MATRIX 410™

Code Quality Verifier Solution Manual

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Matrix 410™ Code Quality Verifier Solution

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REFERENCES

CONVENTIONS

This manual uses the following conventions:

"User" refers to anyone using the Matrix 410™ Code Quality Verifier Solution.
"Reader" refers to the Matrix 410™ reader.
"You" refers to the System Administrator or Technical Support person using this manual to install, configure, operate, maintain or troubleshoot a Matrix 410™ Code Quality Verifier Solution.

REFERENCE DOCUMENTATION

For further details refer to: the VisiSet™ Help On Line, Matrix 410™ Reference Manual, Matrix Series Reading Methods, Matrix 410™ Host Mode Programming, Matrix 410™ SW Parameter Guide, LT-410 Coaxial Lighting System, LT-510 Mini Dome Lighting System, LT-511 Dome Lighting System and LT-630 Four Bar Lighting System provided as supplementary documentation on the VisiSet™ CD-ROM.

SERVICE AND SUPPORT

Datalogic provides several services as well as technical support through its website. Log on to **www.automation.datalogic.com** and click on the links indicated for further information including:

- **PRODUCTS**

  Search through the links to arrive at your product page where you can download specific **Manuals** and **Software & Utilities**

  - **VisiSet™** a utility program, which allows device configuration using a PC. It provides RS232 and Ethernet interface configuration.

- **SERVICES & SUPPORT**

  - **Datalogic Services -** Warranty Extensions and Maintenance Agreements
  - **Authorised Repair Centres**

- **CONTACT US**

  E-mail form and listing of Datalogic Subsidiaries

PATENTS

This product is covered by one or more of the following patents:

U.S. patents: 6,512,218 B1; 6,616,039 B1; 6,808,114 B1; 6,997,385 B2; 7,102,116 B2; 7,282,688 B2

European patents: 999,514 B1; 1,014,292 B1; 1,128,315 B1.

Additional patents pending.

COMPLIANCE

For installation, use and maintenance it is not necessary to open the reader.

EMC COMPLIANCE

In order to meet the EMC requirements:

- connect reader chassis to the plant earth ground by means of a flat copper braid shorter than 100 mm;
- for CBX connections, connect the pin "Earth" to a good Earth Ground
- for direct connections, connect the main interface cable shield to pin K of the 19-pin connector;

POWER SUPPLY

ATTENTION: READ THIS INFORMATION BEFORE INSTALLING THE PRODUCT

This product is intended to be installed by Qualified Personnel only.

This product is intended to be connected to a UL Listed Computer which supplies power directly to the reader or a UL Listed Direct Plug-in Power Unit marked LPS or “Class 2”, rated 10 to 30 V, minimum 1 A.

LED CLASS

Class 1 LED Product to EN60825-1:2001

CE COMPLIANCE

Warning: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

FCC COMPLIANCE

Modifications or changes to this equipment without the expressed written approval of Datalogic could void the authority to use the equipment.

This device complies with PART 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference which may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

GENERAL VIEW

Matrix 410™

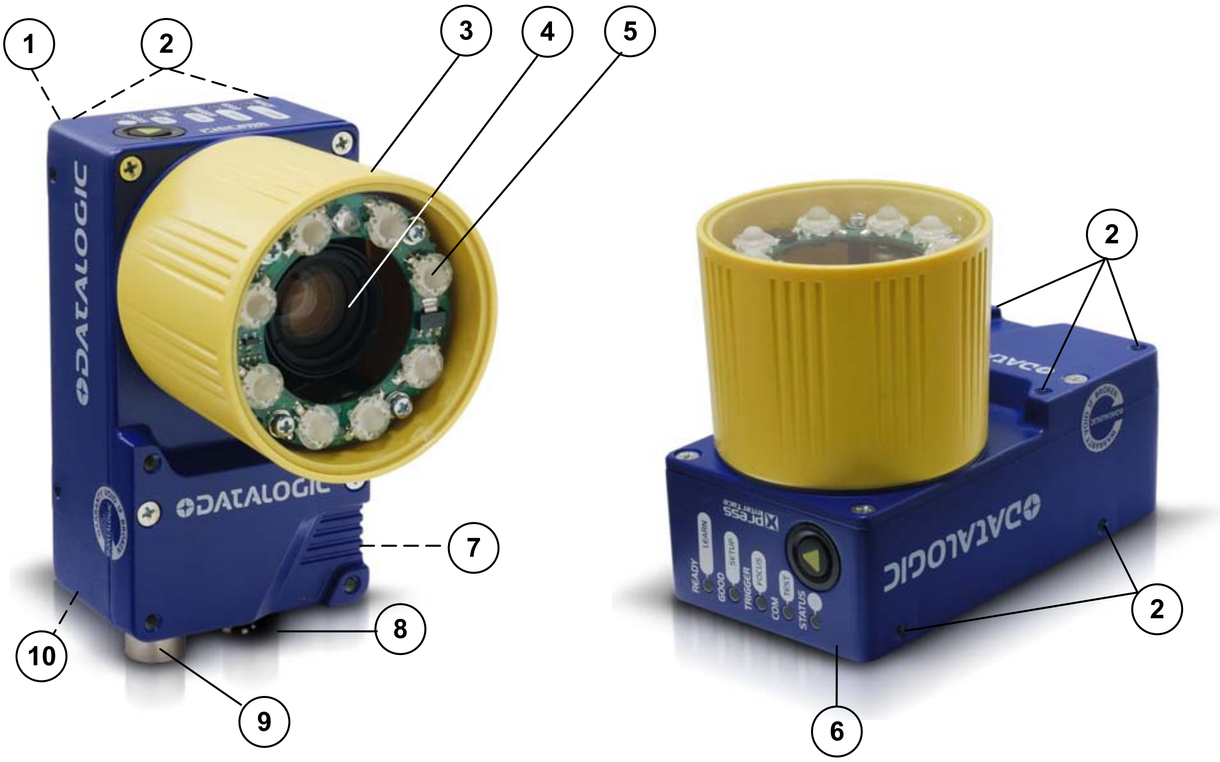


Figure A

1 Device Class Label	6 HMI X-PRESS™ Interface
2 Mounting Holes (12)	7 "POWER ON" LED
3 Lens Cover	8 Power - Serial Interfaces - I/O Connector
4 Lens (separate accessory)	9 Ethernet Connector (Ethernet Models Only)
5 Internal Illuminator (separate accessory)	10 Ethernet Connection LED (Ethernet Models Only)

1 RAPID CONFIGURATION

STEP 1 – CHECK REQUIRED HARDWARE

ISO/IEC 15415 AND ISO/IEC 15416 VERIFICATION

To install the Matrix 410™ reader in an ISO/IEC 15415 or ISO/IEC 15416 symbol verifier configuration, you need the hardware indicated in Figure 1.

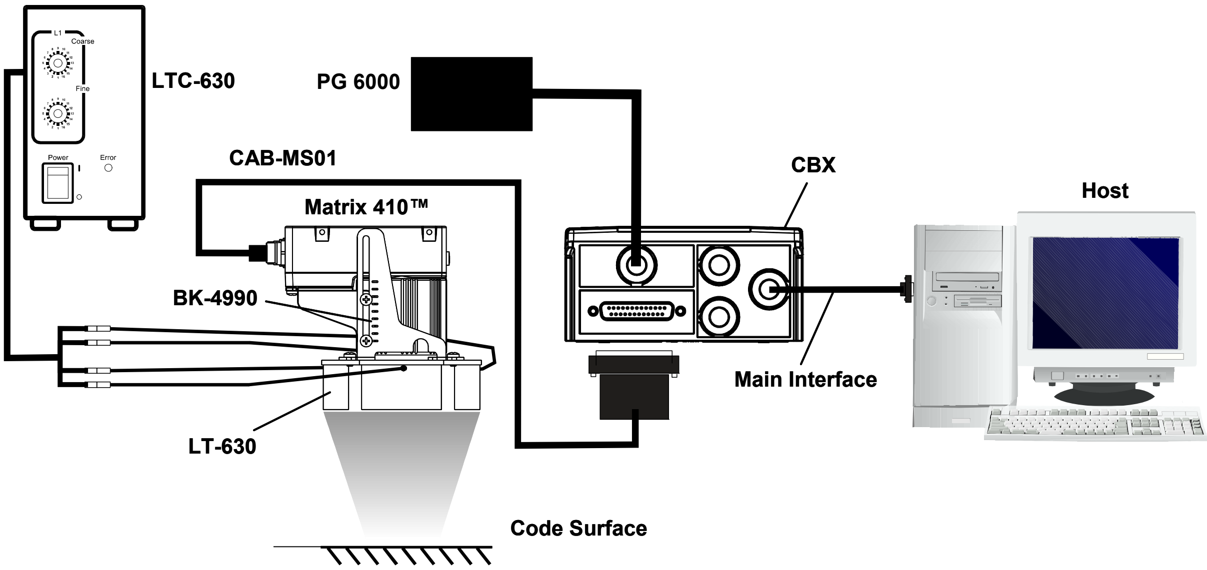


Figure 1 - ISO/IEC 15415 and ISO/IEC 15416 Verifier System Required Hardware

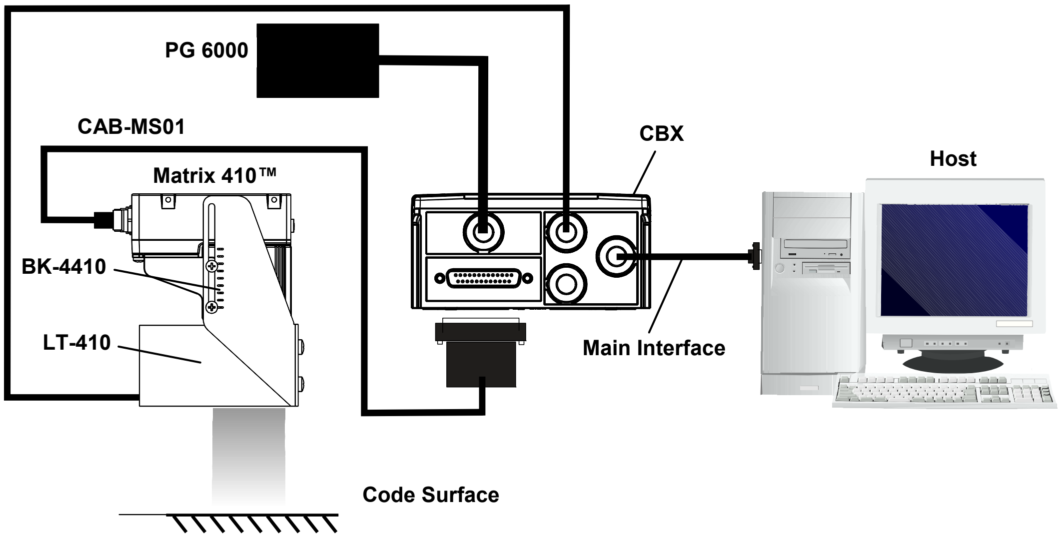
REQUIRED ACCESSORIES:

Item	Accessory	Description	Order No.
1		Matrix 410-x00-0x0 Reader	
	LNS-1116	16 mm C-Mount Lens (Recommended)	93ACC1796
2	CBX100	Compact Connection Box	93A301067
	CBX500	Modular Connection Box	93A301068
3	CAB-MS01	M16-IP67 Cable To CBX (1M)	93A051358
	CAB-ETH-M01	M12-IP67 Ethernet Cable (1M) (Optional)	93A051346
4	PG6000	AC/DC Power Supply Unit (US)	93ACC1718
	PG6001	AC/DC Power Supply Unit (UK)	93ACC1719
	PG6002	AC/DC Power Supply Unit (EU)	93ACC1720
5	LT-630	Four Bar Lighting System	93A401018
	LTC-630	Four Bar Lighting System Controller	93ACC1790
	ISO/IEC Chart	Calibration Chart for Code Verifier Solution (*)	93ACC1841
6	BK-4990	Generic LT Bracket Matrix 410	93ACC1805

(*) Also included in the LT-630 Four Bar Lighting System package.

AS9132A AND AIM DPM VERIFICATION:

To install the Matrix 410™ reader in an AS9132A or AIM DPM symbol verifier configuration, you need the hardware indicated in Figure 2.



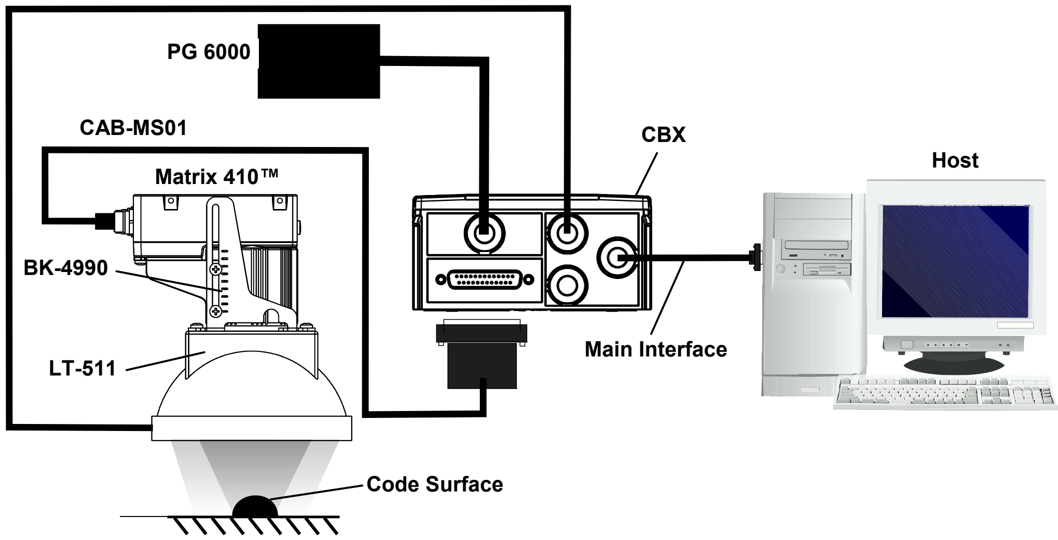


Figure 2 - AS9132 and AIM DPM Verifier System Required Hardware

NOTE	*The recommended ISO/15415 and ISO/IEC 15416 lighting environment (see Figure 1) can also be used for AIM DPM symbol verification according to your application requirements. See par. 4.2.*

REQUIRED ACCESSORIES:

Item	Accessory	Description	Order No.
1		Matrix 410-x00-0x0 Reader	
	LNS-1116	16 mm C-Mount Lens (Recommended)	93ACC1796
2	CBX100	Compact Connection Box	93A301067
	CBX500	Modular Connection Box	93A301068
3	CAB-MS01	M16-IP67 Cable To CBX (1M)	93A051358
	CAB-ETH-M01	M12-IP67 Ethernet Cable (1M) (Optional)	93A051346
4	PG6000	AC/DC Power Supply Unit (EU)	93ACC1718
	PG6001	AC/DC Power Supply Unit (UK)	93ACC1719
	PG6002	AC/DC Power Supply Unit (US)	93ACC1720
5 (*)	LT-410	Coaxial Lighting System	93A401015
	LT-511	Dome Lighting System	93A401017
	LT-630	Four Bar Lighting System	93A401018
	LTC-630	Four Bar Lighting System Controller	93ACC1790
6	BK-4990	Generic LT Bracket Matrix 410	93ACC1805
	BK-4410	Coaxial LT Bracket Matrix 410	93ACC1804

(*) The suggested external lighting systems provide a complete solution for DPM parts verification based on AS9132 and AIM DPM recommendations. The proper lighting environment can be selected according to the characteristics of the surface on which the code is marked and on the chosen printing technique; see Paragraph 4.1 and 4.2 for further details.

STEP 2 – CONNECT THE SYSTEM

To install the Matrix 410™ reader in a symbol verifier system configuration, you need the hardware indicated in Figure 3 or Figure 4. In this layout the data is transmitted to the Host on the main serial interface.

The RS232 auxiliary interface can be used for symbol verifier system configuration by connecting an host computer running VisiSet™.

Refer to Matrix Series Ethernet Service Guide to connect the symbol verifier system to an host computer by Ethernet TCP/IP interface (Matrix 410-x00-010 models only).

ISO/IEC 15415 AND ISO/IEC 15416 VERIFICATION

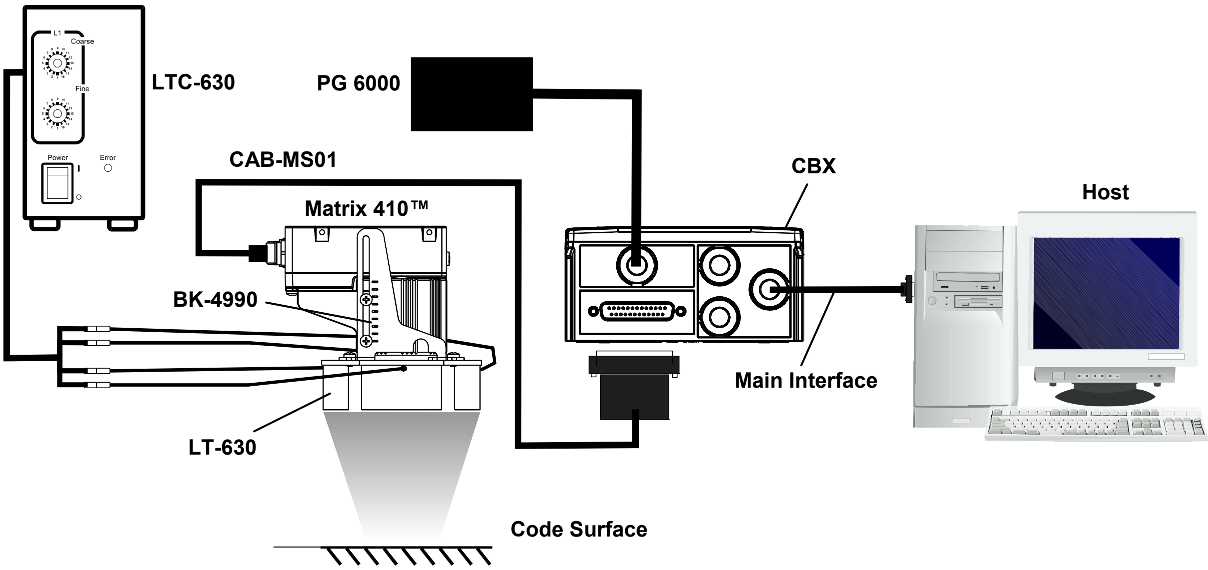


Figure 3 - Matrix 410™ in ISO/IEC 15415 and ISO/IEC 15416 Verifier Layout

1. Connect the Matrix 410™ to the CBX connection box.
2. Connect the LT-630 Four Bar Lighting System wires to the LTC-630 Power Supply Controller through the adapter cable included in the LTC-630 package. Optionally, one of the Matrix digital outputs can be used to switch the illuminator on/off at the LTC-630.
3. Position the “Coarse” and “Fine” regulations of the LTC-630 Power Supply Controller respectively to “**6**” and “**9**” which is the preferred setting for symbol verification.
4. Connect the CBX to the PG600x power supply unit.
5. Connect the selected communication interface to the Host.
6. Connect the main power supply and switch on the system (both PG600x and LTC-630).

NOTE

- For ISO/IEC 15415 and ISO/IEC 15416 verification, check the correct orientation of the four LT-630 lighting bars (**45°**) before performing the verifier system calibration procedure described in **Step 7**.

AS9132A AND AIM DPM VERIFICATION:

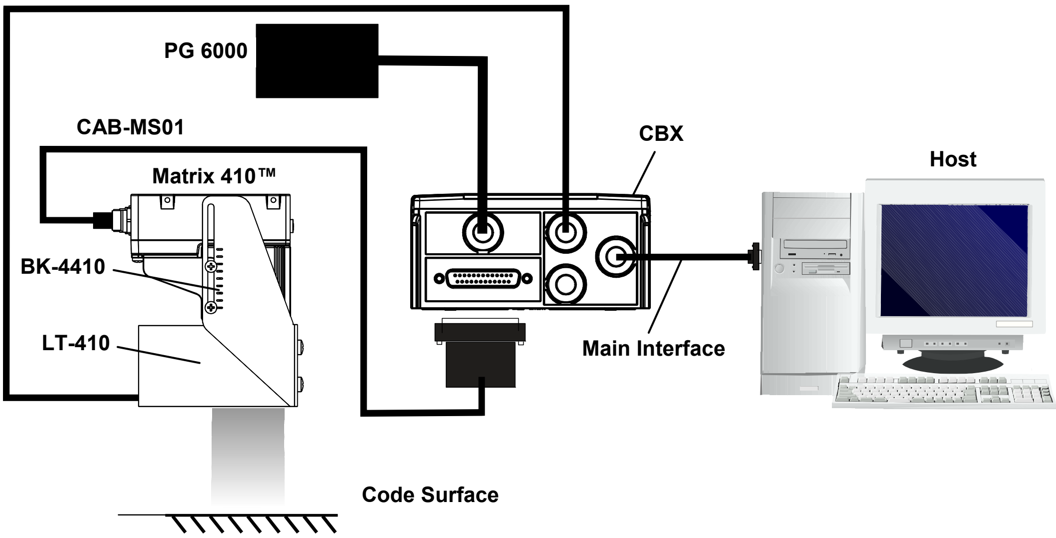


Figure 4 - Matrix 410™ in ISO/IEC 15415 and ISO/IEC 15416 Verifier Layout

1. Connect the Matrix 410™ to the CBX connection box.
2. Connect the selected LT-XXX lighting system to the CBX connection box according to the wiring table below.
3. Connect the CBX to the PG600x power supply unit.
4. Connect the selected communication interface to the Host.
5. Connect the main power supply and switch on the system.

CAUTION

Power is available directly to the Illuminator, independently from the Power Supply Switch inside the CBX.

External Illuminator Wiring:

Illuminator	Wire Color	CBX/Matrix Signal	Meaning
LT-314, LT-316,	White	Vdc	24 Vdc
LT-410, LT-510,	Black	GND	Ground
LT-511	Shield	Earth	Shield/Earth Ground

CBX100/CBX500 PINOUT FOR MATRIX 410™

The table below gives the pinout of the CBX100/CBX500 terminal block connectors. Use this pinout when the Matrix 410™ reader is connected by means of the CBX100/CBX500:

CBX100/500 Terminal Block Connectors	
Input Power	
Vdc	Power Supply Input Voltage +
GND	Power Supply Input Voltage -
Earth	Protection Earth Ground
Inputs	
+V	Power Source – External Trigger
I1A	External Trigger A (polarity insensitive)
I1B	External Trigger B (polarity insensitive)
-V	Power Reference – External Trigger
+V	Power Source – Inputs
I2A	Input 2 A (polarity insensitive)
I2B	Input 2 B (polarity insensitive)
-V	Power Reference – Inputs
Outputs	
+V	Power Source - Outputs
-V	Power Reference - Outputs
O1+	Output 1 +
O1-	Output 1 -
O2+	Output 2 +
O2-	Output 2 -
Auxiliary Interface	
TX	Auxiliary Interface TX
RX	Auxiliary Interface RX
SGND	Auxiliary Interface Reference
ID-NET™	
REF	Network Reference
ID+	ID-NET™ network +
ID-	ID-NET™ network -
Shield	Network Cable Shield

Main Interface			
	RS232	**RS485 Full-Duplex**	**RS485 Half-Duplex**
	TX	TX+	RTX+
	RX	*RX+	
	RTS	TX-	RTX-
	CTS	*RX-	
	SGND	SGND	SGND

(*) Do not leave floating, refer to Matrix 410™ Reference Manual for connection details.

CAUTION

Do not connect GND, SGND and REF to different (external) ground references. GND, SGND and REF are internally connected through filtering circuitry which can be permanently damaged if subjected to voltage drops over 0.8 Vdc.

STEP 3 – MOUNT AND POSITION THE SYSTEM

1. To mount the Matrix 410™, use the mounting brackets to obtain the most suitable position for the reader. Two of the most common mounting configurations are shown in the figures below. Other mounting solutions are provided in the Matrix 410™ Reference Manual.

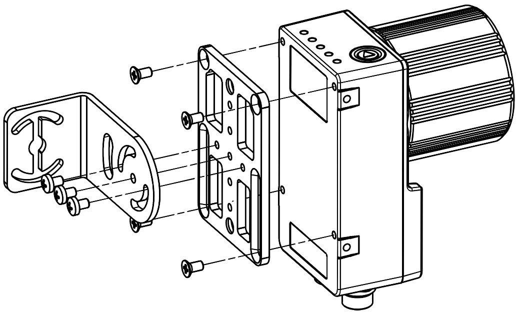


Figure 5 - Positioning with Mounting Bracket

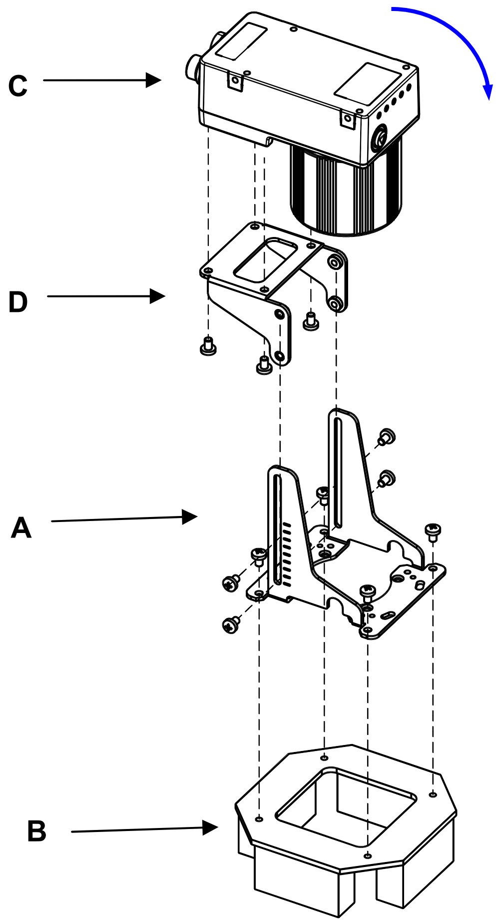
2. Refer to the Reading Features table in Chapter 3 for **FOV calculation** and **minimum distance requirements** according to the reader base/lens combination used for your application.

MOUNTING LT-630

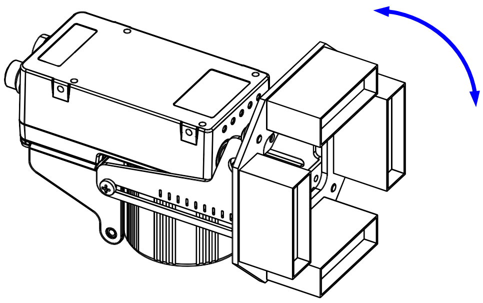
To mount the LT-630 Four Bar Lighting System complete steps 1 and 2 previously described and then continue with step 3 below:

3. The BK-4990 bracket comes already partially mounted (**D**+**A**) with 2 M4 screws.

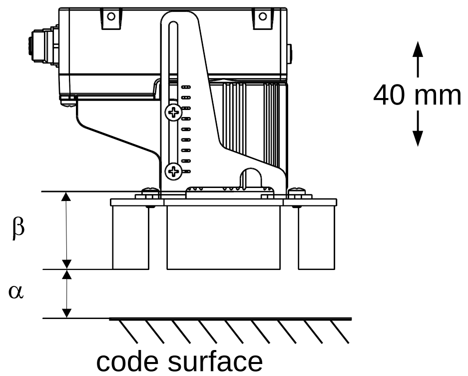
4. Mount the bracket **A** onto the LT-630 illuminator **B** using the 4 M4 screws in the bag marked "Screws for Brackets-LT-314/LT-316/LT-511/LT-630 assembling".



5. Swing the bracket **D** 90° and mount the reader **C** onto it through the mounting holes on the bracket. Use 4 of the M4 screws in the bag marked "Screws for Bracket-Bracket-Reader assembling".



