

OPERATING MANUAL

HD30.1

Spectroradiometer
Data logger



EN
V2.0



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1 Introduction



Fig. 1.1: data logger-indicator HD30.1



Fig. 1.2: measuring probe HD30.S1

The data logger-indicator, running Linux operating system, handles data processing and management. It has a large color touchscreen display, ensuring easy execution, display and logging of measurements.

Spectra and derived quantities can be saved both into internal (150MB) and external memory (micro SD-card¹ or USB device).

The export format is compatible with the most common programs for data analysis and processing. In addition to data storage, the software allows saving graph images.

The main quantities of photo-radiometric interest are directly calculated by the HD30.1 through the supplied software.

The analyzed spectral range varies according to the used measuring probe:

Visible Spectral Region (380nm-780nm) with the HD30.S1 probe,

Ultraviolet Spectral Region (220nm-400nm) with the HD30.S2 probe.

Measuring probes are interchangeable and calibrated (the calibration file is stored inside each probe).

The probe HD30.S1 analyzes the visible spectral region (380nm-780nm) and calculates the following photo-colorimetric quantities: **Illuminance** [lux], **Correlated Color Temperature CCT** [K], **Trichromatic Coordinates** [x,y] (CIE 1931) or [u',v'] (CIE1978), **CRI** (color rendering index, R1...R14, Ra) , **PAR** [μmolphot/sm²] (Fig. 1.3).

¹ Operation is guaranteed only on products supplied by Senseca.

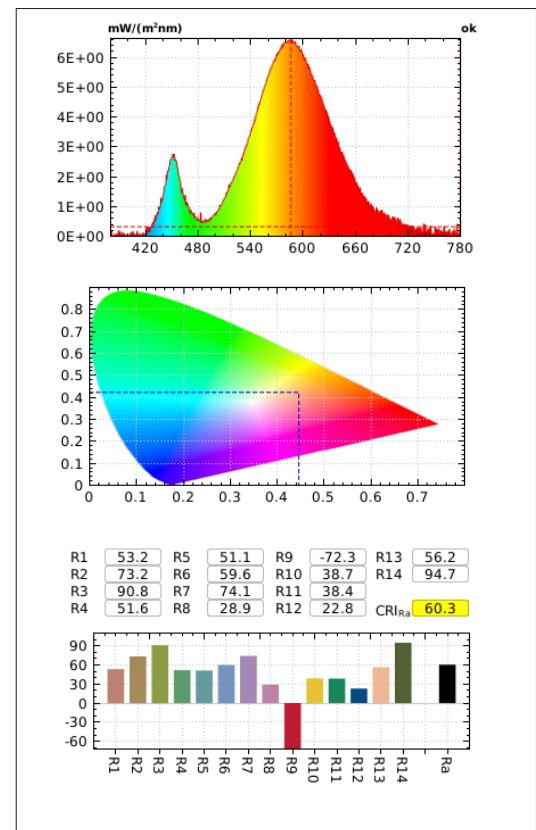
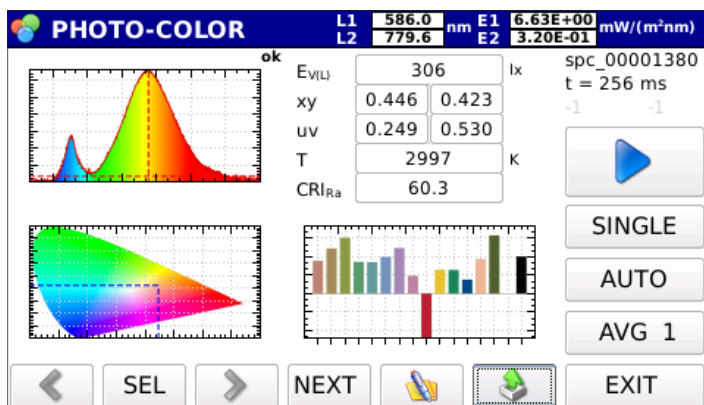


Fig. 1.3: photo-colorimetric quantities

The probe HD30.S2 analyzes the ultraviolet spectral region (220nm-400nm) and calculates the following radiometric quantities: **UVA Irradiance** (W/m²), **UVB Irradiance** (W/m²) and **UVC Irradiance** (W/m²) (Fig. 1.4).

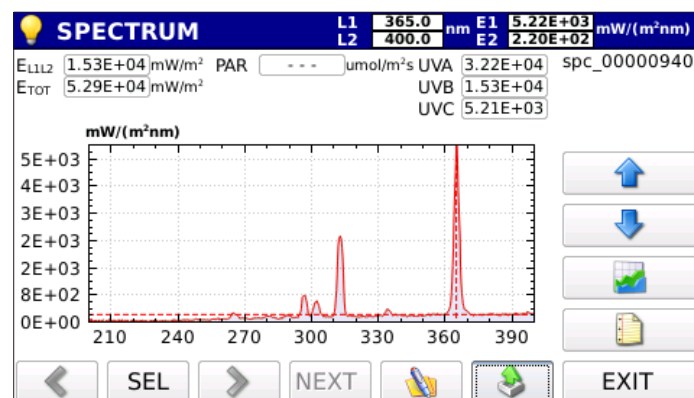


Fig. 1.4: radiometric quantities

Both sensors have a view of the input equipped with a new generation diffuser which allows optimizing the response according to the cosine law and not introducing any spectral deformation. Data concerning the calibration of the probe are stored in non-volatile memory and are read by the indicator.

2 Technical specifications

	HD30.1 +HD30.S1	HD30.1 + HD30.S2
Sensor	Linear CCD (2048 elements)	
Spectral Range	380 nm – 780 nm	220 nm – 400 nm
Type of Spectrometer	Based on transmission diffraction grating	
Numerical Aperture	0.16	
Input Slit	125 μ m	70 μ m
Pass band	4.5 nm	2.5 nm
Wavelength Accuracy	0.3 nm	
Wavelength reproducibility	0.1 nm	
Integration Time	From 1 ms to 4 s	
Integration Mode	Automatic/manual	
Stray Light	<0.03%	
Measuring Mode	Spectral Irradiance, Irradiance, Illuminance [lux], PAR, Proximal Color Temperature, CIE 1931 (x,y) & CIE 1976 (u',v') Trichromatic Coordinates ,CRI, Spectral Transmittance	Spectral Irradiance, UV Irradiance, UVB Irradiance, UVC Irradiance, Spectral Transmittance
Measurement typology	Single , single acquisition with data storage Continuous , continuous acquisition with data storage Monitor , continuous acquisition without data storage Logging , acquisition at set time intervals (3 to 60 min) with data storage	
Input optics dimensions (quartz diffuser)	Φ 11.8 mm	
Cosine Correction	Opaline quartz diffuser (3 mm)	Opaline quartz diffuser (2 mm)
Calibration	Halogen Lamp	Deuterium Lamp
Range of use	Illuminance 5-70.000 lux	
Incertitude	Spectral Irradiance $\pm 5\%$ Illuminance $\pm 4\%$ PAR $\pm 4\%$ CCT $\pm 45K$ x,y ± 0.002 CRI ± 1.5	Spectral Irradiance $\pm 15\%$ UV Irradiance $\pm 6\%$ UVB Irradiance $\pm 8\%$ UVC Irradiance $\pm 10\%$
Operating system	Linux	
Display	4.3" touch screen (480x272 pixel)	
Data Storage	Internal (150 MB) , micro SD card, USB device (option)	
PC Connection	Through Ethernet cable, through mini USB connector	
Power Supply	Rechargeable lithium battery or external power supply SWD05 + CP30 cable.	

	HD30.1 +HD30.S1	HD30.1 + HD30.S2
Exported Data Format	Compatible with the more well-known data management/analysis software	
HD30.1 dimensions/weight	135 x 156 x H 42 mm / 440 g	
Probe dimensions/weight	75 x 150 x H 74 mm / 370 g, cable length 1.5 m	
HD30.1 housing material	ABS	
Operating temperature	0...40 °C	
Update	Automatic via Internet	

3 Commissioning

The instrument is delivered with disconnected battery pack inside the battery compartment.



Fig. 2.1: battery compartment

To connect the battery pack, proceed as follows:

- 1- Remove the cover of the battery compartment (Fig. 2.1).
- 2- Remove the battery pack from the compartment (Fig. 2.2).



Fig. 2.2: battery removed from compartment

3- Plug the battery pack connector to the HD30.1 device (Fig. 2.3).



Fig. 2.3: instrument battery connector

4- Replace the batteries into the battery compartment and close the cover.

5- Switch the device on with the on/off switch (Fig. 2.4).

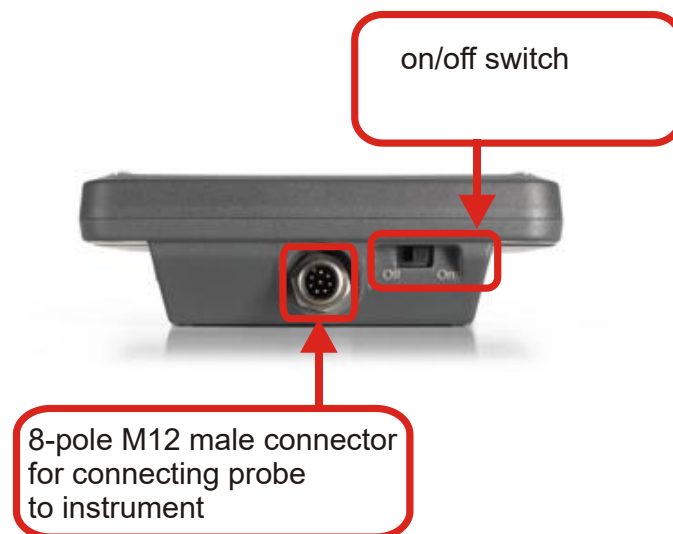


Fig. 2.4: On/Off switch and probe connector

The instrument operates both with the battery and the external power supply (if external power supply is used, the battery must be installed into the instrument).

The instrument is connected to HD30.S1 or HD30.S2 probes through a cable. Connect the probes to the 8-pole male M12 connector located next to the ON/OFF switch (Fig. 2.4).

The instrument is equipped with ports for connection to the network and for the use of memory devices (μ SD card and USB devices) shown in figure 2.5 and 2.6 (in Fig. 2.6 an unused connector also appears).

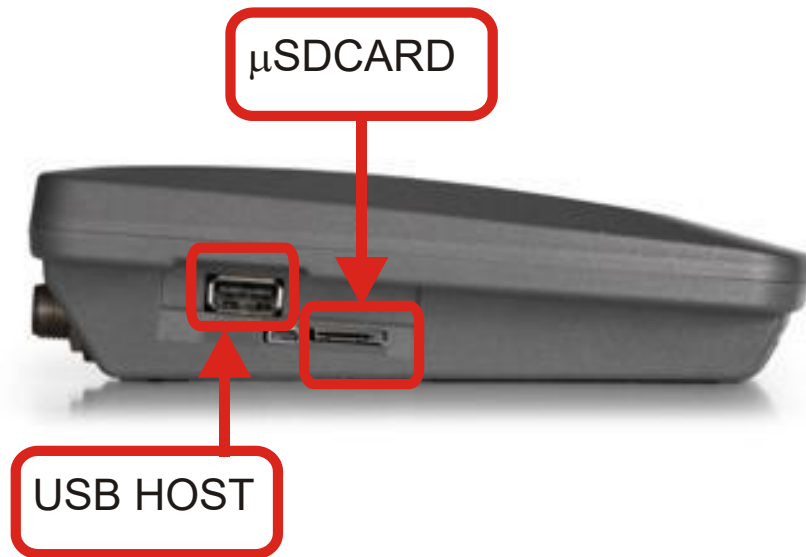


Fig. 2.5: connectors for μ SD card and USB HOST

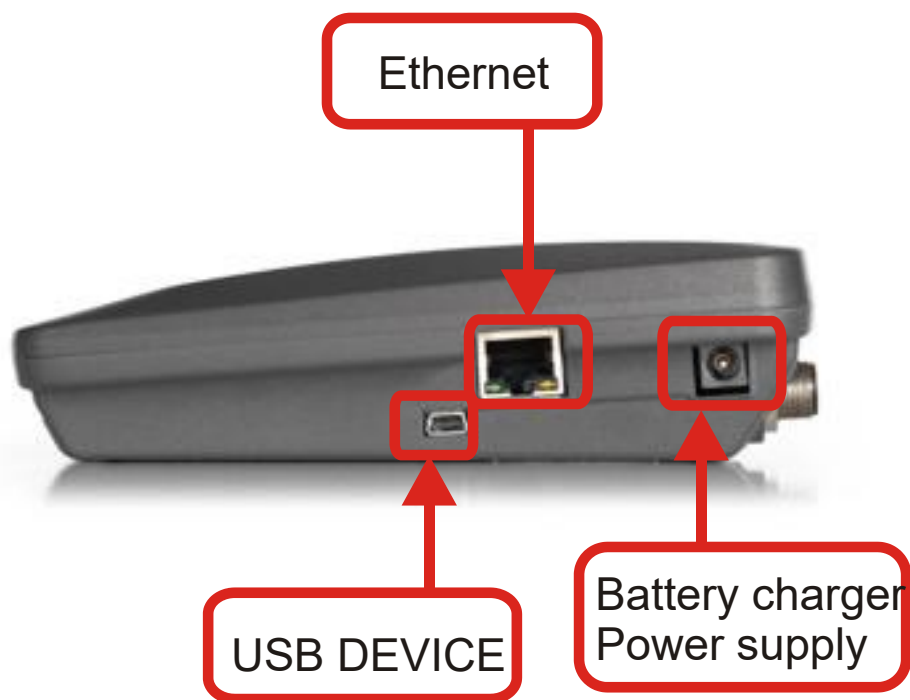


Fig. 2.6: USB DEVICE, Ethernet port and power supply/battery charger connectors

4 Measurement guide

1. When switching the instrument on, a yellow led (steady at first and then blinking) shows that the instrument is starting. After 20 seconds, the instrument is operating and the start-up screen in Fig. 3.1 appears, in which all measurement functions are disabled, if no probe is connected. "Not connected" appears in the top bar.

