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# Telescopio Nazionale Galileo

## HARPS-N LCU Manual

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Draft Manual version 1.1  
TNG-MAN-HARPN-0004  
Date: 20-04-2022

Prepared

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## 1 Introduction

### 1.1 Scope

This Manual is intended to give all necessary information to potential users of the HARPS-N instrument, to help them to use the HARPSN LCU.

The following documents are closely related to this manual and should be consulted as well:

- The HARPS-N User Manual (TNG-MAN-HARPN-0002)
- The HARPS-N Operational Guide (TNG-MAN-HARPN-0003)
- The HARPS-N Startup Manual (TNG-MAN-HARPN-0001)
- The New Short Term Scheduler User Manual (NSTS)
- The DRS User Manual (OG-MAN-HAN-13-0004)

Both are available through the TNG web page

<http://www.tng.iac.es/instruments/harps/>

### 1.2 Additional information

The latest information updates about the HARPS-N instrument can be found on the HARPS-N web pages

<http://www.tng.iac.es/instruments/harps/>

### 1.3 Contact information

Feedback on this User Manual from users is encouraged. Please email to [cosentino@tng.iac.es](mailto:cosentino@tng.iac.es)

### 1.4 Reference documents

- [RD01] [HARPS-N User Manual](#)
- [RD02] [HARPS-N Quick Start Guide](#)
- [RD03] [HARPS-N Operational Guide](#)
- [RD04] [New Short Term Scheduler User Manual \(NSTS\)](#)
- [RD05] [DRS User Manual](#)
- [RD06] [Ucam User manual](#)
- [RD07] [Templates Reference Guide](#)
- [RD08] [Thorium-Argon Atlas](#)
- [RD09] [Design of the LCU for HARPS-N](#)

## 2 The LCU (hardware)

The LCU software is a LabView module which controls the movements and settings of the calibration **unit** and the **front end unit** in order to configure the instrument to the desired layout.

This software can also control the units in stand-alone mode as an engineering interface or by the HARPS-N sequencer using an HTTP connection with REST API interface.

### 2.1 Calibration Unit (CU)

The calibration unit contains the lamps and the power supply and provides the reference source (thorium, tungsten) for the FEU. Two external high-precision references are included. The first is already available and consists of a Fabry-Perot interferometer. The second one, a stabilized laser-frequency comb, is currently under development and will become available in 2013. The CU is connected via two optical fibres to the FEU which redirects the light of the calibration sources into the spectrograph fibres as required. The two calibration fibres can be fed either by the same or independently by two different calibration sources. Of the two Thorium-Argon lamps, the lamp THAR1 is the absolute reference, and its use should be minimized. Typically it is used for 5 minutes per day during the afternoon calibrations, shining on "fibre A". The lamp named "THAR2" is used to measure the instrument drift in parallel with the science observations. The lamp can be switched on at any moment. It is particularly useful when one of the other lamps burns out in the course of the night.

The HARPS-N Calibration Unit has two linear mechanisms to move the reference fibers between 5 positions. Three of the positions have lamps, two of which are Thorium-Argon hollow cathode lamps while the other one is a filament halogen lamp. The other two positions are used for ultra-stable external references which can be fed through an optical fiber connection. At the moment one of these positions hosts the Fabry-Perot interferometer, located in the HARPS-N cabinet, close to the spectrograph.

Table 1 - CU components

Movement/component	Description
Thorium lamps 1 and 2	The Thorium Argon lamps are type 4160AHP from S&J Juniper & Co.
Halogen lamp	The halogen lamp is a type 6337 (TBC) Quartz Tungsten Halogen bulb from Newport
Fabry-Perot	The FP interferometer is located close to the spectrograph

### 2.2 Front End Unit (FEU)

The FEU is the first part of the spectrograph where the incoming light from the telescope and from the calibration unit is conditioned and collimated in the fibers. In this stage the incoming beam from the telescope is corrected by the atmosphere dispersion corrector (ADC). The star is maintained in the fiber thanks to the tip-tilt mirror acting together with the autoguider system. The folding mirror selects which object/reference configuration has to be put into the fibers. The optical scheme in **Error! Reference source not found.** shows the optical path inside the FEU and the main components.