6. Remove the Lens Cover and loosen the Locking Knobs as described in the Matrix 410™ Reference Manual. Swing the bracket **D** 90° returning to the reading position.
7. Position and mount the Matrix assembly over the code reading area at the correct Focus Distance (or range) for your model, (see Chapter 3).
8. Perform the Focusing and Image Density Calibration procedures described in **Step 5**.
9. After Focusing, tighten the Focus and Diaphragm Locking Knobs.
10. Swing the bracket **D** 90° as previously shown to replace the Lens Cover. Swing the bracket **D** 90° returning to the reading position and fix the reader assembly (**C**+**D**) to the illuminator assembly (**A**+**B**) with the remaining 2 M4 screws from the bag marked "Screws for Bracket-Bracket-Reader assembling".



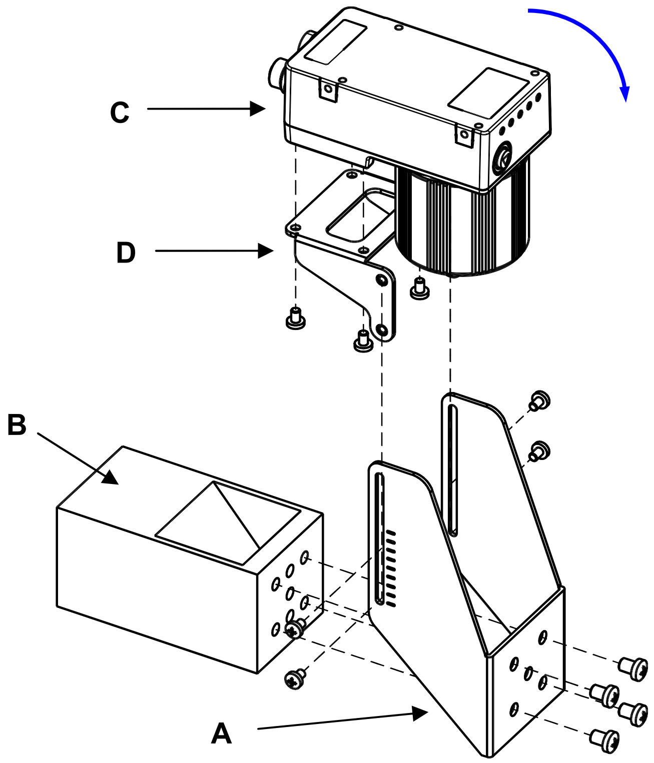
Focus distance $\doteq \alpha + \beta$

The best results for this illuminator are obtained when α is approximately **30 mm** (**1.2"**).

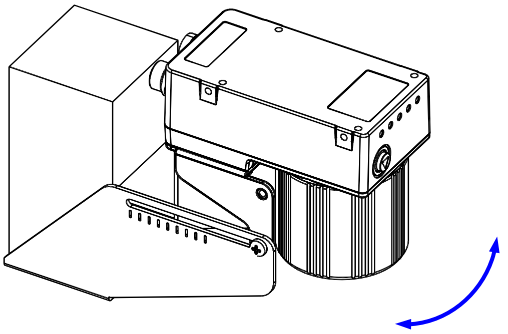
The positioning slots on the brackets allow adjustment to obtain the best results between the reader optimal focus distance and the illuminator optimal working distance. You can verify the reading performance through VisiSet™.

MOUNTING LT-410

To mount the LT-410 Coaxial Lighting System complete steps 1 and 2 previously described and then continue with step 3 below:

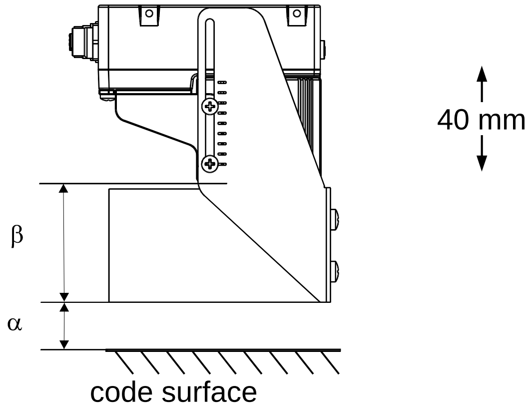


3. The BK-4410 bracket comes already partially mounted (**D**+**A**) with 2 M4 screws.
4. Mount the bracket **A** onto the LT-410 illuminator **B** using the 4 M6x8 screws.
5. Swing the bracket **D** 90° and mount the reader **C** onto it through the mounting holes on the bracket. Use 4 of the M4 screws.



6. Remove the Lens Cover and loosen the Locking Knobs as described in the Matrix 410™ Reference Manual. Swing the bracket **D** 90° returning to the reading position.
7. Position and mount the Matrix assembly over the code reading area at the correct Focus Distance (or range) for your model, (see Chapter 3).
8. Perform the Focusing and Image Density Calibration procedures described in **Step 5**.

9. After Focusing, tighten the Focus and Diaphragm Locking Knobs.
10. Swing the bracket **D** 90° as previously shown to replace the Lens Cover. Swing the bracket **D** 90° returning to the reading position and fix the reader assembly (**C**+**D**) to the illuminator assembly (**A**+**B**) with the remaining 2 M4 screws.



Focus distance $\cong \alpha + \beta$

The best results for this illuminator are obtained when α is approximately **25 mm** (**1"**).

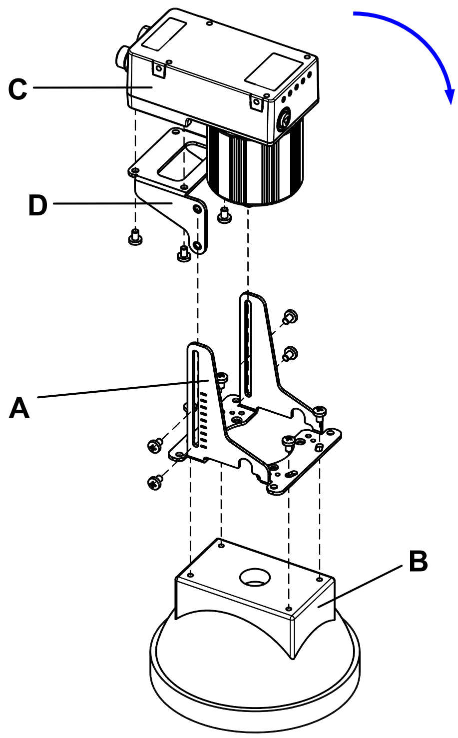
The positioning slots on the brackets allow adjustment to obtain the best results between the reader optimal focus distance and the illuminator optimal working distance. You can verify the reading performance through VisiSet™.

MOUNTING LT-511

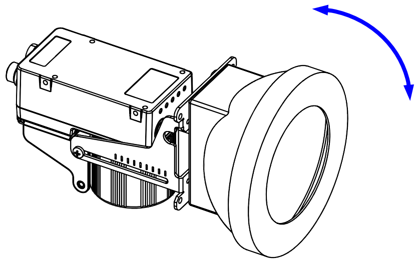
To mount the LT-511 Dome Lighting System complete steps 1 and 2 previously described and then continue with step 3 below:

3. The BK-4990 bracket comes already partially mounted (**D**+**A**) with 2 M4 screws.

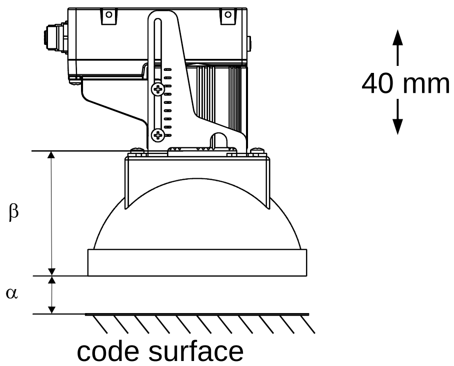
4. Mount the bracket **A** onto the LT-511 illuminator **B** using the 4 M4 screws in the bag marked "Screws for Brackets-LT-314/LT-316/LT-511/LT-630 assembling".



1. Swing the bracket **D** 90° and mount the reader **C** onto it through the mounting holes on the bracket. Use 4 of the M4 screws in the bag marked "Screws for Bracket-Bracket-Reader assembling".



2. Remove the Lens Cover and loosen the Locking Knobs as described in the Reference Manual. Swing the bracket **D** 90° returning to the reading position.
3. Position and mount the Matrix assembly over the code reading area at the correct Focus Distance (or range) for your model, (see Chapter 3).
4. Perform the Focusing and Image Density Calibration procedures described in **Step 5**.
5. After Focusing, tighten the Focus and Diaphragm Locking Knobs.
6. Swing the bracket **D** 90° as previously shown to replace the Lens Cover. Swing the bracket **D** 90° returning to the reading position and fix the reader assembly (**C+D**) to the illuminator assembly (**A+B**) with the remaining 2 M4 screws from the bag marked "Screws for Bracket-Bracket-Reader assembling".



Focus distance = $\alpha + \beta$

The best results for this illuminator are obtained when α is approximately **13 mm** (**0.5"**).

The positioning slots on the brackets allow adjustment to obtain the best results between the reader optimal focus distance and the illuminator optimal working distance. You can maximize the reading performance through VisiSet™.

NOTE

To mount other external illuminators (i.e. LT-314, LT316, LT510) see their specific Instruction manual.

STEP 4 – INSTALLING VISISET™ CONFIGURATION PROGRAM

VisiSet™ is a Datalogic reader configuration tool providing several important advantages:

- Autolearning Wizard for new users;
- Symbol Verification tool;
- Defined configuration directly stored in the reader;
- Communication protocol independent from the physical interface allowing to consider the reader as a remote object to be configured and monitored.

To install VisiSet™, turn on the PC that will be used for the configuration, running Windows 98, 2000/NT, XP or Vista, then insert the VisiSet™ CD-ROM, wait for the CD to autorun and follow the installation procedure.

This configuration procedure assumes a laptop computer, running VisiSet™, is connected to the reader's auxiliary port.
After installing and running the VisiSet™ software program the following window appears:

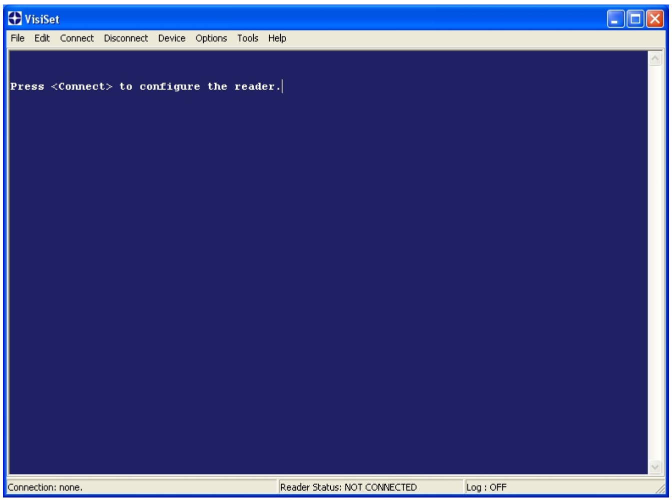


Figure 6 - VisiSet™ Opening Window

Set the communication parameters from the "Options" menu. Then select "Connect", the following window appears:

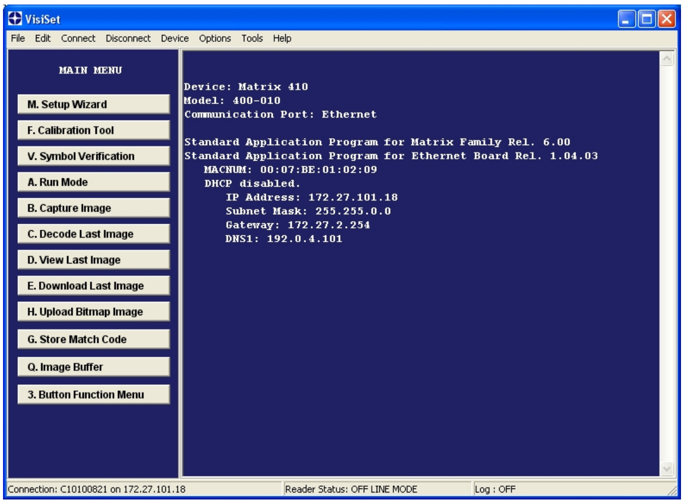
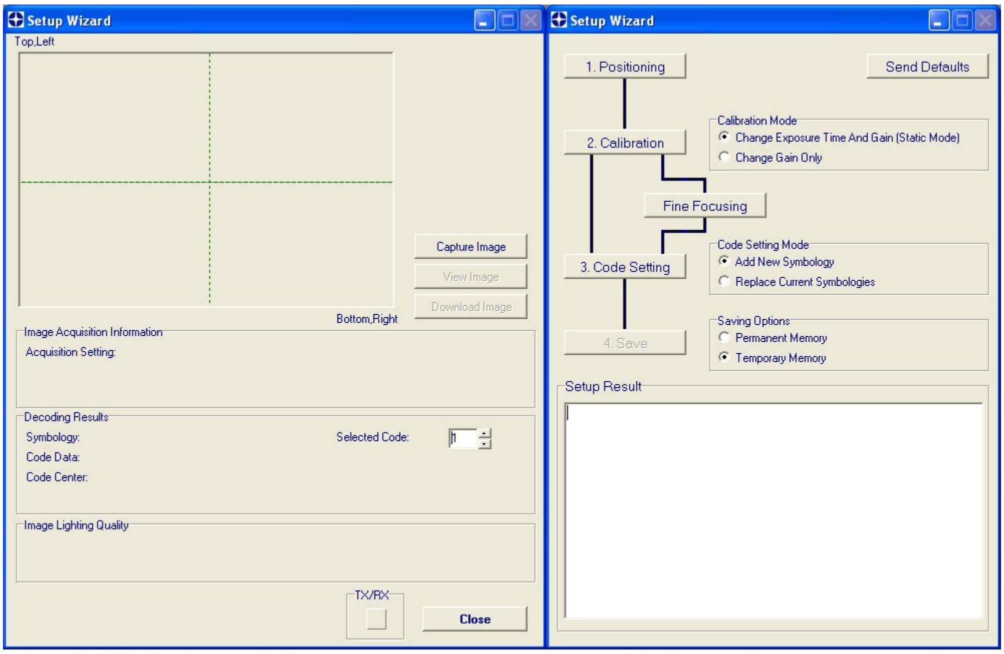


Figure 7 - VisiSet™ Main Window After Connection

STEP 5 – CONFIGURATION USING SETUP WIZARD

The Setup Wizard option is advised for rapid configuration or for new users. It allows reader configuration in a few easy steps.

1. Select the Setup Wizard button from the Main menu.



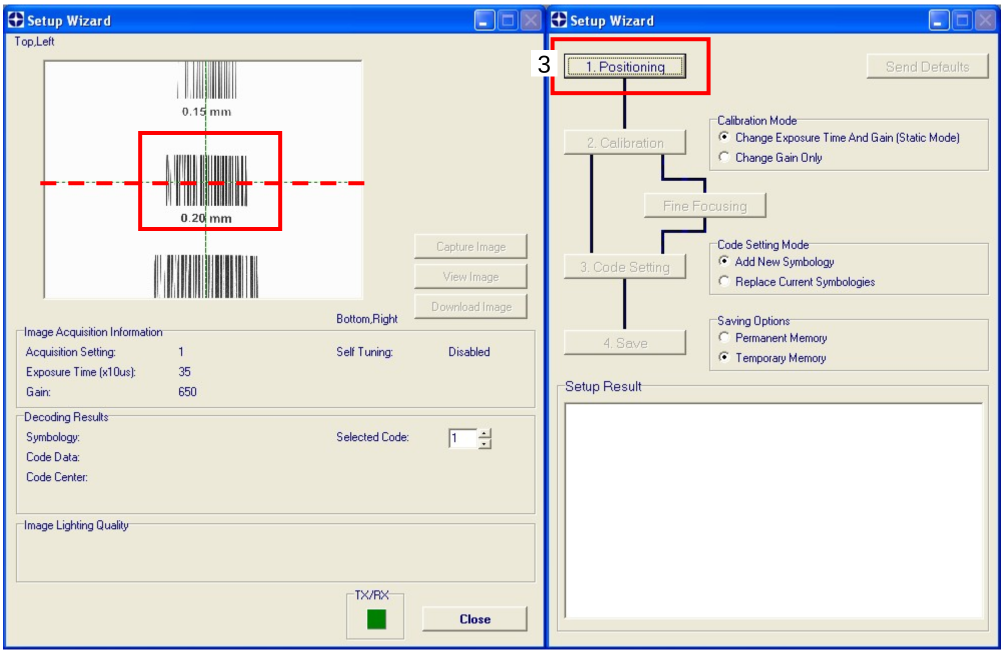
2. Remove the lens cover in order to focus the reader and loosen the two Locking Knobs on the lens.

   Adjust the Focus ring to the "**Far position**" and the Diaphragm ring to the "**F4**"[1] number setting which is the preferred setting for installation.

   Place the **Grade A Barcode Test Chart** in front of the reader at the correct reading distance (see step 3 and the Optical Accessory Selection table in the par. 3.1).

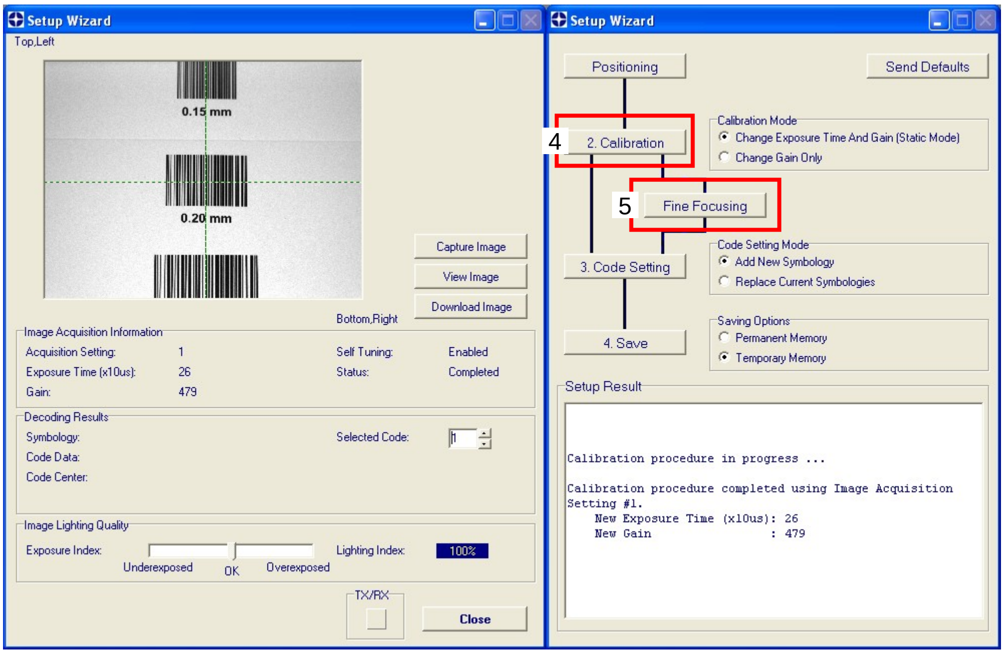
3. Press the "Positioning" button. The reader continuously acquires images and gives visual feedback in the view image window. Select the largest code from the chart that completely fits into the view image window. Move the reader (or code) to center it. The code must be aligned across the X-axis reference line at the center of the FOV. See figure below.

   Press the Positioning button again to stop positioning.

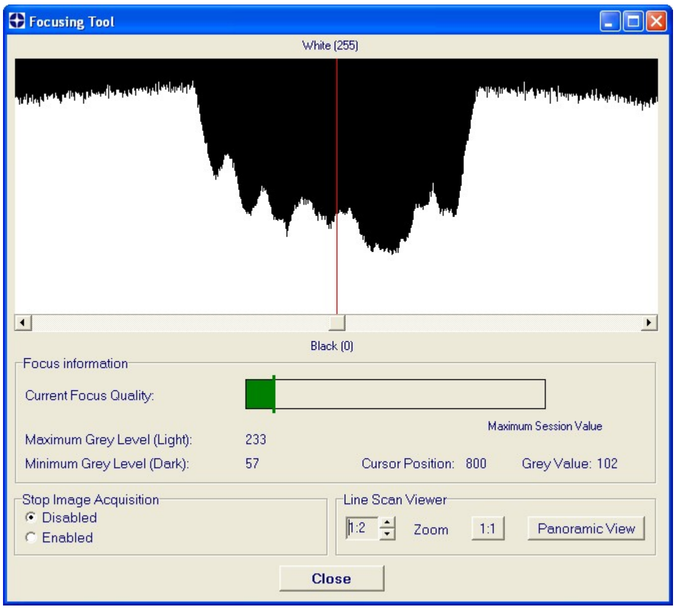


[1] For far reading distances, the Diaphragm ring can be set to values between **F2** and **F4** to increase image lighting.

4. Select a Calibration Mode choice and press the "Calibrate" button. The reader flashes once acquiring the image and auto determines the best exposure and gain settings. If the code symbology is enabled by default, the code will also be decoded.



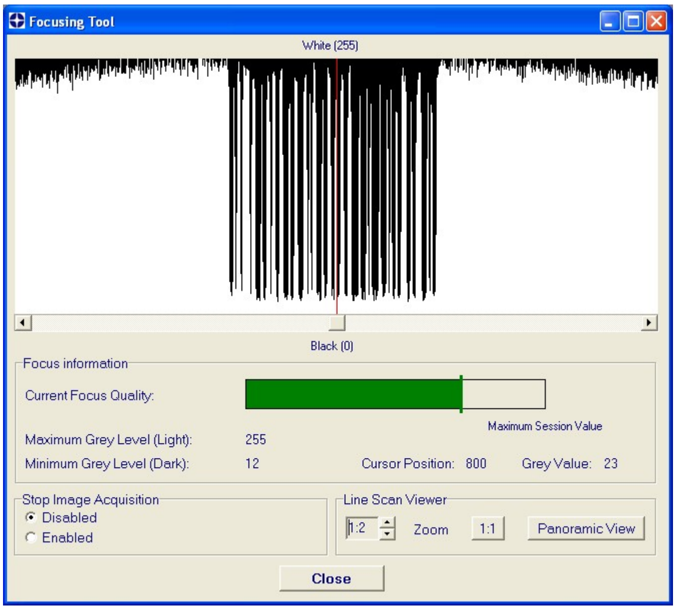
5. Press the "Fine Focusing" button to activate the Fine Focusing Tool.
The reader continuously acquires images and gives visual feedback on the focusing quality in the Focusing Tool window.



Rotate the Focusing ring on the lens. The Current Focus Quality Bar (green) together with the vertical optimal focus line (green) **increase together** until the optimal focus is reached; the vertical optimal focus line stops.

Continue rotating the Focusing ring on the lens a little farther; **the Current Focus Quality Bar decreases** (red) see below.

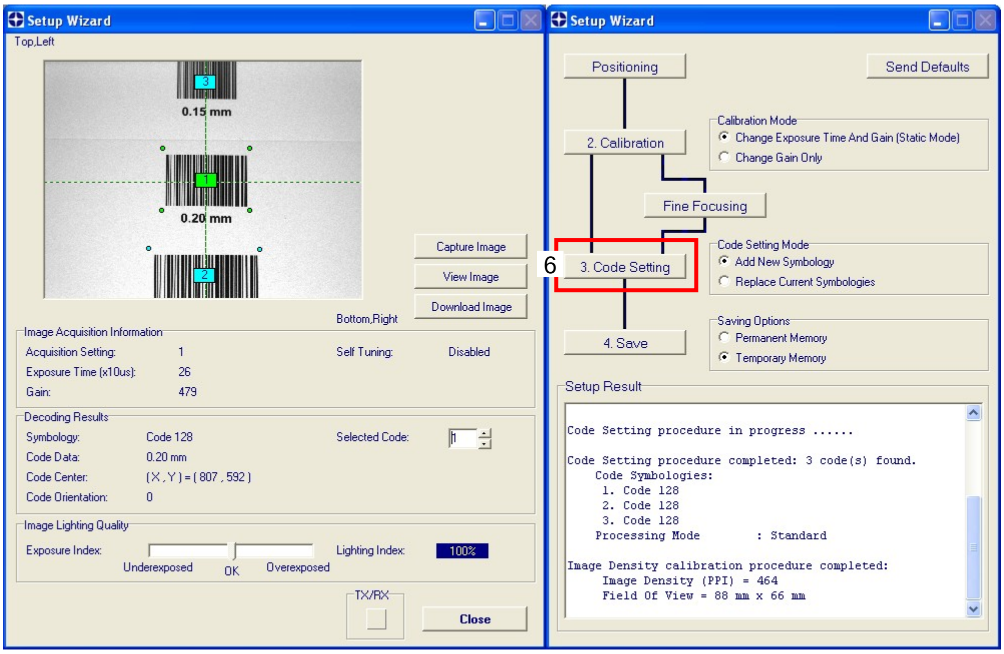
Rotate the Focusing ring in the opposite direction. The Current Focus Quality Bar (green) increases towards the vertical optimal focus line (green) until the optimal focus is reached; **the Current Focus Quality Bar touches the vertical optimal focus line** (indicating the best focus).



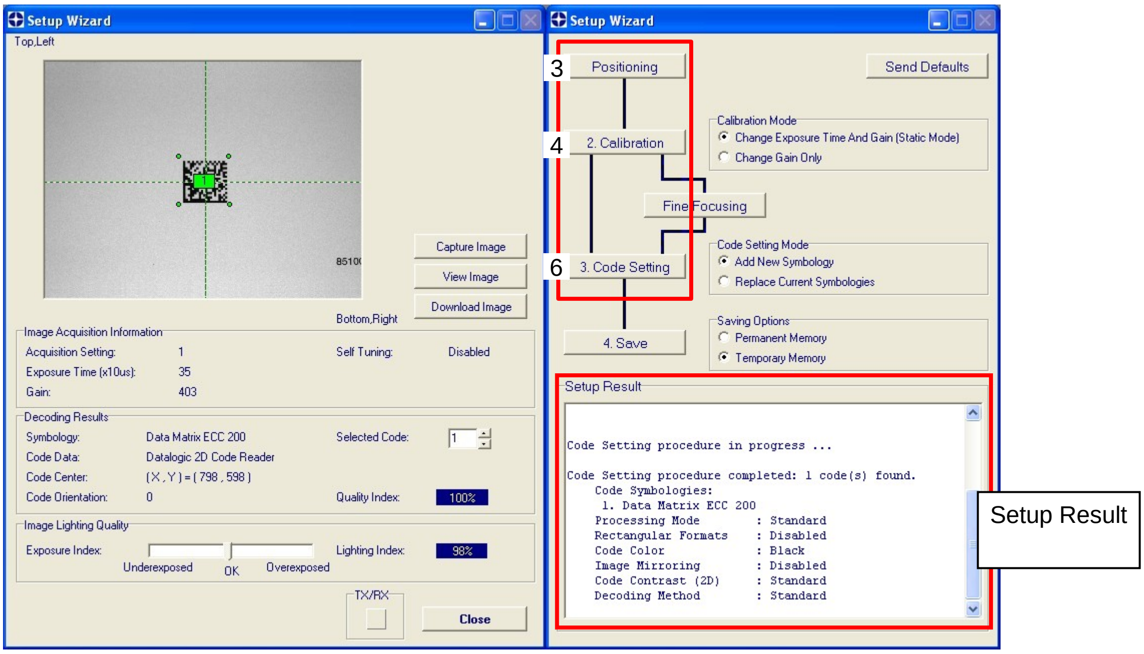
Tighten the Locking Knobs on the lens and press the "Close" button to return to the Setup Wizard.

6. Select a Code Setting Mode choice and press the "Code Setting" button.
   Using the **Grade A Barcode Test Chart**, this step performs image density calibration in order for Matrix 410™ to function correctly and to the fullest extent of its capabilities.

