



Lake Image Systems Ltd

IntegraVision Technical Manual



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Theory of Operation

System Overview

The LIS IntegraVision system is designed to acquire data from one or more printed items either moving at speed during a production process, or while stationary. Typically these items are mail pieces, in either individual sheet form or complete envelope packs, business forms, or other printed materials such as webs carrying unique variable print data.

The data is normally in the form of human readable printed text (typically a sequence number, account number or document ID code), a barcode, (linear or 2D), a postal barcode or an OMR code (Optical Mark Recognition).

The acquisition device is typically a Line Scan or Field Scan video camera (supplied with the system), barcode or 2D scanner or other serial input device (such as mag-stripe reader, network input etc.) The system can take data from up to 12 Field Scan cameras simultaneously, up to 8 serial input devices and up to 4 network devices, or one Line Scan camera.

Once the data has been acquired the system can perform a variety of data integrity functions depending on the application. These functions include:

- Logging the acquired data to a data file either on the host system, or to a pre-determined network location or machine interface.
- Verifying accuracy of the data either by comparison to a print file or database, by confirming that the data is in the correct pre-defined sequence, or matches data previously acquired by other cameras or input devices.

Other capabilities include a variety of control functions, including:

- Identifying changes of data either on the piece or within the relevant file, and controlling other production processes down stream, such as machine stop, divert, selective feeding, or batch control.

The system is based on standard PC architecture, using a Microsoft Windows NT/ XP operating system. The system features a user friendly Graphic User Interface (GUI) for all set up and operation functions.

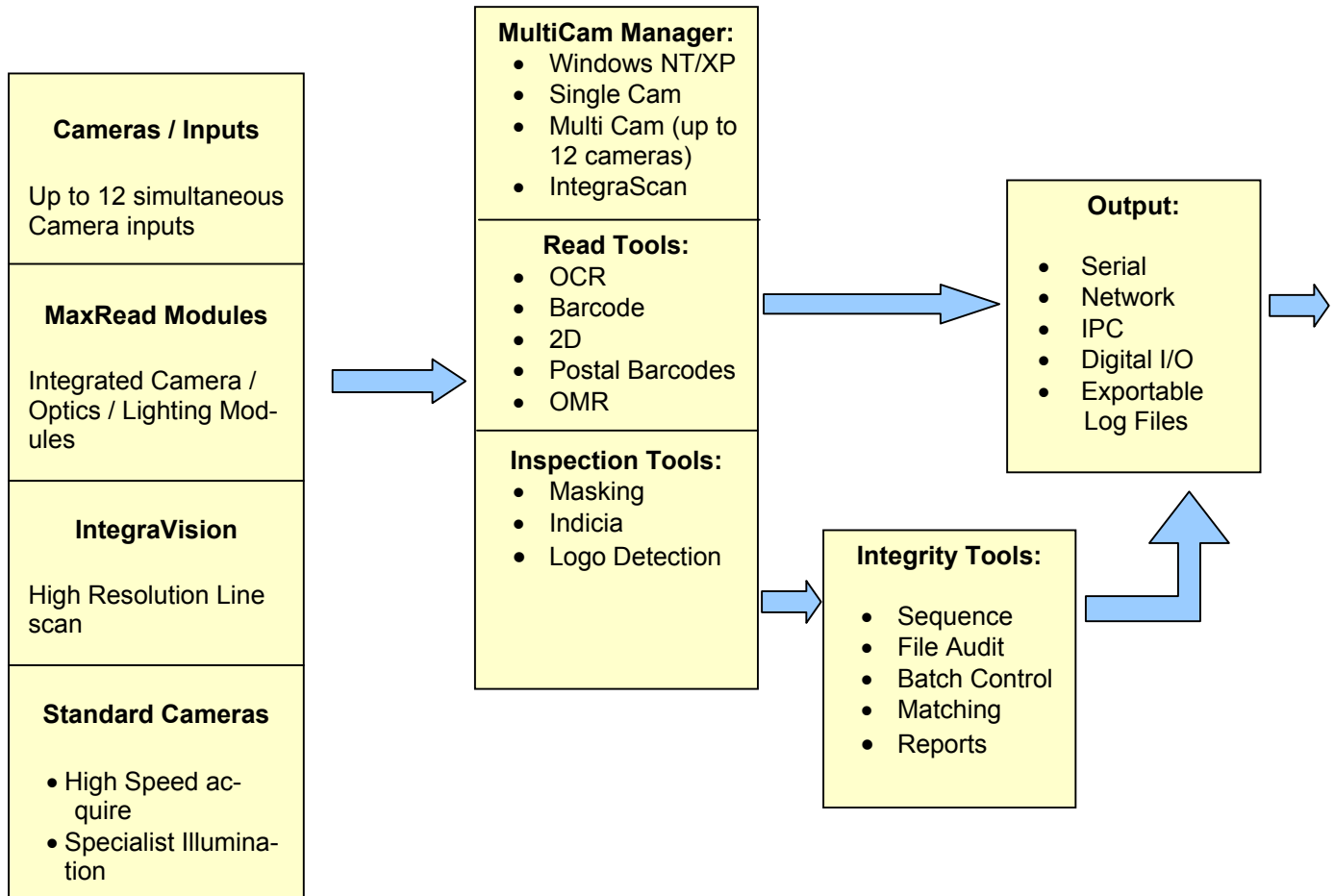


Figure 1 IntegraVision System Overview

Data Acquisition

The systems prime data acquisition device is a video camera module. A Field Scan camera can acquire an image of a small target area from a moving or stationary piece. The system can acquire images from up to 12 field scan cameras simultaneously or asynchronously. A single line scan camera can be used to acquire a high resolution, large format image of an entire mail piece, sheet, or continuous web, however it relies on the linear motion of the piece to build up the complete image.

Using an image of a printed item the system can apply a variety of sophisticated software algorithms to decode features and data within the image. These include human readable printed characters (OCR), barcodes (linear and 2D), postal barcodes and OMR.

For Field Scan applications the system is typically supplied with MaxRead™ camera modules. For Line Scan applications the system is supplied with a single, 2K high speed Line Scan camera as standard.

All MaxRead™ modules contain integral optics and illumination to provide a robust image acquisition device designed specifically for the mailing and printing environment. Other traditional camera technologies can be used where more flexible fields of view or illumination is required.

The Line Scan Camera is supplied with sophisticated optics and 2 continuous (DC) LED light lines.

Other compatible data acquisition devices include:

- Barcode scanners
- 2D scanners
- Mag-Stripe readers

These devices are interfaced with the system through a serial RS232 port.

Triggering

Direct Triggering (Field Scan)

A trigger system is used to identify when the data to be read on the mail piece or printed item is in the field of view of the camera. This is normally on arrival of the leading edge of the mail piece, at an appropriate point during the feed cycle of the production machinery, or at a pre-defined point by the machine control system. The trigger can be a reflective or through beam optical sensor, proximity sensor or TTL level input from another control device.

The trigger interfaces directly with the image acquisition hardware (Frame Grabber) within the PC through an opto-isolated input. On receipt of a valid trigger signal the Frame Grabber activates the Light Control Unit (LCU) to fire the illumination within the camera module, and grabs an image from the camera into buffer memory. The LCU pulses the illumination within the camera module for a 20microsecond period only. On completion of acquisition the image is transferred internally over the PCI bus to the host PC memory. On arrival of the next trigger signal the process is repeated and the buffer memory is overwritten with the latest image.

The Frame Grabber is available in single channel, 2 channel and 4 channel configurations. Up to 3 Frame Grabbers can be operated simultaneously within a system. Each channel can be triggered asynchronously, or simultaneously. Therefore a single trigger can be used to control multiple camera modules, or each camera can operate with its own independent trigger.

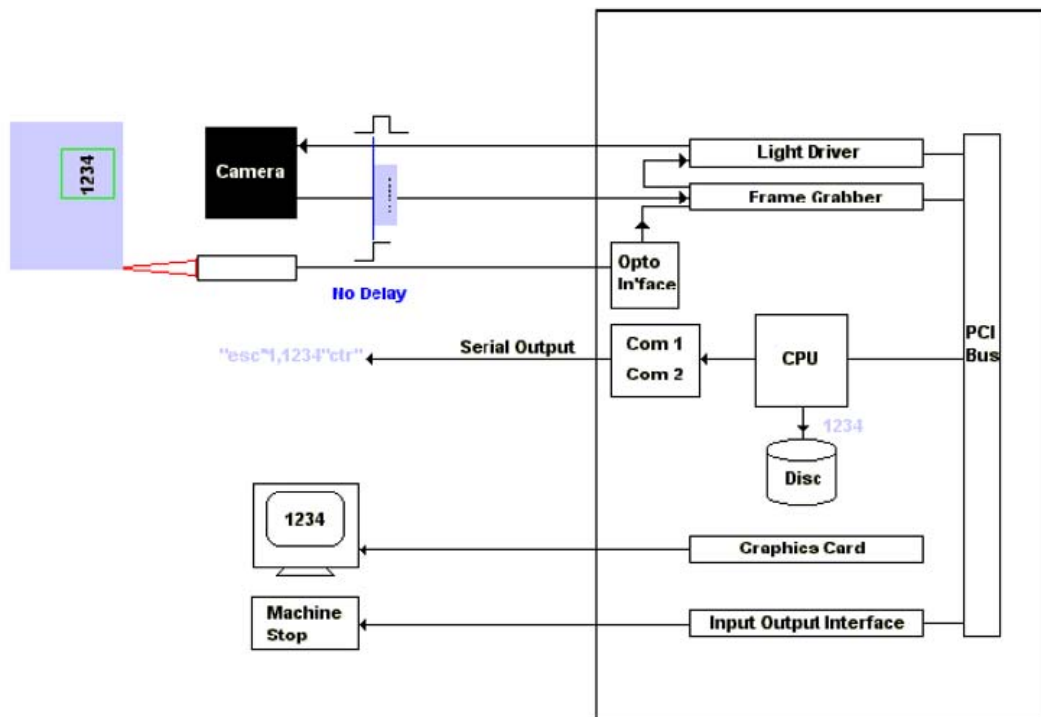


Figure 2 Direct Trigger Configuration

SCM Triggering (Field Scan)

The system can be supplied with an LIS Step Counter Module (SCM). The SCM features 8 digital input / output lines (Digital I/O), an Encoder input and an on-board timer. The encoder can be fitted to the production machinery to monitor the speed or rotation of a shaft within the machine, or the speed of linear motion of a drive belt or similar. The standard encoder supplied with the system will provide 500 pulses per revolution. A software functions allows these pulses / movement to be calibrated into mm's or inches.

When using an encoder the SCM can take the relevant trigger sensor inputs and delay them by a pre-defined number of encoder pulses before triggering the Frame Grabber to acquire an image from a single or multiple cameras. Each camera can be delayed independently from a single or multiple trigger input. This function enables the operator of the system to adjust the point at which the image is acquired without having to physically move the trigger sensor or camera relative to the location of the code on the mail piece or printed item.

In addition the SCM can also delay the triggering of the frame grabber by time (milliseconds). Therefore delayed triggering can be achieved for applications where it is not practical or appropriate to fit an encoder.

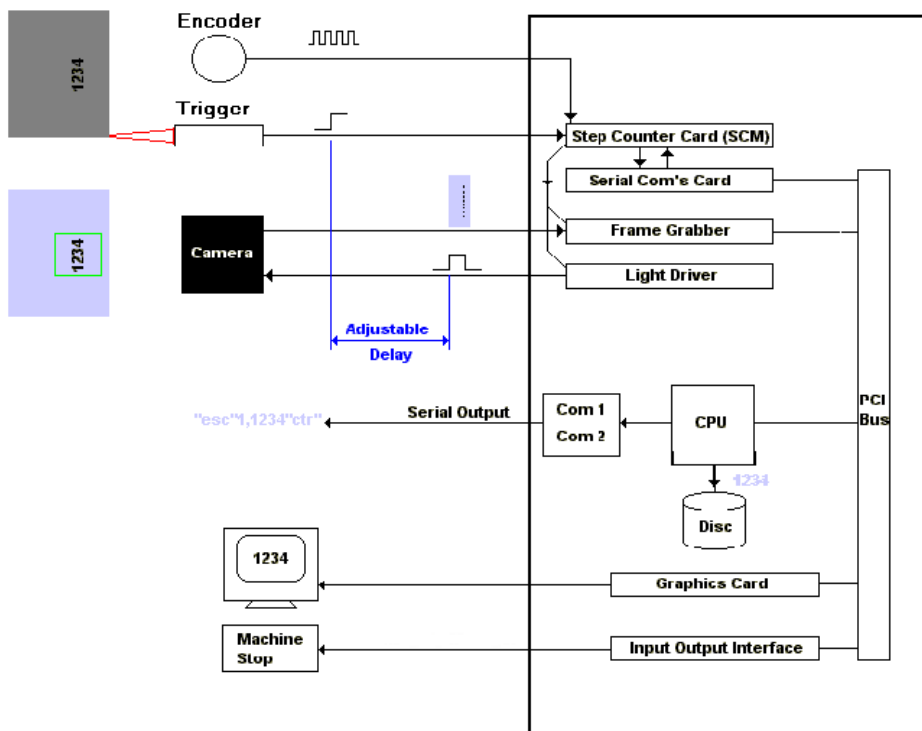


Figure 3 SCM Triggering Configuration (Field Scan)

Triggering (Line Scan)

A line Scan Camera features a single, high resolution, line array of pixels. It relies entirely on the linear travel of the mail piece or printed item over the line array in order to build up a high resolution, large format image at production speeds. An encoder mounted on the production machinery close to the piece is used to synchronise the acquisition of each line of pixels with the speed of the target as it moves past the camera.

A trigger sensor is used to identify the leading edge of the mail piece or printed item. At this point the frame grabber begins to acquire the image at a line rate controlled by the encoder. The image acquisition is complete once the trigger sensor identifies the trailing edge or end of the target piece. At this point the complete image is then transferred to the host PC memory for processing.

The encoder supplied with the system provides 5000 pulses per revolution.

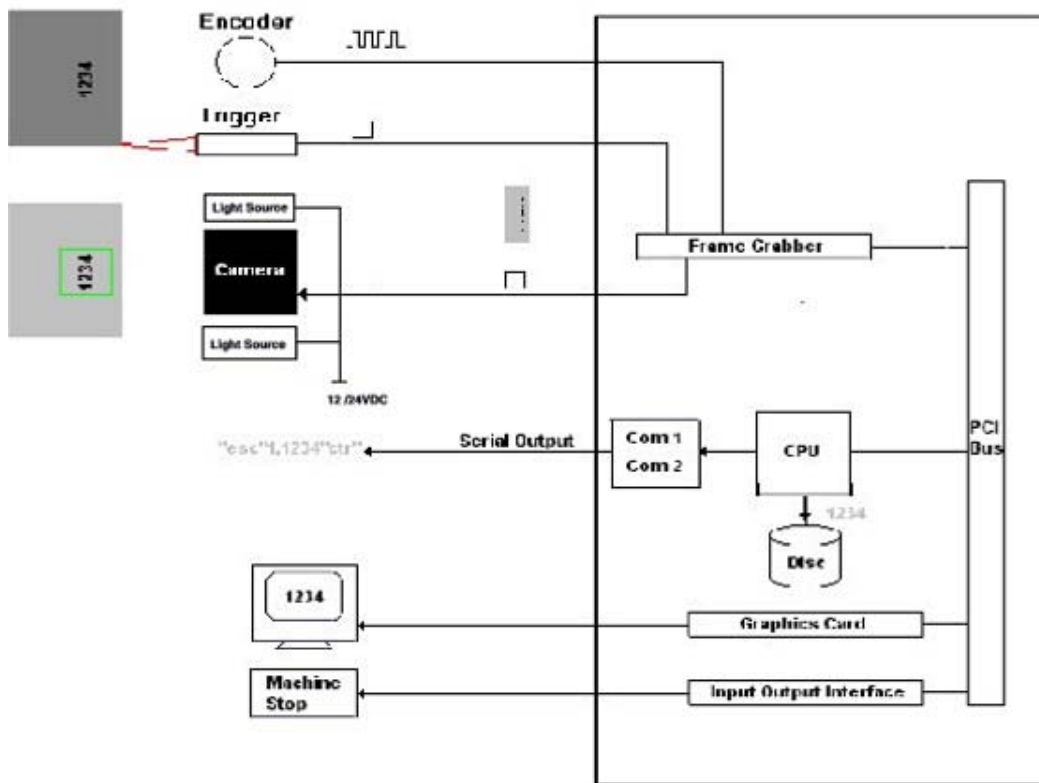


Figure 4 Line Scan Triggering Configuration

Image Processing

Each image consists of pixels with a grey scale value between 0 (black) and 255 (white) (8 bit grey scale imaging). The number of pixels in each image depends on the camera module used for the acquisition, however it is typically 640 x 480 pixels for field scan, and 2048 pixels x approximately 3500 pixels for line scan (depending on the length of the mail piece or printed item).

Once the acquired image has been transferred to the host PC memory a series of image processing functions can be applied in order to firstly locate, and secondly decode or inspect a variety of printed symbologies or features within pre-defined Areas of Interest (AOI's).

The Image Processing functions of the system are controlled within the Multicam Manager environment.

Examples of some of the tools are as follows:

Optical Character Recognition (OCR)

Proprietary OCR algorithms allow the operator to train the system to recognise patterns or characters and therefore decode strings of human readable data.

By defining a grey scale threshold that extracts a character from the background of the image individual bitmap patterns of each character can be stored in a 'font library'. The operator is responsible for categorising each pattern so that the system can decode them correctly. For example the operator will name a pattern of a '3' as '3'. From then on the system will always correctly identify the pattern of a '3' in any subsequent images as a '3'. If, for example, the operator were to incorrectly name a pattern of a '3' as 'X', the system will then always decode a '3' as an 'X'. Multiple font libraries can be trained and stored within the host PC.

The system has the ability to read reverse contrast polarity (white on black) and in various orientations. Other functions can compensate for broken characters and poor quality print. Where possible the font training process has been automated for ease of use.

Barcode and 2D.

A barcode algorithm can locate and decode a wide range of barcodes and 2D formats in most orientations. The configuration of the software tool can be completely automated requiring little or no operator set up.

Postal Barcodes

The Postal Barcode tools can read most standard postal barcodes, including Postnet and Planet code. The system has minimal operator set-up requirements and can read in horizontal or vertical orientations.

Other Inspections

The system includes various other inspection tools that can be used to identify the presence or absence of specific features such as a logo, valid postal indicia mark and valid address.

Data Processing

Once features have been extracted from the image of the printed piece and decoded from patterns back into meaningful data it becomes available for a wide range of further processing applications. This can simply be for data collection purpose, where the decoded data can be converted into various protocol formats and transmitted via network or serial interfaces to other locations. Alternatively it can be used to compare against or amend the original print or data file for data integrity applications.

The system also has the ability to monitor the data to verify that it complies with a pre-defined sequence or criteria. In the event an error is detected the system can control further machine processes, such as machine stop, or divert. The system has the ability to track the piece through the machine process by machine cycles and/or time in order to control the machine stop or divert at the appropriate time.

Reporting functionality within the system allows productivity data such as number of completed pieces, errors, missing pieces, % of job completed etc. to be monitored and reported on the host machine or remotely over the network interface.

Data Output

The system features a flexible data output capability that allows data from each individual camera to be transmitted over a range of serial, or network interfaces. The protocol format for each interface can be pre-defined enabling multiple inspections, from multiple cameras to be transmitted to multiple locations.

Reports can be generated in various formats from the data decoded and the inspections performed. These reports can feature time and date stamps for each individual record and can also contain user and machine information, job I.D's, and various other production or job related details. The reports can be stored on the host PC or transferred to another network location.

Digital I/O

The system features 3, digital Output Lines as standard. These are identified for use as Divert, Batch and Machine Stop outputs, and can be configured to operate according to the results of the individual system read and inspection tools. They can be set to activate on an individual event occurring or after 'X' number of consecutive events.

The output polarity and pulse duration of each line can be configured as required, and is opto isolated for protection.

Operator Functions

Once Windows NT has started and the operator has logged in, the LIS IntegraVision program will start automatically and bring up the 'Load Job' screen.

Loading a Job

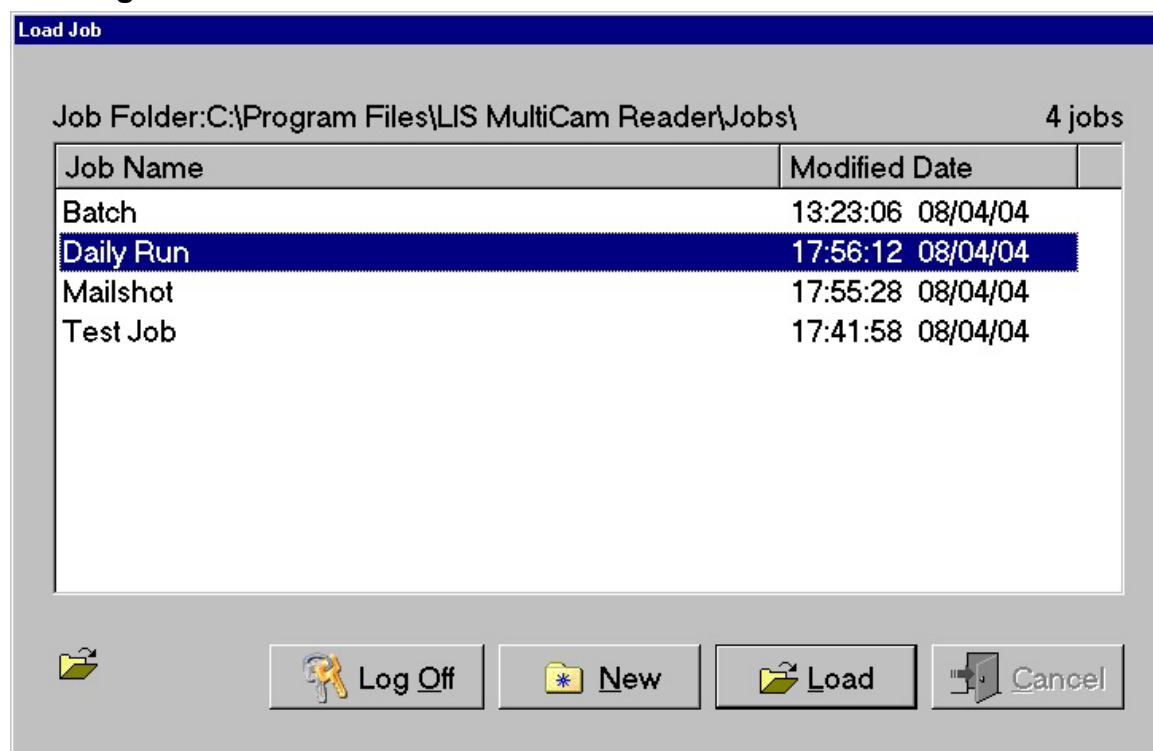


Figure 5 Load Job Screen

From this screen the operator has the ability to select an existing previously trained job, or create a new job.

To select an existing job:

- select the appropriate job name using the mouse and select "**L**oad"..

This will load all the parameters associated with the selected job.

To create a new job:

- select **N**ew, and enter an appropriate name, then select **S**ave.

Main Screen (Single Camera Operation)

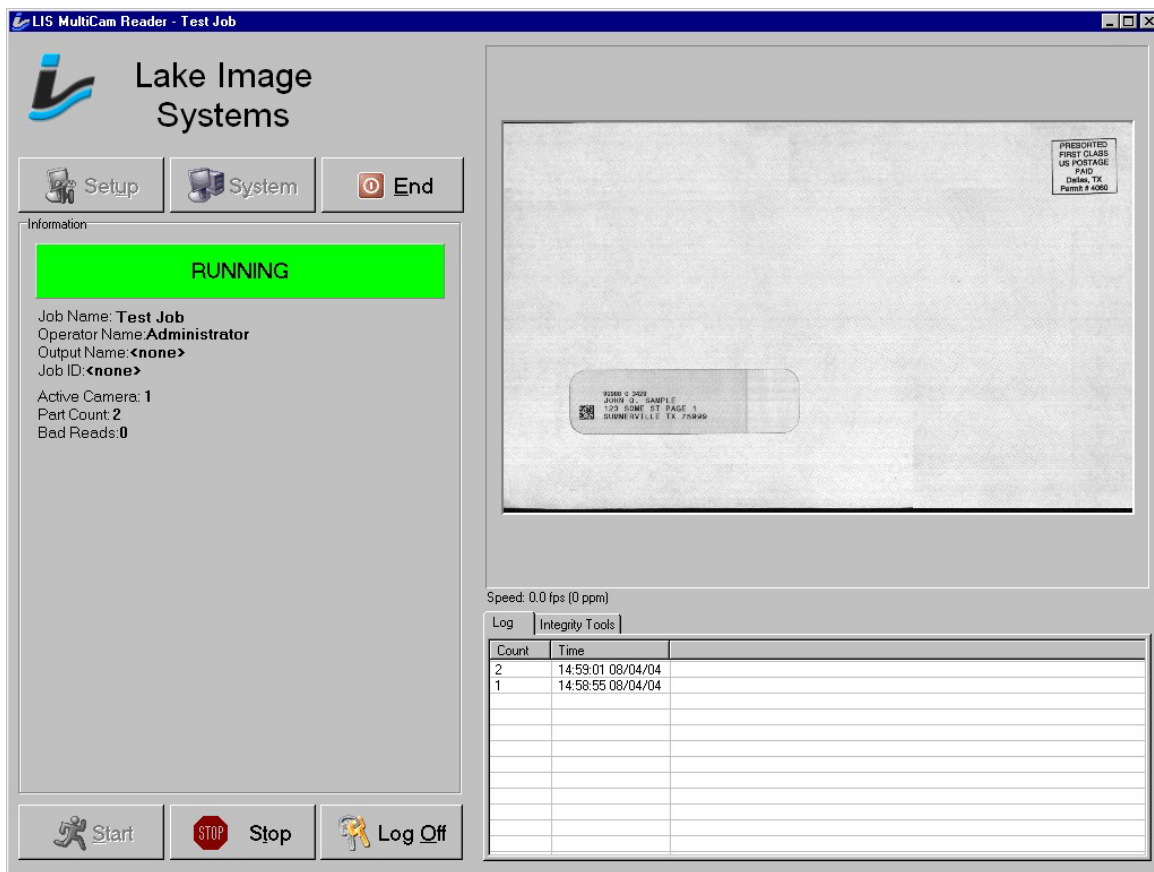


Figure 6 Main Screen (Single Camera Operation)

Figure 6 shows the main screen of the Multicam reader when configured to operate in the simple Single Camera Mode. Alternatively it may be configured as Figure 7, for multiple camera operation.

Main Screen (Multiple Camera Operation)

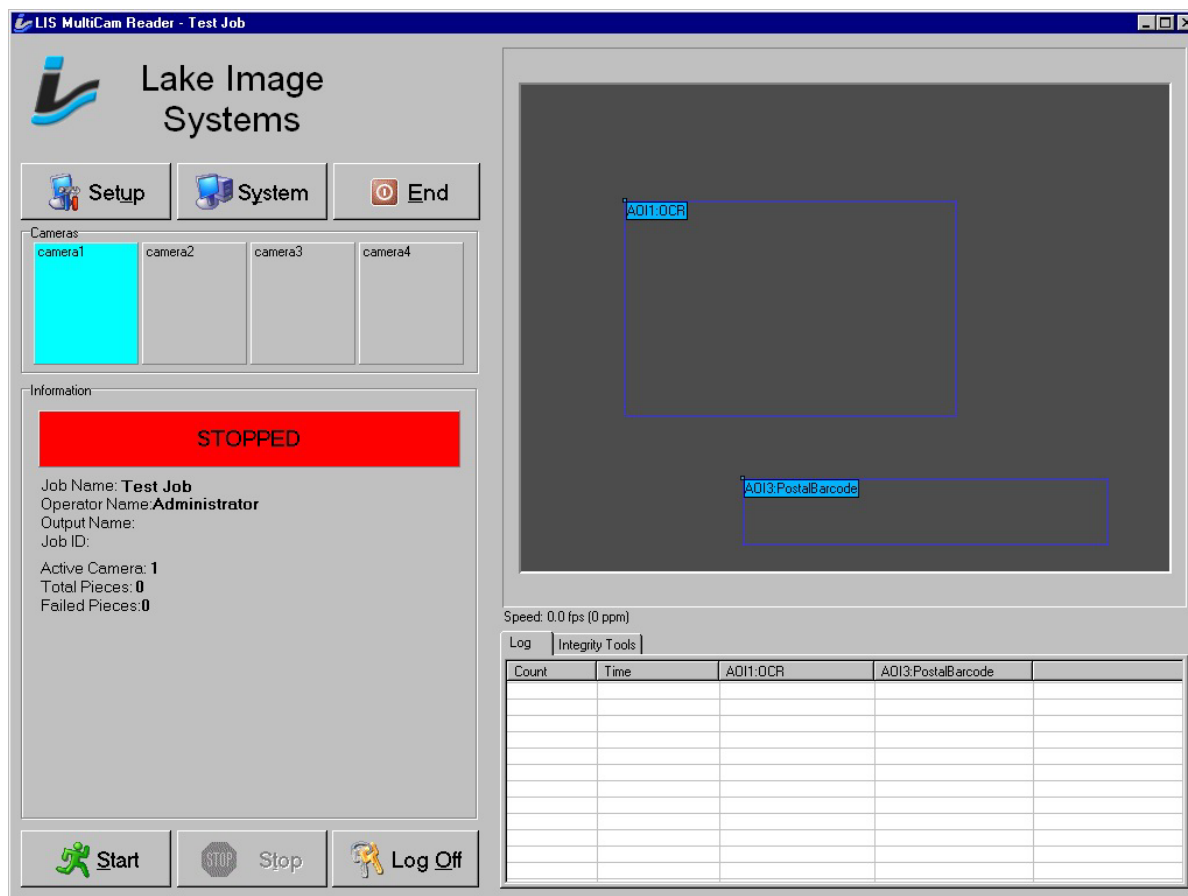


Figure 7 Main Screen (Multi Camera Operation)

Figure 7 shows the main screen of the Multicam reader.

