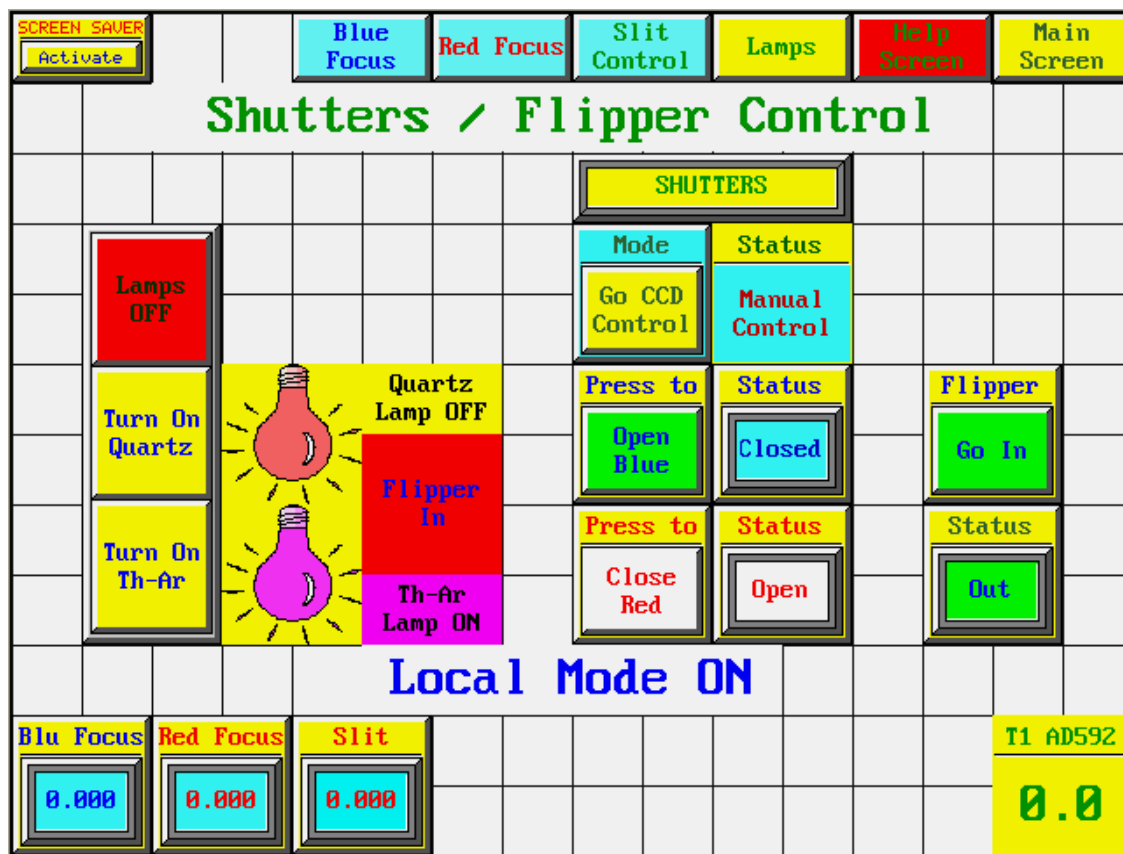


Figure 6. Shutters / Flipper control screen.

Help screen #1.

This is very straight forward. It contains mainly text intended to help the user understand the functions every screen is able to perform.

Notice that on the top row, the second 'exit door' from the right takes you to screen 'Help #2'. More important, the first 'exit door' to the left takes you to the focus Sequence screen (specially designed for Instrument Specialists).

		Focus Sequence	Blue Focus	Red Focus	Slit Control	Lamps Shutters	Help 2	Main Screen
Remote Mode (from the control room using this touchpanel).								
It allows the user to control / monitor all the mechanisms of the instrument. Touchpanel and PLC communicate through a crossed Ethernet cable (No network involved), which has been installed on the Patch Panel (equipment room) for connecting outlets #44 (NASE platform) and #22 (Control room).								
Description of screens.								
The top row of each screen allow access to the other screens, by pressing the related cells. The status of the mechanisms not related to the screen and the temperature inside the instrument are displayed on the bottom row. All the active outputs are disabled when leaving a screen.								
1. Main screen appears upon PLC power-up. It shows the user all the current status of the instrument. Pressing the proper cell, you can access to specific screens, which will allow you to control the related mechanisms. Here you can also adjust the screen's contrast.								
2. Slit and Blue/Red Focus screens have the same functions. Left switch enables 'Manual', 'Table' or 'Go to' modes (only one can be active, Manual is default). Manual mode: Pressing 'Go Forward' / 'Go reverse' moves the device accordingly. Table mode: Pressing the 'Select' cell brings up a numeric entry keypad. There you set the number of the position wanted for the device (according to a table). Target position is on the center of the screen and changes according to previous selection. Current position is on the right. The device moves until current position reaches target position within a tolerance range. 'Go to' mode: Works the same way described above. Pressing 'Type in wanted' brings up other entry keypad. You enter an 'analog' position, which is reached.								