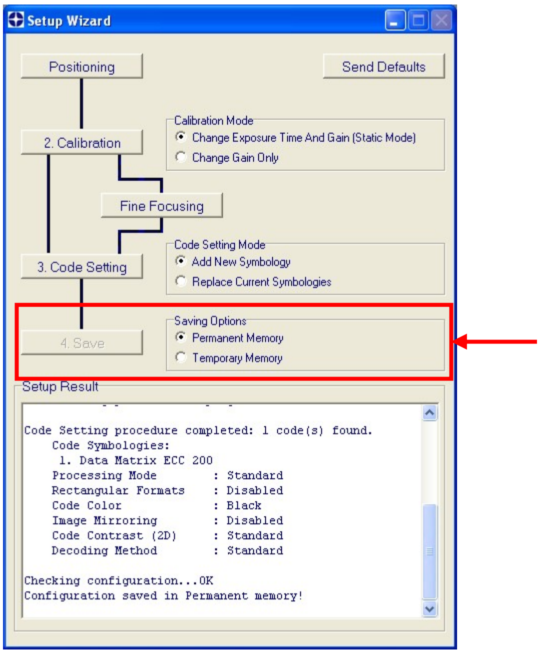
   The Setup Result section of the Setup Wizard window shows the code type results and the image density calibration settings.



7. Place the **application specific code** in front of the reader at the same reading distance and repeat steps 3, 4, and 6.



8. Select a Saving Options choice and press the "Save" button.



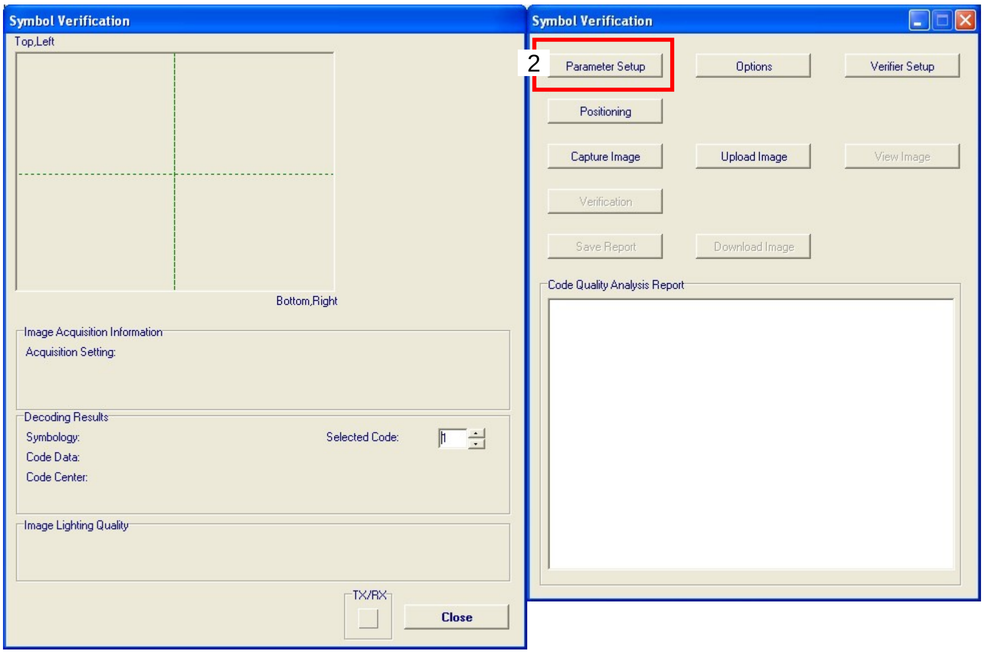
9. Close the Setup Wizard.

NOTE	*If your application has been configured using the VisiSet™ Setup Wizard, your reader is ready. If necessary you can use VisiSet™ for advanced reader configuration.*

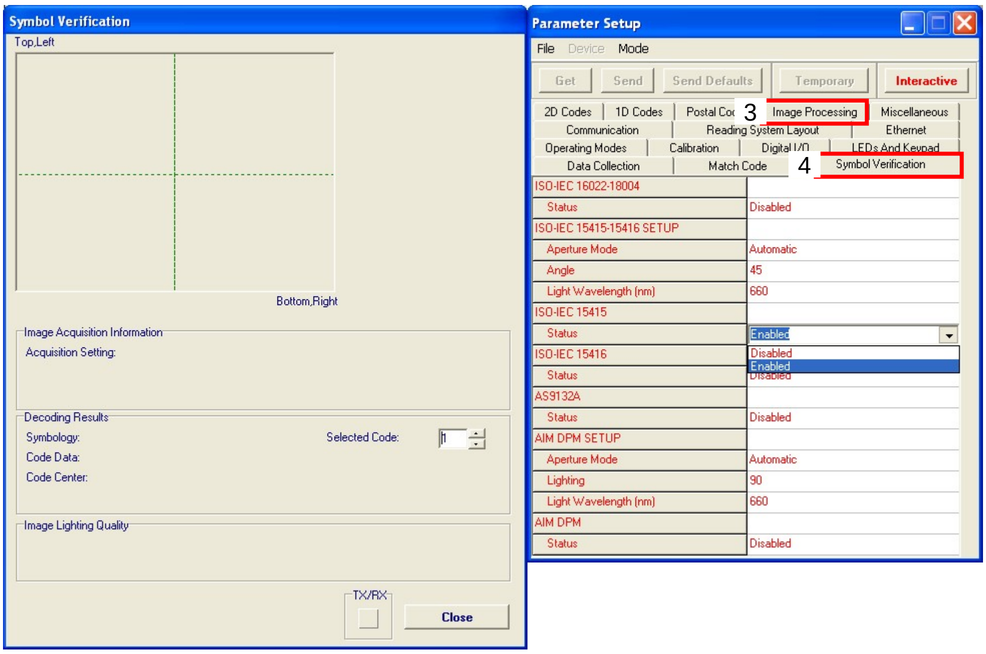
STEP 6 – SETTING VERIFICATION PARAMETERS

Before calibrating and validating your code quality verifier system, you need to set the parameters for the ISO/IEC 15415, AS9132A, AIM DPM or ISO/IEC 15416 verification process.

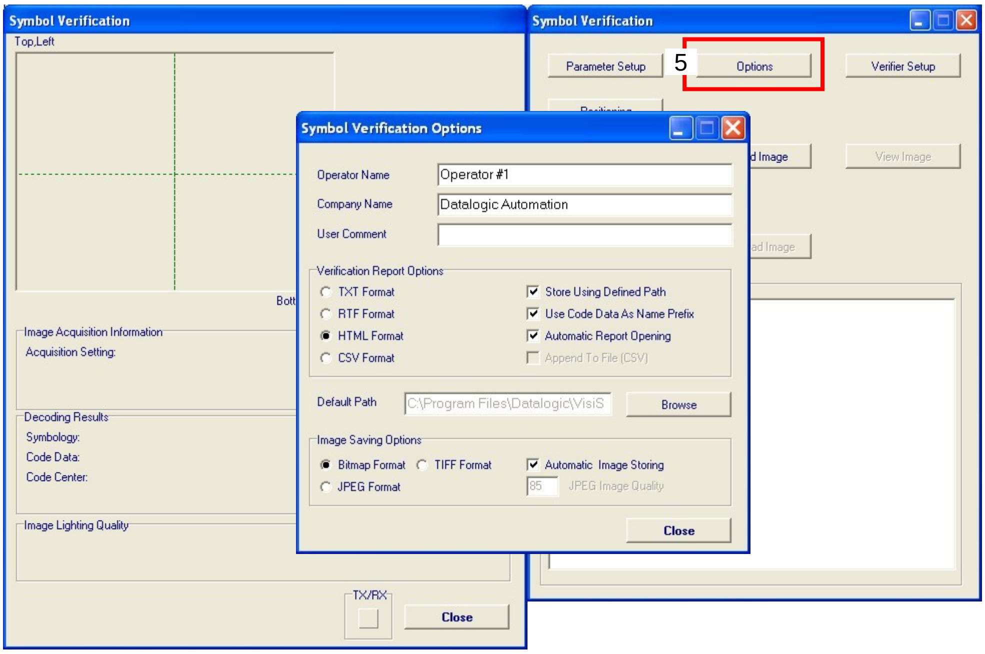
1. Select the “Symbol Verification” button from the Main menu.
2. Select the “Parameter Setup” button from the Symbol Verification window.



3. From the Parameter Setup > Image Processing folder set the Image Processing parameter to Advanced Code Setting.
4. From the Parameter Setup > Symbol Verification folder enable the Verification Standard and, if necessary, configure the related parameters as appropriate to your application. See paragraphs 5.4.1 to 5.4.4 for further details.



5. Select the “Options” button from the Symbol Verification window.



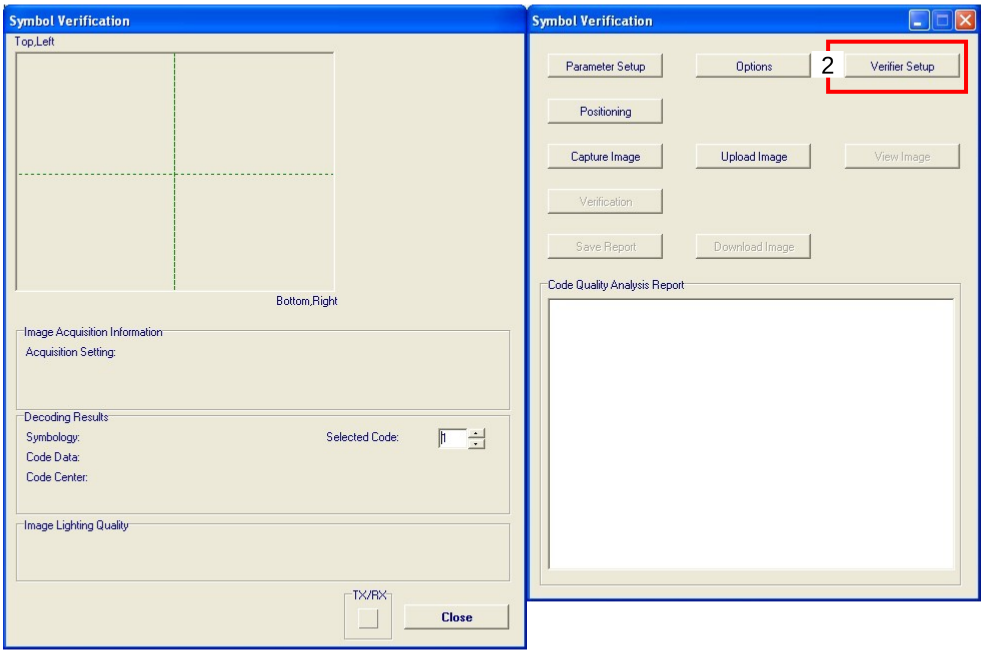
The Symbol Verification Options window allows setting the default verification report and image formats, the default saving path and other options automatically activated after the verification process.

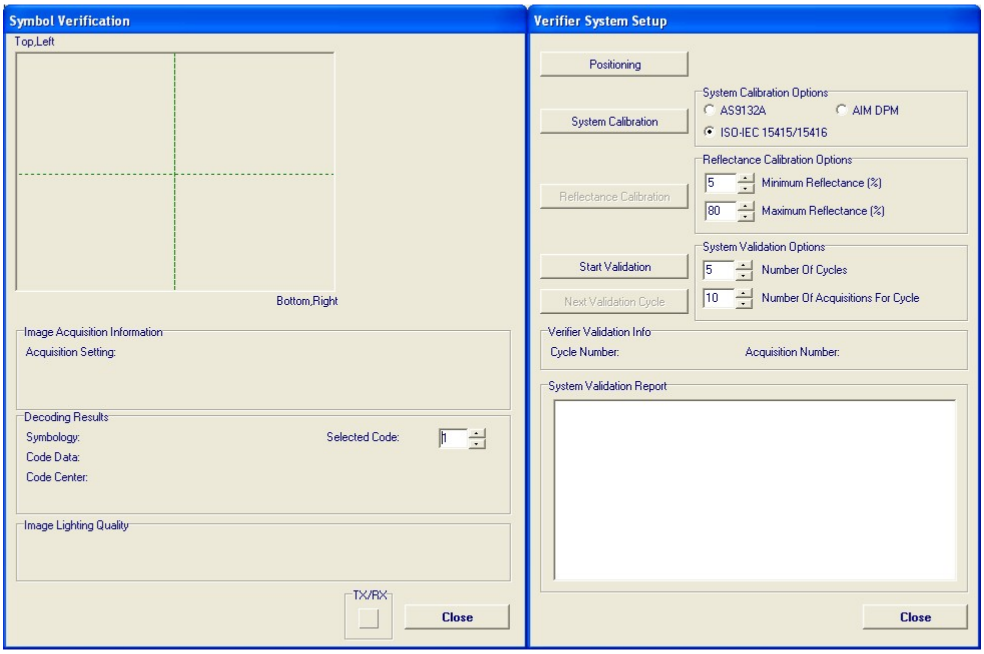
NOTE	*Since the ISO/IEC 15415-15416 system calibration procedure is performed on the Data Matrix symbol printed on the **ISO/IEC Calibration Chart** (see **Step 7**), if QR Code and 1D symbologies need to be verified they must be manually enabled from the Parameter Setup > 2D Codes or 1D Codes folder.*

STEP 7 – CALIBRATE VERIFIER SYSTEM

The Verifier Setup option allows system configuration and calibration in a few easy steps.

1. Select the “Symbol Verification” button from the Main menu.
2. Select the “Verifier Setup” button from the Symbol Verification window.



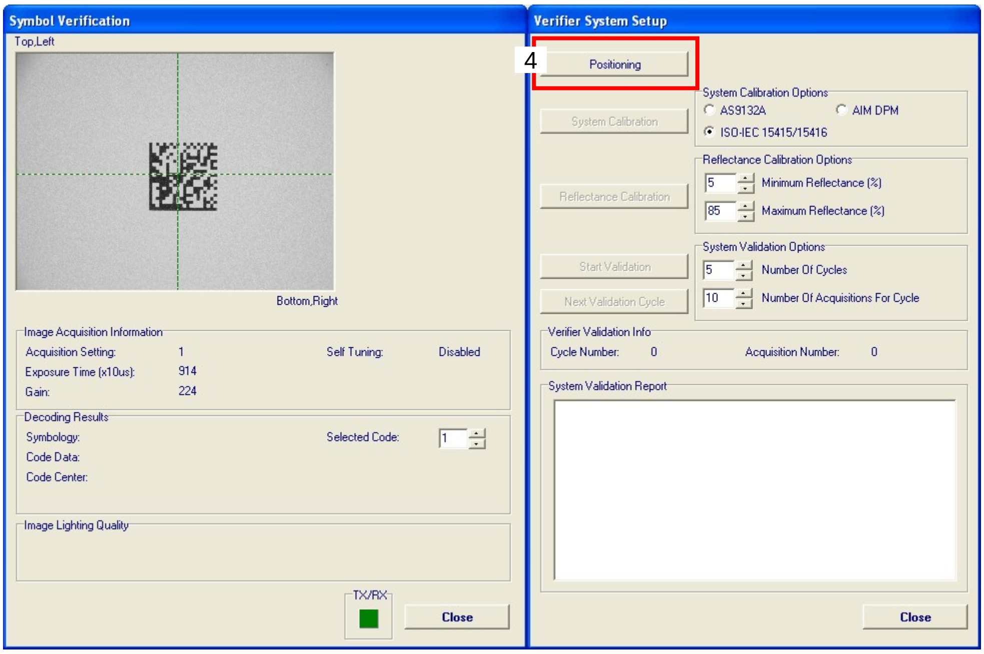


ISO/IEC 15415 AND ISO/IEC 15416 VERIFICATION

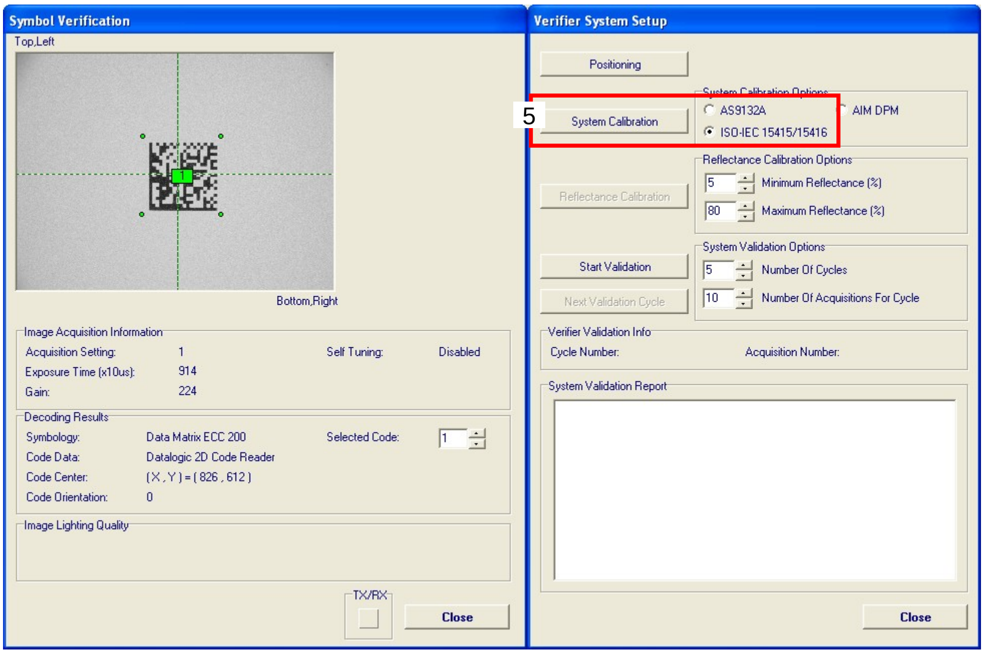
3. Place the Data Matrix 24mils **calibration symbol** printed on the **ISO/IEC Calibration Chart** in front of the reader. This reference chart also includes the minimum and maximum reflectance values for ISO/IEC Reflectance Calibration procedure.

4. Press the “Positioning” button. The reader continuously acquires images and gives visual feedback in the view image window. Move the code to the center of the field of view. The code must be aligned across the X-axis reference line at the center of the FOV. See figure above.

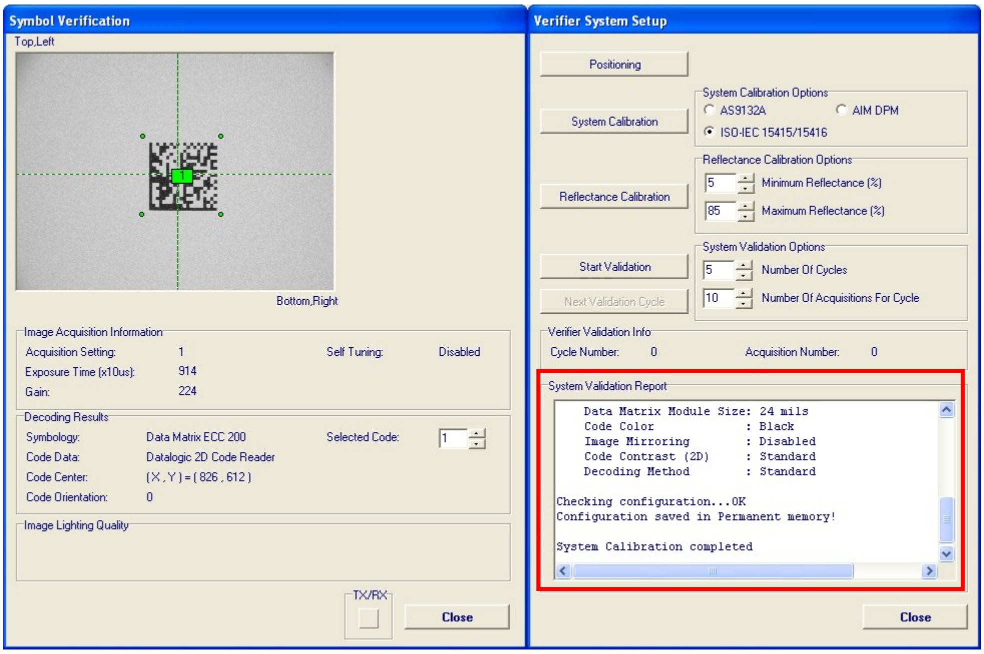
   Press the “Positioning” button again to stop positioning.



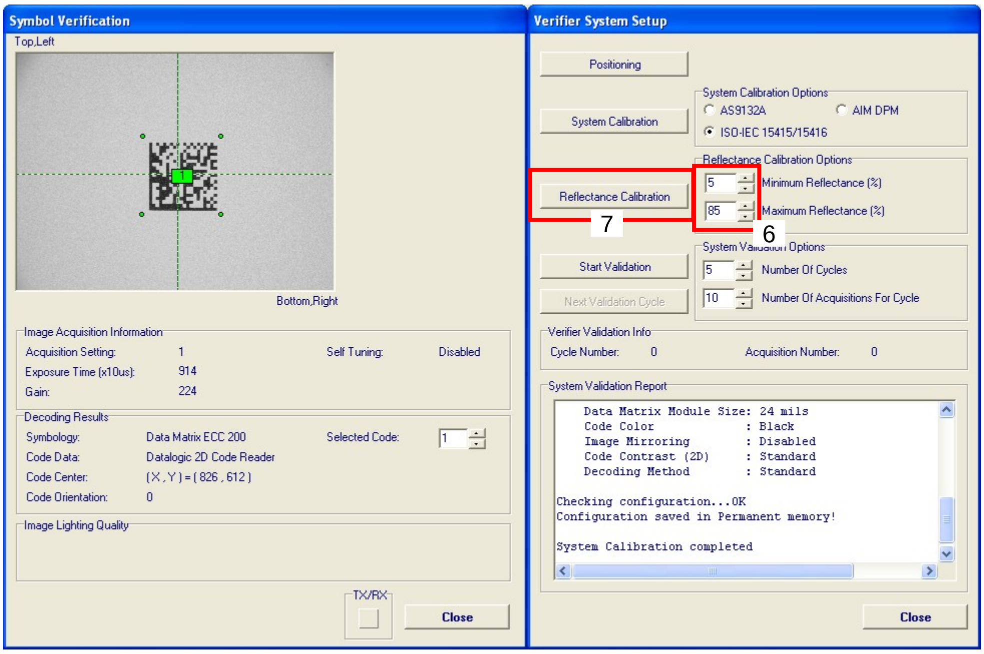
5. Select **ISO-IEC 15415/15416** option and press the "System Calibration" button. The reader flashes once acquiring the image and auto determines the best Exposure and Gain settings. Moreover, the reader auto determines the best Image Processing and Decoding parameters.



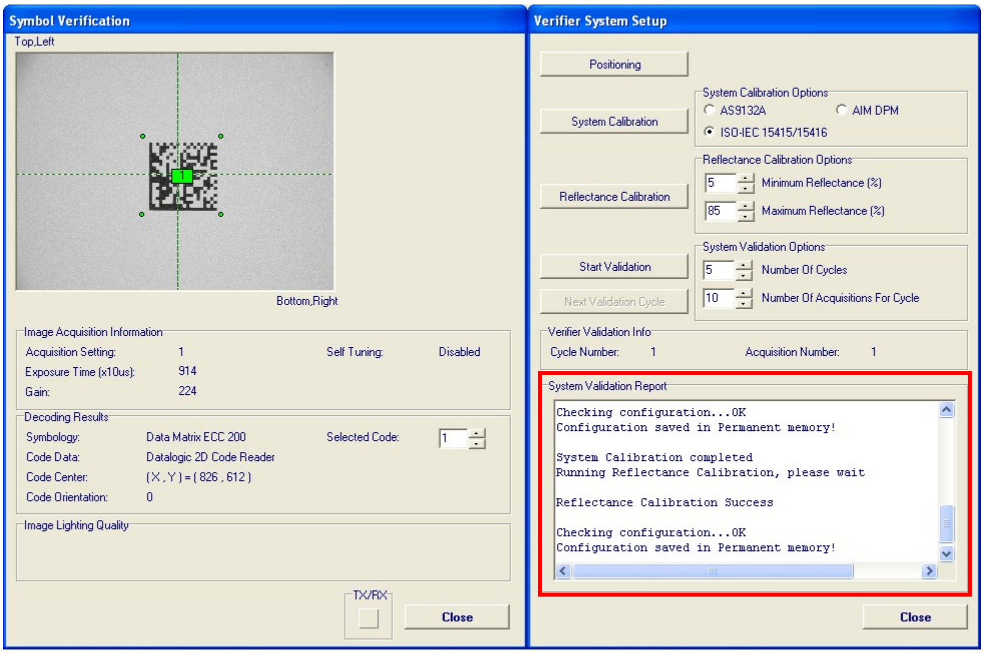
The System Validation Report section of the Verifier System Setup window shows the code type results and the calibration settings.



6. Use the spin boxes in the Reflectance Calibration Options section to set the Minimum and Maximum Reflectance (%) values provided in the **ISO/IEC Calibration Chart**.
7. Press the “Reflectance Calibration” button. The reader flashes several times and auto calibrates the best Exposure and Gain parameters. The System Validation Report section of the Verifier System Setup window shows the Reflectance Calibration results.



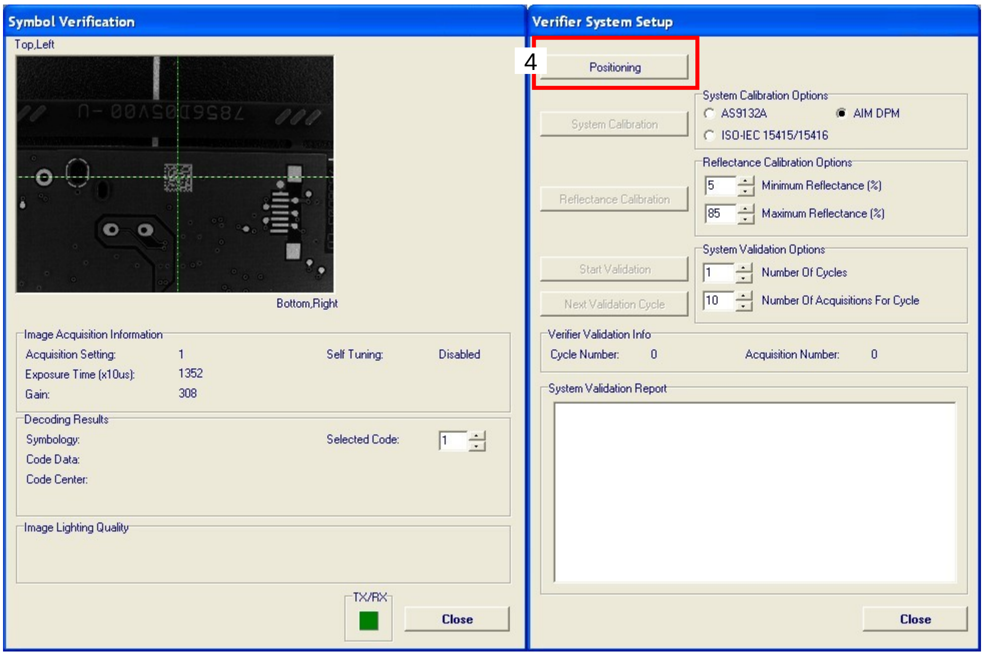
The System Validation Report section of the Verifier System Setup window shows the Reflectance Calibration results.



