

L3C216 SERIES CAMERA OPERATION MANUAL



L3C216 Camera Operation Manual

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GENERAL DESCRIPTION

You have purchased a precision low light level camera that produces high-resolution continuous video for display on a standard 625-line monitor or for subsequent processing on a computer system.

The image sensor is 2/3" format and protected from condensation and dirt by a cover slip, which also isolates the cooled image sensor from the outside world.

FEATURES

The camera offers the following features:

- Fast start (usable image after only a second of switch-on, full performance at room temperature in average light levels after 5 seconds and full performance at room temperature after about 30 seconds in very low light levels).
- Full support of both manual iris and auto-iris C-mount video lenses.
- Preset back focal distance and planarity of sensor to the lens mount.
- Non-microphonic sensor – image stable in high ambient noise environment.
- Field blanking period optical dispersion to eliminate frame transfer highlight distortion.
- Silent operation – no cooling fan.
- C-mount lens mounting as standard (alternatives could be made available to special order).
- 625-line interlaced 50 Hz standard video output at 75 Ω .
- Can be adjusted without a PC (all common functionality).

QUICK START GUIDE

Read this regardless – it will only take 2 minutes and might save days!

What's in the Box

The following checklist confirms what will have been packed at the factory. Check off the items on opening the box prior to unpacking the piece parts:

- Camera body complete.
- Body cap (C-mount hole cover) affixed to camera body.
- CD with “L3C216 driver software” in its own case and electronic version of this manual.
- Data sheet.
- Serial lead (9-way D female to 15-way mini-D (female), 1.8 m).
- A mating connector for the power socket.
- A mating connector for the video-iris driver socket.

Delivery Check

- 1) Verify that the outer case has no significant transit damage. If damage is evident, reject the package and contact the supplier at once of the problem.
- 2) Carefully open the packing case and confirm that the items above are all present inside.

How to Unpack

- Items may simply be lifted out of the case. Be sure that no leads or flying connectors are trapped within the foam as you do so.
- Before removing the caps from the lens and camera body, be sure that the area in which you are working is clean and nominally dust-free.

What Else You Need

- An appropriate power source.
 - The camera requires 12 V DC at up to 2 A peak (less than 1 A steady state).
 - One option e2v would endorse is EOS model LFZVC36FS12E 12 V 3 A regulated, universal mains input 90 – 264 V AC 50 or 60 Hz, RS order code 377-7062. That PSU comes terminated with a 2.5 mm circular DC power jack that must be replaced with the 4-way HR10 line socket, supplied with the camera. There is no mains cord supplied with this PSU. An IEC320 (C8) cord will be needed, terminated in a plug to suit the local conditions. For the UK an appropriate mains lead can be obtained from RS, order code 452-669.
 - The camera power input HR10 connector pin-outs are as follows:
 - Pins 1, 2: +12 V input.
 - Pins 3, 4: 0 V (ground).
- A lens. The camera supports “video iris” lenses and manual iris lenses, both fixed focal length and zoom, with C-mount 2/3” format image.
 - If the lens is motorised zoom and/or focus, an additional supply and control for the zoom is required.
- BNC to BNC lead, 75 Ω to drive a standard 625-line monitor.
- A camera mount, either with a bespoke flange to hold it by the front plate or a tripod mount.
- Alternative/additional ¼ Whitworth tapped holes are available on each side as alternative mounting methods. If these are used, care must be taken to ensure the vents on those faces are not obstructed.
- Either a video monitor with BNC terminated input or a CameraLink expansion for a PC and a PC is required to capture video output. The former is preferred for initial connectivity for simplicity.
- A windows-based (W98SE through to XP) PC with a serial port is optional, but if used allows more detailed control of the camera than available on the limited on-screen menu accessible with switches on the rear flange of the camera.
- A PC with CameraLink adapter/frame grabber allows video to be captured on the PC and either streamed or subsequently processed after capture. The PC specification is dependent on the chosen CameraLink adapter – the two must be compatible (beyond the scope of this manual).

Connecting and Powering Up - Basic

- Mount the camera to the tripod or camera head via either the lower tripod mount or the bespoke front-mounted flange. Do not over-tighten.
- Ensure the air is nominally dirt-free, and remove the front cap of the camera body.
- Check the faceplate of the camera is clean and if necessary gently stroke the camera faceplate using a lens tissue dampened with IPA to remove light debris.
- Remove the rear cap of the lens and screw the lens into the camera body until the flanges meet, then turn the lens a further 2 – 3° to tighten it. Do not over-tighten.
- If the lens is a video-iris type, plug the cable into the 4-way socket on the top flange of the camera. A suitable connector is provided with the camera for use with lenses that have incompatible connectors. Connections are:
 - Pin 1) red Power 12 V regulated, 50 mA
 - Pin 2) not used
 - Pin 3) white Video signal
 - Pin 4) black Ground.
- If the video is to be fed to a standard 625-line monitor, connect the BNC lead between the socket labelled “VIDEO” on the camera rear face to the 75 Ω-terminated video input socket on the monitoring device. This step is useful for initial setting up of the camera even if the eventual use will be using a PC via a CameraLink interface.
- Connect the power lead from the PSU to the “Power” socket on the camera. This is a bayonet connector and fits in only one orientation. Holding the rubber boot, gently press the connector while rotating until the connector moves forward, then press slightly more firmly allowing the knurled ring to slide forwards latching the connector. To unplug, pull back the knurled ring and the connector withdraws.
- Remove the front cap from the lens (it likely just pulls off) and connect the mains to the power supply/switch on the power supply.

Connecting Advanced Features #1 – CameraLink

If CameraLink interface is to be used, it is assumed that the CameraLink adapter/frame grabber is pre-installed on the PC and that any software that came with the CameraLink hardware is already installed on the PC.

- Connect the dedicated CameraLink data cable (not supplied) between the CAMERALINK port on the rear face of the camera to the Camera Link Base port output on the CameraLink adapter.
- Ensure that no serial lead is connected to the I/O connector on the camera, which would potentially take priority of communications.
- For CameraLink operation, refer to the separate CameraLink documentation supplied with the CameraLink PC adapter/frame grabber.
- Set the frame grabber configuration to suit the L3C216 Camera viz.:
 - Resolution 768 x 576 12 bits Monochrome – Non-Interlaced (Progressive).
 - Valid signal source – Use LVAL/FVAL/DVAL from camera
 - Pixel clock 29.44 MHz.

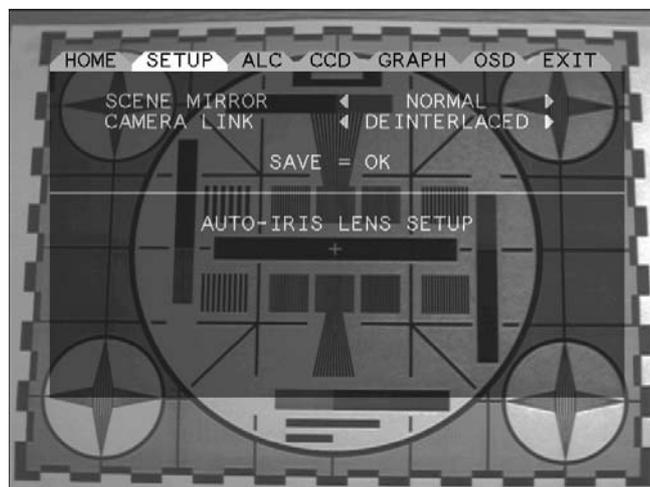
CameraLink Video Mode

The CCD sensor used in the L3C216 camera is a 625-line 50 Hz interlaced field device. The Camera Link output merges the 2 interlaced fields into a single progressive 25 Hz field via an in-built field store. The technique is commonly called 'weave'. Because the 2 interlaced fields are 20 ms apart, rapid horizontal movement across the video field may introduce a ragged 'mouse teeth' effect across the vertical edges of the moving object. Additional processing is available within the camera to remove this effect, with a very slight penalty in perceived vertical resolution. If this is desirable in your particular application proceed as follows:

- Press both outside buttons simultaneously to get OSD.