Figure 7. Help screen #1.

Help screen #2.

This is very straight forward. It contains mainly text intended to help the user understand the functions every screen is able to perform.

Notice that on the top row, the second 'exit door' from the right takes you to screen 'Help #3', and that the first one to the left takes you back to screen 'Help #1'.

		Back to Help 1	Blue Focus	Red Focus	Slit Control	Lamps Shutters	Help 3	Main Screen
<p>4. Lamps screen is oriented to the observers. The switch at the left allows Quartz / Th-Ar lamps to be turned ON (only one at a time) or OFF (top cell). The rest of the screen shows the lamps' status, as well as the flip mirror status. Reach control of Shutters/Flipper by pressing the proper cell on the top row.</p>								
<p>5. Shutters / Flipper screen: The upper left cell enables manual / CCD control of the shutters (CCD is default). In Manual, the middle and lower left cells Open/Close the Blue/Red shutters respectively. The cells beside the mentioned ones show the current status of the related devices. On the right, the top cell allows moving the Flip mirror IN/OUT, and the bottom one shows its status.</p>								
<p>6. Focus sequence screen: Designed specially for Instrument Specialists. It is reached through the related cell on the top row of the 'Help' screen. A switch on top allows enabling 'Table' mode of Blue/Red Focus (only one at a time), or disabling both (left cell). Table mode is described on 'Help' screen. Control of the Th-Ar lamp is at the right of the screen, as well as the status of the lamp and the Flipper.</p>								
<p>A graph of the temperature inside the instrument is shown on the lower left of the screen.</p>								
<p>Please notice: Control of the instrument is taken over by the local controller (at the instrument) when 'Local' mode is enabled on it (pressing F1). Message 'Local Mode ON' is displayed on the lower area of all screens of the remote controller (touchpanel). You can change screens, but cannot control anything.</p>								
<p>Remote control is recovered when F1 is pressed on the local controller (message 'Local Mode On' disappears of touchpanel screens).</p>								

Figure 8. Help screen #2.

Help screen #3.

This screen is a rough description of the functions that can be performed by the local control unit (on the electronics control box, attached to the 'rear' of the instrument).

Notice that on the top row, the second 'exit door' from the right takes you to back to screen 'Help #2', and that the first one to the left takes you to screen 'Help #1'.

		Back to Help 1	Blue Focus	Red Focus	Slit Control	Lamps Shutters	Back to Help 2	Main Screen
<p>Local Mode. The controller is an EZ-428 panel (at instrument), press F1 for local control. From there, press:</p> <p>F2 for Shutters control F3 for Lamps (plus Flipper) control F4 for Slit control F5 for Focus mechanisms control</p> <p>Within Shutters control, F4 opens Blue shutter and F5 the Red one (both momentary). The ESC button takes you to 'local options'.</p> <p>Within Lamps control, F4 turns on the HCL and F5 the QL (both momentary)</p> <p>Within Slit control, the Up button moves it 'up' and the down button moves it 'down'. Press F5 for 'Steps' option. ESC for Local Options.</p> <p>Within Focus control, press F2 for Blue or F3 for Red. ESC for Local Options. For both mechanisms, Up and Dwn buttons are used the same way the work with the slit.</p> <p>In Blue focus control, press F3 to get to Red Focus control. F5 for 'Steps' option (Table mode). Press ESC for Local Options. In Red focus control, press F2 to get to Blue Focus control. F5 for 'Steps' option (Table mode). Press ESC for Local Options.</p>								

Figure 9. Help screen #3.

Focus sequence screen .

This screen was specially designed for the Instrument Specialist. Considering that for safety reasons all the devices and mechanisms are turned off upon leaving a screen, we needed one which contained all the necessary functions that are carried out during a focus sequence.

To the right of the center area, we have the control of the Th-Ar lamp. It works the same way as on the Lamps screen.