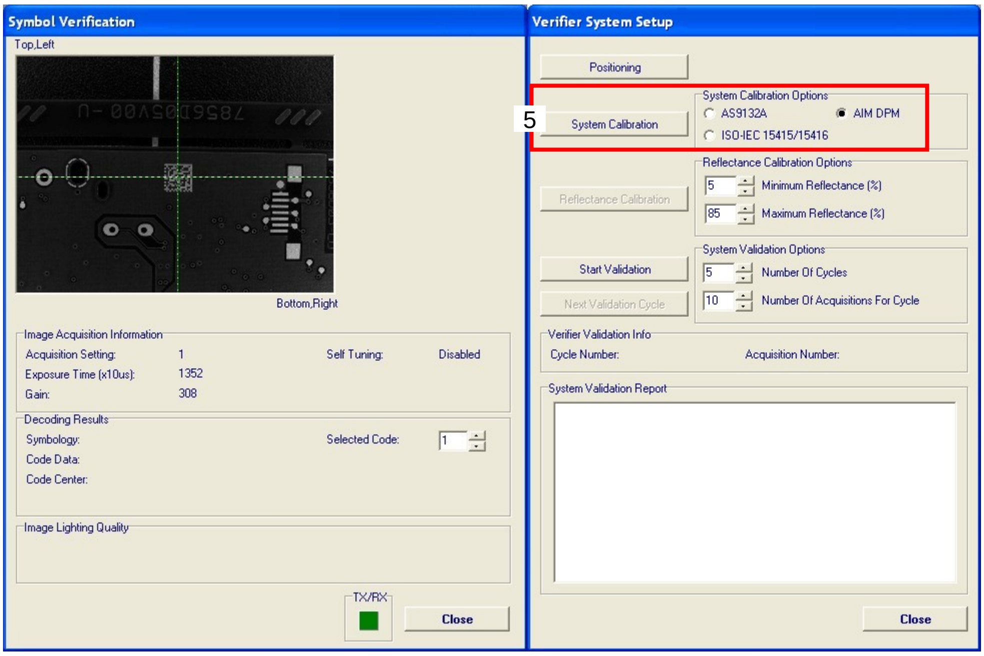
AS9132A AND AIM DPM VERIFICATION

3. Place a reference code in front of the reader. The reference code must match the symbology and the features (marking method, color, ..) of the codes to be verified in your application.
4. Press the "Positioning" button. The reader continuously acquires images and gives visual feedback in the view image window. Move the code to the center of the field of view. The code must be aligned across the X-axis reference line at the center of the FOV. See figure above.

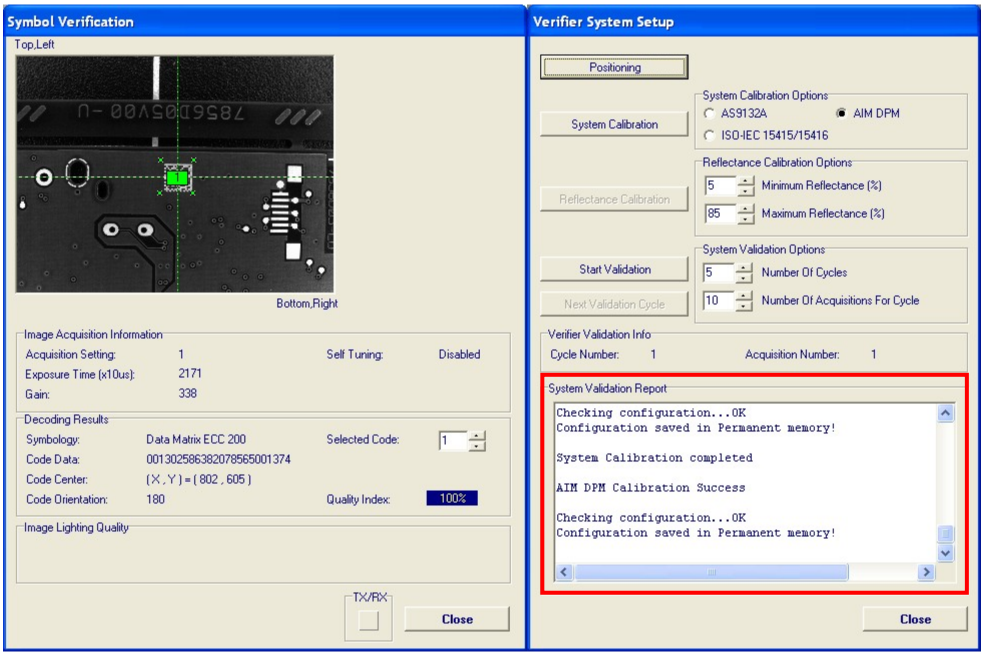
   Press the “Positioning” button again to stop positioning.



5. Select **AS9132A** or **AIM DPM** option and press the "System Calibration" button. The reader flashes once acquiring the image and auto determines the best Exposure and Gain settings. Moreover, the reader auto determines the best Image Processing and Decoding parameters.



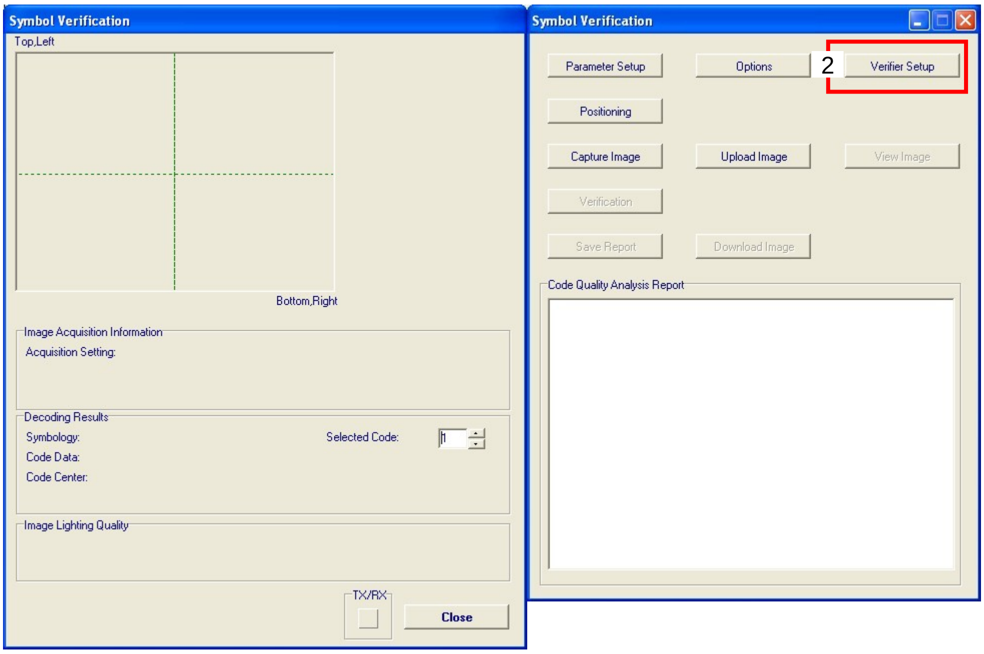
The System Validation Report section of the Verifier System Setup window shows the code type results and the calibration settings.

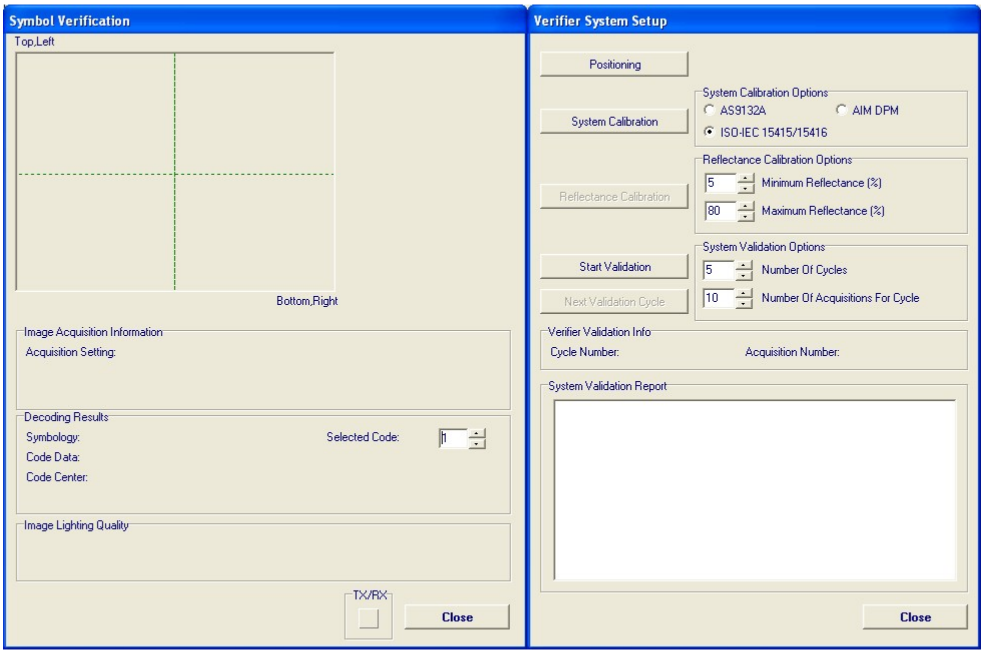


STEP 8 – VALIDATE VERIFIER SYSTEM

Once the verifier system is calibrated, the Verifier Setup option can be used to evaluate its measurement stability in a few easy steps.

1. Select the “Symbol Verification” button from the Main menu.
2. Select the “Verifier Setup” button from the Symbol Verification window.

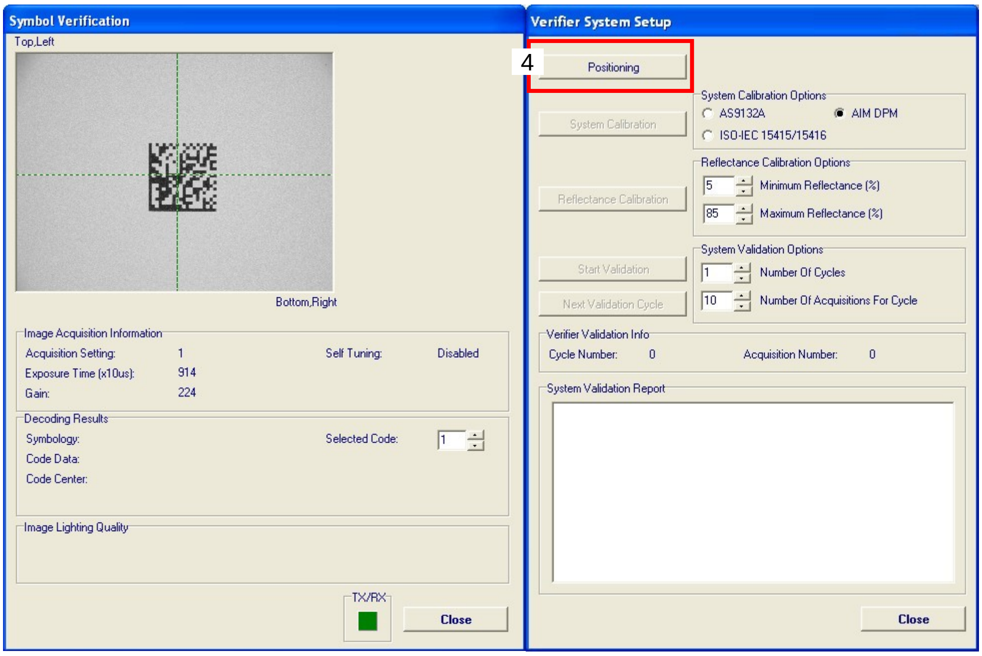




3. Place a reference code in front of the reader. The reference code must match the symbology and the features (marking method, color, ..) of the codes to be verified in your application.

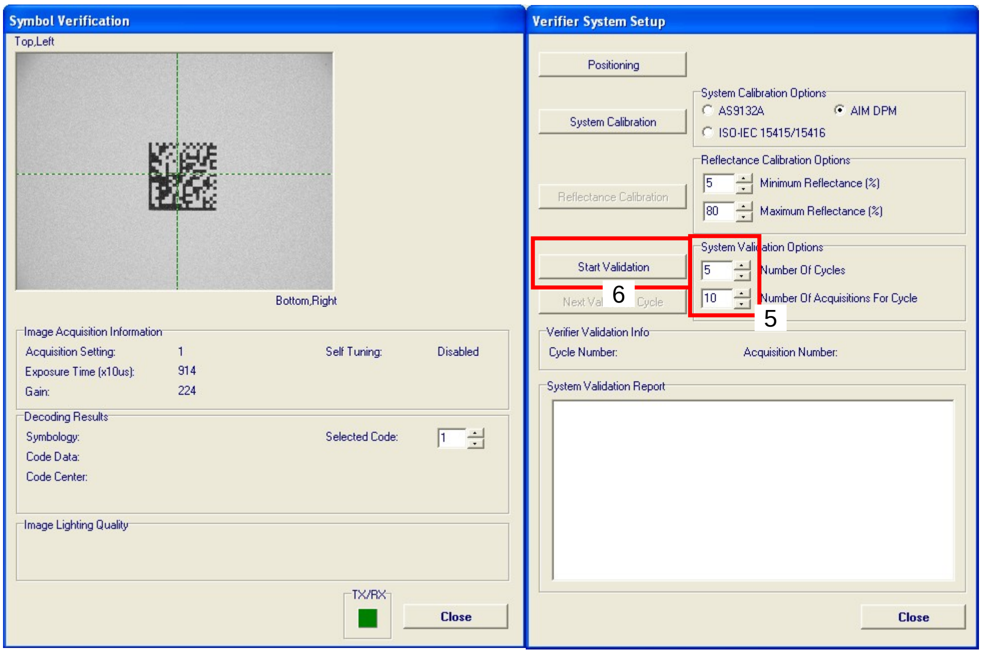
4. Press the "Positioning" button. The reader continuously acquires images and gives visual feedback in the view image window. Move the code to the center of the field of view. The code must be aligned across the X-axis reference line at the center of the FOV. See figure above.

   Press the “Positioning” button again to stop positioning.

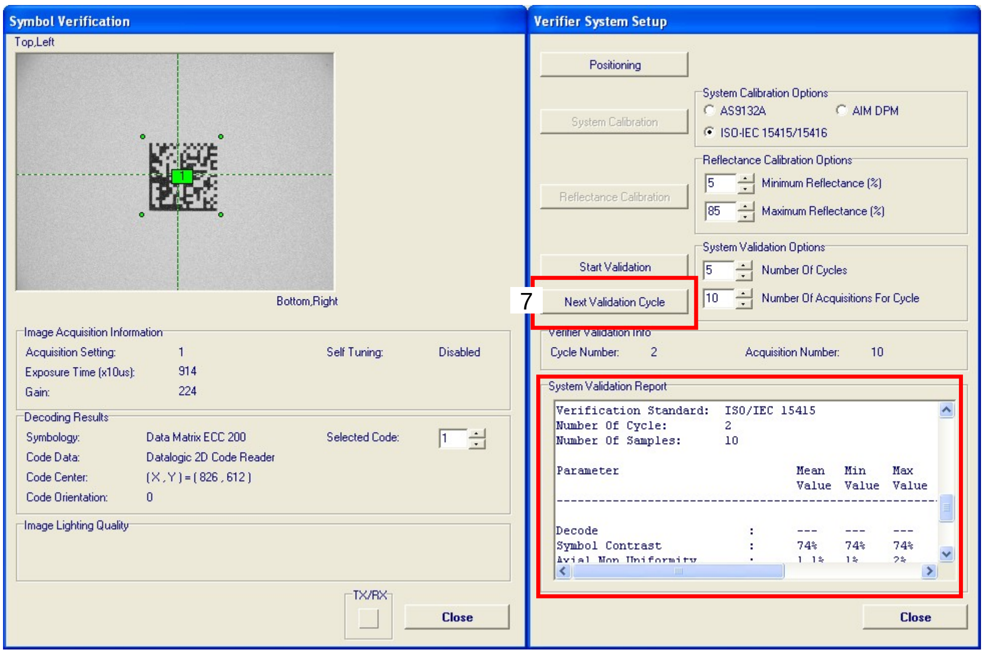


5. Use the spin boxes in the System Validation Options section to set the Number Of Cycles and the the Number Of Acquisitions For Cycle to be performed (suggested values are respectively “**5**” and “**10**”).

6. Press the “Start Validation” Button. The reader performs the specified number of image acquisitions and gives visual feedback in the System Validation Report section.



7. Repeat **step 4** for each of the following angles, rotating the symbol clockwise approximately 72°, 144°, 216° and 288° in order to achieve a full 360° rotation. After each rotation press the “Next Validation Cycle” button. The reader performs the specified number of image acquisitions and gives visual feedback in the System Validation Report section.



8. After the final rotation and trigger, the Verifier System Measurement Stability window related to the enabled Standard is shown (see Figure 8 and Figure 9).

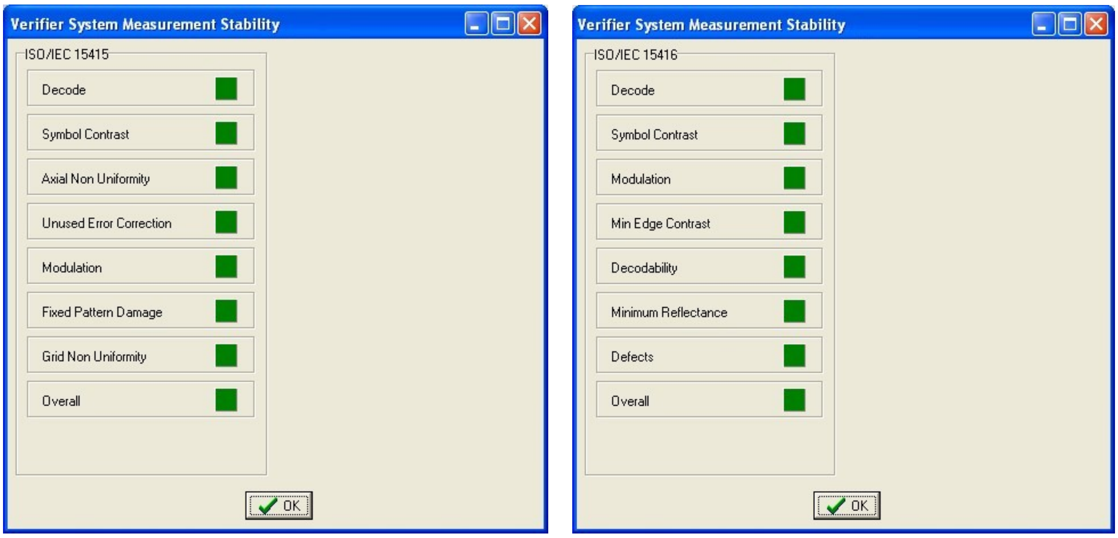


Figure 8 - ISO/IEC 15415 And ISO/IEC 15416 Measurement Stability windows

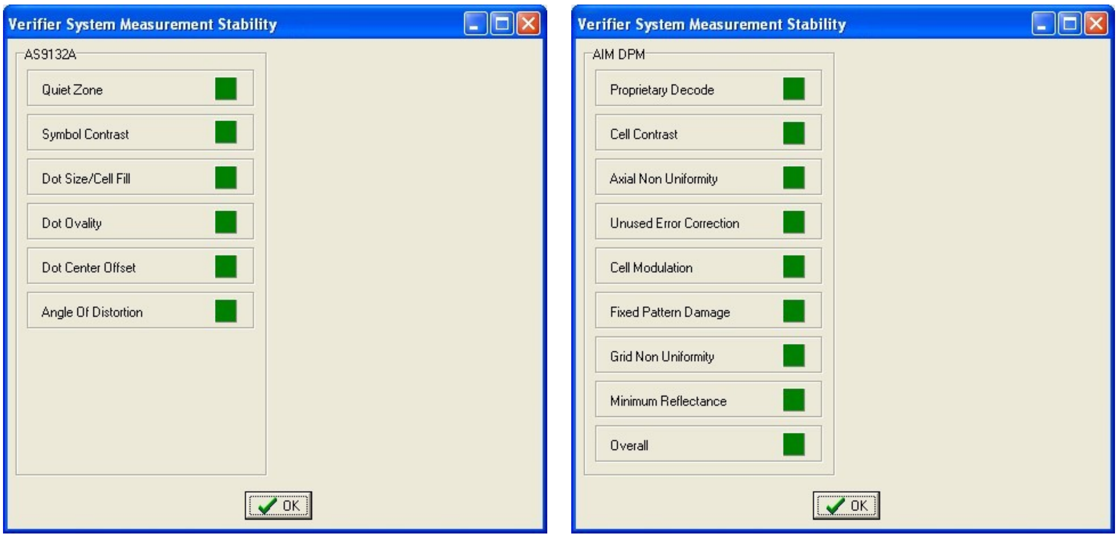
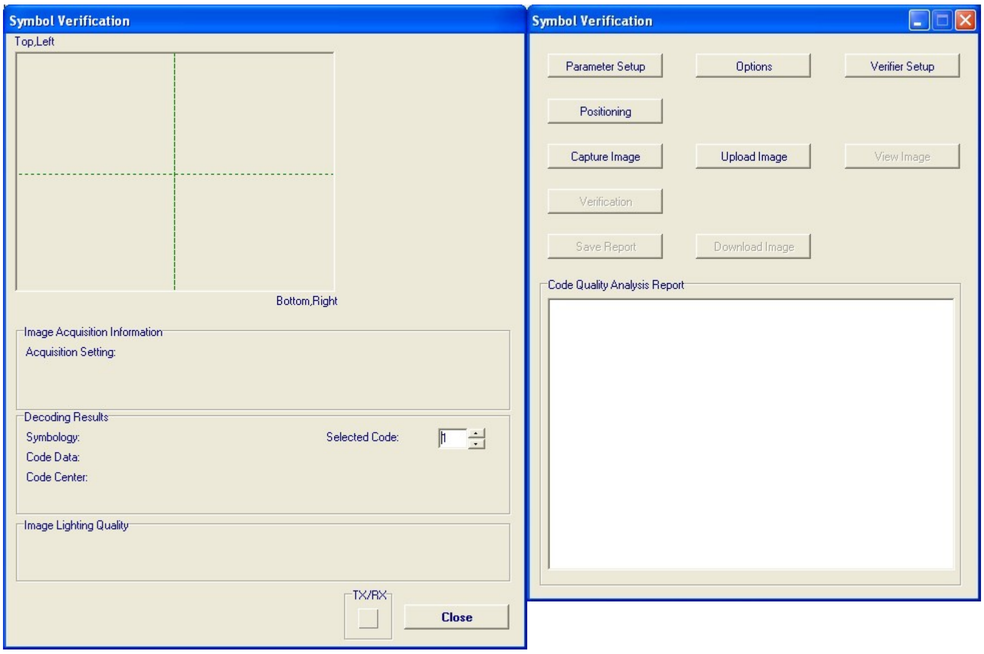


Figure 9 - AS9132A And AIM DPM Measurement Stability windows

STEP 9 – VERIFY SYMBOL

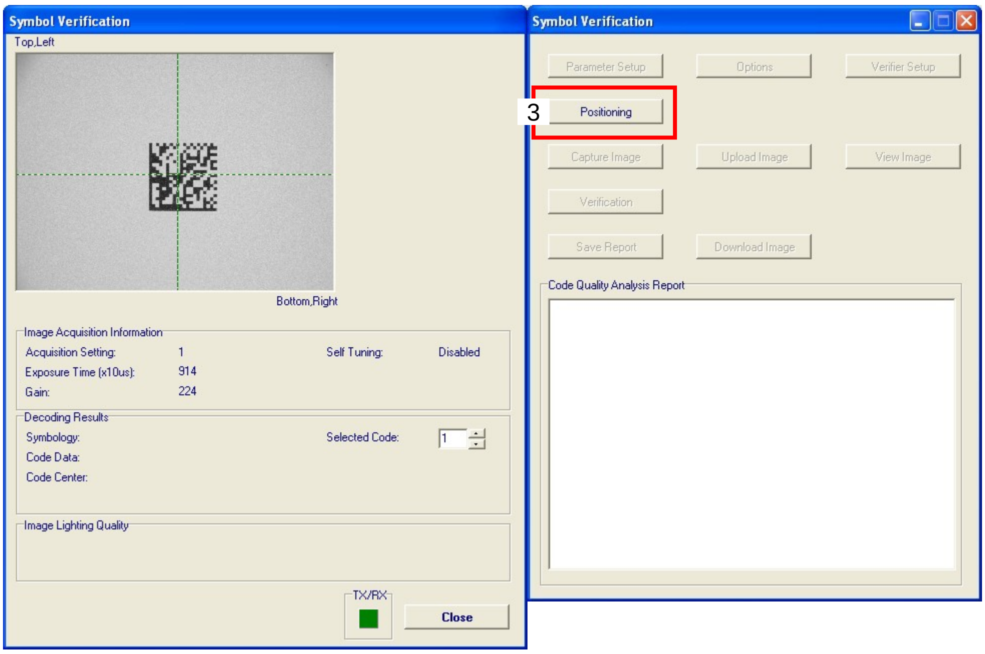
When the system is configured and calibrated, you can again open the Symbol Verification window and perform the selected verification procedure.

1. Select the “Symbol Verification” button from the Main menu.

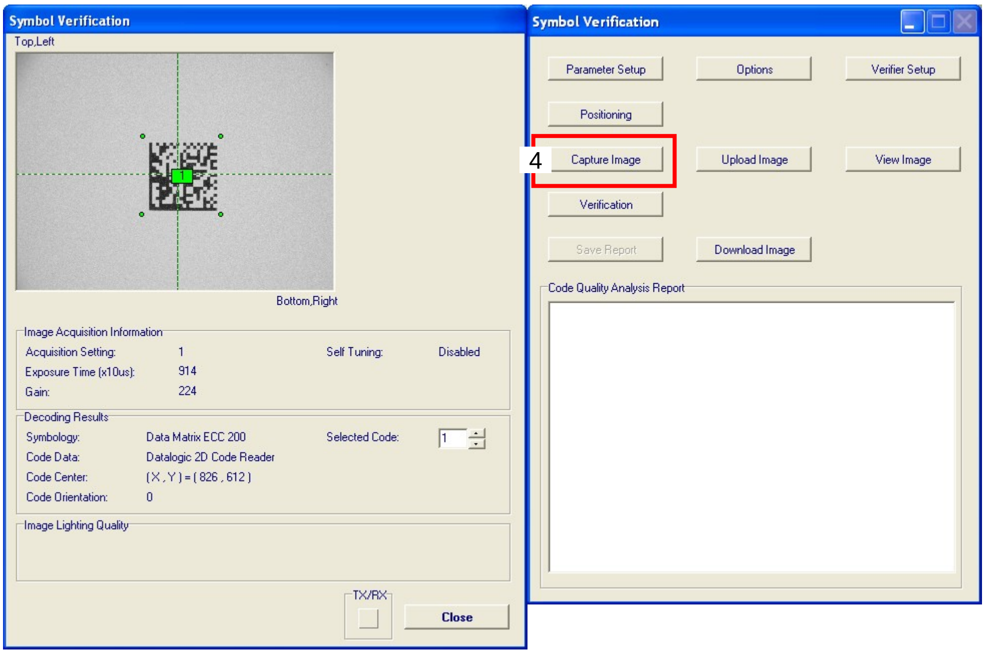


2. Place the code to be verified in front of the reader.
3. Press the "Positioning" button. The reader continuously acquires images and gives visual feedback in the view image window. Move the code to the center of the field of view. The code must be aligned across the X-axis reference line at the center of the FOV. See figure above.