- Press the right-arrow button on the camera once so that the SETUP tab information is shown on the monitor.



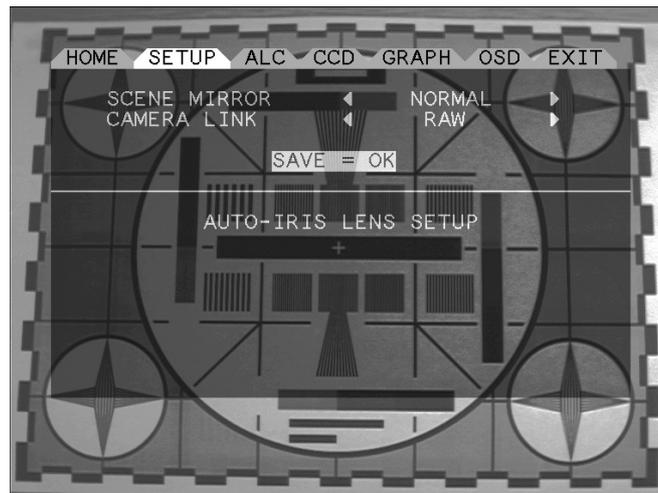
- Press the down arrow twice to highlight the 'CAMERA LINK' text.



- Press the right or left key to select between the 'RAW', 'DEINTERLACED' and 'OFF' settings. The 'RAW' setting will output a basic field combined 'weave' output, the 'DEINTERLACED' setting will remove the horizontal motion artefacts with a slight perceived loss of vertical resolution. The 'OFF' setting disables the CameraLink output and enables the frame timing outputs from the I/O multifunction connector (see appendix). These outputs are provided to drive a stand-alone analogue frame store.



- Press the down arrow once to highlight the 'SAVE = OK' text



- Press the 'OK' button. Text should change to 'SAVED'. Exit the display menu by pressing the up button 3 times, and left button twice (EXIT Tab). Press 'OK'.

Connecting Advanced Features #2 – Serial Connection and Software Installation

- If CameraLink interface is to be used, Serial connectivity to the camera can be made via the CameraLink interface.
- Alternatively, the Serial connectivity can be made with the dedicated lead (supplied) that runs between the 9-way serial port on the PC (or adapter) and the 15-way sub-min D connector labelled I/O on the camera rear face. Secure both ends of the serial cable with the jack screws once the lead is pushed home.
- Whichever connection means is adopted, it is necessary to install the PC-based software before control of the camera can be established. Do this as follows:
 - Place the CD into the PC drive.
 - Open the CD using Windows Explorer or "My Computer", then double-click "Setup" or "Setup.exe". Go with default options, only replacing files where the file to be copied is younger than the file to be overwritten.
- The program "L3C216" is now installed. Run it as follows:
 - Click Start... All Programs... L3C216 GUI... L3C216GUI

USING THE CAMERA

Video on a Monitor

- The video to the monitor is always present on the terminated BNC connector irrespective of alternative video connectivity or activity.

Video on a PC

- To get video on a PC, it is necessary to have a CameraLink adapter installed on the PC and for the camera to be connected to the CameraLink Base channel connector on the CameraLink interface/frame grabber using a proprietary CameraLink cable.

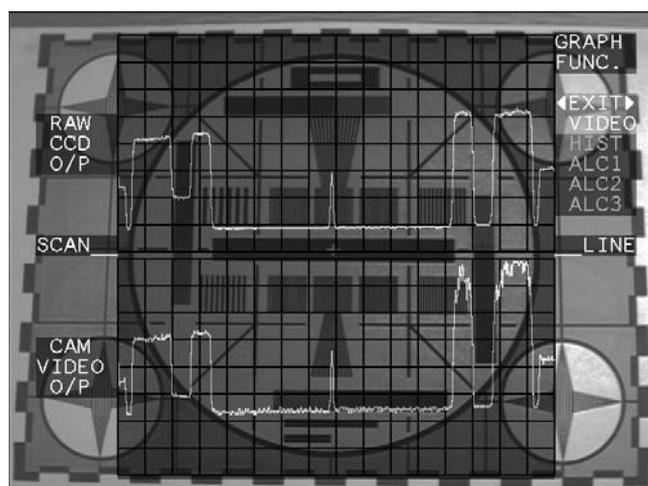
- Further detail for this mode of video operation should be sought from the CameraLink Frame grabber/PC interface documentation.

Choosing and Setting Up the Lens

- The lens focal length, zoom ratio and aperture should be selected for the use to which the camera is to be put. As a guide, a 16 mm lens gives a $\pm 20^\circ$ field of view.
- For use in high infrared scene content, a NIR lens is preferable to ensure focus is maintained across the region of the electromagnetic spectrum over which the camera is sensitive.
- To focus the lens, find a scene with an edge transition and adjust the focus ring to maximise the sharpness of the transition. By using the OSD 'scope trace feature of the camera this operation can be done most precisely.
 - Press both outside buttons simultaneously to get OSD.

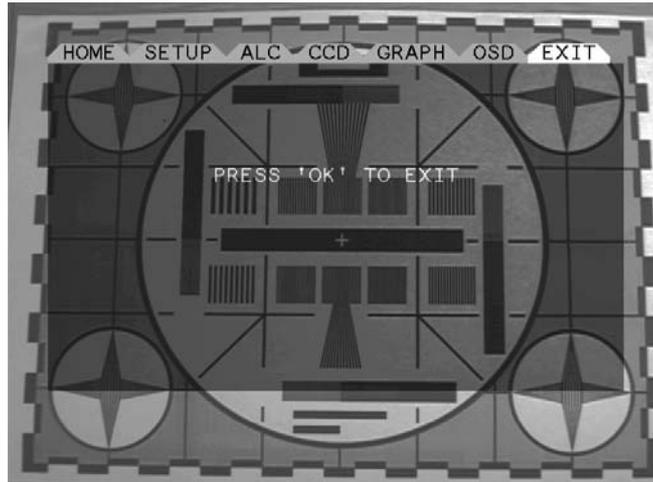


- Press the right arrow 4 times to select the Graph tab.



- Adjust the focus to get maximum HF (fastest rise time) signal in the area of interest on the upper trace. The displayed video line is indicated by the "SCAN LINE" markers half-way down the frame.

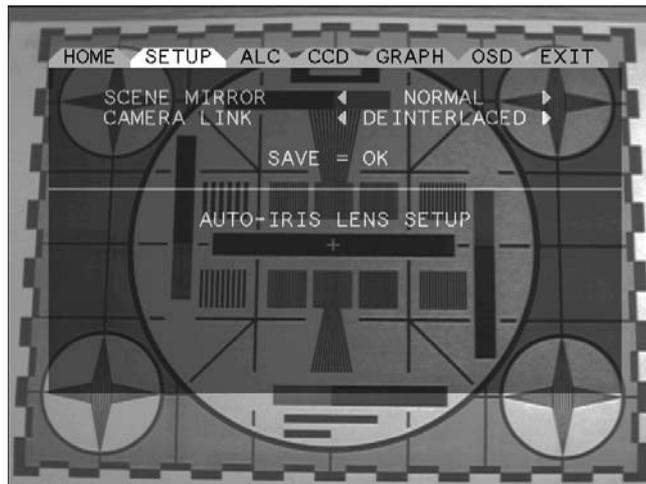
- Lock the focus if appropriate.