Regardless of the operating mode, the Main Screen will display the following information about the current selected job:

- **Title bar**
The current job name appears to the right of the LIS Multicam Reader title.
- **Camera Select Panels**
Each camera (maximum 12) has a select panel displaying the camera title and the result of the last read; These texts are 'greyed out' on those cameras that have not been enabled from within the Configuration Setup utility. The camera title can be edited to be more meaningful in the setup utility described later in this manual.
A single left click on a camera panel changes the colour from grey to blue and selects the output from that camera to be shown on the display on the right hand side of the screen. Double left clicking on the panel opens the OCR Setup window for that camera.

- **Image Display Panel**

Displays the image from the previous read of the currently selected camera, continuously updating as new reads occur. Just below the display panel, the read frequency of the selected camera is displayed in both Frames Per Second and Pieces Per Minute.

- **Read Log**

Pressing the 'Log' tab on the lower right hand side of the screen provides a list of the previous 300 camera reads including the date and time of read, the characters recognised and the actual RS232 output string sent.

Log Integrity Tools				
Count	Time	AOI1:PostalBarcode	AOI2:ProductDetect	
19	21:24:12 08/04/04	871850100000	Pass 13083	
18	21:24:09 08/04/04	787322216778	Pass 13206	
17	21:24:06 08/04/04	871203756498	Pass 13148	
16	21:24:03 08/04/04	467509230806	Pass 12926	
15	21:24:00 08/04/04	609389600018	Pass 12752	
14	21:23:58 08/04/04	445128047744	Pass 13181	
13	21:23:56 08/04/04	335655944303	Pass 13226	
12	21:23:54 08/04/04	190331306013	Pass 12973	
11	21:23:51 08/04/04	386556162891	Pass 13229	
10	21:23:46 08/04/04	No read	Fail 0	
9	21:23:43 08/04/04	469238783479	Pass 13020	
8	21:23:40 08/04/04	447083648646	Pass 13206	

Figure 8 Read Log Panel

- **Integrity Tools Log**

Pressing the 'Integrity Tools' tab on the lower right hand side of the screen provides a list of all the integrity events (i.e. stoppages and warnings) accrued in the current job. There are 4 columns as follows:

1. **Piece ID** Either the read data or, if referenced to an input file, then the file entry value. Note that if this piece has caused a stoppage, a red cross will appear on the extreme left of this column; double clicking the red cross brings up a dialogue box with the 'Continue' button which releases the stop signal.
2. **Time Stamp** The date and time that the piece was inspected.
3. **Action** The action that was taken, i.e. piece diverted, machine stopped or warning issued.
4. **Description** A description of the error that occurred.

Log		Integrity Tools	
Piece ID	Time Stamp	Action	Description
✖ 355945244702	21:24:18 - 04/08/04	none	Piece Missing
✖ 810033479997	21:24:18 - 04/08/04	none	Piece Missing
✖ 271059753975	21:23:46 - 04/08/04	Piece Diverted	AOI1:PostalBarcode Failed
✖ 541148822014	21:23:33 - 04/08/04	Piece Diverted	AOI1:PostalBarcode Failed

Figure 9 Integrity Tools Panel

Main Screen Control Buttons

- **System (CONTROL BUTTON)**

Selecting the System button will display the following selections:

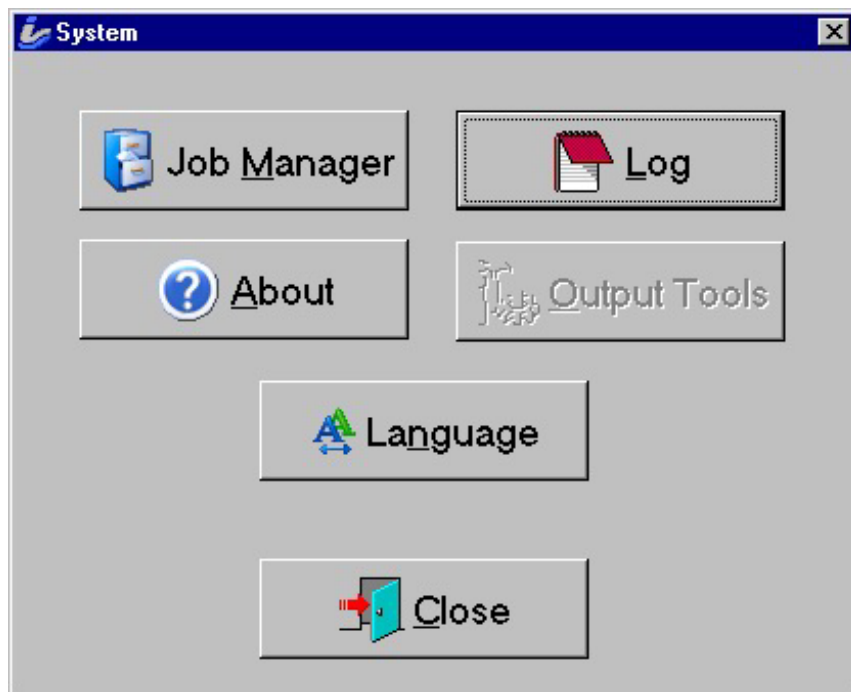


Figure 10 System Screen

- **Job Manager**

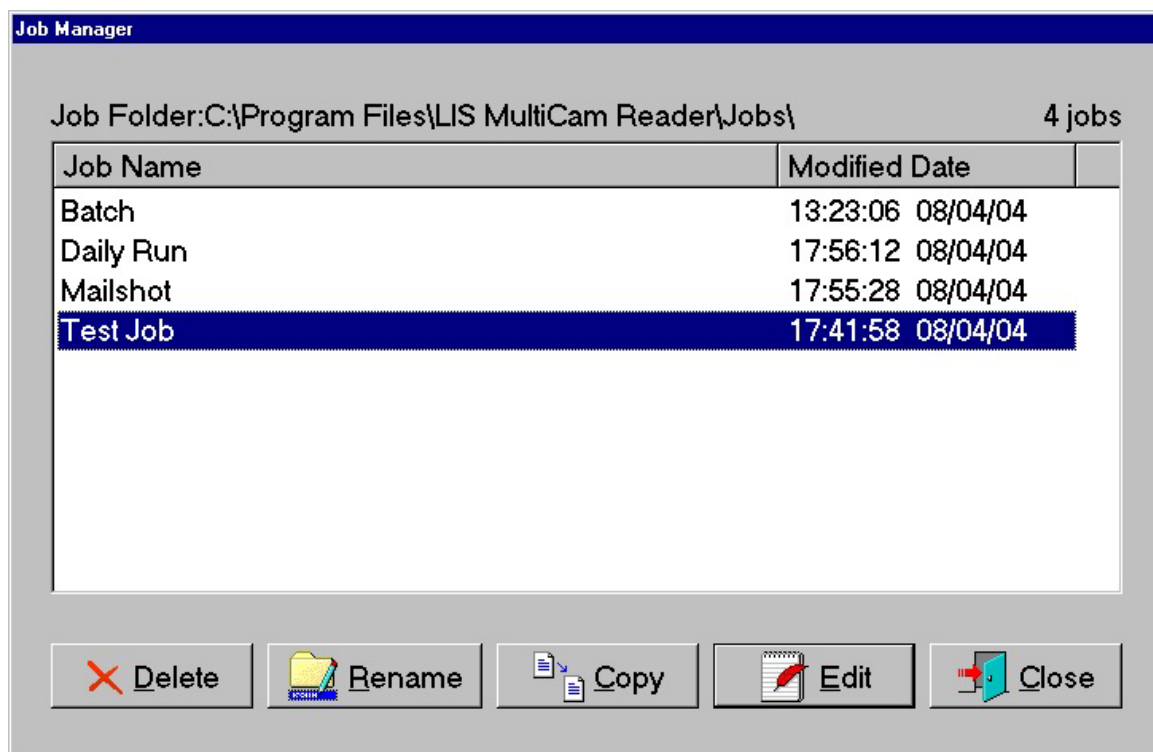


Figure 11 Job Manager Window

- **Ddelete** will remove the selected job.
 - **Rename** is used to change the name of the selected job.
 - **Copy** is used to make a duplicate of the selected job and then save under a new name.
 - **Edit** opens a text file permitting changes to the job file, advanced users only.
 - **Close** exits the Job manager window.
- **Log**
 - **Clear** clears the read log of the currently selected camera.
 - **Clear All** clears the read logs of all the cameras.

- **About!** displays information about the software version loaded and Lake Image Systems Limited contact details.



Figure 12 About Window

- **Language**

Allows the operator to change the current system language.

- **Close**

Will close the System screen and return to the Main screen

- **Start (CONTROL BUTTON)**

The first time this button is pressed after loading a job the operator will be prompted to enter the Production Job Name and ID at a minimum.

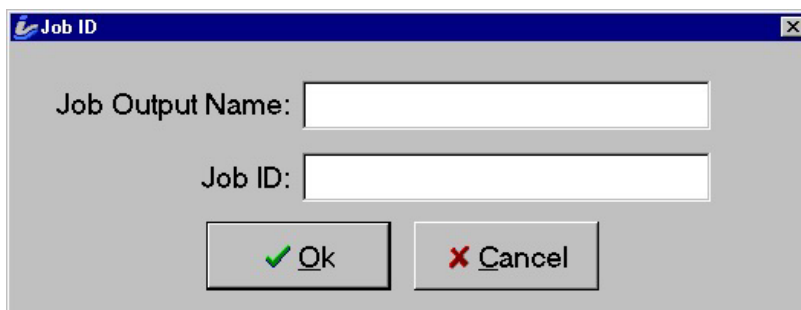
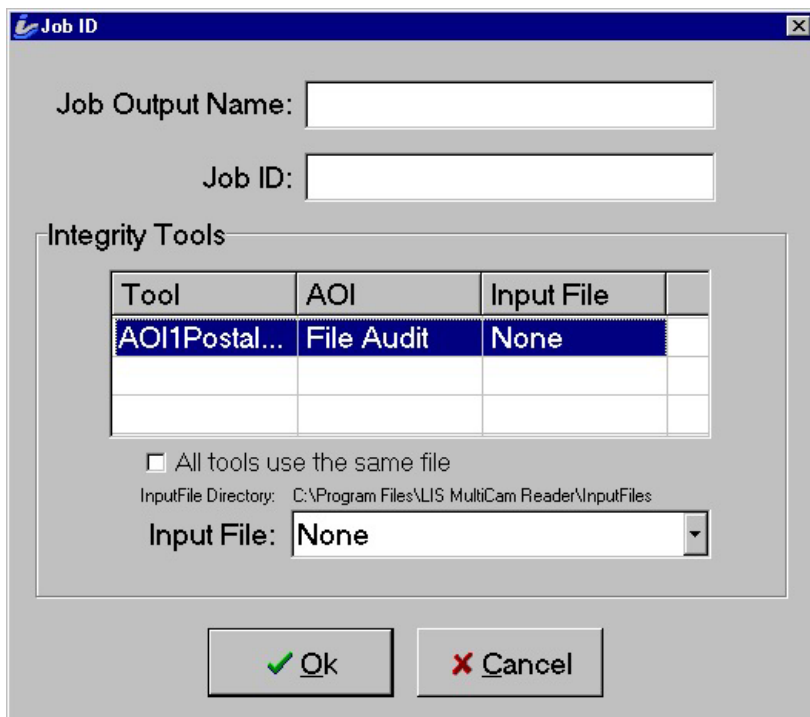


Figure 13 Job ID Window

If the chosen job has any defined integrity checks requiring an input data file the operator will also be prompted to choose the relevant file at this point.

A screenshot of the 'Job ID' dialog box. It has a title bar with a blue background and a close button. The main area is light gray. At the top, there are two text input fields: 'Job Output Name:' and 'Job ID:'. Below these is a section titled 'Integrity Tools' which contains a table. The table has four columns: 'Tool', 'AOI', 'Input File', and an empty column. The first row is highlighted in blue and contains 'AOI1Postal...', 'File Audit', and 'None'. Below the table is a checkbox labeled 'All tools use the same file'. Underneath the checkbox is a text label 'InputFile Directory:' followed by the path 'C:\Program Files\VIS MultiCam Reader\InputFiles'. Below that is a text input field for 'Input File:' with 'None' selected in a dropdown menu. At the bottom are two buttons: 'Ok' with a green checkmark icon and 'Cancel' with a red X icon.

Tool	AOI	Input File	
AOI1Postal...	File Audit	None	

Figure 14 Job ID with Integrity Window

- **Stop (CONTROL BUTTON)**

Selecting Stop will pause the processing of the current Job. At this point the operator will be asked to confirm the reason for the job pause from a pre-defined list.

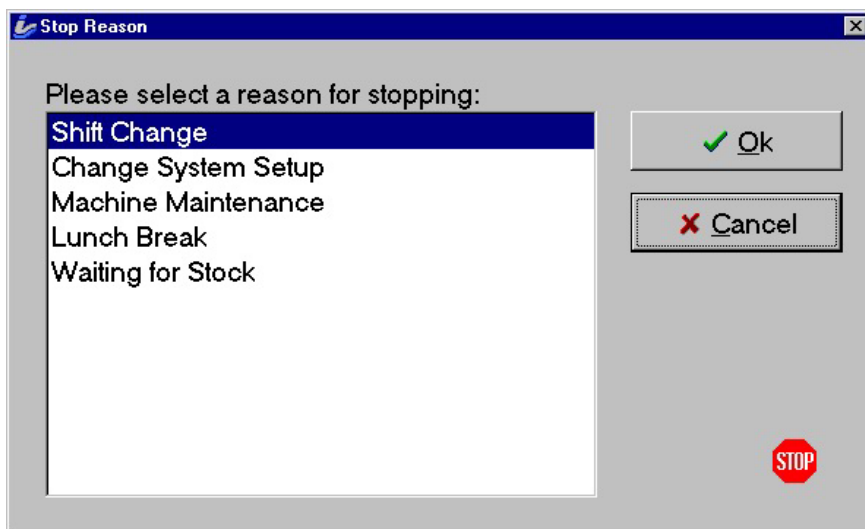
A screenshot of the 'Stop Reason' dialog box. It has a title bar with a blue background and a close button. The main area is light gray. At the top, it says 'Please select a reason for stopping:'. Below this is a list box containing five items: 'Shift Change', 'Change System Setup', 'Machine Maintenance', 'Lunch Break', and 'Waiting for Stock'. The 'Shift Change' item is selected and highlighted in blue. To the right of the list box are two buttons: 'Ok' with a green checkmark icon and 'Cancel' with a red X icon. In the bottom right corner of the dialog is a red octagonal stop sign icon with the word 'STOP' in white.

Figure 15 Stop Reason Window

- **End (CONTROL BUTTON)**

End will terminate the current job and return the system to the Load Job Screen (See figure 5)

- **Log Off (CONTROL BUTTON)**

This button is only available if User Log On is enabled, and more than 1 user is defined on the system. This returns the operator to the Log In screen.

- **Setup (CONTROL BUTTON)**

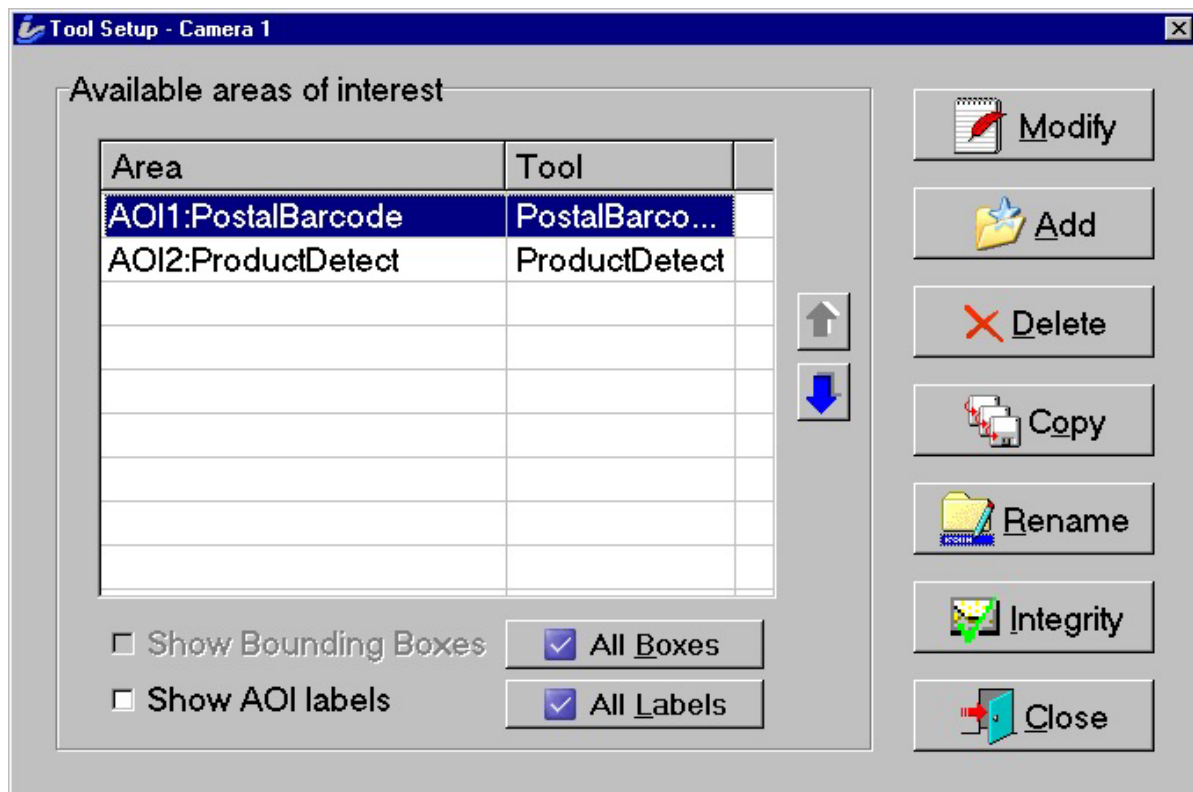


Figure 16 Tool Setup Window.

This screen lists all the Areas of Interest and relevant tools trained and running for the current selected job. If the job is being trained from new, this list will be empty, allowing the operator to begin adding areas and tools as required.

At this point the operator can Modify, Delete, Copy and Rename any of the AOI's listed by highlighting them and selecting the relevant control button.

New or additional tools and AOI's can be added using the Add control button if required. This will present the operator with a list of the available tool types.

Read Tools Setup.

When a tool is selected from the setup window the parameters can be changed by selecting the modify button. The following sections explain the setup procedure for each tool separately.

Barcode Reading Set-up

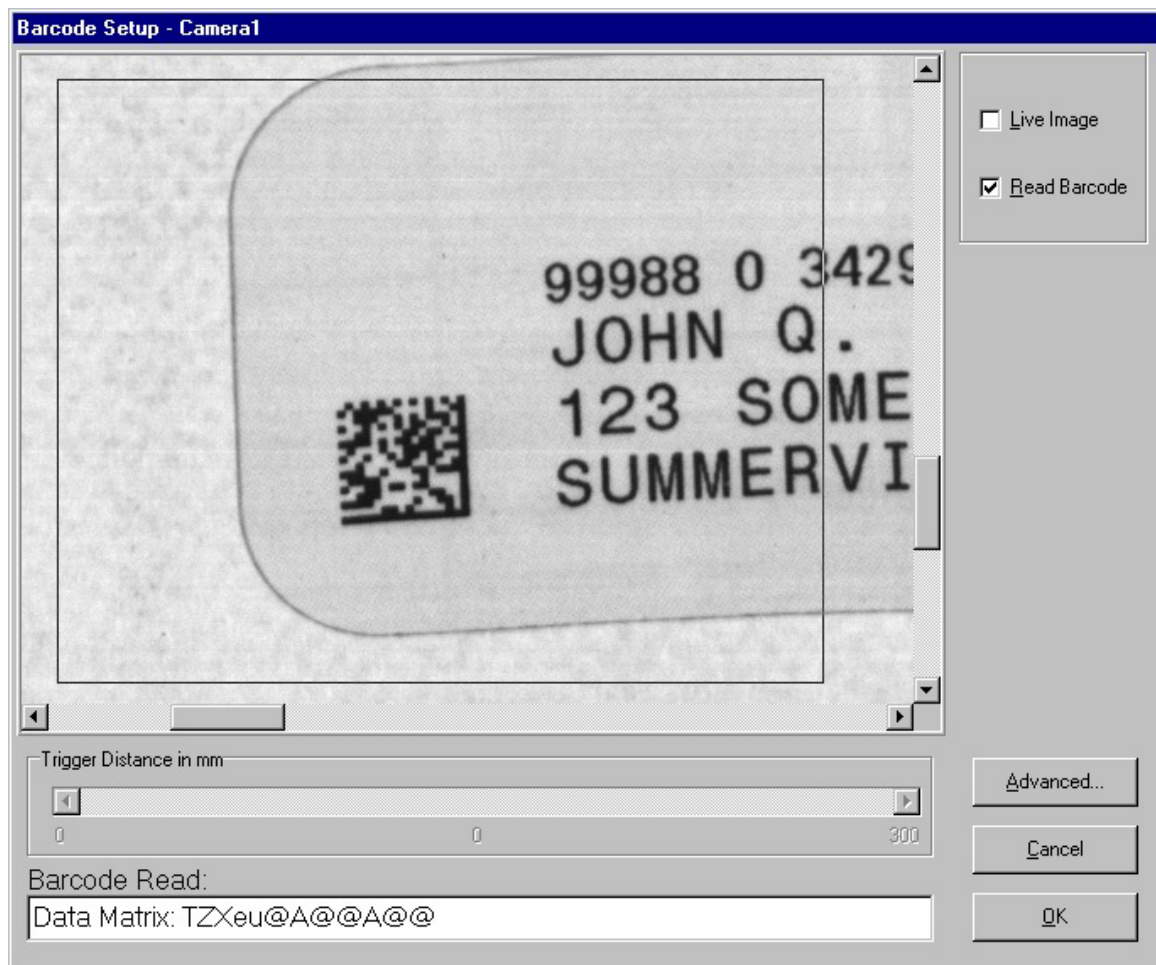


Figure 17 Barcode Camera Setup Screen

- Select **“live image”** and centre the image to be read in the image window by jogging the machine or manually locating by hand.
- Deselect **“Live Image”** when the image read is stable.
- Create an Area of Interest (AOI) by left clicking the mouse over the image area and ‘drawing’ a ‘box’ around the target code. The AOI is used to identify the area within the image where the target code is likely to appear from image to image.
When setting the AOI area, variation in the position of the target image must also be taken into account. This can be influenced by machine settings/timings and size of document inside the envelope etc.

Create or resizing a AOI

Hold the left mouse button down while drawing a box around the image. Release the left mouse key. The AOI can be resized by placing the cursor on top of AOI box. The cursor will change to a direction arrow cursor. Hold the left mouse key down to resize the AOI.

- **Live Image**
Switches the system into a live 'video' condition. This feature is used in setting up the initial image capture or retraining the image capture.
- **Read Barcode**
This enables the software to read the image capture and display data in the "**Barcode Read**" text box, and is used for verification of the read accuracy.
- **Advance**
This feature allows the user to select the type of barcode(s) to read. Select "**Advanced**" to setup the type of barcode in detail.

Barcode Advanced Settings

The system can automatically detect the type and direction of barcodes, however if high processing speeds are required it is advisable to select the correct type of Barcode and its direction.

The "**Barcode Advanced Setup**" window displays a list of all the different codes formats that can be decoded.

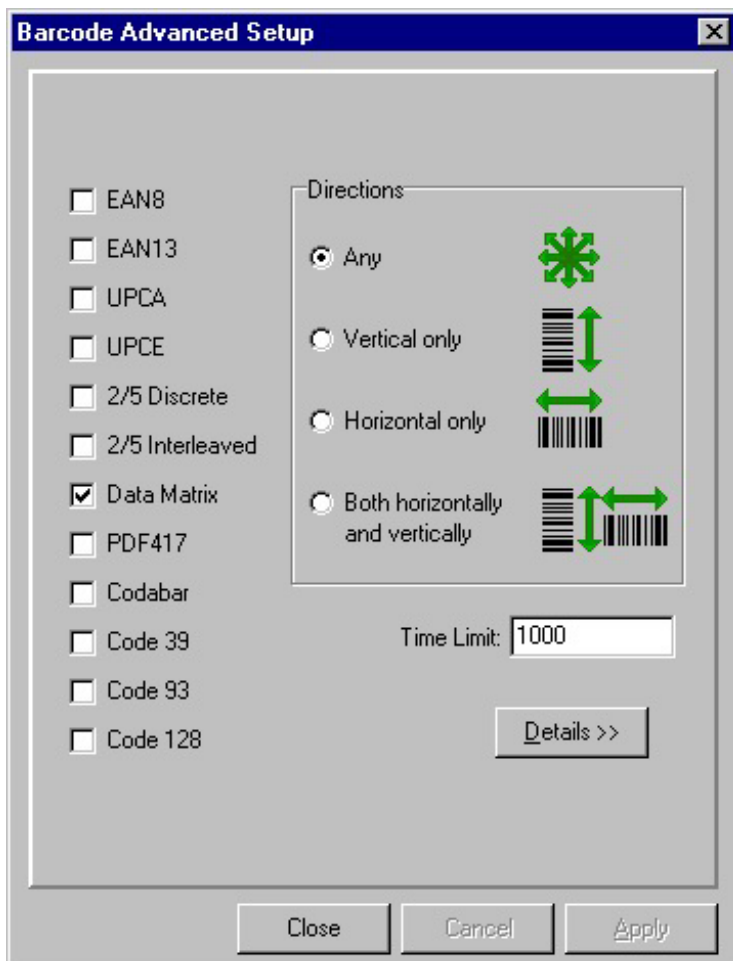


Figure 18 Barcode Advanced Setup Screen

- Select the bar-code type (i.e. Data Matrix).
- Select the direction the code appears or select “**Any**” if this is unknown.
- Select “**Details**”. This allows you customize the decoding of the selected barcode job.

Barcode Tool Properties

This feature allows the user to select very specific properties for the barcode or range of barcode properties. Below is an example of Data Matrix properties.

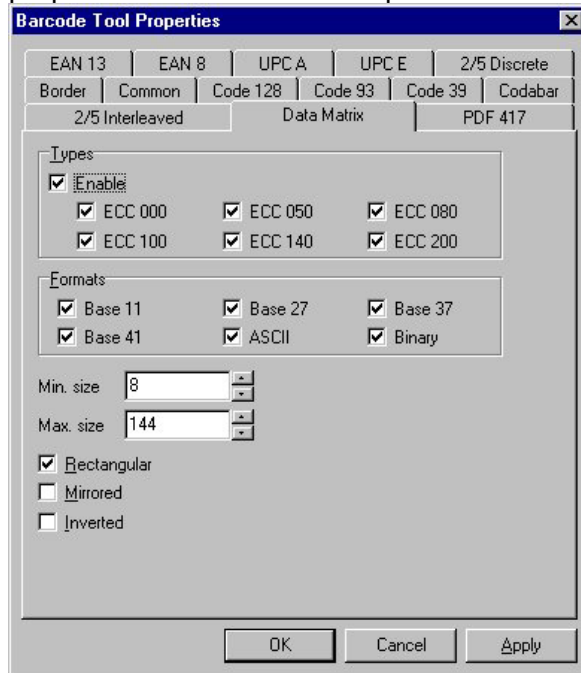


Figure 19 Barcode Tool Properties Screen

- Select “**Apply**” to accept any changes
- Select “**OK**”
- Select “**Read Barcode**” to verify the barcode can be decoded. If not, go back to “**Advance**” to make sure the correct tool and parameters have been selected.
- From the “**Barcode Setup**” screen, select “**OK**”. The “**Main Screen**” is displayed. The job is now running.
- Across the bottom of the “**Main Screen**”, is a slide bar for setting the trigger delay for the camera. Start the mail processing equipment and move the slide bar until the code appears in the middle of the screen.
- The vision system is now ready for mail processing equipment to run the job.
- If changes need to be made to the AOI during a job run, **STOP** the mail processing equipment.

Select “Setup” in the upper left corner of the tool bar.

Select “Setup” or (Ctrl + U). This takes you to the “Barcode Setup” menu where the AOI can be repositioned.

Optical Character Recognition (OCR) Set-up

On the main screen, double click on the camera panel of the camera to be set up or select through Main Screen Setup control button.