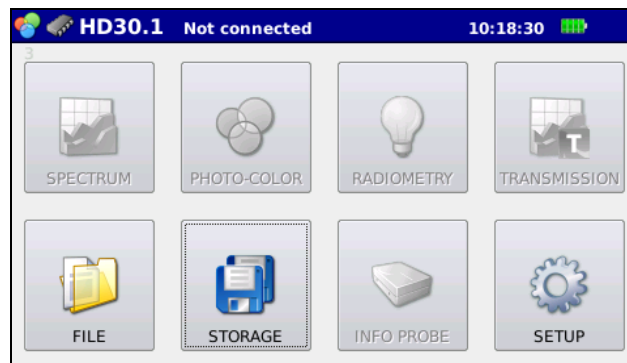


Fig. 3.1: start-up screen with no probe connected.

If a probe is connected to the instrument, the start-up screen shows the enabled measurement options available for the connected probe:

- *Spectrum, photo-colour, radiometry and transmission* for the HD30.S1 probe (Fig. 3.2)



Fig. 3.2: start-up screen with HD30.S1 probe connected

- *Spectrum, radiometry and transmission* for the HD30.S2 probe (Fig. 3.3)

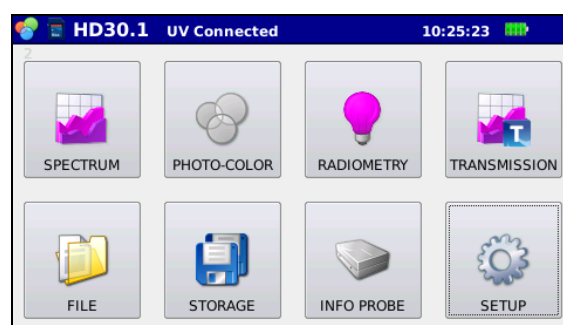


Fig. 3.3: start-up screen with HD30.S2 probe connected

Connected will appear in the top bar to show that a probe is connected.

2. Connect the device for the data storage (otherwise data will be saved in the internal memory of the instrument, the device where data are stored is shown in the blue bar on the top); for more details, see chapter “Handling and storing measurements”.

3. Select the type of analysis to be performed among the available ones:

3.1 SPECTRUM (HD30.S1 and HD30.S2 probes),

In this mode, the emission spectrum of the sources can be displayed or ambient light can be measured in a simple and immediate manner with no further operations. The start-up screen for this measurement will be displayed as shown on Fig. 3.4.

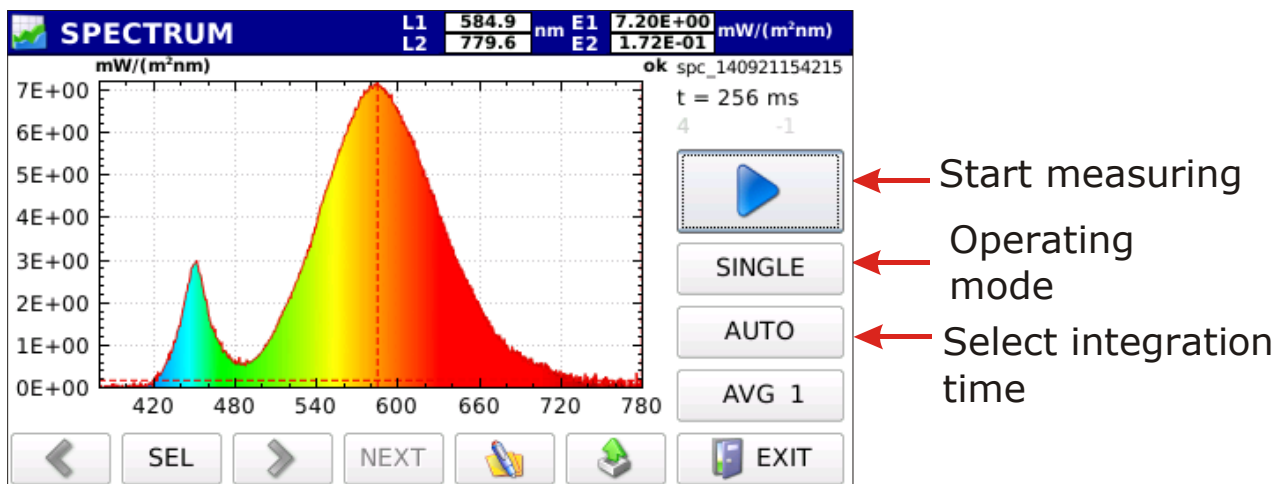


Fig. 3.4: spectrum measured in “SPECTRUM” operating mode

3.1.1. Select the operating mode of the instrument among the available four modes (SINGLE, CONTINUE, MONITOR, LOGGING). By pressing the SINGLE button, two arrow sliders are displayed; by pressing the “down arrow” button, the operating mode changes as shown on Fig. 3.5.

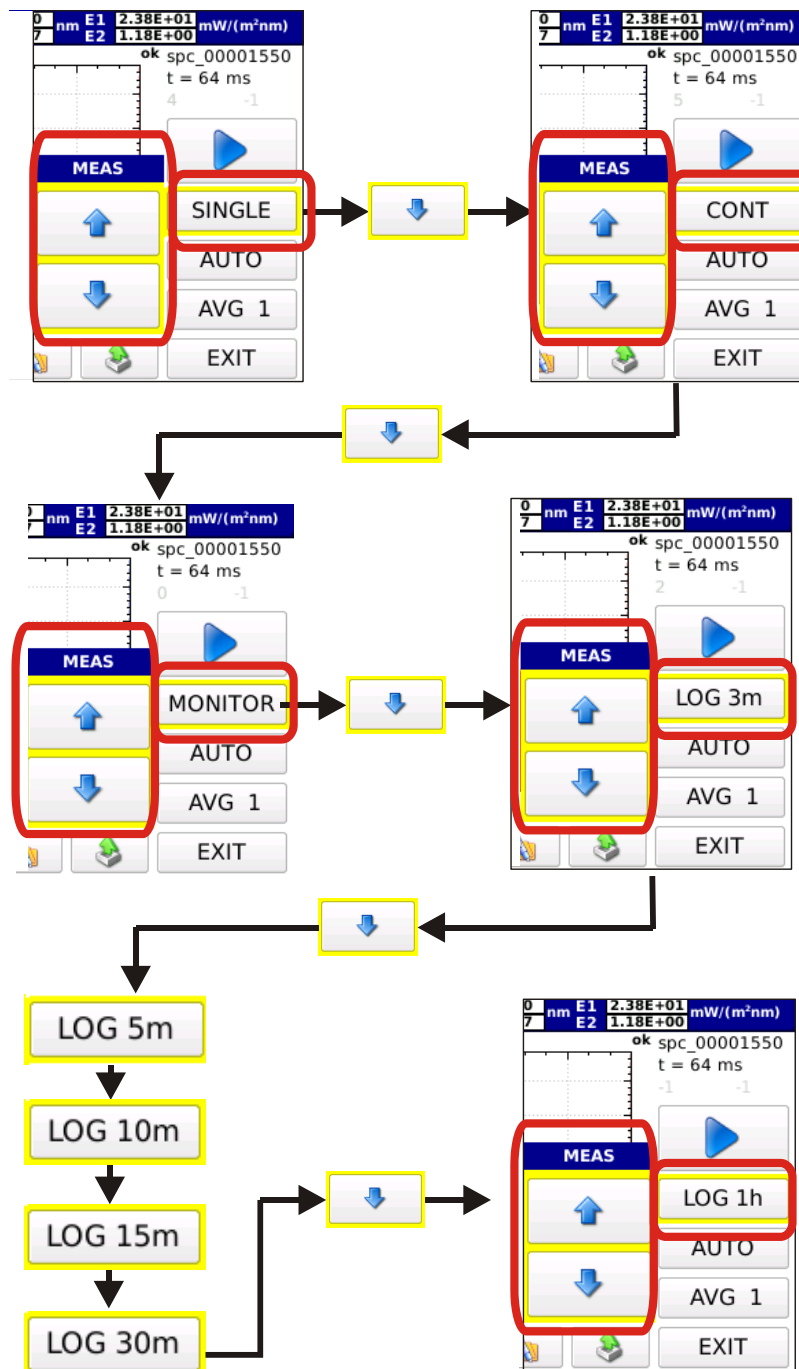


Fig. 3.5: operating mode selection using the arrow keys
(the arrows disappear by pressing any other key)

3.1.1.1 SINGLE

Single measurement. The measurement is started by pressing the “Start measuring” button. Once the measurement is completed, the results are saved in a file with the file name automatically assigned (the name of the saved file is like: spv-yymmddHHMMSS.txt for measurements performed by the probe HD30.S1 and spu-yymmddHHMMSS.txt for measurements performed by the probe HD30.S2).

3.1.1.2 CONTINUE (CONT)

Measurements performed are continuous. Measurements are started by pressing the "Start measuring" button; once the measurement is completed, the instrument starts a new measurement. Measurements are stopped by pressing the  button. All measurements are stored in a directory named spv-yymmddHHMMSS.txt for measurements performed with the HD30.S1 probe and spu-yymmddHHMMSS.txt for measurements performed with the HD30.S2 probe.

3.1.1.3 MONITOR

Measurements performed are continuous and are started by pressing the "Start measuring" button; once the measurement is completed, the instrument starts a new measurement. Measurements are stopped by pressing .

Note: Measurements are not saved.

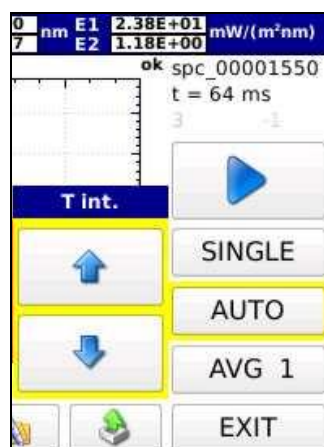
3.1.1.4 LOGGING (LOG 3m)

The instrument performs a measurement on expiry of a set time interval. The logging interval can be selected among 3, 5, 10, 15, 30, 60 min.

Logging is enabled by pressing the "Start measuring" button and stopped with . All measurements are saved in a single directory automatically created under the name of LOG-yymmddHHMMSS (logging start date and time), files saved in the directory will be named spv-yymmddHHMMSS.txt for measurements performed with the HD0.S1 and spu-yymmddHHMMSS.txt for measurements performed with the HD30.S2. While measuring, the page header blinks red and shows the remaining time before next log.



3.1.2 Integration **time calculation**. Integration time selection is automatic by default. Pressing the AUTO button the two arrows for the manual setting of the integration time are displayed:



3.1.2.1 Manual Selection: the integration time is manually selected with the up and down arrow keys. The available integration times are: 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096 ms.

At the top of the graph, the instrument will show if the performed measurement is underexposed or overexposed (Fig. 3.6).

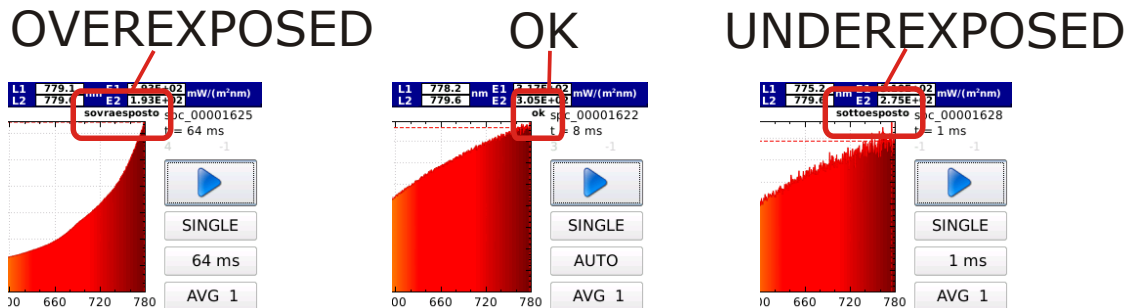


Fig. 3.6: correct exposure time is displayed on top of graph

In Monitor, Continuous and Logging operating modes, measurements will be all performed with the same integration time set before starting measurements.

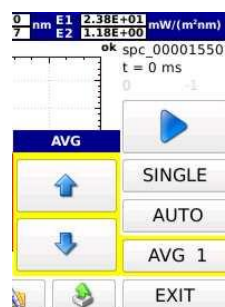
3.1.2.2 Automatic Selection (default)

In SINGLE mode, at the start of the measurement, the instrument searches for the best integration time. The search may take up to 30 seconds. Once the search process is completed, the instrument carries out the measurement by using the optimal integration time.

If the instrument is in CONT, MONITOR e LOG 3m operating modes, it will start searching for the optimal integration. Measurements are started after determining the integration time. At each measurement, if the previous measurement is underexposed, the new integration time will be increased; if it is overexposed, the integration time will be reduced, if the measurement is optimal, the new integration time will not be changed.

3.1.3 Averaged measurements (AVG)

Set the desired number of samples to be averaged by means of the AVG key and arrow keys that appear when the key is pressed (the maximum number of averaged samples is set to 20).



3.1.4 Press the "Start measuring" key to perform the measurement.

Once the measurement is completed, the spectrum will be displayed; wavelengths will be shown in the X-axis as nanometers (220 nm-400 nm for the HD30.S2 probe, 380 nm-780 nm for the HD30.S1 probe) and the measured spectral irradiances in the Y-axis: the last spectrum is displayed in continuous and logging operating modes (Fig. 3.7).

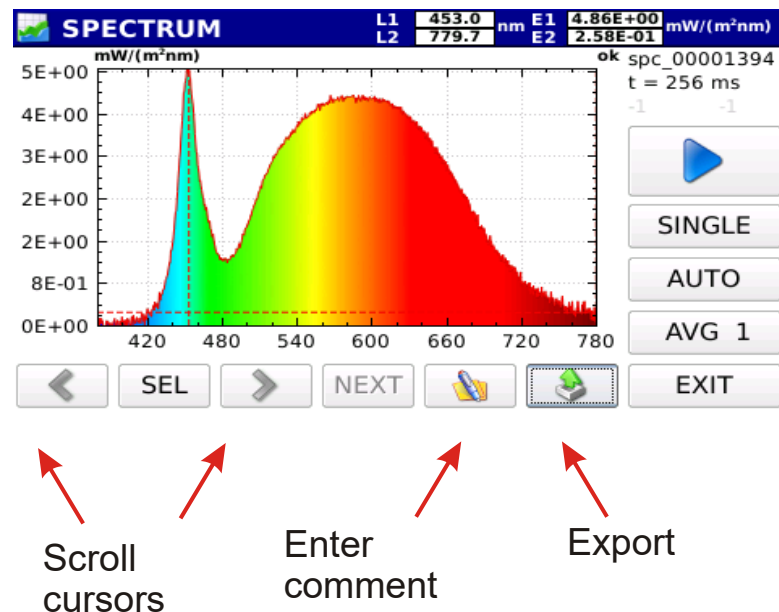


Fig. 3.7: spectrum display at the end of measurement

The name of the saved file and the integration time used for measuring are shown on top right of the screen (Fig. 3.8).