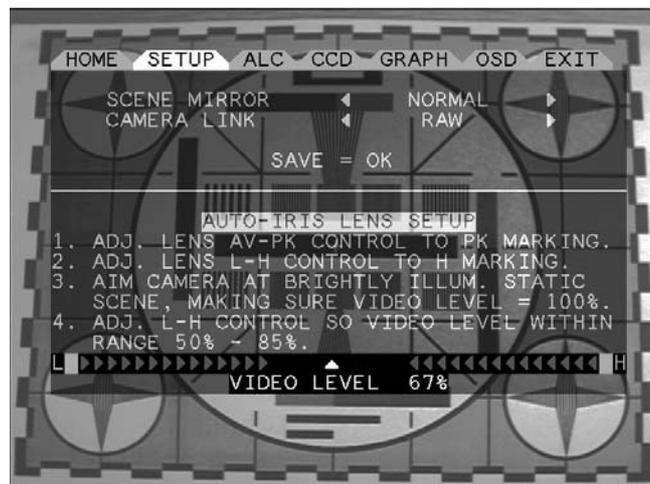
- Press the right arrow key twice more to select Exit, then press the central OK button to confirm.
- On first use of a video auto-iris lens it will be necessary to set up the lens iris for optimum performance, as follows:
 - Press the outer pair of buttons on the rear of the camera at the same time to produce an on-screen menu.



- Press the right-arrow button on the camera once so that the SETUP tab information is shown on the monitor.

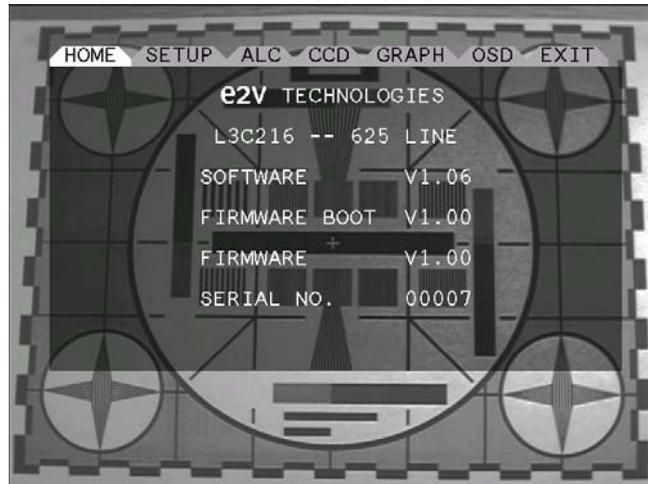


- Press the down arrow 4 times to highlight the 'AUTO-IRIS LENS SETUP' text



- Ensure auto-iris lens control cable is plugged into the socket on top of the camera.
- Remove adjustment dust caps from the side of the lens.
- On the adjustment marked Av-Pk, rotate the control until it is fully toward 'Pk'.
- On the adjustment marked "Level", rotate the control fully toward the 'H' marking.
- Aim the camera toward a brightly illuminated static scene.
- Slowly rotate the Level adjustment toward the L until the video level is in the range 50% to 85%. Ideally try to get the highlighted pointer indicator within the centre blank area (see screenshot above).
- Replace the dust caps.
- Exit the on screen display by pressing the up arrow 4 times, left arrow twice, then the centre OK button.

- If your application's optical configuration results in a mirrored image out of the camera, do the following:
 - Press both outside buttons simultaneously to get OSD.



- Press the right-arrow button on the camera once so that the SETUP tab information is shown on the monitor.



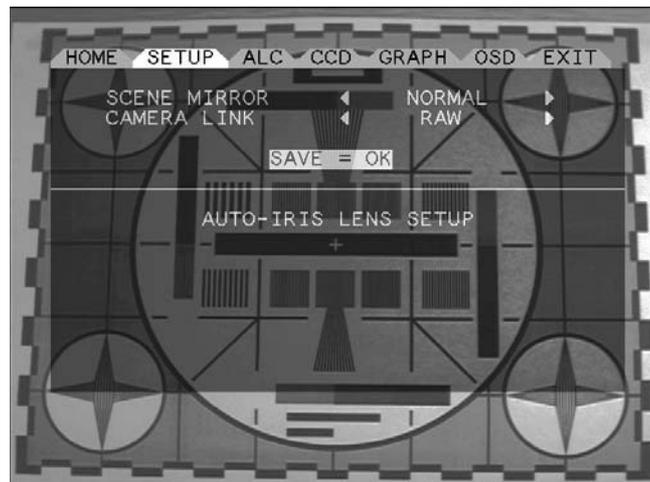
- Press the down arrow button once to highlight 'SCENE MIRROR'



- Press the right (or left) arrow once to change the setting between 'NORMAL' and 'MIRROR'. Settle on the 'MIRROR' setting.



- Press the down arrow twice to highlight the 'SAVE = OK' text



- Press the 'OK' button. Text should change to 'SAVED'. Exit the display menu by pressing the up button 3 times, and left button twice. Press 'OK'

Your camera should now be fully configured for your application.

DOS AND DON'TS

DO

- Remember this is a precision optical instrument. It is optically robust, mechanically strong, but is not designed to withstand high mechanical shock.
- Keep the ventilation slots in the camera uncovered and free from dust and debris.
- Power the camera down and cap the lens when not required.
- Clean the camera periodically (see below).

DON'T

- Do not install or use the camera outdoors without additional protection. It is not weatherproof at all. If an outdoor installation is to be contemplated, an additional weatherproof housing with appropriate cooling capability should be used to house the camera system.
- Video-iris lenses and manual lenses are supported. A DC motor-iris lens is not specifically compatible. However, adaptors are available for most motor iris lenses.
- Do not install the camera in areas of high magnetic field. A small susceptibility to DC magnetic fields may cause loss of performance in some situations.
- Do not cap the lens for long periods with the camera powered up. Whilst the camera is designed to withstand such operation, capping the powered camera forces high CCD gain and maximum Peltier activity in the camera, which in turn slowly ages the sensor and stresses the camera system unnecessarily.
- Do not wet the camera, or use solvents.
- Do not store or allow the camera to stand in direct sunlight. The power absorbed by the camera in such conditions raises the temperature rapidly and causes unnecessary stress to the sensor and circuitry.

SERVICING (INCLUDING ROUTINE MAINTENANCE)

Periodically, the camera should be serviced and adjusted for optimum performance and longevity.

- In dusty environments, it may be necessary to clean the front of the lens. Follow manufacturer's/supplier's guidelines for this.
- With the camera unpowered, vacuum-clean the camera via its cooling slots and polish with a soft dry cloth. If necessary a damp cloth may be used (but not dripping).
- If the picture looks unusually noisy or areas are whiting out, adjust the lens iris (or for video iris lenses, adjust the video iris settings). See above.
- If there are "donuts" in high light level fields (when the lens is stopped down) it is probable that the faceplate or one surface of the lens has dust. Clean the lens in accordance with the manufacturer's instructions and clean the faceplate with the lens removed, gently stroke the camera faceplate using a lens tissue dampened with IPA to remove light debris.