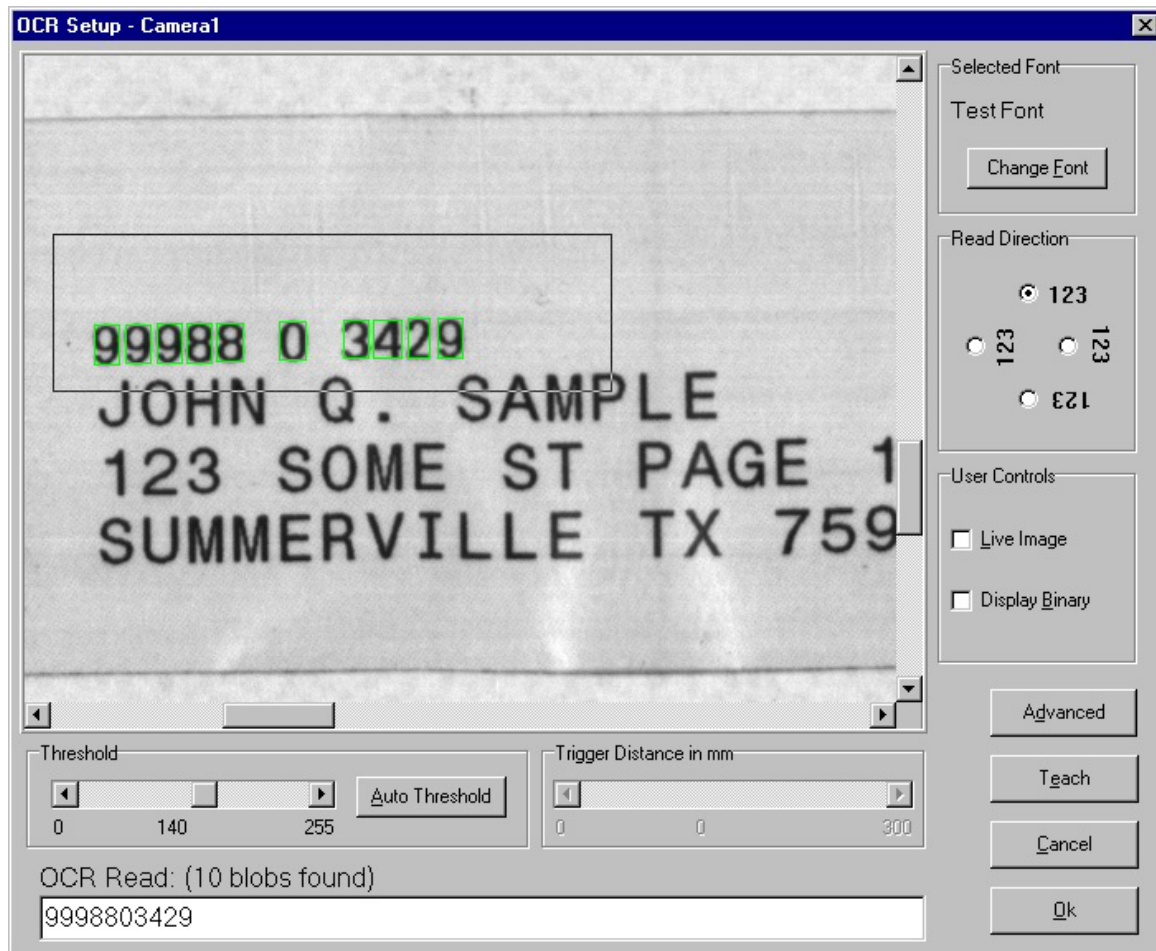


Figure 20 OCR Camera Setup Screen

Font Training

Note, the font training procedure can be simplified by first printing the string 0123456789 on stock paper in the correct font and size as the live job.

1. **Image Capture:** Place the document under the camera in the normal running orientation, select 'Live Image' and centre the character string in the image window. Select the correct 'Read Direction' and deselect 'Live Image' when the image is stable.

2. **Area Of Interest:** Create a 'Area Of Interest' (AOI) neatly around the character string by left clicking the mouse with the cursor at a point just above and to the left of the string, dragging and releasing the mouse when the cursor is just below and to the right of the string. The Area of Interest serves to exclude any characters or objects not required to be processed.

Note that when defining the AOI for live running, variation in the position of the target image must be taken into account. *Part* of a neighbouring character or graphic may encroach into the AOI and will be ignored providing it is not the full character and that the tick box 'AOI Edge Filter' on the 'Advanced Setup' screen has been selected.

3. **Threshold:** A typical image will consist of a black font on a light grey background. The OCR software needs to apply a threshold to the varying grey scales in the image in order to differentiate what is dark enough to be part of a character (or blob) and the lighter areas which will be considered background.. The threshold operates between values of 0 and 255, 0 being white and 255 being black. An '**Auto Threshold**' button is provided which sets the threshold to an optimum value. Checking the '**Display Binary**' tick box, applies the currently set threshold such that the pure black on white image is displayed.

- Select "**Auto Threshold**" to derive the optimum value.
- With the **AOI** correctly placed around the characters and the threshold set **RED** boxes will be drawn around each character and not anywhere else in the window. If the correct threshold has been found there will be the same number of Red boxes as blobs (characters) counted in the **OCR read** area at the bottom of the screen.
- Check the image to ensure there are no other features in the image being highlighted by a red outline. If there are then adjust the threshold or the AOI to remove them.
- Click on the "**Change Font**" button followed by "**New Font**".

4. Font Creation and Training



Figure 21 Font Selection Screen

- Select **New Font**
- Enter a font name, which corresponds with the job or font.
- Click “OK”
- This returns the user to the “OCR Setup” screen.
- Click on the “**Teach**” button to open the “**LIS Font Trainer**” screen

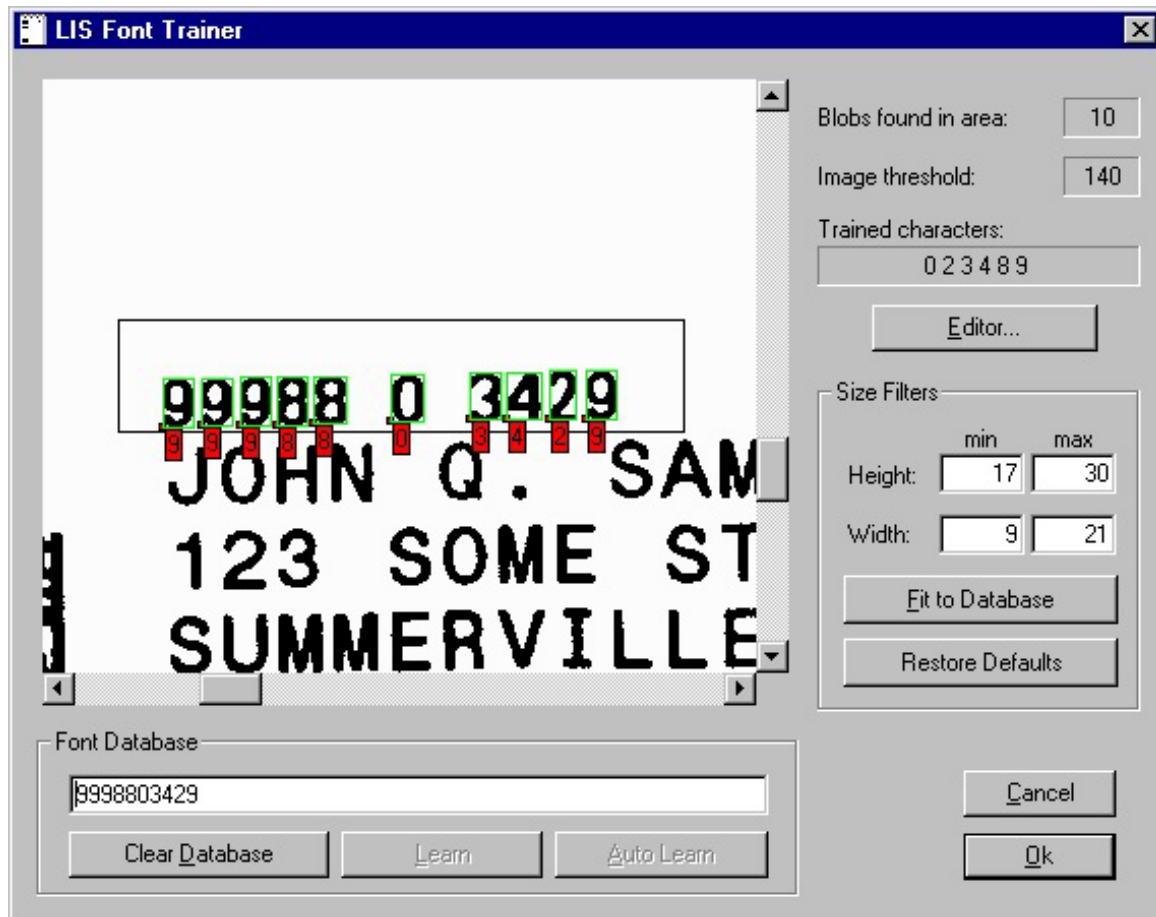


Figure 22 Font Training Screen

- Green Boxes should now surround the required characters. If boxes do not appear, click “**Restore Defaults**” in the size filters area.
Note that in the top right hand area, the screen is reporting the number of ‘blobs’ found in the ‘Region of Interest’, the current setting of the ‘Image Threshold’ and a list of the trained character classes in the currently active font (if any).
- With the example of the required characters in the Region of Interest, and the threshold set at Auto, in the “**Font Database**” area type in the numbers in the order in which they appear in the image window above.
- At this point the user can choose between using the “**Learn**” or “**Auto Learn**” buttons. It is standard practice to ‘teach the font’ at the auto threshold level, and then at levels slightly above and slightly below auto threshold, i.e. three examples of each character. If the user needs to specify the threshold levels at which the font must be taught, then pressing the “**Learn**” button followed by “**Fit to Database**” will enter just one example of

the font into the database. It is then necessary to return to the “**OCR Setup**” screen to set the next required threshold level before repeating the teach process.

Note that a list of the ‘Learnt classes’ (characters) is now displayed on the right hand side of the Font Trainer screen.

Alternatively, having typed in the character string as above, pressing the “**Auto Learn**” button will automatically teach three examples of each character at i) The currently set threshold ii) Ten points above current threshold and iii) ten points below current threshold. After pressing “**Auto Learn**” press “**Fit to Database**”. This will set an average character size for the font data. If a graphic or other characters appear in the AOI that are outside this size criteria they are ignored, minimising false read issues.

Click on OK to return to the OCR Setup screen.

- At this stage, the **AOI** is marked closely around the string. The **AOI** should now be increased to cope with a certain amount of document movement. To do this drag any side or corner of the **AOI**, or simply draw a new **AOI** by using the left mouse button to hold and dragging.

5. Variable Trigger Distance: On systems where the image needs to be captured after a time or machine movement delay from the instant that ‘Triggering’ occurs, an adjustable bar at bottom of the ‘OCR Setup’ screen allows control of the delay value.

When the job is first run, if the image is not appearing in the centre of the window then the trigger delay must be changed. The adjustment bar runs from **0** to **300**, this is a measurement in **mm** or **mS**. If it is not clear which way to adjust the slide bar start at the low end and slowly increase the value until the target character string appears in the image. If an image is not found then the scaling may need to be adjusted, see section ‘SCM Settings’.

On a fixed trigger system, the trigger distance bar at the bottom of the screen should be ignored. When the job is first run, if the image is not appearing in the centre of the window then the camera may need to be moved and/or the trigger sensor repositioned.

Advanced Setup features

From the OCR Setup screen, press the 'Advanced' button to access the following advanced setup features.

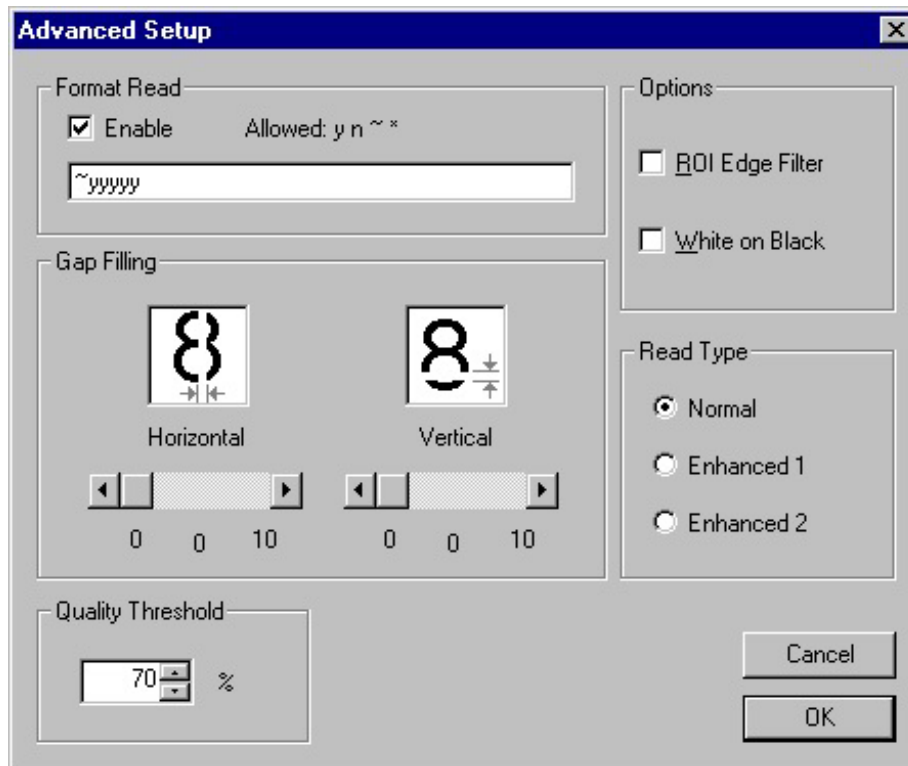


Figure 23 Advanced Setup Screen

- **Format Read:** Ticking the box 'Format Read' allows the user to then specify certain character positions within the overall string which are significant and only those characters will be processed. For example, in a string of 10 characters, perhaps only characters 9 and 10 are significant for the purposes of document integrity.

If required, tick the Format Read 'Enable' box, position the cursor in the text box below and type 'n' and 'y' characters to this line to indicate which are the significant characters. For example if characters 9 and 10 were the only significant characters, then the overall string would read – 'nnnnnnnnnyy'.

If a variable number of characters precede the significant characters, then the tilda (~) symbol can be used to indicate 'everything up to'. E.g. '~yy' would mean that everything except the last two characters can be ignored.

The asterisk symbol '*' specifies that all the characters within the AOI are significant.

Note that when bounding boxes are being displayed, the 'ignored' characters are bounded in a yellow box.

- **AOI Edge Filter:** When this box is checked, part of a neighbouring character or graphic that may encroach into the AOI, or touch the AOI boundary will be ignored.
- **White on Black:** Check this box when the text to be read is white on a black background.
- **Gap Filling:** Normally, any break in a character will cause it to be identified as two characters. However, if the printed text to be read may be subject to missing lines or 'gaps' (as sometimes is the case with dot matrix printers) then in this panel the user may specify the maximum number of pixels that the software may 'fill in' to restore the shape of the character. Please note that if the Gap Filler value is set too high it may join all the individual characters together.
- **Quality Threshold:** When the system is running it will process each object it finds in turn, by comparing it to every example of the characters it has been taught, keeping track as it goes of which taught character is physically most similar to the object found. At the end of this process, the object will be identified as the character with the highest physical similarity providing the similarity is at least as high as the **Image Quality Threshold**. This has a default value of 70% which is adequate for most applications.
- **Read Type:** This feature should be set to 'Normal' unless the system is having difficulty distinguishing between very similar characters. If this is the case, selecting 'Enhanced 1' will, at the end of the normal search process, invoke an additional processing of the top ten scoring characters where their position is moved by 1-pixel in 8 different directions and the score re-evaluated. Selecting 'Enhanced 2' invokes a 2-pixel move and re-evaluation in addition to the 1 pixel operation. While this can enhance reading capability for some fonts it requires more processing time from image to image.

Font Editing

Sometimes it is desirable to be able to view the trained characters and, if necessary, delete either the entire character class or some examples of a class. An example of this requirement would be if it were suspected that a character had been incorrectly trained.

Pressing the 'Editor' button on the 'Font Trainer' screen opens the 'Font Editor' screen.

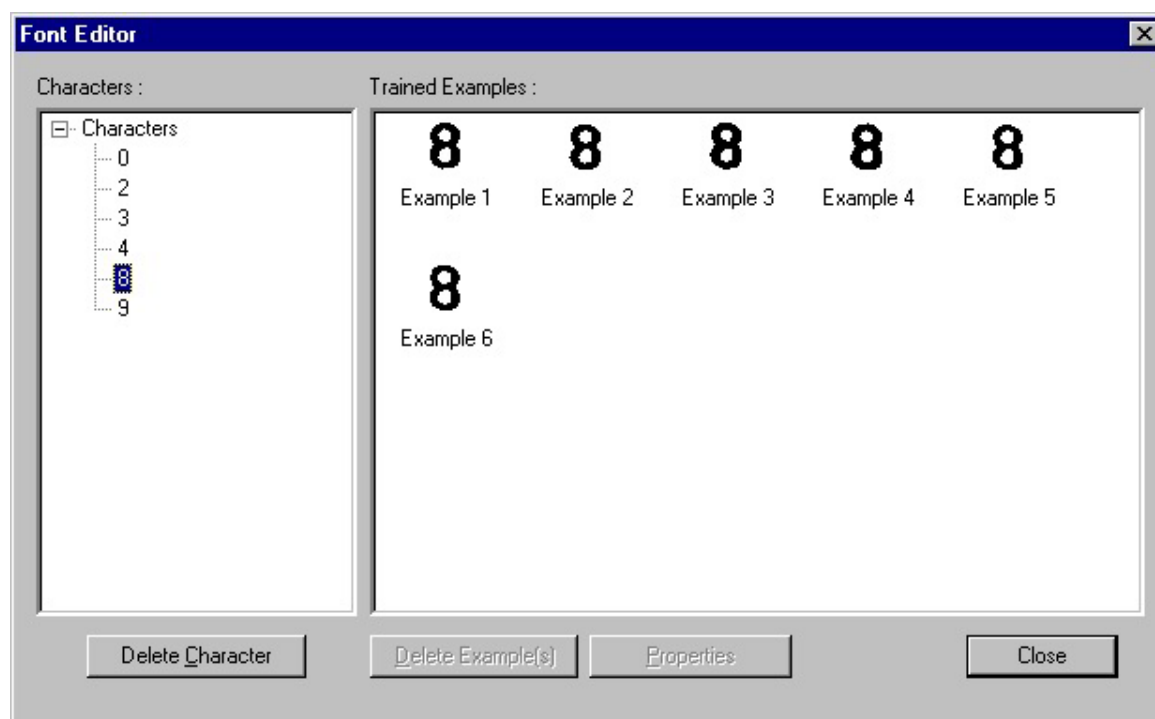


Figure 24 Font Editor Screen

Highlighting a character class in the left hand box will cause all the trained examples of that character to be displayed in the right hand box. Pressing 'Delete Character' will cause the entire character class to be deleted.

Highlighting an individual example in the right hand box, allows it to be deleted by pressing the 'Delete Example' button

Highlighting an individual example in the right hand box and pressing 'Properties' brings up the 'Properties' window, which displays the actual bit (pixel) map of the character, and in the right hand panel displays the width and height of the character in pixels.

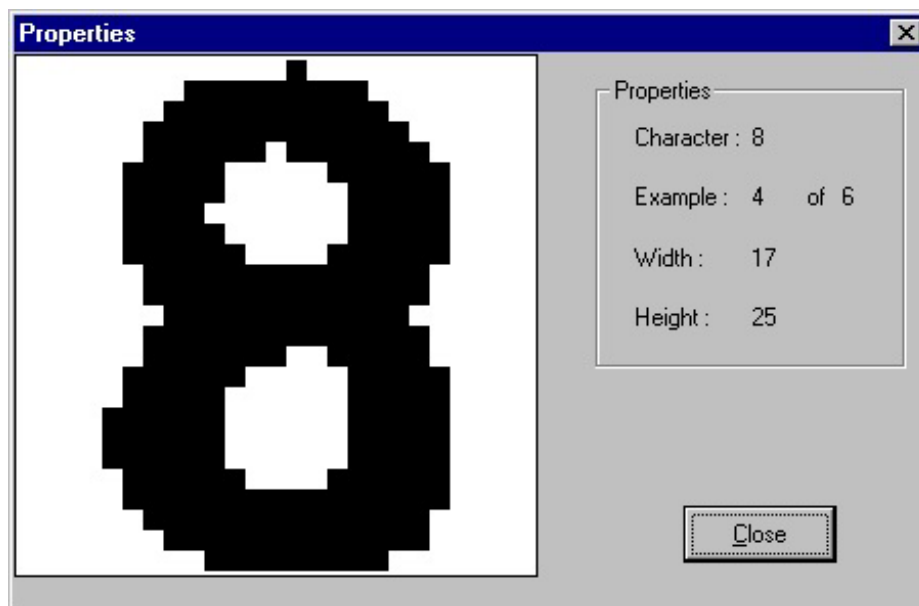


Figure 25 Example Properties Screen

Address Masking Set-up

On the main screen, double click on the camera panel of the camera to be set up or select through Main Screen Setup control button.

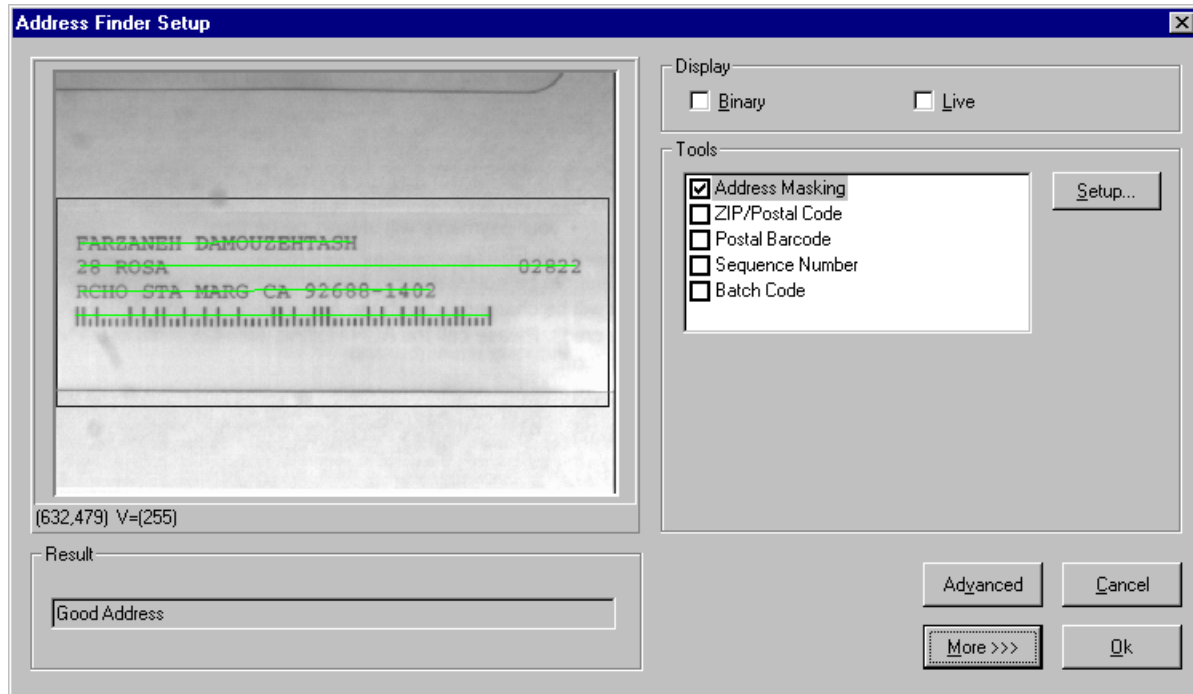


Figure 26 Address Masking Camera Setup Screen

The default address masking set-up screen is shown above. The captured image with the area of interest is displayed. The address masking is split into five independent tools:

- **Address Masking:** This tool is used to check the address is constructed correctly, i.e. it contains the correct number of lines, and each line contains sufficient characters.
- **Zip/Postal Code:** This tool is used to read the ZIP or Postal code from the address using Optical Character Recognition (OCR).
- **Postal Barcode:** The barcode above or below the address can be read using this tool.
- **Sequence Number & Batch Code:** These optional tools can be used to read a sequence or batch code from within the address structure using OCR.

Each tool is enabled/disabled by clicking the checkbox next to the tool name. Additional set-up parameters are displayed (such as font name, and location) below the tool list, when the tool is enabled and highlighted. Clicking the Setup button to the right of the tool list displays further options associated with the currently highlighted tool. These dialogs are detailed in later sections.

Additional set-up parameters, such as the Threshold and Size Filters, can be shown or hidden using the 'More' button. These settings are used by all of the above tools.

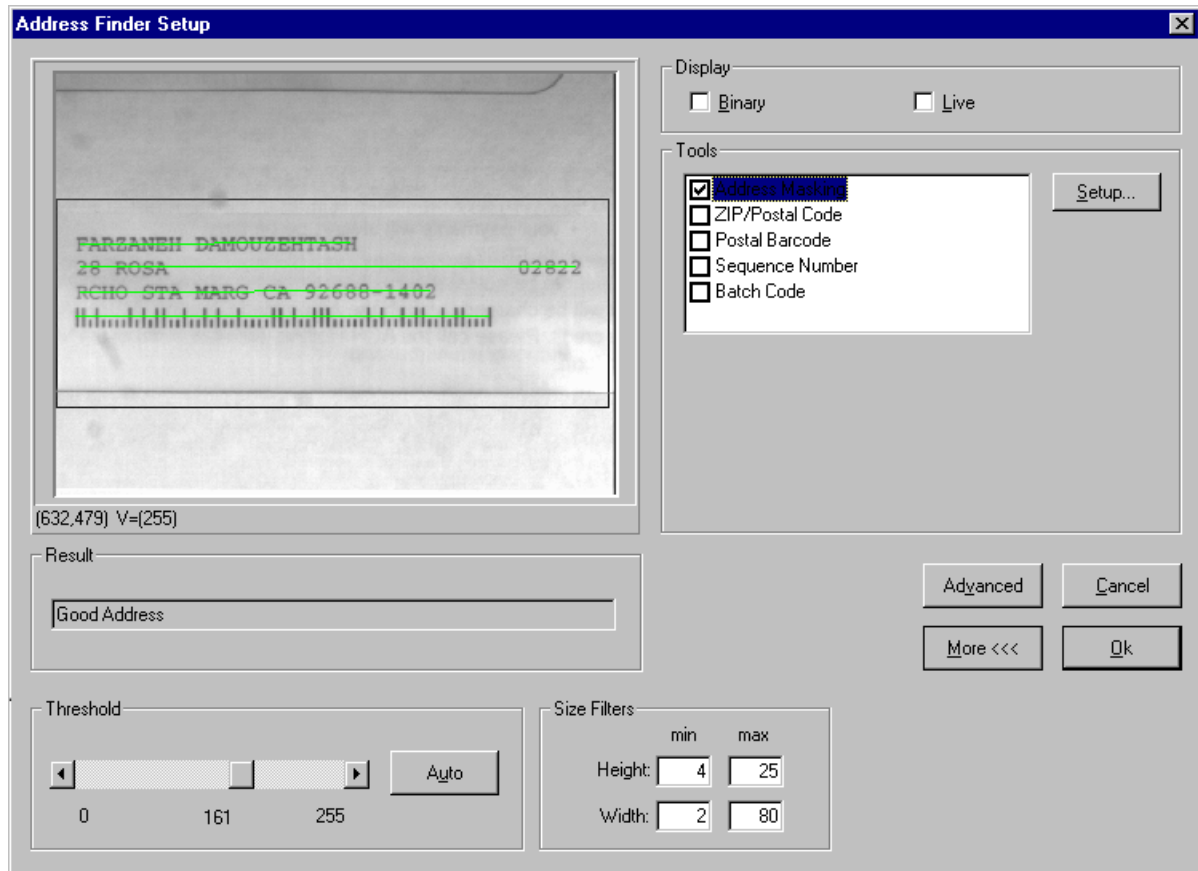


Figure 27 Address Masking Camera Setup Screen

- Threshold:** A typical image will consist of a black address on a light grey background. The software needs to apply a threshold to the varying grey scales in the image in order to differentiate what is dark enough to be part of a character (or blob) and the lighter areas that will be considered background. The threshold operates between values of 0 and 255, 0 being black and 255 being white. An '**Auto**' button is provided which sets the threshold to an optimum value.
- Size filters:** These determine the minimum and maximum sizes of characters and bar-code lines to be detected by the address finder.

Advanced Setup

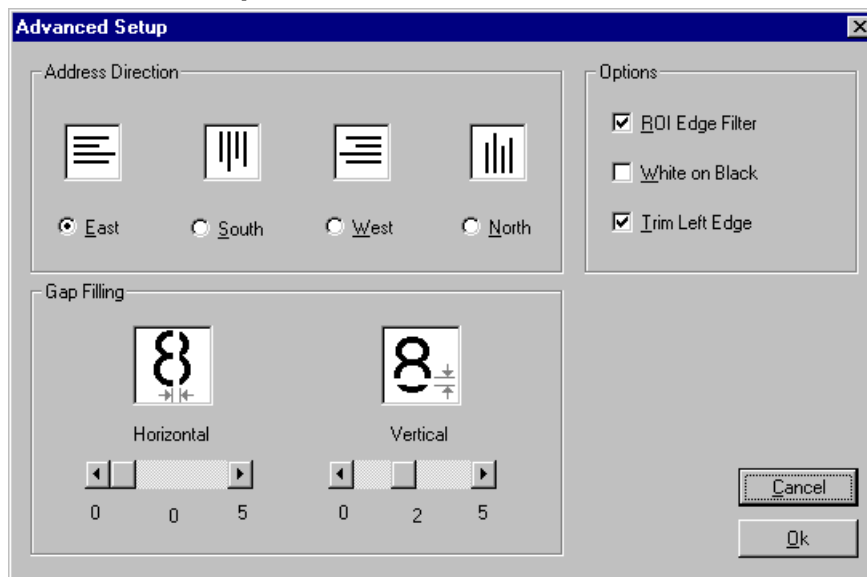


Figure 28 Address Masking Advanced Setup Screen

Clicking on the Advanced button on the main Address Masking screen displays the above dialog. The settings are used to control all of the tools.