SPV_140921154215
T=256ms

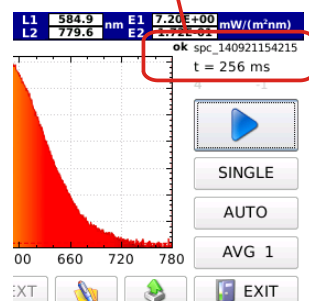


Fig. 3.8: data concerning file and integration

Exit the screen by pressing the EXIT key (bottom right) to display the other measurements concerning the same acquisition (continuous or logging mode), the program will return to the main screen.

Press the FILE key, select the directory of the measurements of interest, upload the file by using the arrow keys on the right of the screen, scroll the files of interest concerning the performed acquisition (for more details see the chapter **Handling and storing measurements**).

The measured spectrum is displayed with two cursors (L1, L2). The cursor position is shown on the top bar together with the measured irradiance value.



Initially, the cursor L1 is positioned on the maximum spectral irradiance value, while L2 is positioned at the extremity of the wavelength available on the probe.

You can select which cursor should be moved using the SEL key, select "L1-L2" if you want to move the two cursors at the same time. Cursors are moved by using the left and right arrow keys.

By pressing the  key, the box (Fig. 3.9) for adding a comment to the measurement shown on the screen will be displayed.

SPECTRUM		L1		E1	
		582.3	nm	3.94E+00	mW/(m²nm)
		779.6		1.83E-01	
		L2		E2	

back clear exit

0	1	2	3	4	5	6	7	8	9
q	w	e	r	t	y	u	i	o	p
a	s	d	f	g	h	j	k	l	
shift	z	x	c	v	b	n	m	Char	Enter
Space									

Fig. 3.9 : comment box

Press EXIT to return to the main menu Fig.3.1.

3.2 PHOTO-COLOR (HD30.S1 Probe)

This operating mode is active only with the probe HD30.S1. Besides the emission spectrum, the main photo-colorimetric quantities can be displayed, such as: illuminance (Lux), trichromatic coordinates CIE 1931 (x, y) and CIE 1976 (u',v'), the Correlated Color Temperature CCT (K) and the Color Rendering Index CRI (the general index and the index of each of the 14 reference samples). By pressing the PHOTO-COLOR button you access the screen in Fig. 3.10.

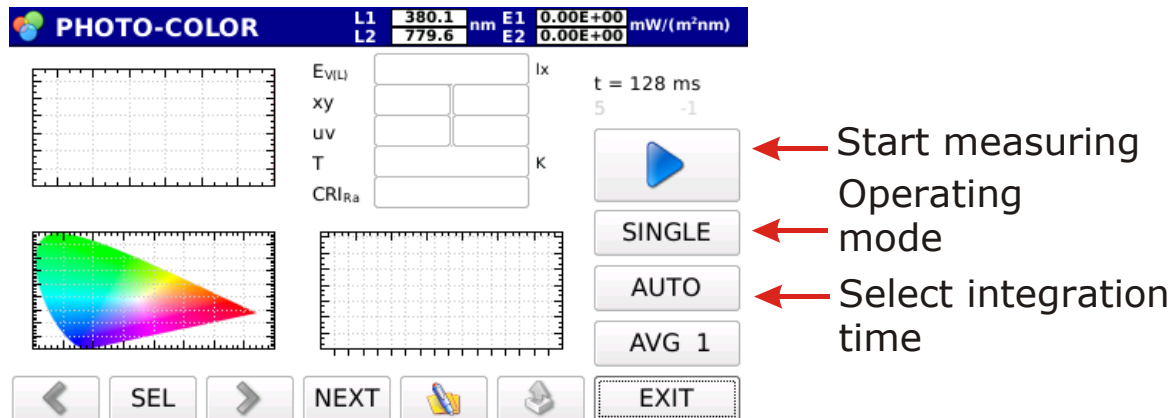


Fig. 3.10: PHOTO-COLOR measuring mode startup screen

3.2.1 Select the operating mode of the instrument among the four available modes (SINGLE, CONTINUE, MONITOR, LOGGING). By pressing SINGLE, the two scroll arrow cursors are displayed, pressing the down arrow makes the operating mode change as shown on Fig. 3.11.

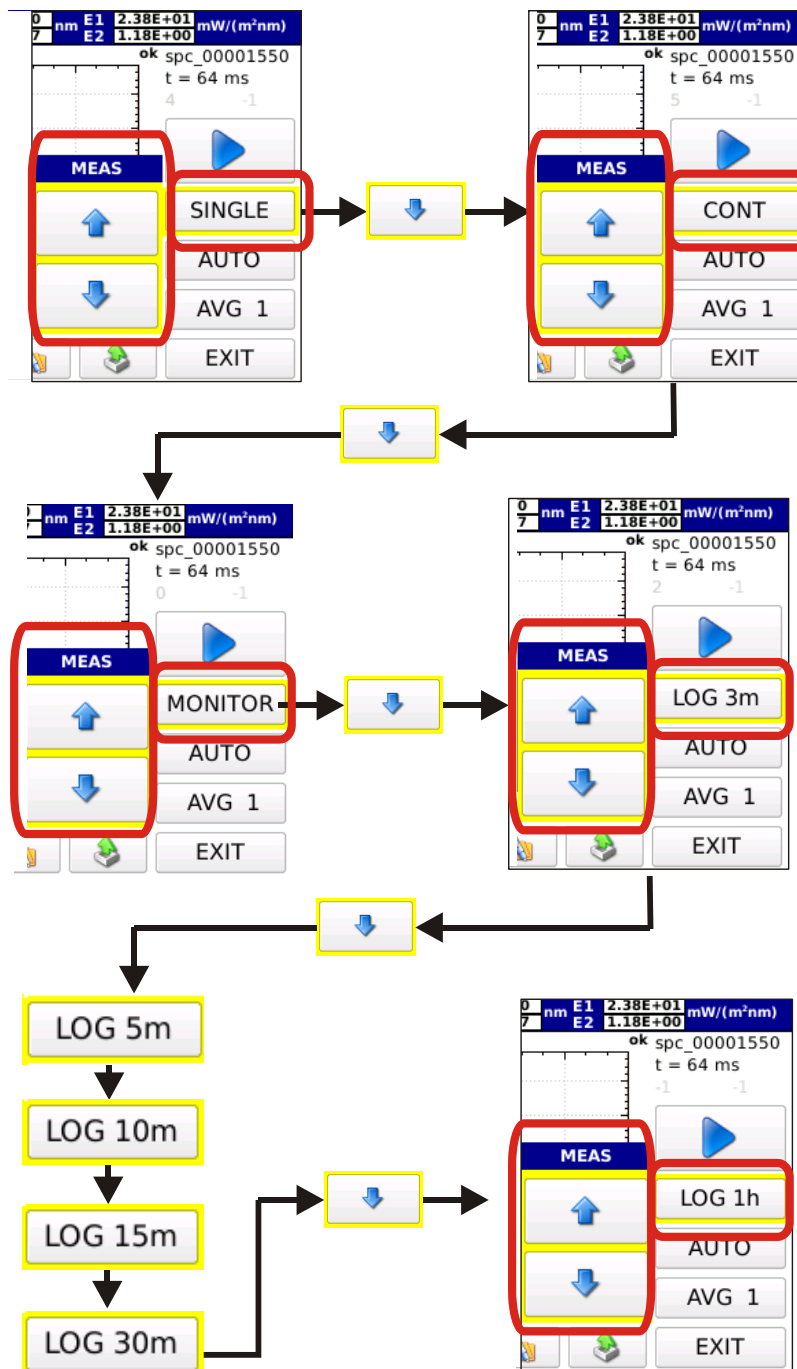


Fig. 3.11: operating mode selection using the arrow keys
(the arrows disappear by pressing any other key)

3.2.1.1 SINGLE

Single measurement. Measurement is started by pressing the "Start measuring" key. Once the measurement is completed, the results are saved in a file with an automatically assigned name (the name of the saved file is like: spv-yyymmddHHMMSS.txt).

3.2.1.2 CONTINUE (CONT)

Measurements are performed in continuous. Measurements are started by pressing the "Start measuring" button; once the measurement is completed, the instrument starts a new measurement. Measurements are stopped by pressing  button. All measurements are stored in a work directory named spv-yymmddHHMMSS.txt.

3.2.1.3 MONITOR

Measurements are performed continuously and are started by pressing the "Start measuring" button; once the measurement is completed, the instrument starts a new measurement. Measurements are stopped by pressing  .

Note: Measurements are not saved.

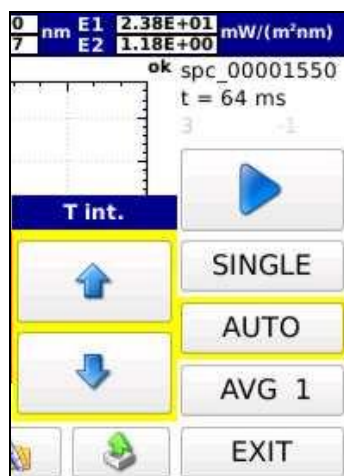
3.2.1.4 LOGGING (LOG 3m)

The instrument carries out a measurement on the expiry of a set interval. The logging interval can be selected among the following time intervals: 3 , 5 , 10 , 15 , 30 , 60 min.

Logging is started by pressing the "Start measuring" button and stopped by pressing  . All measurements are saved in a single, automatically created directory named LOG-yymmddHHMMSS (logging start date and time), files saved in the directory will be named spv-yymmddHHMMSS.txt. While measuring, the page header blinks red and shows the remaining time before next log.



3.1.2 Integration time calculation selection. Integration time selection is automatic by default. Pressing the AUTO button displays the two arrows for the manual setting of the integration time:



3.2.2.1 Manual Selection: the integration time is selected manually by using the up and down arrow keys. The available integration times are: 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096 ms.

On top of the graph the instrument will show if the measurement just performed is underexposed or overexposed (Fig. 3.12).

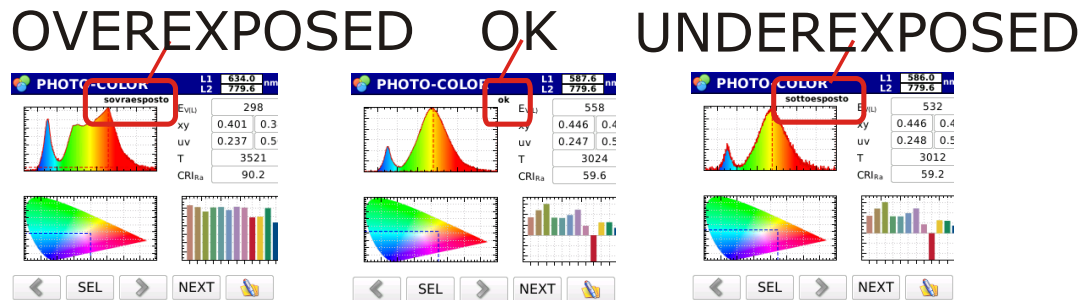


Fig. 3.12: correct exposure indication

In Monitor, Continuous and Logging operating modes, measurements will be all carried out with the same integration time set before starting measuring.

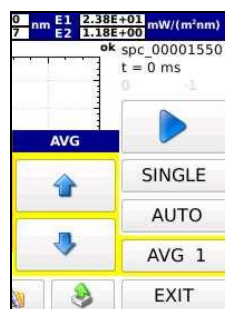
3.2.2.2 Automatic Selection (default)

In SINGLE mode, at measurement start-up the instrument searches for the optimal integration time. The search may take up to 30 seconds. Once the search process is completed, the instrument carries out the measurement with the optimal integration time.

With CONT, MONITOR or LOG 3m operating modes, at measurement start-up the instrument searches for the optimal integration time. Measurements are started after determination of the integration time. At each measurement, if the previous measurement is underexposed or overexposed, the new integration time will be changed; if the measurement is optimal, the new integration time will not be changed.

3.2.3 Averaged measurements (AVG)

Set the number of the desired samples to be averaged by pressing the AVG button and the arrow keys that appear (the maximum number of averaged samples is set to 20).



3.2.4 Press the "Start measuring" button to perform the measurement.

Once the measurement is completed, the spectrum will be displayed, wavelengths will be shown in the X axis as nanometers and the measured spectral irradiances in the Y-axis: the last spectrum is displayed in continuous and logging operating modes (Fig. 3.13).

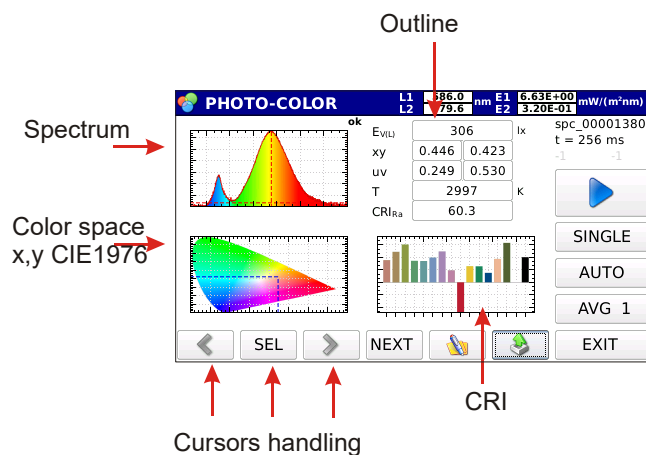


Fig. 3.13: Example of screen in PHOTO-COLOR measuring mode after measurement completion

The acquired spectrum is displayed on the top left of the screen; x, y coordinates are shown on bottom left, inside the colour space CIE 1932 (x,y); the general colour-rendering index Ra and the 14 indexes for each sample are shown on the right bottom. The main photometric info is summarized on top right:

E _{V(L)}	306	lx
xy	0.446 0.423	
uv	0.249 0.530	
T	2997	K
CRI _{Ra}	60.3	

Illuminance

Coordinates (x,y) CIE 1931

Coordinates (u',v') CIE 1976

Correlated Color Temperature K

CRI Ra

The name of the saved file and the integration time used for measuring are shown on top right of the screen (Fig. 3.14).

