REFERENCE MANUAL

> Matrix 300™

DATALOGIC

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Matrix 300™ Reference Manual

Ed.: 07/2014

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29/07/14

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REFERENCES

CONVENTIONS

This manual uses the following conventions:

"User" refers to anyone using a Matrix 300™ reader.
"Reader" refers to the Matrix 300™ reader.
"You" refers to the System Administrator or Technical Support person using this manual to install, configure, operate, maintain or troubleshoot a Matrix 300™ reader.

REFERENCE DOCUMENTATION

For further details refer to: the VisiSet™ Help On Line, Matrix Reading Methods, Matrix Host Mode Programming, Matrix SW Parameter Guide, Matrix Code Quality Verifier Solution provided as supplementary documentation on Mini-DVD.

SUPPORT THROUGH THE WEBSITE

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

- **Products - Industrial Automation - Identification**

  Select your product from the links on the **Identification** page. The product page describes specific Info, Features, Applications, Models, Accessories, and Downloads including documentation, software drivers, and the VisiSet™ utility program, which allows device configuration using a PC through Serial and Ethernet interfaces.

- **Support & Services - Industrial Automation**

  Several links from the **Industrial Automation** list take you to additional services such as: Service Program which contains Maintenance Agreements and Warranty Extensions; Repair Centers; On-Line RMA Return Material Authorizations; Technical Support through email or phone, Partner Program; Downloads for additional downloads.

PATENTS

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

Utility patents: US6,512,218 B1; US6,616,039 B1; US6,808,114 B1; US6,997,385 B2; US7,053,954 B1; US7,387,246 B2; US8,058,600 B2; EP996,284 B1; EP999,514 B1; EP1,014,292 B1; EP1,128,315 B1; EP1,396,811 B1; EP1,413,971 B1; JP4,435,343 B2; JP4,571,258 B2.

Additional patents pending.

COMPLIANCE

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

Only connect Ethernet and dataport connections to a network which has routing only within the plant or building and no routing outside the plant or building.

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;
- connect pin "Earth" of the CBX connection box to a good Earth Ground;
- for direct connections, connect your cable shield to the locking ring nut of the 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 (LPS or “Class 2”) which supplies power directly to the reader, or a UL Listed Direct Plug-in Power Unit (rated 10 to 30 V, minimum 1 A) marked LPS or “Class 2”, or Power over Ethernet source Device supplied by UL Listed Direct Plug-in Power Unit marked LPS or “Class 2”.

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.

LASER SAFETY

The Matrix 300™ internal illuminators contain two aiming Laser LEDs used to position the reader.

This product conforms to the applicable requirements of IEC 60825-1 and complies with 21 CFR 1040.10 except for deviations pursuant to Laser Notice N° 50, date June 24, 2007. This product is classified as a Class 2 laser product according to IEC 60825-1 regulations.

CAUTION: Use of controls or adjustments or performance of procedures other than those specified herein may result in exposure to hazardous visible laser light.

Disconnect the power supply when opening the device during maintenance or installation to avoid exposure to hazardous laser light. The laser beam can be switched on or off through a software command.

LED SAFETY

LED emission according to EN 62471.

HANDLING

The Matrix 300™ is designed to be used in an industrial environment and is built to withstand vibration and shock when correctly installed, however it is also a precision product and therefore before and during installation it must be handled correctly to avoid damage.

- avoid that the readers are dropped (exceeding shock limits).

- do not fine tune the positioning by striking the reader or bracket.

- do not weld the reader into position which can cause electrostatic, heat or reading window damage.

- do not spray paint near the reader which can cause reading window damage.

GENERAL VIEW

Matrix 300™

Liquid Lens Models

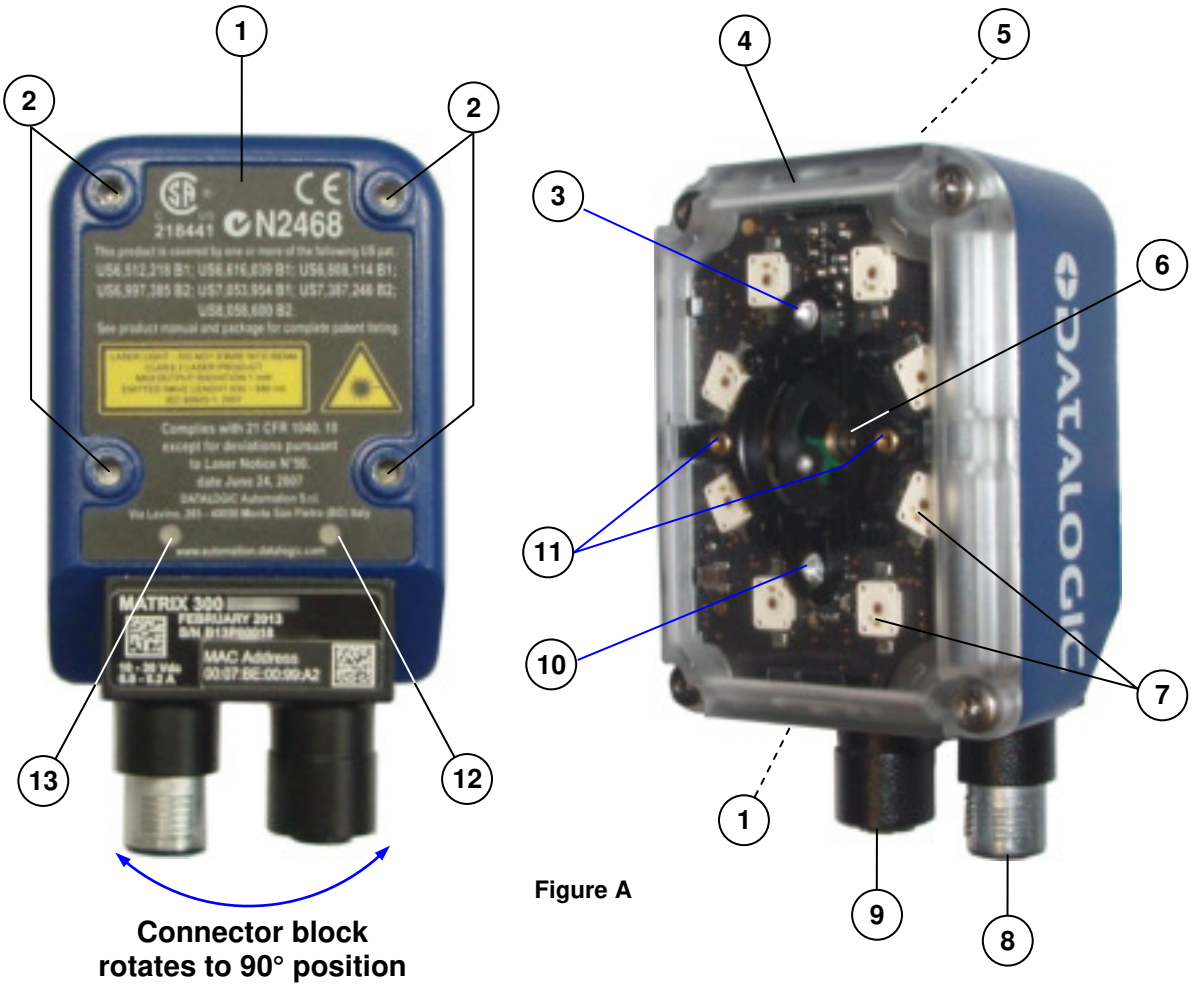


Figure A

1. Device Class and Warning Labels
2. Bracket Mounting Holes (4)
3. Good Read LED (green)
4. Lens Cover
5. HMI X-PRESS™ Interface
6. Lens
7. Internal Illuminator
8. Power - Serial Interfaces - I/O Connector
9. Ethernet Connector
10. No Read LED (red)
11. Aiming System Laser Pointers
12. Ethernet Connection LED
13. Power On LED

Matrix 300™

Fixed Lens Models

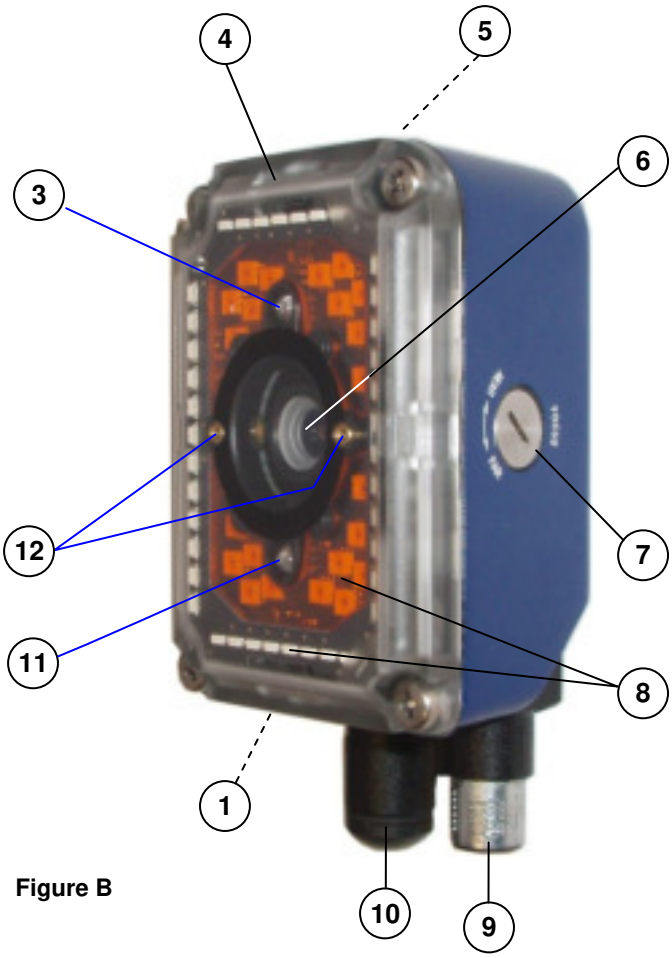


Figure B

1. Device Class and Warning Labels
2. Bracket Mounting Holes (4)
3. Good Read LED (green)
4. Lens Cover
5. HMI X-PRESS™ Interface
6. Lens
7. Focus Adjustment Screw
8. Internal Illuminator
9. Power - Serial Interfaces - I/O Connector
10. Ethernet Connector
11. No Read LED (red)
12. Aiming System Laser Pointers
13. Ethernet Connection LED
14. Power On LED

1 RAPID CONFIGURATION

STEP 1 – CONNECT THE SYSTEM

To connect the system in a Stand Alone configuration, you need the hardware indicated in Figure 1. In this layout the data is transmitted to the Host on the main serial interface. Data can also be transmitted on the RS232 auxiliary interface independently from the main interface selection.

When One Shot or Phase Mode Operating mode is used, the reader is activated by an External Trigger (photoelectric sensor) when the object enters its reading zone.

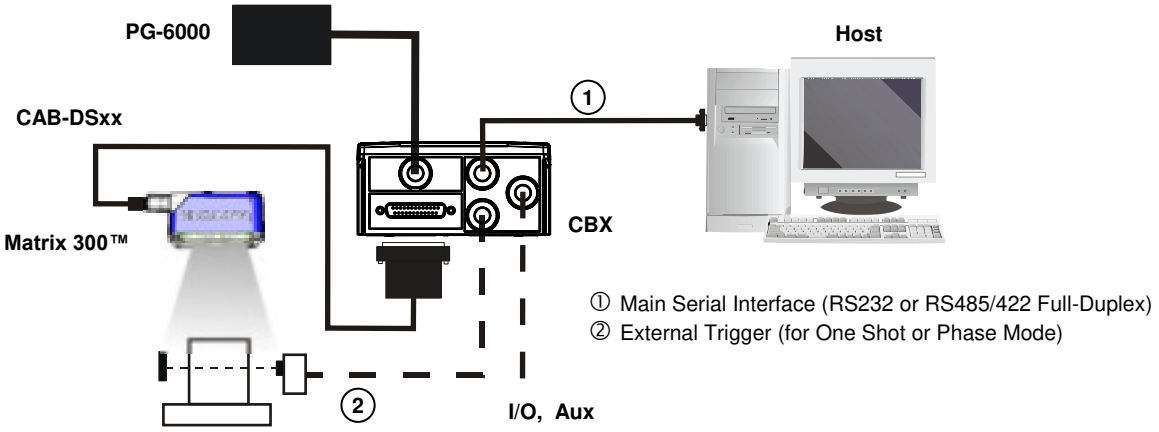


Figure 1 – Matrix 300™ in Stand Alone Layout

CBX100/CBX500 Pinout for Matrix 300™

The table below gives the pinout of the CBX100/CBX500 terminal block connectors. Use this pinout when the Matrix 300™ reader is connected by means of the CBX100/CBX500:

CBX100/500 Terminal Block Connectors			
Input Power		**Outputs**	
Vdc	Power Supply Input Voltage +	+V	Power Source - Outputs
GND	Power Supply Input Voltage -	-V	Power Reference - Outputs
Earth	Protection Earth Ground	O1+	Output 1 +
		O1-	Output 1 -
Inputs		O2+	Output 2 +
+V	Power Source – External Trigger	O2-	Output 2 -
I1A	External Trigger A (polarity insensitive)	O3A	Output 3 (CBX500 only)
I1B	External Trigger B (polarity insensitive)		
-V	Power Reference – External Trigger		
+V	Power Source – Inputs	**Auxiliary Interface**	
I2A	Input 2 A (polarity insensitive)	TX	Auxiliary Interface TX
I2B	Input 2 B (polarity insensitive)	RX	Auxiliary Interface RX
-V	Power Reference – Inputs	SGND	Auxiliary Interface Reference
Shield		**ID-NET™**	
Shield	Network Cable Shield	REF	Network Reference
		ID+	ID-NET™ network +
		ID-	ID-NET™ network -

Main Interface		
	RS232	**RS485/422 Full-Duplex**
	TX	TX+
	RTS	TX-
	RX	*RX+
	CTS	*RX-
	SGND	SGND

* Do not leave floating, see par. 4.2.2 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 2 – MOUNT AND POSITION THE READER

1. To mount the Matrix 300™, use the mounting brackets to obtain the most suitable position for the reader. The most common mounting configuration is shown in the figure below.