- Camera control using “Cameralink” (not supplied).
- The camera conforms to The CameraLink ‘Base’ specification Version 1.2 dated January 2007.
- For details of operation of the camera using CameraLink, please refer to CameraLink documentation supplied with the CameraLink frame grabber/PC interface.
- Controlling the camera using CameraLink is in fact Serial control but making use of the CameraLink connector for the purpose. Refer to Serial camera control below for control facilities available.
- **Note:** A serial lead plugged in to the I/O socket takes precedence and may prevent successful serial communication on the CameraLink connector.

CAMERA CONTROL USING GENERIC SERIAL PORT CONTROL (SUPPLIED)

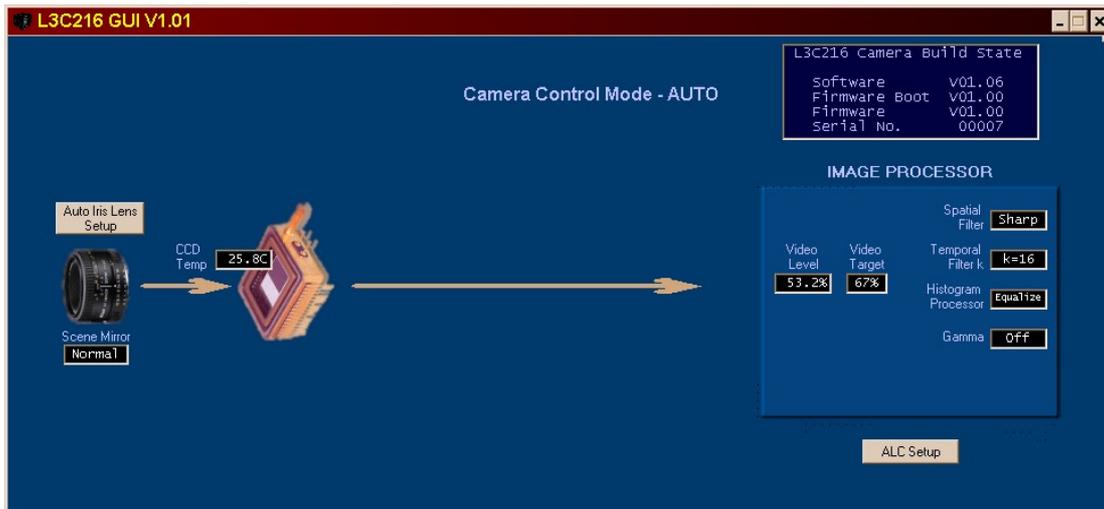
General – Establishing Communications

- The serial connection to a PC and the serial software, both supplied, need to be installed as above under “Connection advanced features #2.
- With the camera powered up and viewing a representative scene, open the camera control software.
 - Click Start... All Programs... L3C216 GUI... L3C216GUI



- Select the correct serial port from the dialog box. If a choice is presented and you are unsure which to select, try then one at a time. Clicking one will either hang the software searching for a camera (in which case close the software, re-open it and try a different port) or will produce the CCD graphic showing communications are established.

- Make a note of the correct port for subsequent sessions if appropriate.



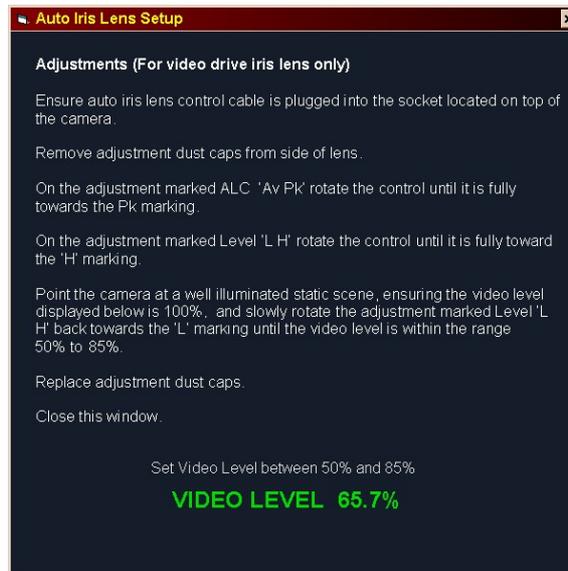
- Assuming communication is established with the camera, you will be presented with an overview of the current camera build state and operating parameters. From left to right: Scene Mirror, Auto Iris set-up, CCD temperature, an ALC Setup button, and an Image Processor parameters box.

Scene Mirror

Indicates the current state of the image reversal feature. This can be changed local to the camera via the menu system.

Auto Iris

A means for auto iris calibration is presented via the 'Auto Iris Lens Setup' button opens a new window for auto iris calibration.



- Follow the on-screen instructions.
- **Note:** Auto Iris lenses can also be conveniently calibrated via the camera on screen menu system

CCD Temp

Indicates the current CCD image sensor operating temperature.

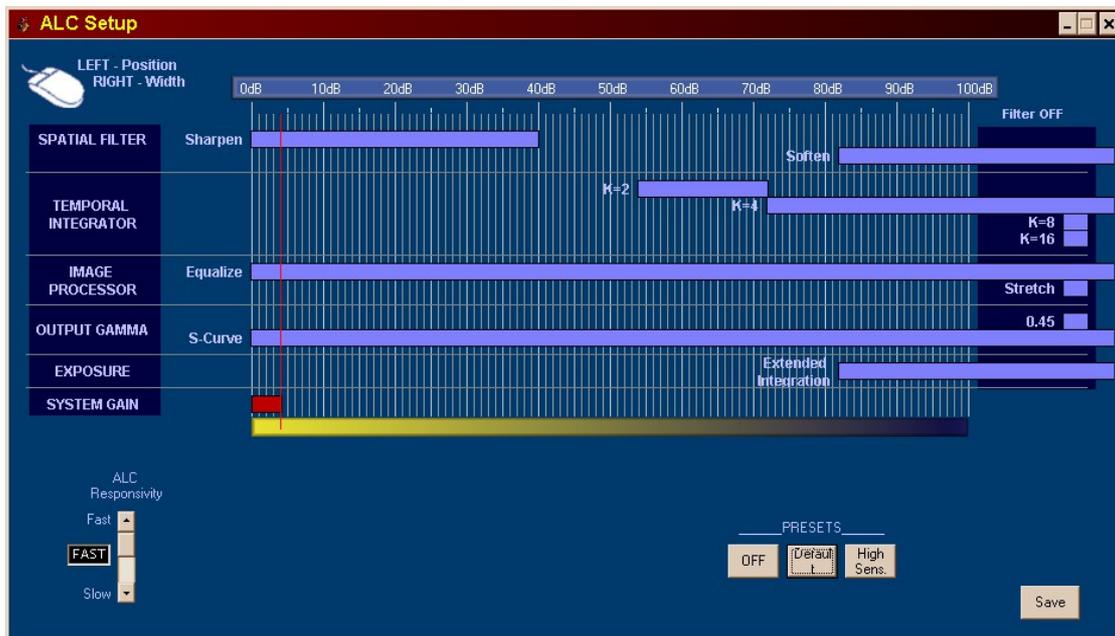
Image Processor Display

Within the 'Image Processor' display box you will find the following functions:

- Video Level: displays the actual achieved video level from the CCD/ analogue front end before being presented to the image processor. Under normal conditions it will closely match the VIDEO TARGET. If an auto iris lens is fitted, then in high illumination conditions (i.e. Twilight and above) VIDEO LEVEL will be controlled by the lens (see Auto iris lens calibration).
- Video Target: displays the % video level the ALC system is tasked to achieve out of the CCD/ analogue front end before being presented to the image processor. 100% represents peak white or maximum light level the sensor can cope with without clipping. The VIDEO TARGET is factory set and normally set at a lower level than 100% to allow adequate headroom for scene highlights.
- Spatial Filter: Indicates the current filter state. Options are SHARP/SOFT/OFF
- Temporal Filter k: Indicates the current filter k coefficient. Options are OFF / K=2 / K=4 / K=8 / K=16.
- Histogram Processor: Indicates the current image processor function. Options are EQUAL (Histogram equalization) / STRETCH (Image endpoint stretch) / OFF.
- Gamma: (Video output gamma correction) indicates the current curve map type. Options are OFF / 0.45 (Conventional gamma 0.45 curve) / SCURVE (S-curve gives increased black and white gain with decreased mid band gain. Enhances low/high level detail).