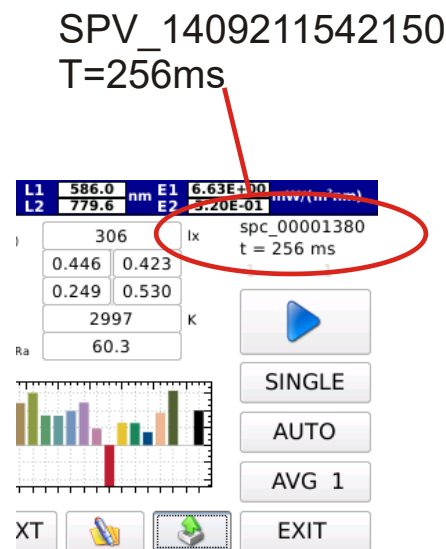


Fig. 3.14: data concerning file and integration

Press EXIT (bottom right) to display the other measurements related to the same acquisition (continuous or logging mode), the program will return to the main screen. Press  and select the directory related to the measurements of interest, upload the file and scroll the files of the same log or continuous measurement by using the arrow keys on the right of the screen (for more details see chapter **Handling and storing measurements**).

The measured spectrum is displayed together with the two cursors (L1, L2). The position of the wavelength the two cursors are pointing to is shown on the top bar along with the value of the measured spectral irradiance and of the cursors wavelength.



At first, L1 cursor is positioned on the maximum spectral irradiance value, while L2 is positioned at the extremity of the wavelength available on the probe.

You can select which cursor should be moved using the SEL button; select "L1-L2" if you want to move the two cursors at the same time. Cursors are moved using the left and right arrow keys.

Press EXIT to return to the main menu Fig.3.1.

Press NEXT (on the bottom bar) to display one graph at a time following the sequence in Fig. 3.15.

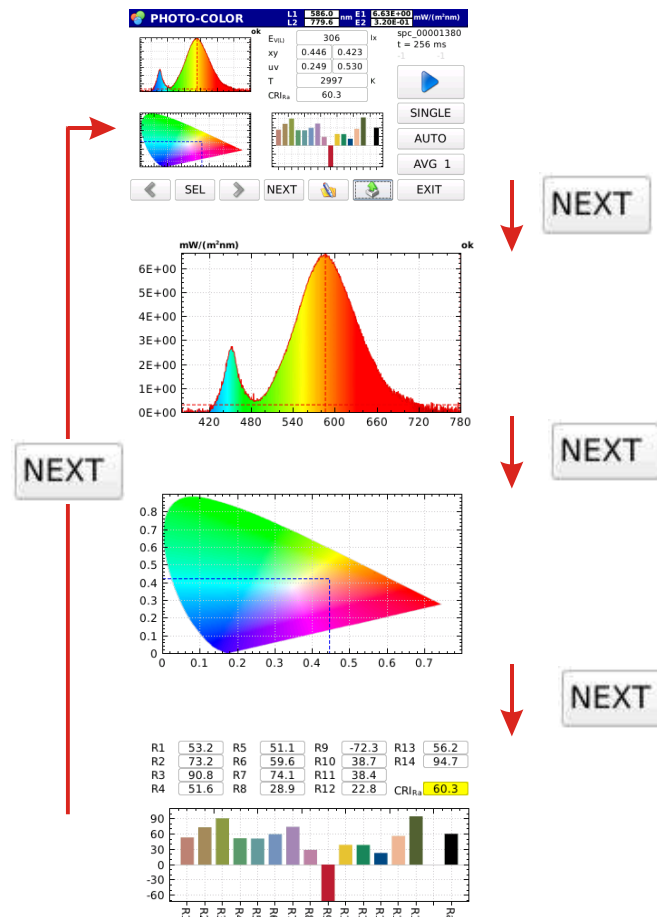


Fig. 3.15: Different displays of the measurements acquired in PHOTO-COLOR mode

Press NEXT to move from one display to next one.

By pressing  the box (Fig 3.16) for adding a comment to the measurement shown on the screen will be displayed.

The figure shows the comment box interface in SPECTRUM mode. The top status bar displays L1: 582.3 nm, L2: 779.6 nm, E1: 3.94E+00 mW/(m²nm), and E2: 1.83E-01 mW/(m²nm). Below the status bar is a text input field labeled 'comment'. To the right of the input field are buttons for 'back', 'clear', and 'exit'. Below the input field is a numeric keypad (0-9) and an alphanumeric keypad (q-w-e-r-t-y-u-i-o-p, a-s-d-f-g-h-j-k-l, shift-z-x-c-v-b-n-m, Char, Enter). A 'Space' button is also present.

Fig. 3.16: comment box

3.3 RADIOMETRY (HD30.S1 and HD30.S2)

Spectral irradiance and main radiometric quantities can be displayed in this mode:

Total irradiance (W/m^2) in the entire spectral range covered by the currently used probe;

Irradiance (W/m^2) in the interval selected by L1 and L2 cursors;

PAR $\mu\text{Mol}/(\text{fot} \cdot \text{s} \cdot \text{m}^2)$ with the HD30.S1 probe;

Irradiance (W/m^2) in UV, UVB, UVC bands with HD30.S2 probe (Fig 3.17).

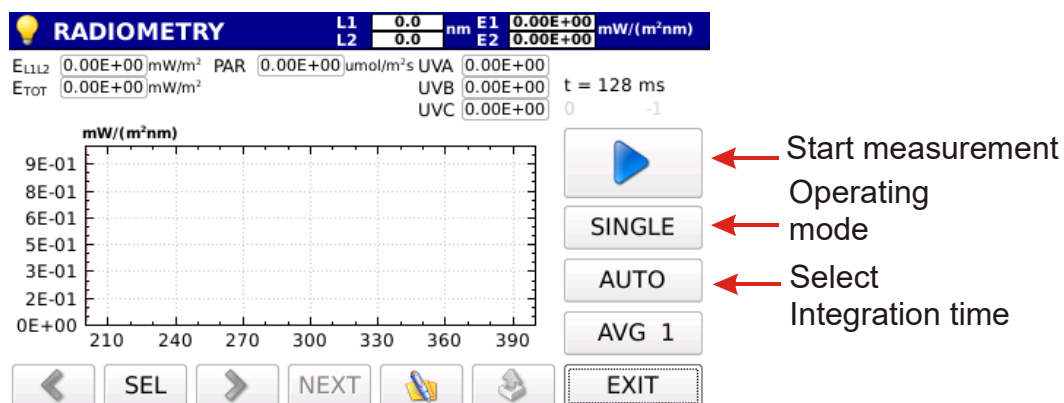


Fig3.17: Start-up screen in RADIOMETRY mode

3.3.1 Select the operating mode of the instrument among the four available modes (SINGLE, CONTINUE, MONITOR, LOGGING). By pressing SINGLE, the two scroll arrow cursors are displayed, pressing the down arrow makes the operating mode change as shown on Fig. 3.18.

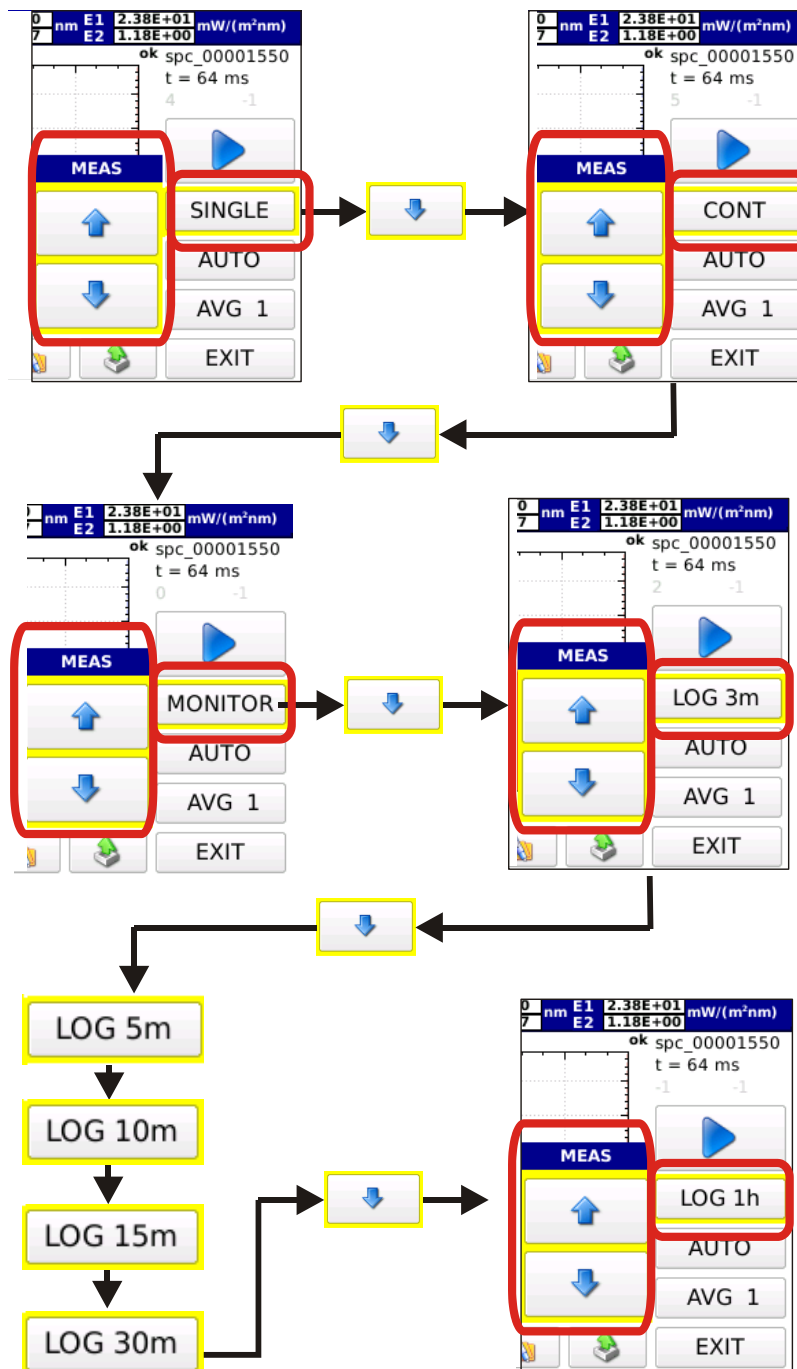


Fig. 3.18: operating mode selection using the arrow keys
(the arrows disappear by pressing any other key)

3.3.1.1 SINGLE

Single measurement. Measurement is started by pressing the "Start measuring" button. Once the measurement is completed, results are saved in a file with an automatically assigned file name (the name of the saved file is like: spv-yymmddHHMMSS.txt for measurements performed with the HD30.S1 probe and spu-yymmddHHMMSS.txt for measurements performed with the HD30.S2 probe).

3.3.1.2 CONTINUE (CONT)

Measurements are carried out in continuous mode. Measurements are started by pressing the “Start measuring” key; once the measurement is completed, the instrument starts a new measurement. Measurements are stopped by pressing . All measurements are saved in the work directory named spv-yymmddHHMMSS.txt for measurements performed with the HD30.S2 probe.

3.3.1.3 MONITOR

Measurements are carried out in continuous mode and are started by pressing the “Start measuring” key; once the measurement is completed, the instrument starts a new measurement. Measurements are stopped by pressing .

Note: measurements are not saved.

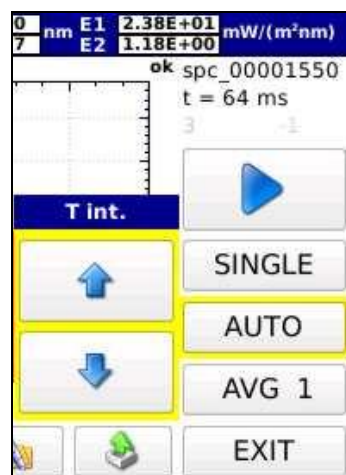
3.3.1.4 LOGGING (LOG 3m)

The instrument performs a measurement on expiry of a set time interval. The logging interval can be selected among the following time intervals: 3, 5, 10, 15, 30, 60 min.

Logging is enabled by pressing the “Start measuring” key and stopped with . All measurements are saved in a single directory automatically created under the name of LOG-yymmddHHMMSS (logging start date and time); the files saved in the directory will be named spv-yymmddHHMMSS.txt for measurements performed with HD30.S1 and spu-yymmddHHMMSS.txt for measurements performed with HD30.S2. While measuring, the page header blinks red and shows the remaining time before next log.



3.3.2 Integration time calculation selection. The integration time is automatically selected by default. Press AUTO to display the two arrows for the manual setting of the integration time:



3.3.2.1 Manual Selection: the integration time is selected manually by using the up and down arrow keys. The available integration times are: 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096 ms.

The instrument will show on top of the graph if the measurement just performed is underexposed or overexposed (Fig. 3.19).

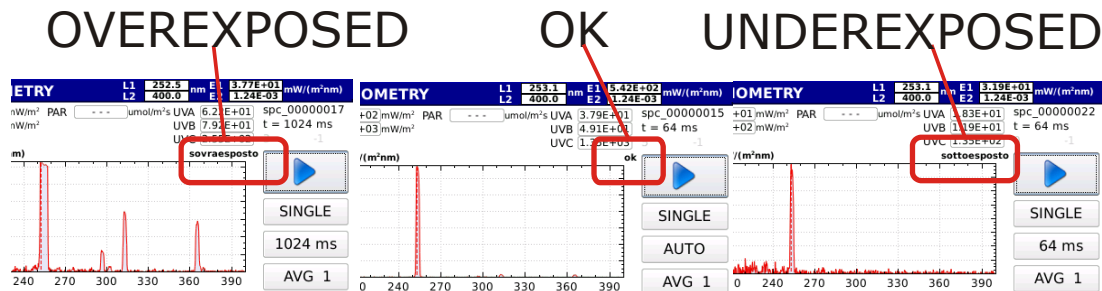


Fig. 3.19: correct exposure indication

In Monitor, Continuous and Logging operating modes, measurements will be all carried out with the same integration time set before starting measuring.

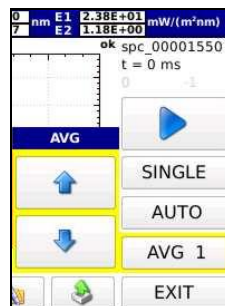
3.3.2.2 Automatic Selection (default)

In SINGLE mode, at measurement start-up the instrument searches for the optimal integration time. The search may take up to 30 seconds. Once the search process is completed, the instrument carries out the measurement with the optimal integration time.

In CONT, MONITOR or LOG 3m operating modes, at measurement start-up the instrument searches for the optimal integration time. Measurements are started after determination of the integration time. At each measurement, if the previous measurement is underexposed or overexposed, the new integration time will be changed, if the measurement is optimal, the new integration time will not be changed.