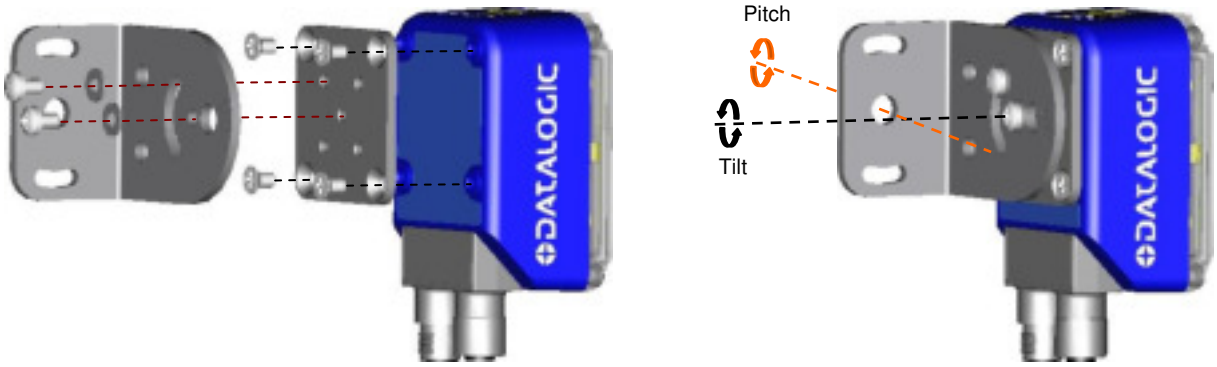


Figure 2 –Positioning with Mounting Bracket

2. When mounting the Matrix 300™ take into consideration these three ideal label position angles: **Pitch or Skew 10° to 20° and Tilt 0°**, although the reader can read a code at any tilt angle provided the code fits into the Field Of View (FOV).

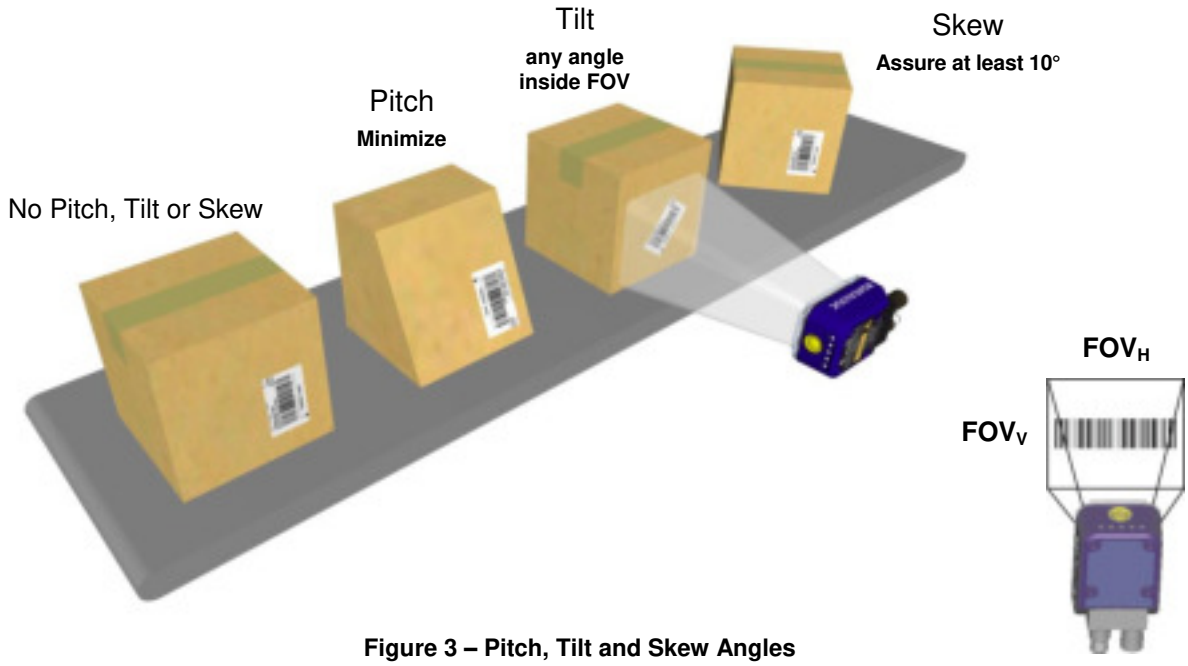


Figure 3 – Pitch, Tilt and Skew Angles

3. Refer to the reading diagrams in chp. 6 to determine the distance your reader should be positioned at.

NOTE: Rapid Configuration of the Matrix 300™ reader can be made **either** through the X-PRESS™ interface (steps 3-4) which requires no PC connection, **or** by using the VisiSet™ Setup Wizard (steps 5-6). Select the procedure according to your needs.

STEP 3 – AIM AND AUTOFOCUS THE READER

(Liquid Lens Models only)

Matrix 300™ provides a built-in laser pointer aiming system to aid reader positioning. For Liquid Lens models the autofocus feature is also incorporated into this function. The aiming system is accessed through the X-PRESS™ Interface.

1. Power the reader on. During the reader startup (reset or restart phase), all the LEDs blink for one second. On the reverse side of the reader near the bracket, the “POWER ON” LED (blue) indicates the reader is correctly powered.
2. Place the **Grade A Barcode Test Chart** in front of the reader at the correct reading distance for your application. See the Reading Diagrams in chapter 6 for reference.
3. Enter the Aim/Autofocus function by pressing and holding the X-PRESS™ push button until the Aim LED is on.
4. Release the button to enter the Aim function. The laser pointers turn on, and the Autofocus procedure begins, see Figure 4. The Aim LED will blink until the procedure is completed.

   Within 3 seconds (before the reader flashes), center one of the larger codes on the aiming system pointers (the code must not move during this procedure).

   The Autofocus procedure ends when the Reading Distance and PPI values are successfully saved in the reader memory, the Aim LED will stop blinking and Matrix 300™ emits 3 high pitched beeps.

   If the Autofocus cannot be reached after a timeout of about 3 (three) minutes Matrix 300™ will exit without saving the parameters to memory, the Aim LED will stop blinking and in this case Matrix 300™ emits a long low pitched beep.

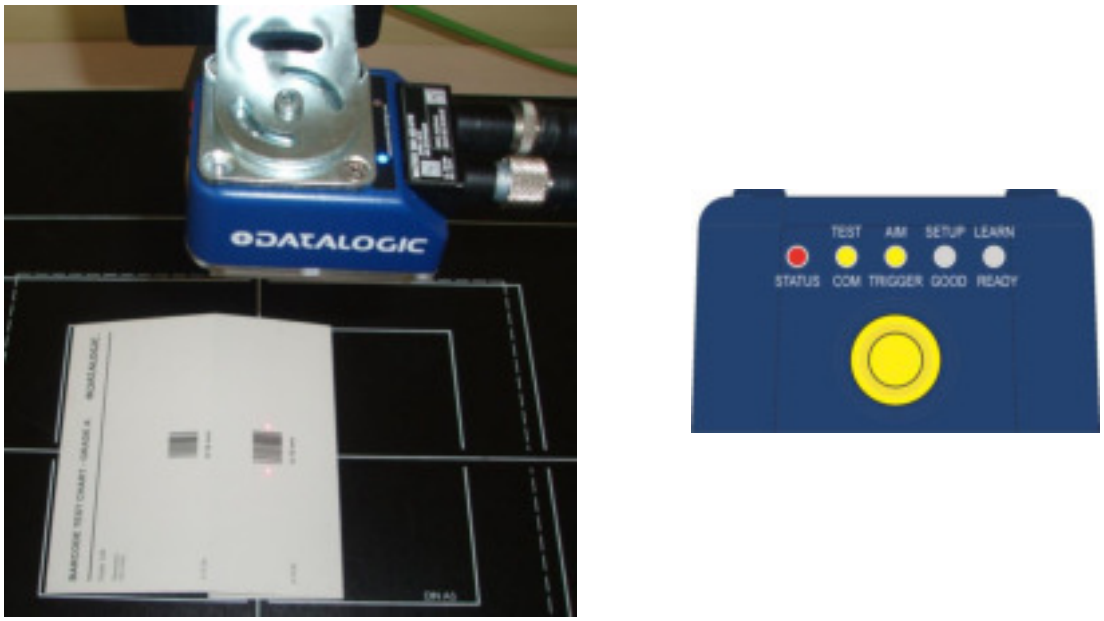


Figure 4 – X-PRESS™ Interface: Aim/Autofocus Function

NOTE: You can exit the Aim/Autofocus function at any time by pressing the X-PRESS™ push button once. After a short delay the autofocus procedure is cancelled and the laser pointers turn off.

(Fixed Lens Models only)
The Matrix 300™ fixed lens models are factory focused to a precise Reading Distance. If this distance is compatible with your application you can use the X-PRESS™ Interface to install the reader, if not, use the VisiSet™ procedure described in step 6B.

1. Place the reader at the factory focused Reading Distance and go to step 4.

   Factory focus for 6 mm fixed lens models is **85 mm**.

STEP 4 – X-PRESS™ CONFIGURATION

Once Matrix 300™ has focused at the correct reading distance, you must configure it for optimal code reading relative to your application. This configuration can be performed either through the X-PRESS™ Interface or the VisiSet™ configuration program.

Aim

1. Enter the Aim function by pressing and holding the X-PRESS™ push button until the Aim LED is on.
2. Release the button to enter the Aim function. The laser pointers turn on.
3. **Select a single code from your application**. Position the code at the center of the FOV (equidistant from the laser pointers).

   For Liquid Lens models the reader may start flashing and try to perform autofocus however this will have no effect on the application specific code; it can be ignored.

   Exit the Aim function by pressing the X-PRESS™ push button once. After a short delay the Aim function is cancelled and the laser pointers turn off.

Figure 5 – X-PRESS™ Interface: Aim Function

Setup

4. Enter the Setup function by pressing and holding the X-PRESS™ push button until the Setup LED is on.
5. Release the button to enter the Setup function. The Setup LED will blink until the procedure is completed.

   The Setup procedure ends when the Image Acquisition parameters are successfully saved in the reader memory, the Setup LED will stop blinking and Matrix 300™ emits 3 high pitched beeps.

   If the calibration cannot be reached after a timeout of about 5 (five) seconds Matrix 300™ will exit without saving the parameters to memory, the Setup LED will stop blinking and in this case Matrix 300™ emits a long low pitched beep.

Figure 6 – X-PRESS™ Interface: Setup Function

Learn

6. Enter the Learn function by pressing and holding the X-PRESS™ push button until the Learn LED is on.
7. Release the button to enter the Learn function. The Learn LED will blink until the procedure is completed.

   The Learn procedure ends when the Image Processing and Decoding parameters are successfully saved in the reader memory, the Green Spot is activated, the Learn LED will stop blinking and Matrix 300™ emits 3 high pitched beeps[1].

   If the autolearning cannot be reached after a timeout of about 3 (three) minutes Matrix 300™ will exit without saving the parameters to memory, the Learn LED will stop blinking and in this case Matrix 300™ emits a long low pitched beep.

Figure 7 – X-PRESS™ Interface: Learn Function

NOTE: The Grade A Barcode Test Chart cannot be used to set the Code 128 symbology (even though the reader successfully reads the code). Use the application specific code if you need to set this symbology.

NOTE: You can exit the Learn function at any time by pressing the X-PRESS™ push button once. After a short delay the Learn procedure is cancelled.

NOTE: If you have used this procedure to configure Matrix 300™ go to step 7.

Reset Reader to Factory Default (Optional)

If it ever becomes necessary to reset the reader to the factory default values, you can perform this procedure by holding the X-PRESS™ push button pressed while powering up the reader. **You must keep the X-PRESS™ push button pressed until the power up sequence is completed** (several seconds) and all LEDs blink simultaneously 3 times.

All LEDs remain on for about 1 second, then off for one second, the Configuration and Environmental parameters are reset, and the status LED remains on. If connected through a CBX500 with display module, the message "Default Set" is shown on the display.

[1] *The Learn procedure will not recognize Pharmacode symbologies.*

STEP 5 – INSTALLING VISISET™ CONFIGURATION PROGRAM

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

- Setup Wizard for rapid configuration and new users;
- Defined configuration directly stored in the reader;
- Communication protocol independent from the physical interface allowing the reader to be considered 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, Vista, 7 or 8; then insert the VisiSet™ Mini-DVD, wait for it to autorun and follow the installation procedure.

This configuration procedure assumes a laptop computer, running VisiSet™, is connected to the reader's auxiliary port. The reader can also be connected to VisiSet™ through the on-board Ethernet by following the procedure in chp. 7.