- **Address Direction:** The direction should be set according to the orientation of the address within the image.
- **ROI Edge Filter:** When this box is checked, part of a neighbouring character or graphic that may encroach into the ROI, or touch the ROI boundary will be ignored.
- **White on Black:** Check this box when the text to be read is white on a black background.
- **Trim Left Edge:** When this option is checked, the address finder will attempt to straighten up the left hand edge of the address. This is useful for filtering out characters or features such as the left edge of the address window. Do not check this option if the address does not have a straight left edge.
- **Gap Filling:** Normally, any break in a character will cause it to be identified as two characters. However, if the printed text to be read may be subject to missing lines or 'gaps' (as sometimes is the case with dot matrix printers) then in this panel the user may specify the maximum number of pixels that the software may 'fill in' to restore the shape of the character. Please note that if the Gap Filler value is set too high it may join all the individual characters together.

Address Masking Tool

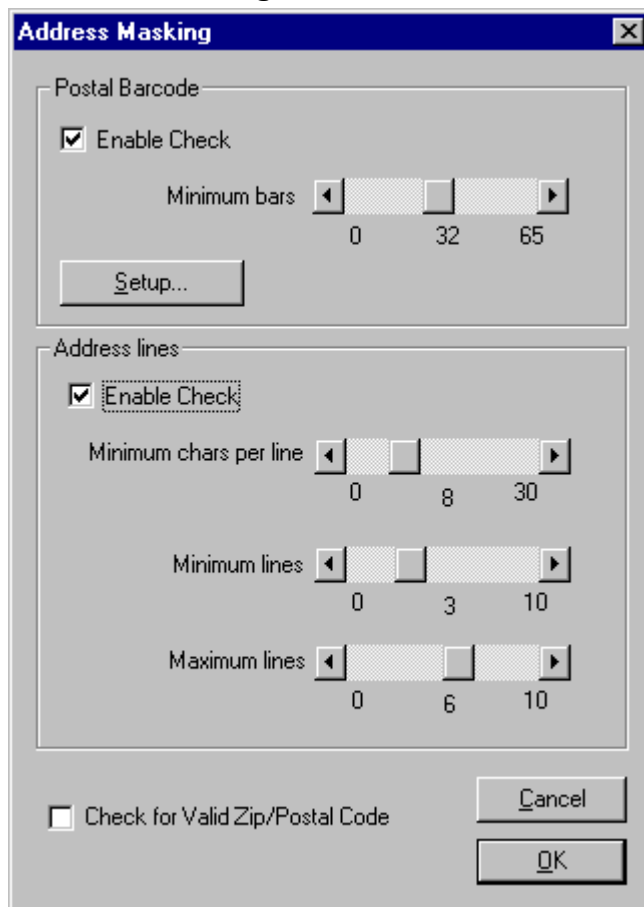


Figure 29 Address Masking Tool Setup Screen

The Address Masking Tool set-up screen is used to configure how to determine whether the address is valid. Any combination of the following checks can be enabled, and if any one of them passes, the address is assumed valid. If none are selected the address is always bad.

- Postal Barcode:** This checks for any line within the address to contain a minimum number of 'blobs' or bars. If this is enabled and the line is found, and the barcode is successfully decoded, then address is passed. Pressing the 'Setup...' button displays a dialog to select the type of barcodes to be read, this is detailed in the barcode reading section below. For optimal performance only select those barcode that will be in the address.
- Address Lines:** This checks that the address contains the correct number of lines. The number of lines should be between the Minimum and Maximum values. For a line to be counted, it must have more than the 'Minimum chars per line'. It should be noted that no OCR is performed on the characters to determine this.
- Check for Valid Zip/Postal Code:** If the Zip/Postal Code tool is enabled on the main set-up screen, then this check box is available. If the check options is enabled, the address is assumes valid if the OCR tool correctly reads all characters.

ZIP/Postal Code, Sequence Number and Batch Code Tools

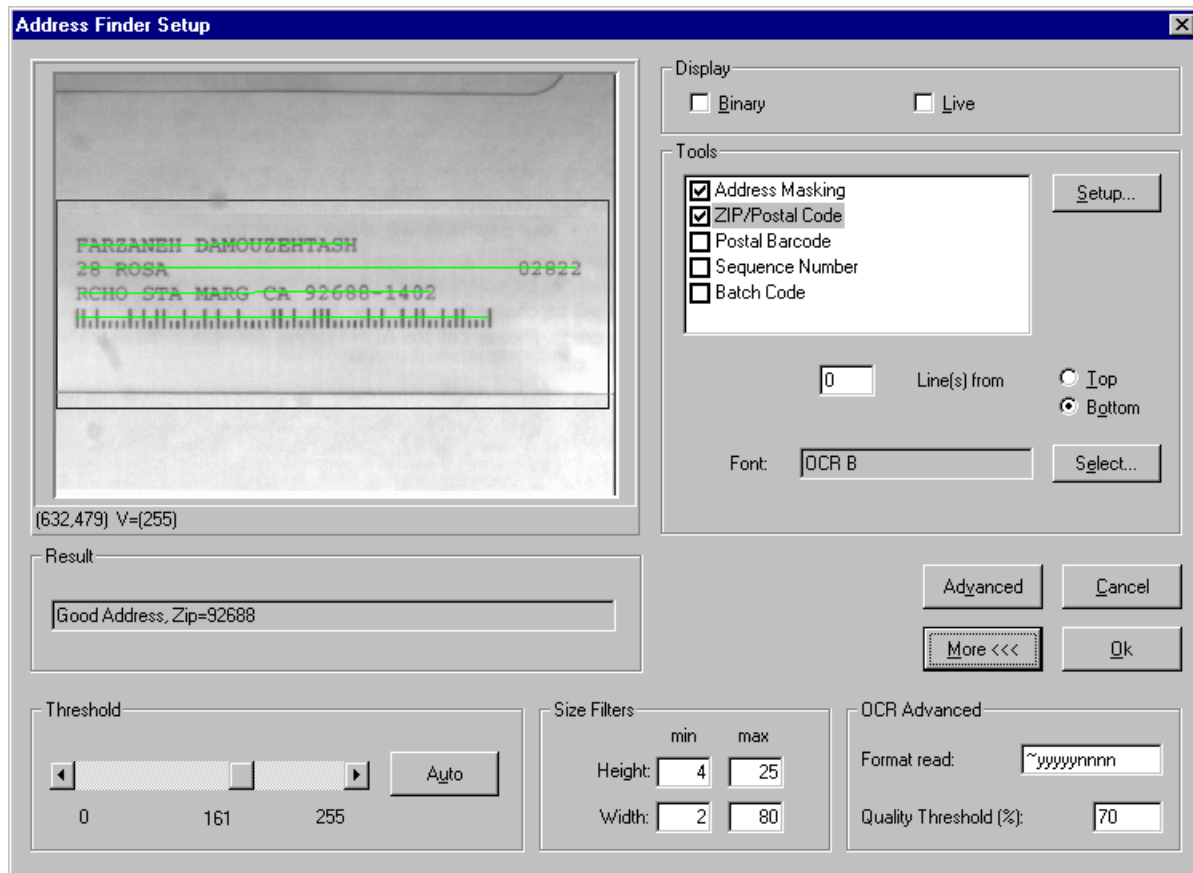


Figure 30 ZIP/Postal Code Tool Screen

Selecting and enabling any of the ZIP/Postal Code, Sequence Number or Batch Code tools displays the additional OCR related options. Each tool has its own unique settings, and these must be set-up independently. Clicking on the 'Setup...' button displays the OCR set-up dialog if a font is already selected, or prompts the user to select or create a new font. Font training is detailed in a later section.

- **n Line(s) from Top/Bottom:** This determines which line within the address is to be read. Selecting '0 line(s) from Top' will mean that the top line of the address is read. It should be noted that lines that contain a barcode are not counted. This means setting '0 lines from Bottom' will read the last line if not postal barcode is present or the line above the postal barcode if it is present.
- **Font:** The name of the font is displayed, and another font can be loaded using the 'Select...' button.
- **Format Read:** Entering a format allows the user to then specify certain character positions within the overall string which are significant and only those characters will be processed. For example, in a string of 10 characters, perhaps only characters 9 and 10 are significant for the purposes of document integrity.

If required, tick the Format Read 'Enable' box, position the cursor in the text box below and type 'n' and 'y' characters to this line to indicate which are the significant characters. For example if characters 9 and 10 were the only significant characters, then the overall string would read – 'nnnnnnnyy'.

If a variable number of characters precede the significant characters, then the tilde (~) symbol can be used to indicate 'everything up to'. E.g. '~yy' would mean that everything except the last two characters can be ignored.

The asterisk symbol '*' specifies that all the characters within the AOI are significant.

- **Quality Threshold:** When the system is running it will process each object it finds in turn, by comparing it to every example of the characters it has been taught, keeping track as it goes of which taught character is physically most similar to the object found. At the end of this process, the object will be identified as the character with the highest physical similarity providing the similarity is at least as high as the **Image Quality Threshold**. This has a default value of 70% which is adequate for most applications.
- assumes valid if the OCR tool correctly reads all characters.

ZIP/Postal Code, Sequence Number and Batch Code Tools

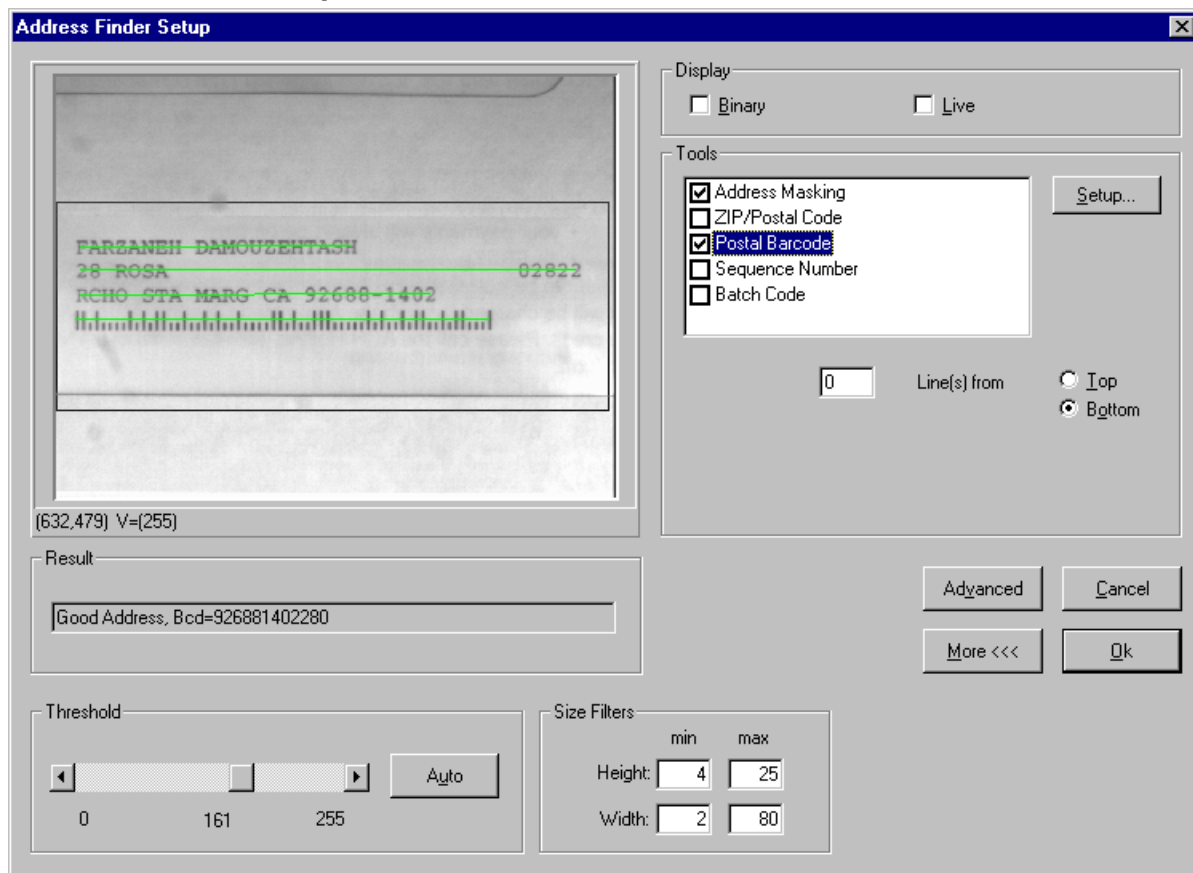


Figure 31 Postal Barcode Tool Screen

Selecting and enabling the Postal Barcode tool displays the additional barcode related options.

- ***n* Line(s) from Top/Bottom:** This determines which line within the address is to be read. Selecting '0 line(s) from Top' will mean that the top line of the address is read.

Clicking the 'Select...' button displays the dialog below. This enables the different barcode types to be enabled/disabled as required. For optimal performance only select the type(s) of barcode contained in the address being inspected.

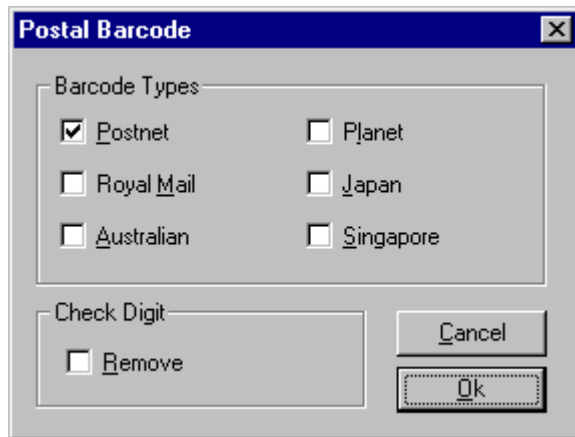


Figure 32 Postal Barcode Setup Screen

- **Check Digit - Remove:** If the barcode contains a check digit, then enabling this option results in the barcode data having this digit or digits removed.

Address Masking Setup

1. **Image Capture:** Select the correct 'Read Direction' in the Advanced dialog. Place the document under the camera in the normal running orientation, select 'Live Image' and centre the character string in the image window. Deselect 'Live Image' when the image is stable.
2. **Area Of Interest:** Create an 'Area Of Interest' (AOI) around the address by left clicking the mouse with the cursor at a point just above and to the left of the address window, dragging and releasing the mouse when the cursor is just below and to the right of the window. The Area of Interest serves to exclude any characters or objects not required to be processed.
Note that when defining the AOI for live running, variation in the position of the target image must be taken into account. Part of a neighbouring character or graphic may encroach into the AOI and will be ignored providing it is not the full character and that the tick box 'AOI Edge Filter' on the 'Advanced Setup' screen has been selected.
3. **Threshold:** A typical image will consist of a black font on a light grey background. The software needs to apply a threshold to the varying grey scales in the image in order to differentiate what is dark enough to be part of a character (or blob) and the lighter areas which will be considered background. The threshold operates between values of 0 and

255, 0 being white and 255 being black. An '**Auto**' button is provided which sets the threshold to an optimum value. Checking the '**Display Binary**' tick box, applies the currently set threshold such that the pure black on white image is displayed.

- Select "**Auto**" to derive the optimum value.
- With the **AOI** correctly placed around the characters and the threshold set **RED** boxes will be drawn around each character and not anywhere else in the window. If the correct threshold has been found there will be the same number of Red boxes as blobs (characters) counted in the **OCR read** area at the bottom of the screen.
- Check the image to ensure there are no other features in the image being highlighted by a red outline. If there are then adjust the threshold or the AOI to remove them.
- Click on the "**Change Font**" button followed by "**New Font**".

4. Font Creation and Training

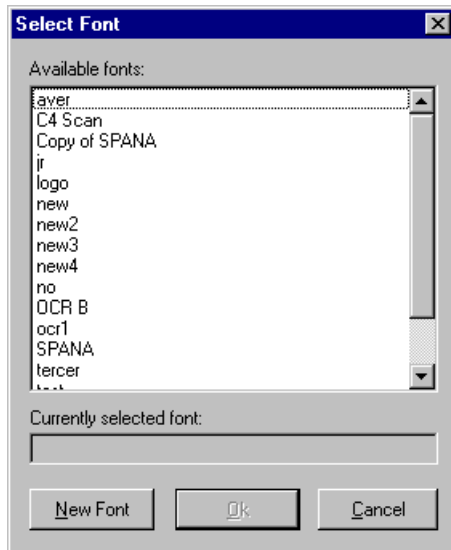


Figure 33 Font Selection Screen

- Select **New Font**
- Enter a font name, which corresponds with the job or font.
- Click "**OK**"
- This returns the user to the "OCR Setup" screen.
- Click on the "**Teach**" button to open the "**LIS Font Trainer**" screen

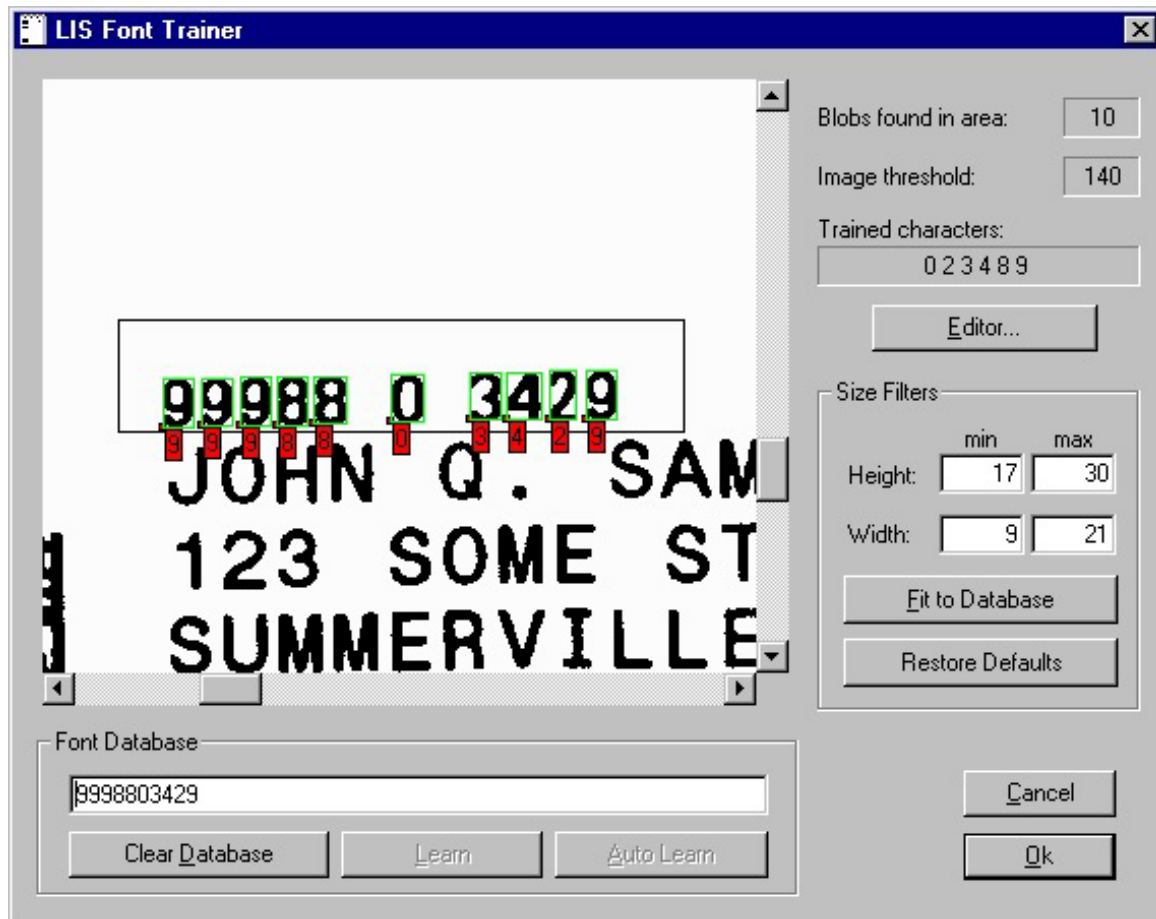


Figure 34 Font Training Screen

- Green Boxes should now surround the required characters. If boxes do not appear, click **“Restore Defaults”** in the size filters area.
Note that in the top right hand area, the screen is reporting the number of ‘blobs’ found in the ‘Region of Interest’, the current setting of the ‘Image Threshold’ and a list of the trained character classes in the currently active font (if any).
- With the example of the required characters in the Region of Interest, and the threshold set at Auto, in the **“Font Database”** area type in the numbers in the order in which they appear in the image window above.
- At this point the user can choose between using the **“Learn”** or **“Auto Learn”** buttons. It is standard practice to ‘teach the font’ at the auto threshold level, and then at levels slightly above and slightly below auto threshold, i.e. three examples of each character. If the user needs to specify the threshold levels at which the font must be taught, then pressing the **“Learn”** button followed by **“Fit to Database”** will enter just one example of the font into the database. It is then necessary to return to the **“OCR Setup”** screen to set the next required threshold level before repeating the teach process.
Note that a list of the ‘Learnt classes’ (characters) is now displayed on the right hand side of the Font Trainer screen.

Alternatively, having typed in the character string as above, pressing the **“Auto Learn”** button will automatically teach three examples of each character at i) The currently set

threshold ii) Ten points above current threshold and iii) ten points below current threshold. After pressing "**Auto Learn**" press "**Fit to Database**". This will set an average character size for the font data. If a graphic or other characters appear in the AOI that are outside this size criteria they are ignored, minimising false read issues.

Click on OK to return to the OCR Setup screen.

- At this stage, the **AOI** is marked closely around the string. The **AOI** should now be increased to cope with a certain amount of document movement. To do this drag any side or corner of the **AOI**, or simply draw a new **AOI** by using the left mouse button to hold and dragging.

Font Editing

Sometimes it is desirable to be able to view the trained characters and, if necessary, delete either the entire character class or some examples of a class. An example of this requirement would be if it were suspected that a character had been incorrectly trained.

Pressing the 'Editor' button on the 'Font Trainer' screen opens the 'Font Editor' screen.

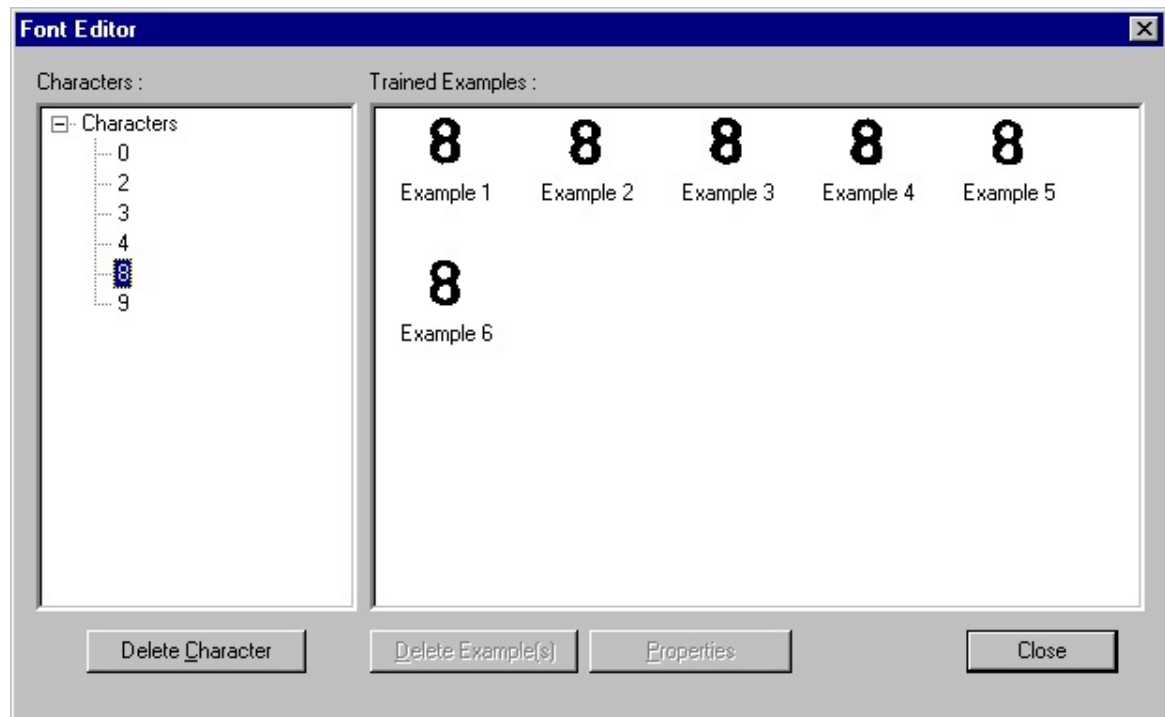


Figure 35 Font Editor Screen

Highlighting a character class in the left hand box will cause all the trained examples of that character to be displayed in the right hand box. Pressing 'Delete Character' will cause the entire character class to be deleted.

Highlighting an individual example in the right hand box, allows it to be deleted by pressing the 'Delete Example' button

Highlighting an individual example in the right hand box and pressing 'Properties' brings up the 'Properties' window, which displays the actual bit (pixel) map of the character, and in the right hand panel displays the width and height of the character in pixels.

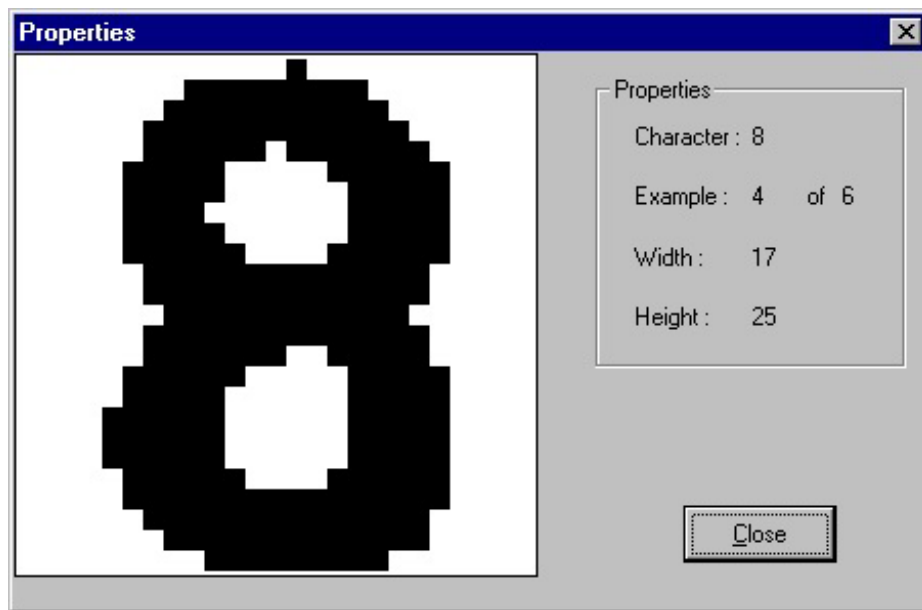


Figure 36 Example Properties Screen

Postal Barcode Tool Set-up

On the main screen, double click on the camera panel of the camera to be set up or select through Main Screen Setup control button.

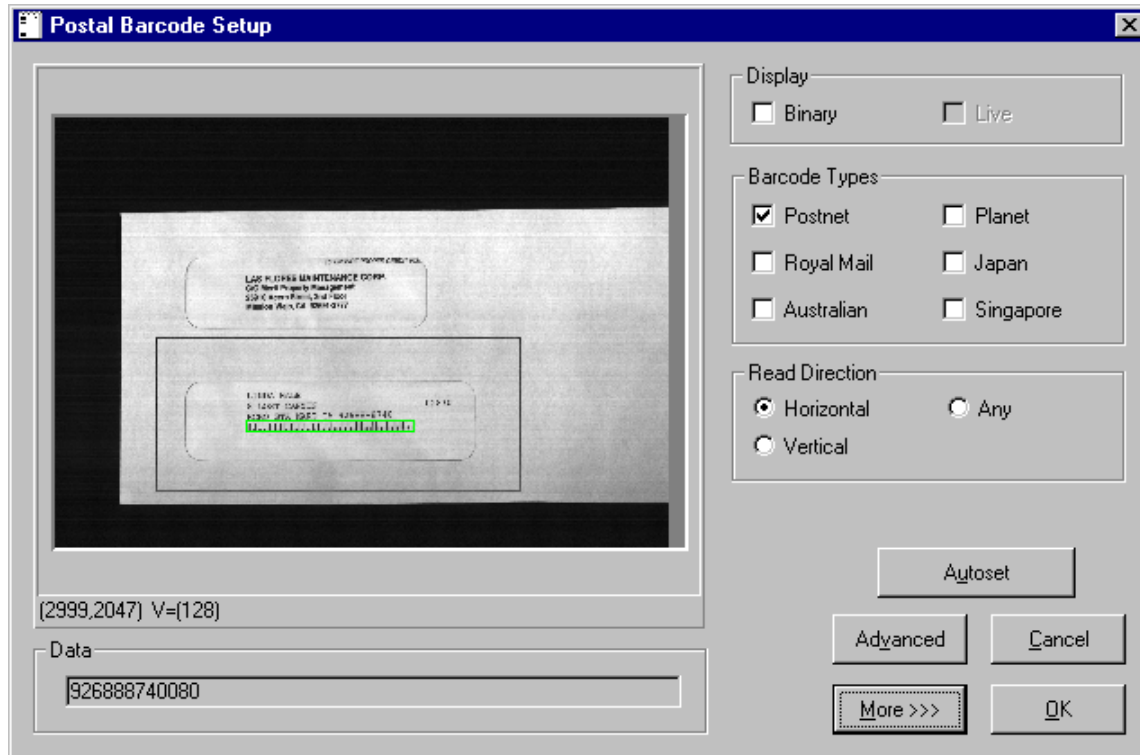


Figure 37 Postal Barcode Camera Setup Screen

The default Postal Barcode set-up screen is shown above. The captured image with the area of interest is displayed. To the right of the image are the check boxes to determine which barcode types are to be read, and in which orientation.