ALC Setup

Opens a new window where many post processing functions can be adjusted to suit the individual's requirement.



- The dB bar across the top of the page, together with the 'System Gain' cursor represents the current total system gain of the camera between the CCD sensor and the camera video output (both analogue BNC and Camera Link). It is the system gain value that determines the current configuration of the camera's image processor.
- Each image processing function has an associated horizontal bar which determines its on and off system gain switching points via the dB scale.
- The ALC Setup system allows you to reconfigure all the switching points to optimise the camera for your own application.
- Placing the mouse cursor over a filter control bar and depressing the left mouse button allows you to drag the bar and reposition horizontally.
- Placing the mouse cursor over a filter control bar and depressing the right mouse button allows you to change the horizontal width of the bar.
- If a particular filter function/value is not required left mouse click on the bar and drag to the extreme right and drop in the 'Filter Off' Box.
- The system gain cursor is capped at 100 dB. To ensure a filter remains switched on up to this point and beyond it is permissible to have the right hand 'tail' of a filter bar overhang into the Filter Off area. Provided the start point is situated at <100 dB the filter will remain on notionally to the infinity dB point.
- If you are happy with your adjustments of ALC, press the 'Save' button to put a permanent copy in the cameras own configuration memory. You will be locked out from further saves unless you close and re-open the 'ALC Setup' window.

- If you have adjusted the ALC settings and are unhappy with the result or you are unsure of how best to optimise them, there are three preset formats available, one of which is likely to be close to optimum for your situation. The three preset configurations are available via the cluster of buttons marked 'Presets':
 - 'Off' preset will remove all signal processing between the CCD sensor and video output and may be a useful starting point if you intend optimising the camera for your own application.
 - 'Default' preset will reload the configuration originally set in the factory.
 - 'High Sens' (High sensitivity) preset optimises the camera for very low light operation.

Image Processing Functions

Spatial Filter - Sharpen

In good signal/noise conditions the image can benefit from applying the sharpen filter to give a subjectively better looking crisp image. A side effect of the filter is that it will also enhance any noise in the system so cannot be used over the entire dynamic range. Typically it is worth turning off the filter at around the 40 dB point to maintain image quality.

Spatial Filter – Soften

At lower noise levels noise in the image can become troublesome. As the light level decreases spatial resolution in the system also decreases purely as a physical effect. For some types of application softening the reduced resolution image will allow suppression of noise and give a subjectively improved looking image. Typically you would not apply the soften filter until at least 70 dB of system gain has been applied.

Use of the sharpen and soften filters is mutually exclusive. If both filters are used the ALC Setup system will only allow you to switch in the sharpen filter at a higher light level than the soften filter. You are also prevented from overlap situations.

Temporal Integrator

The temporal integrator operates by merging several fields of video together before output. It has the advantage of maintaining image spatial resolution, but at the cost of decreased temporal resolution (Image lag). For scenes that are static or only have slow movement within them the filter can be used to good effect. Increasing values of the filter 'k' factor improves the video signal/noise ratio by a factor of \sqrt{k} but also increases the image lag. The filter would typically only be used when image noise becomes prevalent; the severity of the filter is application dependent and best optimized by experimentation.

If several values of 'k' are used through the camera gain range then the ALC setup GUI will force the condition whereby increasing values of 'k' can only exist from left to right.

Image Processor – Equalize

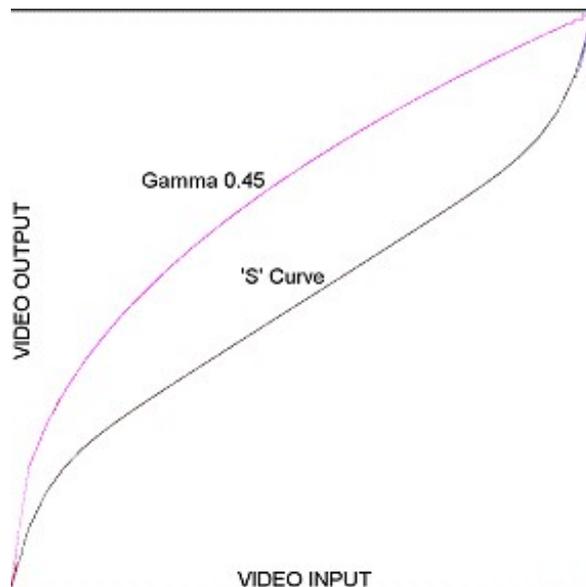
When enabled the image processor performs a special modified form of histogram equalization dynamically on a field-by-field basis. It puts the camera into a high dynamic range (HDR) mode. For the uninitiated the image presented may appear to be extremely false looking, but allows the full dynamic range of the available video signal to be efficiently mapped to your chosen display system and vastly improve the image detail in both blacks and whites. By way of example consider the scenario of viewing an outside scene incorporating a highly lit sky, with a comparatively low-lit scene below the horizon. With conventional camera systems you have a choice of either correctly exposing the sky while completely losing all foreground detail, or correctly expose the foreground while the sky becomes saturated/washed out. The use of the equalize function allows enhanced viewing of the sky cloud formations together with airborne objects, but still resolving all the image detail in the much darker foreground. If switched in it can be generally applied across the whole dynamic range, but the end user has full control.

Image Processor – Stretch

When enabled the image processor inspects the frame image histogram and determines the optimum black and white endpoints. The endpoints are then used to determine the optimum gain/offset values to apply to the image to make best use of the display device dynamic range. Using stretch produces a more natural looking image and may be acceptable for certain applications. The technique is not as effective at extracting image detail as equalization. It is perfectly permissible to mix the equalize/stretch functions through the camera dynamic range.

Output Gamma - 0.45 and S-Curve

To compensate for the combined non-linear response of the display device and the human eye, the image-processed video is finally passed through a lookup table before being output (this applies to both the analogue and Camera Link outputs). The shape of the transfer function is determined by the S Curve/Gamma 0.45 selection.



Camera Video output LUT curves

It is permissible and feasible to mix the Gamma 0.45/S-Curve functions through the camera dynamic range to make a composite curve to suit.

Exposure – Extended Integration

Under normal conditions the CCD image integration time is set to 20 ms. At low light levels (system gain typically >80 dB) it is advantageous to increase the integration time to 40 ms, thus doubling the sensitivity of the system. This mode is called Extended Integration. It is useful as a last ditch move to obtain usable images at very low light levels. Using Extended Integration will increase the lag (limit sensitivity to movement) of the system.