After installing and running the VisiSet™ software program the following window:

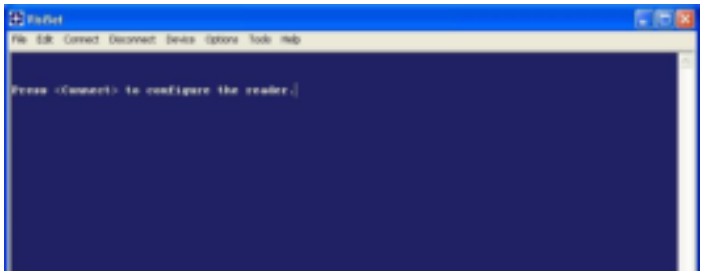


Figure 8 - VisiSet™ Opening Window

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

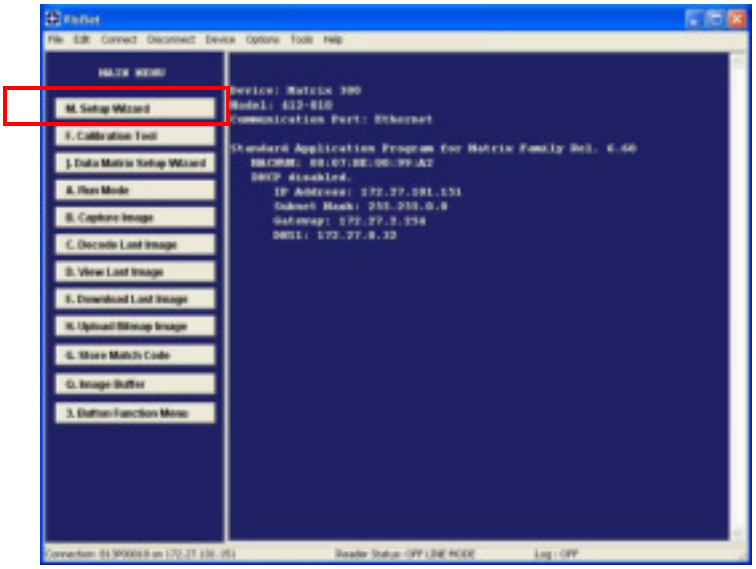


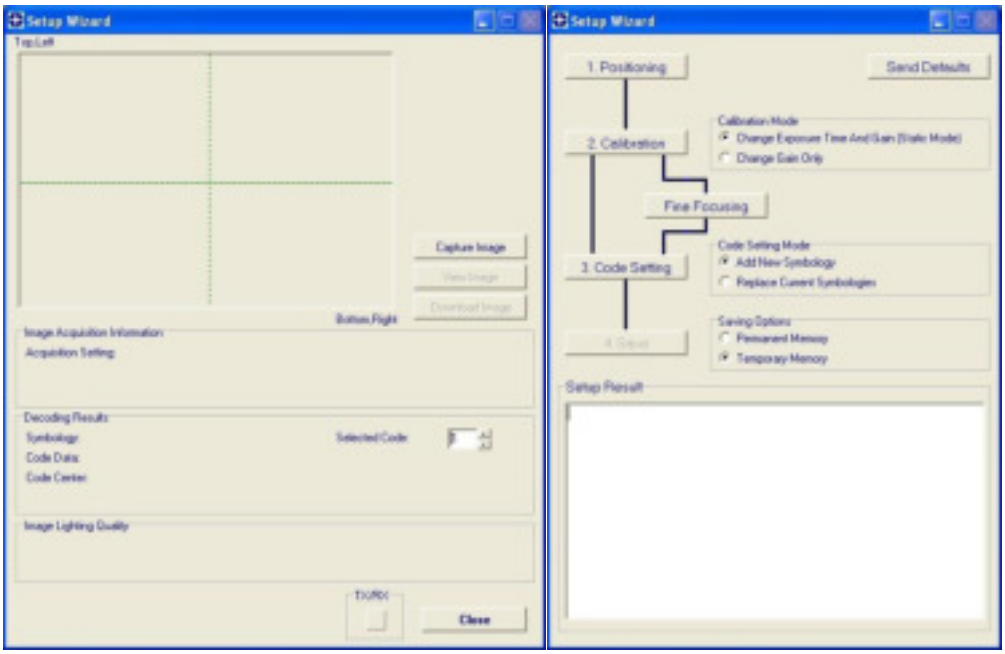
Figure 9 - VisiSet™ Main Window After Connection

STEP 6A – USING SETUP WIZARD FOR LIQUID LENS MODELS

NOTE: For Fixed Lens models go to Step 6B.

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

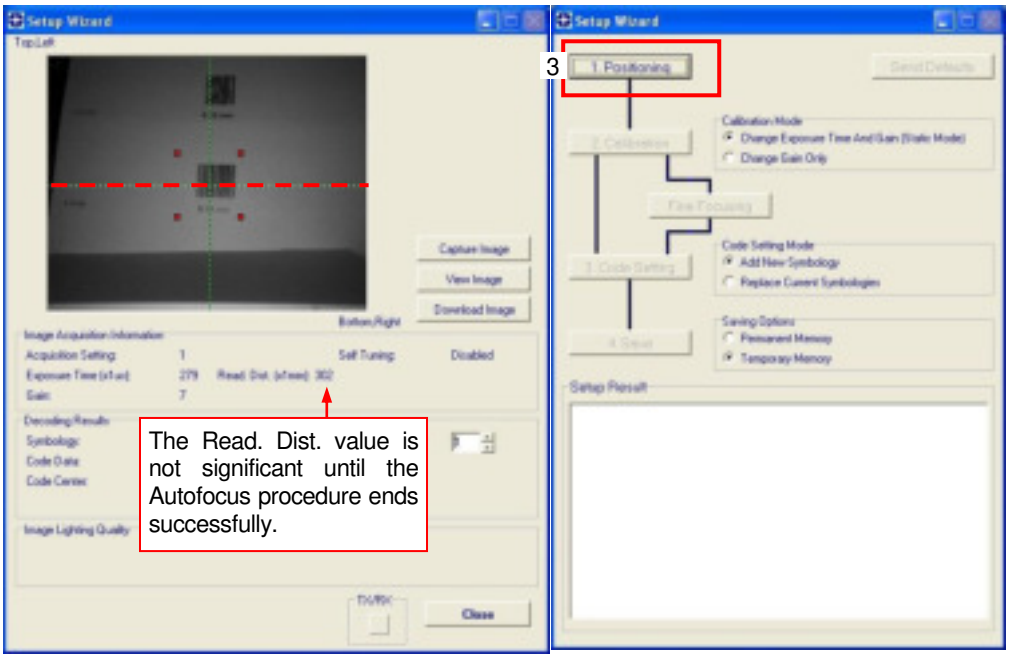
1. Select the Setup Wizard button from the Main menu.



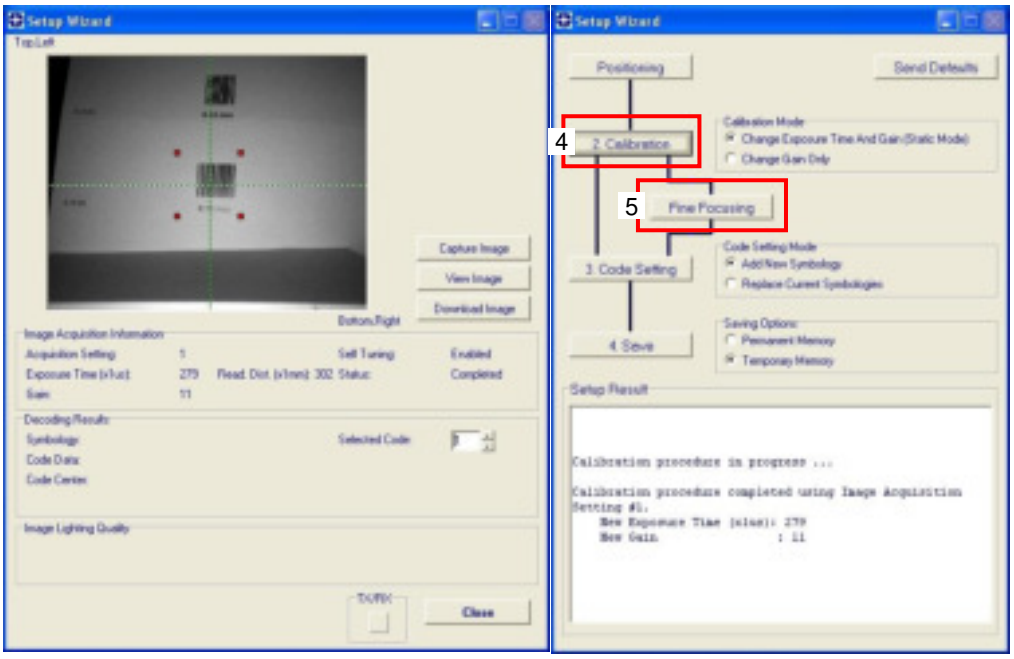
2. Place the **Grade A Barcode Test Chart** in front of the reader at the correct reading distance for your application. See STEP 2 - Mount and Position the Reader and the Reading Diagrams in chapter 6 for reference.

3. Press the "Positioning" button. The reader continuously acquires images and gives visual feedback in the view image window. The Setup Wizard now shows four delimiters (red points) in the acquired images which indicate the region in which the calibration algorithm is active. Choose one of the larger codes and move either 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.

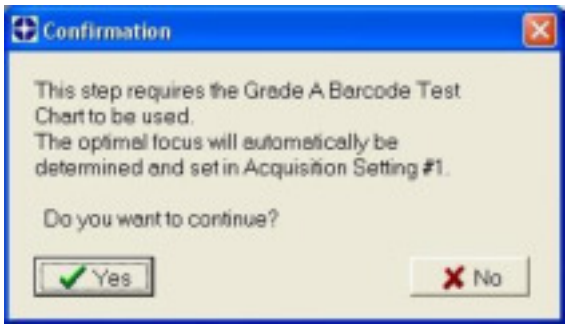


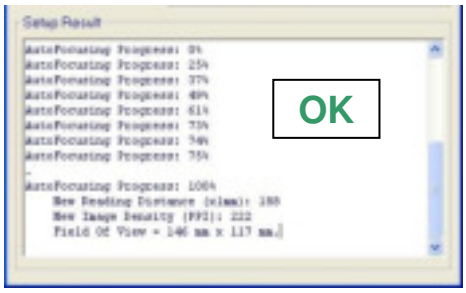
4. Select a Calibration Mode choice and press the "Calibrate" button. The reader flashes once acquiring the image and auto determines the best exposure and gain settings.

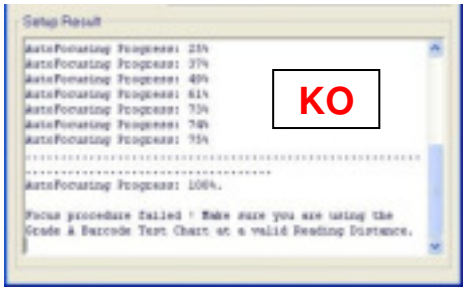


5. Press the "Fine Focusing" button to activate the Focus procedure.

CAUTION: For Liquid Lens models, the Fine Focusing procedure requires the **Grade A Barcode Test Chart** to be used; otherwise the procedure will fail.







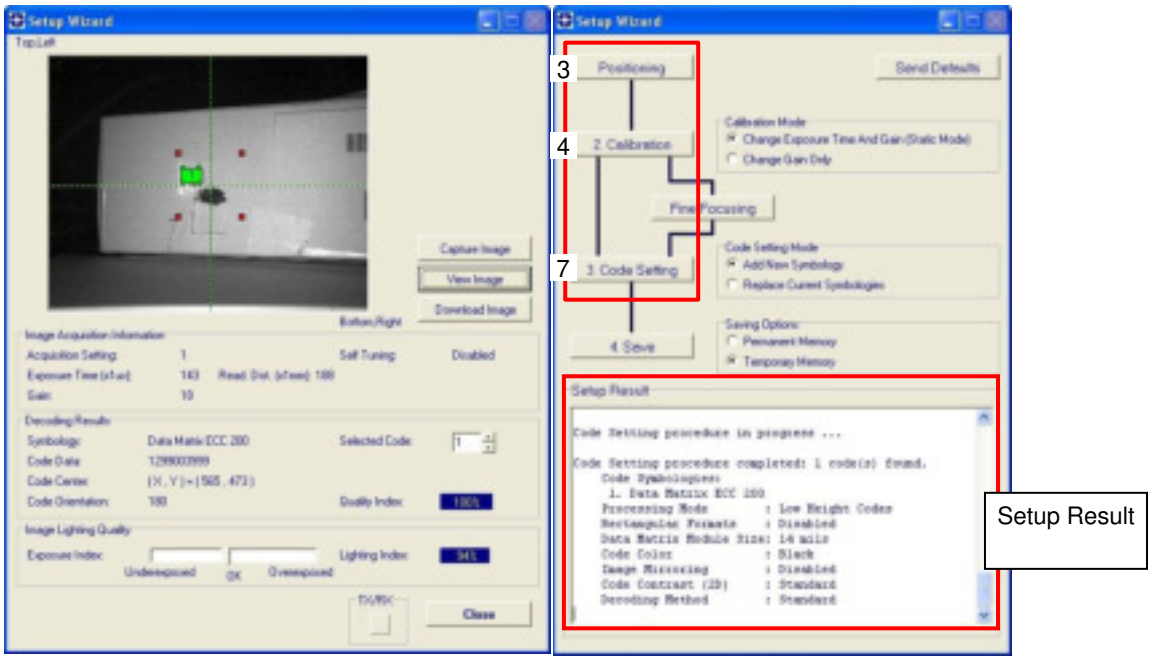
The reader starts the focus procedure and gives visual feedback in the Setup Wizard window. The Setup Result section of the Setup Wizard window reports the procedure progress (in percentage).

At the end of the procedure the Reading Distance, PPI and FOV data are reported.

6. Now place **a single application specific code** in front of the reader (at the same reading distance) and repeat steps 3, and 4. Do not perform step 5 "Fine Focusing".

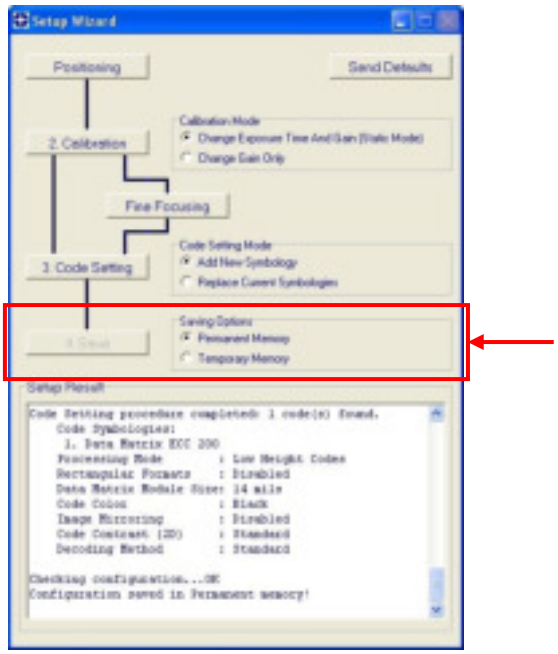
7. Select a Code Setting Mode choice and press the "Code Setting" button.