To the left of the center area, there is a tri-state switch which allows you to enable Blue or Red Focus mechanisms (only one at a time), or to disable both of them. Below that we have the Blue focus control, which works the same way the 'Table' mode works on the 'Blue Focus control' screen. And below that we have the Red focus control, which works the same way the 'Table' mode works on the 'Red Focus control' screen. Messages 'blue focus stuck' or 'red focus stuck' will only appear on screen when the related mechanism gets 'stuck' (already described for the slit control screen).

The graph to the left bottom corner of the screen shows the evolution of the temperature inside the instrument during the last 60 minutes. You can also scroll using its arrows and see how the temperature has evolved the last 4 hours. The bottom line has already been described on previous screen descriptions.

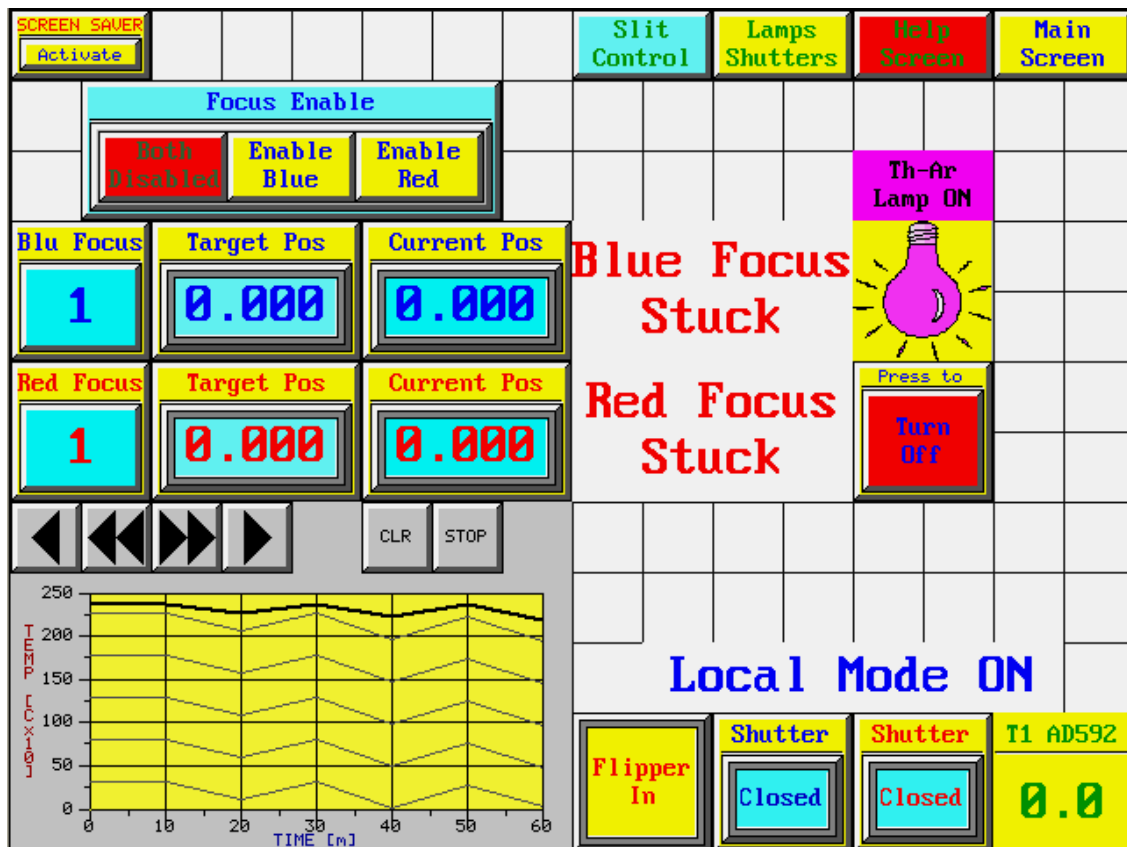


Figure 10. Focus sequence screen.