- **Barcode Types:** The types of barcode available to be read are listed. Only enable those types that are to be read within the current job. Enabling extras will impact on performance.
- **Read Direction:** This determines which direction the barcode is to be read. Horizontal and Vertical should be used whenever possible, as reading any angle will greatly impact performance.
- **Binary:** Checking this option will display a black and white version of the image based on the current threshold.
- **Live:** The option enable new images to be captures from the camera.

Additional set-up parameters, such as the Threshold and Size Filters, can be shown or hidden using the 'More' button.

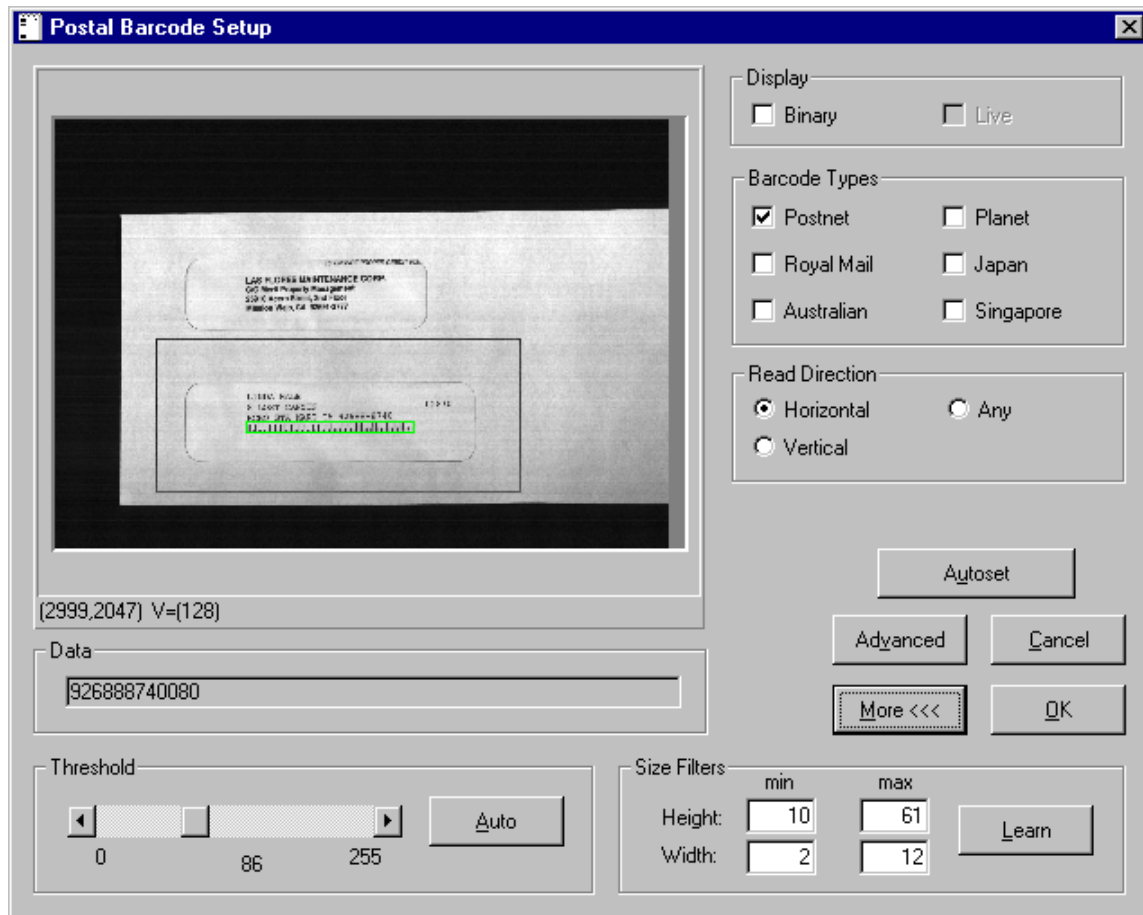


Figure 38 Postal Barcode Camera Setup Screen (More)

- Threshold:** A typical image will consist of a black address on a light grey background. The software needs to apply a threshold to the varying grey scales in the image in order to differentiate what is dark enough to be part of a barcode (or blob) and the lighter areas that will be considered background. The threshold operates between values of 0 and 255, 0 being black and 255 being white. An '**Auto**' button is provided which sets the threshold to an optimum value.
- Size filters:** These determine the minimum and maximum sizes of characters and barcode lines to be detected by the address finder. The **Learn** button will set the filters to any features contained with the current AOI. This is useful for manually learning the sizes of the bars. to perform this, firstly draw a small AOI just containing the barcode, or some of the barcode, then select **Learn**. Now return the AOI to its original size.

Advanced Setup

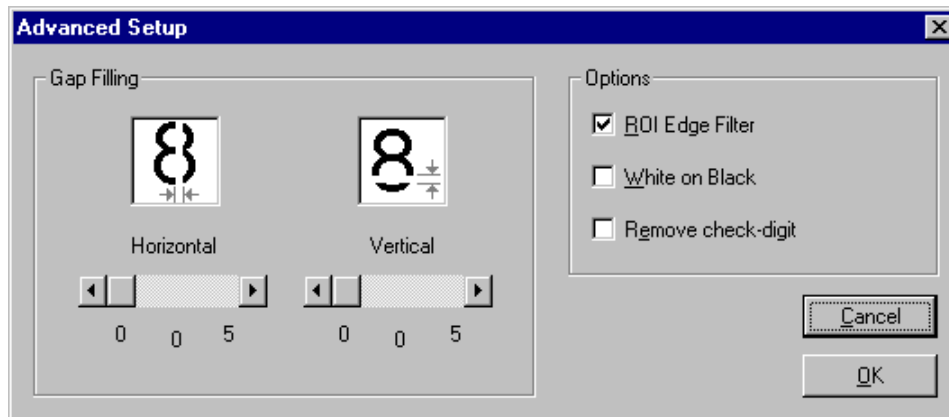


Figure 39 Postal Barcode Advanced Setup Screen

Clicking on the Advanced button on the main Postal Barcode screen displays the above dialog. The settings are used to control all of the tools.

- **ROI Edge Filter:** When this box is checked, part of a neighbouring character or graphic that may encroach into the ROI, or touch the ROI boundary will be ignored.
- **White on Black:** Check this box when the text to be read is white on a black background.
- **Remove Check Digit:** If the barcode contains a check digit, then enabling this option results in the barcode data having this digit or digits removed.
- **Gap Filling:** Normally, any break in a bar will cause it to be identified as two bars. However, if the printed text to be read may be subject to missing lines or 'gaps' (as sometimes is the case with dot matrix printers) then in this panel the user may specify the maximum number of pixels that the software may 'fill in' to restore the shape of the character. Please note that if the Gap Filler value is set too high it may join all the individual bars together.

Postal Barcode Setup Procedure

1. **Image Capture:** Select the correct 'Read Direction' in the dialog. Place the document under the camera in the normal running orientation, select 'Live Image' and centre the barcode in the image window. Deselect 'Live Image' when the image is stable.
2. **Area Of Interest:** Create an 'Area Of Interest' (AOI) around the address by left clicking the mouse with the cursor at a point just above and to the left of the address window, dragging and releasing the mouse when the cursor is just below and to the right of the window. The Area of Interest serves to exclude any objects not required to be processed. Note that when defining the AOI for live running, variation in the position of the target image must be taken into account. *Part* of a neighbouring character or graphic may encroach into the AOI and will be ignored providing it is not the full bar and that the tick box 'AOI Edge Filter' on the 'Advanced Setup' screen has been selected.

3. **Autoset:** With the read direction and AOI correctly set, press the **Autoset** button. This will initially perform an Auto Threshold. Using various initial size filters the system will attempt to read a barcode of any of the available types. If a barcode is successfully decoded the barcode type and size filters will be optimally set for the barcode found. If the barcode is not read using this method, try drawing an AOI around the barcode, excluding as many extraneous features as possible. The hit **Autoset** once again, and after a successful read return the AOI to its original size.

Product Detect Tool Set-up

On the main screen, double click on the camera panel of the camera to be set up or select through Main Screen Setup control button.

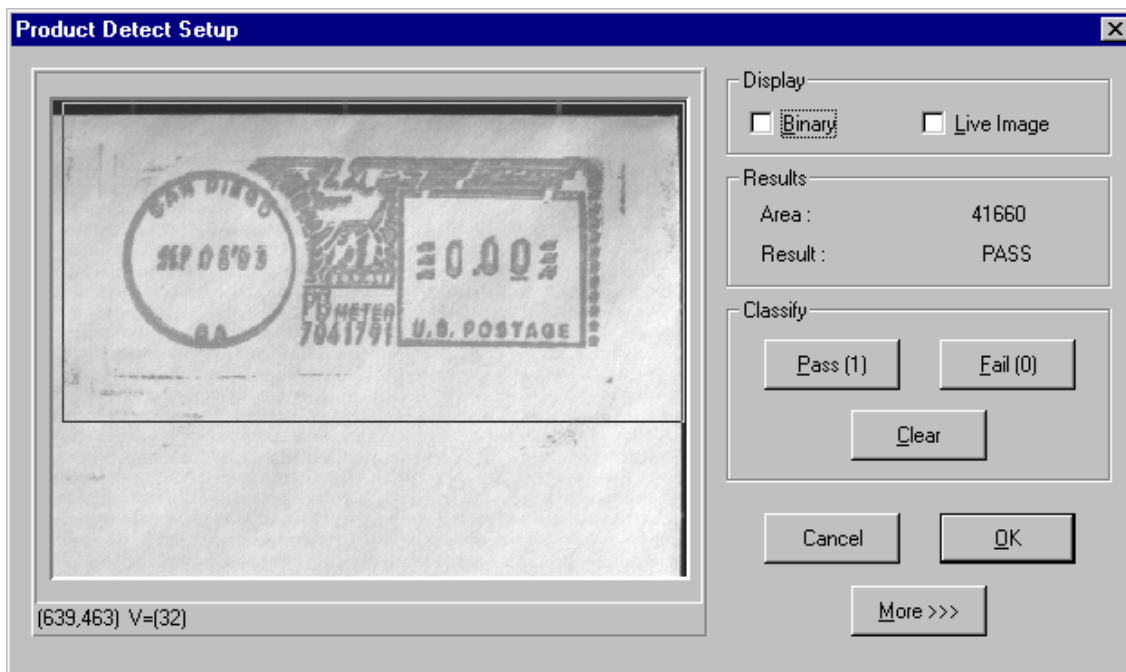


Figure 40 Product Detect Camera Setup Screen

The default Product Detect set-up screen is shown above. The captured image with the area of interest is displayed. Displayed to the right of the image are the display controls, results and classifier buttons. Additional set-up parameters, such as the Threshold and Size Filters, can be shown or hidden using the 'More' button.

The Product Detect works by performing a dual-threshold on the image. The image contains pixels with values in the range 0 (black) to 255 (white). The dual-threshold allows a range of levels to be accepted; when the binary checkbox is enable, the accepted pixels are shown black on a white background.

Accepted pixels that fall within the threshold range, and are within the Area of Interest (AOI), are counted to give a resulting area. A product is then passed or failed if its area falls within set limits.

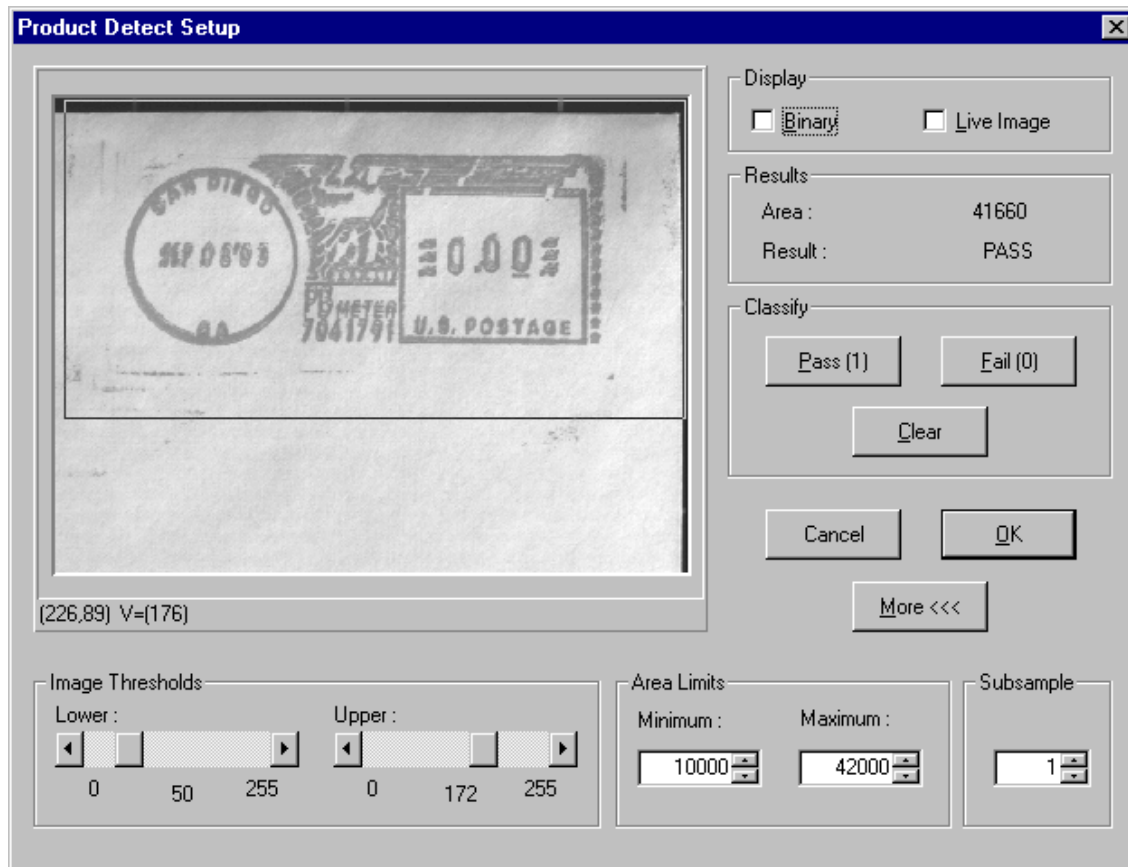


Figure 41 Product Detect Camera Setup Screen (More)

- **Binary:** Checking this option will display a black and white version of the image based on the current thresholds.
- **Live:** The option enable new images to be captures from the camera.
- **Image Thresholds:** A typical image will consist of a black address, text or logo on a light grey background. The software needs to apply a threshold to the varying grey scales in the image in order to differentiate what is 'product' to that will be considered as back-ground. The threshold operates between values of 0 and 255, 0 being black and 255 being white.
- **Area limits:** These values determine the minimum and maximum areas to be a pass
- **Subsample:** On large images is may become too time consuming to count every pixel with the AOI. Setting this value greater than 1, will cause the system to count every n^{th} pixel. This has the effect of speeding up the count, but will also reduce the accuracy; though the area returned will be of a similar size.

Product Detect Classifier Setup Procedure

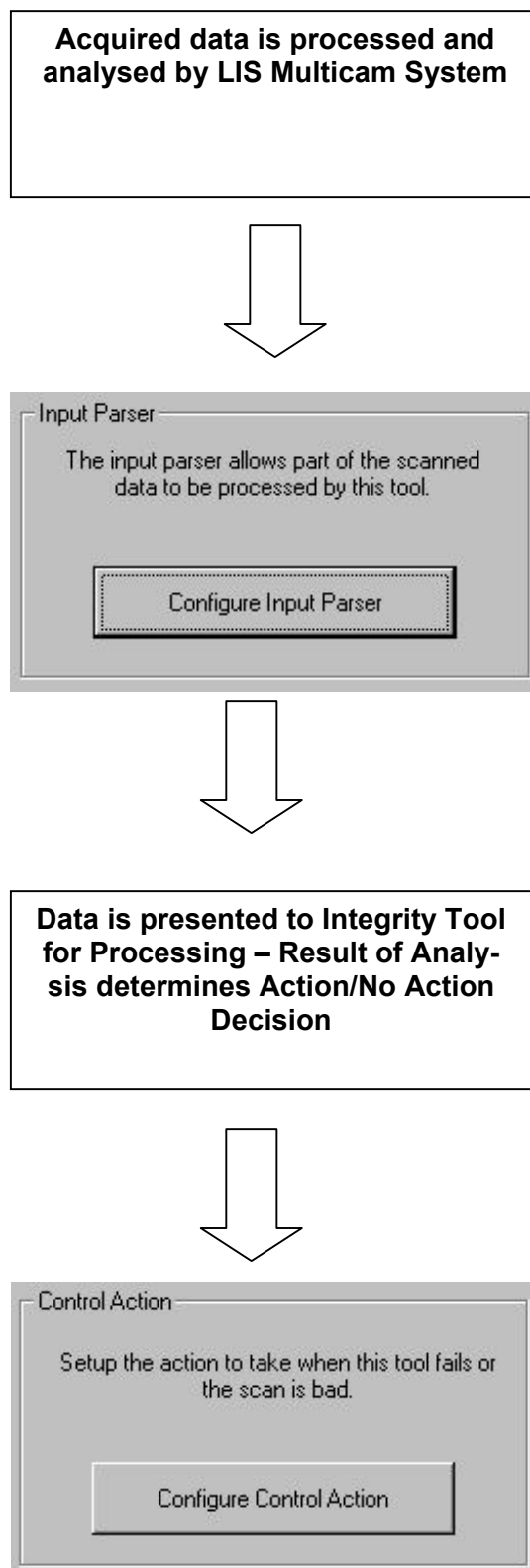
1. **Image Capture:** Place a 'good' document under the camera in the normal running orientation, select 'Live Image' and centre it in the image window. Deselect 'Live Image' when the image is stable.
2. **Area Of Interest:** Create an 'Area Of Interest' (AOI) around the feature to be checked by left clicking the mouse with the cursor at a point just above and to the left of the address window, dragging and releasing the mouse when the cursor is just below and to the right of the window. The Area of Interest serves to exclude any objects not requiring to be processed.
Note that when defining the AOI for live running, variation in the position of the target image must be taken into account.
3. **Classify:** Press the **Pass** button. This will initially perform an Auto Threshold on the image, and set the area limits accordingly. At this point, manually adjust the threshold as required. Presenting further good and bad documents to the camera and pressing the **Pass** or **Fail** button each time, the system will build up statistics on the documents that is has seen, and will attempt to optimise the upper and lower area limits accordingly. Pressing **Clear** button will reset the classifier statistics, but will leave the thresholds and area limits unchanged.

Introduction to LIS Multicam Integrity Tools

A suite of integrity tools is available to enhance the functionality of the LIS Multicam application.

1. **Static Verify Tool** – this tool is for use when each item is expected to have the same information on it; for example, to check that the correct envelope type is being used, the envelope stock code may be checked if it is displayed on the exterior of the envelope.
2. **Stop and Divert** – allows system to halt line or divert item if read/inspection fails.
3. **File Audit** – allows operator to verify that items match up to expectations extracted from a database file.
4. **Incremental Check** – allows system to highlight missing items from run.
5. **Batch Control** – allows system to collate items into batches/bundles, primarily for mail-sort applications. The mailsort batch code can either be printed directly on the item or referenced from a database file.

The Principals of the LIS Multicam Integrity Tool Suite



How to select LIS Multicam Integrity Tools

All LIS Multicam Integrity Tools are incorporated into a job in the same way.
To add an Integrity Tool to a Job, from the job main screen, click on 'Setup', as shown below.

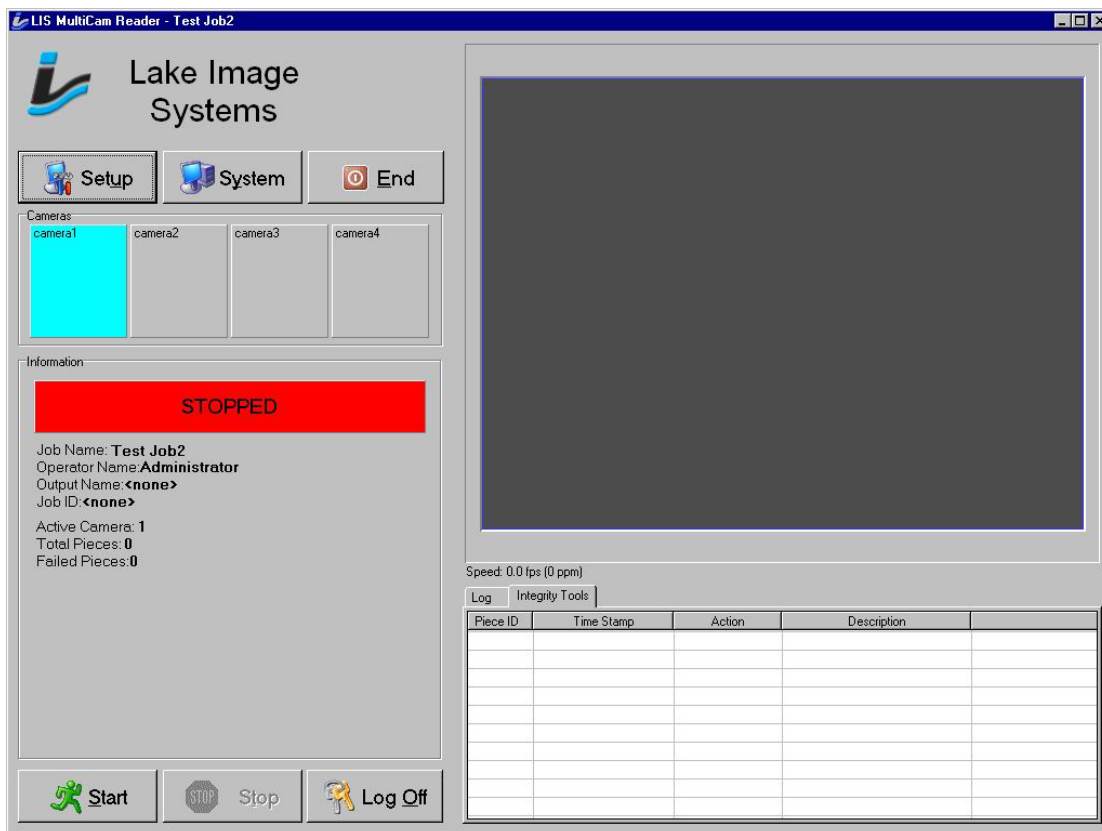


Figure 42 Main Screen

How to configure LIS Multicam Integrity Tools

Configure Input Parser

Nearly all of the Multicam Integrity Tools have common requirements in terms of how the input data is selected. This is done by using the Configure Input Parser button, which will be displayed once you have chosen the tool you wish to use.

Click 'Configure Input Parser' the following screen will appear:-

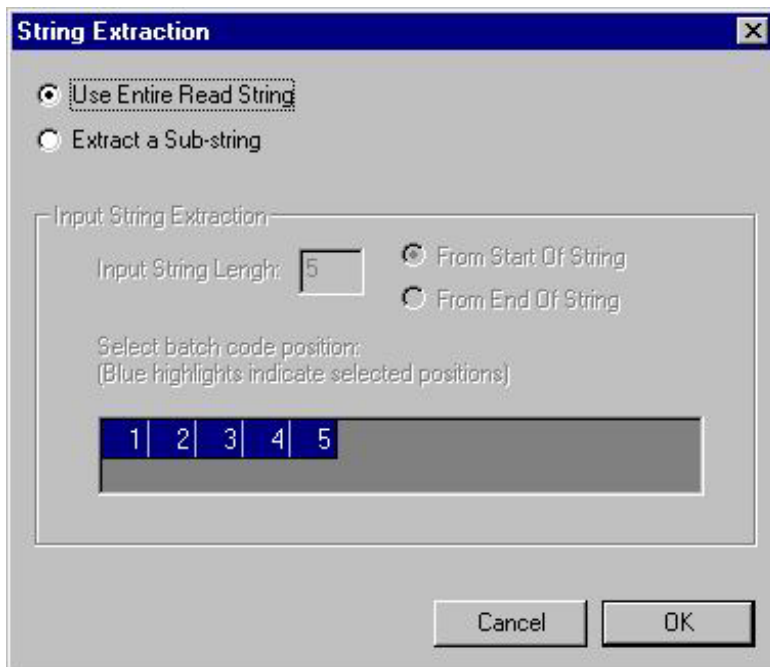
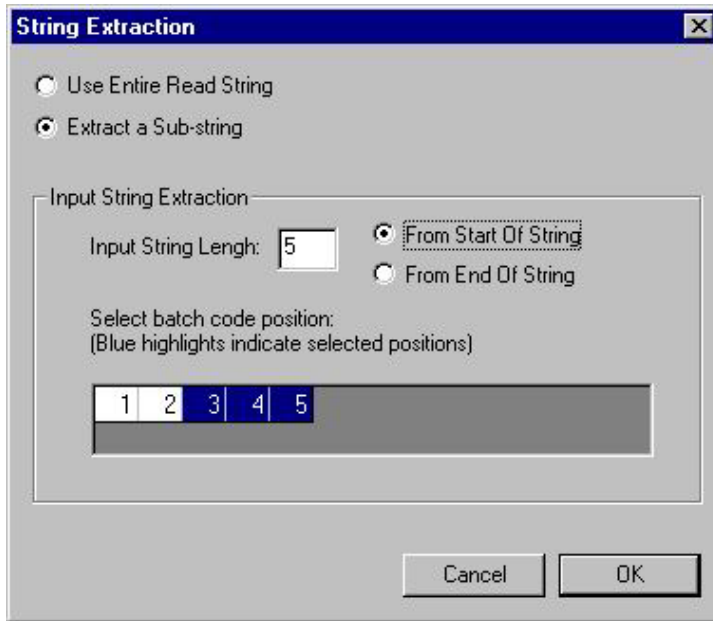
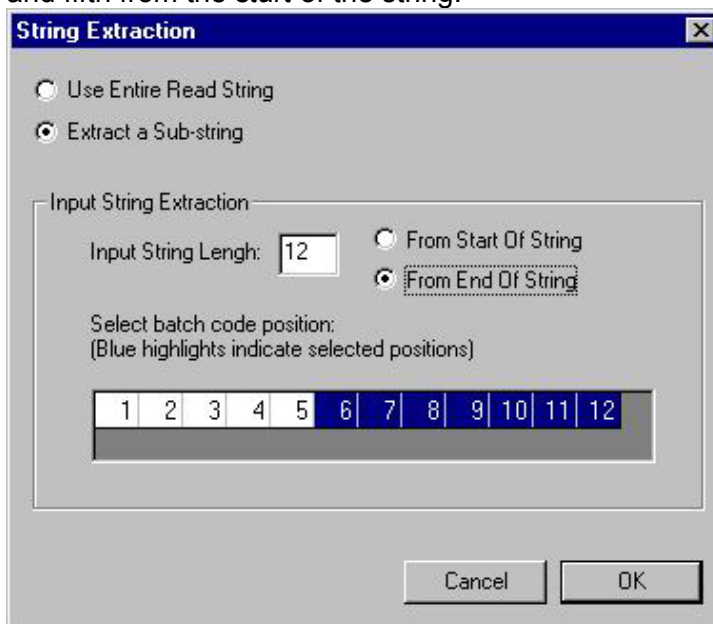


Figure 43 String Extraction

With the radio buttons you have the choice of using the entire string that appears in the Area of Interest as shown above, or you can decide to use just some of the characters – known as a sub-string.

**Figure 44 String Extraction Example 1**

For example, in the screenshot above, the third, fourth and fifth characters will be used from an expected string length of five. These will be counted from the Start of the string; so if for any reason the string is not of the expected length, the characters selected will always be the third, forth and fifth from the *start* of the string.

**Figure 45 String Extraction Example 2**

In the example above, the system will use the last seven characters from the end of an expected string of twelve. These will be counted from the End of the string; so if for any reason the string is not of the expected length, the characters selected will always be the last seven characters from the *end* of the string. The boxes are highlighted in blue by positioning the mouse pointer over the boxes of the characters required and clicking the left mouse button and dragging until the required characters are highlighted in blue. Press OK button once you are happy with your selection.