   The Setup Result section of the Setup Wizard window shows the code type results.



NOTE: The Grade A Barcode Test Chart cannot be used to set the Code 128 symbology (even though the reader successfully reads the code). Use the application specific code if you need to set this symbology.

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



9. Close the Setup Wizard.

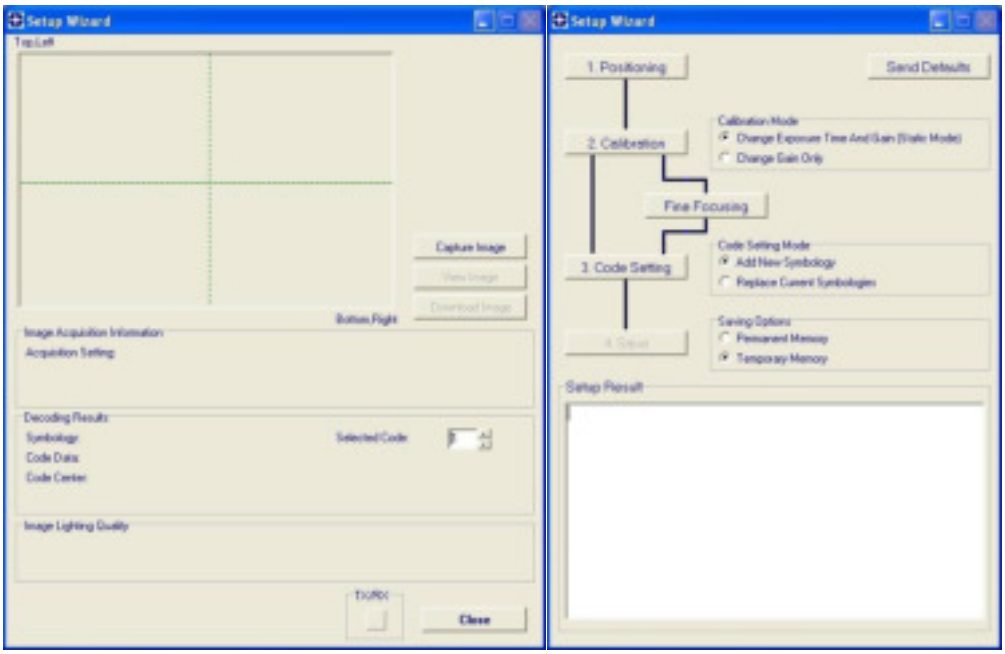
NOTE: If your application has been configured using the VisiSet™ Setup Wizard, your reader is ready. If necessary you can use VisiSet™ for advanced reader configuration.

STEP 6B – USING SETUP WIZARD FOR FIXED LENS MODELS

NOTE: For Liquid Lens models go to Step 6A.

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

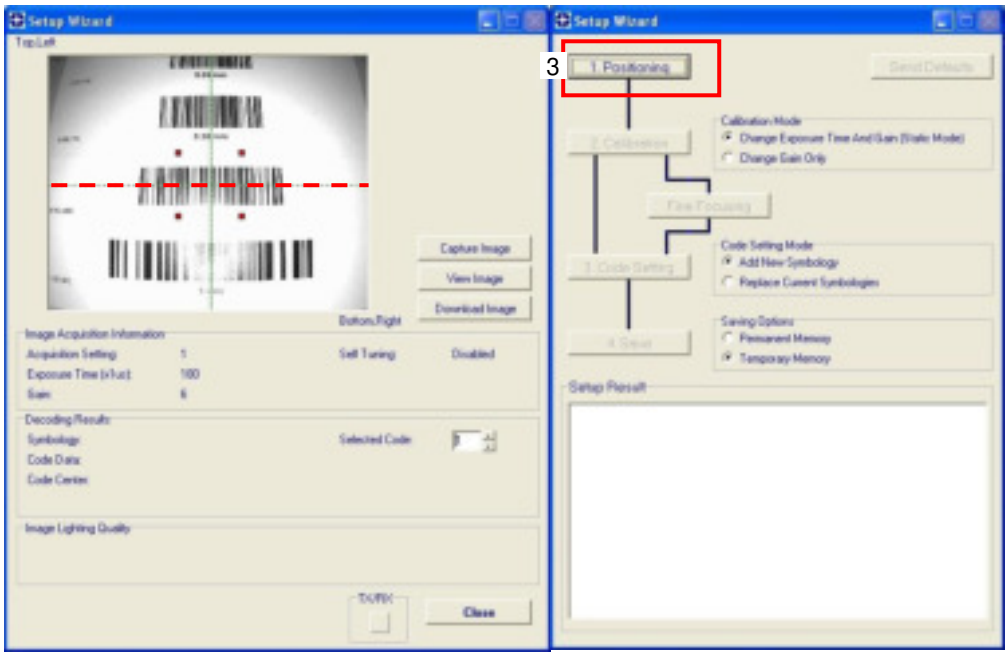
1. Select the Setup Wizard button from the Main menu.



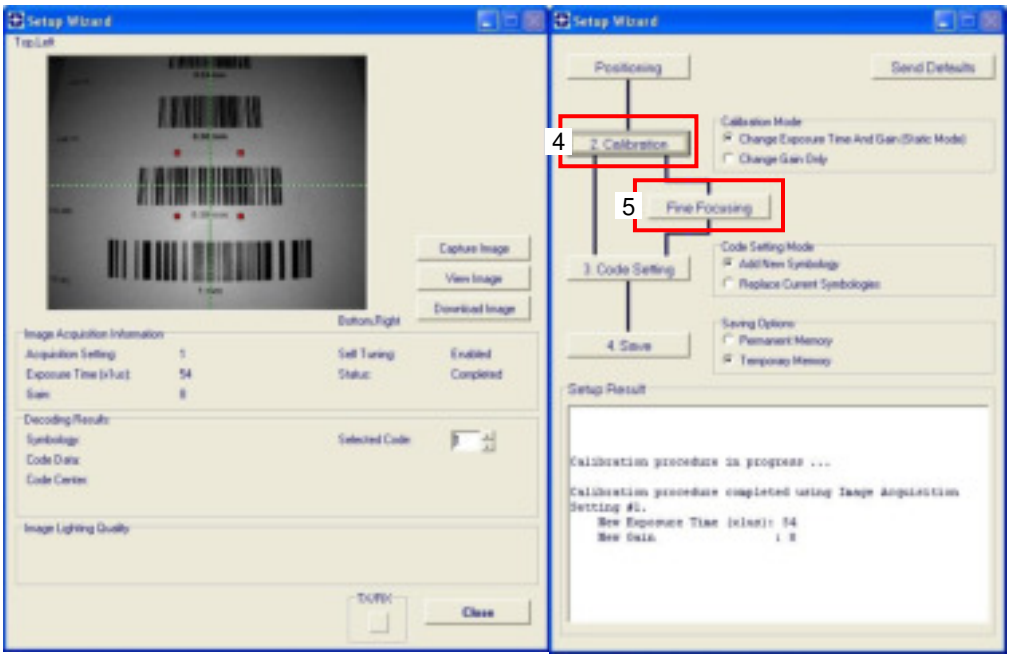
2. Place the **Grade A Barcode Test Chart** in front of the reader at the correct reading distance for your application. See STEP 2 - Mount and Position the Reader and the Reading Diagrams in chapter 6 for reference.

3. Press the "Positioning" button. The reader continuously acquires images and gives visual feedback in the view image window. The Setup Wizard now shows four delimiters (red points) in the acquired images which indicate the region in which the calibration algorithm is active. Choose one of the larger codes and move either 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.

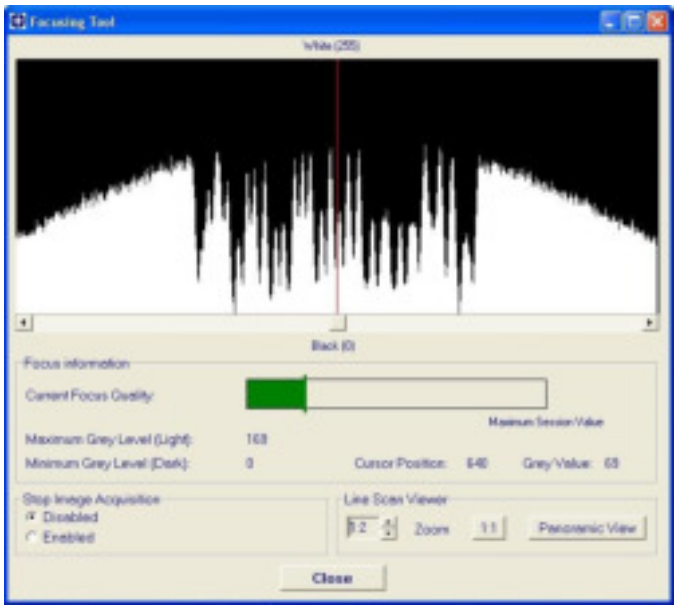
   Press the Positioning button again to stop positioning.



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.



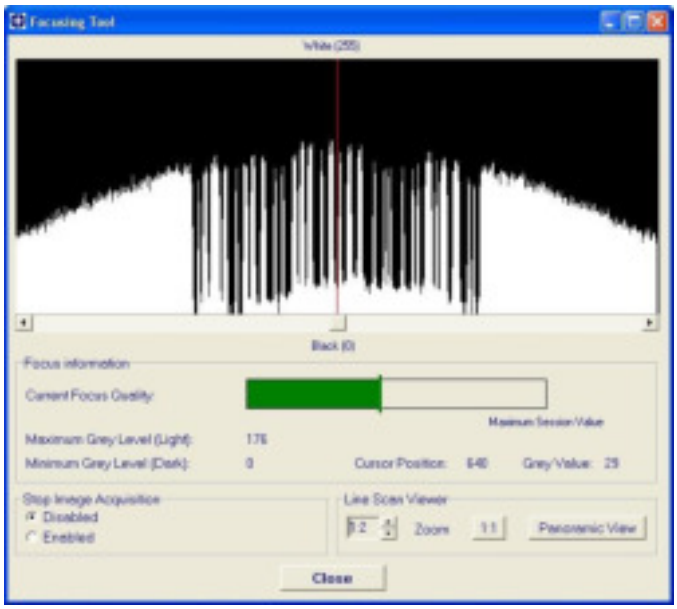
5. Press the "Fine Focusing" button to activate the Focus procedure.
The reader continuously acquires images and gives visual feedback on the focusing quality in the Focusing Tool window.



Rotate the Focusing screw on the side of the reader. 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 screw a little farther; **the Current Focus Quality Bar decreases** (red) see below.

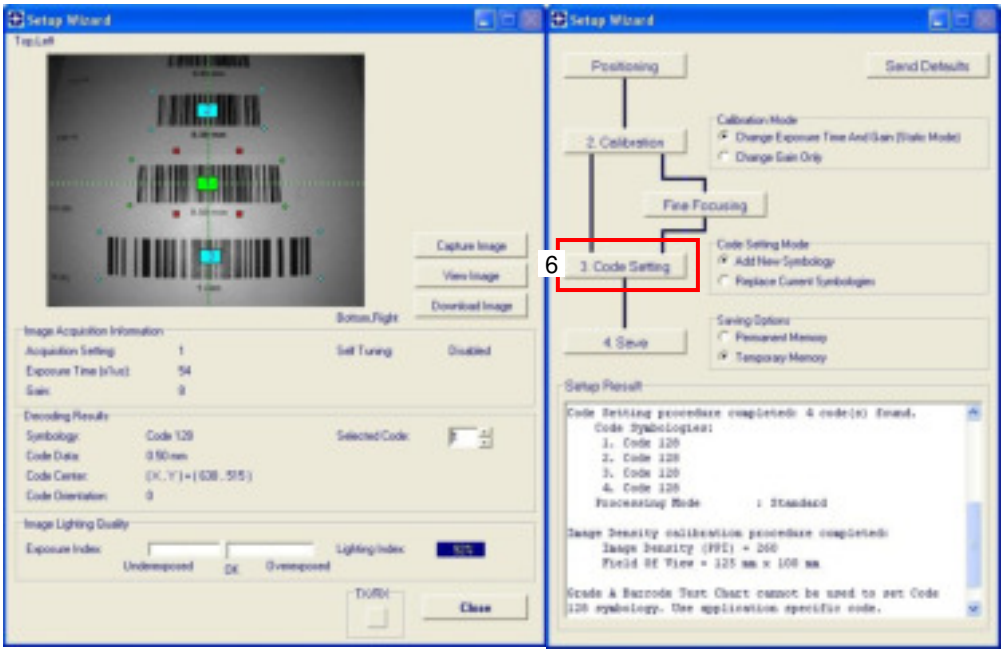
Rotate the Focusing screw in the opposite direction. The Current Focus Quality Bar (green) increases towards the vertical optimal focus line (green) until the optimal focus is reached; **the Current Focus Quality Bar touches the vertical optimal focus line** (indicating the best focus).



Press the "Close" button to return to the Setup Wizard.

6. Press the "Code Setting" button. The **Grade A Barcode Test Chart**, allows image density calibration to be performed so that Matrix 300™ will function correctly and to the fullest extent of its capabilities.