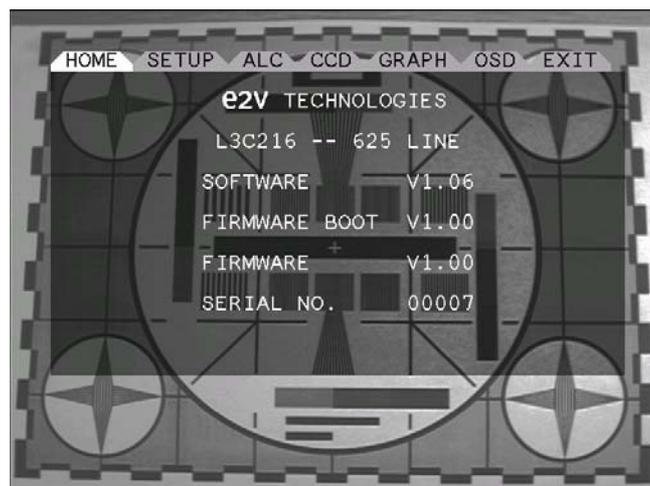
ALC Responsivity

ALC Responsivity controls the speed at which the ALC (Exposure control) system attempts to correct for errors in camera video level. In FAST mode the system will rapidly respond to the immediate changes in scene illumination. This may not be ideal in certain circumstances, e.g. in a scene with explosions/flashing lights or rapidly moving bright objects that go in and out of the field of view. In such conditions it is recommended that the ALC response is switched to 'SLOW'. This will force the ALC to ignore single frame large variations in scene luminance. The factory default is FAST.

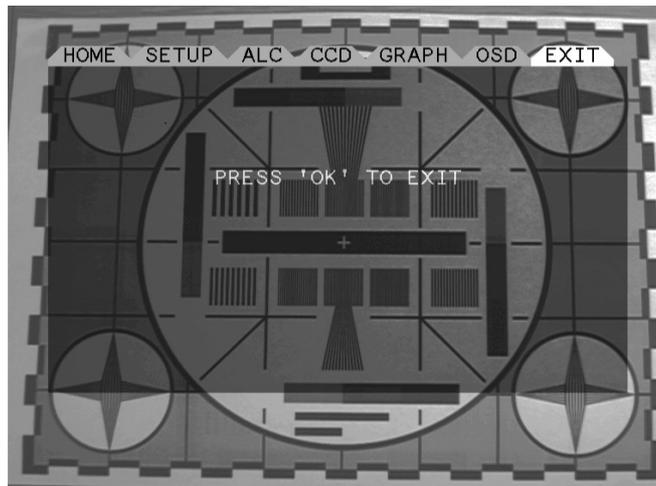
CAMERA CONTROL USING REAR FACE PUSH BUTTONS

Five pushbuttons in a row are presented on the rear panel. Reading from left to right, they are labelled respectively with left-arrow, right-arrow, 'ok', up-arrow, and down-arrow.

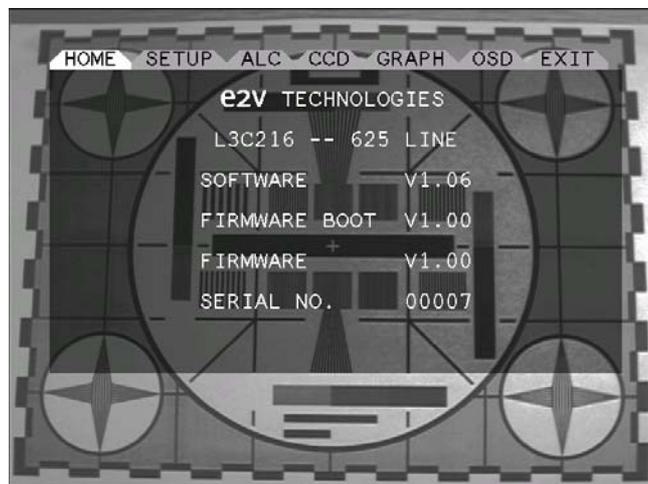
- To invoke the on-screen information, the two outside buttons (left-arrow and down-arrow) are pressed simultaneously.



- To exit the on-screen information, the up-arrow is pressed once or twice if necessary to take the highlighted cursor to the top row, then the left or right-arrow pressed repeatedly until "Exit" is highlighted, then the OK button is pressed exiting the on-screen menu function.



- Seven top-level options (including “Exit”) are presented. To move from one to another, press either the left or right-arrow button repeatedly until the cursor highlights the function (in the case of OSD and GRAPH, the function operates straight away, but left or right arrow still cycles through to the next/previous function). Each top-level function is explained below, and with the exception of “Setup” is for information only, without offering any adjustment features:
 - Home displays the company name (e2v technologies), camera type (L3C216 – 625 line), software version, firmware boot version, firmware version and serial number. You may be asked to quote this information in the event of needing technical support.

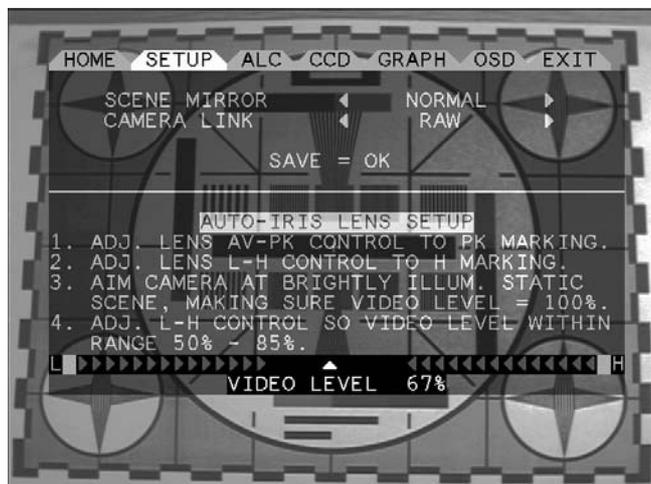


- Setup provides two sub-options, “Scene Mirror” and “Camera Link”, which are selectable by pressing the down-arrow button once or twice respectively. Changing either or both of these options has immediate effect on the image, but a power down and back up again restores the last saved settings.



- The Scene Mirror function permits either “normal” or “mirror”. Normal, the default setting, is a natural image. Mirror provides horizontal lateral inversion, which can be used if your application’s optical configuration results in a mirrored image out of the camera.
- The Camera Link function allows for Raw (default) and De-interlaced. The CCD sensor used in the L3C216 camera is a 625-line 50 Hz interlaced field device. The Camera Link output merges the 2 interlaced fields into a single progressive 25Hz field via a field store. The technique is commonly called ‘weave’. The weave function is invoked by selecting the ‘RAW’ option. Because the 2 interlaced fields are 20 ms apart, rapid horizontal movement across the video field will introduce a ragged ‘mouse teeth’ effect across the vertical edges of the moving object. Additional processing is available within the camera to remove this effect, with a perceived slight reduction in vertical resolution. This function is invoked by selecting the ‘DEINTERLACED’ option.

The auto-iris lens setup function when selected temporarily reconfigures the camera internally to allow easy calibration of an optional auto iris lens.