VI. Tables.

As the slit plate has 22 slits, the PLC has a table for keeping the positions of all of them. For the two focus mechanisms, I have created 20-position tables, with positions separated 4 units (actual 4mV) from each other for making the focus sequence easier to carry out. If the optimum calculated focus is not a value in the table, there is always the chance of getting there by using the 'Go to' mode. The values (positions) contained in the mentioned tables are the following:

Slit Table		
Position	Physical Slit	Value [V]
1	0.35 x 0.35	1.392
2	1.00 x 0.35	1.348
3	1.00 x 0.50	1.307
4	1.00 x 0.70	1.268
5	1.00 x 1.00	1.223
6	1.50 x 0.35	1.182
7	1.50 x 0.50	1.144
8	1.50 x 0.70	1.107
9	1.50 x 1.00	1.063
10	1.50 x 1.50	1.019
11	2.00 x 0.35	0.978
12	2.00 x 0.50	0.944
13	2.00 x 0.70	0.902
14	2.00 x 1.00	0.863
15	2.00 x 1.50	0.819
16	2.00 x 2.00	0.764
17	0.35 x 5.00	0.712
18	0.50 x 5.00	0.672
19	0.70 x 5.00	0.634
20	1.00 x 5.00	0.594
21	1.50 x 5.00	0.551
22	2.00 x 5.00	0.499
Minimum Physical limit		0.430
Minimum SW limit		0.440
Maximum SW limit		1.500

Blue Focus Table	
Position	Value [V]
1	1.124
2	1.128
3	1.132
4	1.136
5	1.140
6	1.144
7	1.148
8	1.152
9	1.156
10	1.160
11	1.164
12	1.168
13	1.172
14	1.176
15	1.180
16	1.184
17	1.188
18	1.192
19	1.196
20	1.200
Min SW limit	0.900
Max SW limit	1.450

Red Focus Table	
Position	Value [V]
1	1.024
2	1.028
3	1.032
4	1.036
5	1.040
6	1.044
7	1.048
8	1.052
9	1.056
10	1.060
11	1.064
12	1.068
13	1.072
14	1.076
15	1.080
16	1.084
17	1.088
18	1.092
19	1.096
20	1.100
Min SW limit	0.800
Max SW limit	1.350

NOTE: The table for the Slit positions was modified on July 2010, and it was updated on this manual on August 9th, 2010.

Patricio Jones (August 9^h, 2010).

VII. Local panel functions.

Local panel is able to perform the same functions described for the touch panel, with slight differences. The messages and instructions to the user are limited by the display of the Local panel (4 lines of 20 characters each, maximum).



Figure 11. Local control panel (showing remote mode screen).

On the picture above you see the local control panel. The white pushbuttons labeled F1 through F5 are the 'function buttons' used for selecting the different choices given by the program, which are detailed on the description of each 'screen'. The blue ones are 'control buttons' and their functions are also described throughout the rest of this manual, although they are very intuitive.

The function buttons F2 through F5 have been configured as temporary. The F1 function button was configured as alternate (AKA 'toggle'). Every time you press a pushbutton, the red LED on top of it will turn ON, so for the temporary buttons their LEDs will turn ON for a short time. For the alternate button, its LED will stay ON while the status of the button is ON, and stay OFF when its status is OFF.

The following is a detailed description of each 'screen' or set of messages on the panel display.

A. Messages on local panel's display.

A.1. Remote mode screen.

The panel is able to display two kind of messages, defined as 'local' messages and 'PLC' messages. 'Local' messages are the ones set by the panel itself, while 'remote' messages are triggered by the PLC. Every time the PLC triggers a message, the red LED of the panel labeled as 'PLC message' turns on and stays on until the user presses the 'ESC' button (pressing 'ESC' again will take you back to PLC messages if there still is one available).

This panel was programmed for having only one 'local' message, which is displayed while the instrument is controlled by the touch panel, and it shows the current status of the mechanisms of the instrument. This means that the local message is the default 'screen' which is displayed while the instrument is under 'Remote' control. This screen looks as below:

```
B1F b.bbb RdF r.rrr
Slit s.sss Temp tt.t
ThArLmp x  QLmp x
F1:On>Lcl Off>Remote
```

The top line shows the current position of the Blue Focus (to the left) and the current position of the Red Focus (to the right). The second line shows the current (analog) position of the Slit mechanism and the current temperature inside the instrument. The third line shows the status of the Th-Ar lamp (to the left) and the status of the Quartz lamp (to the right), where x is 0 for 'LAMP OFF' and 1 for 'LAMP ON'.

The bottom line contains instructions: Its text means that when F1 is ON the instrument is under local control, and when F1 is OFF, is under remote control (touch panel). F1 is a toggle pushbutton (below the display) and a red LED tells you whether is ON or OFF.

Going into local control mode (F1 ON) makes the PLC to take over the panel screen, so the 'PLC message' LED will stay ON until remote mode is restored (F1 OFF).

A.2. 'Going back to remote mode' screen.