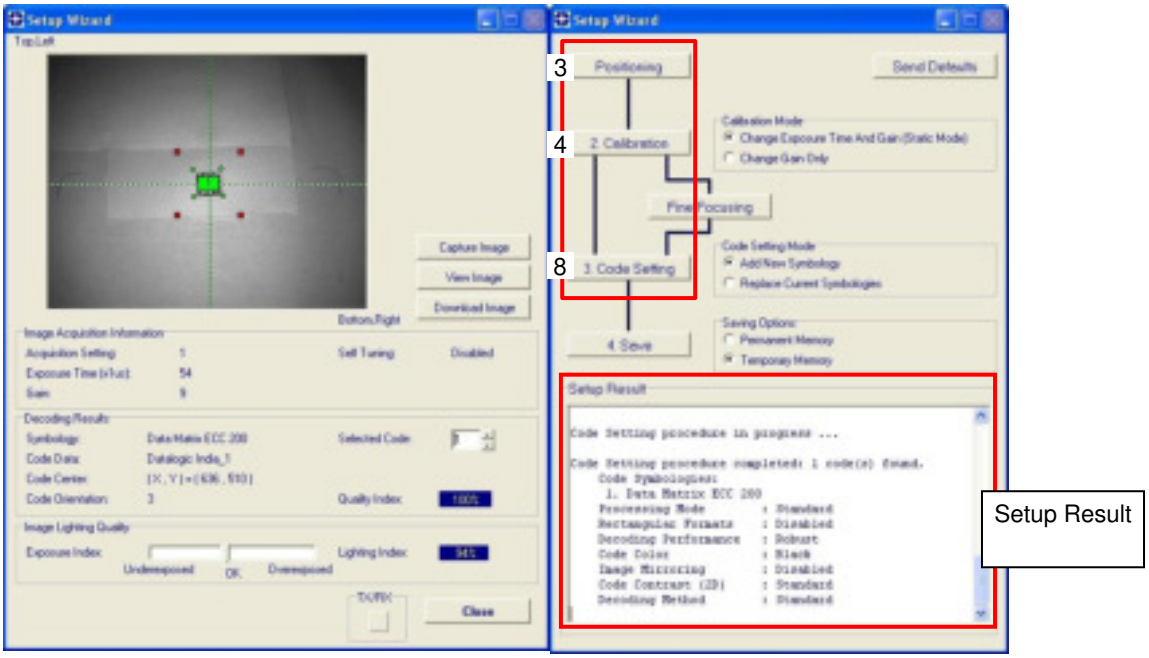
   The Setup Result section of the Setup Wizard window shows the code type results and the image density calibration settings reporting PPI and FOV.



7. Now place **a single application specific code** in front of the reader (at the same reading distance) and repeat steps 3, and 4. Do not perform step 5 "Fine Focusing".

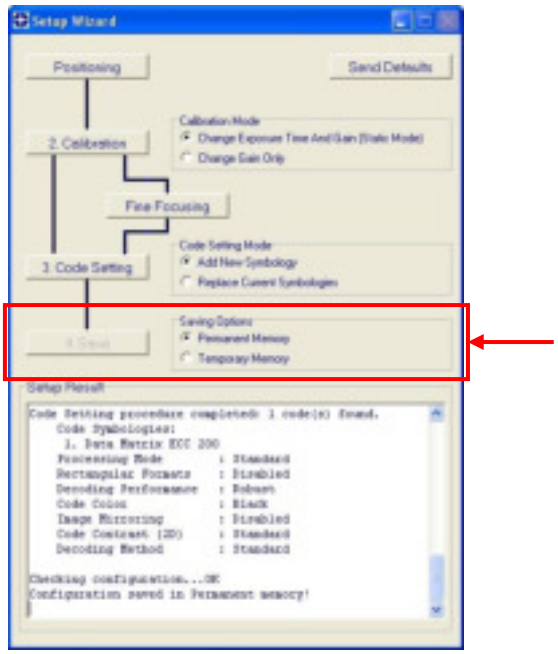
8. Select a Code Setting Mode choice and press the "Code Setting" button.

   The Setup Result section of the Setup Wizard window shows the code type results.



NOTE: The Grade A Barcode Test Chart cannot be used to set the Code 128 symbology (even though the reader successfully reads the code). Use the application specific code if you need to set this symbology.

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



10. 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 7 – TEST MODE

Use a code suitable to your application to test the reading performance of the system.

1. Enter the *Test* function by pressing and holding the X-PRESS™ push button until the Test LED is on.

2. Release the button to enter the *Test* function.

   Once entered, the Bar Graph on the five LEDs is activated and if the reader starts reading codes the Bar-Graph shows the Good Read Rate. In case of no read condition, only the STATUS LED is on and blinks.

Figure 10 – X-PRESS™ Interface: Test Function

3. To exit the Test, press the X-PRESS™ push button once.

NOTE: By default, the Test exits automatically after three minutes.

The Bar Graph has the following meaning:

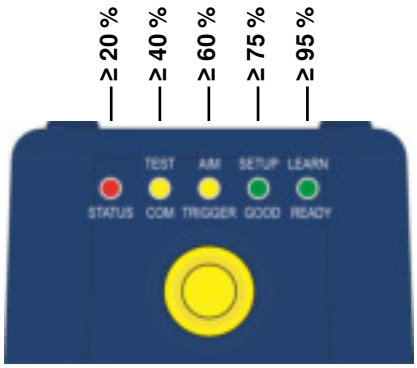


Figure 11 – Test Function Bar Graph

ADVANCED READER CONFIGURATION

For further details on advanced product configuration, refer to the VisiSet™ Help On-Line. The following are alternative or advanced reader configuration methods:

Advanced Configuration Using VisiSet™

Advanced configuration can be performed through the VisiSet™ program by selecting *Device> Get Configuration From Temporary Memory* to open the Parameter Setup window in off-line mode. Advanced configuration is addressed to expert users being able to complete a detailed reader configuration. The desired parameters can be defined in the various folders of the Parameter Setup window and then sent to the reader memory (either Temporary or Permanent):

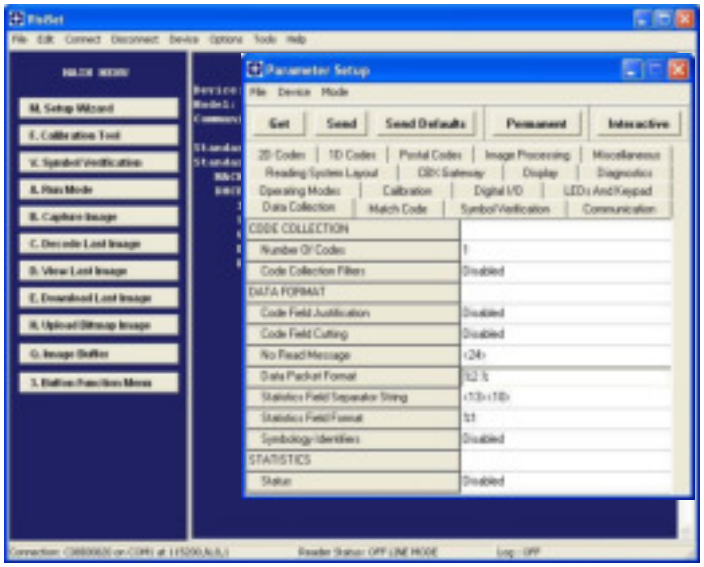


Figure 12 - VisiSet™ Parameter Setup Window

Host Mode Programming

The reader can also be configured from a host computer using the Host Mode programming procedure, by commands via the serial interface. See the Host Mode Programming file on the Mini-DVD.

Alternative Layouts

If you need to install an Ethernet network, ID-NET™ network, or Fieldbus network, refer to the Matrix 300™ Reference Manual.

The reader can also be setup for alternative layouts by reading programming barcodes. See the "Setup Procedure Using Programming Barcodes" printable from the Mini-DVD.

2 INTRODUCTION

2.1 PRODUCT DESCRIPTION

Matrix 300™ is a Datalogic industrial compact 2D imager designed and produced to be a high performance affordable solution for both linear and two-dimensional code reading applications.

Matrix 300™ uses imaging technology and provides complete reading system functions by integrating image capturing, decoding and communicating in a single compact and versatile product.

Matrix 300™ features excellent reading and verifying performance thanks to its 1.3 Mega pixel sensor and smart proprietary decoding libraries.

Innovative X-PRESS™ interface, combined with illuminator laser pointers for aiming, autofocus and a Good Read Spot, enhance the ease of setup and use.

Rugged construction, IP67 protection and max 50°C operative temperature make the Matrix 300™ the ideal product for industrial applications.

Matrix 300™ has been developed for use in numerous industries like:

Automotive
- DPM (Direct Part Marked) Reading and Verification
- Tires Sorting

Electronics
- Large PCB Board Tracking
- Electronics Product Tracking

Distribution & Retail Industry
- Presentation Scanner
- Small Objects Tracking & Sorting
- Warehouse applications

Medical & Pharmaceutical
- Medical Devices Traceability
- Pharmaceutical and Medicine Manufacturing
- Chemical & Biomedical Analysis

Food & Beverage
- Work in Progress Traceability
- Code Quality Control

This technology intrinsically provides omni-directional reading.

Standard Application Program

A Standard Application Program is factory-loaded onto Matrix 300™. This program controls code reading, data formatting, serial port and Ethernet interfacing, and many other operating and control parameters. It is completely user configurable from a Laptop or PC using the dedicated configuration software program VisiSet™, provided on Mini-DVD with the reader.

There are different programmable operating modes to suit various code reading system requirements.

Quick, automatic focus, positioning, calibration and code setting of the imager can be accomplished using the X-PRESS™ button and LEDs on top of the reader without the necessity of a PC.

The previous functions can also be performed through VisiSet™ through the Setup Wizard. This tool includes visual feedback from the reader.

VisiSet™ provides a Calibration Tool to verify the exact positioning of the reader and to maximize its reading performance.

Statistics on the reading performance can also be visualized through a dedicated window in VisiSet™.

Programmability

If your requirements are not met by the Standard Application Program, Custom Application Programs can be requested at your local Datalogic distributor.

Some of the main features of this reader are given below:

Excellent Performance

- 1.3 MPixels (SXGA)
- Adjustable focus through Software controlled Liquid Lenses
- Powerful Internal Lighting Systems
- Outstanding decoding capability on 1D, 2D, Stacked, Postal symbologies
- Excellent performance on DPM applications
- Omni-directional reading
- Frame Rate up to 60 frames/sec
- Region Of Interest Windowing for higher frame rate
- Up to 100 readable codes in a single frame

Ease of Setup

- Quick installation without PC by using X-PRESS™ interface for easy and intuitive setup
- Laser pointers for aiming
- Automatic Imager calibration and Code Settings
- Calibration Tool to verify exact code positioning in the Field of View and to maximize the reading performance
- Windows-based VisiSet™ software to configure the reader parameters via PC serial or Ethernet interface
- User-defined database of Image Acquisition Settings (parameter sets)
- Smart Fast Bracket

Ease of Use

- X-PRESS™ interface LEDs provide operational and performance feedback
- Green Spot and beeper for immediate Good Read feedback
- Different operating modes to suit various application requirements
- Multi Image Acquisition Settings for higher reader flexibility
- Run Time Self-Tuning for extreme reader flexibility
- Image saving and storage with buffering capability
- Diagnostic software tools

Flexible Solution

- Adjustable Liquid lens models
- Complete set of Accessories like mounting brackets, connection boxes, cables and photocells
- Ethernet Connectivity with TCP/IP socket for reader parameter configuration, data and image transfer, FTP client, etc.
- On-board Ethernet supports EtherNet/IP (explicit messaging), Profinet I/O and Modbus TCP protocols
- 3 serial communication interfaces (Main, Auxiliary, ID-NET™)
- General purpose I/Os

Versatility

- Excellent reading performance on Direct Part Marked (DPM) symbols
- Code Quality Metrics according to ISO/IEC 16022, ISO/IEC 18004, ISO/IEC 15415, ISO/IEC 15416 and AS9132 and AIM DPM standards.
- Match Code option with a user-defined match code database

Industrial Strength

- Industrial compact 2D reader
- Rugged metal construction
- Sealed circular connectors
- IP67 protection class
- 50 °C max operating temperature
- Supply voltage ranges from 10 to 30 Vdc

The reader is particularly suitable for industrial environments where protection against harsh external conditions is required.

The reader is contained in an aluminum housing; with its internal illuminator, lens and protective cover, the mechanical dimensions are 95 x 54 x 43 mm and it weighs about 238 g.

Electrical connection of Power, Host interfaces and I/O signals is provided through an M12 (IP67) 17-pin connector (Figure A, 9). A standard M12 D-Coded (IP67) Ethernet connector is also present (Figure A, 10).

2.2 INDICATORS AND KEYPAD BUTTON

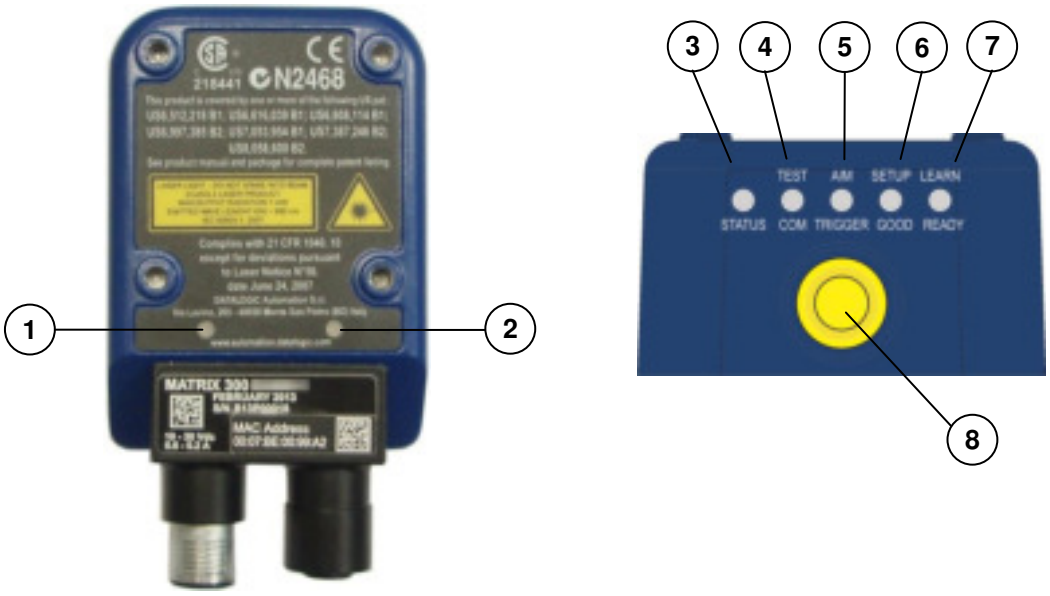


Figure 13 - Indicators

The following LED indicators are located on the reader:

PWR	blue LED indicates that the reader is connected to the power supply (Figure 13, 1)
NET	yellow LED indicates connection to the on-board Ethernet network (Figure 13, 2)

In normal operating mode the colors and meaning of the five LEDs are illustrated in the following table:

READY	green LED indicates that the reader is ready to operate (Figure 13, 7)
GOOD	green LED confirms successful reading (Figure 13, 6)
TRIGGER	yellow LED indicates the status of the reading phase (Figure 13, 5)
COM	yellow LED indicates active communication on the main serial port * (Figure 13, 4)
STATUS	red LED indicates a NO READ result (Figure 13, 3)

* When connected to a Fieldbus network through the CBX500, the COM LED is always active, even in the absence of data transmission, because of polling activity on the Fieldbus network.