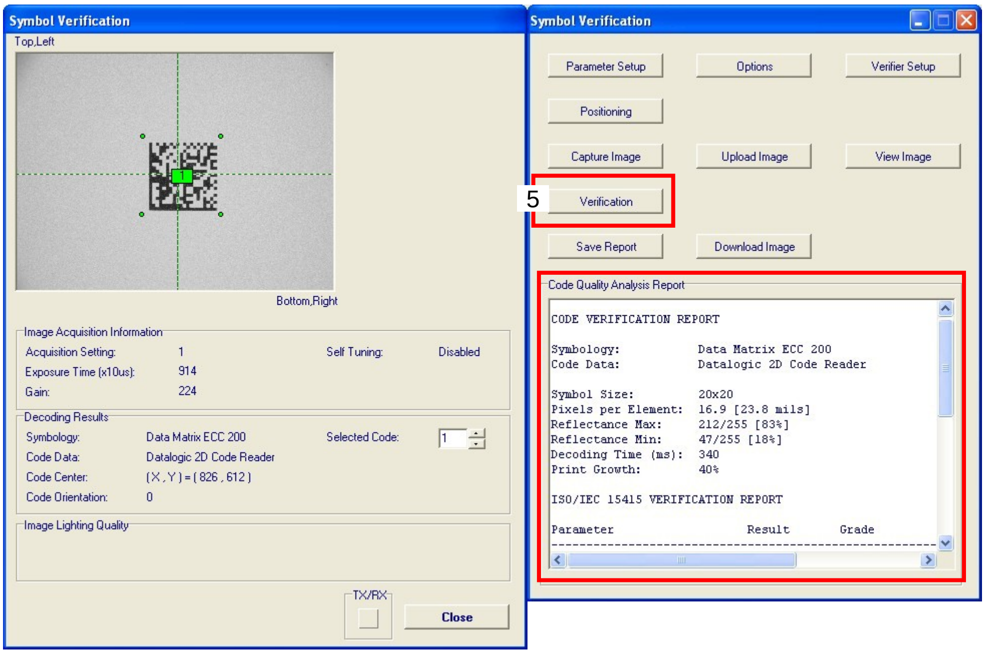
   Press the “Positioning” button again to stop positioning.



4. Press the “Capture Image” button. The reader flashes once to acquire the image and gives visual feedback in the view image window. If necessary, press the “View Image” button to visualize the full resolution image in a separated window.



5. Press the “Verification” button. The reader processes the image and displays verification results in the Code Quality Analysis Report section.



STEP 10 – SAVE VERIFICATION REPORT

The Symbol Verification window allows to generate and save a report containing your verification results.

1. Press the “Save Report” button. The reader generates and saves the verification report as an HTML, RTF, TXT or CSV file according to the settings configured in the Symbol Verification Options window (see **Step 6**).

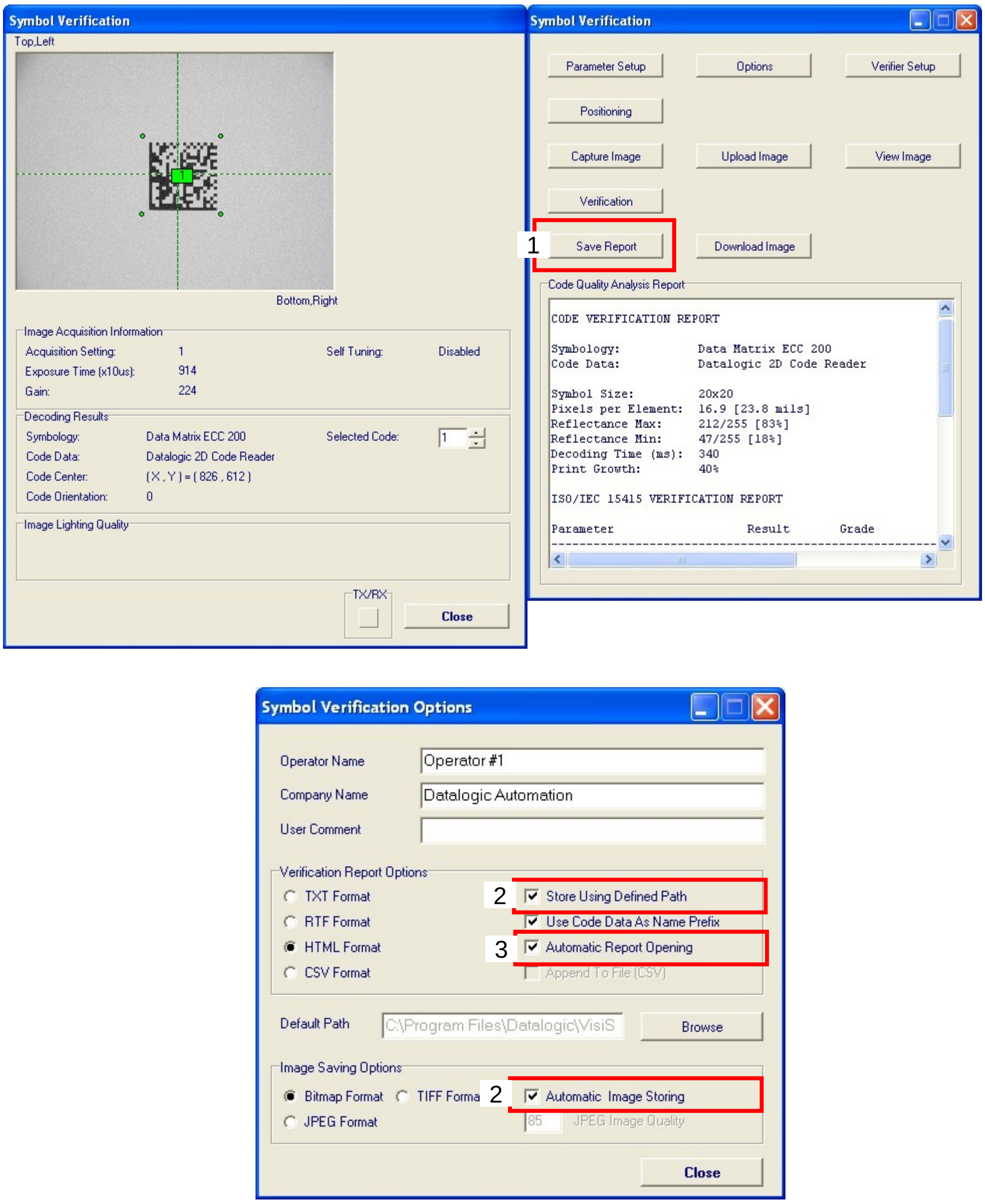


Figure 10 - Symbol Verification Options window

2. If the “Store Using Defined Path” option is disabled, select where the verification report must be stored and the file name in the Save As window. Once you have pressed the “Save” button the reader starts to transfer the report to the selected location. If the “Automatic Image Storing” option is enabled, the acquired image will automatically be transferred to the same location.

3. If the “Automatic Report Opening” option is enabled, the verification report is automatically opened in the chosen format.

CODE VERIFICATION REPORT

Symbology:	Data Matrix ECC 200
Code Data:	0013025863820785650013 74

Code data and symbology

Symbol Size:	16x16
Pixels per Element:	8.7 [11.1 mils]
Reflectance Max:	215/255 [84%]
Reflectance Min:	41/255 [16%]
Decoding Time (ms):	202
Print Growth:	20%
Mean Light:	199/255 [78%]

Non-graded parameters (Pixels per Element, Print Growth, ..)

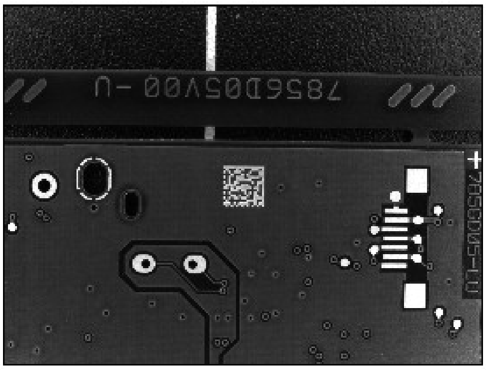
AIM DPM VERIFICATION REPORT

Aperture Mode:	Automatic
Light Wavelength:	660 nm
Angle:	90

Code quality analysis results and grades (Cell Contrast, Axial Non Uniformity, Unused Error Correction, ..)

Parameter	Result	Grade
Proprietary Decode	PASS	A (4)
Cell Contrast	75%	A (4)
Axial Non Uniformity	2%	A (4)
Unused Error Correction	100%	A (4)
Cell Modulation	---	A (4)
Fixed Pattern Damage	---	A (4)
Grid Non Uniformity	20%	A (4)
Minimum Reflectance	78%	A (4)
Overall	**4.0**	**DPM4.0/09/660/90 [A]**

Symbol Image (scaled 328x248)



Acquired code image

Report Created On:	Tue Feb 26 15:46:45 2008
Report Saved In:	C:\Program Files\Datalogic\VisiSet2 \001302586382078565001374_2008Feb26_154645.html
Image Source:	Captured Image Saved In: C:\Program Files\Datalogic\VisiSet2 \001302586382078565001374_2008Feb26_154645.html.bmp
Firmware Version:	Standard Application Program for Matrix Family Rel. 5.10
Configuration Tool:	rel. 5.10
Device:	Matrix 400
Model:	600-010

Reference Data (Reader firmware version and serial number, VisiSet™ configuration tool version, Device Model, Operator Name, Company Name, ..)

Figure 11 – Example AIM DPM Verification Report (HTML Format)

2 SYMBOL VERIFICATION OVERVIEW

2.1 INTRODUCTION

Matrix 410™ can be used to evaluate printed or marked symbols according to the ISO/IEC 15415, ISO/IEC 15416, AS9132 and AIM DPM standards.

The purpose of verification is to guarantee reliability of 2D and 1D codes according to the criteria summarized in the above mentioned symbol verification standards. Verification ensures that the automatic data collection system provides the following benefits: lower cost, more productivity, less reading errors.

ISO-IEC 16022
(Data Matrix - International Symbology Specification)
The ISO-IEC 16022 Standard specifies general requirements (data character encoding, error correction rules, decoding algorithm, etc.) for Data Matrix symbology.

ISO-IEC 18004
(QR Code - International Symbology Specification)
The ISO-IEC 18004 Standard specifies general requirements (data character encoding, error correction rules, decoding algorithm, etc.) for QR Code symbology.

ISO-IEC 15415
(2D Symbols - Print Quality Test Specification)
The ISO-IEC 15415 Standard specifies the methodologies for the measurement of specific attributes of two-dimensional bar code symbols, and methods for evaluating and grading these measurements and deriving an overall assessment of symbol quality.

ISO-IEC 15416
(Linear Symbols - Print Quality Test Specification)
The ISO-IEC 15416 Standard specifies the methodologies for the measurement of specific attributes of linear bar code symbols, and methods for evaluating and grading these measurements and deriving an overall assessment of symbol quality.

AIM DPM
(Direct Part Mark Quality Guideline)
The AIM DPM Quality Guideline is applicable to the symbol quality assessment of direct parts marking performed in using two-dimensional bar code symbols. It defines modifications to the measurement and grading of several symbol quality parameters.

The marking processes covered by this guideline are as follows: Dot Peening, Ink Jet, Laser Etching and Electro-Chemical Etching.

AS9132A
(Data Matrix Quality Requirements for Parts Marking)
This SAE Aerospace Standard (AS) defines uniform Quality and Technical requirements relative to direct parts marking performed in using Data Matrix symbology.

The marking processes covered by this standard are as follows: Dot Peening, Ink Jet, Laser Etching and Electro-Chemical Etching.

2D CODES PARAMETERS OVERVIEW

	ISO/IEC 16022-18004	ISO/IEC 15415	AIM DPM	AS9132A
Angle Of Distortion				✓
Axial Non Uniformity	✓	✓	✓	
Cell Contrast			✓	
Cell Modulation			✓	
Decode		✓	✓	
Dot Center Offset				✓
Dot Ovality				✓
Dot Size / Cell Fill				✓
Fixed Pattern Damage		✓	✓	
Grid Non Uniformity		✓	✓	
Minimum Reflectance			✓	
Modulation		✓		
Print Growth	✓	Non Graded	Non Graded	
Quiet Zone				✓
Symbol Contrast	✓	✓		✓
Unused Error Correction	✓	✓	✓	

2.2 ISO/IEC 15415 2D STANDARD

The ISO-IEC 15415 Standard specifies the methodologies for the measurement of specific attributes of two-dimensional bar code symbols, and methods for evaluating and grading these measurements and deriving an overall assessment of symbol quality.

Each quality parameter shall be measured and a grade on a descending scale of integers from 4 to 0 shall be allocated to it. The grade 4 represents the highest quality, while the grade 0 represents failure.

SCAN GRADE

The scan grade is the lowest grade achieved for the following seven parameters:

- Decode
- Symbol Contrast (SC)
- Modulation (MOD)
- Fixed Pattern Damage
- Axial Non-Uniformity (ANU)
- Grid Non-Uniformity (GNU)
- Unused Error Correction (UEC)

OVERALL SYMBOL GRADE

The (Overall) Symbol Grade is only meaningful if it is expressed in conjunction with the measurement wavelength and aperture used. It should be shown in the format:

Grade / Aperture / Wavelength [/ Angle]

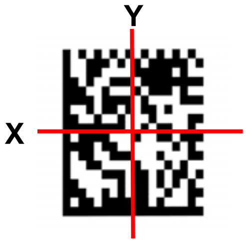
Where:

- “Grade” is the overall symbol grade (i.e. the the arithmetic mean of the individual Scan Grades for a number of tested images of the symbol).
- “Aperture” is the aperture reference number or the diameter in thousandths of an inch (to the nearest thousandth) of the synthetized aperture.
- “Wavelength” is the peak light wavelength in nanometres.
- “Angle” is the angle of incidence of the illumination relative to the plane of the symbol of the illumination (if 45° it is omitted).

GRADED PARAMETERS

Axial Non-Uniformity (ANU)

Measures and grades the squareness of all modules in the direction of each of the symbol's major axes (X-axis and Y-axis) by applying the decode algorithm to the binarized image.

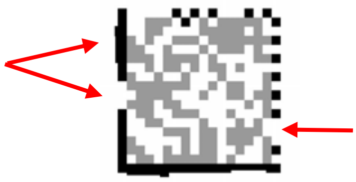


Decode

This parameter tests, on a Pass/Fail basis, whether the symbol has all its features sufficiently correct. If the image cannot be decoded using the symbology reference decode algorithm, then it shall receive the failing grade 0. Otherwise, it shall receive the grade 4.

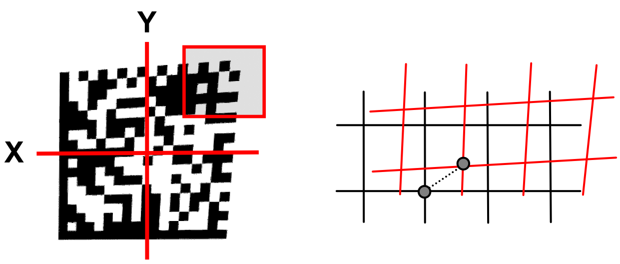
Fixed Pattern Damage (FPD)

This parameter tests that damage to the Finder Pattern, Quiet Zone, Clock and other fixed patterns in a symbol does not reduce unacceptably the ability of the reference decode algorithm to locate and identify the symbol within the field of view, by inverting the apparent state of one or more modules from Light to Dark or vice versa.
The particular patterns to be considered, and the amounts of damage corresponding to the various grade thresholds, require to be specified independently for the Symbology concerned.



Grid Non-Uniformity (GNU)

Measures and grades the largest vector deviation of the grid intersections, determined by the reference decode algorithm from the binarized image of a given symbol, from their "ideal" theoretical position. Assuming a grid on which the ideal angle of intersection is 90°, any angle deviation from 90° constitutes Grid Non-Uniformity.



Modulation (MOD)

Modulation is a measure of the uniformity of reflectance of the dark and light modules respectively. Some printing/background factors may reduce the apparent margin between the reflectance of a module and the Global Threshold.

Symbol Contrast (SC)

ymbol Contrast tests that the two reflective states in the symbol, namely Light and Dark, are sufficiently distinct within the symbol.

Unused Error Correction (UEC)

This parameter tests and grade the extent to which regional or spot damage in the symbol has eroded the information redundancy margin that error correction provides. 100% Unused Error Correction Capacity is the ideal condition.

NON GRADED PARAMETERS

Print Growth

Measures the deviation of actual elements dimension from the expected element dimension due to printing problems (i.e. overprint or underprint).

Underprinting Overprinting

2.3 AS9132 2D STANDARD

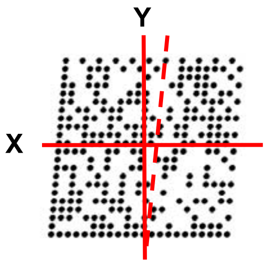
This SAE Aerospace Standard (AS) defines uniform Quality and Technical requirements relative to direct parts marking performed in using Data Matrix symbology. The marking processes covered by this standard are as follows: Dot Peening, Ink Jet, Laser Etching and Electro-Chemical Etching.

AS9132 measures and tests various properties like angle of distortion, dot size fill, dot position and dot ovality on a Pass/Fail basis. When using the AS9132 metrics, each module is analyzed and graded as “acceptable” (Pass) or “failure” (Fail).

GRADED PARAMETERS

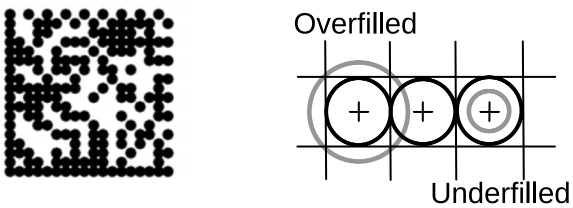
Angle Of Distortion

Angle of distortion measures the angular deviation from 90 degrees axes between rows and columns of the symbol.
Acceptable value: lower than ±7 degrees.



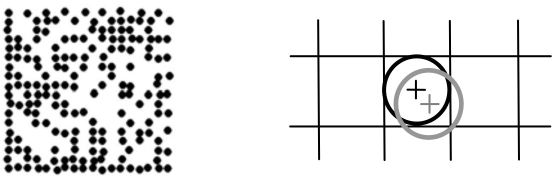
Dot Size / Cell Fill

Measures and compares the actual dot or cell size to the nominal cell size. No more than 2% of the elements should be outside this limit. It is calculated according to the specified module shape (circular or square).
Acceptable value: 60% to 105%.



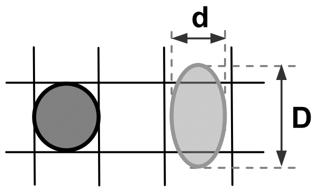
Dot Center Offset

Measures and compares the actual dot position to the nominal cell position. All elements should respect this limit. It is calculated only for circular module shape.
Acceptable value: 0 to 20%.



Dot Ovality

Evaluate the ovality of each dot by measuring the difference between its height (D) and width (d) expressed as percentage differences from the nominal circle values. It is calculated only for circular module shape.
Acceptable value: < = 20%.



Quiet Zone

Measures the Quiet Zone (margin) around the symbol. It shall be equal to or greater than 1 module size.

Symbol Contrast

Symbol Contrast measures the difference between light and dark symbol elements, and between the Quiet Zone and the outer limit elements.
It is meaningful only for laser etching or electro chemical etching marking methods.

2.4 AIM DPM QUALITY GUIDELINE

The AIM DPM Quality Guideline is applicable to the symbol quality assessment of direct parts marking performed in using two-dimensional bar code symbols. It defines modifications to the measurement and grading of several symbol quality parameters.
The marking processes covered by this guideline are as follows: Dot Peening, Ink Jet, Laser Etching and Electro-Chemical Etching.

Each quality parameter shall be measured and a grade on a descending scale of integers from 4 to 0 shall be allocated to it. The grade 4 represents the highest quality, while the grade 0 represents failure.

LIGHTING ENVIRONMENTS

The defined lighting environments are denoted in the reported grade using the format defined in IEC/ISO 15415 using the angle specifier with a combination of numbers and letters as defined below.

- Diffuse Perpendicular (On-axis / Bright Field) (**90)**
  The symbol is uniformly illuminated with diffuse light incident at 90 degrees to the plane of the symbol. The angle specifier shall be 90 to denote this lighting environment.
- Diffuse Off-axis (**D**)
  A diffusely reflecting dome is illuminated from below so that the reflected light falls non-directionally on the part and does not cast defined shadows. This is commonly used for reading curved parts.
- Low angle One, Two or Four direction (**30S, 30T** or **30Q**)
  Light is aimed at the part at an angle of 30 degrees from one side, two sides or four sides. The light may be incident from any of the possible orientations with respect to the symbol. The lighting shall illuminate the entire symbol area with uniform energy.
- Medium Angle Four Direction (**45Q**)
  Light is aimed at the part at an angle of 45 degrees from four sides. The light may be incident from any of the four possible orientations with respect to the symbol The lighting shall illuminate the entire symbol area with uniform energy.

SCAN GRADE

The scan grade is the lowest grade achieved for the following seven parameters:

- Decode
- Cell Contrast (CC)
- Cell Modulation (CM)
- Fixed Pattern Damage
- Axial Non-Uniformity (ANU)
- Grid Non-Uniformity (GNU)
- Minimum Reflectance (MR)
- Unused Error Correction (UEC)

OVERALL SYMBOL GRADE

The (Overall) Symbol Grade is only meaningful if it is expressed in conjunction with the measurement wavelength and aperture used. It should be shown in the format:

DPM Grade / Aperture / Wavelength [/ Angle Specifier]

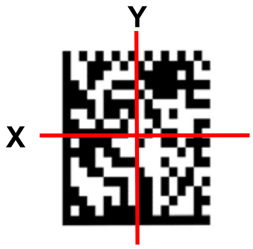
Where:

- "Grade" is the Overall Symbol Grade (i.e. the the arithmetic mean of the individual Scan Grades for a number of tested images of the symbol).
- "Aperture" is the diameter in thousandths of an inch (to the nearest thousandth) of the synthetized aperture used to obtain the grade for the symbol.
- "Wavelength" is the Peak Light Wavelength in nanometres.
- "Angle Specifier" is the lighting environment used to obtain the grade of the symbol (if 45Q no DPM processing is performed and it is omitted).

GRADED PARAMETERS

Axial Non-Uniformity (ANU)

Measures and grades the squareness of all modules in the direction of each of the symbol's major axes (X-axis and Y-axis) by applying the decode algorithm to the binarized image.

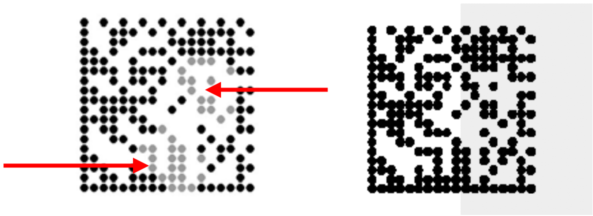


Cell Contrast (CC)

Measures and grades the difference between the means of brightest and darkest values of the symbol (instead of determining differences between the brightest and darkest values).

Cell Modulation (CM)

Cell modulation analyzes the grid center points within the data region to determine the reflectance uniformity of light and dark elements after considering the amount of error correction available in the code.

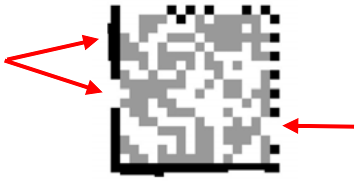


Decode

The Decode parameter tests, on a Pass/Fail basis, whether the symbol has all its features sufficiently correct o be readable. If the image cannot be decoded using the symbology reference decode algorithm, then it shall receive the failing grade 0. Otherwise, it shall receive the grade 4.

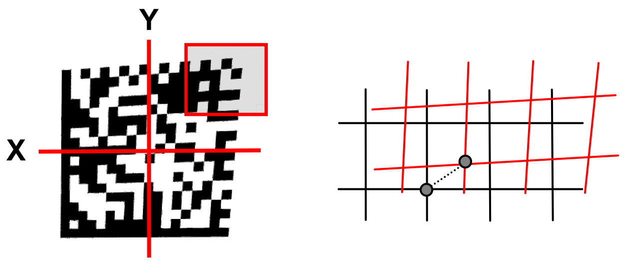
Fixed Pattern Damage (FPD)

This metric is similar to Cell Modulation, but it analyzes the finder pattern and clock pattern as well as the quiet zone around the code instead of the data region.



Grid Non-Uniformity (GNU)

Measures and grades the largest vector deviation of the grid intersections, determined by the reference decode algorithm from the binarized image of a given symbol, from their “ideal” theoretical position. Assuming a grid on which the ideal angle of intersection is 90°, any angle deviation from 90° constitutes Grid Non-Uniformity.



Minimum Reflectance (MR)

The image brightness is adjusted on a reference part, after which this calibrated value is compared with the reflectance of that part. Minimum Reflectance is the ratio of the parts reflectance to the calibrated reflectance.

Unused Error Correction (UEC)

This parameter tests and grade the extent to which regional or spot damage in the symbol has eroded the information redundancy margin that error correction provides.
100% Unused Error Correction Capacity is the ideal condition.

NON GRADED PARAMETERS

Print Growth

Measures the deviation of actual elements dimension from the expected element dimension due to printing problems (i.e. overprint or underprint).

Underprinting Overprinting

2.5 ISO/IEC 15416 1D STANDARD

The ISO-IEC 15416 Standard specifies the methodologies for the measurement of specific attributes of linear bar code symbols, and methods for evaluating and grading these measurements and deriving an overall assessment of symbol quality.

Bar code symbol quality assessment shall be based on an analysis of the Scan Reflectance profiles. The scan reflectance profile is a record of the Reflectance values measured on a single line across the entire width of the barcode.

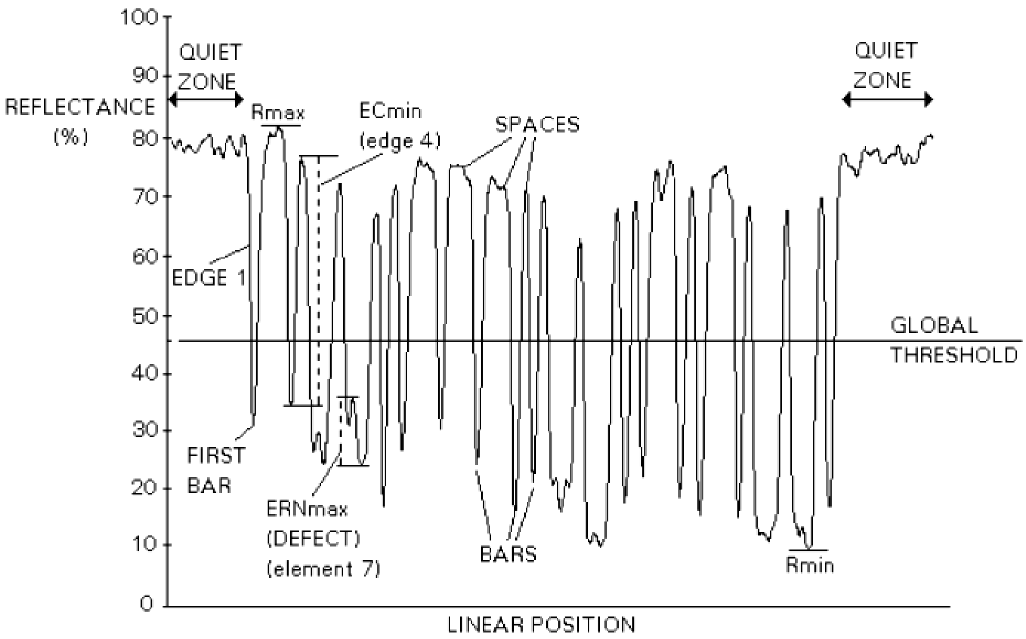


Figure 12 – Scan Reflectance Profile

Symbol Quality grading shall be used to derive a relative measure of symbol quality under the measurement conditions used. Each scan reflectance profile shall be analyzed and a grade on a descending scale of integers from 4 to 0 shall be allocated to each of the parameters evaluated

SCAN REFLECTANCE PROFILE GRADE

The Scan Reflectance Profile Grade shall be the lowest grade of the following:

- Decode
- Symbol Contrast (SC)
- Minimum Reflectance (Rmin)
- Minimum Edge Contrast (ECmin)
- Modulation (MOD)
- Defects
- Decodability (V)

OVERALL SYMBOL GRADE

The (Overall) Symbol Grade is only meaningful if it is expressed in conjunction with the measurement wavelength and aperture used. It should be shown in the format:

Grade / Aperture / Wavelength

Where:

- "Grade" is the overall symbol grade (i.e. the the arithmetic mean of the individual Scan Reflectance Profile Grades calculated on the requested number of scans to one decimal place).
- "Aperture" is the aperture reference number or the diameter in thousandths of an inch (to the nearest thousandth) of the synthetized aperture.
- "Wavelength" is the peak light wavelength in nanometres.