Table 2 - FEU components

Movement/component	Description
Calibration fold mirror	linear mechanism with 4 fixed positions
Dust Cover	linear mechanism with two positions (open/close)
Guide camera	FLI PL47-20 (TBC). Connection to the LCU in the control rack is via USB
Guide camera ND filter	Two rotating wheels, with three filters and a transparent glass each, producing attenuation density from 0 to 6 (factor 1 to 1'000'000)
Calibration ND filter	Two rotating wheels with unconstrained motion (can be set to any position in 360 deg). Attenuation range of 1 to 300.

ADC prism	Two atmospheric density compensation prisms with unconstrained motion
Tip-tilt mirror	Precision piezo motor and strain gauge position sensors

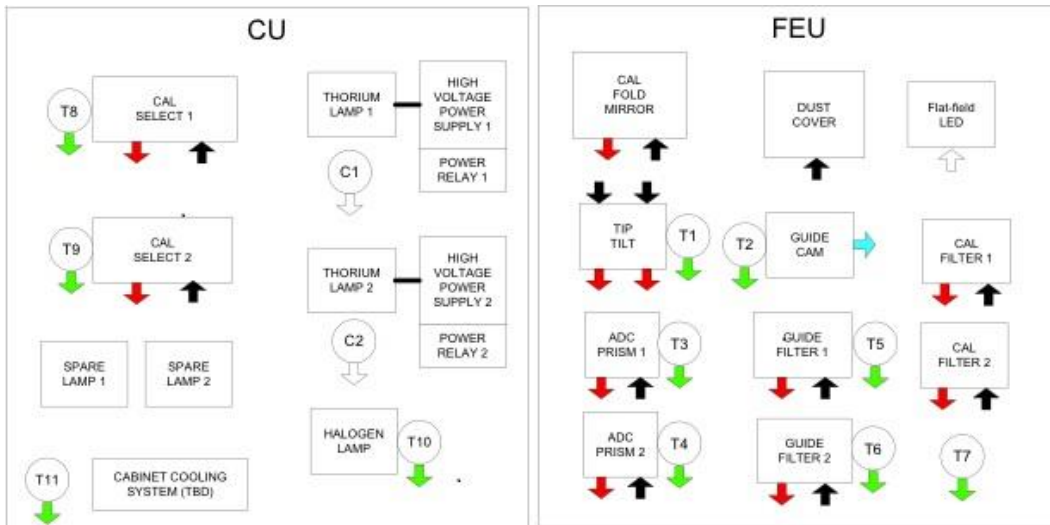


Figure 1 - Calibration and Front End Unit

### 3 The LCU (software)

#### 3.1 The Front End and Calibration Unit (LCU) Start-up

The software used to operate with the FEU runs on a Windows PC that is located in Nasmyth B, in a rack close to the Calibration Unit. The user will interact with the FEU software by a remote connection from a linux machine.

In order to connect to FEU computer and start the LabView software, is necessary to open a remote desktop connection (from the **wsoper** workstation located in the control room):

- a) Click on the **HarpsNLCU icon** (Figure 2), or open a shell from any linux machine and type:  
`rdesktop -T LCU 161.72.92.20 -g89%`  
 This will start the remote connection with the FEU PC.