During the reader startup (reset or restart phase), these five LEDs blink for one second.

In X-PRESS™ Configuration mode the colors and meaning of these five LEDs are described in par. 2.4.

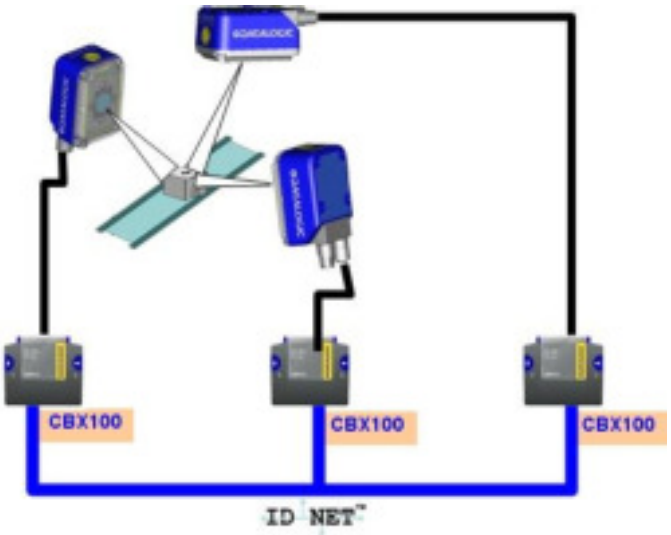
The keypad button (Figure 13, 8), is software programmable. By default it starts the X-PRESS™ interface for quick installation without using a PC (see chp. 1).

2.3 ID-NET™

The ID-NET™ network is a built-in high-speed interface dedicated for high-speed reader interconnection. ID-NET™ is in addition to the Main and Auxiliary serial interfaces.

The following network configurations are available:

- **ID-NET™ M/S Synchronized:** Single station – multiple readers

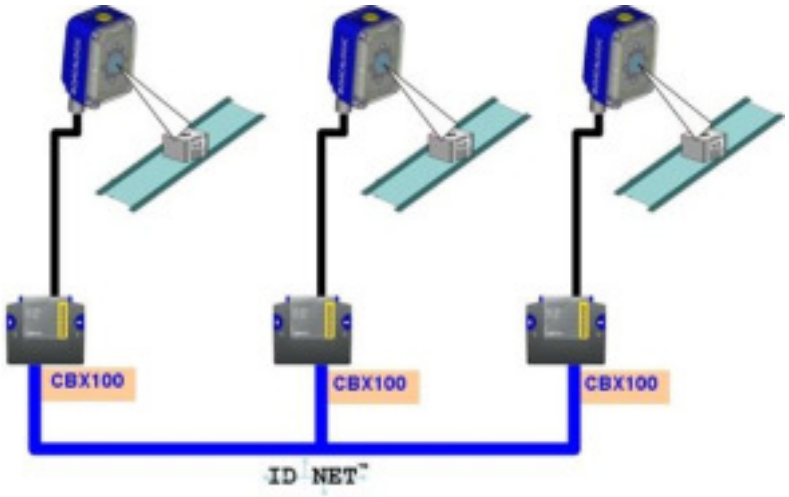


ID-NET™ interface allows local connection of multiple readers reading different sides of the same target. All readers share a single presence sensor and activate/deactivate simultaneously.

At the end of each reading phase a single data message is transmitted to the host.

Thanks to ID-NET™, data communication among readers is highly efficient so that an immediate result will be available.

- **ID-NET™ M/S Multidata:** Multiple stations – single reader



ID-NET™ interface allows connection of readers reading objects placed on independent conveyors. All readers are typically located far away from each other and they use a dedicated presence sensor.

At the end of each reading phase, each reader transmits its own data message to the host. Thanks to ID-NET™, data collection among readers is accomplished at a high speed without the need of an external multiplexing device. This leads to an overall cost reduction and to a simple system wiring.

2.3.1 How To Setup/Configure the Reader Network

A complete ID-NET™ reader network can be easily setup through VisiSet™ as follows:

Mounting & Connection

1. Mechanically mount/install all the readers (refer to par. 3.2 and 3.3).
2. Wire ID-NET™ (refer to par. 4.3 or **Error! Reference source not found.**).
3. Power up the entire system.

Configuration of Slaves

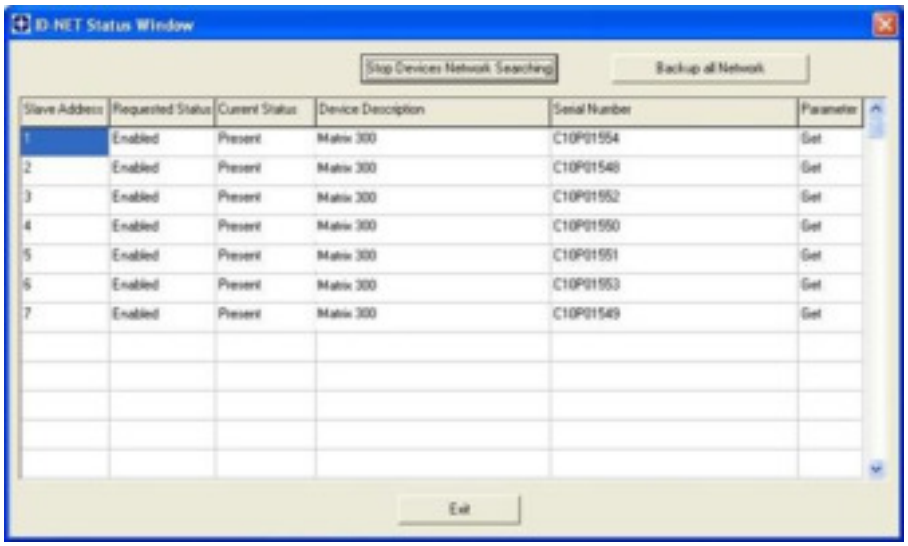
1. Connect a PC equipped with VisiSet™ to the Main, Auxiliary or Ethernet interface of the planned Slave reader.
2. Launch VisiSet™ and connect to the Slave reader.
3. From the VisiSet™ Device Menu select "Parameter Setup".
4. Set the Role of the Slave reader (Synchronized or Multidata) from the Reading System Layout > Device Network Setting > Topology Role parameter.
5. Set the Slave Address according to the desired value **1-31** from the Reading System Layout > Device Network Setting > Slave Address parameter. Each reader must have a different Address on the ID-NET™ Network.

6. If necessary, set the ID-NET™ baudrate from the Reading System Layout > Device Network Setting > Network Baud Rate parameter, (500 kbs default).
7. Configure the other device parameters via VisiSet™ [Operating Mode, Calibration, Data Collection parameters, etc.].
8. The Slave device is now Configured. Physically connect it to the Master/Slave network. If using the CBX connection box equipped with a BM100 Backup module, you can perform Device Backup at the Slave (see par. 2.4 for details).

The Slave device is now Configured. Repeat these steps for each Slave reader in the ID-NET™ network.

Configuration of Master

1. Connect a PC equipped with VisiSet™ to the Main, Auxiliary or Ethernet interface of the planned Master reader.
2. Launch VisiSet™ and connect to the Master reader.
3. From the VisiSet™ Device Menu select "Parameter Setup".
4. Set the Role of the Master reader (Synchronized or Multidata) from the Reading System Layout > Device Network Setting > Topology Role parameter.
5. Enable the planned Slave device N from the Reading System Layout > Expected Slave Device #N > Status parameter and, if desired, set the related identification string from the Expected Slave Device #N > Device Description parameter. Repeat this step for all planned Slave devices.
6. If necessary, set the ID-NET™ baudrate from the Reading System Layout > Device Network Setting > Network Baud Rate parameter, (500 kbs default).
7. Configure the other device parameters via VisiSet™ [Operating Mode, Calibration, Data Collection parameters, etc.].
8. The Master device is now Configured. Physically connect it to the Master/Slave network. If using the CBX connection box equipped with a BM100 Backup module, perform a Network Backup at the Master (see par. 2.4 for details).
9. From the VisiSet™ Device Menu select "ID-NET™ Status Window" and click on the "Look For Devices On Network" button to check the status of the expected Slave devices within the ID-NET™ network.

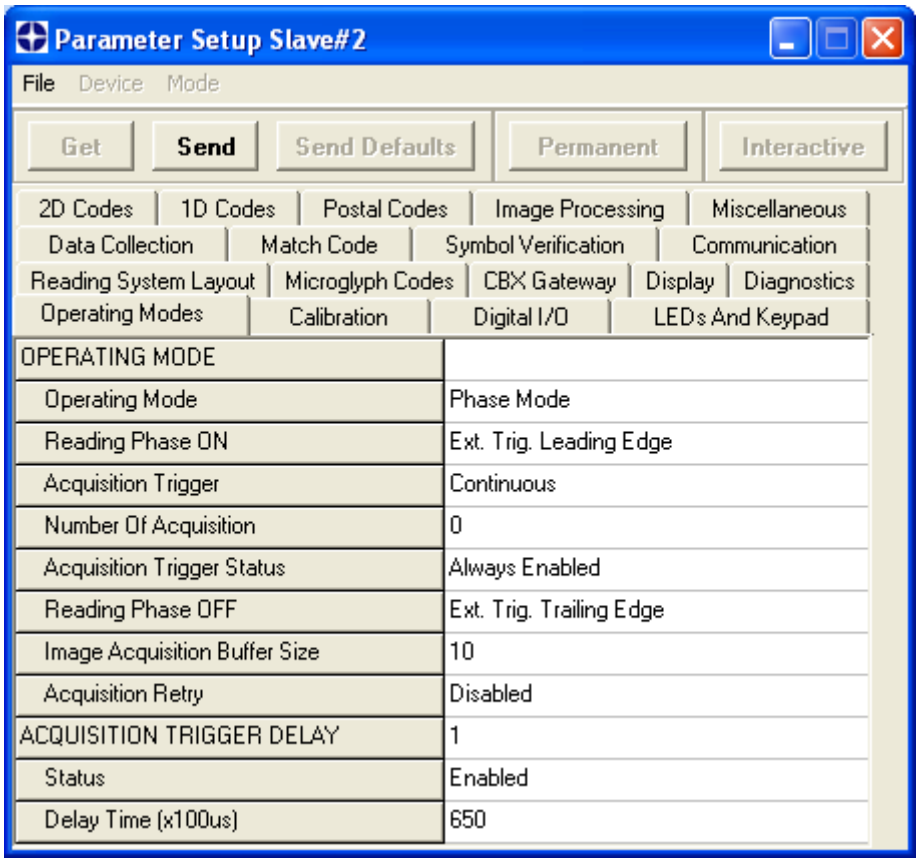


The reader network is ready.

2.3.2 ID-NET™ Slave Management Through Master

When an ID-NET™ layout has already been configured, it is possible to modify the configuration of any Slave from VisiSet through the Master.

1. Connect a PC equipped with VisiSet™ to the Main, or Auxiliary interface of the Master reader.
2. Launch VisiSet™ and connect to the Master reader.
3. From the VisiSet™ Device Menu select "ID-NET™ Status Window" and click on the "Look For Devices On Network" button to check the status of the expected Slave devices within the ID-NET™ network.
4. Click anywhere in the row of the specific slave in the ID-NET Status Window when its Current Status is "Present". The Parameter Setup window will be displayed after a time based on the network speed, with the configuration of the selected slave.
5. From the specific Slave Parameter Setup Window, change any parameter (not in interactive mode), save the configuration to a file, or load a configuration from a file.
6. Send the modified configuration to the slave.



CAUTION: If a wrong configuration is set or if the Slave Reading System Layout parameters are changed, the slave could lose the network connection.

2.4 EXTERNAL MEMORY BACKUP AND RESTORE THROUGH VISISET™

The "External Memory Backup" or "External Memory Restore" functions allow performing Complete Configuration and Environmental parameter storage for network and reading devices. Backup & Restore can be applied to any reader connected through a device having External Backup Memory, regardless of the reader's network configuration. Backup & Restore automatically checks whether a previous backup or configuration is already available for each device, speeding the procedure up and making it more secure.