GRADED PARAMETERS

Decode
The symbology reference decode algorithm shall be used to decode the symbol using the element edges determined on the Scan Reflectance profile. This algorithm may be found in the symbology specification.

Decodability
The decodability of a bar code symbol is a measure of the accuracy of its production in relation to the appropriate reference decode algorithm.

Defects
Defects are irregularities found within elements and quiet zones, and are measured in terms of element reflectance non-uniformity.
Element reflectance non-uniformity within an individual element or quiet zone is the difference between the reflectance of the highest peak and the reflectance of the lowest valley.
Defect measurement is expressed as the ratio of the maximum element Reflectance Non-Uniformity (ERNmax) to Symbol Contrast.

Minimum Edge Contrast (EC)
Edge contrast is the difference between the Rs (Space Reflectance) and Rb (Bar Reflectance) of adjoining elements including quiet zones.
The lowest value of edge contrast found in the scan reflectance profile is the minimum edge contrast, ECmin.

Minimum Reflectance (Rmin)
Rmin is the lowest reflectance value in the scan reflectance profile. Rmin shall not be higher than 0,5 x Rmax. This parameter is intended to ensure that Rmin shall not be too high, especially when the value of Rmax is high.

Modulation (MOD)
Modulation is the ratio of the minimum edge contrast to Symbol Contrast. It can be considered as the quality of the Analog signal related to the printing contrast.

Symbol Contrast (SC)
Symbol contrast is the difference between the highest and lowest reflectance values in a scan reflectance profile.

3 READING FEATURES

3.1 OPTICAL ACCESSORY SELECTION

Referring to Figure 13 and the formula below, use the data in the following table to calculate the FOV for your application.

Model	Lens	Viewing Angle **Horizontal**	Viewing Angle **Vertical**	Viewing Angle **Diagonal**	**Min Focus Distance** mm
Matrix 410 400-0x0 (SXGA)	LNS-1109 9 mm	48.5°	39.5°	60°	**85**
	LNS-1112 12.5 mm	37°	30°	46.5°	**85**
	LNS-1116 16 mm	28.5°	23°	36°	**85**
	LNS-1125 25 mm	18.5°	15°	23.5°	**135**
	LNS-1135 35 mm	13°	10,5°	16.5°	**235**
	LNS-1150 50 mm	9°	7°	11.5°	**500**
Matrix 410 600-0x0 (UXGA)	LNS-1006 6 mm	59.5°	46.5°	71°	**85**
	LNS-1109 9 mm	40.5°	31°	49.5°	**85**
	LNS-1112 12.5 mm	31°	23.5°	38°	**85**
	LNS-1116 16 mm	24°	18°	30°	**85**
	LNS-1125 25 mm	15°	11.5°	19°	**135**
	LNS-1135 35 mm	11°	8.5°	13.5°	**235**
	LNS-1150 50 mm	7.5°	5.5°	9.5°	**500**

The viewing angle has a tolerance of ± 1° depending on the focus distance.

$$FOV_x = 2\left[(d + 35\text{ mm})\tan(\alpha_x/2)\right]$$

where:

FOV_x = horizontal, vertical or diagonal FOV
α_x = horizontal, vertical or diagonal viewing angles.
d = focus distance

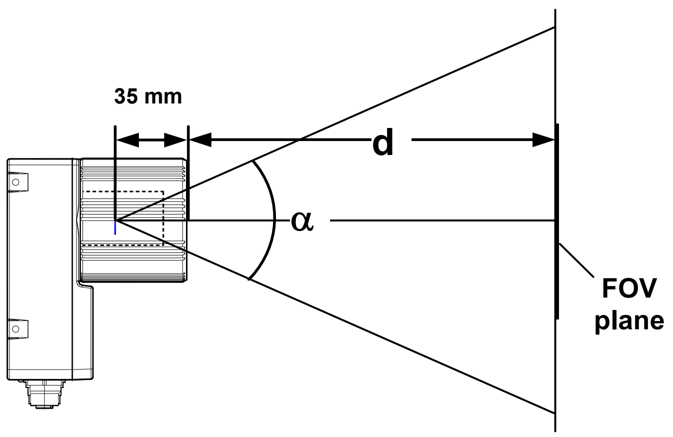


Figure 13 – Reading Distance References

Example:

The FOV for a **Matrix 410 600-0x0 base** using the **16 mm lens** at a **focus distance of 200 mm** is:

$$FOV_H = 2\ [(200\ mm + 35\ mm)\ \tan(24°/2)] = \mathbf{100\ mm}$$
$$FOV_V = 2\ [(200\ mm + 35\ mm)\ \tan(18°/2)] = \mathbf{74\ mm}$$

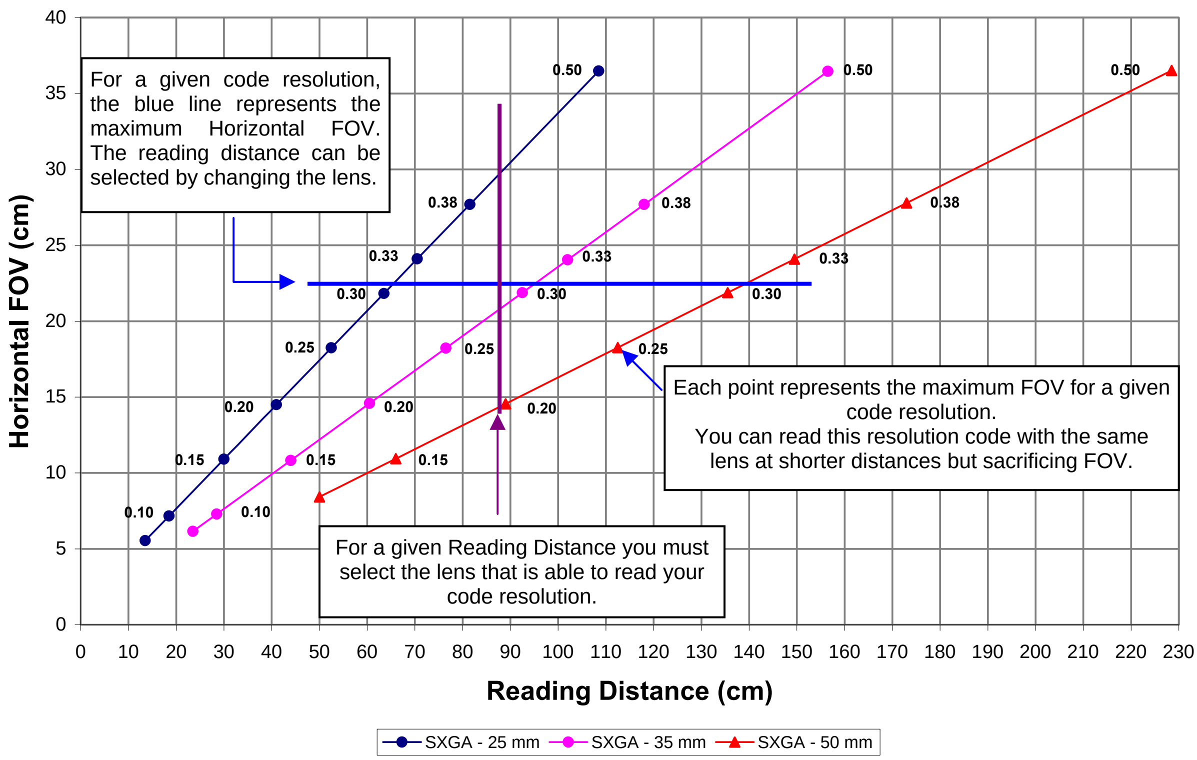
3.2 HORIZONTAL FOV VS. READING DISTANCE DIAGRAMS

The following graphs represent the Horizontal Field of View (FOV) and Reading Distance based on the combination of a certain sensor (Matrix 410™ base model) and the 16mm lens (recommended for symbol verification).

Each point represents the maximum achievable Field of View with the selected code resolution (in this point DOF is limited).

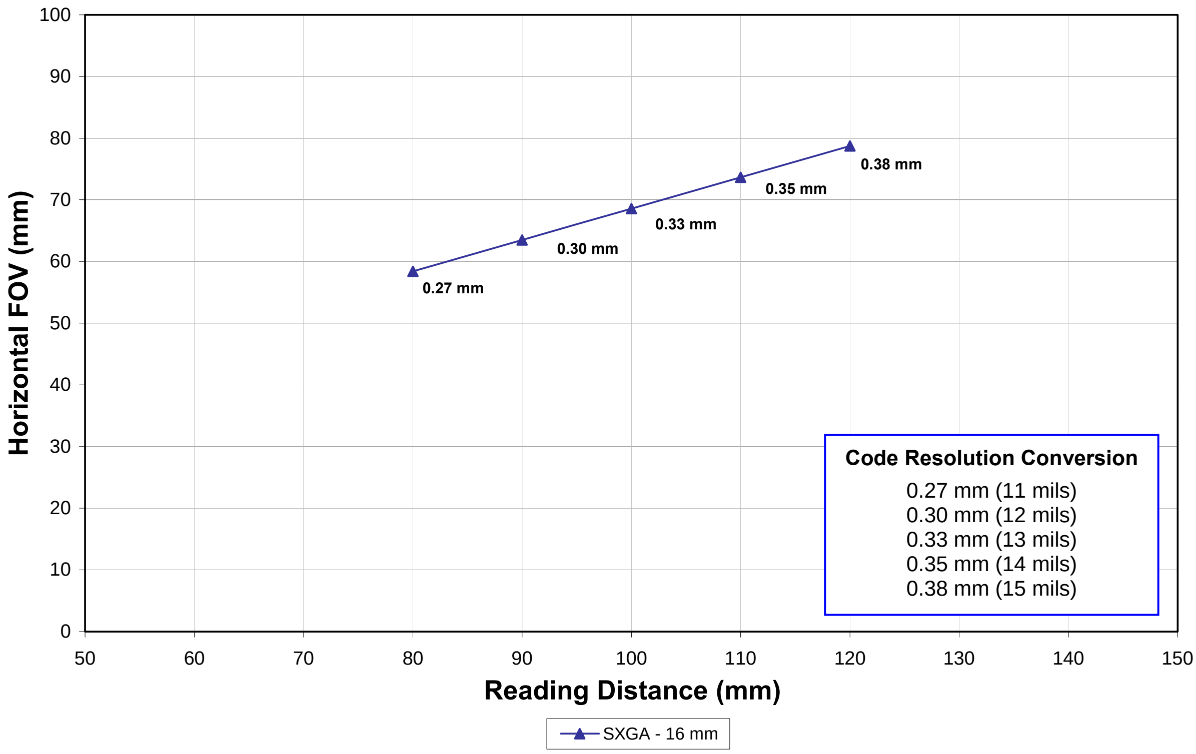
NOTE	*The following diagrams are given for typical performance at 25°C using high quality grade A symbols according to ISO/IEC 15416 (1D code) and ISO/IEC 15415 (2D code) print quality test specifications. Testing should be performed with actual application codes in order to maximize the application performance.*

3.2.1 How to Use the Diagrams

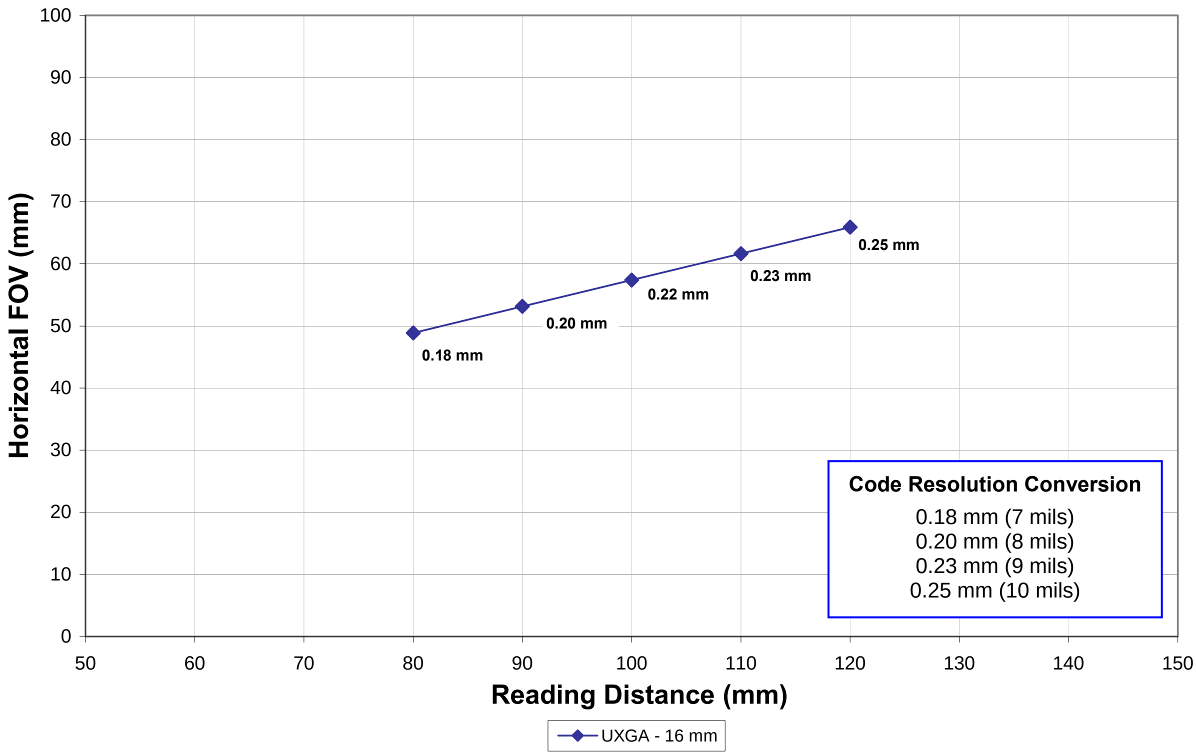


3.2.2 1D (Linear) Codes

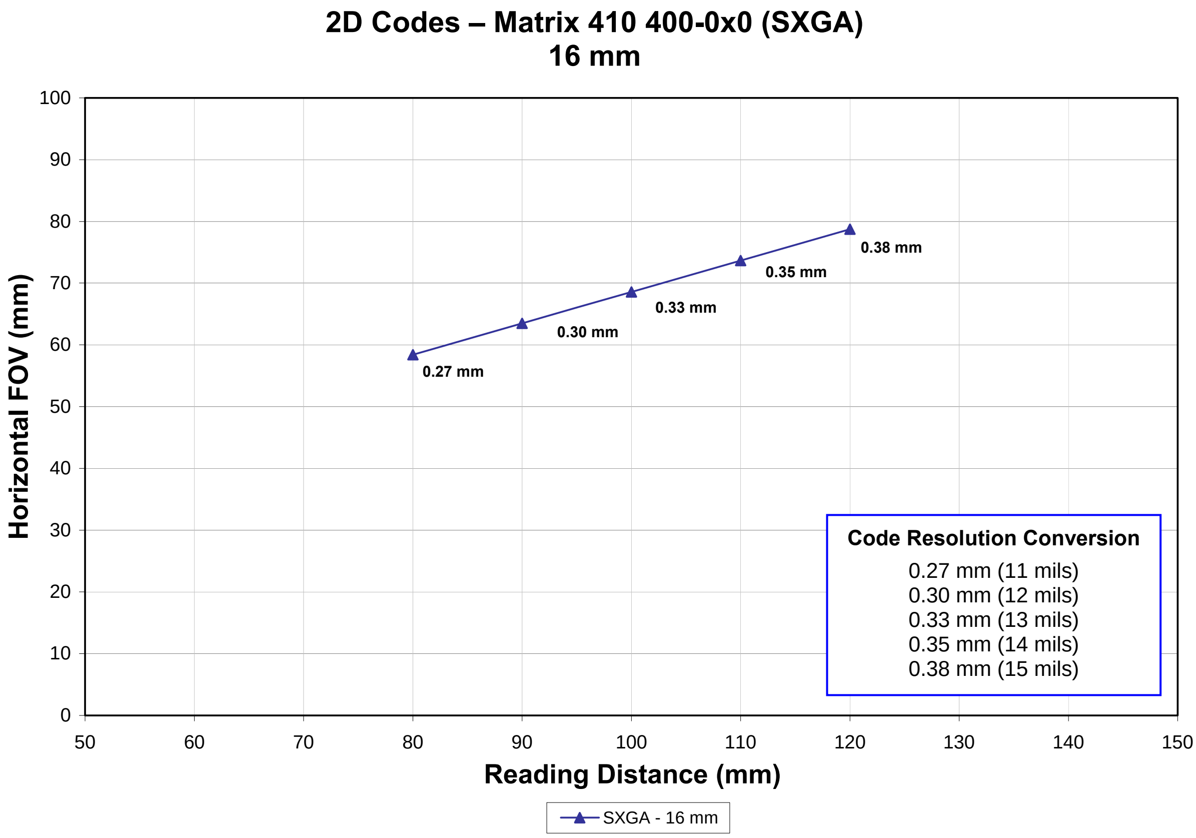
1D Codes – Matrix 410 400-0x0 (SXGA)
16 mm

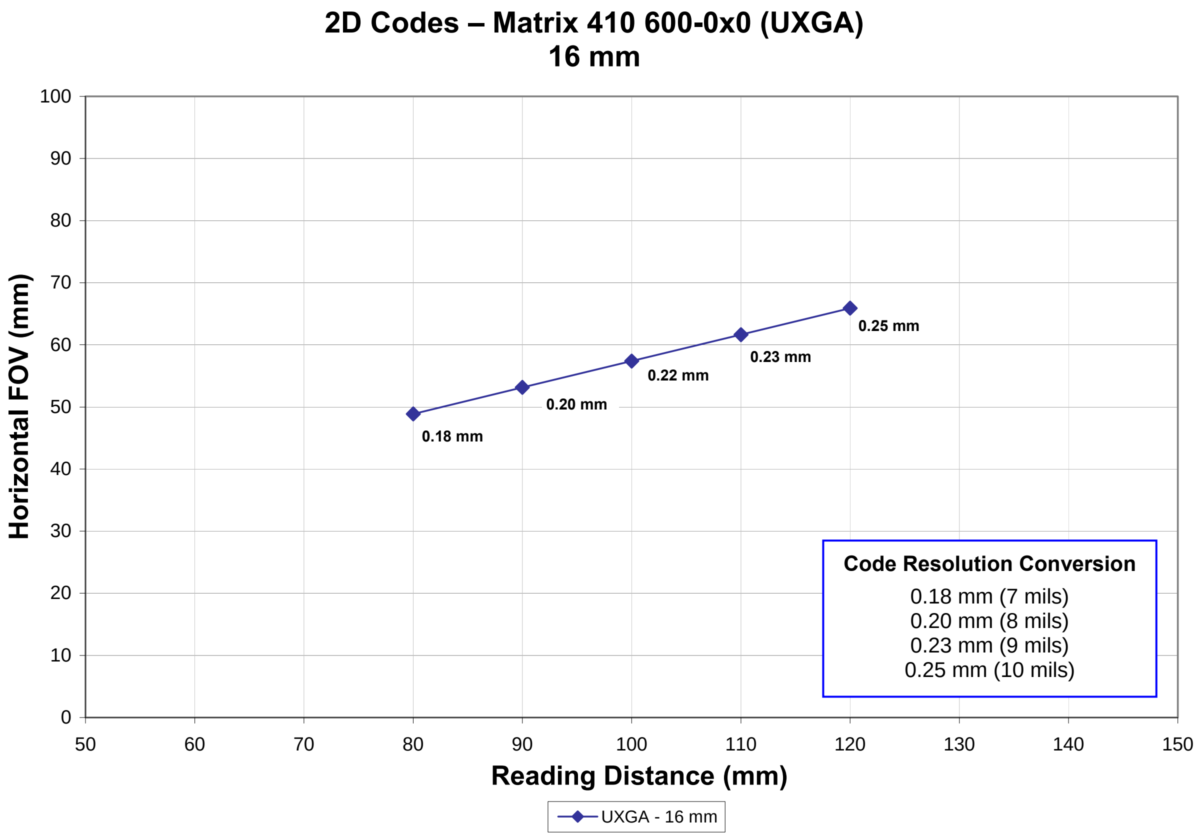


1D Codes – Matrix 410 600-0x0 (UXGA)
16 mm



3.2.3 2D (Bi-dimensional) Codes





4 EXTERNAL LIGHTING SYSTEMS

4.1 INTRODUCTION

A series of accessory illuminators are available meet symbol verification requirements.

- The LT-630 Four Bar Lighting System is designed for Code verification applications according to ISO/IEC 15415 or ISO/IEC 15416 specifications.

Figure 14 - LT-630 Four Bar Lighting System

- The LT-410 Coaxial Lighting System is an axial diffuse illuminator designed for reading codes produced by Dot Peening or Laser Etching on flat parts having a matte, specular or mixed surface reflectivity.

Figure 15 - LT-410 Coaxial Lighting System

- The LT-510 Mini Dome Lighting System is a diffuse mini dome light designed for reading printed label or Direct Marking codes on small parts with a curved or specular surface.

Figure 16 - LT-510 Mini Dome Lighting System

- The LT-511 Dome Lighting System is a diffuse dome light designed for reading printed label or Direct Marking codes on parts with a curved surface.

Figure 17 - LT-511 Dome Lighting System

- The LT-314 45° Dark Field Ring Lighting System is designed for reading codes produced by Dot Peening or Laser Etching on flat, reflective parts.

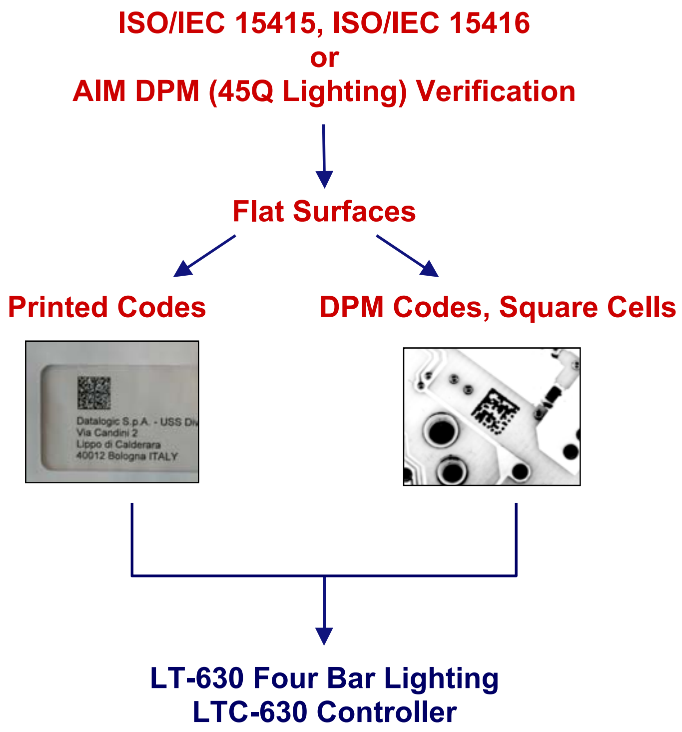
Figure 18 - LT-314 45° Dark Field Ring Lighting System

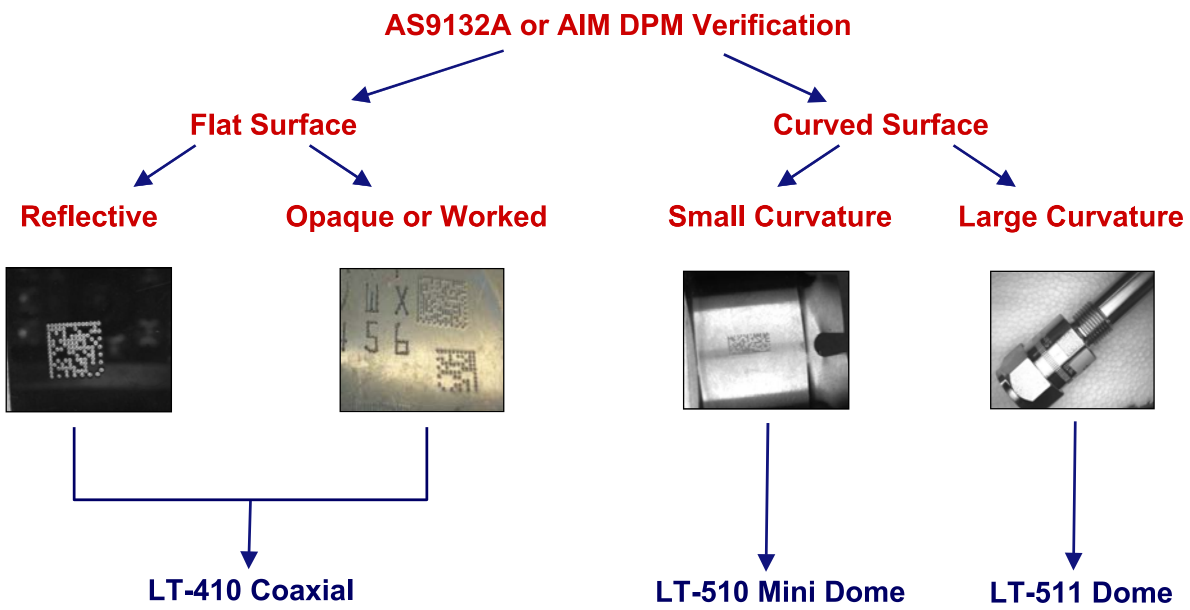
- The LT-316 60° Dark Field Ring Lighting System is designed for reading codes produced by Dot Peening (especially by a 120° stylus) or Laser Etching on flat, reflective parts.

Figure 19 - LT-316 60° Dark Field Ring Lighting System

4.2 HOW TO SELECT THE RIGHT EXTERNAL LIGHTING SYSTEM

The following figures indicate which External Illuminator to use based on the selected Standard and on the code reading application:





5 SOFTWARE CONFIGURATION

Software configuration of your Matrix 410™ for code quality verification applications can be accomplished by using the VisiSet™ Autolearning Wizard and Symbol Verification tools for easy setup. These procedures are described in chapter 1.

For all other applications use VisiSet™ through the reader serial ports (or Ethernet port for Matrix 410™ Ethernet models only).

NOTE

Before using VisiSet™ via Ethernet, it is necessary to configure Matrix 410™ Ethernet port parameters using VisiSet™ via Main or Auxiliary serial port (for further details refer to the VisiSet™ Help on line).

5.1 VISISET™ SYSTEM REQUIREMENTS

To install and run VisiSet™ you should have a Laptop or PC that meets or exceeds the following:

- Pentium processor
- Win 98/2000, NT 4.0, XP or Vista
- 32 MB Ram
- 5 MB free HD space
- one free RS232 serial port with 115 Kbaud
- SVGA board (800x600) or better using more than 256 colors

5.2 INSTALLING VISISET™

To install VisiSet™, proceed as follows:

1. Turn on the Laptop or PC that will be used for configuration (connected to the Matrix 410™ communication ports).
2. After Windows finishes booting, insert the CD-ROM provided.
3. Launch VisiSet™ installation by clicking Install.
4. Follow the instructions in the installation procedure.

5.3 STARTUP

After completing the mechanical and electrical connections to Matrix 410™, you can begin software configuration as follows:

1. Power on the Matrix 410™ reader. Wait for the reader startup. The system bootstrap requires a few seconds to be completed. The reader automatically enters Run Mode.
2. Run the VisiSet™ program.
3. Press **Connect** on the VisiSet™ menu bar. The PC will automatically connect to the Matrix 410™ reader.

Upon connection, Matrix 410™ exits Run Mode and displays the Main Menu on VisiSet™ with all the commands necessary to monitor your reader's performance. You can select these commands using the mouse or by pressing the key corresponding to the letter shown on the button. See Figure 20.