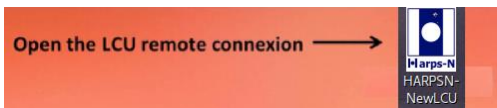


Figure 2 - WSOPER workstation desktop

- b) Start the control software by clicking the icons corresponding to the control (Figure 3):



Figure 3 - FEU desktop screenshot

The LCU GUI starts and appears as shown in Figure 4. The LCU GUI is made up by three parts:

1. The Device status frame
2. The control system frame
3. The log report frame

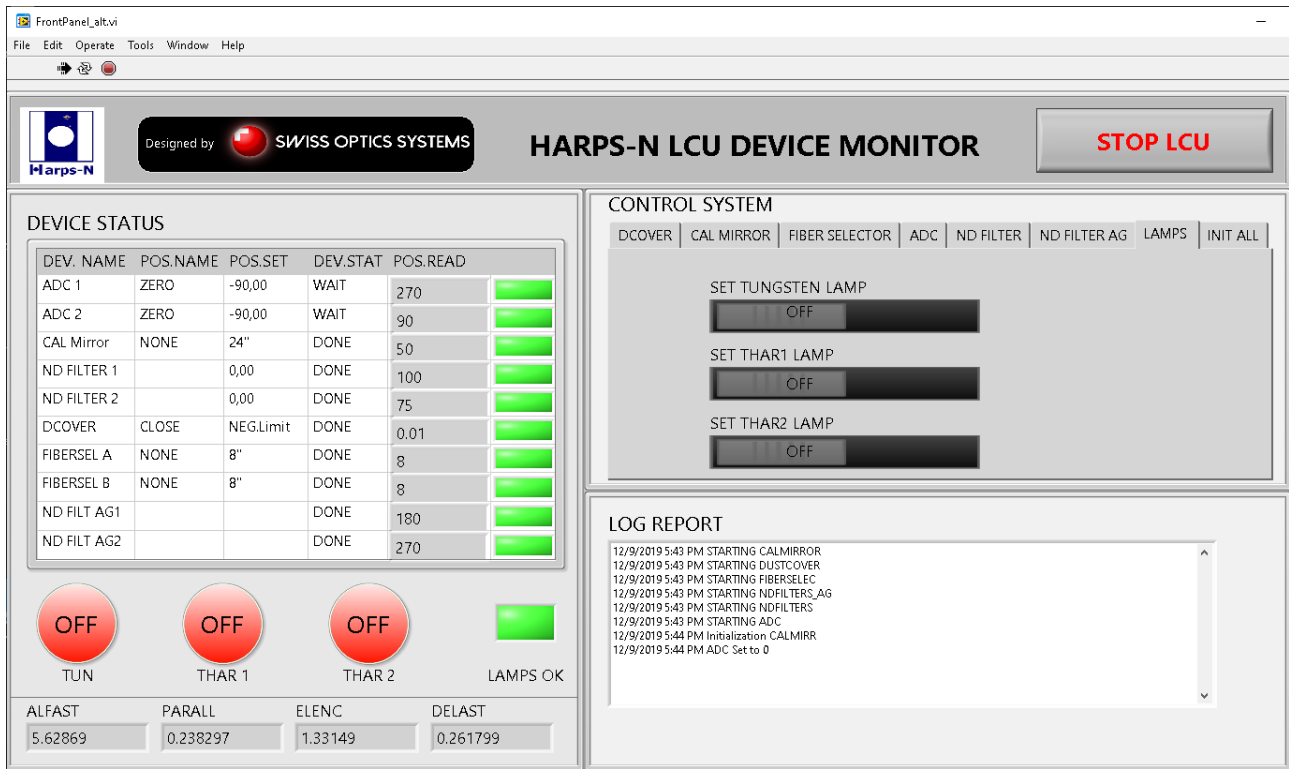


Figure 4 - HARPS-N LCU device monitor

### 3.2 Device status frame

In the DEVICE STATUS frame are shown the configuration of the LCU and some telemetry variables.

The first group of values represents the status of the devices.

- DEV.NAME is the mnemonic name of the device
- POS.NAME is the name of the position selected
- POS.SET is the selected position
- DEV.STAT is the status of the device
- POS.READ is the position (in count) read by the encoder
- The last indicator is a colour associated with the device (ready,standby,not-ready)

The second group show some telemetry values of the TCS:

- ALFAST
- PARALL
- ELENC
- DELAST

The circular buttons show the status of the lamps (ON/OFF)

To stop the LCU and close the program click on the **Stop LCU** button and then close the window.