- To calibrate an auto- iris lens:
 - Ensure auto-iris lens control cable is plugged into the socket on top of the camera.
 - Remove adjustment dust caps from the side of the lens.
 - On the adjustment marked Av-Pk, rotate the control until it is fully toward 'Pk'.
 - On the adjustment marked "Level", rotate the control fully toward the 'H' marking.
 - Aim the camera toward a brightly illuminated static scene.
 - Slowly rotate the Level adjustment toward the L until the video level is in the range 50% to 85%. Ideally try to get the highlighted pointer indicator within the centre blank area (see screenshot above).
 - Replace the dust caps.
- To save any changes made to either of the above, press the down-arrow once or twice more to highlight "Save=ok", then press "OK". The last button press turns the screen message to "Saved", and the settings will henceforth be remembered even at power-down.
- To move back to the main menu, press the up-arrow button repeatedly until only the top line shows the highlight.

ALC provides detailed technical information on the camera auto light-level control and image processing function set-up

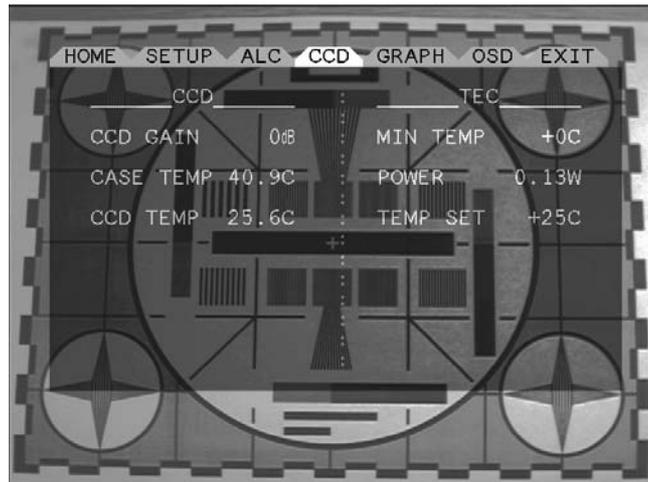


- ALC MODE confirms whether the camera is under internal control (AUTO) or external control via the PC GUI (MANUAL). In free-standing operation, the camera will always be in AUTO mode. Unless there are compelling reasons to do so, AUTO is preferred, not only for maximum visual acuity on the monitor but also for maximum protection of the imager from optical overload.

- VIDEO TARGET displays the % video level the ALC system is tasked to achieve out of the CCD/ analogue front end before being presented to the image processor. 100% represents peak white or maximum light level the sensor can cope with without clipping. The VIDEO TARGET is factory set and normally set at a lower level than 100% to allow adequate headroom for scene highlights.
- VIDEO LEVEL displays the actual achieved video level from the CCD/ analogue front end before being presented to the image processor. Under normal conditions it will closely match the VIDEO TARGET. If an auto iris lens is fitted then in high illumination conditions (i.e. twilight and above), VIDEO LEVEL will be controlled by the lens (see Auto Iris lens calibration).
- ALC RESPONSE displays the speed at which the ALC system will attempt to correct for errors in video level. In FAST mode the system will rapidly respond to the immediate changes in scene illumination. This may not be ideal in certain circumstances e.g. in a scene with explosions/flashing lights or rapidly moving bright objects that go in and out of the field of view. In such conditions it is recommended that the ALC response be switched to 'SLOW'. This will force the ALC to ignore single frame large variations in scene luminance. The factory default is FAST.
- The ALC response can be changed via the ALC setup menu available in the supplied PC GUI software (see below).
- SYSTEM GAIN displays the total gain applied to the video signal between the CCD faceplate and the camera video out (Analog or Camera Link). With an f1.4 lens the following rule of thumb values give an indication of illumination level:

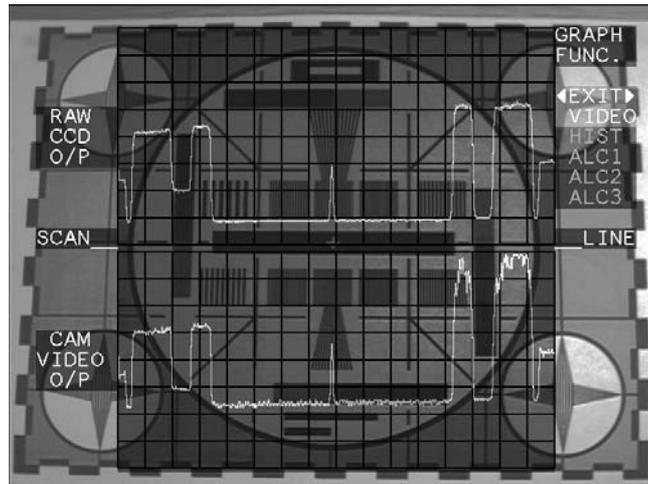
Twilight	<12 dB
Deep Twilight	~30 dB
Full Moon	~45 dB
Quarter Moon	~65 dB
Starlight	~75 dB
Overcast Starlight	>90 dB
- The SYSTEM GAIN measurement is used to determine the switching points of various image-processing functions that are used to optimise the subjective appearance of the displayed video.
 - The right-hand column displays the currently applied switching points for the image processing functions. The camera is supplied with a factory default set which has been optimised to yield good visual results under most conditions. These may not be ideal for your own particular application and may be optimised via the supplied PC GUI.

CCD is an information only display. The items shown are as follows:

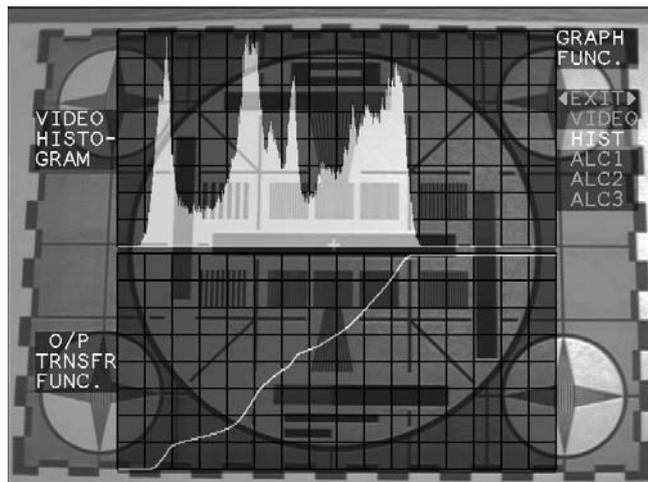


- CCD Gain – a measure of the low light output register gain being called upon for the prevailing scene – for darker scenes, the gain increases. It is one element used to calculate the final system gain.
- CASE TEMP: this is a measure of the temperature of the CCD package that has a low thermal resistance path to the camera case. For normal scenes where the camera is not being heated incidentally, the temperature is only a few degrees above the ambient temperature. For lower light scenes where the CCD gain is higher and the Peltier cooler is striving to reduce the CCD temperature, the case temperature rises. Once up to 50 °C, the system relaxes gracefully for self-preservation and a small worsening in signal to noise may be noticed in dim scenes. This is fully reversible.
- CCD Temp: this is the actual temperature of the image sensor. The aiming temperature is dependent on scene illumination. For bright scenes, the CCD will be at or close to a preset +25 °C temperature. As the scene illumination decreases and further gain is applied to the CCD output registers the temperature will gradually decrease until it reaches the TEC (Thermoelectric cooler) MIN TEMP setting.
- TEC Min Temp is an absolute limit set to ensure that the cooler does not try to reduce the CCD temperature below this level. The factory default for this is 0 °C.
- POWER is the amount of power being drawn by the Peltier cooling device, which rises progressively as the ambient temperature increases above the CCD Temp, and rises rapidly as the scene brightness is reduced and the TEMP SET value steps down below the current CCD TEMP value. Once the equilibrium is reached, the power levels off.
- Temp Set is the optimum programmed CCD temperature setpoint, and will dynamically change depending on scene illumination. This reduces as the scene gets dimmer.