3.3.3 Averaged measurements (AVG)

Set the desired number of averaged samples by pressing the AVG button and the arrow keys that appear when pressing (the maximum number of averaged samples is set to 20).



3.3.4 Press the "Start measuring" button to perform the measurement.

Once the measurement is completed, the spectrum will be displayed; wave-lengths will be shown in the X-axis as nanometers and the measured spectral irradiances in the Y-axis: the last spectrum is displayed in continuous and logging operating modes (Fig 3.20).

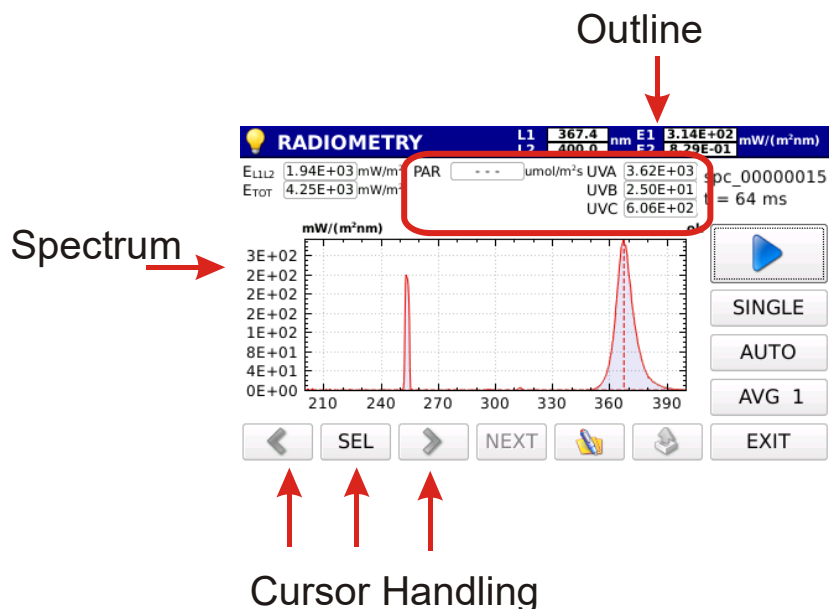


Fig. 3.20: Example of screen in RADIOMETRY measuring mode after measurement

Irradiance integral values are shown on top of the screen :



Irradiance between the two cursors L1_L2

Total Irradiance

PAR (only with HD30.S1 probe)

UV Irradiance (only with HD30.S2 probe)

UVB Irradiance (only with HD30.S2 probe)

UVC Irradiance (only with HD30.S2 probe)

The name of the saved file and the integration time used for measuring are displayed on top right of the screen (Fig. 3.21).

SPV_141112150012
T=64ms

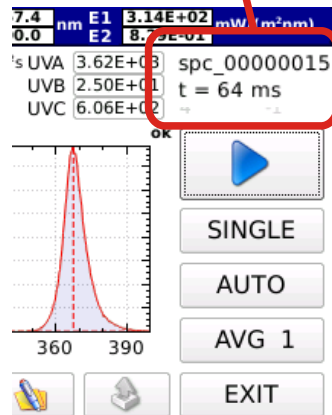


Fig. 3.21: data concerning file and integration

Press EXIT (bottom right) to exit and display the other measurements concerning the same acquisition (continuous or logging mode), the program will return to the main screen. Press  to select the directory with the desired measurements, upload the file and scroll the files related to the same log or continuous measurement using the arrow keys on the right of the screen (see chapter **Handling and storing measurements** for more details).

The measured spectrum is displayed together with the two cursors (L1, L2). The position of the wavelength indicated by the two cursors is shown in the top bar along with the measured spectral irradiance value and the wavelength of the cursors.



At first L1 cursor is positioned on the maximum spectral irradiance while L2 is positioned at the extremity of the wavelength available on the probe.

Press the SEL button and select the cursor you want to move; select "L1-L2" to move the two cursors at the same time. Cursors are moved by using left and right arrow keys.

By pressing , the box (Fig. 3.22) where you can add a comment to the measurement shown on the screen will be displayed.

Fig. 3.22: comment box

Press EXIT to return to the main menu (Fig.3.1).

3.4 TRANSMITTANCE (HD30.S1 and HD30.S2)

Under this mode, you can measure the transmission in the spectral range covered by the probe in use. Measurement is carried out in two distinct steps;

A- the first step needed is to acquire the reference spectrum (against which transmission will be calculated),

B- only later spectral transmission can be measured.

Select the transmission of measurement to access the window below:

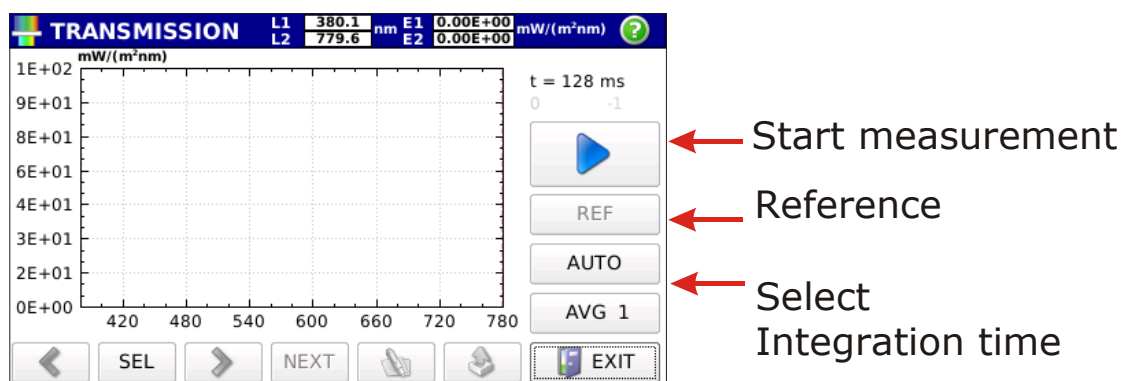
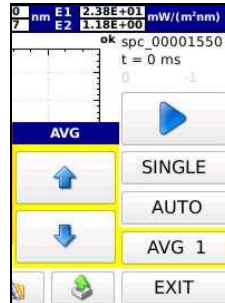


Fig. 3.23: TRANSMISSION measurement screen

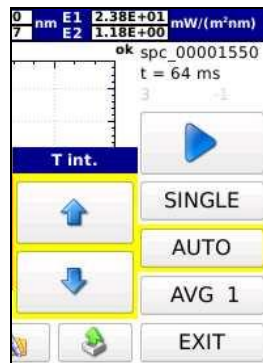
Follow the steps indicated hereafter to acquire the reference spectrum.

3.4.1 Set measurement average (AVG)

Set the number of samples you wish to be averaged to perform measurements by using the AVG key and the arrows that appear when the key is pressed (the maximum number of averaged samples is set to 20).



3.4.2 Integration Time calculation. The integration time selection is automatically made by default through the dedicated button; use the arrows to perform the desired selection:



3.4.2.1 Manual selection: the integration time is manually selected using the up and down arrows: 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096 ms.

The instrument will show in the upper end of the spectrum if the spectrum reference measurement just performed is underexposed or overexposed (Fig. 3.24).

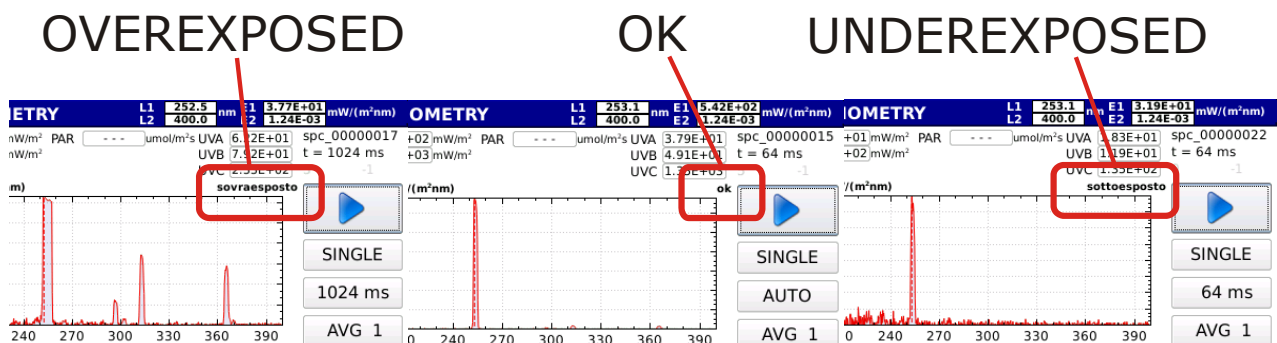


Fig. 3.24: correct exposure indication

3.4.2.2 Automatic selection (default)

The instrument searches for the optimal integration time when the reference measurement is started. The search can take up to 30 seconds. At the end of the search, the instrument performs the measurement with the optimal integration time.

The integration time used for the calculation of the reference spectrum will be kept for all transmission of the measurements.

3.4.3 Press REF to acquire the reference spectrum. The spectrum is displayed on the screen (Fig. 3.25).

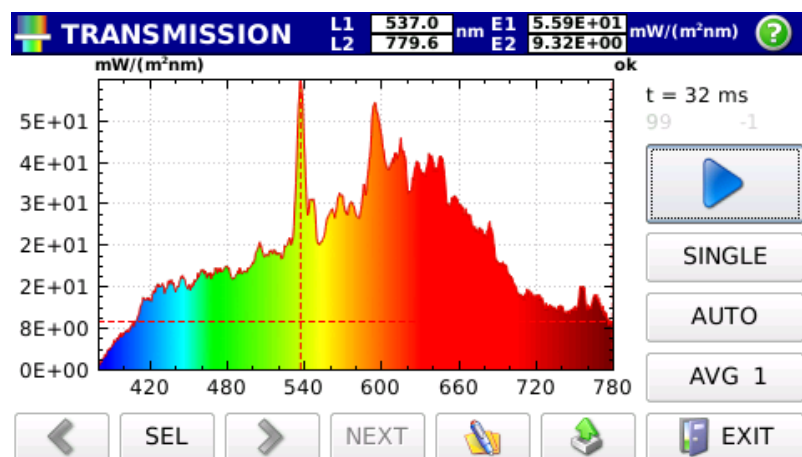


Fig. 3.25: reference spectrum acquisition

At this stage the “Start measuring” button is enabled and the transmission measurement can be carried out.

3.4.4 By pressing the Start button (enabled only if the reference spectrum has been performed) you launch the transmission measurement displayed on the screen (Fig. 3.26).

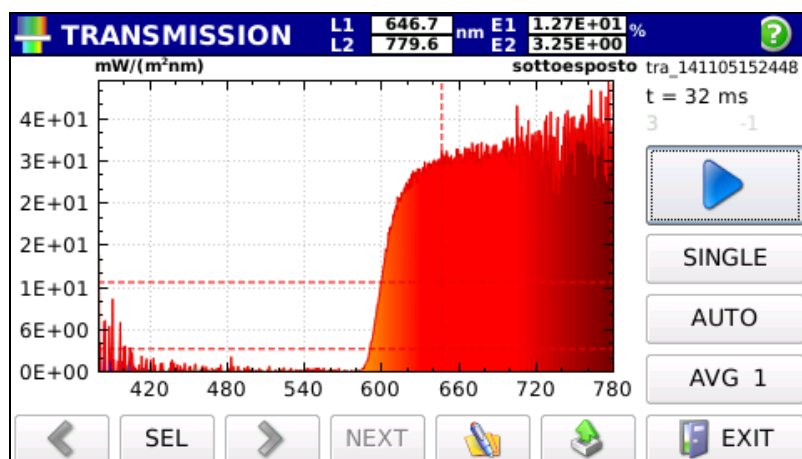


Fig. 3.26: spectral transmission measurement

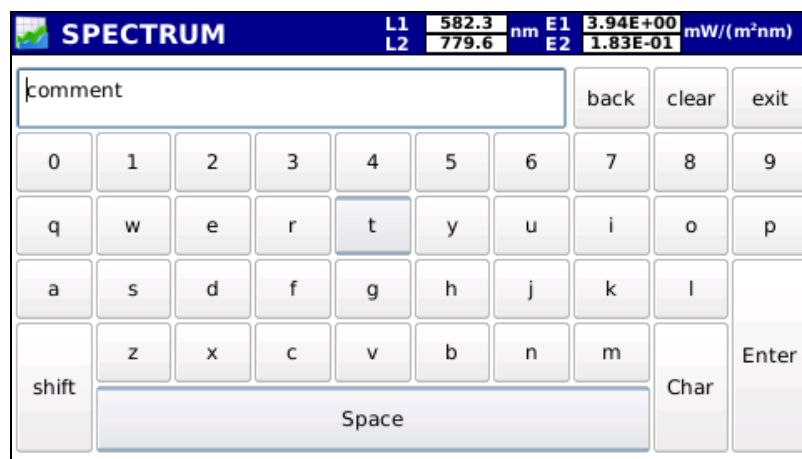
The name of the saved file is shown on top right of the screen (in the form of trv-yymmddHHMMSS.txt for HD30.S1 probe and tru-yymmddHHMMSS.txt for HD30.S2 probe) along with the integration time used for the measurement.

A new transmission measurement can be performed by pressing Start (you don't need to acquire each time the reference spectrum).

Transmission is displayed together with the two cursors (L1, L2). The position wavelength of the two cursors are pointing to is shown on the top bar along with the spectral transmission value (in %).

You can select which cursor to move by using the SEL button, selecting "L1-L2" moves the two cursors at the same time. Cursors can be moved by using the left and right arrows.

Press  to display the box (Fig. 3.27) where adding a comment to the measurement displayed on the screen.



SPECTRUM										L1	582.3	nm	E1	3.94E+00	mW/(m²nm)
										L2	779.6	nm	E2	1.83E-01	mW/(m²nm)
comment										back		clear		exit	
0	1	2	3	4	5	6	7	8	9						
q	w	e	r	t	y	u	i	o	p						
a	s	d	f	g	h	j	k	l							
shift	z	x	c	v	b	n	m	Char		Enter					
Space															

Fig. 3.22: comment box

Press EXIT to return to the main menu (Fig.3.7).

5 Handling and storing measurements

The acquired measurements can be handled/displayed using STORAGE and FILE buttons in the main screen (Fig. 4.1).