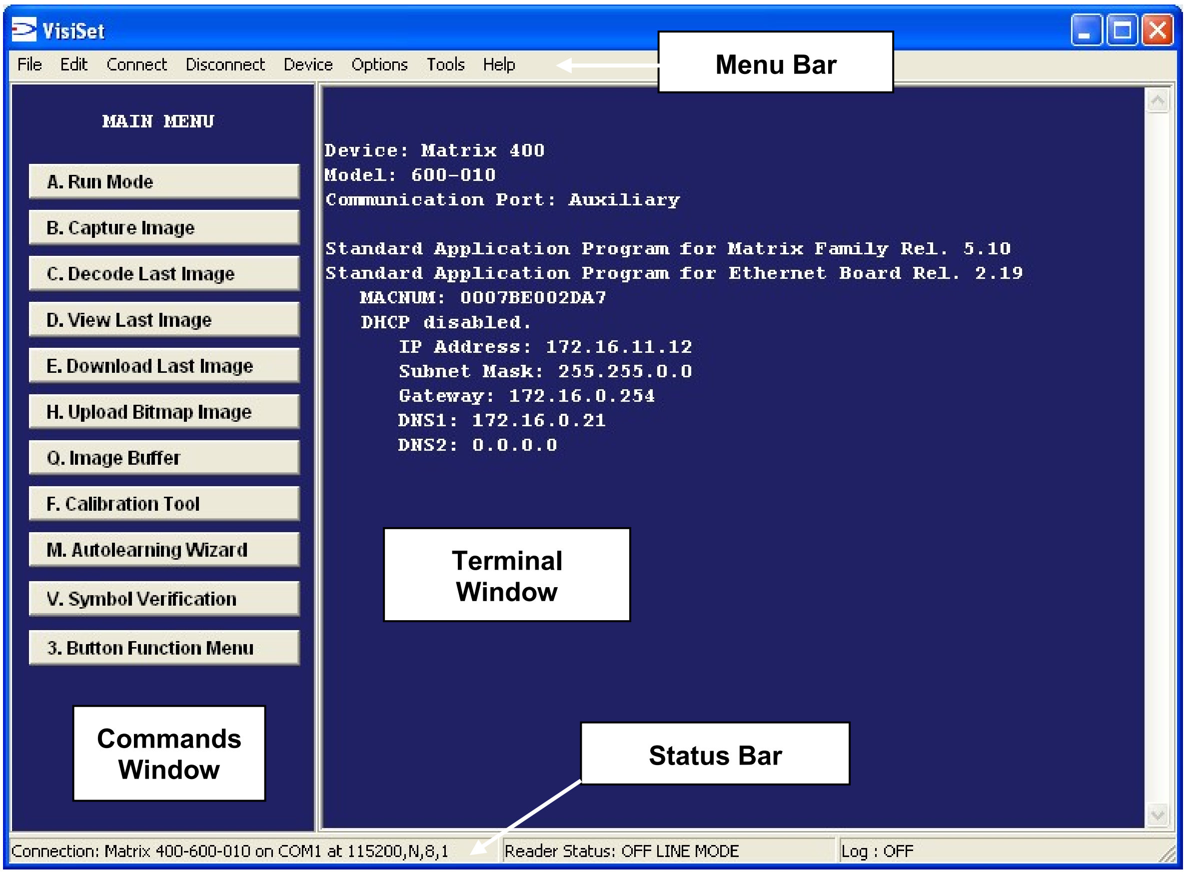


Figure 20 – VisiSet™ Main Window

5.3.1 VisiSet™ Options

The **Options** item from the VisiSet™ menu (see Figure 20) presents a window allowing you to configure:

- the logging function (**Log**)
- VisiSet™ window properties (**Environment**)
- VisiSet™ communication channel (**Communication**)

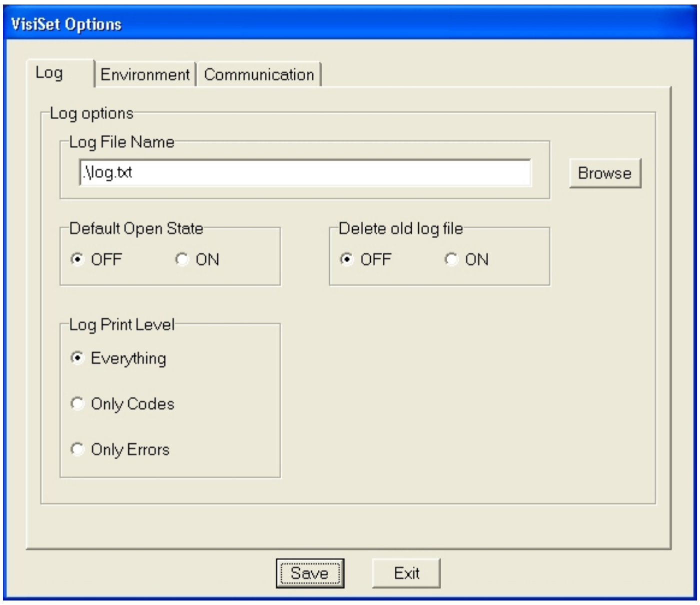


Figure 21 - Options - Log

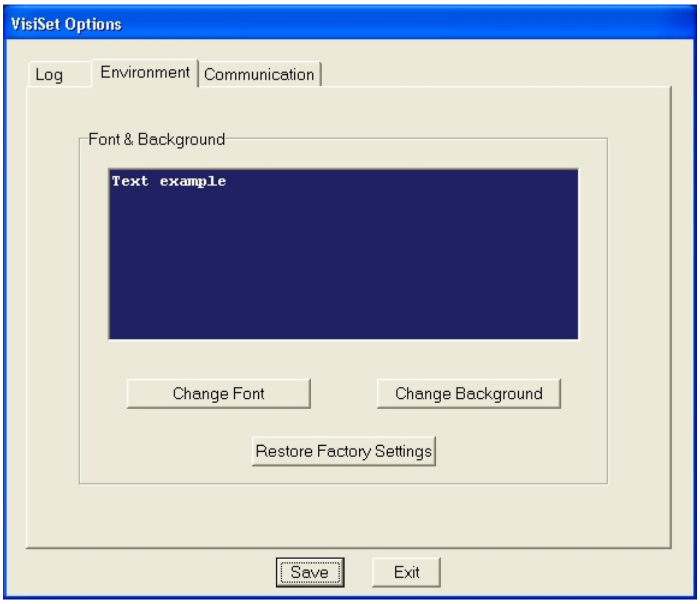


Figure 22 - Options - Environment

The **Communication** folder allows choosing between Serial ports or Ethernet as communication channels.

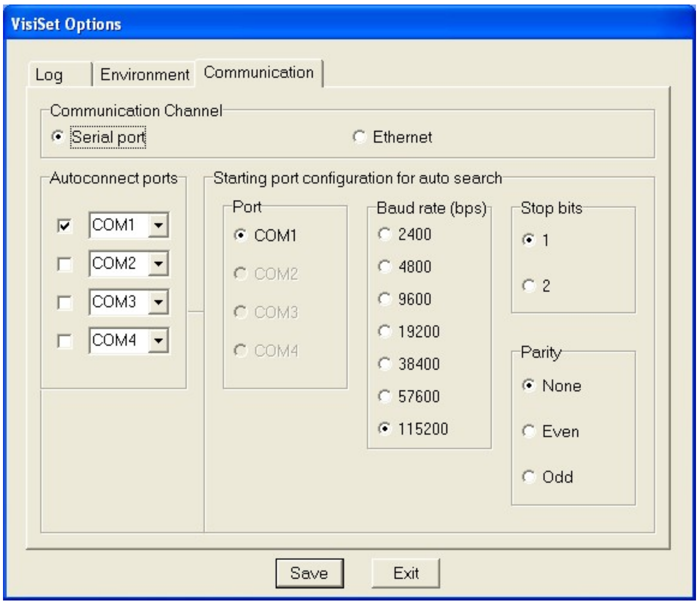


Figure 23 - Options – Communication: Serial Port

If selecting Serial port, it is possible to define all the serial ports to explore and the starting port configuration for the Autoconnect procedure.

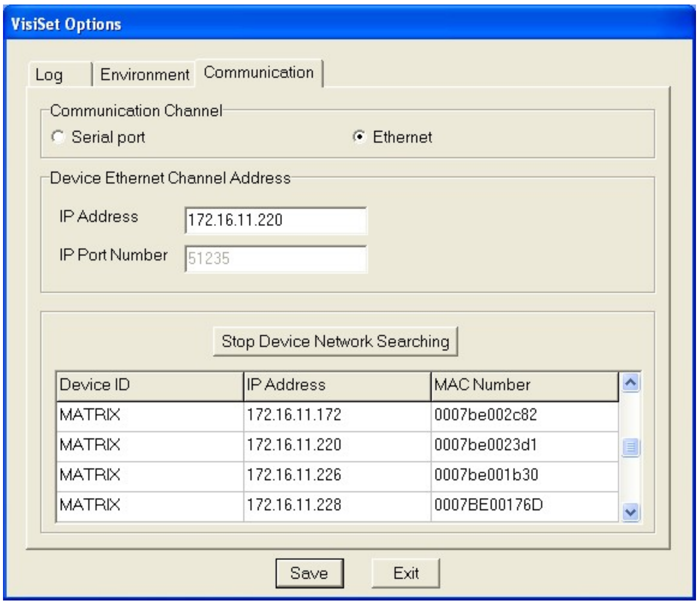


Figure 24 - Options – Communication: Ethernet

If selecting Ethernet, it is necessary to define the IP Address of the reader to be connected to. You can easily find it by just clicking on the Look for devices on network button, and then selecting and saving the desired device as soon as it appears.
Only Datalogic devices are visualized in the list. Any unknown device refers to older version products. The IP Port number has a fixed value.

5.3.2 Edit Reader Parameters

The Parameter Setup window displays the configuration parameters grouped in a series of folders. Each parameter can be modified by selecting a different item from the prescribed list in the box, or by typing new values directly into the parameter box.

By right clicking the mouse when positioned over the name of a specific Parameter or Group, a pop-up menu appears allowing you to directly manage that particular parameter or group.

- You can **View the Selected Value** for each parameter.
- You can **Restore the Default Value** of each parameter or of all the parameters of a group.
- **Get Properties** gives information about the parameter in the form of a pop-up hint that describes the default value and the range/list of valid values.
- The **Short Help** gives information about the parameter in the form of a pop-up hint.

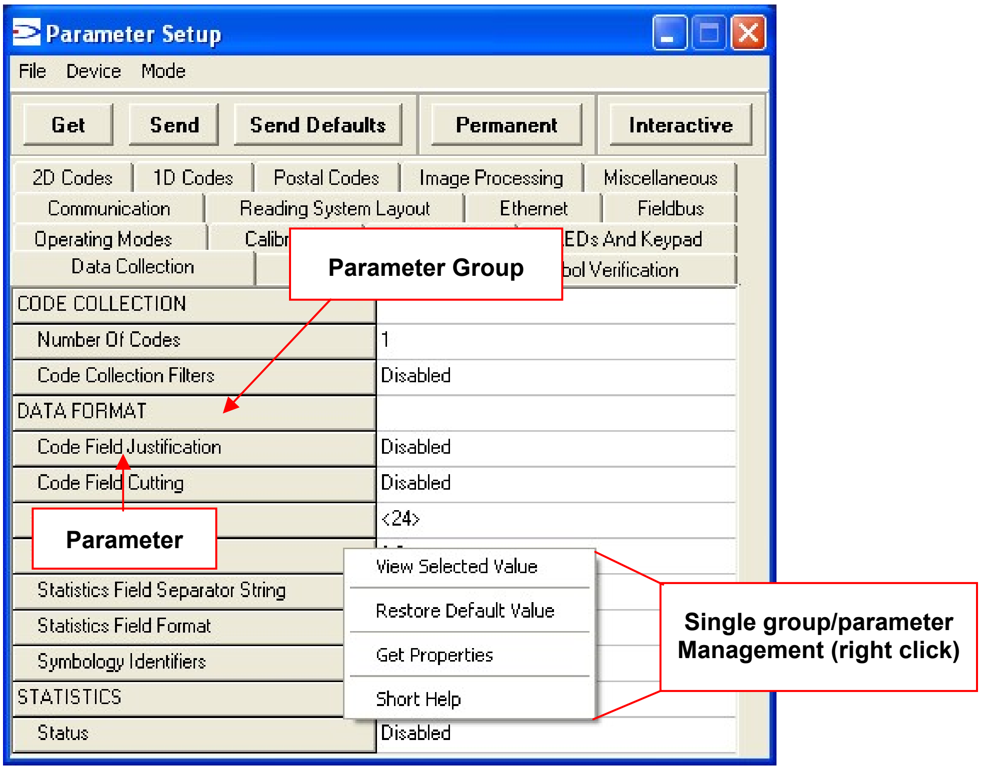


Figure 25 - Editing Parameters

When all the configuration parameters are set correctly, save them to the Matrix 410™ reader by pressing the Send button. See Figure 25.

For successive configuration of other readers or for backup/archive copies, it is possible to save the configuration onto your PC by selecting the **Save Configuration File** option from the **File** menu.

Load Configuration File (available in the **File** menu) allows you to configure a reader from a previously saved configuration file (.ini).

Parameters to verify/modify:

❑ Operating Mode	Sets the parameters which customize the reader operating mode starting from three main modes: One Shot: acquires a single image based on the selected value for the Acquisition Trigger and Acquisition Trigger Delay. Continuous: continuously acquires images with a rate up to the maximum allowable frame rate per second for the given sensor depending on the decoding time and the Region of Interest settings. Phase Mode: acquires images during the reading phase depending on the selected value for the Acquisition Trigger and Acquisition Trigger Delay. The Reading Phase ON and Reading Phase OFF events mark respectively the beginning and end of the reading phase.
❑ Calibration	Calibrates the acquisition parameters to maximize the reading performance.
❑ Communication	Configures the parameters relative to each serial port regarding the transmission, message formatting and string receiving. Any change to the VisiSet™ communication port parameters (baud rate, data bits, etc.) is effective as soon as the reader is disconnected from VisiSet™.
❑ Ethernet	Sets the parameters related to the Ethernet interface and to its communication channels.
❑ Fieldbus	Sets the parameters related to the External Fieldbus interface through the CBX500 and to its communication channels.
❑ Reading System Layout	Allows configuring the device according to the desired layout: Standalone, ID-NET™ or Master/Slave RS232
❑ Image Processing	Sets the image processing parameters shared by all available symbologies.
❑ 1D & 2D, Postal Codes	Sets the characteristics of the code symbologies to be read.
❑ Data Collection	Defines the code-collection parameters and the output message format.
❑ Digital I/O	Configures the reader input/output parameters.
❑ Match Code	Allows setting a user-defined code and relative parameters to which the read code will be compared (matched).
❑ Miscellaneous	Sets the reader name and the saved image format.
❑ Symbol Verification	Sets the parameters relative to the various specifications in the Standards which regulate code validation.
❑ LEDs And Keypad	Sets the X-PRESS™ LED and Keypad parameters related to their selected Functions: Beeper, Green Spot, Autolearning, Positioning, etc.

5.3.3 Send Configuration Options

The device parameters are divided into two main classes, **Configuration** and **Environmental** which are effected differently by the Send Configuration and Send Default Configuration commands.

Configuration Parameters regard parameters that are specific to the device. These parameters are influenced by the Send Configuration and Send Default Configuration commands, that is they are overwritten by these commands.
The same parameters are modified by the following "Send Configuration with Options" and "Send Default Configuration with Options" dialogs from the Device Menu:

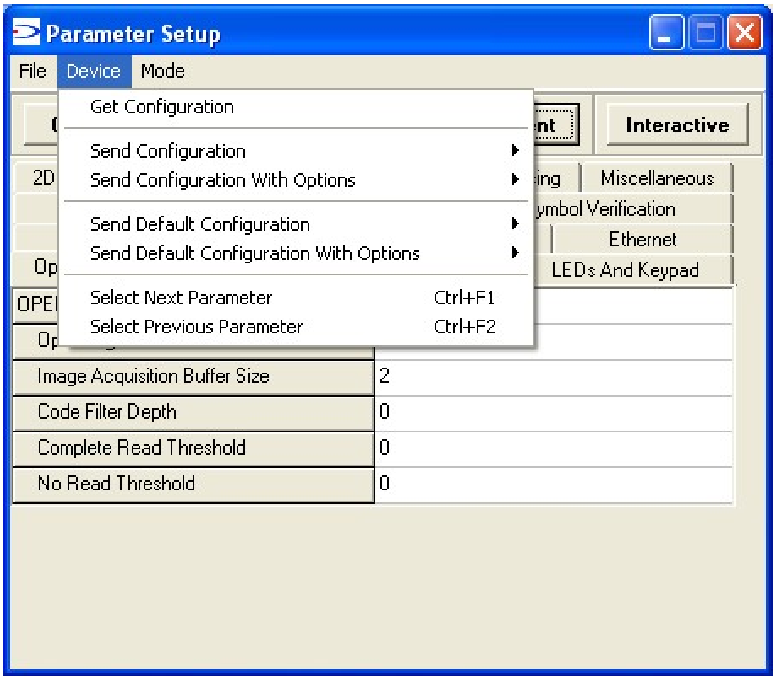


Figure 26 - Send Configuration Options

Environmental Parameters regard the device Identity and Position in a Network (ID-NET™, Master/Slave RS232, MUX32, Ethernet) and are not influenced by the "Send Default Configuration" and "Send Configuration" commands.
This allows individual devices to be configured differently without affecting their recognized position in the network.

For device replacement it is necessary to send the previously saved configuration (both Configuration and Environmental parameters) to the new device. To do this select "Send Configuration with Options" from the Device Menu and check the Environmental Parameters checkbox:

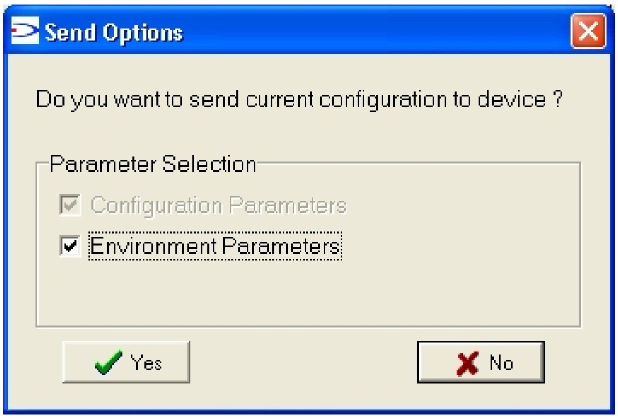


Figure 27 – Send Configuration With Options

In order to return a device to its absolute default parameters including Environmental parameters, the following Send Default Configuration with Options" dialog must be used:

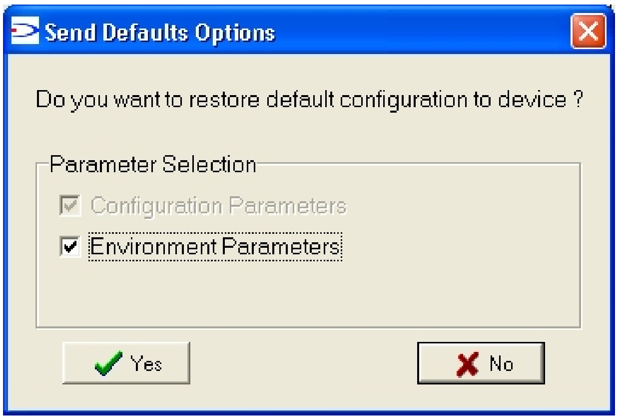


Figure 28 – Send Default Configuration With Options

5.4 CONFIGURATION

Once connected to Matrix 410™ as described in paragraph 5.3, you can modify the configuration parameters for **off line or on line symbol verification** applications.

5.4.1 ISO/IEC 15415 Verification Setup

Allows to configure lighting and camera settings to comply with ISO/IEC 15415 optical requirements for 2D symbol verification.

ISO-IEC 15415-15416 SETUP

Aperture Mode
Allows configuration of the Aperture parameter according to the ISO-IEC 15415 and ISO-IEC 15416 international standards. The possible selections are:

- *Automatic*: the physical size of the virtual aperture applied to the captured symbol image is automatically calculated by the verification software.
- *Custom*: allows specifying the physical size of the virtual aperture applied to the captured symbol image.

Aperture (mils)
Sets the physical size of the virtual aperture applied to the captured symbol image by the verification software.

Angle
Sets the incidence angle at which the symbol is illuminated by the lighting system during the verification process.

Light Wavelength (nm)
Sets the wavelength in nanometres of the LED illumination directed at the symbol during the verification process. The possible selections are:

- *White*
- *660 nm*
- *760 nm*

ISO-IEC 15415

Status
Enables/disables symbol verification according to the ISO-IEC 15415 international standard for Data Matrix ECC200 and QR Code symbologies.

5.4.2 ISO/IEC 15416 Verification Setup

Allows to configure lighting and camera settings to comply with ISO/IEC 15416 optical requirements for 1D symbol verification.

ISO-IEC 15415-15416 SETUP

Aperture Mode
Allows configuration of the Aperture parameter according to the ISO-IEC 15415 and ISO-IEC 15416 international standards. The possible selections are:

- *Automatic*: the physical size of the virtual aperture applied to the captured symbol image is automatically calculated by the verification software.
- *Custom*: allows specifying the physical size of the virtual aperture applied to the captured symbol image.

Aperture (mils)
Sets the physical size of the virtual aperture applied to the captured symbol image by the verification software.

Angle
Sets the incidence angle at which the symbol is illuminated by the lighting system during the verification process.

Light Wavelength (nm)
Sets the wavelength in nanometres of the LED illumination directed at the symbol during the verification process. The possible selections are:

- *White*
- *660 nm*
- *760 nm*

ISO-IEC 15416

Status
Enables/disables symbol verification according to the ISO-IEC 15416 international standard for Code 128, Code 39, Interleaved 2 of 5, Codabar, Code 93, EAN-8/EAN-13, UPC-A/UPC-E symbologies.

Grade Type
Allows selecting the appearance of the ISO-IEC 15416 verification output. The possible selections are:

- *10 Scans*: supplies Scan Reflectance Profile Grades for each quality parameter on each of 10 code scans.
- *Media*: supplies the mathematical average Scan Reflectance Profile Grade for each quality parameter over 10 code scans.
- *Media & 10 Scans*: supplies Scan Reflectance Profile Grades for each quality parameter on each of 10 code scans plus the mathematical average.

5.4.3 AS9132A Verification Setup

Allows to configure camera settings to comply with AS9132A requirements for 2D symbol verification.

AS9132A

Status
Enables/disables symbol verification according to the AS9132A standard for direct part mark Data Matrix ECC200 symbology.

Module Shape
Allows specifying the module shape of the code to be verified (circular or square). This option affects the symbol verification results according to the AS9132A standard.
The possible selections are:

- *Dot* : Circular modules.
- *Square*: Quadrate modules.

Marking Method
Allows specifying the method used to create the symbol to be verified. This option affects the symbol verification results according to the AS9132A standard.
The possible selections are:

- *Ink Jet / Dot Peening*: the symbols are created by the injection of electrically charged ink or using a percussive marking method to create contrast between light and dark modules.
- *Laser Etching / Chemical Etching*: the symbols are created using a laser (i.e. YAG, YVO4 or CO2) on a variety of metal substrates or using an electro-chemical process on conductive metal substrates.

5.4.4 AIM DPM Verification Setup

Allows to configure lighting and camera settings to comply with AIM DPM Quality Guideline optical requirements for 2D symbol verification.

AIM DPM SETUP

Aperture Mode
Allows configuration of the Aperture parameter according to the AIM DPM quality guideline.
The possible selections are:

- *Automatic*: the physical size of the virtual aperture applied to the captured symbol image is automatically calculated by the verification software.
- *Custom*: allows specifying the physical size of the virtual aperture applied to the captured symbol image.

Aperture (mils)
Sets the physical size of the virtual aperture applied to the captured symbol image by the verification software.

Lighting

Indicates the angle and configuration of lighting environment used in the verifier system according to the AIM DPM quality guideline.
The possible selections are:

- *90*: Diffuse Perpendicular (On Axis DOAL /Bright field)
- *D*: Diffuse Off Axis (Dome lighting)
- *30Q*: Low angle, Four Direction lighting
- *30T:* Low angle, Two Direction
- *30S*: Low Angle, Single Direction
- *45Q*: Medium Angle, Four Direction

See paragraph 2.4 for further details.

Light Wavelength
Sets the wavelength in nanometres of the LED illumination directed at the symbol during the verification process.

- *White*
- *660 nm*
- *760 nm*

AIM DPM

Status
Enables/disables symbol verification according to the AIM DPM quality guideline for direct part mark Data Matrix ECC200 and QR Code symbologies.

5.4.5 Digital Outputs Activation

Matrix 410™ digital outputs can be used to indicate if one or more grades of the decoded symbol fall below the selected threshold grade.

DIGITAL I/O - OUTPUT 1, 2

Activation Events
Defines the event(s) which will activate the output. Among the available activating event selections, several Standard Code Quality Parameters are listed. If selected, the codes read must meet or exceed these Standards in order to avoid output activation.

It is possible to select more than one event so that any one of them will cause the output activation. To do this, from the pull down menu, hold down the CTRL key and select the desired events with the mouse. The events will be listed separated by a comma.
By selecting None the output is always in idle state.

ISO-IEC 16022-18004 Threshold
This parameter is available when the ISO-IEC 16022-18004 ***Status*** parameter is enabled.
It defines the grade threshold for the ISO/IEC 16022 and ISO/IEC 18004 code quality parameter(s) selected in Activation Events, under which the output will be activated. A code presented to the reader which has at least one of the selected code quality parameter grades lower than that specified in this parameter will activate the output.
The valid Activation Events for this standard are:

- ISO-IEC Symbol Contrast
- ISO-IEC Print Growth
- ISO-IEC / AIM DPM Axial Non Uniformity
- ISO-IEC / AIM DPM Unused Error Correction

ISO-IEC 15415 Threshold
This parameter is available when the ISO-IEC 15415 ***Status*** parameter is enabled.
It defines the grade threshold for the ISO/IEC 15415 code quality parameter(s) selected in Activation Events, under which the output will be activated. A code presented to the reader which has at least one of the selected code quality parameter grades lower than that specified in this parameter will activate the output.
The valid Activation Events for this standard are:

- ISO-IEC Symbol Contrast
- ISO-IEC / AIM DPM Axial Non Uniformity
- ISO-IEC / AIM DPM Unused Error Correction
- ISO-IEC Modulation
- ISO-IEC / AIM DPM Fixed Pattern Damage
- ISO-IEC / AIM DPM Grid Non Uniformity
- ISO-IEC / AIM DPM Decode

ISO-IEC 15416 Threshold
This parameter is available when the ISO-IEC 15416 ***Status*** parameter is enabled.
It defines the grade threshold for the ISO/IEC 15416 code quality parameter(s) selected in Activation Events, under which the output will be activated.
A code presented to the reader which has at least one of the selected code quality parameter grades lower than that specified in this parameter will activate the output.

The valid Activation Events for this standard are:

- ISO-IEC Symbol Contrast
- ISO-IEC Modulation
- ISO-IEC Min Edge Contrast
- ISO-IEC Decodability
- ISO-IEC / AIM DPM Minimum Reflectance
- ISO-IEC Defects
- ISO-IEC / AIM DPM Decode

AIM DPM Threshold
This parameter is available when the AIM DPM *Status* parameter is enabled.
It defines the grade threshold for the AIM DPM code quality parameter(s) selected in Activation Events, under which the output will be activated. A code presented to the reader which has at least one of the selected code quality parameter grades lower than that specified in this parameter will activate the output.
The valid Activation Events for this standard are:

- ISO-IEC / AIM DPM Axial Non Uniformity
- ISO-IEC / AIM DPM Unused ECC
- ISO-IEC / AIM DPM Fixed Pattern Damage
- ISO-IEC / AIM DPM Grid Non Uniformity
- ISO-IEC / AIM DPM Minimum Reflectance
- ISO-IEC / AIM DPM Decode
- AIM DPM Cell Contrast
- AIM DPM Cell Modulation

AS9132 (Parameter not visible)
AS9132 parameters are calculated on Pass/Fail basis: when the AS9132A *Status* parameter is enabled, a code presented to the reader which has at least one of the selected code quality parameter grades equal to Fail will activate the output.
The valid Activation Events for this standard are:

- AS9132 Dot Size/Cell Fill
- AS9132 Dot Center Offset
- AS9132 Dot Ovality
- AS9132 Quiet Zone
- AS9132 Angle Of Distortion
- AS9132 Symbol Contrast

Number of Events
Defines the number of activation events which must occur within the last #N reading phases to activate the output.