As already explained, to leave local mode you press F1 while its LED is ON. When F1 is OFF the system is under Remote mode. Along with that, a message screen is displayed to help the user understand what is going on.

```
This is REMOTE MODE
(F1 LED is OFF)
Press ESC button for
remote mode display
```

As indicated on the lower two lines, you have to press the ESC pushbutton to take the panel back to the 'remote mode screen' or display.

B. Local mode screens.

B.1. Local Options screen.

The first screen that shows up upon going into local mode is also known as 'Local Options', and it is shown below. It tells the user that systems is in local mode (top line). Press: F2 to get to the shutters control screen, F3 to get to the Lamps control screen, F4 for the Slit control screen, and F5 for the Focus control screen.

```
Local mode: Select
F2 Shutters F3 Lamps
F4 Slit F5 Focus
```

B.2. Shutters control screen.

From here, pressing F4 will temporarily open the Blue Shutter (while F4 is being pressed), and pressing F5 will do the same to the Red Shutter (There is no feedback for the shutters status, although you can hear them opening and closing). Press F3 to get to the Lamps control screen. Press ESC to go back to the 'Local Options' screen (above).

```
Shutter contl: Press
F4>Opn Bl F5>Opn Rd
F3> Lamps Control
ESC> Local Options
```

B.3. Lamps control screen.

Pressing F4 will temporarily turn ON the Th-Ar lamp, and pressing F5 will temporarily turn ON the Quartz lamp. The third line shows the status of the lamps, where x is 0 for 'LAMP OFF' and 1 for 'LAMP ON'. Press F2 if you want to get to the Shutters control screen. Press ESC to go back to the 'Local Options' screen.

```
Lamps control: Press
F4>ON-ThAr F5>ON-QL
Status ThArL x QL x
F2>Shutters ESC>Optn
```

B.4 Slit control screen (manual mode).

You get to this screen by pressing F4 on the 'Local Options' screen. It allows 'Manual' control of the slit mechanism. Pressing the UP pushbutton will move the mechanism towards upper analog values, and pressing the DOWN pushbutton will move the mechanism towards lower analog values. The range of movement is limited by software to 0.440V (lower limit) and 1.500V (upper limit). The physical lower limit for the mechanism is 0.430V. Remember that the analog values are not the slit positions (see the Slit positions table). In the third line you can see the current (analog) position of the mechanism. Press F5 if you want to move the Slit mechanism using the 'Table' mode. Press ESC to go back to the 'Local Options' screen.

```
Slit control: Press
^ Up    v Dwn
Slit x.xxx F5=>Steps
ESC> Local Options
```

B.5. Slit control screen (Table mode).

You get to this screen by pressing F5 on the 'Slit control (manual mode)' screen. It allows you to move the Slit mechanism using the 'Table' mode, which is quite similar to the 'Table (Steps)' mode of the touch panel. The second line shows the analog Target position for the table position selected (on the third line) and the current analog position of the mechanism.

In order to move the mechanism, you have to place the display's blinking cursor on the third line by using the UP / DOWN pushbuttons. Once there, pressing the ENTER button will make the cursor to appear over the slit table position wanted (showed as xx to the right end of the line), allowing you to change the wanted position by using the UP and DOWN buttons (press ENTER to validate you new choice). The 'target' position (second line) will change according to the selected position (see the Slit positions table) and the mechanism will consequently move up or down until the 'current' value reaches the 'target' value (be patience, this process may take a while). The wanted position value of the third line is limited between 1 and 22, according to the table.

Press F4 if you want to go back to the Slit 'Manual mode' screen. Press ESC to go to the 'Local Options' screen.

```
Local Slit (Steps)
Trgt x.xxx Cur x.xxx
Go to Slit Pos#xx
F4>Lcl Slit ESC>Optns
```

B.6 Local Focus selection screen.

You get to this screen by pressing F5 on the 'Local Options' screen. Press F2 or F3 if you want to move the Blue or the Red Focus mechanism respectively. Press ESC to go back to the 'Local Options' screen.

```
Local Focus: Select
F2>Blue F F3>Red F

ESC> Local Options
```

B.7 Blue Focus control screen (manual mode).