These functions are supported by VisiSet™ for all reading devices having sw 6.10 and later when connected to:

- CBX + BM100 and/or BM2x0 (sw release 2.02.01 and later)
- QL500 (Ethernet TCP/IP) (sw release 2.02.01 and later)
- QLM-Series Gateways (reading device sw release 6.50 and later)

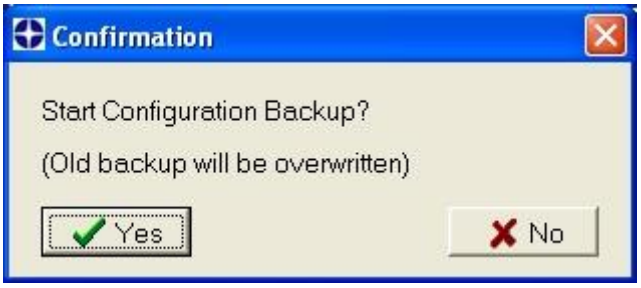
NOTE:

- *Before executing a Backup on a BM100 backup module make sure the Write Protection switch is set to Unlocked.*
- *If BM100 and BM2x0 are both installed B&R is automatically performed only on the BM100 module.*
- *BM2x0 can execute B&R only with Network up and running (network cable connected).*
- *QL500 can backup up to 10 nodes (Master + 9 slaves).*

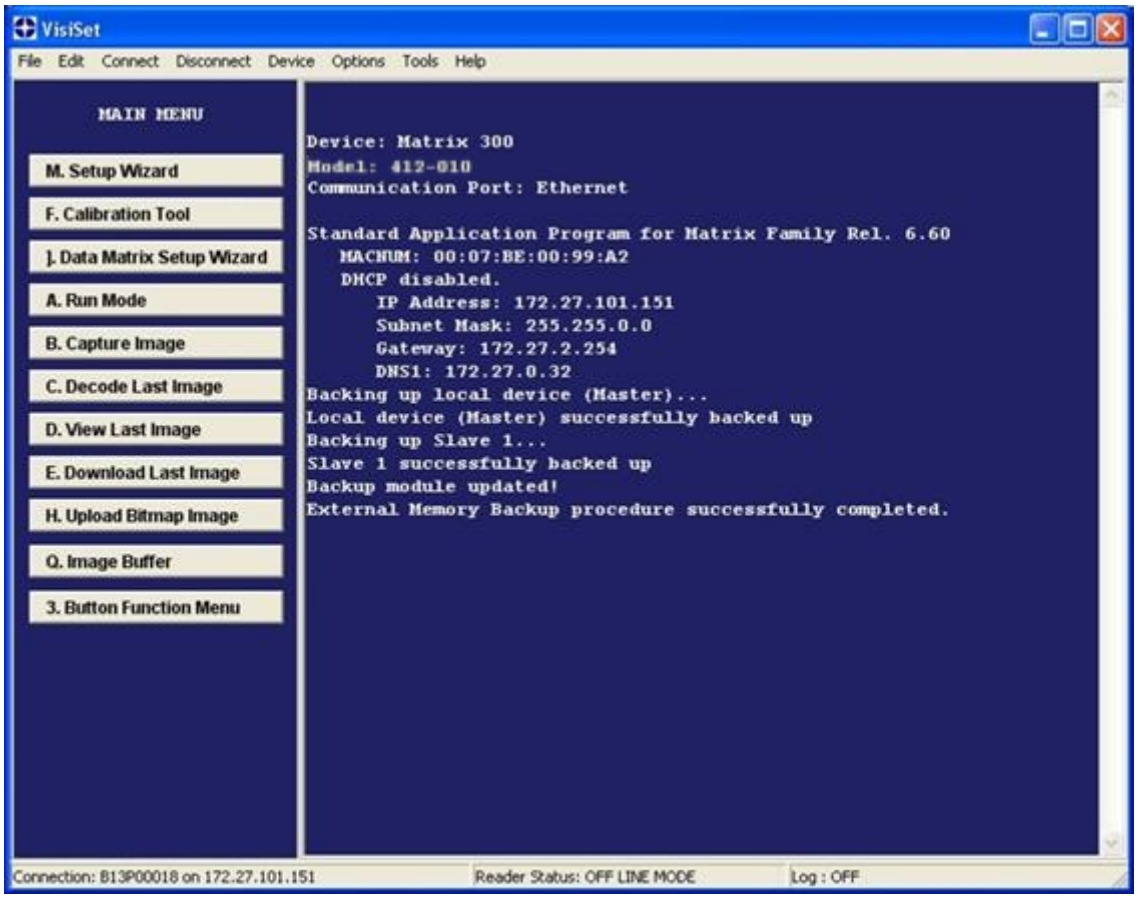
Backup

To perform a **Backup**:

1. Select "External Memory Backup" from the VisiSet™ Device menu
2. You will be warned that the previous backup will be overwritten. Confirm by clicking Yes.



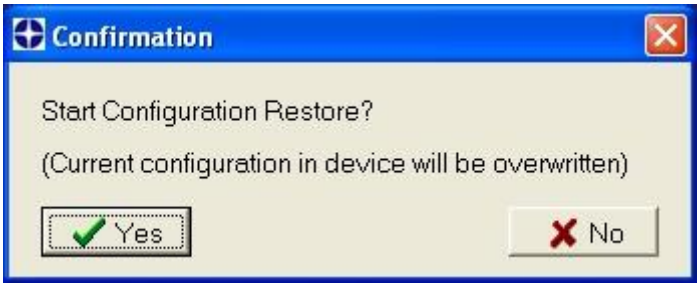
The VisiSet™ Main window shows information as the backup procedure is performed and a message indicating successful completion.



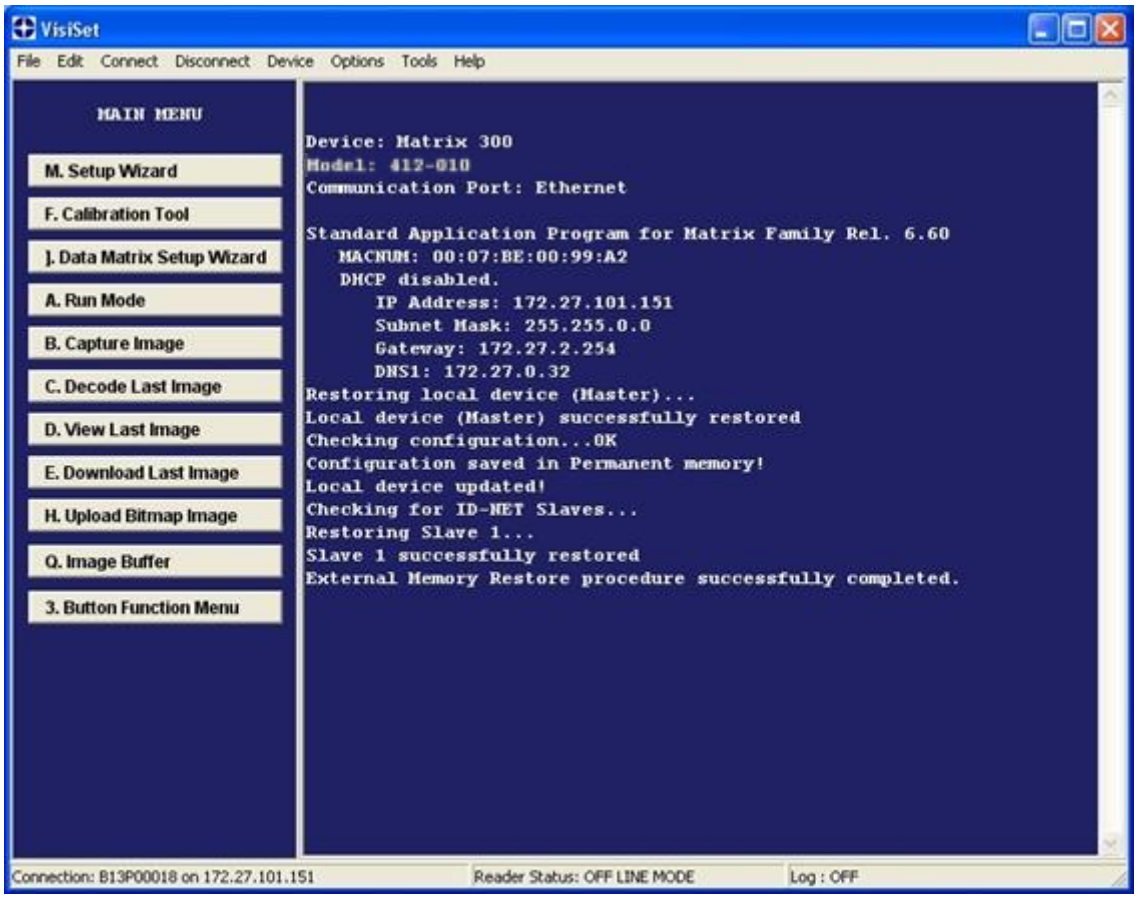
Restore

To perform a **Restore**:

1. Select "External Memory Restore" from the VisiSet™ Device menu
2. You will be warned that the current device configuration(s) will be overwritten. Confirm by clicking Yes.



The VisiSet™ Main window shows information as the restore procedure is performed and a message indicating successful completion.



Replacement

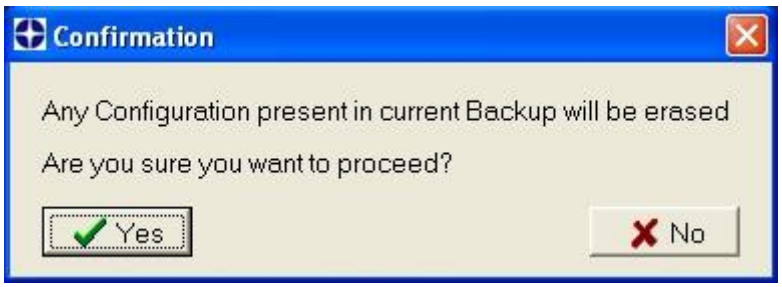
The **External Memory Restore** function also provides easy and secure Single Device Replacement:

1. Remove the device to be replaced
2. Connect the new device (make sure the new device has been previously set to default)
3. Run the Restore procedure by selecting the "External Memory Restore" item (see: Restore procedure)

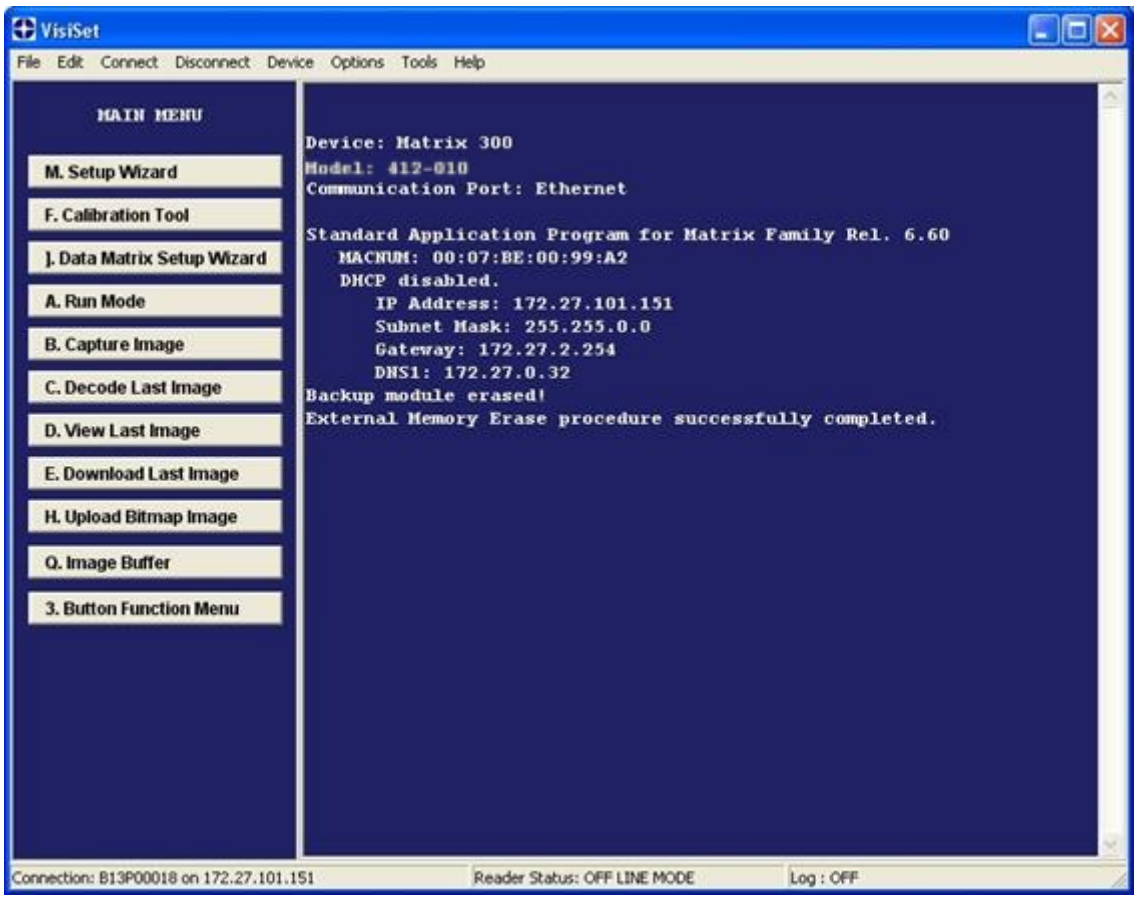
Erase

To **Erase** any previous Backup:

1. Select "External Memory Erase" from the VisiSet™ Device menu
2. You will be warned that all device configurations in the current backup will be erased. Confirm by clicking Yes.



The VisiSet™ Main window shows a message indicating successful completion.