GRAPH shows traces of both the raw CCD output (upper trace) and the final video output from the image processor (lower trace) of a central line across the field. This can be used to optimise focus and to assess noise reduction activity from the filters deployed.

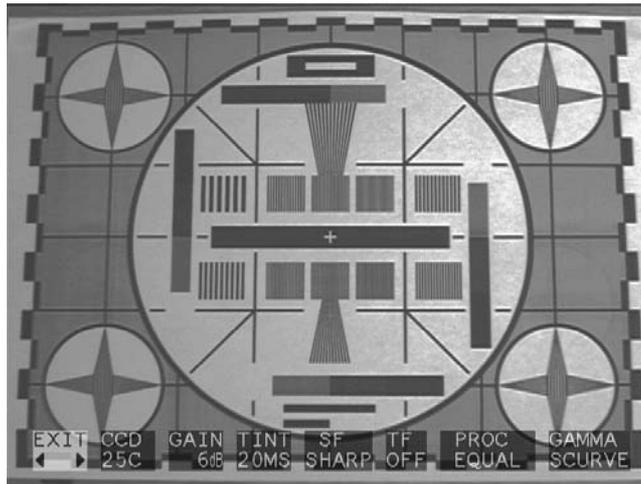


- By pressing the down button the traces step change to others. On the first press the top trace displays a histogram of the scene in view. The axis is displayed as black (0% video) on left, and white (100% video) on right. The histogram is auto scaled vertically based on the most prominent grey level in the scene. The lower trace displays the video transfer function currently in use. Input is X-axis, output is Y-axis.



- Further presses of the down button yield other functions that are used for factory calibration of your camera. The currently selected graph is shown by highlighted text on the right upper part of the image. To come out of the graph function press the 'up' button until the Exit text is reached, then press right or left to come back to the tabbed menu.

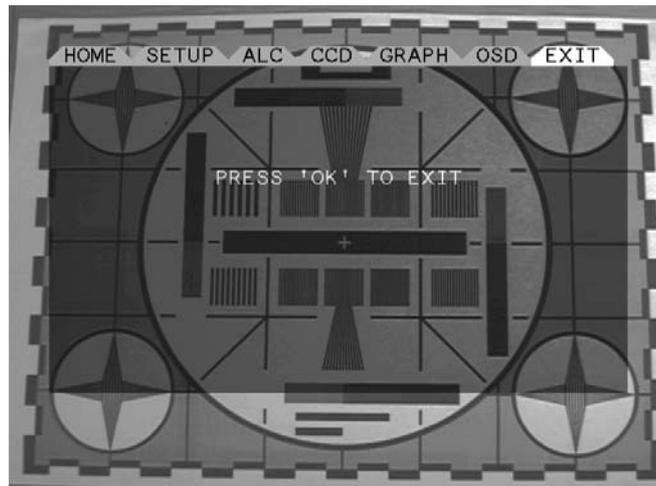
OSD: This provides a summary along the bottom of the display of the camera's set points and actual operating parameters.



From left to right:

- EXIT: is provided as a reminder that pressing a right or left button will take you back to the tabbed menu.
- CCD: Indicates the current operating temperature of the CCD sensor (Celsius).
- GAIN: Indicates the total system gain currently applied between CCD sensor and camera video output.
- TINT: Indicates the current sensor image integration time (in milliseconds).
- SF (Spatial Filter): Indicates the current filter state. Options are SHARP/SOFT/OFF.
- TF (Temporal Filter): Indicates the current filter k coefficient. Options are OFF/K2/K4/K8/K16.
- PROC (Image Processor): Indicates the current image processor function. Options are EQUAL (Histogram equalization) / STRETCH (Image endpoint stretch) / OFF.
- GAMMA (Video output gamma correction): indicates the current curve map type. Options are OFF / 0.45 (Conventional gamma 0.45 curve) / SCURVE (S-curve gives increased black and white gain with decreased mid band gain. Enhances low/high level detail).

EXIT: provides a graceful means to leave the on-screen information system. Pressing 'ok' turns off the On-Screen Display.



POWERING DOWN

There is no special power down sequence, simply remove the prime mover power by turning off the power supply at the main or by unplugging the power connector on the rear of the camera. The power supply should be unplugged from the mains when the camera is not in use and the lens capped. However, the lens cap should be removed when the camera is to be operated.

STORAGE

When not required for a prolonged period and for transport, e2v recommends that the camera and ancillary components be returned to the case in which they were received. This in turn should be stored in a dry room not in direct sunlight.

TROUBLESHOOTING GUIDE (TOP LEVEL)

1. Be very careful wiring up the power plug. The camera is not reverse polarity protected. Getting this wrong will cause fuse rupture that is inaccessible to the user, necessitating the camera be returned to the factory.
2. The optical surface of the camera nears the lens is in fact an LCP shutter. Excess pressure on this can cause permanent optical degradation. Follow cleaning instructions carefully.
3. The circuitry is on boards close to the case edge. Some connections could be reached with a screwdriver through the cooling slots on the case. Whilst there are no high voltage points accessible, such action is likely to cause damage to circuits.
4. With a uniform scene of low contrast, the default processing option will stretch this dynamically in an attempt to present maximum possible information to the user. If the scene is dark, the system gain also will be high, giving a grey level when other cameras would give a black level. This is perfectly normal behaviour, but if the user prefers the more conventional black level performance, the image processing function should be set to off via the ALC set-up menu on the PC GUI.
5. With serial control via PC software, a saving of ALC parameters to the camera disables subsequent saves in that ALC session. If further ALC adjustments are required to be saved, it is first necessary to close the ALC window and re-open it.
6. Resonant magnetic circuitry may be susceptible to high magnetic fields. If the camera performs in a strange manner and there are strong magnetic fields present, try moving it a short distance to see if the situation changes.

APPENDIX – CONNECTOR PINOUTS

Power Connector (Hirose HR10 4-way plug)

PIN	FUNCTION
1	+12 V dc input
2	+12 V dc input
3	0 V dc input
4	0 V dc input

I/O Connector (15-way high-density D plug)

PIN	FUNCTION
1	Video Out (common with BNC socket)
2	GEN_SE_IN (single-ended logic level mixed sync genlock input)
3	0 V
4	RS232 IN
5	RS232 OUT
6	EXT_SE_IN (reserved single-ended logic level input)
7	Frame Sync output - (LVDS)
8	Field Sync output - (LVDS)
9	Line Sync output - (LVDS)
10	Pixel Sync output - (LVDS)
11	0 V
12	Frame Sync output + (LVDS)
13	Field Sync output + (LVDS)
14	Line Sync output + (LVDS)
15	Pixel Sync output + (LVDS)

Note 1 Sync outputs are not available when genlocked.

Note 2 Sync outputs assume CameraLink timing when CameraLink is enabled. Set CameraLink option to OFF in the OSD menu for normal sync output timing.

Iris Connector (QQQ 4-way socket)

PIN	FUNCTION
1	+12 V dc output 50 mA max
2	not connected
3	video output
4	0 V dc output

Cameralink Connector (3M 26-way MDR socket)

Standard base configuration with 12 bit video.

Serial port is disabled when a host is detected on the I/O connector serial port pins.