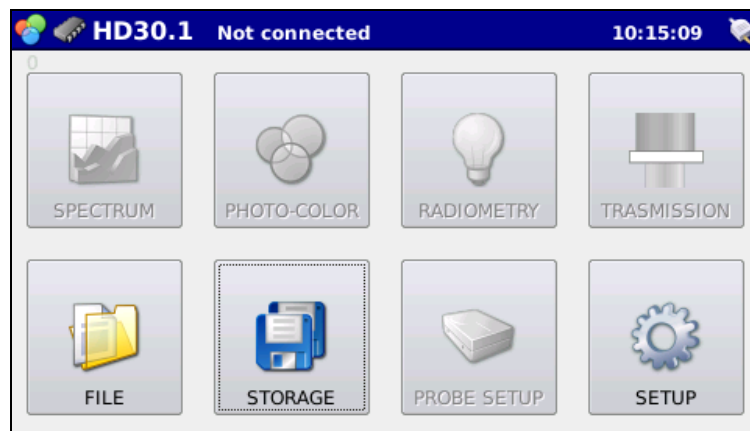


Fig. 4.1: STORAGE and FILE buttons

As a first step, you need to select the device where you want data to be stored (internal memory, μ SDcard or USB device). **If the user make no selection, the instrument data storage is set to internal memory**

4.1 Press STORAGE to access the device manager window (Fig. 4.2) for selection of the storage device.

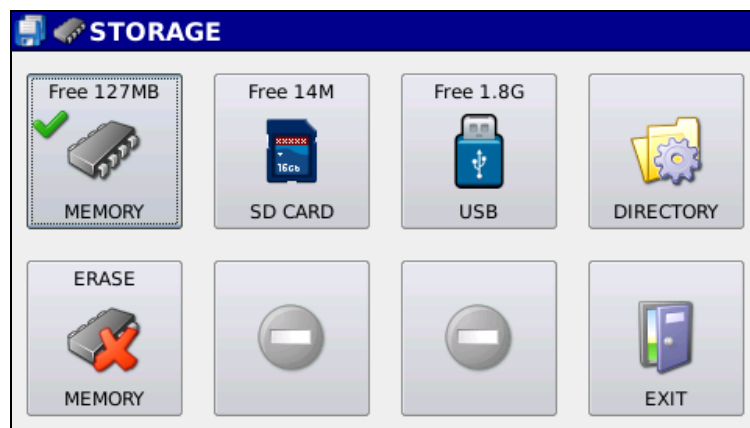


Fig 4.2: STORAGE window with internal memory selected for measurements storage

Each time the instrument is switched on, the selected storage device is the internal memory. The amount of available free memory is shown at the centre top of the icon; a green check mark indicates that the device is currently selected for data storage.

4.1.1 Working directory selection

Once you have selected the internal memory, data are saved in the DATA directory; the working directory can be changed by pressing DIRECTORY. Pressing the button opens the figure 4.3 screen.

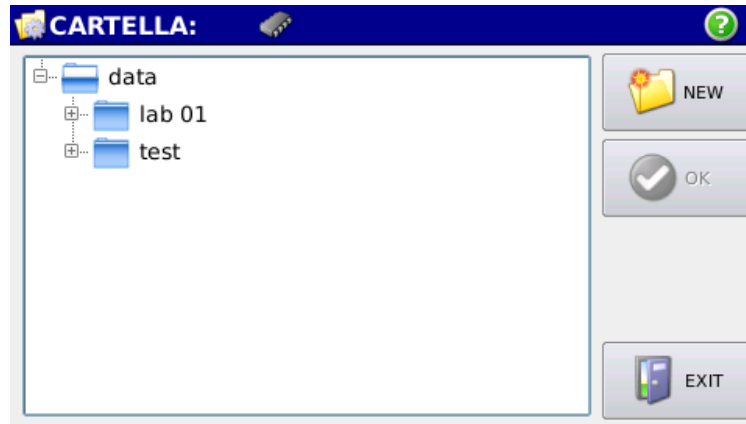


Fig. 4.3: screen for working directory creation/selection in the internal memory

Available directories appear in the centre of the screen, a new directory can be created by pressing NEW.

Press OK to store measurements in a selected directory: the selected working directory will be displayed in the blue top bar.

Press the ERASE MEMORY button to erase the internal memory: a message will appear asking for confirmation; press "Yes" to erase the memory. **Note: CONFIRMATION OF MEMORY DELETION WILL MAKE DATA RECOVERY IMPOSSIBLE.**

4.2 Press SD CARD to select μ SDcard as default memory. If the card is not present, the message μ SDcard NOT PRESENT will appear. If the memory card is properly installed, the screen will appear as in Fig. 4.4.



Fig. 4.4: STORAGE screen after selection of the μ SDcard as working memory

A green check mark will appear on the button.

4.2.1 Working directory selection

Once you have selected the μ SDCard, data are saved in the DATA directory; the working directory can be changed by pressing DIRECTORY. Pressing the button opens the fig. 4.5 screen.

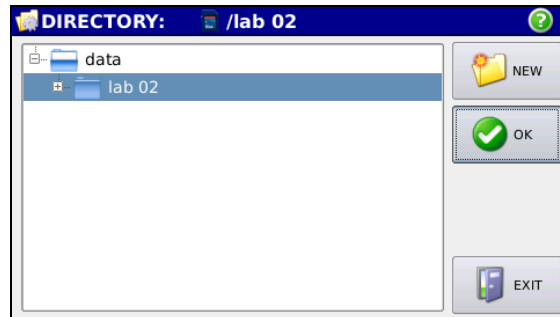


Fig. 4.5: Screen for working directory creation/selection on μ SDCARD

Created directories appear in the centre of the screen; a new directory can be created by pressing NEW.

Press OK to set measurements storage in a selected directory: the selected working directory will be displayed in the blue top bar.

To erase the μ SDCARD memory, press the ERASE SD CARD button: a message will appear asking for confirmation; press "Yes" to erase the memory. **Note: CONFIRMATION OF MEMORY DELETION WILL MAKE DATA RECOVERY IMPOSSIBLE.**

4.2.2 Press A SD CARD DA MEMORY if you want to transfer the content of the internal memory to the μ SDCARD. All data are transferred to the DATA directory; existing data on the memory card will be overwritten.

4.2.3 Press A SD CARD DA USB if you want to transfer the content of the USB device to the μ SDCARD. All data are transferred to the DATA directory; the existing data will be overwritten.

4.3 Press USB to select the USB device as default storage memory. If the USB device is not present, the message USB NOT PRESENT will appear. If the device is properly installed, the screen will appear as in Fig. 4.6.

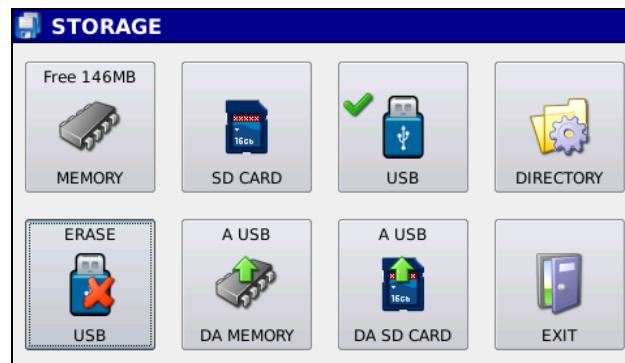


Fig. 4.6: STORAGE screen after selection of the USB device as working memory

A green check mark will appear on the button.

4.3.1 Working directory selection

Once you have selected the USB device, data are saved in the DATA directory; the working directory can be changed by pressing DIRECTORY. Pressing the button opens the Fig. 4.7 screen.

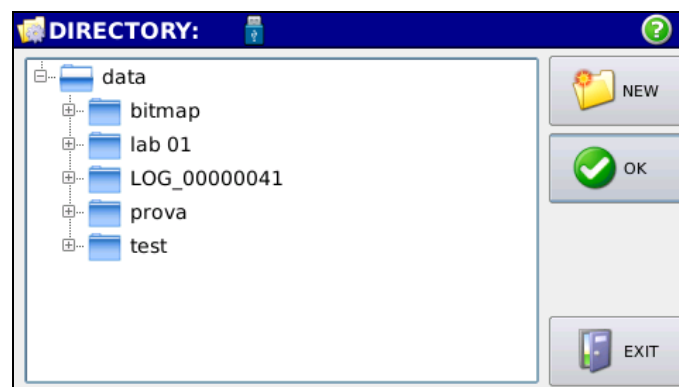


Fig. 4.7: screen for the creation/selection of the work directory on a USB device

Available directories appear in the center of the screen, a new directory can be created by pressing NEW.

Press OK to save measurements in a selected directory; the selected work directory will appear in the blue top bar.

Press ERASE USB to erase the USB device memory: a message will appear asking for confirmation; press "Yes" to erase the memory. **Note. CONFIRMATION OF MEMORY DELETION WILL MAKE DATA RECOVERY IMPOSSIBLE.**

4.3.2 Press A USB DA MEMORY if you want to transfer the content of the internal memory to the USB device. All data are transferred to the DATA directory; the existing data will be overwritten.

4.3.3 Press A USB DA SD CARD if you want the content of the μ SDCARD to be transferred to the USB device. All data are transferred to the DATA directory; existing data on USB device will be overwritten.

4.4 Press EXIT to return to the main screen (Fig. 4.1).

4.5 Press FILE in the main screen to display stored measurements (Fig. 4.1). Pressing the button will open the Fig. 4.8 window.

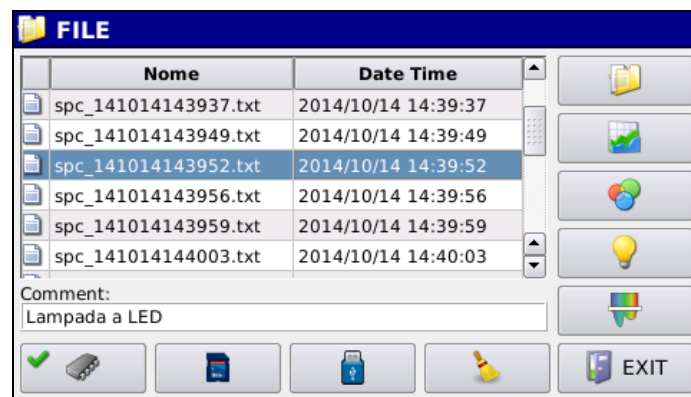


Fig. 4.8: display of the measurements stored in one of the available memories (internal memory, μ SDcard, USB device)

The screen shows the list of files and directories.

The current memory appears at the bottom of the screen (in the example, the internal memory has been selected) with a green check mark. You can select another memory device by pressing one of the available selection buttons.

A comment can be added into the stored files. This is shown in the comment box.

Select the desired directory to display files; then select the file to be displayed.

Press  to return to the selected storage device.

4.5.1 Select the desired file. The selected file will appear on BLUE background (Fig. 4.8); at this stage, the file can be displayed using the buttons on the right of the screen (Fig. 4.9).

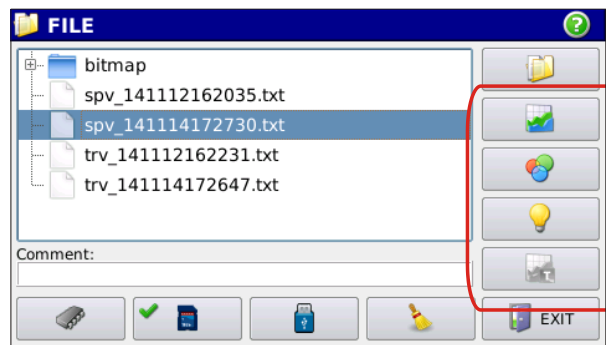


Fig. 4.9: data contained into selected file can be displayed by using the highlighted keys

Press  to display the selected measurement (Fig. 4.10).

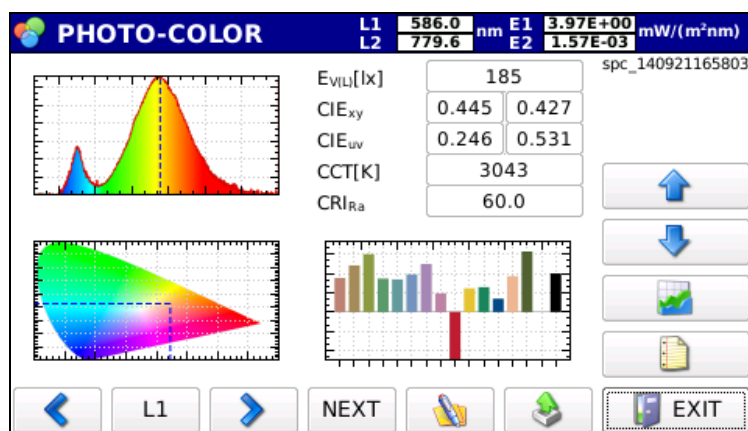


Fig. 4.10: screen showing SPC_140921165803 file loaded from internal memory with PHOTO-COLOR analysis.

The arrows highlighted in Fig. 4.11 allow next measurement to be displayed directly with no need to go back to the FILE menu (Fig. 4.8).

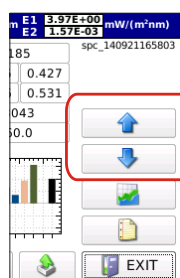


Fig. 4.11 : arrow keys can be used to display files stored in memory

The spectrum is displayed together with the two cursors (L1, L2). The position of the wavelength the two cursors are pointing to is shown on the top bar along with the measured spectral irradiance value and the wavelength of cursors.



L1 cursor is positioned on the maximum spectral irradiance while L2 is positioned on the bigger wavelength available in the current probe.

Pressing SEL allows you to select the cursor you want to move, selecting "L1-L2" will allow you to move the two cursors at the same time. Cursors are moved using the left and right arrow keys.

Press EXIT to return to the FILE menu (Fig. 4.8).

Press NEXT (bottom bar) to display one graph at a time following the sequence in Fig. 4.12.

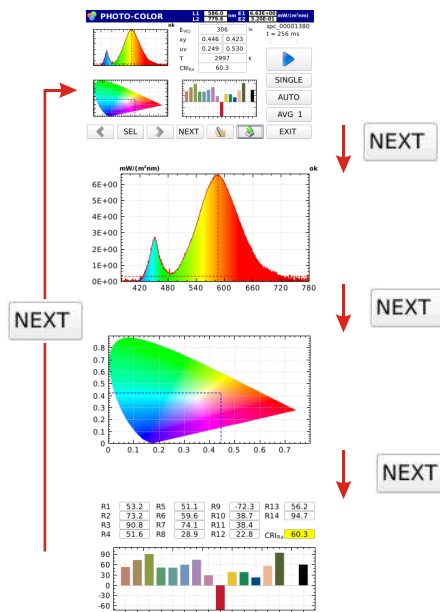


Fig. 4.12: various displays in PHOTO-COLOR mode.