Number of Reading Phases
Defines the number of reading phases during which the selected Activation Events are examined.

5.4.6 Code Filtering

Matrix 410™ allows ordering read codes and filtering them according to their symbology, length, position and quality grades.

DATA COLLECTION - CODE FILTER SETTING

Code Quality Index
The Code Quality Index allows selecting from a list of Standard code quality parameters, which the codes read must meet or exceed in order to be accepted in the collection.

ISO-IEC 16022-18004 Threshold
This parameter is available when the ISO-IEC 16022-18004 ***Status*** parameter is enabled.
It defines the grade threshold for the ISO/IEC 16022 and ISO/IEC 18004 code quality parameter selected in Code Quality Index, under which the code will be filtered. A code presented to the reader which has a code quality parameter grade lower than that specified in this parameter will cause the code to be filtered (not collected).
The valid code quality parameters for this standard are:

- ISO-IEC / AIM DPM Overall Grade
- ISO-IEC Symbol Contrast
- ISO-IEC Print Growth
- ISO-IEC / AIM DPM Axial Non Uniformity
- ISO-IEC / AIM DPM Unused Error Correction

ISO-IEC 15415 Threshold
This parameter is available when the ISO-IEC 15415 SYMBOL VERIFICATION parameter is enabled. It defines the grade threshold for the ISO/IEC 15415 code quality parameter selected in Code Quality Index, under which the code will be filtered. A code presented to the reader which has a code quality parameter grade lower than that specified in this parameter will cause the code to be filtered (not collected).
The valid code quality parameters for this standard are:

- ISO-IEC / AIM DPM Overall Grade
- ISO-IEC Symbol Contrast
- ISO-IEC / AIM DPM Axial Non Uniformity
- ISO-IEC / AIM DPM Unused Error Correction
- ISO-IEC Modulation
- ISO-IEC / AIM DPM Fixed Pattern Damage
- ISO-IEC / AIM DPM Grid Non Uniformity
- ISO-IEC / AIM DPM Decode

ISO-IEC 15416 Threshold

This parameter is available when the ISO-IEC 15416 ***Status*** parameter is enabled.
It defines the grade threshold for the ISO/IEC 15416 code quality parameter selected in Code Quality Index, under which the code will be filtered. A code presented to the reader which has a code quality parameter grade lower than that specified in this parameter will cause the code to be filtered (not collected).
The valid code quality indexes for this standard are:

- ISO-IEC / AIM DPM Overall Grade
- ISO-IEC Symbol Contrast
- ISO-IEC Modulation
- ISO-IEC Min Edge Contrast
- ISO-IEC Decodability
- ISO-IEC / AIM DPM Minimum Reflectance
- ISO-IEC Defects
- ISO-IEC / AIM DPM Decode

AIM DPM Threshold

This parameter is available when the AIM DPM ***Status*** parameter is enabled.
It defines the grade threshold for the AIM DPM code quality parameter(s) selected in Code Quality Index, selected in Code Quality Index, under which the code will be filtered. A code presented to the reader which has a code quality parameter grade lower than that specified in this parameter will cause the code to be filtered (not collected).
The valid code quality parameters for this standard are:

- ISO-IEC / AIM DPM Overall Grade
- ISO-IEC / AIM DPM Axial Non Uniformity
- ISO-IEC / AIM DPM Unused ECC
- ISO-IEC / AIM DPM Fixed Pattern Damage
- ISO-IEC / AIM DPM Grid Non Uniformity
- ISO-IEC / AIM DPM Minimum Reflectance
- ISO-IEC / AIM DPM Decode
- AIM DPM Cell Contrast
- AIM DPM Cell Modulation

AS9132 (Parameter not visible)

AS9132 parameters are calculated on Pass/Fail basis: when AS9132 *Status* parameter is enabled, a code presented to the reader which has at least one of the selected code quality parameter grades equal to Fail will cause the code to be filtered (not collected).
The valid code quality parameters for this standard are:

- AS9132 Dot Size/Cell Fill
- AS9132 Dot Center Offset
- AS9132 Dot Ovality
- AS9132 Quiet Zone
- AS9132 Angle Of Distortion
- AS9132 Symbol Contrast

5.4.7 Output Message Format

Matrix 410™ allows to include in the output data string, information about the code quality parameters calculated according to the available symbol verification Standards.

DATA COLLECTION – DATA FORMAT

Data Packet Format

Allows the definition of the output data string format. It is possible to type any printable or non-printable character and to select special symbols to have a customized data format output. Non-printable characters are written in decimal notation between the <>, while printable characters can be typed directly from the keyboard.

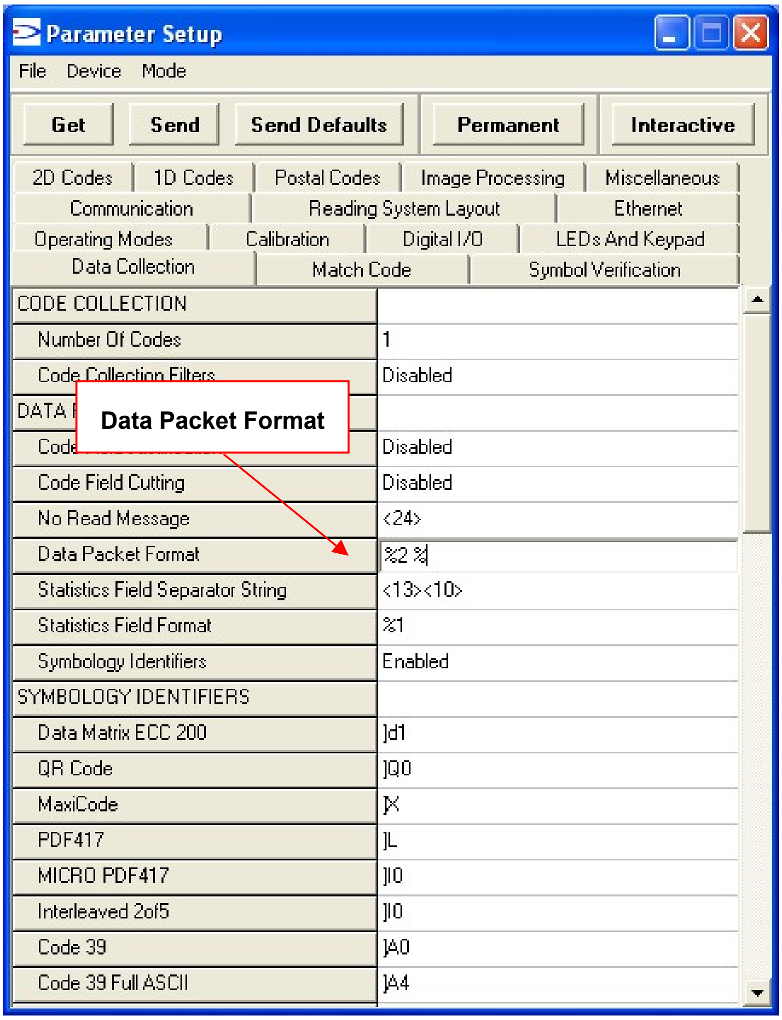


Figure 29 - Data Packet Format Parameter

Several code-related fields can be included in the Data Packet Format as special symbols:

- Code Identifier
- Code Center Position
- Code Orientation
- Code Data Length
- Decoding Time (ms)
- …

You can also include information about the code quality parameters calculated according to the following Standards:

- ISO/IEC 16022 (grade and numeric values)
- ISO/IEC 18004 (grade and numeric values)
- ISO/IEC 15415 (grade and numeric values)
- ISO/IEC 15416 (grade and numeric values)
- AS9132A (grade and numeric values)
- AIM DPM (grade and numeric values)

To open the window with the list of the Data Packet Format Special Symbols, position the cursor in the Data Packet Format field and press the **% key**. The following window will appear:

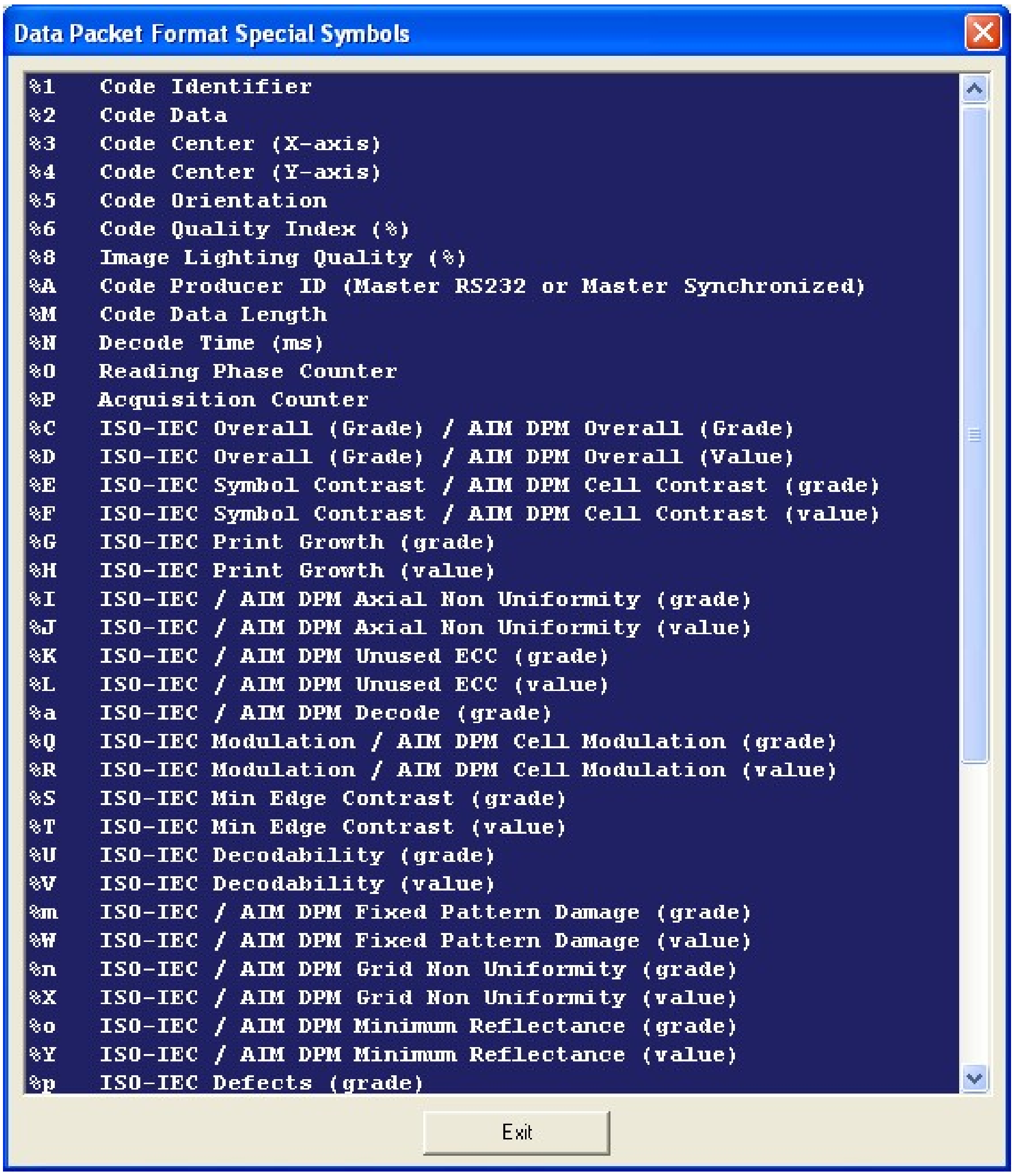


Figure 30 - Data Packet Format Special Symbols Window

Example: to have a Data Packet composed of Code Data followed by the ISO/IEC 15415 code quality parameters (grade only) in parenthesis, separated by a comma and a space, the Data Packet Format string must be the following:

Data Packet Format = %2 (%C, %E, %I, %K, %a, %m, %Q, %n)

The transmitted code quality parameters have the following format:

- 1 character for code quality parameters expressed as grade (i.e. A,B,C,D,F or P,F)
- 1 character for code quality parameters expressed as a numeric value corresponding to a grade (0,1,2,3,4).
- 4 numeric characters for code quality parameters expressed as a percentage (including the decimal point) (example: 78% → 0.78).
- 3 numeric characters for AS9132A Angle Of Distortion parameter (example: 3° → 003).

When ISO/IEC 16022-18004 ***Status*** parameter is enabled, the following code quality parameters can be included in the Data Packet Format string:

- %C ISO-IEC / AIM DPM Overall (Grade)
- %D ISO-IEC / AIM DPM Overall (Value)
- %E ISO-IEC Symbol Contrast / AIM DPM Cell Contrast (grade)
- %F ISO-IEC Symbol Contrast / AIM DPM Cell Contrast (value)
- %G ISO-IEC / AIM DPM Print Growth (grade)
- %H ISO-IEC / AIM DPM Print Growth (value)
- %I ISO-IEC / AIM DPM Axial Non Uniformity (grade)
- %J ISO-IEC / AIM DPM Axial Non Uniformity (value)
- %K ISO-IEC / AIM DPM Unused ECC (grade)
- %L ISO-IEC / AIM DPM Unused ECC (value)

When ISO/IEC 15415 ***Status*** parameter is enabled, the following code quality parameters can be included in the Data Packet Format string:

- %C ISO-IEC / AIM DPM Overall (Grade)
- %D ISO-IEC / AIM DPM Overall (Value)
- %E ISO-IEC Symbol Contrast / AIM DPM Cell Contrast (grade)
- %F ISO-IEC Symbol Contrast / AIM DPM Cell Contrast (value)
- %H ISO-IEC / AIM DPM Print Growth (value)
- %I ISO-IEC / AIM DPM Axial Non Uniformity (grade)
- %J ISO-IEC / AIM DPM Axial Non Uniformity (value)
- %K ISO-IEC / AIM DPM Unused ECC (grade)
- %L ISO-IEC / AIM DPM Unused ECC (value)
- %a ISO-IEC / AIM DPM Decode (Grade)
- %Q ISO-IEC Modulation / AIM DPM Cell Modulation (grade)
- %R ISO-IEC Modulation / AIM DPM Cell Modulation (value)
- %m ISO-IEC / AIM DPM Fixed Pattern Damage (grade)
- %W ISO-IEC / AIM DPM Fixed Pattern Damage (value)
- %n ISO-IEC / AIM DPM Grid Non Uniformity (grade)
- %X ISO-IEC / AIM DPM Grid Non Uniformity (value)

When ISO/IEC 15416 ***Status*** parameter is enabled, the following code quality parameters can be included in the Data Packet Format string:

- %C ISO-IEC / AIM DPM Overall (Grade)
- %D ISO-IEC / AIM DPM Overall (Value)
- %E ISO-IEC Symbol Contrast / AIM DPM Cell Contrast (grade)
- %F ISO-IEC Symbol Contrast / AIM DPM Cell Contrast (value)
- %a ISO-IEC / AIM DPM Decode (Grade)
- %Q ISO-IEC Modulation / AIM DPM Cell Modulation (grade)
- %R ISO-IEC Modulation / AIM DPM Cell Modulation (value)
- %S ISO-IEC Min Edge Contrast (grade)
- %T ISO-IEC Min Edge Contrast (value)
- %U ISO-IEC Decodability (grade)
- %V ISO-IEC Decodability (value)
- %p ISO-IEC Defects (grade)
- %Z ISO-IEC Defects (value)
- %o ISO-IEC / AIM DPM Minimum Reflectance (grade)
- %Y ISO-IEC / AIM DPM Minimum Reflectance (value)

When AIM DPM ***Status*** parameter is enabled, the following code quality parameters can be included in the Data Packet Format string:

- %C ISO-IEC / AIM DPM Overall (Grade)
- %D ISO-IEC / AIM DPM Overall (Value)
- %E ISO-IEC Symbol Contrast / AIM DPM Cell Contrast (grade)
- %F ISO-IEC Symbol Contrast / AIM DPM Cell Contrast (value)
- %H ISO-IEC / AIM DPM Print Growth (value)
- %I ISO-IEC / AIM DPM Axial Non Uniformity (grade)
- %J ISO-IEC / AIM DPM Axial Non Uniformity (value)
- %K ISO-IEC / AIM DPM Unused ECC (grade)
- %L ISO-IEC / AIM DPM Unused ECC (value)
- %a ISO-IEC / AIM DPM Decode (Grade)
- %Q ISO-IEC Modulation / AIM DPM Cell Modulation (grade)
- %R ISO-IEC Modulation / AIM DPM Cell Modulation (value)
- %m ISO-IEC / AIM DPM Fixed Pattern Damage (grade)
- %W ISO-IEC / AIM DPM Fixed Pattern Damage (value)
- %n ISO-IEC / AIM DPM Grid Non Uniformity (grade)
- %X ISO-IEC / AIM DPM Grid Non Uniformity (value)
- %o ISO-IEC / AIM DPM Minimum Reflectance (grade)
- %Y ISO-IEC / AIM DPM Minimum Reflectance (value)

When AS9132A ***Status*** parameter is enabled, the following code quality parameters can be included in the Data Packet Format string:

- %q AS9132 Dot Size/Cell Fill (grade)
- %u AS9132 Dot Size/Cell Fill (value)
- %r AS9132 Dot Center Offset (grade)
- %v AS9132 Dot Center Offset (value)
- %s AS9132 Dot Ovality (grade)
- %w AS9132 Dot Ovality (value)
- %t AS9132 Angle Of Distortion (grade)
- %y AS9132 Angle Of Distortion (value)
- %z AS9132 Quiet Zone (grade)
- %0 AS9132 Quiet Zone (value)
- %b AS9132 Symbol Contrast (grade)
- %c AS9132 Symbol Contrast (value)

NOTE

*Some AS9132A code quality parameters are calculated according to the configured **Module Shape** and **Marking Method** parameters value. When a code quality parameter is not available, a string containing "?" character is transmitted.*

6 TECHNICAL FEATURES

6.1 MATRIX 410™ TECHNICAL FEATURES

ELECTRICAL FEATURES	
Power Supply Voltage Consumption	 10 to 30 Vdc 0.8 to 0.27 A, 8 W max.; 0.5 to 0.17 A, 5 W typical
Communication Interfaces Main - RS232 - RS485 full-duplex - RS485 half-duplex	 2400 to 115200 bit/s 2400 to 115200 bit/s 2400 to 115200 bit/s
Auxiliary - RS232	2400 to 115200 bit/s
ID-NET™	Up to 1MBaud
Ethernet (Ethernet Models only)	10/100 Mbit/s
Inputs Input 1(External Trigger) and Input 2	 Opto-coupled and polarity insensitive
Max. Voltage	30 Vdc
Max. Input Current	10 mA
Outputs Output 1 and Output 2	 Opto-coupled
V_{Out} (I_{Load} = 0 mA) Max.	30 Vdc
V_{Out} (I_{Load} = 10 mA) Max.	1.8 Vdc
$P_D = V_{Out} \times I_{Load}$ Max.	170 mW

OPTICAL FEATURES	4xx-xxx models	6xx-xxx models
Image Sensor	CMOS	CCD
Image Format	SXGA (1280x1024)	UXGA (1600x1200)
Frame Rate	27 frames/sec.	15 frames/sec.
Pitch	± 35°	
Tilt	0° - 360°	
Lighting System	Internal or External Illuminator (accessories)	
LED Safety Class	Class 1 to EN60825-1	

ENVIRONMENTAL FEATURES	
Operating Temperature	0 to 50 °C (32 to 122 °F) *
Storage Temperature	-20 to 70 °C (-4 to 158 °F)
Max. Humidity	90% non condensing
Vibration Resistance EN 60068-2-6	14 mm @ 2 to 10 Hz; 1.5 mm @ 13 to 55 Hz; 2 g @ 70 to 200 Hz; 2 hours on each axis
Bump Resistance EN 60068-2-29	30g; 6 ms; 5000 shocks on each axis
Shock Resistance EN 60068-2-27	30g; 11 ms; 3 shocks on each axis
Protection Class EN 60529	IP67 **

PHYSICAL FEATURES	
Dimensions	125 x 65 x 86 mm (4.92 x 2.56 x 3.39 in.) with lens cover
Weight	482 g. (17 oz.) with lens and internal illuminator
Material	Aluminium

* high ambient temperature applications should use metal mounting bracket for heat dissipation

** when correctly connected to IP67 cables with seals and the Lens Cover is correctly mounted.

SOFTWARE FEATURES		
Readable Code Symbologies		
1-D and stacked	**2-D**	**POSTAL**
• PDF417 Standard and Micro PDF417 • Code 128 (EAN 128) • Code 39 (Standard and Full ASCII) • Code 32 • MSI • Standard 2 of 5 • Matrix 2 of 5 • Interleaved 2 of 5 • Codabar • Code 93 • Pharmacode • EAN-8/13 - UPC-A/E (including Addon 2 and Addon 5) • GS1 DataBar Family • Composite Symbologies	• Data Matrix ECC 200 (Standard, GS1 and Direct Marking) • QR Code (Standard and Direct Marking) • Micro QR Code • MAXICODE • Aztec Code	• Australia Post • Royal Mail 4 State Customer • Kix Code • Japan Post • PLANET • POSTNET • POSTNET (+BB) • Intelligent Mail • Swedish Post
Operating Mode	ONE SHOT, CONTINUOUS, PHASE MODE	
Configuration Methods	X-PRESS™ Human Machine Interface Windows-based SW (VisiSet™) via serial or Ethernet link Serial Host Mode Programming sequences	
Parameter Storage	Permanent memory (Flash)	

CODE QUALITY VERIFICATION	
Standard	**Supported Symbologies**
ISO/IEC 16022	Data Matrix ECC 200
ISO/IEC 18004	QR Code
ISO/IEC 15415	Data Matrix ECC 200, QR Code
ISO/IEC 15416	Code 128, Code 39, Interleaved 2 of 5, Codabar, Code 93, EAN-8/13, UPC-A/E
AS9132A	Data Matrix ECC 200
AIM DPM	Data Matrix ECC 200, QR Code

USER INTERFACE	
LED Indicators	Power, Ready, Good; Trigger; Com, Status, (Ethernet Network); Green Spot
Keypad Button	Configurable via VisiSet™

GLOSSARY

AIM
(Association for Automatic Identification and Mobility): AIM Global is the international trade association representing automatic identification and mobility technology solution providers.

AIM DPM Quality Guideline
Standard applicable to the symbol quality assessment of direct part marking (DPM) performed in using two-dimensional bar code symbols. It defines modifications to the measurement and grading of several symbol quality parameters.

AS9132
Standard defining uniform quality and technical requirements for direct part marking (DPM) using Data Matrix symbologies.

Barcodes (1D Codes)
A pattern of variable-width bars and spaces which represents numeric or alphanumeric data in machine-readable form. The general format of a barcode symbol consists of a leading margin, start character, data or message character, check character (if any), stop character, and trailing margin. Within this framework, each recognizable symbology uses its own unique format.

BIOS
Basic Input Output System. A collection of ROM-based code with a standard API used to interface with standard PC hardware.

Bit
Binary digit. One bit is the basic unit of binary information. Generally, eight consecutive bits compose one byte of data. The pattern of 0 and 1 values within the byte determines its meaning.

Bits per Second (bps)
Number of bits transmitted or received per second.

Byte
On an addressable boundary, eight adjacent binary digits (0 and 1) combined in a pattern to represent a specific character or numeric value. Bits are numbered from the right, 0 through 7, with bit 0 the low-order bit. One byte in memory can be used to store one ASCII character.

Composite Symbologies
Consist of a linear component, which encodes the item's primary data, and an adjacent 2D composite component, which encodes supplementary data to the linear component.

Dark Field Illumination
Lighting of surfaces at low angles used to avoid direct reflection of the light in the reader’s lens.

Decode
To recognize a barcode symbology *(e.g.,* Codabar, Code 128, Code 3 of 9, UPC/EAN, etc.) and analyze the content of the barcode scanned.

Depth of Field
The difference between the minimum and the maximum distance of the object in the field of view that appears to be in focus.

Diffused Illumination
Distributed soft lighting from a wide variety of angles used to eliminate shadows and direct reflection effects from highly reflective surfaces.

Direct Part Mark (DPM)
A symbol marked on an object using specific techniques like dot peening, laser etching, chemical etching, etc.

EEPROM
Electrically Erasable Programmable Read-Only Memory. An on-board non-volatile memory chip.

Element
The basic unit of data encoding in a 1D or 2D symbol. A single bar, space, cell, dot.

Flash
Non-volatile memory for storing application and configuration files.

Host
A computer that serves other terminals in a network, providing services such as network control, database access, special programs, supervisory programs, or programming languages.

Image Processing
Any form of information processing for which the input is an image and the output is for instance a set of features of the image.

Image Resolution
The number of rows and columns of pixels in an image. The total number of pixels of an image sensor.

Image Sensor
Device converting a visual image to an electric signal. It is usually an array of CCD (Charge Coupled Devices) or CMOS (Complementary Metal Oxide Semiconductor) pixel sensors.

IEC
(International Electrotechnical Commission): Global organization that publishes international standards for electrical, electronic, and other technologies.

IP Address
The terminal's network address. Networks use IP addresses to determine where to send data that is being transmitted over a network. An IP address is a 32-bit number referred to as a series of 8-bit numbers in decimal dot notation (*e.*g., 130.24.34.03). The highest 8-bit number you can use is 254.

ISO
(International Organization for Standardization): A network of the national standards institutes of several countries producing world-wide industrial and commercial standards.

LED (Light Emitting Diode)
A low power electronic light source commonly used as an indicator light. It uses less power than an incandescent light bulb but more than a Liquid Crystal Display (LCD).

LED Illuminator
LED technology used as an extended lighting source in which extra optics added to the chip allow it to emit a complex radiated light pattern.

Matrix Symbologies (2D Codes)
An arrangement of regular polygon shaped cells where the center-to-center distance of adjacent elements is uniform. Matrix symbols may include recognition patterns which do not follow the same rules as the other elements within the symbol.

Multidrop
A communication protocol for connecting two or more readers in a network with a concentrator (or controller) and characterized by the use of individual device addresses.

Multi-row (or Stacked) Symbologies
Symbologies where a long symbol is broken into sections and stacked one upon another similar to sentences in a paragraph.

RAM
Random Access Memory. Data in RAM can be accessed in random order, and quickly written and read.

Symbol Verification
The act of processing a code to determine whether or not it meets specific requirements.

Transmission Control Protocol/Internet Protocol (TCP/IP)
A suite of standard network protocols that were originally used in UNIX environments but are now used in many others. The TCP governs sequenced data; the IP governs packet forwarding. TCP/IP is the primary protocol that defines the Internet.

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CE

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declares that the

MATRIX 410; 2D Imager

and all its models

are in conformity with the requirements of the European Council Directives listed below:

2004 / 108 / EC EMC Directive

This Declaration is based upon compliance of the products to the following standards:

EN 55022 (CLASS A ITE), SEPTEMBER 1998:	*INFORMATION TECHNOLOGY EQUIPMENT* *RADIO DISTURBANCE CHARACTERISTICS* *LIMITS AND METHODS OF MEASUREMENTS*
EN 61000-6-2, SEPTEMBER 2005:	*ELECTROMAGNETIC COMPATIBILITY (EMC)* *PART 6-2: GENERIC STANDARDS - IMMUNITY FOR INDUSTRIAL ENVIRONMENTS*

Monte San Pietro, June 28th, 2010

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