You get to this screen by pressing F2 on the 'Local Focus selection' screen or by pressing F2 on the Red Focus control (manual mode) screen. It allows 'Manual' control of the blue focus mechanism. The second line shows you the current analog position of the mechanism. Pressing the UP pushbutton will move the mechanism towards upper analog values, and pressing the DOWN pushbutton will move the mechanism towards lower analog values. The range of movement is limited by software to 0.900V (lower limit) and 1.450V (upper limit). Press F5 if you want to move the blue focus mechanism using the 'Table' mode. Press F3 if you want to get to the Red Focus control screen (manual mode). Press ESC to go back to the 'Local Options' screen.

```
Local Blue Focus
Bl F x.xxx ^Up vDwn
F3>Rd Focus F5>Steps
ESC> Local Options
```

B.8. Blue Focus control screen (Table mode).

You get to this screen by pressing F5 on the 'Blue Focus control (manual mode)' screen. It allows you to move the blue focus mechanism using the 'Table' mode, which is quite similar to the 'Table (Steps)' mode of the touch panel. The second line shows the analog Target position for the table position selected (on the third line) and the current analog position of the mechanism.

In order to move the mechanism, you have to place the display's blinking cursor on the third line by using the Up / DOWN pushbuttons. Once there, pressing the ENTER button will make the cursor to appear over the slit table position wanted (showed as xx to the right end of the line), allowing you to change the wanted position by using the UP and DOWN buttons (press ENTER to validate you new choice). The 'target' position (second line) will change according to the selected position (see the Slit positions table) and the mechanism will consequently move up or down until the 'current' value reaches the 'target' value (be patience, this process may take a while). The wanted position value of the third line is limited between 1 and 20, according to the table.

Press F2 if you want to go back to the blue focus 'Manual mode' screen. Press ESC to go to the 'Local Options' screen.

```
Lcl Blue Foc (Steps)
Trgt x.xxx Cur x.xxx
Go to Bl Foc Pos#xx
F2>Bl Foc ESC>Lcl Op
```

B.9 Red Focus control screen (manual mode).

You get to this screen by pressing F3 on the 'Local Focus selection' screen or by pressing F3 on the Blue Focus control (manual mode) screen. It allows 'Manual' control of the red focus mechanism. The second line shows you the current analog position of the mechanism. Pressing the UP pushbutton will move the mechanism towards upper analog values, and pressing the DOWN pushbutton will move the mechanism towards lower analog values. The range of movement is limited by software to 0.800V (lower limit) and 1.350V (upper limit). Press F5 if you want to move the red focus mechanism using the 'Table' mode. Press F2 if you want to get to the Blue Focus control screen (manual mode). Press ESC to go back to the 'Local Options' screen.

```
Local Red Focus
Rd F x.xxx ^Up vDwn
F2>B1 Focus F5>Steps
ESC> Local Options
```

B.10. Red Focus control screen (Table mode).

You get to this screen by pressing F5 on the 'Red Focus control (manual mode)' screen. It allows you to move the red focus mechanism using the 'Table' mode, which is quite similar to the 'Table (Steps)' mode of the touch panel. The second line shows the analog Target position for the table position selected (on the third line) and the current analog position of the mechanism.

In order to move the mechanism, you have to place the display's blinking cursor on the third line by using the Up / DOWN pushbuttons. Once there, pressing the ENTER button will make the cursor to appear over the slit table position wanted (showed as xx to the right end of the line), allowing you to change the wanted position by using the UP and DOWN buttons (press ENTER to validate you new choice). The 'target' position (second line) will change according to the selected position (see the Slit positions table) and the mechanism will consequently move up or down until the 'current' value reaches the 'target' value (be patience, this process may take a while). The wanted position value of the third line is limited between 1 and 20, according to the table.

Press F3 if you want to go back to the red focus 'Manual mode' screen. Press ESC to go to the 'Local Options' screen.

```
Lcl Red Foc (Steps)
Trgt x.xxx Cur x.xxx
Go to Rd Foc Pos#xx
F3>Rd Foc ESC>Lcl Op
```

B.11. Other screens.

You might have already noticed that on almost every screen, the ESC pushbutton takes you to the 'Local Options' screen. During the development of the control system I realized that sometimes the local panel takes a while before processing that the ESC pushbutton has been pressed. That is why I included a 'Please wait...' message. It means that you need to refrain from pressing the same button again or other button if you feel like 'nothing is going on'.

```
Please Wait...
```

You might have already noticed that on almost every screen, the ESC pushbutton takes you to the 'Local Options' screen. During the development of the control system I realized that sometimes the local panel takes a while before processing that the ESC pushbutton has been pressed. That is why I included a 'Please wait...' message. It means that you need to refrain from pressing the same button again or other button if you feel like 'nothing is going on'.