Press  to display the box (Fig. 4.13) where a comment can be added to the measurement shown on the screen.

The figure shows a comment box interface. At the top, the 'SPECTRUM' title bar displays L1: 582.3 nm, L2: 779.6 nm, E1: 3.94E+00 mW/(m²nm), and E2: 1.83E-01 mW/(m²nm). Below the title bar is a text input field labeled 'comment'. To the right of the input field are buttons for 'back', 'clear', and 'exit'. Below the input field is a numeric keypad (0-9) and a QWERTY keyboard layout. At the bottom are 'shift', 'Space', 'Char', and 'Enter' buttons.

Fig. 4.13: comment box

4.6 Press  to display (Fig. 4.14) the spectral irradiance data in steps of 1 nm.

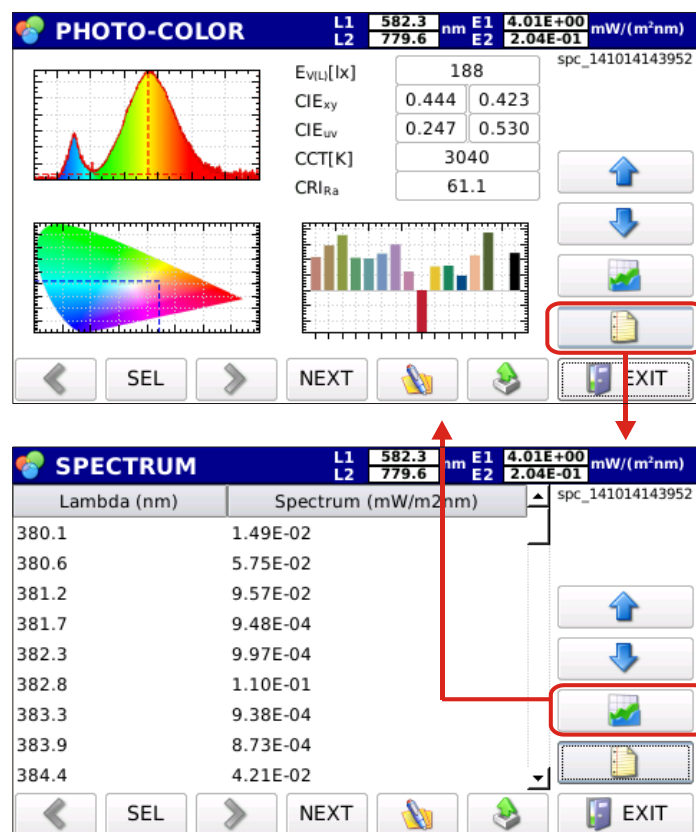


Fig. 4.14: spectral irradiance data in text format

Press  to return to the previous page.

Press EXIT to return to the file handling page (Fig. 4.8).

4.7 Press EXIT in the file handling window to return to the start-up screen (Fig. 4.15).

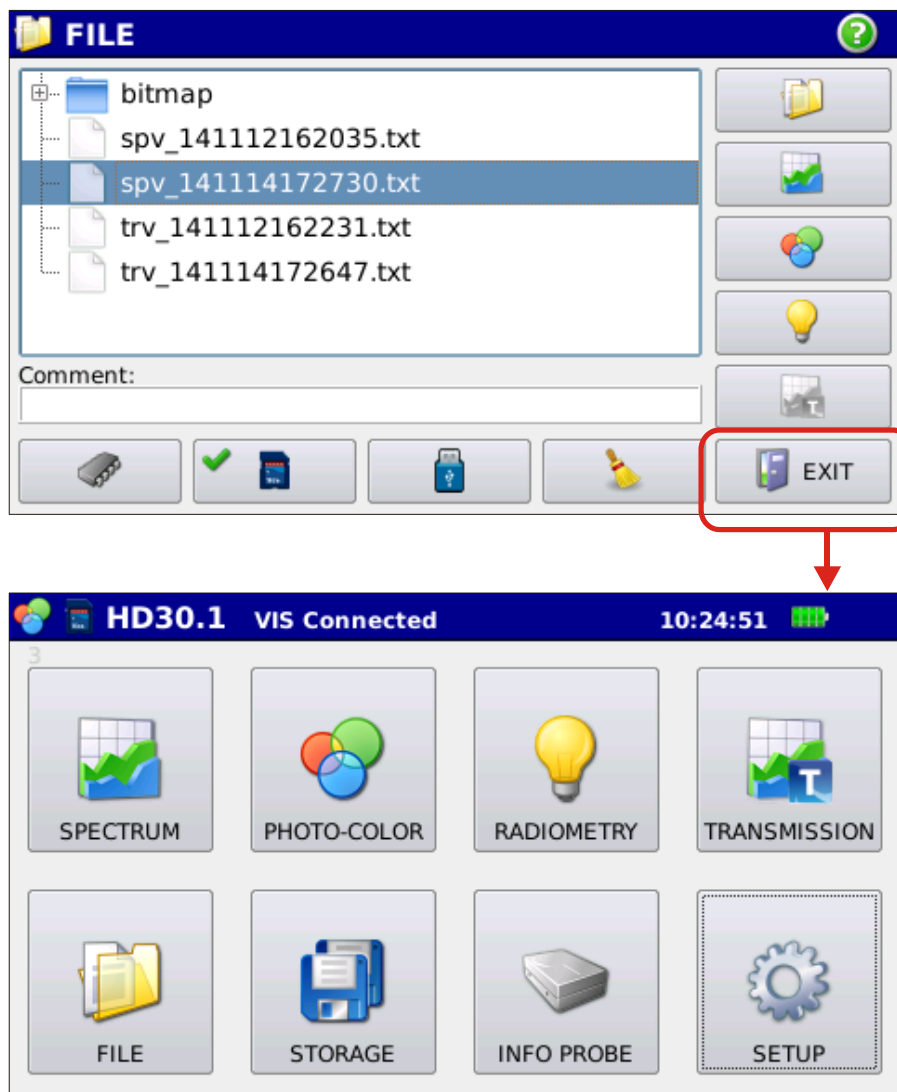


Fig. 4.15: returning to the main menu from stored measurements management menu

6 Software update

The software update can only be performed if the instrument is powered by the power supply.

Before upgrading, save the data into an external memory.

In order to update the software, it is necessary to connect the instrument to an Ethernet network. Once you the instrument has been connected from the main menu, press the keys following the sequence in Fig. 5.1.



Fig. 5.1: sequence to be followed for software update

The last screen of figure 5.1 shows the currently used software version; press  to connect the instrument to website and check the update status of the software under usage.

If a more updated software version is available, the program asks for the permission of updating the software (Fig. 5.2):

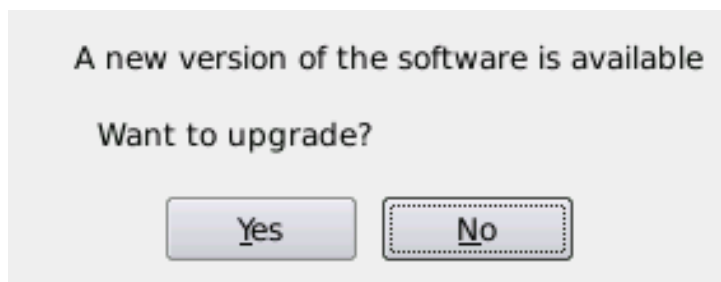


Fig. 5.2: confirmation window for software update

Once the software update has been allowed, the new version is downloaded and installed.

The new software becomes operational the next time the instrument is turned on.

If for any reason the instrument cannot be connected to the network, a message appears.



7 Instrument SETUP

Press SETUP in the main menu to access the configuration page. Press EXIT to exit the SETUP menu.



Fig. 6.1: instrument configuration page

The SETUP menu includes 8 buttons with the following functions:

6.1 BUZZER ON: Activating acoustic signals. When the program starts, the Buzzer is active and each press of a button is indicated by a sound; in order to disable this function, it is necessary to press the BUZZER key, so to change its status (Fig. 6.2).

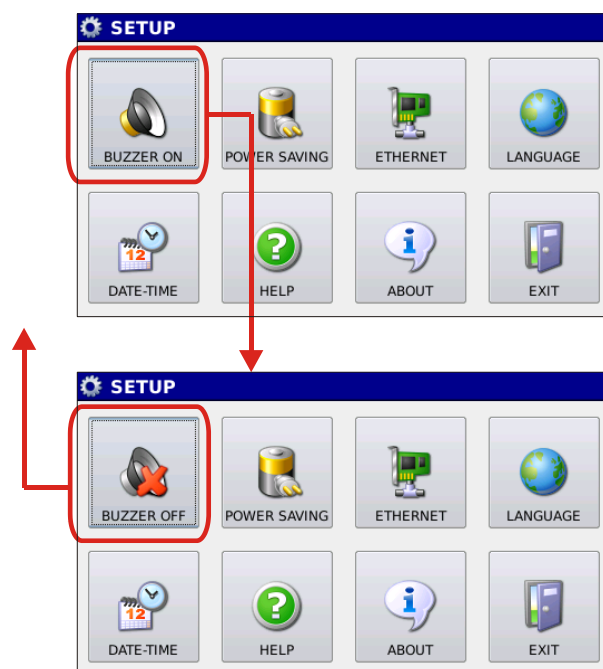


Fig. 6.2: activating/deactivating acoustic signals through Buzzer key

6.2 POWER SAVING: Power saving configuration. Press the POWER SAVING button to access the window for the management of the brightness level of the screen and the Stand-by time (Fig. 6.3).

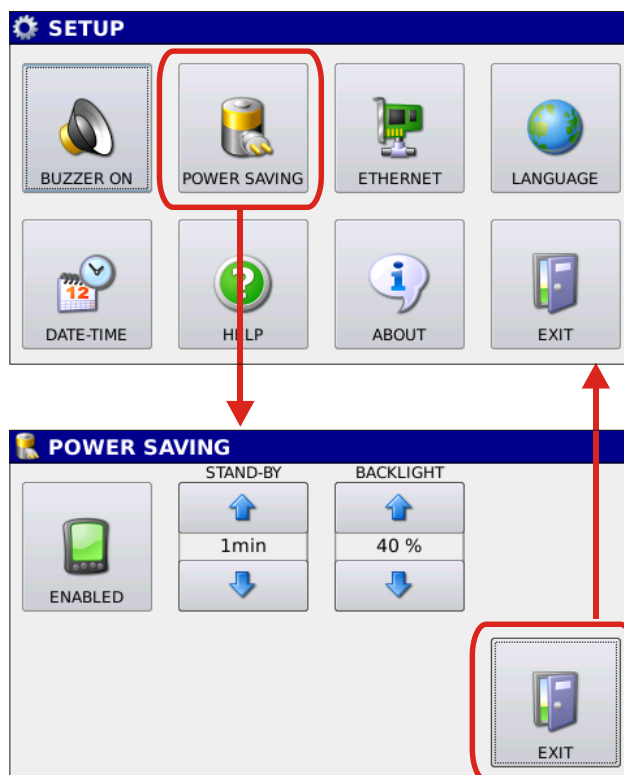


Fig. 6.3: power Saving Management Window

By using the "STAND-BY" arrows it is possible to set the time interval after which the screen is turned off (if no key is pressed). In order to activate the screen again, it is necessary to press the white button on the instrument (Fig. 6.4).

After 30 seconds of inactivity, the screen reduces brightness to 10%; as soon as a key is pressed on the screen or the white button on the instrument, the monitor brightness returns to the set value.



Fig. 6.4: Monitor reactivation button

The monitor brightness level is set using the "BACKLIGHT" arrows. To optimize energy consumption, the monitor brightness is automatically reduced if no key is pressed within 30 seconds. Pressing any key, brightness returns to the set value.

Pressing ENABLED will change the status and the DISABLED icon will appear. In this way, the ON/OFF and power saving functions of the monitor screen are disabled.

The charge level of the batteries is shown on the starting page in the blue band at the top right (Fig. 6.5).



Fig. 6.5: battery level

Next to the charge level is shown the presence of the power supply:

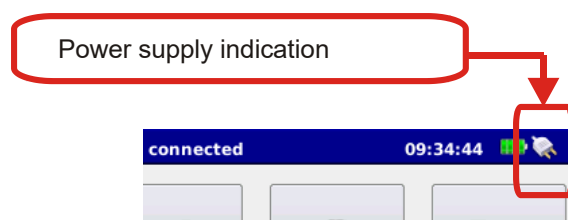


Fig. 6.6: indication of power supply

When the charge level of the batteries reaches 10%, a message appears on the screen prompting the user. With the battery charge below 10% the instrument does not perform any measurements.

6.3 ETHERNET: Network connection configuration. By pressing the ETHERNET key allows you to access the window for managing connection to the instrument network (Fig. 6.7).

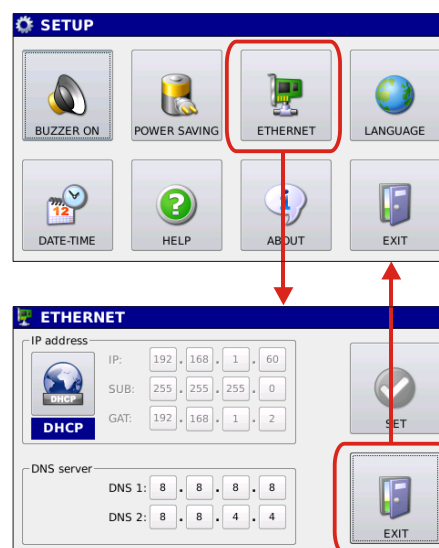


Fig. 6.7: Ethernet connection configuration menu

The first box on top of the window (IP address) in the Ethernet connection configuration menu concerns the setting of the network address defined by:

IP address

SUBnet mask

GATeway

Pressing DHCP changes from DHCP mode to manual mode. In the first case, it is the router that assigns the IP address to the device (default setting). In the second case, parameters for connection must be defined by the user.

The second box at the bottom of the window is used to define primary and secondary DNS.

Note: The connection to the network **is necessary** for the software update.

6.4 LANGUAGE: Setting the Language. By pressing the Language button it is possible to access the language selection menu (Fig. 6.8).



Fig. 6.8: language setting window

On top right of the icon with the selected language there is a green checkmark; if you wish to select a different language, simply press the key corresponding to the desired language. Press EXIT to return to the SETUP menu.