Configure Control Action

When the 'Configure Control Action' button is selected the following screen will appear:

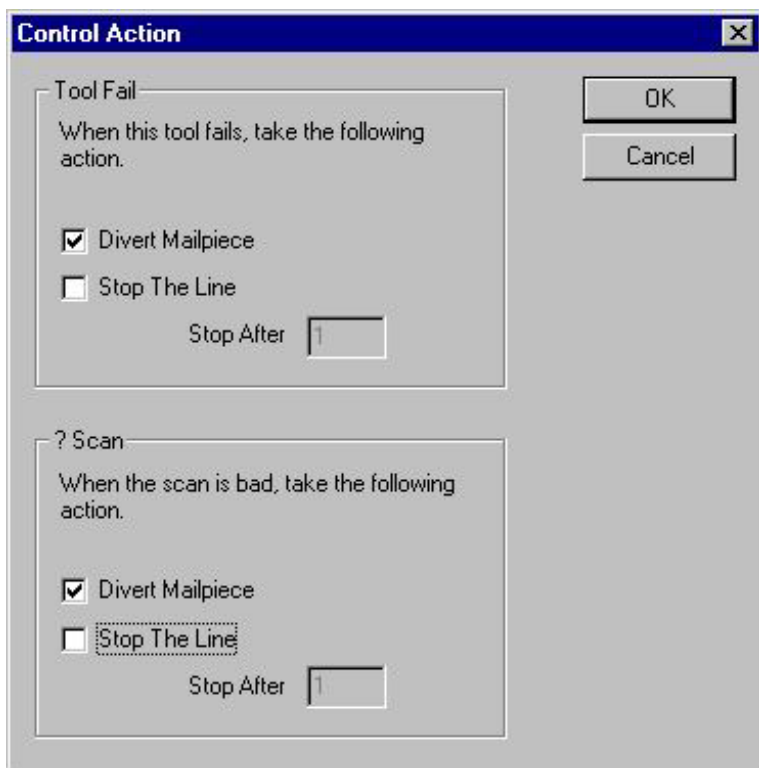
The image shows a Windows-style dialog box titled "Control Action". It has a blue title bar with a close button (X) in the top right corner. The dialog is divided into two main sections. The top section is titled "Tool Fail" and contains the text "When this tool fails, take the following action." Below this text are two checkboxes: "Divert Mailpiece" (checked) and "Stop The Line" (unchecked). To the right of these checkboxes is a "Stop After" label followed by a text box containing the number "1". The bottom section is titled "? Scan" and contains the text "When the scan is bad, take the following action." Below this text are two checkboxes: "Divert Mailpiece" (checked) and "Stop The Line" (unchecked). To the right of these checkboxes is a "Stop After" label followed by a text box containing the number "1". On the right side of the dialog, there are two buttons: "OK" and "Cancel".

Figure 46 Configure Control Action

The Tool fail panel allows the user to choose the action when mailpiece fails this integrity check.

The ?Scan panel allows the user to choose the action when the scan fails – for example if there is a bad read due to a damaged or illegible item.

In both cases the user has the possibility of Diverting the mailpiece and/or stopping the line either immediately or after a number of consecutive failures – both are possible, or you may consider not having any action at all; the failure of the tool will still appear in the log file.

Integrity Tool 1: Static Verify

Press 'Setup' in Main Screen, as described at beginning of this section.

Highlight the relevant 'Area of Interest' then press 'Integrity' and 'Add' – Select 'Static Verify' from the pulldown list.

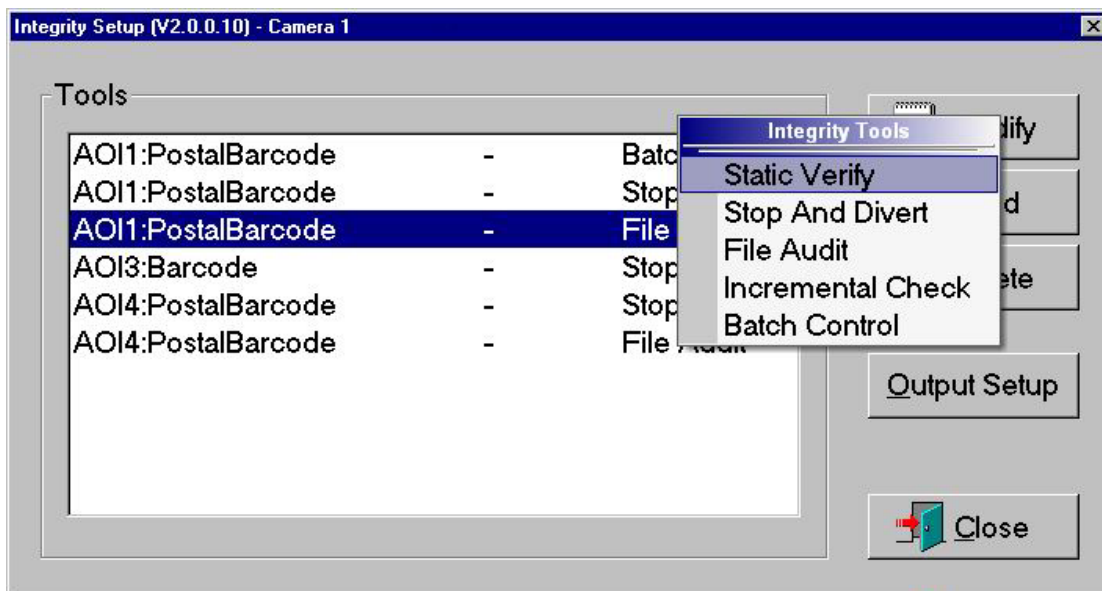


Figure 47 Adding Integrity Tool

The following screen will appear.

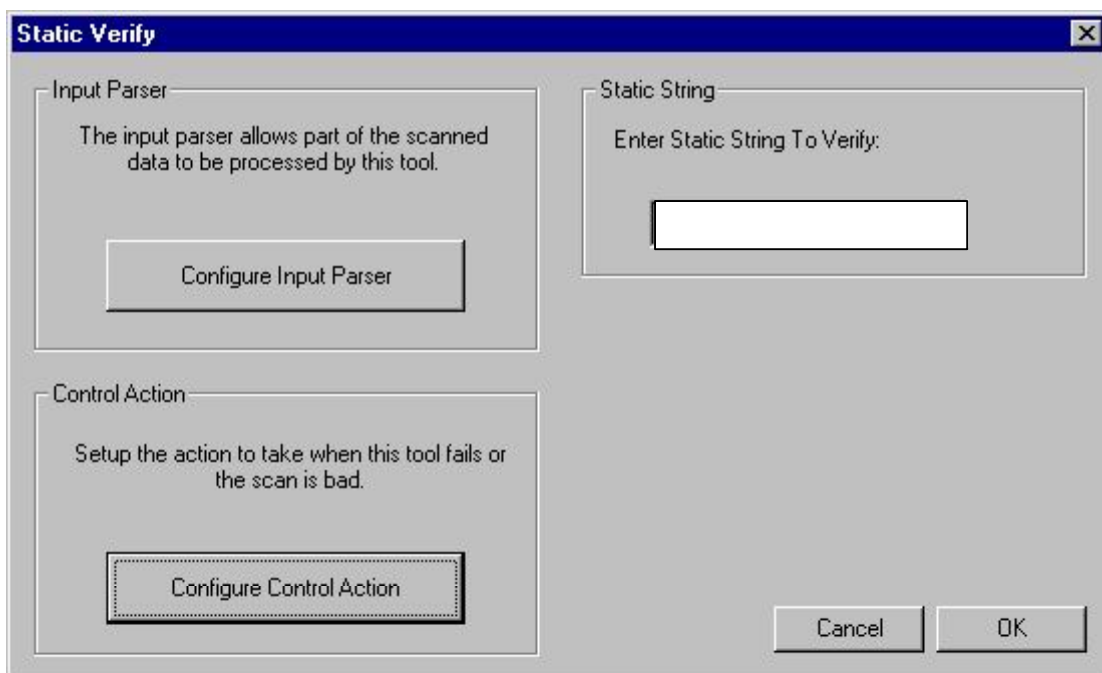


Figure 48 Static Verify tool

Click 'Configure Input Parser' and configure the data input as described at the beginning of the Integrity Tools section.

Click 'Configure Control Action' and set up the actions to take place when the tool flags an error, as described at the beginning of the Integrity Tools section.

Now you have configured the Input Parser and Control Actions for the tool, you can enter more specific requirements that you want the tool to check.

In the empty dialogue box on the right of the Static Verify Screen enter the static string characters that are required to be seen on the inspected items (with consideration to the settings you have already entered using Configure Input Parser.

If the item does not display the static string, a control action will be executed, the exact form of the control action is determined by the 'Configure Control Action' button in the Static Verify Screen.

Integrity Tool 2: Stop and Divert

Press 'Setup' in Main Screen, as described at beginning of this section.

Highlight the relevant 'Area of Interest' then press 'Integrity' and 'Add' – Select 'Stop And Divert'.

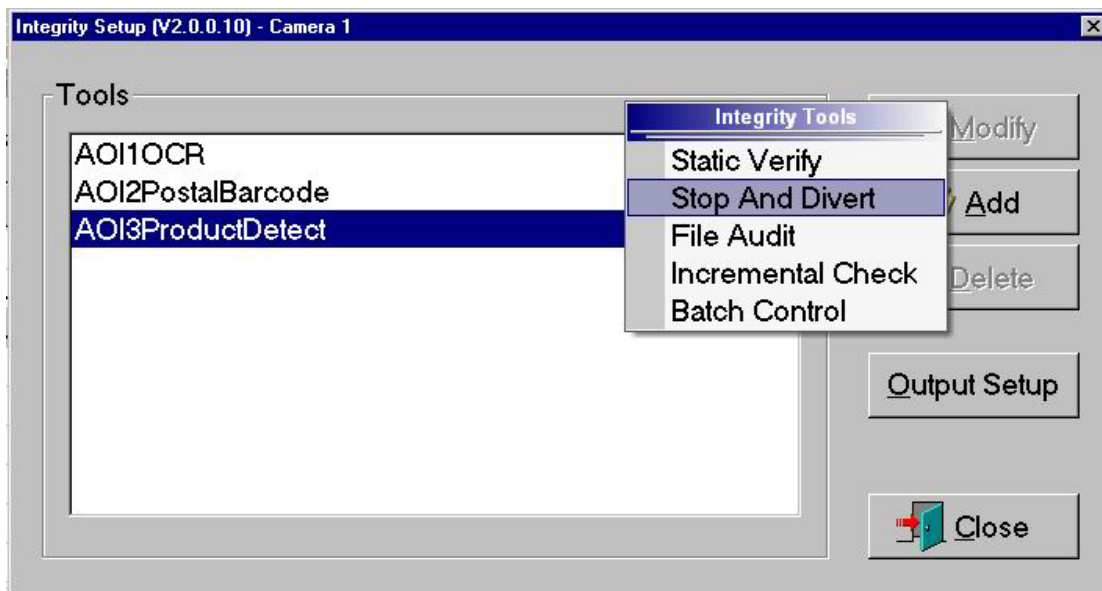
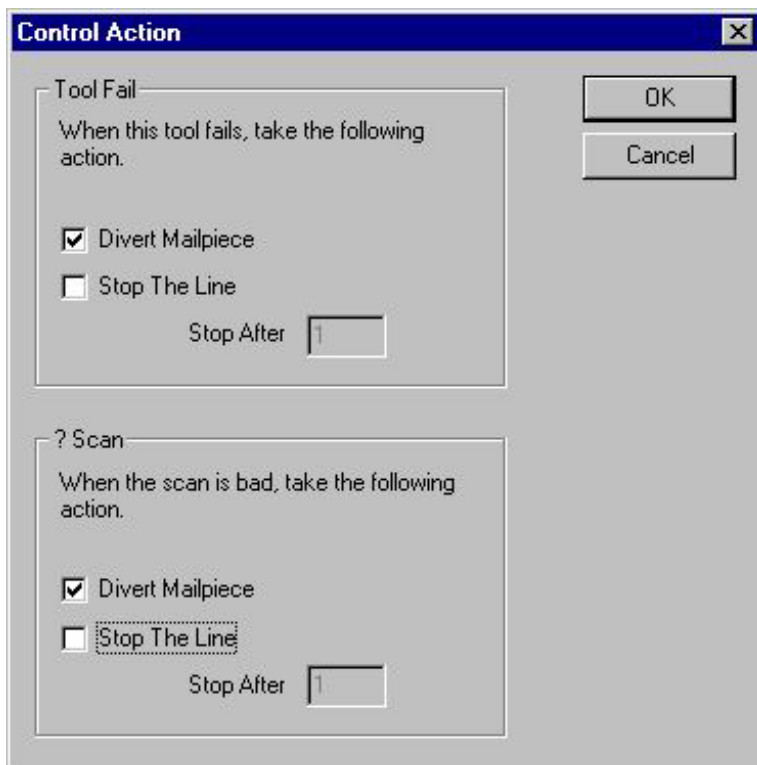


Figure 49 Adding Stop and Divert

The following screen will appear:-



Now click on the Configure Control Action button; you will see the following screen:

A screenshot of a Windows-style dialog box titled "Control Action". The dialog has a blue title bar with a close button (X) in the top right corner. It contains two main sections. The first section is titled "Tool Fail" and contains the text "When this tool fails, take the following action." Below this text are two checkboxes: "Divert Mailpiece" (checked) and "Stop The Line" (unchecked). To the right of these checkboxes is a "Stop After" label followed by a text box containing the number "1". The second section is titled "? Scan" and contains the text "When the scan is bad, take the following action." Below this text are two checkboxes: "Divert Mailpiece" (checked) and "Stop The Line" (unchecked). To the right of these checkboxes is a "Stop After" label followed by a text box containing the number "1". In the top right corner of the dialog, there are two buttons: "OK" and "Cancel".

Use of this screen will enable you to tell the system what to do if the tool fails. You have the possibility of Diverting the mailpiece and/or stopping the line – both are possible, or you may consider not having any action at all; the failure of the tool will still appear in the log file. In the lower area of this screen you can choose an action or actions to occur if the scan fails – for example if there is a bad read due to a damaged or illegible item.

If for any reason there is a bad read, a control action will be executed, the exact form of the control action is determined by the 'Configure Control Action' button in the Stop and Divert Screen.

Integrity Tool 3: File Audit

Press 'Setup' in Main Screen, as described at beginning of this section.

Highlight the relevant 'Area of Interest' then press 'Integrity' and 'Add' – Select 'File Audit'.

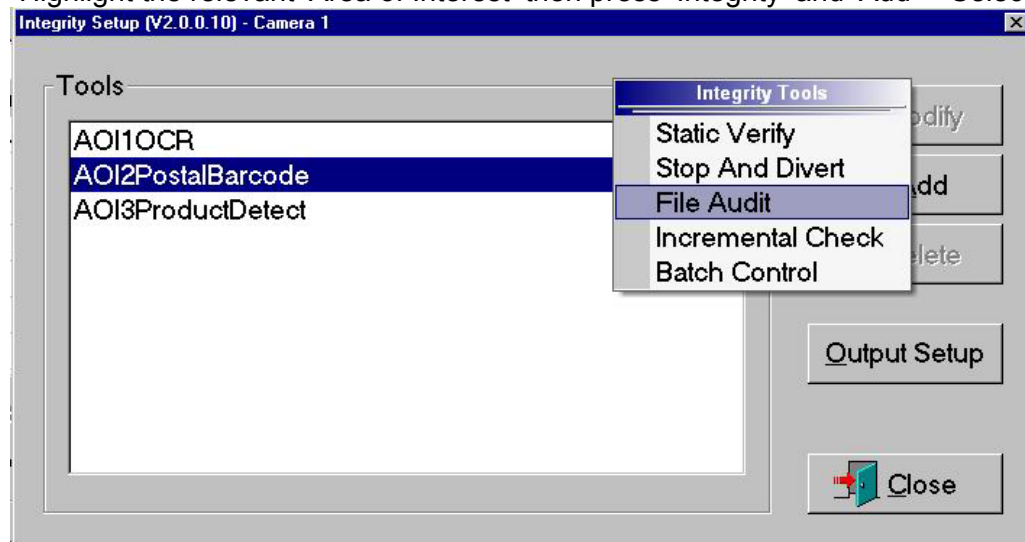


Figure 50 Adding File Audit tool

The following screen will appear.

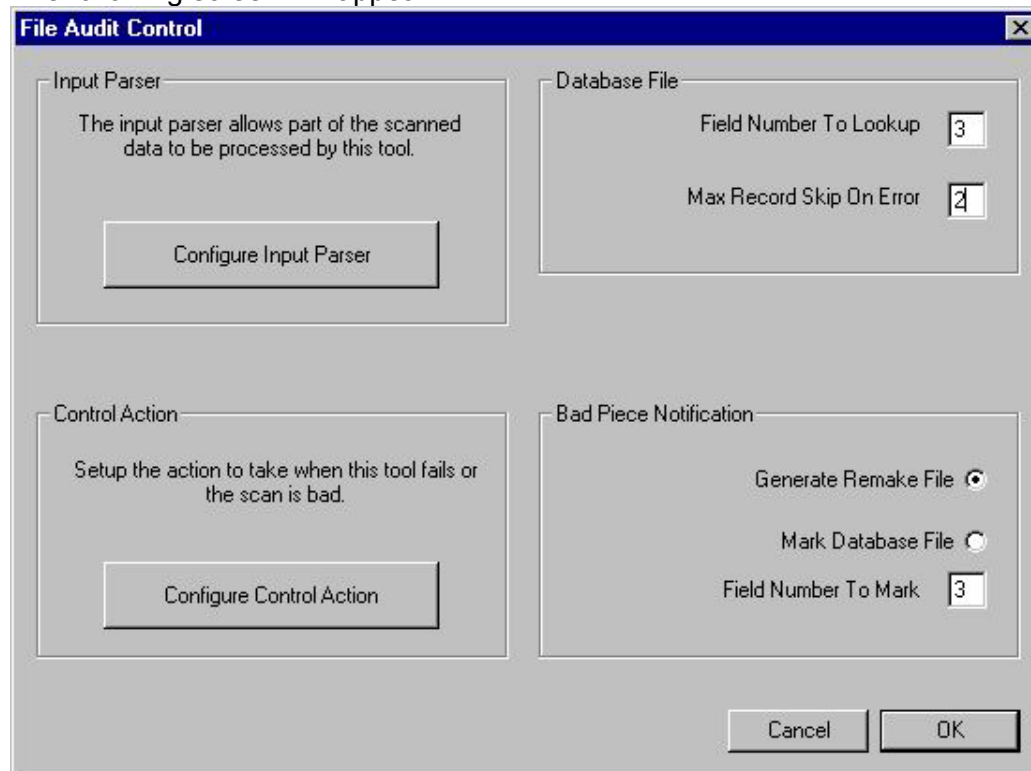


Figure 51 File Audit Setup Dialogue

Click 'Configure Input Parser' and configure the data input as described at the beginning of the Integrity Tools section.

Click 'Configure Control Action' and set up the actions to take place when the tool flags an error, as described at the beginning of the Integrity Tools section.

Now you have configured the Input Parser and Control Actions for the tool, you can enter more specific requirements that you want the tool to check.

In the screen above, the tool has been configured to take the information as defined in the 'Configure Input Parser' and compare it with the records in a .CSV file from field number three. In this example the system is permitted to skip no more than two records which do not agree with the looked up field number before invoking the action defined by the Configure Control Action.

Bad Piece Notification - The system can be configured to either generate a Remake file, which contains all failed/missing pieces to permit a reprint run of these items, or write the status of each mail piece back to the input file in the field defined here.

When you are happy with the configuration, press OK, close the tools screen.

Integrity Tool 4: Incremental Check

Press 'Setup' in Main Screen, as described at beginning of this section.

Highlight the relevant 'Area of Interest' then press 'Integrity' and 'Add' – Select 'Incremental Check'

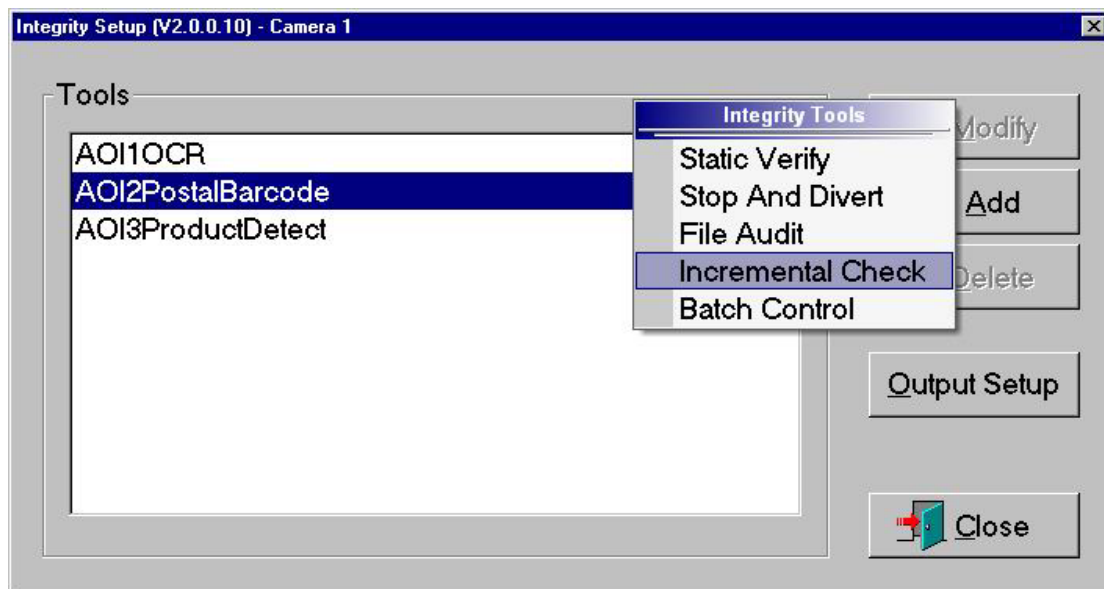


Figure 52 Adding an Incremental Tool

The following screen will appear

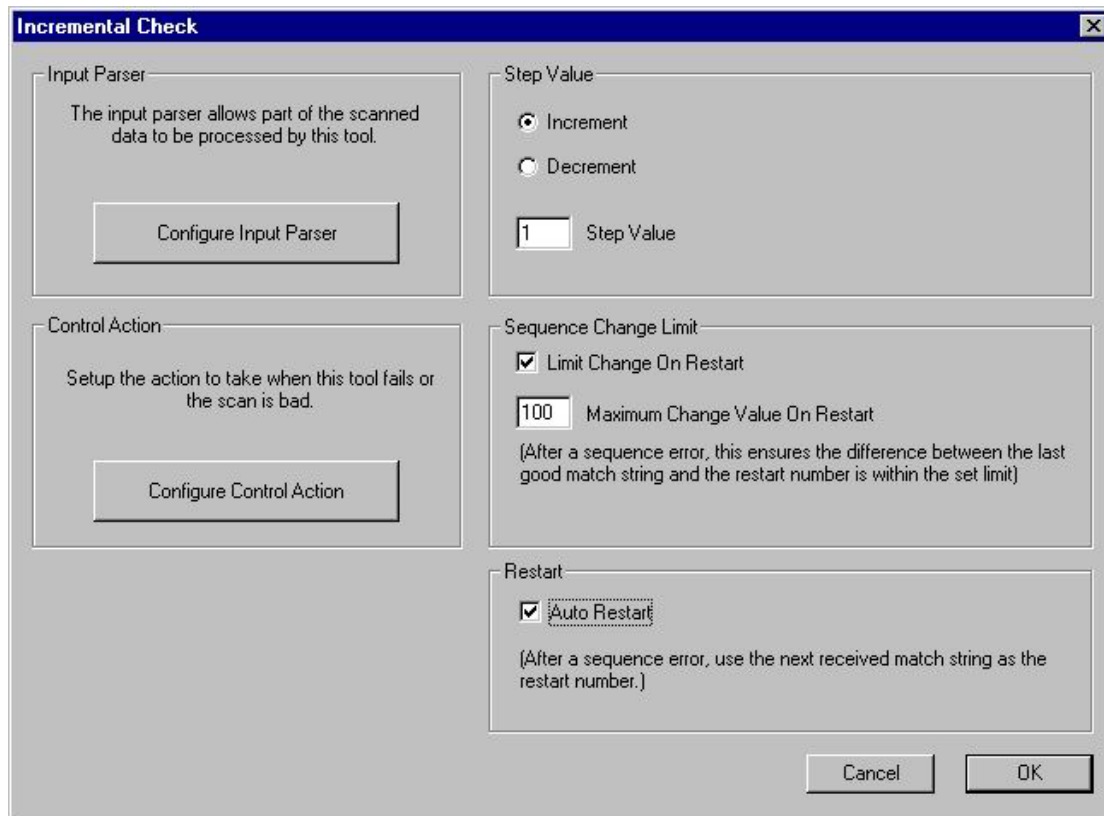
The 'Incremental Check' dialog box is a standard Windows-style window with a title bar and a close button. It is divided into four main sections. The 'Input Parser' section on the top left contains a descriptive text and a 'Configure Input Parser' button. The 'Control Action' section on the bottom left contains another descriptive text and a 'Configure Control Action' button. The 'Step Value' section on the top right has two radio buttons for 'Increment' (selected) and 'Decrement', and a numeric input field set to '1'. The 'Sequence Change Limit' section on the bottom right has a checked checkbox for 'Limit Change On Restart' and a numeric input field set to '100'. Below this is a text explanation of the limit. The 'Restart' section at the bottom has a checked checkbox for 'Auto Restart' and a text explanation. 'Cancel' and 'OK' buttons are at the bottom right.

Figure 53 The Incremental Tool setup

Click 'Configure Input Parser' and configure the data input as described at the beginning of the Integrity Tools section.

Click 'Configure Control Action' and set up the actions to take place when the tool flags an error, as described at the beginning of the Integrity Tools section.

Now you have configured the Input Parser and Control Actions for the tool, you can enter more specific requirements that you want the tool to check.

In the example above, the system takes the number obtained by the system parameters set out in the 'Configure Input Parser', and expects this number to increase by one with each item that is scanned.

Step Value Area - Choose if the sequence will be incrementing or decrementing and by what amount.

Sequence Change Limit Area - You can also choose to Limit the Change On Restart if you wish. The system will not allow a restart to occur if there are more that this amount missing from the sequence.

Restart Area - Auto-Restart is a useful facility allowing you continue processing with the minimum of interruption; it takes the next presented number following a tool fail as the beginning of the next sequence.

Integrity Tool 5: Batch Control

Press 'Setup' in Main Screen, as described at beginning of this section.

Highlight the relevant 'Area of Interest' then press 'Integrity' and 'Add' – Select 'Batch Control'

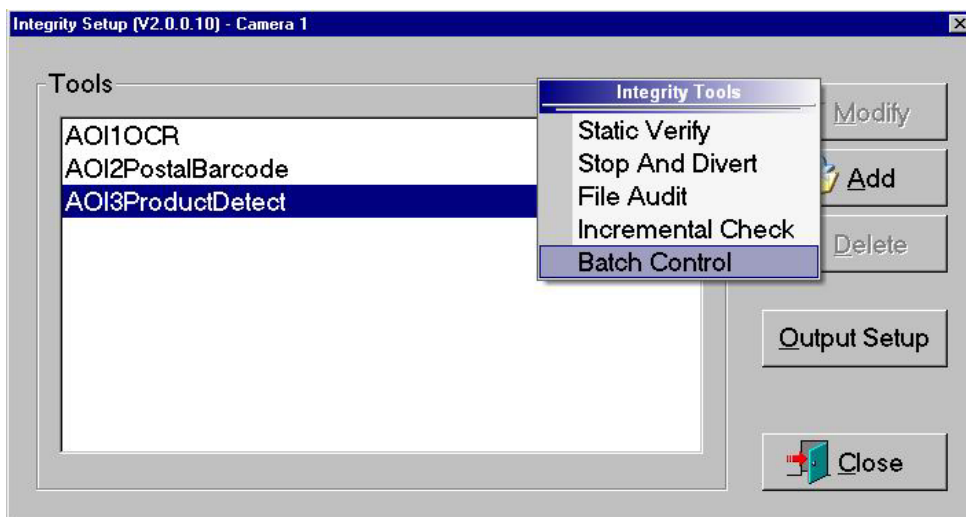


Figure 54 Adding a Batch Tool

The following screen will appear

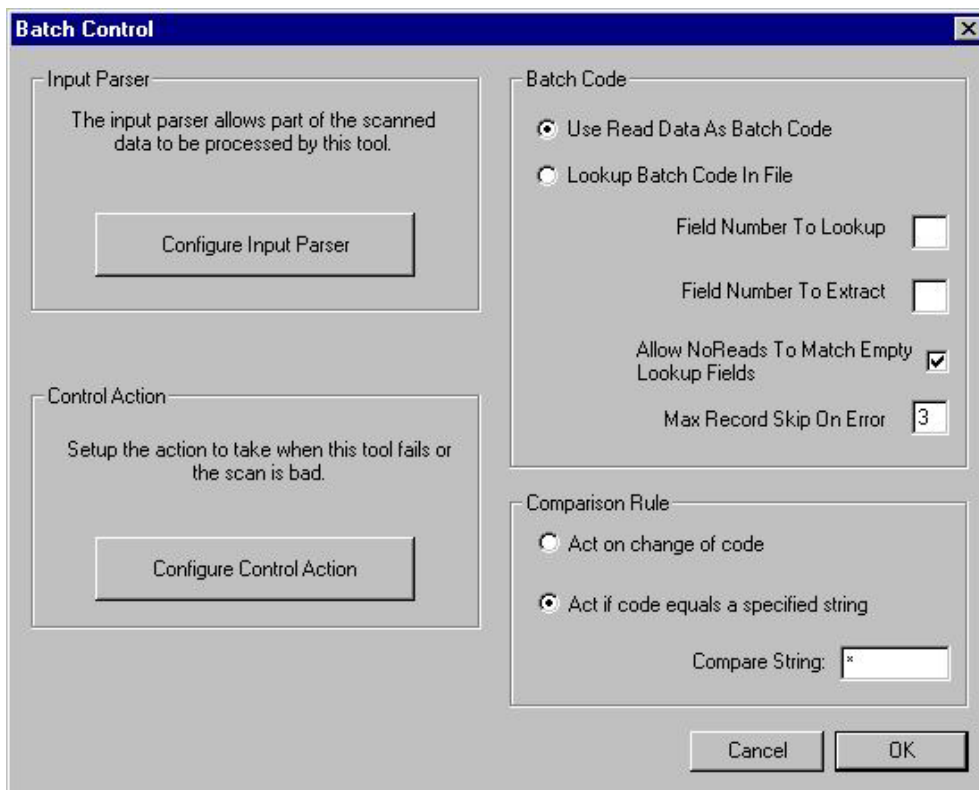


Figure 55 Batch Tool setup

Click 'Configure Input Parser' and configure the data input as described at the beginning of the Integrity Tools section.