### 3.3 The control system frame

The control system frame allows the operator to turn on the motors and to initialize each devices of the LCU separately. When a device is selected in the **menu tabs** the frame show the actions available for each device. The two buttons **POWER** and **INITIALIZE** are present for all the devices (except for the lamps control).

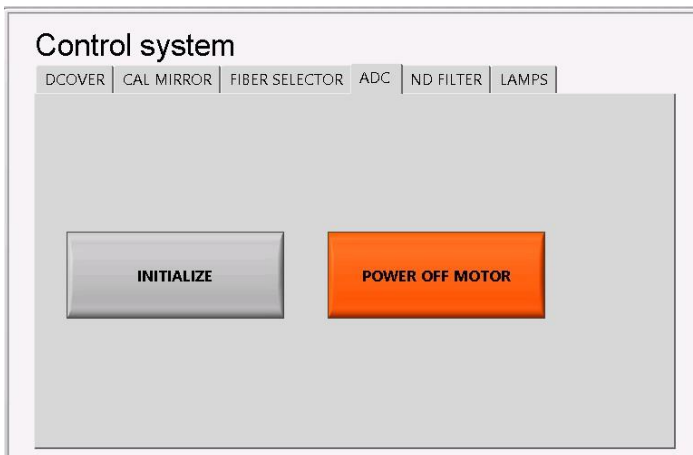


Figure 5 - power and initialization frame

### 3.3.1 Power and initialize procedures

The start-up procedures for the LCU consist in:

1. Select the device in the control system menu tab
2. Click on the **Initialize** button and wait until the button of the corresponding device in the device status frame turn to green.

### 3.3.2 Devices operation description

The devices selectable in the menu bar are:

- DCOVER (dust cover)
- CAL MIRROR (calibration mirror)
- FIBER SELECTOR
- ADC
- ND FILTER (neutral density filter)
- LAMPS

#### 3.3.2.1 Dust cover

The operations allowed for the dust cover are:

1. Initialize
2. Open/close the dust cover

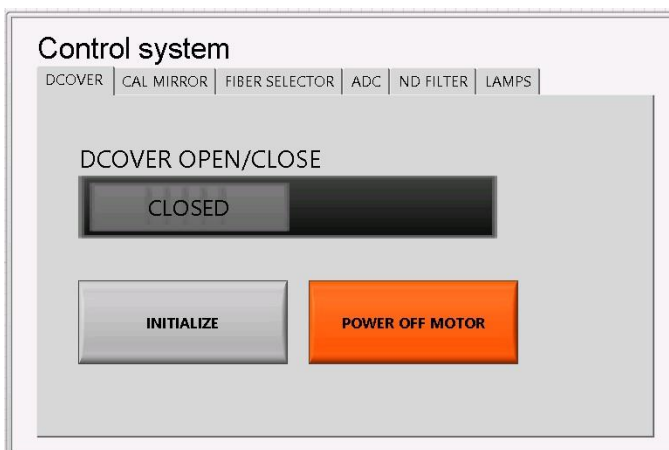


Figure 6 - Control system - Dust Cover

#### 3.3.2.2 Calibration Mirror

The operations allowed for the calibration mirror are:

1. Initialize
3. Select the calibration mirror position



- NONE
- FIBA
- FIBB
- BOTH

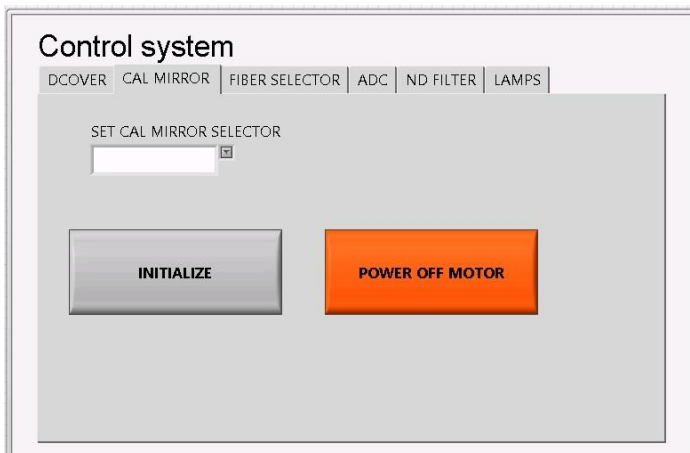


Figure 7 - Control system - Calibration mirror

### 3.3.2.3 Fiber selector

The operations allowed for the fiber selector are:

1. Initialize
2. Select the fiber position for each fiber
  - NONE
  - TUN
  - THAR1
  - THAR2
  - FP
  - COMB

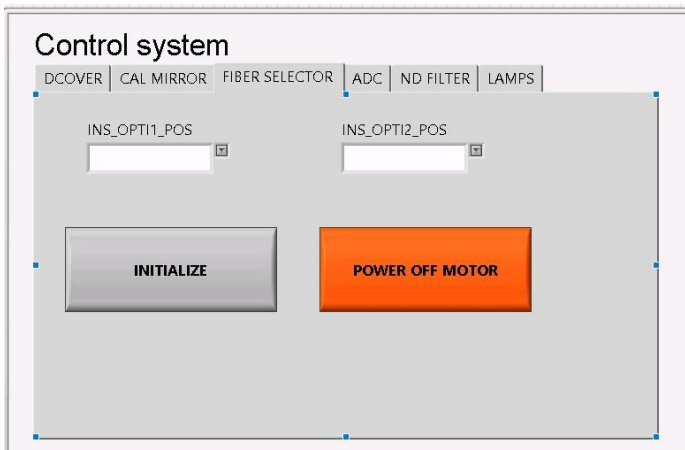


Figure 8 - Control system - Fiber selector

### 3.3.2.4 ADC

The operations allowed for the ADC are:

1. Initialize

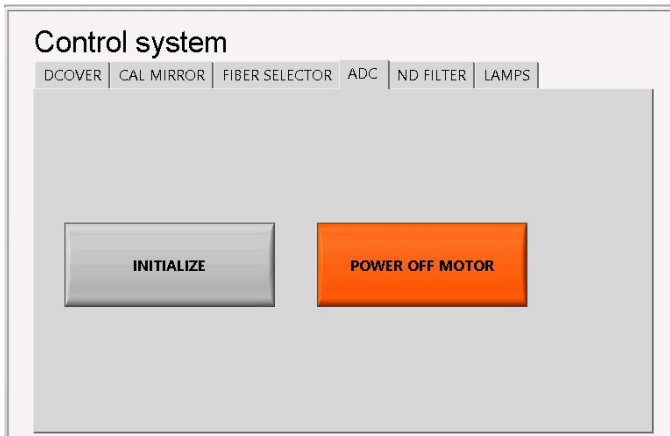


Figure 9 - Control system - ADC

### 3.3.2.5 ND filter

The operations allowed for the ND filter are:

1. Initialize
2. Set the ND position for each filter (0-3)

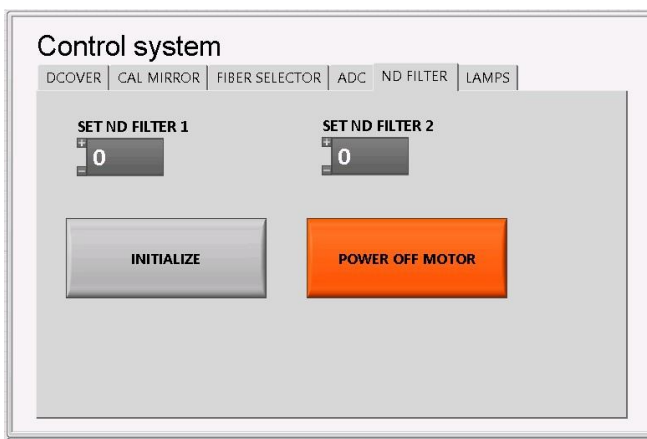


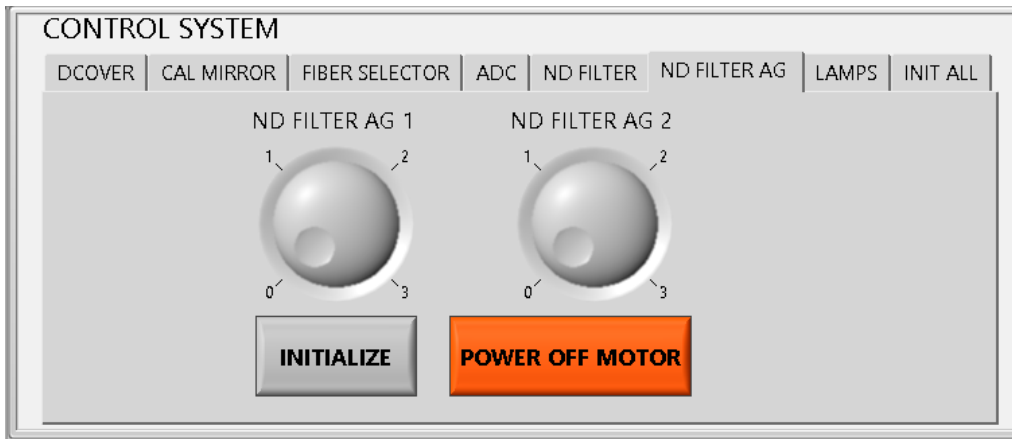
Figure 10 - Control system - ND filter

### 3.3.2.6 AG ND filter

The operations allowed for the AG ND filter are:

3. Initialize

#### 4. Set the ND position for each filter (0-3)



#### 3.3.2.7 LAMPS

The operations allowed for the lamps selector are the Ignition and shutdown of the lamps.

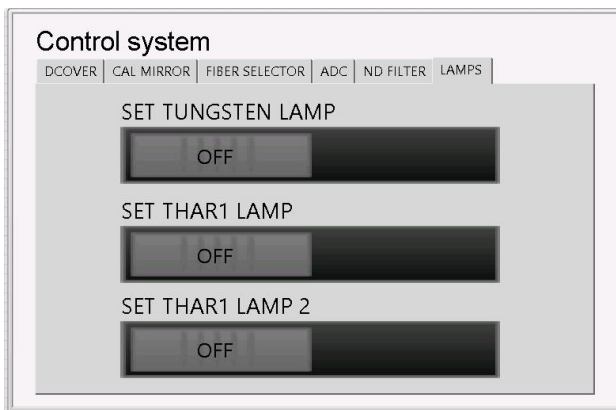


Figure 11 - Control system - Lamps

#### 3.3.2.8 Init ALL

This button initializes all the LCU motors.

### 3.4 The log report frame

In this frame are automatically visualized and time stamped all the relevant events of the LCU unit. At the same time a log file is generated and stored in the system.

## Appendix D – List of acronyms

ADC	Atmospheric Dispersion Compensator
AG	Auto-Guider
CCD	Charge Coupled Device
CU	Calibration Unit
DFS	Data Flow System
DRS	Data Reduction Software
E2DS	Extracted 2-Dimensional Spectrum
ETC	Exposure Time Calculator
FEU	Front End Unit
FITS	Flexible Image Transport System
FWHM	Full Width at Half Maximum

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HARPS-N	High Accuracy Radial velocity Planet Searcher in the North hemisphere
ND	Neutral Density
NSTS	New Short Time Scheduler
OB	Observing Block
RV	Radial Velocity
SA	Support Astronomer
SNR	Signal to Noise Ratio
TBC	To Be Confirmed
TBD	To Be defined
TBF	To be fixex
ThAr	Thorium Argon
TNG	Telescopio Nazionale Galileo
TO	Telescope Operator
VA	Visiting Astronomer