6.5 DATE-TIME: Setting date and time. By pressing the Date-time button it is possible to access the window for date/time setting (Fig. 6.9).

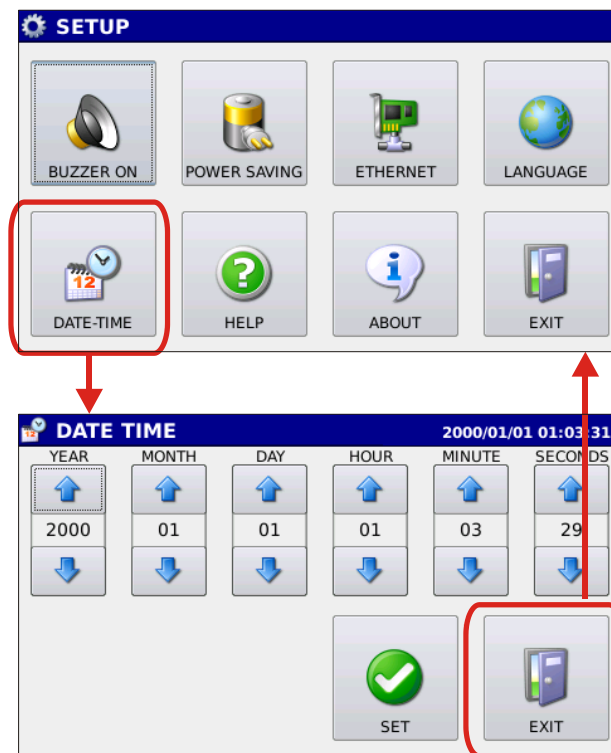


Fig. 6.9: date/time setting window

Once you have properly set date and time using the arrow keys, press SET to make the change effective.

Press EXIT to return to the SETUP menu.

6.6 HELP. Pressing Help allows you to refer to the user manual.

6.7 ABOUT: Checking and updating the Software. See chapter 5 for a detailed explanation of the **About** key.

6.8 EXIT. Pressing Exit makes you return to main menu (Fig. 6.1).

8 Exporting measurements

The instrument allows you to export the performed measurements to a pdf file; besides the pdf file, a text file is generated where the wavelength in 1-nm steps and the measured spectral irradiance are shown respectively in two columns (in the case of transmission measurements, the measured spectral transmission is shown).

The generated pdf file shows the spectral irradiance in 1 nanometres steps and the processed data.

Export can be performed at the end of the measurement by pressing the  key in Fig. 7.1.

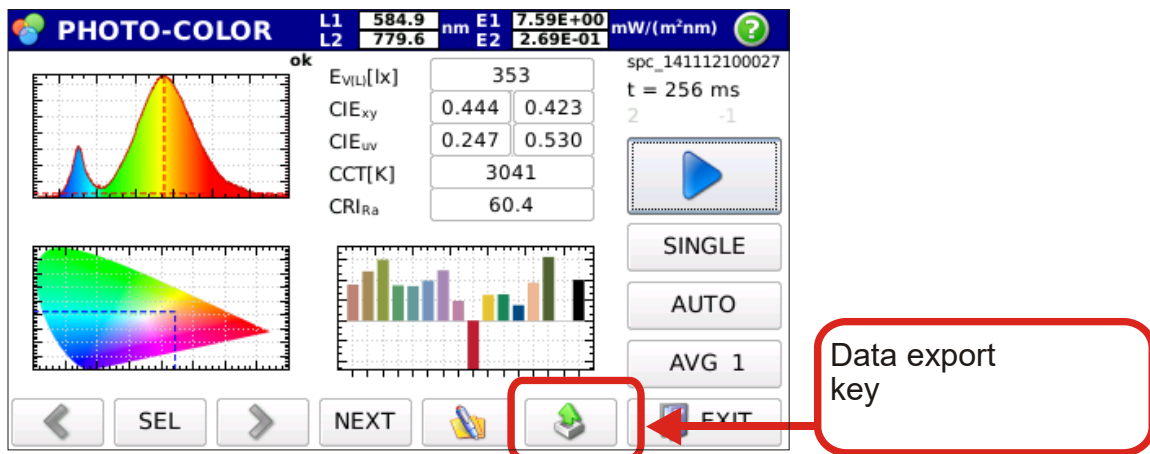


Fig. 7.1: exporting the measurement just performed

or can be performed on a previously stored measurement. In this case, you need first to display the measurement you want to export data of (chapter 4). The key to be depressed to perform the export operation remains  as shown in Fig. 7.2.

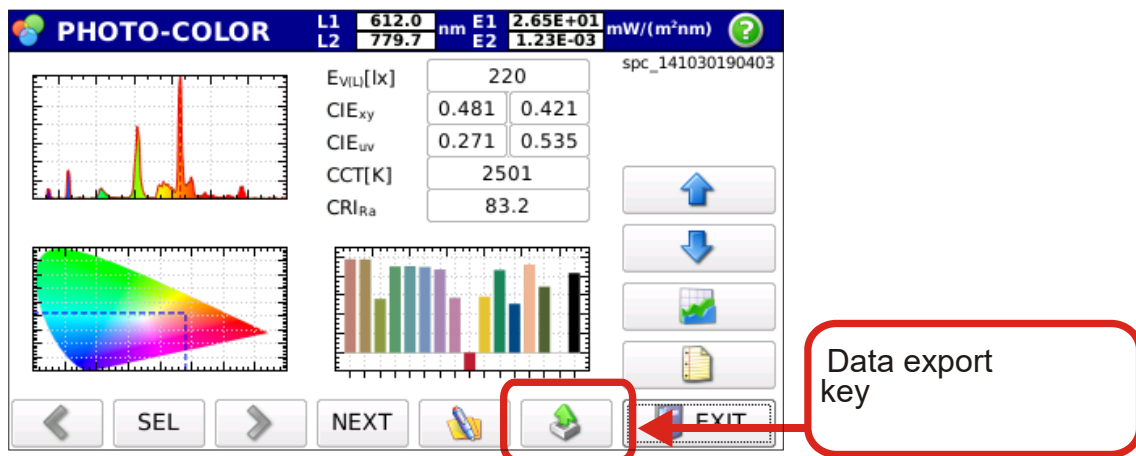


Fig. 7.2: exporting a previously performed measurement

If the measurement is displayed in SPECTRUM mode, exported data are only those related to spectral irradiance (the spectrum image appears in the exported file) and the file is saved with the following name:

rsp-yymmddHHMMSS.pdf

the text file containing only spectral irradiance data is saved with the name :

r1n_ yymmddHHMMSS.txt

If the measurement is displayed in PHOTO-COLOR mode, the exported data are spectral irradiance and all data related to calculated photo-colorimetric quantities (the spectrum image, the x,y coordinates image within the CIE 1931 colour space and the chromatic rendering index are shown in the exported file). The file is saved with the following name:

rph-yymmddHHMMSS.pdf

the text file containing only spectral irradiance data is saved with the name:

r1n_ yymmddHHMMSS.txt

If the measurement is displayed in RADIOMETRY mode, the exported data are spectral irradiance and all the calculated radiometric data (the spectrum image appears in the exported file). The file is saved with the following name:

rrd-yymmddHHMMSS.pdf

the text file containing only spectral irradiance data is saved with the name:

r1n-yymmddHHMMSS.txt

In TRANSMISSION measurements, spectral transmission is exported in 1 nanometer steps, (the spectral transmission image appears in the exported file) :

rtr-yymmddHHMMSS.pdf

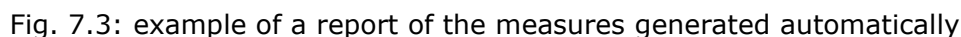
the text file containing only spectral irradiance data is saved with the name:

r1n-yymmddHHMMSS.txt

Fig. 7.3 shows an example of a report generated in PHOTO-COLOR mode. It is possible to change the "logo" image with other images.

To change image, save the image to insert as "logo.png" on microSD card, in main directory; at this point, every time the report is generated the image will appear in place of the written

2 : 4.



9 Probes calibration

Each probe is individually calibrated in our laboratories.

The HD30.S1 probe covers the visible spectrum (380...780 nm); it is calibrated by using a reference standard halogen lamp of which the spectral irradiance at the different wavelengths is known.

The HD30.S2 probe covers the ultra-violet spectrum (220...400 nm); it is calibrated by using a reference standard deuterium lamp of which the spectral irradiance at the different wavelengths is known.

The calibration file is stored into the probe and is read by the software each time the probe is connected to the HD30.1. By pressing the INFO PROBE button, the data related to the calibration file of the installed probe is displayed in the main window (Fig. 8.1).

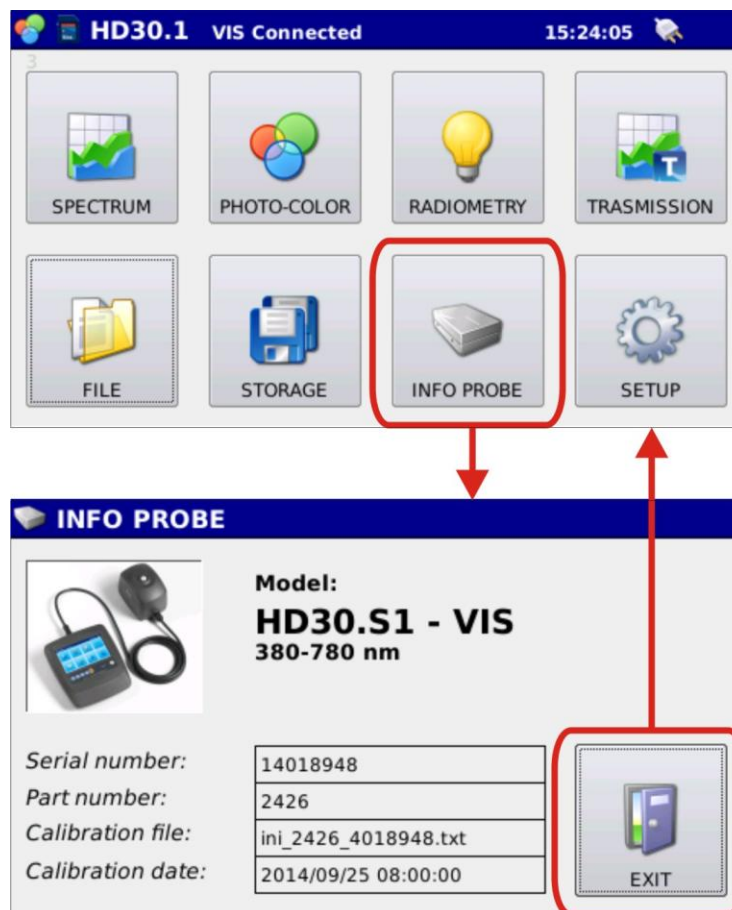


Fig. 8.1: Access to the window displaying info on connected probe calibration

10 Maintenance

Do not use aggressive cleaning agents or incompatible with the materials indicated in the technical specifications. For cleaning, use a soft dry cloth or slightly dampened with clean water.

11 Safety instructions

The instrument proper operation and operating safety can be ensured only in the climatic conditions specified in this manual and if all standard safety measures as well as the specific measures described in this manual are followed.

Do not use the instruments in places where there are:

- Corrosive or flammable gases.
- Direct vibrations or shocks to the instrument.
- High-intensity electromagnetic fields, static electricity.

User obligations

The instrument operator shall follow the directives and regulations below that refer to the treatment of dangerous materials:

- EU directives on workplace safety.
- National law regulations on workplace safety.
- Accident prevention regulations.

12 Ordering codes

The instrument is supplied with lithium rechargeable battery, **SWD05** power supply unit, **CP30** power supply cable, 8 GB μ SD card and carrying case.

Probes must be ordered separately.

Probes

HD30.S1 Spectroradiometer for the measurement in the visible spectral range (380...780 nm). The power is supplied by the HD30.1 data logger. The 1.5 m cable with 8-pole M12 connector for the connection to the data logger is included. Supplied with calibration report.

HD30.S2 Spectroradiometer for the measurement in the ultraviolet spectral range (220...400 nm). The power is supplied by the HD30.1 data logger. The 1.5 m cable with 8-pole M12 connector for the connection to the data logger is included. Supplied with calibration report.

Kit

HD30.1K Kit including HD30.1 data logger + HD30.S1 spectroradiometer for the measurement in the visible spectral range (380...780 nm) + HD30.S2 spectroradiometer for the measurement in the ultraviolet spectral range (220...400 nm).

Accessories

VTRAP30 Tripod, height 157 mm.

Spare parts

SWD05 **100-240 Vac / 5 Vdc-1 A** mains power supply. Output with A type USB connector.

CP30 Power supply cable with A type USB connector on one side and coaxial DC plug on the other side.

BAT30 Rechargeable battery.

MicroSD 8 GB MicroSD card.

Notes

Notes

WARRANTY

The manufacturer is required to respond to the "factory warranty" only in those cases provided by Legislative Decree 6 September 2005 - n. 206. Each instrument is sold after rigorous inspections; if any manufacturing defect is found, it is necessary to contact the distributor where the instrument was purchased from. During the warranty period (24 months from the date of invoice) any manufacturing defects found will be repaired free of charge. Misuse, wear, neglect, lack or inefficient maintenance as well as theft and damage during transport are excluded. Warranty does not apply if changes, tampering or unauthorized repairs are made on the product. Solutions, probes, electrodes and microphones are not guaranteed as the improper use, even for a few minutes, may cause irreparable damages.

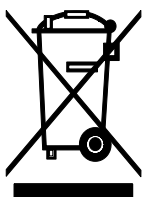
The manufacturer repairs the products that show defects of construction in accordance with the terms and conditions of warranty included in the manual of the product. For any dispute, the competent court is the Court of Padua. The Italian law and the "Convention on Contracts for the International Sales of Goods" apply.

TECHNICAL INFORMATION

The quality level of our instruments is the result of the continuous product development. This may lead to differences between the information reported in the manual and the instrument you have purchased.

We reserve the right to change technical specifications and dimensions to fit the product requirements without prior notice.

DISPOSAL INFORMATION



Electrical and electronic equipment marked with specific symbol in compliance with 2012/19/EU Directive must be disposed of separately from household waste. European users can hand them over to the dealer or to the manufacturer when purchasing a new electrical and electronic equipment, or to a WEEE collection point designated by local authorities. Illegal disposal is punished by law.

Disposing of electrical and electronic equipment separately from normal waste helps to preserve natural resources and allows materials to be recycled in an environmentally friendly way without risks to human health.



RoHS

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