Click 'Configure Control Action' and set up the actions to take place when the tool flags an error, as described at the beginning of the Integrity Tools section.

Now you have configured the Input Parser and Control Actions for the tool, you can enter more specific requirements that you want the tool to check.

Batch Code area – “Use read data as the batch code” would be used if the postal break code or symbol is printed on the mail piece. Alternatively the postal break information may be contained in a file in which case the “look up batch code from a file” option would be selected and a unique ID or even the postnet read from the mail piece would be used to look up the batch code from the file.

The max record skip on error allows the system to look forward in the file to find the record to accommodate missing mail pieces.

Comparison rule area – Choose here whether the batch output will be triggered when code changes. For example each batch has the same code assigned to each piece or when the code is the same as the entered code. For example when the last piece in the batch is marked with a specific code or even a simple asterisk as in the example above.

Choosing an Input File

If an Integrity tool has been included that requires an input file, such as the File Audit tool or the Batch control tool When the job is started the user will be presented with the following window.



The dialog box titled 'Job ID' contains the following fields and controls:

- Job Output Name:** Text box containing 'FileAudit'.
- Job ID:** Text box containing '004'.
- Integrity Tools:** A table with 4 columns: Tool, AOI, Input File, and an empty column.

Tool	AOI	Input File	
AOI1:OCR	File Audit	1 to 25.csv	

- ☐ All tools use the same file
- InputFile Directory: C:\Program Files\LIS MultiCam Reader\InputFiles
- Input File: Dropdown menu showing '1 to 25.csv'.
- Buttons: 'Ok' (with a green checkmark icon) and 'Cancel' (with a red X icon).

Figure 56 Choosing the Input File

Once you have typed a Job Output Name and Job ID into the empty dialogue boxes (already done in the example above), click on the greyed area relating to the tool, it will then be highlighted in blue, and you will be able to select the input file that you wish to use for that particular tool.

It is possible to have more than one Integrity Tool running in each job, and if required, a different Input file can be specified for each Tool. Alternatively, you could check the 'All tools use the same file' box – the data will in that case be drawn from the same data file. In the example above an input file called 1 to 25.csv has been chosen. Once the input information has been specified in this way, the job can be run.

Installation Set-up

Setup Menu

The Setup Menu defines Multicam Reader parameters (i.e. SCM, Camera Configuration and other settings).

To open the setup menu from the Windows desktop screen, Select **Start >Programs > LIS Multicam Reader > LIS Multicam Setup**.

Access to the Setup screens is only allowed to 'Supervisor' or 'Engineer' level users, therefore prior to entering the setup screens the user is requested to enter the correct password, see figure 18.

The default 'Engineer' level user has user name 'Administrator' with password 1234, but this may be changed from within Setup.

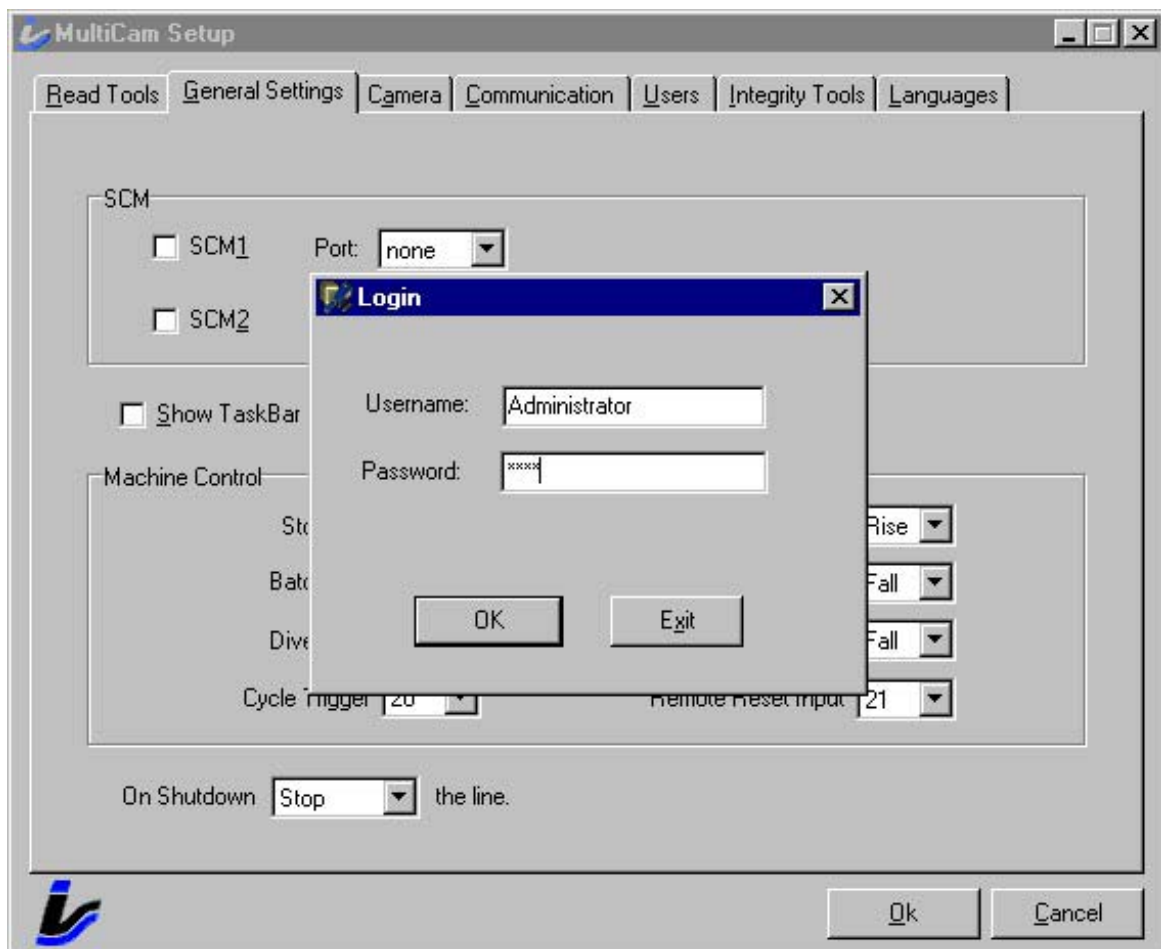


Figure 57 Setup Login Dialogue box.

Read Tools

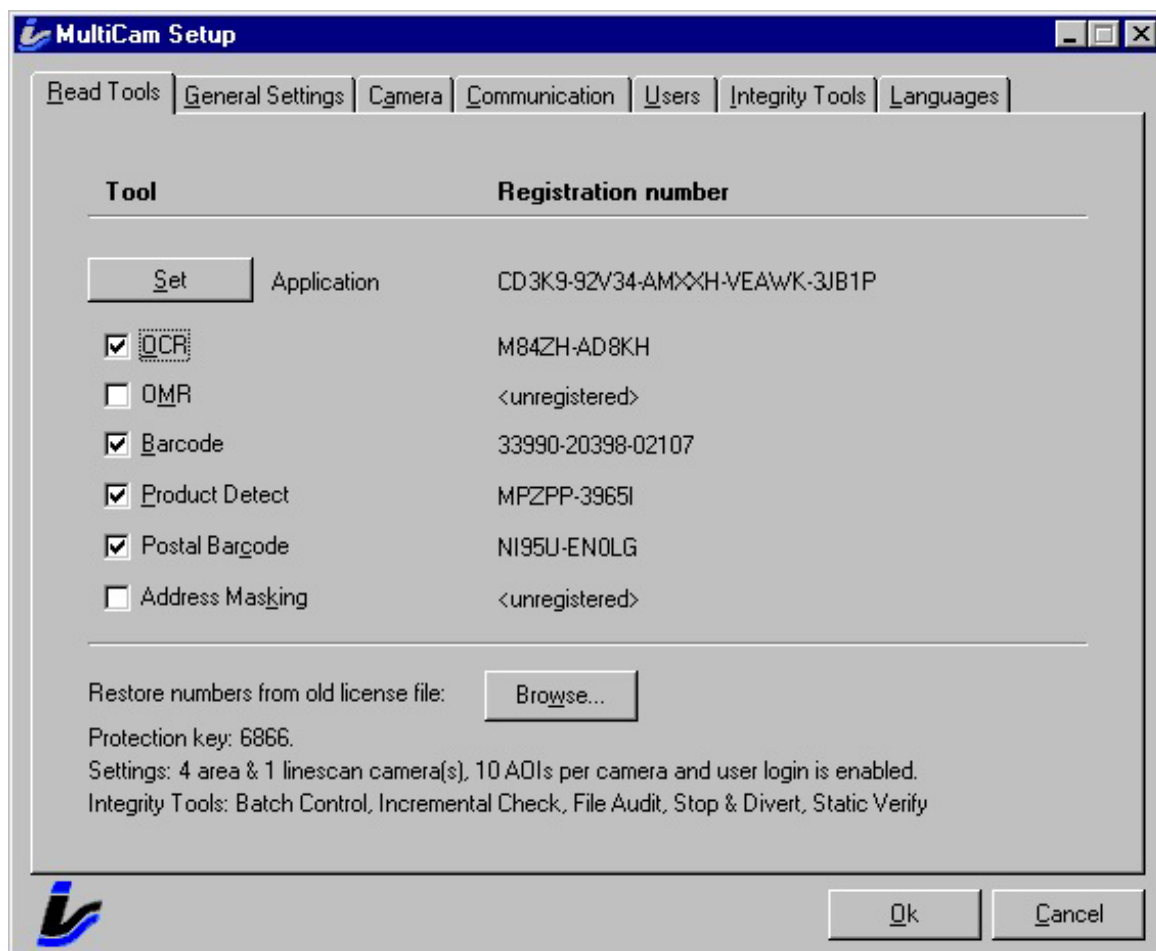


Figure 58 Read Tools Screen

This window allows the user to enable the required decoding and integrity tools for the Multicam Reader software by entering the correct registration codes.

Firstly, pressing the 'Set' button causes the user to be prompted for a 25 character registration code which configures various features of the main Multicam program such as the number of cameras, 'Areas of Interest' and Integrity tools that are enabled. The resulting configuration can be read at the bottom of the screen as per the example in Figure 19.

Secondly, placing ticks in the required read tool boxes down the left side of the screen causes the user to be prompted for 10 character registration codes to enable these tools.

Alternatively these registration codes may be held in a file named 'licence.ini' located either on a supplied floppy disk or on the Windows Xp desktop. Pressing the 'Browse' button allows the user to navigate to that location and select the file, at which point all the registration codes will be entered automatically.

General Settings

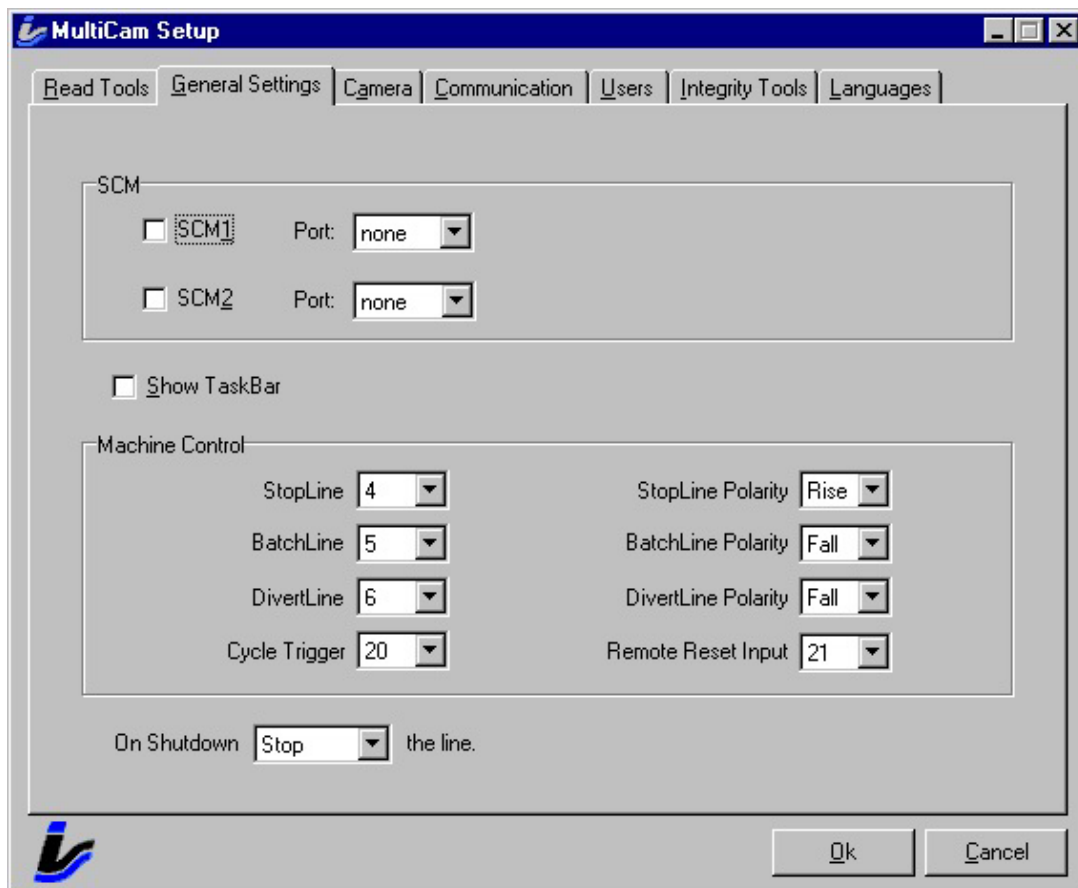


Figure 59 General Settings Screen

- **SCM Panel**
Tick to set how many SCM cards are fitted and to which comms ports they are connected. If SCM cards are fitted (systems with variable time/distance triggering) then normally SCM1 would be connected to Comm5 and SCM2 (where more than 8 cameras fitted) to Comm6.
- **Show Taskbar**
Tick to display the windows taskbar at the bottom of the screen while Multicam is running.
- **Machine Control**
When integrity tools are to be used, the user can specify here which output channel numbers on the 'OPTO' board are to be used for the Stop, Batch and Divert signals. On an LIS 'Blue Box' industrial chassis system, these channel numbers relate directly to the numbering beneath the red lights on the front of the box. The user can also specify the active state for each of these signals, either Falling or Rising.

Where it is necessary to implement a delay in product cycles before activating an output (eg for the Divert tool) a cycle trigger is connected which provides a signal once per

product cycle. The user specifies here which input of the I/O card the trigger is connected to. This is usually input 20, which relates to channel 8 on the OPTO board.

When an integrity tool has activated the stop line, it is normally necessary to click a 'continue' button on the screen. Alternatively, it's possible to wire a hardware continue button to the system via the 'OPTO' board. The user can specify here which I/O input pin the signal is connected to, this is normally pin 21, which relates to channel 7 on the OPTO board.

- On Shutdown...
This selection enables the host machine and production process to be held in a Start or Stop state in the event the LIS system is turned off.

Camera

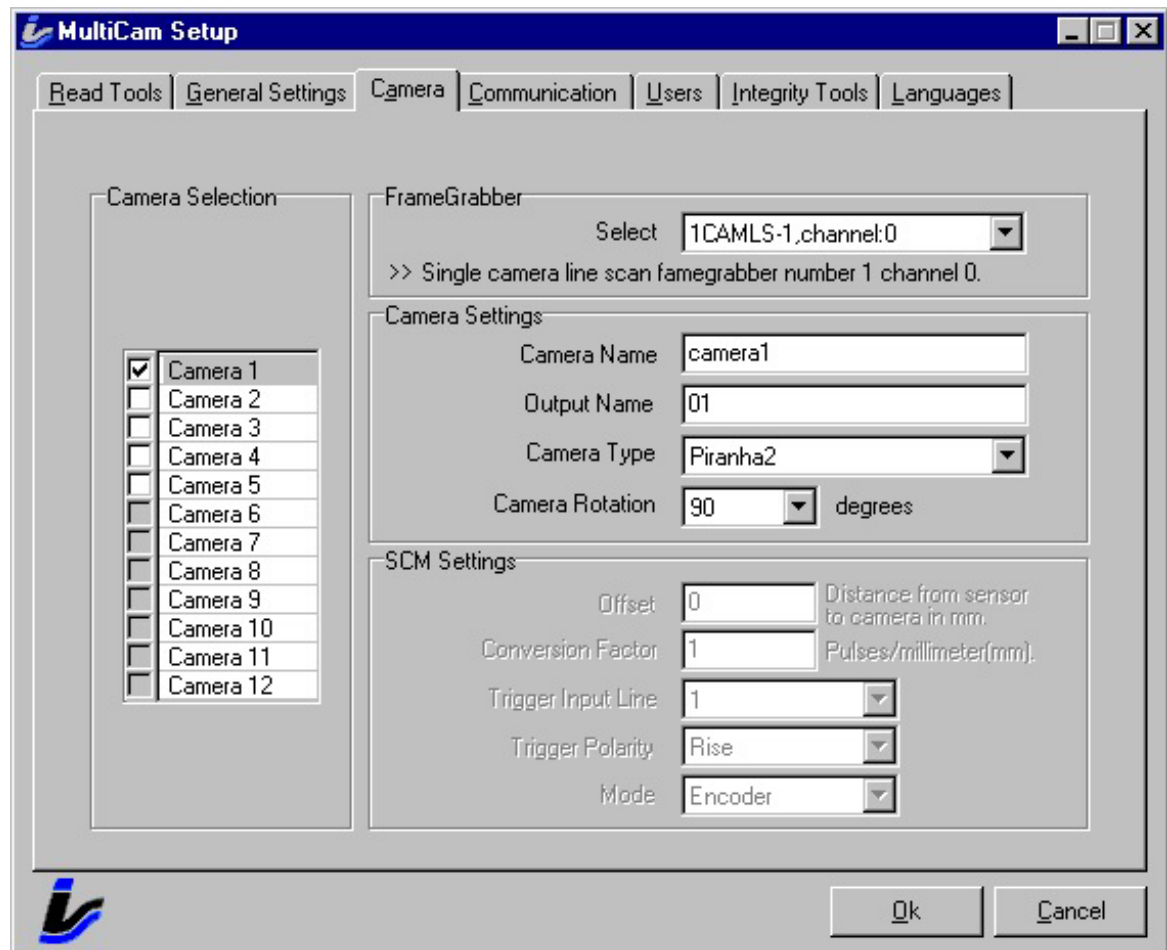


Figure 60 Camera Screen

- Camera Selection**
 Tick the boxes on the left to enable the required cameras.
 Highlight a camera, in order to edit the settings **for that camera** using the remaining panels in this window.
- Framegrabber**
 For each camera selected, select the type of framegrabber in use and the relevant channel number. In the example above, Camera 1 is being used with a single channel line scan framegrabber and is connected to channel 0.

- **Camera Settings**

Camera Name: A meaningful name may be entered which will then appear against that camera on the main running screen, or any log files and reports if required.

Output Name: This is an ID tag sent as part of the serial output message, and is usually left as the camera number, as shown.

Camera Type: Select the camera type from the drop down selection in this field. The camera types listed will vary according to which framegrabber has been specified.

Note that the Maxread selection is suitable for LIS Maxread, Panasonic 602/622, and Sony N50 type cameras.

Camera Rotation: From the drop down selection, a rotation value of 90, 180 or 270 degrees can be selected to adjust the orientation of the image on the screen.

- **SCM Settings**

Offset: This value is an approximate distance between the trigger sensor and the camera in mm.

Conversion Factor: This converts encoder pulses into linear distance (mm)

Trigger Input Line: The SCM card has 8 input 'trigger' lines and 8 output lines to trigger the Framegrabber / Lightdriver. Here, any of the 8 input lines can be allocated as the trigger for any of the 8 output lines.

*Note:- Input channel 1 on the SCM card is a special case in that it is connected to both trigger input 1 **and** the TDC (Top Dead Centre) signal from the encoder (OR function). Therefore, when connecting a trigger to channel 1 with an encoder fitted, the TDC signal wire from the encoder (Pink) must be disconnected to avoid 'double' triggering.*

Trigger Polarity: This setting is dependent on the type of sensor used and whether it is required to trigger from the leading or trailing edge of the document.

Select if a rising signal edge or falling signal edge from the optical sensor is to be used to trigger the SCM.

Mode: This determines whether the SCM is to be used to create a time delay or count encoder pulses after it has received the trigger from the optical sensor.

Communication

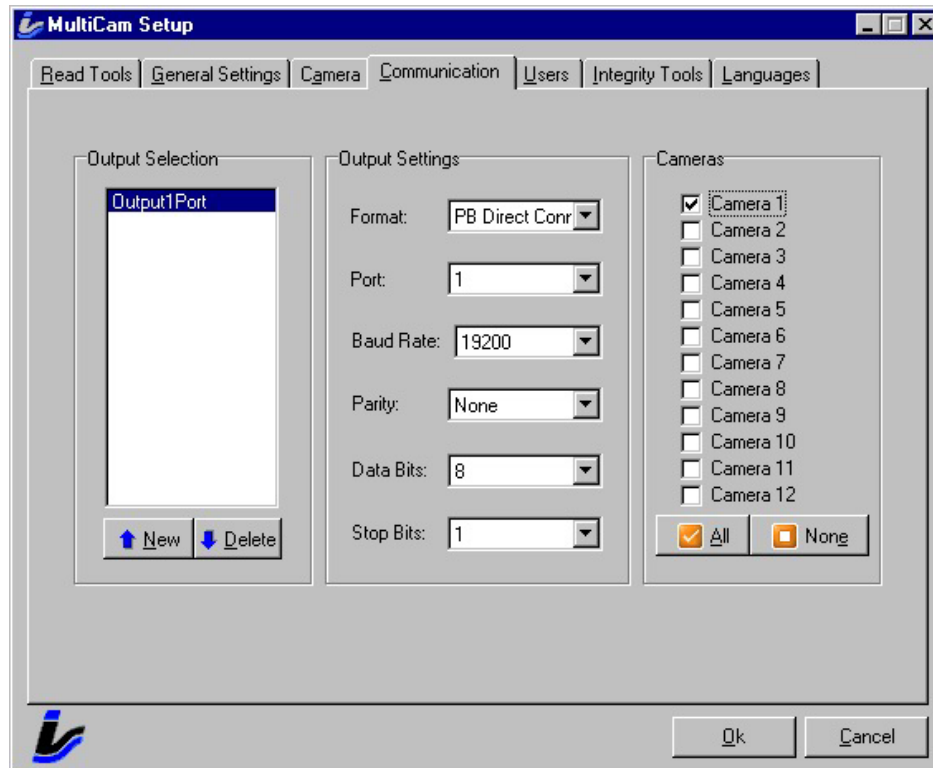


Figure 61 Communication Screen

- **Output Selection**

This panel allows the user to add communications outputs either to external equipment or to another reporting or integrity control package running on the same PC. Multiple outputs can be selected, providing there are sufficient communications ports available. To add an output, click 'New'

- **Comm. Port Settings**

Type in the required Comm. Port settings for the output highlighted in the Output Selection panel. Note that the formats that appear in the 'Format' drop down selection are those that exist as <name.fmt> files in the directory C:\Program Files\LIS Multicam Reader\OutpFmts.

Further formats may be available in the C:\Program Files\LIS Multicam Reader\OutpFmtsAvail directory, and should be moved into 'OutpFmts' if required.

Also, a utility exists (C:\Program Files\LIS Multicam Reader\OutpFmtSetup.exe) to create new output formats if required, including any control characters (line feed, carriage return etc) that may need to be included in the output string.

- **Cameras**

Having highlighted the relevant Output Selection, tick those cameras that are required to output on that channel.

Users

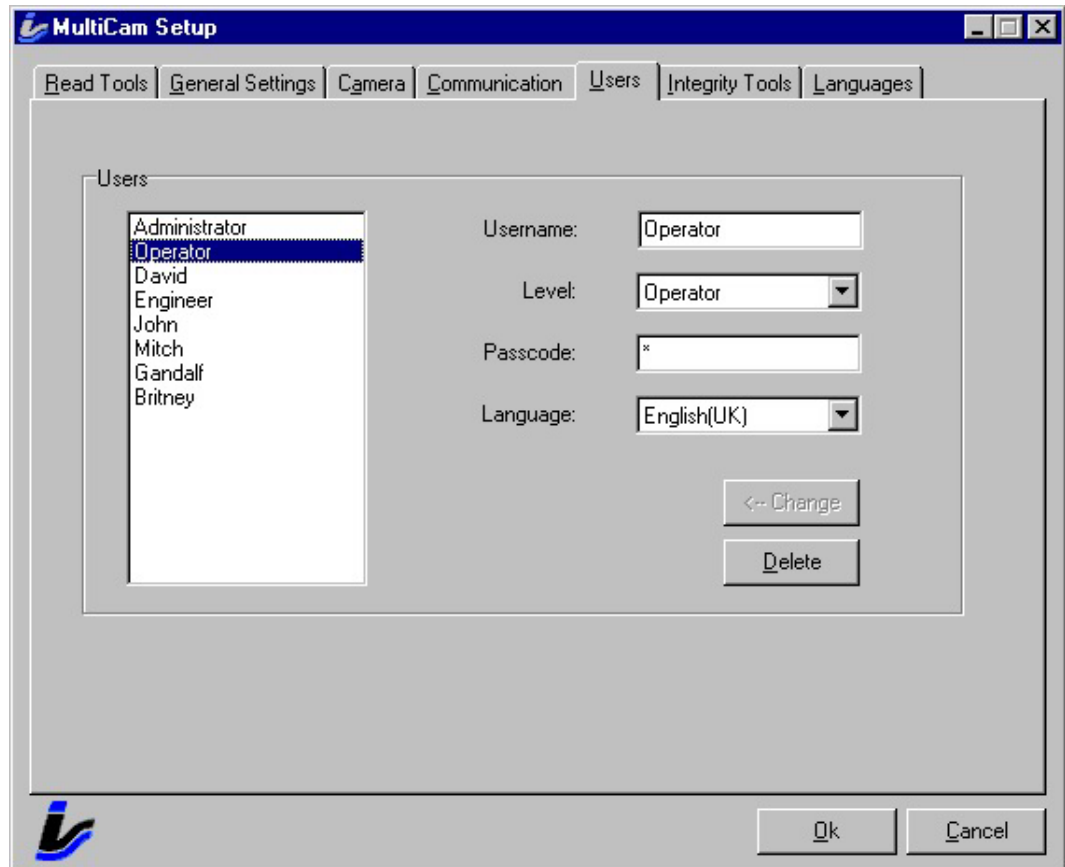


Figure 62 Users Screen

The Multicam application is accessed by logging in as one of the listed 'users'. On this screen, user names can be set up along with their access levels, passcodes and preferred language. To add a new user, type in the new user name, make the level, passcode and language selections, and press 'Change'

If the Multicam registration code includes 'Login enable', then users can only enter the application after entering a passcode unique to that user, and access to certain functions will be restricted as follows:

Operator: Can only select the required job, start and stop the job.

Supervisor: As per 'Operator', but can also edit job parameters and enter the setup areas to train fonts, adjust 'Areas of Interest' etc.
A Supervisor level user can enter the application setup utility to review the settings, but cannot make changes except on the 'Users' screen where a new user may be added / deleted providing that user is at supervisor or operator level.

Engineer: As per 'Supervisor' but able to make changes to all the setup utility sections.

Integrity Tools

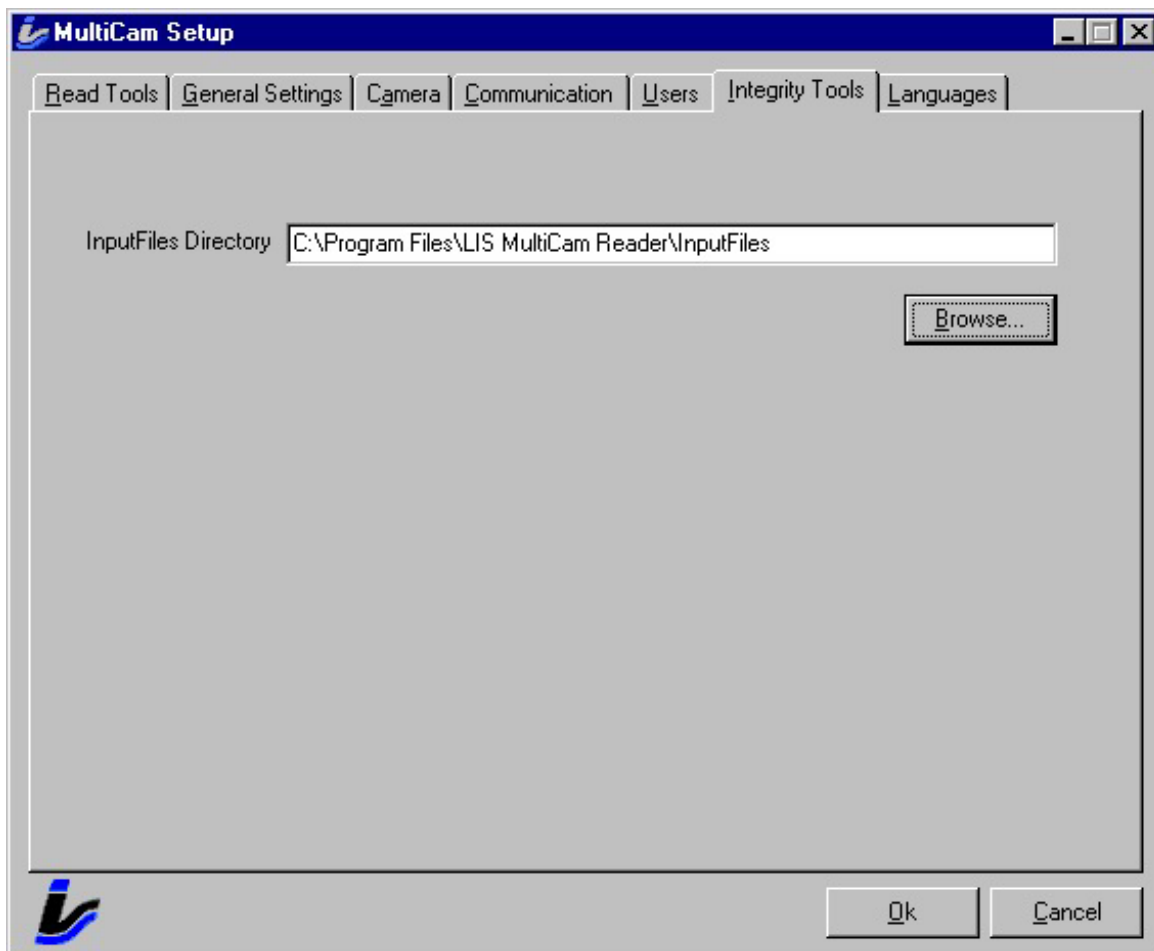


Figure 63 Integrity Tools

This screen enables the identification of the relevant input file for any integrity applications.

Languages

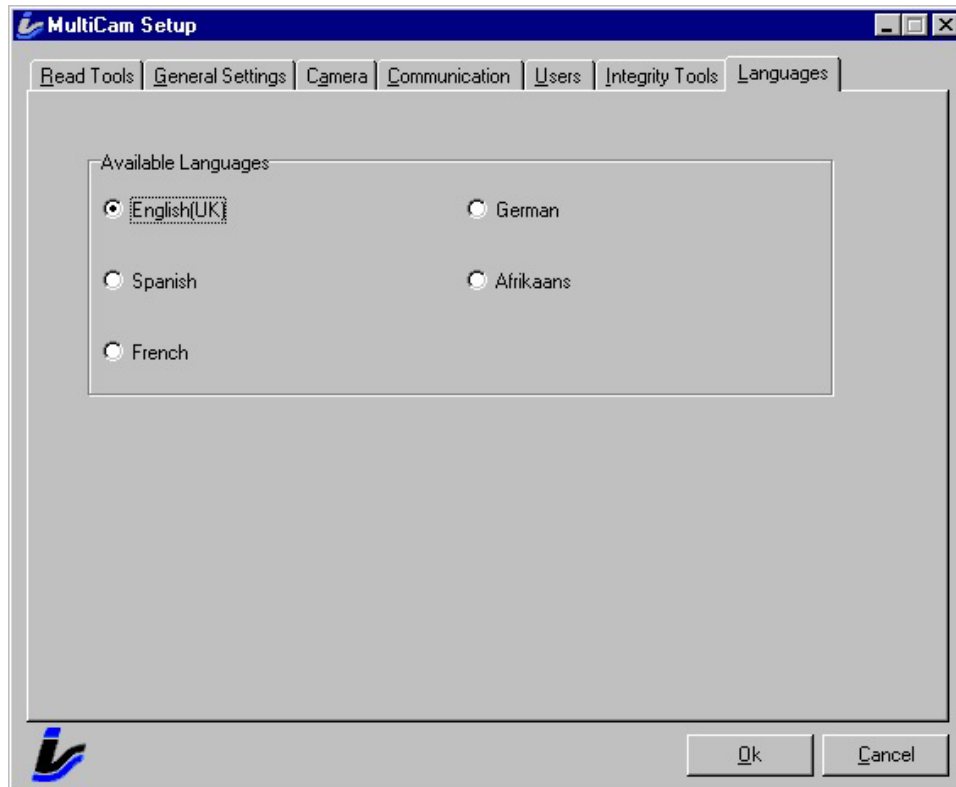


Figure 64 Languages

A user language can be selected for general operation. This is independent of the logged in user language specified in the User screen.

SCM System Description and Diagnostics

SCM System Description

If a variable delay is required between the trigger point and the frame grab, an SCM (Step Counter Module) card will be fitted along with a comms card in the adjacent slot. A ribbon cable connects between connectors CN3 on the SCM card and CN3 on the comms card, (System COM port 5)

After a document has been detected by the optical trigger sensor the SCM will initiate a delay before activating the Framegrabber / Lightdriver which may be either:

- After a specified amount of machine movement in mm.
- After a real time Delay in mS.

If an SCM is selected then a slide bar is displayed on the bottom of the main screen for adjusting the capture position of the image based on encoder pulses (mm) or time delay (mS).

If document position is selected then an encoder must be fitted to the machine.

On receipt of a trigger signal, the SCM counts pulses from the encoder and after a set number of pulses will signal the Light Driver and Frame Grabber Cards, capturing an image.

If time mode is selected then the SCM will use an internal clock to give a time delay from when the optical sensor first sees the document until it sends the signal to the Light Driver and Frame Grabber Cards capturing an image. (used when all documents pass the camera at a fixed speed)

Step Counter Module (SCM) Diagnostic

This tool is used for testing the encoder and trigger input(s) configuration. To open this program go to the task bar select:

Start > Programs > Lake Image Systems Ltd > Utilities > Step Counter Module Diagnostic.

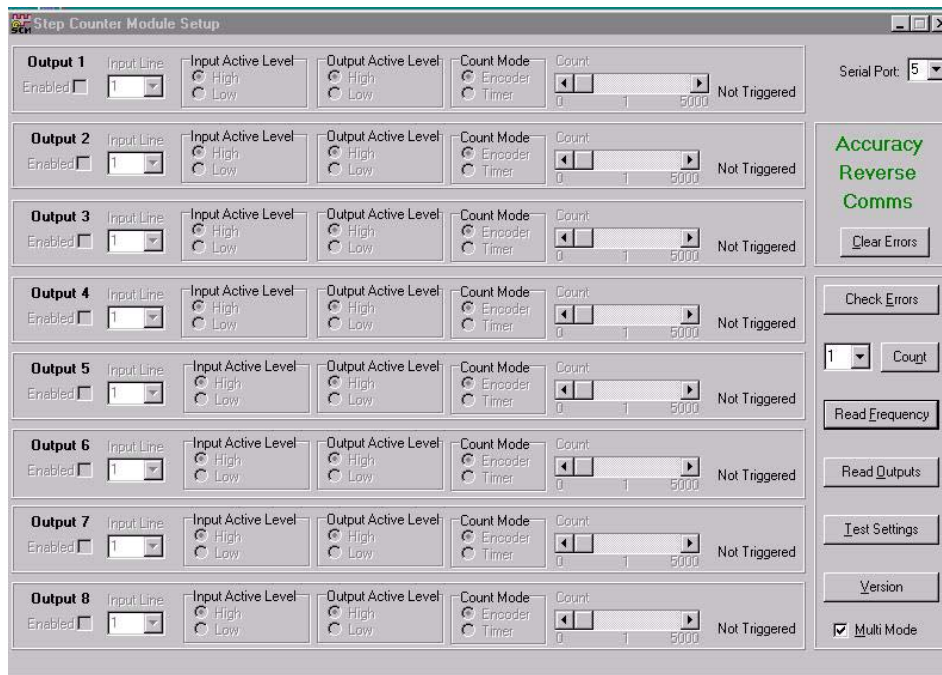


Figure 65 Step Counter Module Test Screen

- Serial Port**
 This configures the serial communication between the serial card and the software. Default port is **5**.
- Outputs 1-8**
 This monitors the output from each trigger.
- Clear Errors**
 This is used to reset any errors. Accuracy, Reverse and Comms are highlighted with green. This indicates no problems exist. If a fault does exist, the fault status color will change to red. **Example:** The encoder is installed on a shaft spinning in clockwise direction. The hardware is configured for counter-clockwise direction. With the machine is running, select "**Clear Errors**" and Select "**Check Errors**" the green highlight for "**Reverse**" will change to a red highlight, indicating improper rotation. To correct the problem

the SCM card has a brown and red switch. To change direction, simply move both the switches to opposite positions.

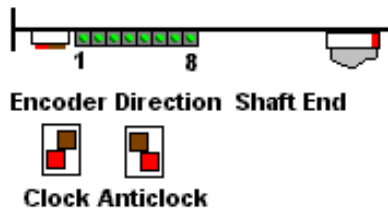


Figure 66 SCM Option Switches

- **Check Errors**
Displays a message at the bottom of the screen and/or one of the green highlights changes to red.
- **Count**
Counts the encoder pulses for each trigger output.
- **Read Frequency**
Displays the number of pulses per 0.1 second. This is used to determine rpm's of the encoder.
- **Read Outputs**
Activates all the trigger outputs
- **Test Settings**
Turns the outputs "ON"
- **Version**
Detects the SCM firmware version.
- **Multimode**
Enables more than one output at a time.

Checking a Trigger Input

Set the required Output to Enable

Set this Output to Timer mode and slider bar offset to about 400

Set Input Lines Identification to 1

Click Read Outputs.

Activate the input, check the output required flicks to triggered on the screen.

Repeat for other inputs as required.

Checking an Encoder Input

With the Encoder connected

Check operation of the trigger sensor

Click on Test Settings.

Set required Output to about 500 (1 revolution of the test encoder)

Click on Clear Errors.

Click on Read Outputs.

Rotate Machine and Encoder.

Activate the Trigger Detector

The Output on the screen should change to counting.

Continue to turn clockwise slowly for about a full revolution of the encoder and the output should change to Not Triggered.

Control Connections

There can be many variations for these connections dependent upon options selected at time of installation and machine type that the LIS System is fitted to.

The actual configuration of the link-up is also dependent upon, whether a standard PC or a LIS 'Blue Box' is used. A buffered PCI card is fitted to the motherboard, and is configured in software. It is connected to the Opto 22 board via a modified (wire 20 must be broken) 50 way ribbon cable. Different modules can be fitted to this board dependent on the functionality required

Standard PC System

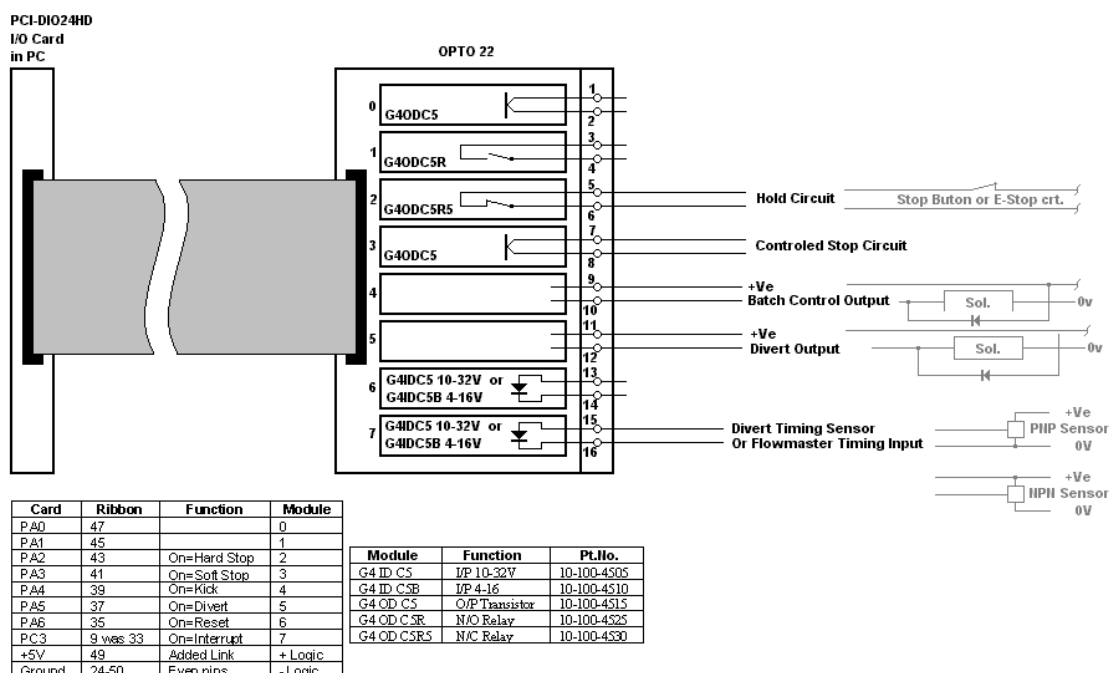


Figure 67 Free Standing PC Interface Connections

- Divert Output, used to reject defective documents
- Controlled stop circuit, only used to invoke a controlled machine remote stop.
- Hold Stop Circuit, used as the main stop control, used to break the E stop cct.
- Batch Control, used to activate an ink roller or kicker to batch control the output from the machine.
- Remote reset button, a special option currently only used in matching systems.
- Used as a timing reference point on MultiCam systems to trigger the Divert Gate or Batch control.

LIS 'Blue Box' System

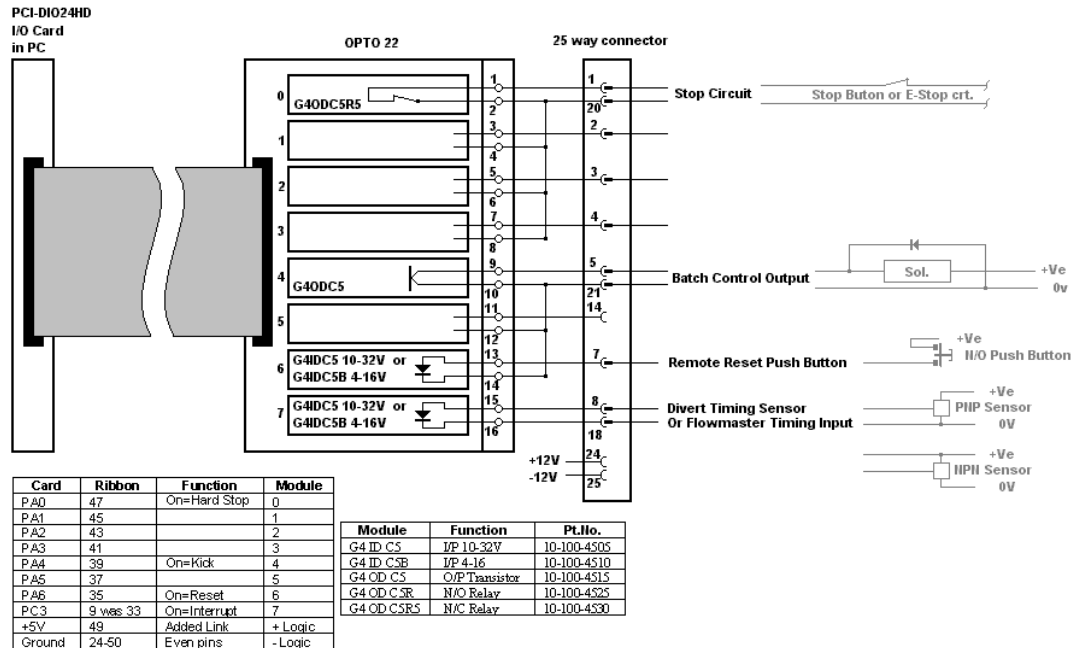


Figure 68 LIS 'Blue Box' Interface Connections

- Stop Circuit, used as the main stop control
- Batch Control, used to activate an ink roller or kicker to batch control the output from the machine.
- Remote reset button, a special option currently only used in matching systems.
- Used as a timing reference point on MultiCam systems to trigger the Divert Gate or Batch control.

Free Standing PC External Connections

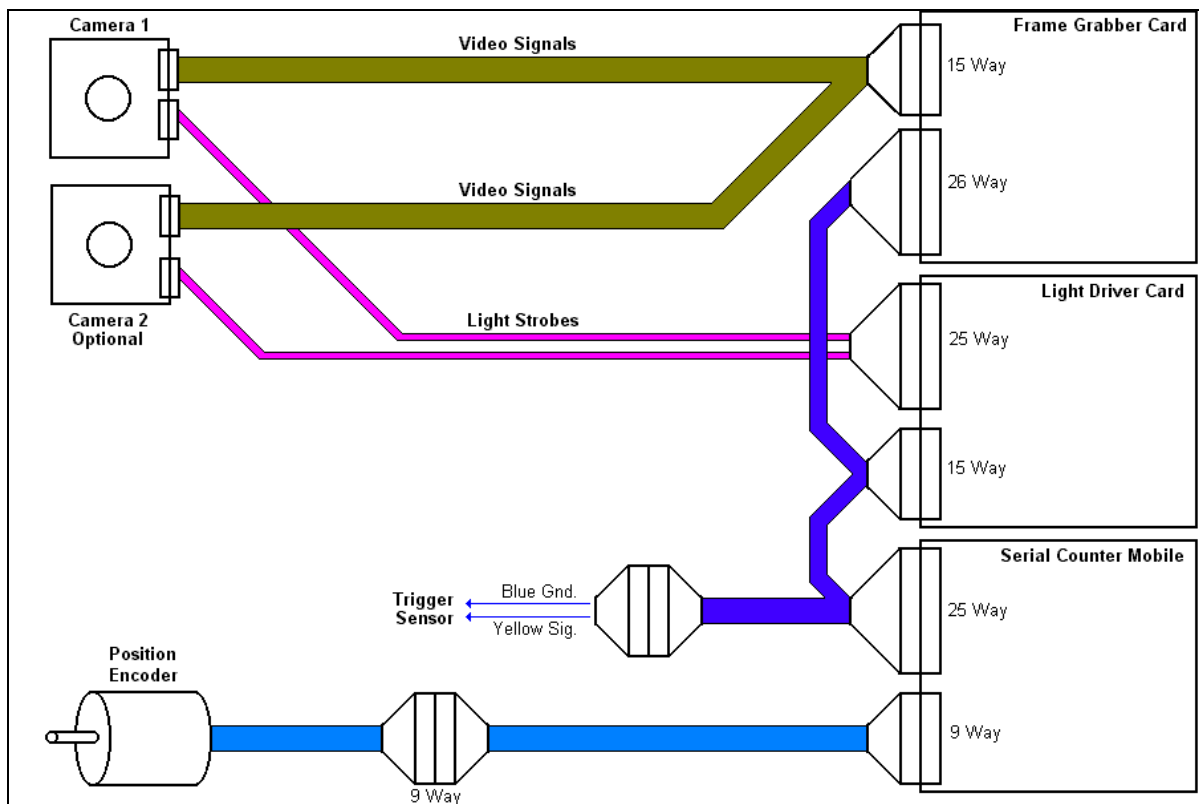


Figure 69 LIS PC External Connections, with SCM

The above drawing shows the connections to a camera system using two cameras, excluding Keyboard, mouse and monitor which are connected in the normal way directly to the PC

Light Driver Connections

15 Way D-Type Plug Pin Number	Isolated Trigger Input Function	Voltage Links	Source
1	Channel 1 Current input	●	
2	Channel 1 Voltage input	●	Frame Grabber O/P 1
3	Channel 1 Common Return	● ●	
4	Channel 2 Current input	●	
5	Channel 2 Voltage input	● ●	Frame Grabber O/P 2
6	Channel 2 Common Return	●	
7	Channel 3 Current input	●	
8	Channel 3 Voltage input	● ●	Frame Grabber O/P 3
9	Channel 3 Common Return	●	
10	Channel 4 Current input	● ●	
11	Channel 4 Voltage input	●	Frame Grabber O/P 4
12	Channel 4 Common Return	●	
13	+12V Internal Power Supply (200mA)		
14	+5V Internal Power Supply (200mA)		

25 Way D-Type Socket Pin Number	2 Ch Light Head Output	Function
1	Channel 1 Output 1	
2	Channel 1 Output 2	
3	Channel 1 Output 3	Drives Light Head 1, Blue, pin 1
4	Channel 1 Output 4	Drives Light Head 1, Green, pin 3
5	Channel 2 Output 1	
6	Channel 2 Output 2	
7	Channel 2 Output 3	Drives Light Head 2, Black, pin 1
8	Channel 2 Output 4	Drives Light Head 2, Green, pin 3
9	No Connection	
10	No Connection	
11	No Connection	
12	No Connection	
13	No Connection	
14	No Connection	
15	No Connection	
16	No Connection	
17	No Connection	
18	Channel 1 Power Supply	Light Head 1 Supply, Red, pin 2
19	Channel 1 Power Supply	Light Head 1 Supply, Yellow, pin 4
20	Channel 2 Power Supply	Light Head 2 Supply, Red, pin 2
21	Channel 2 Power Supply	Light Head 2 Supply, Yellow, pin 4
22	No Connection	
23	No Connection	
24	No Connection	
25	No Connection	

Frame Grabber Connections

15 Way Connector Pin Number	Function	Cam 1 Pin	Cam 2 Pin	Wire Color	Camera Function
1	CAM1 Video Input		4	Red	Video Signal
2	CAM0 Video Input	4		Red	Video Signal
3	No connection				
4	DGND1 Digital ground		5	Green	HD Rtn.
4	DGND1 Digital ground		8	Black Scr.	Frame Reset Rtn.
4	DGND1 Digital ground		12	Blue Scr.	VD Rtn
5	DGND0 Digital ground	5		Green	HD Rtn.
5	DGND0 Digital ground	8		Black Scr.	Frame Reset Rtn.
5	DGND0 Digital ground	12		Blue Scr.	VD Rtn.
6	AGND1 Analog ground		3	Red Scr.	Video Rtn.
7	AGND0 Analog ground	3		Red Scr.	Video Rtn.
8	FRESET1 Frame reset (VSCLOCK)		9	Black	Frame Reset Sig.
9	FRESET0 Frame reset (VSCLOCK)	9		Black	Frame Reset Sig.
10	+ 12V_gnd Power return	1	1	Black	Both, DC -Ve
10	+ 12V_gnd Power return	10	10	Green	Both, DC -Ve
11	CHSYNC1 Compos-ite/Horizontal Sync		6	Green	HD Sig.
12	VSYNC1 Vertical Sync		7	Blue	VD Sig.
13	CHSYNC0 Composite/Horizontal Sync	6		Green	HD Sig.
14	VSYNC0 Vertical Sync	7		Blue	VD Sig
15	+ 12V Power	2	2	Red	Both, DC +Ve
15	+ 12V Power	11	11	Blue	Both, DC +Ve

26 Way Connector Pin Number	Function	Wire Color	System Function
6	STROBE0 Strobe output 0	Black	Light Driver, pin 1, Strobe 1 Trigger
7	STROBE1 Strobe output 1	Yellow	Light Driver, pin 5, Strobe 2 Trigger
8	STROBE2 Strobe output 2	Green	Light Driver, pin 8, Strobe 3 Trigger
9	STROBE3 Strobe output 3	White	Light Driver, pin 11, Strobe 4 Trigger
14	+12V_GND +12V ground	Blue	Light Driver, pin 15, Gnd.
14	+12V_GND +12V ground	Blue	SCM pin 15, Gnd.
17	TRIGGER0 Trigger input 0	Black	SCM pin 9, Camera 1 Trigger pulse
18	TRIGGER1 Trigger input 1	Yellow	SCM pin 10, Camera 2 Trigger pulse
23	+12V supply	Red	+Ve
25	TRIGGER2 Trigger input 2	Green	SCM pin 11, Camera 3 Trigger pulse
26	TRIGGER3 Trigger input 3	White	SCM pin 12, Camera 4 Trigger pulse

SCM & Encoder Connections

25 Way Connector Pin Number	Function	Wire Color	System Function	15 Way Connector Pin Number	Sensor NPN
1	I/P 1	Black	Sensor 1 Trigger Input	1	Sig. Yellow or Black
2	I/P 2	Yellow	Sensor 2 Trigger Input	2	Sig. Yellow or Black
3	I/P 3	Green	Sensor 3 Trigger Input	3	Sig. Yellow or Black
4	I/P 4	White	Sensor 4 Trigger Input	4	Sig. Yellow or Black
5	I/P 5		Spare		
6	I/P 6		Spare		
7	I/P 7		Spare		
8	I/P 8		Spare		
9	O/P 1	Black	Camera 1 Trigger		
10	O/P 2	Yellow	Camera 2 Trigger		
11	O/P 3	Green	Camera 3 Trigger		
12	O/P 4	White	Camera 4 Trigger		
13	+5V	Red	+5V	13	+Ve, Red or Brown
14 to 21	0V	Blue	0V	9 to 12 & 14	-Ve, Blue
22	O/P 8		Spare		
23	O/P 7		Spare		
24	O/P 6		Spare		
25	O/P 5		Spare		

9 way "D" type	Rotary Encoder	Wire Colour
1	+12V	Brown (Red)
2	C (PIP)	Pink (Blue), If using external triggers disconnect.
3	B	Yellow
4	A	Green
5	0V (GND)	White

LIS Blue Box External Connections

All connections are made to a connection panel, found at the back of the unit.

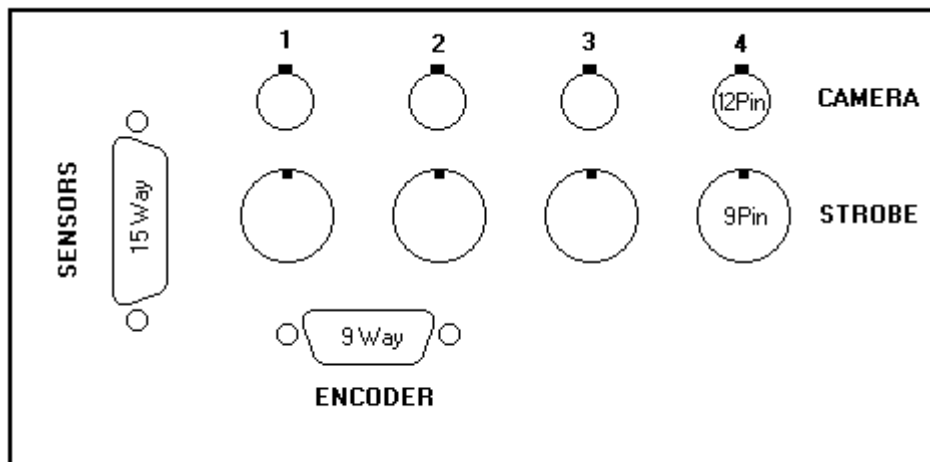


Figure 70 LIS Blue Box Rear Panel

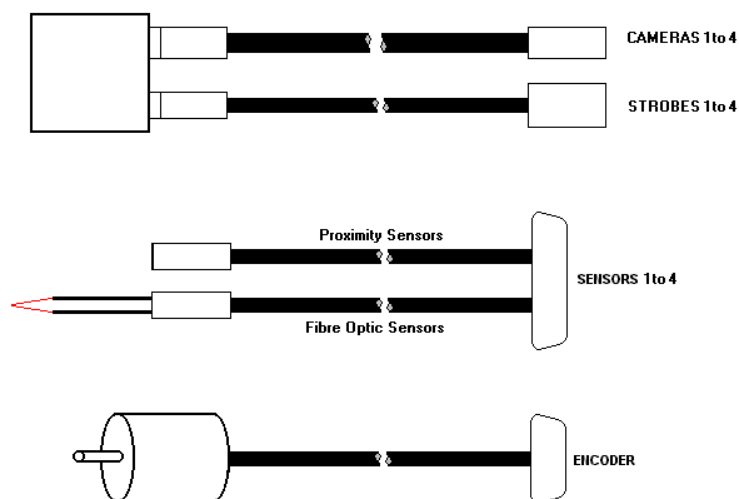


Figure 71 LIS Blue Box External Connections

Sensors	Function	Sensor NPN
1	Sensor 1 Trigger Input	Signal Yellow or Black
2	Sensor 2 Trigger Input	Signal Yellow or Black
3	Sensor 3 Trigger Input	Signal Yellow or Black
4	Sensor 4 Trigger Input	Signal Yellow or Black
5	Sensor 5 Trigger Input	Signal Yellow or Black
6	Sensor 6 Trigger Input	Signal Yellow or Black
7	Sensor 7 Trigger Input	Signal Yellow or Black
8	Sensor 8 Trigger Input	Signal Yellow or Black
9 to 12 & 14	0V	-Ve, Blue
15	+12V	+Ve, Red

Encoder	Function	Wire Colour
1	+12V	Brown (Red)
2	C (PIP)	Pink (Blue), If using external triggers disconnect.
3	B	Yellow
4	A	Green
5	0V (GND)	White

Camera	Function	Wire Color	Camera Function
1	+ 12V_gnd Power return	Black	DC –Ve
2	+ 12V Power	Red	DC +Ve
3	AGND0 Analog ground	Red Scr.	Video Rtn.
4	CAM0 Video Input	Red	Video Signal
5	DGND0 Digital ground	Green	HD Rtn.
6	CHSYNC0 Composite/ Horizontal Sync	Green	HD Sig.
7	VSYNC0 Vertical Sync	Blue	VD Sig
8	DGND0 Digital ground	Black Scr.	Frame Reset Rtn.
9	FRESET0 Frame reset (VSCLOCK)	Black	Frame Reset Sig.
10	+ 12V_gnd Power return	Green	DC –Ve
11	+ 12V Power	Blue	DC +Ve
12	DGND0 Digital ground	Blue Scr.	VD Rtn.

Strobe	Function	Wire Color	Camera 4 Way Connector
1	VLP	Yellow	4
2	LP Out 4	Green	3
5	LP Out 3	Blue	1
6	VLP	Red	2
OR	Function	Wire Color	Camera 6 Way Connector
1	VLP	White	2
2	LP Out 4	Yellow	3
3	LP Out 2	Red	4
5	LP Out 3	Green	5
6	VLP	Black	1
7	LP Out 1	Blue	6