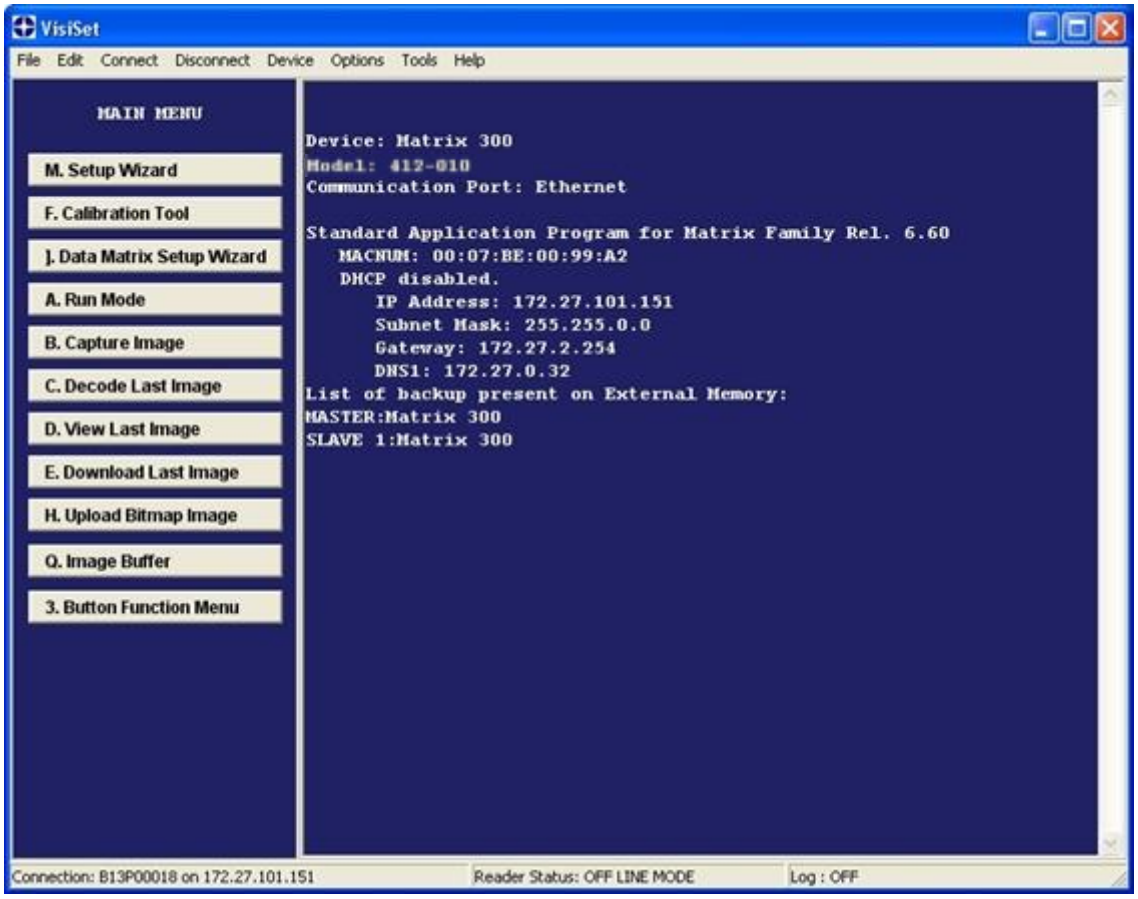


List

To see a **List** of the current Backup:

1. Select "External Memory Read Backup" from the VisiSet™ Device menu.

The VisiSet™ Main window shows a list of devices in the current Backup.



The following is a list of possible error messages displayed on the VisiSet™ main window in case of an External Memory function failure:

- **Module not present**: backup module not mounted (BM100) or not ready (QL500, BM2x0)
- **Unable to Read Backup State**: VisiSet™ is unable to connect to the backup memory
- **Backup function not allowed**: when device is in X-PRESS™ Menu mode (BM100, QLM) or is out of memory (QL500)
- **Failed! (Device not found)**: Master is unable to reach the addressed device
- **Failed! (Module is write protected)**: BM100 Write Protection switch is set to Locked

2.5 X-PRESS™ HUMAN MACHINE INTERFACE

X-PRESS™ is the intuitive Human Machine Interface designed to improve ease of installation and maintenance.

Status information is clearly presented by means of the five colored LEDs, whereas the single push button gives immediate access to the following relevant functions:

- Learn to self-detect and auto-configure for reading unknown codes
- Setup to perform Exposure Time and Gain calibration
- Aim/Autofocus to turn on the laser pointers to aid positioning and focusing
- Test with bar graph visualization to check static reading performance

2.5.1 X-PRESS™ Functions

Quick access to the following functions is provided by an easy procedure using the push button:

1 – **Press** the button (the Status LED will give a visual feedback).

2 – **Hold** the button until the specific function LED is on (Test, Aim, Setup or Learn).

3 – **Release** the button to enter the specific function.

Once button is pressed, the cycle of LEDs activation is as follows:

Release button
to Exit

➔

Release button
to enter Test Mode

➔

Release button
to enter Aim/Autofocus Mode

➔

Release button
to enter Setup Mode

➔

Release button
to enter Learn Mode

➔

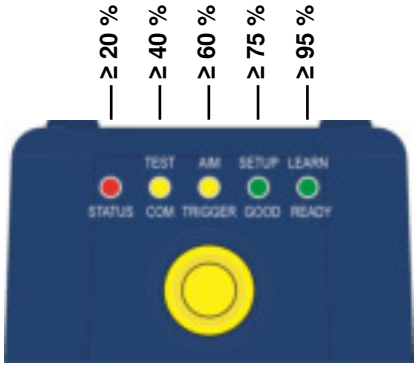
Release button
to Exit

➔ (cycle)

Test Mode (Function 1)

Once entered, the Bar Graph on the five LEDs is activated and if the imager starts reading codes the Bar-Graph shows the Good Read Rate. In case of a NO READ condition, only the Status LED is on and blinks.

The Bar Graph has the following meaning:



To exit the Test Mode, press the X-PRESS™ push button once.

NOTE: By default, the Test exits automatically after three minutes.

Aim/Autofocus (Function 2)

This function causes the laser pointers to turn on. Since the laser pointers are centered on the FOV they can be used to position the imager on the code. The Aim LED blinks to indicate this state. After a short delay, this function also performs the Autofocus procedure for Liquid Lens models.

You can exit the Aim/Autofocus function at any time by pressing the X-PRESS™ push button once. After a short delay the autofocus procedure is cancelled and the laser pointers turn off.

Setup (Function 3)

Once entered, the imager automatically performs Image Acquisition parameter calibration for the specific code presented to it.

The Setup LED will blink until the procedure is completed.

The Setup procedure ends when the Image Acquisition parameters are successfully saved in the reader memory, the Setup LED will stop blinking and Matrix 300™ emits 3 high pitched beeps.

If the calibration cannot be reached after a timeout of about 5 (five) seconds Matrix 300™ will exit without saving the parameters to memory, the Setup LED will stop blinking and in this case Matrix 300™ emits a long low pitched beep.

Learn (Function 4)

Once entered, the imager starts a procedure to automatically detect and recognize codes which are presented to it.

The Learn LED will blink until the procedure is completed.

The Learn procedure ends when the Image Processing and Decoding parameters are successfully saved in the reader memory, the Green Spot is activated, the Learn LED will stop blinking and Matrix 300™ emits 3 high pitched beeps.

If the autolearning cannot be reached after a timeout of about 3 (three) minutes, Matrix 300™ will exit without saving the parameters to memory, the Learn LED will stop blinking and in this case Matrix 300™ emits a long low pitched beep.

You can exit the Learn function at any time by pressing the X-PRESS™ push button once. After a short delay the Learn procedure is cancelled.

2.5.2 Diagnostic Indication

The “STATUS” and “READY” LEDs blink simultaneously while the "GOOD" LED is on to signal the presence of an error. Diagnostic message transmission on interfaces can be enabled to provide details about specific error conditions. See the Diagnostic Error Conditions chart in the Help On Line.

LED	STATUS
READY	BLINK
GOOD	ON to indicate an error
TRIGGER	
COM	
STATUS	BLINK

2.6 MODEL DESCRIPTION

Matrix 300™ readers are described by their model number which indicates the characteristics listed in the diagram below. Not all combinations are available. For a complete list of combinations see the Models tab on the Product page of the website.

MATRIX 300 4XX-0XX

Internal Illuminator
1 = Wide Angle Red
5 = Wide Angle White
7 = Light DPM
8 = Multi-Light DPM

Lens Type
1 = 6 mm (fixed lens manual focus)
2 = 9 mm (liquid lens auto focus)

Input Power
1 = Standard 10 - 30 Vdc
4 = PoE 48 Vdc

Options
0 = Standard
1 = ESD Safe
2 = ESD Safe + YAG Cut Filter

2.6.1 Lighting System Notes

The following table shows the Matrix 300™ lens/illuminator combinations. For more information see the Application Note on illuminator selection on the mini-DVD.

Matrix 300 Models		Internal Illuminators	
Model	**Lens Type**	**LEDs**	**Type**
Matrix 300 411-0xx	6 mm Fixed Lens	8	Red Wide Angle
Matrix 300 481-0xx		24/39	Red Bright/Blue Dark Field DPM (sw configurable chains)
Matrix 300 412-0xx	9 mm Liquid Lens	8	Red Wide Angle
Matrix 300 452-0xx		8	White Wide Angle
Matrix 300 472-0xx		24/26	Red Bright Field DPM (sw configurable chains)
Matrix 300 482-0xx		24/39	Red Bright/Blue Dark Field DPM (sw configurable chains)

2.7 ACCESSORIES

The following accessories can be used with the Matrix 300™ reader.

Accessory	Description	Order No.
Cables		
CAB-DS01-S	M12-IP67 Cable To CBX or QL (1M)	93A050058
CAB-DS03-S	M12-IP67 Cable To CBX or QL (3M)	93A050059
CAB-DS05-S	M12-IP67 Cable To CBX or QL (5M)	93A050060
CAB-ETH-M01	M12-IP67 Ethernet Cable (1M)	93A051346
CAB-ETH-M03	M12-IP67 Ethernet Cable (3M)	93A051347
CAB-ETH-M05	M12-IP67 Ethernet Cable (5M)	93A051348
CBL-1534.02	Adapter Cable Ethernet M12 to RJ45	93A050057
CBL-1480-01	Thin M12/5P Male/Female (1M)	93A050049
CBL-1480-02	Thin M12/5P Male/Female (2M)	93A050050
CBL-1490	Term. Resist. Thin M12/5P/Male	93A050046
CBL-1496	Term. Resist. Thin M12/5P/Female	93A050047
Connectivity		
CBX100	Compact Connection Box	93A301067
CBX500	Modular Connection Box	93A301068
BM100	Backup Module for CBX100/500	93ACC1808
BM150	Display Module for CBX500	93ACC1809
Various Fieldbus and Non-Fieldbus Host Interface Modules and All-In-One Connection Box Kits are available		
BA100	DIN Rail Adapters	93ACC1821
BA200	Bosch Adapters	93ACC1822
Various M12 Panel Connectors for CBX Connection Boxes are available		
BA900	Two Cable Glands Panel	93ACC1847
QL100	Quick Link Slave ID-NET T-Connector	93ACC1860
QL150	Quick Link Slave ID-NET + Service T-Connector	93ACC1868
QL200	Quick Link Slave ID-NET + Power T-Connector	93ACC1861
QL300	Quick Link Master ID-NET - Serial Host Connector	93ACC1862
QL500	Quick Link Master ID-NET - Ethernet Host Connector (includes Ethernet/IP explicit messaging)	93ACC1864
QLM500	Quick Link Metal Master ID-NET - EthernNet/IP Gateway	93ACC0037
QLM600	Quick Link Metal Master ID-NET - Profibus Gateway	93ACC0033
QLM700	Quick Link Metal Master ID-NET - Profinet I/O Gateway	93ACC0038
Various M12 Service Cables and Field Mount Connectors are available for Quick Link Series Connectors		
Power Supplies		
PG6002	AC/DC Power Supply Unit (US)	93ACC1718
PG6001	AC/DC Power Supply Unit (UK)	93ACC1719
PG6000	AC/DC Power Supply Unit (EU)	93ACC1720
Sensors		
MEP-593	Photocell Kit PNP (PH-1)	93ACC1791
MEP-543	Photocell Kit-NPN	93ACC1728
S3Z-PR-5-C11-PL	Diffuse Proximity Sensor	95B010011

2.8 APPLICATION EXAMPLES

2.8.1 Document Handling

Matrix 300™ is profitably used in the omnidirectional reading of 2D, stacked, linear and postal codes for example in automated document handling and mail processing systems (see Figure 14).

Figure 14 - Address Coded in Data Matrix Symbology for Automated Mail Processing

2.8.2 Deformed or Overprinted Code Reading

Matrix 300™ assures the reading of deformed and / or overprinted codes, even though damaged or printed on high reflective surfaces (see Figures 17, 18, 19).

Figure 15 - Unidose Flow-Pack with PDF417 Code

Figure 16 - Overprinted Barcode Readable by Matrix 300™ also Through the Envelope Window Film

Figure 17 - Barcode Printed on Curved Surface Readable by Matrix 300™ in spite of Image Optical Distortion

2.8.3 Direct Part Marking

Matrix 300™ is also very powerful in reading low-contrast direct part marked codes (see Figures 20, 21, and 22).

Figure 18 - Dot Matrix Code Directly Marked on Metal Surface by Using Dot Peening Technology

Figure 19 - Dot Peening Marking on Metal Surface with Multi-dot per Code Element

Figure 20 - Directly Marked Dot Matrix Code Characterized by Outstanding Separation Distance between Adjacent Code Elements

2.8.4 Ink-Jet Printing Technology

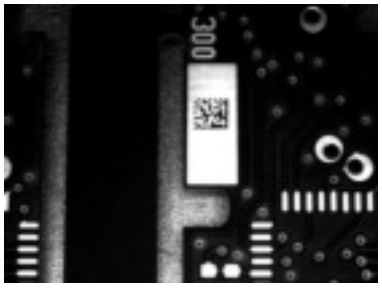


Figure 21 - Dot Matrix Code Directly Marked on PCB Copper Pad by Using Ink-Jet Technology

2.8.5 Laser Marking/Etching Technology

Figure 22 - Data Matrix Code Directly Marked on PCB Surface by Using Laser Etching Technology

CAUTION: If application codes must be read which are produced by Laser Marking in real time, use Matrix 300™ models incorporating YAG Filters in order to avoid burning the CMOS sensor.

3 INSTALLATION

3.1 PACKAGE CONTENTS

Verify that the Matrix 300™ reader and all the parts supplied with the equipment are present and intact when opening the packaging; the list of parts includes:

- ❑ Matrix 300™ reader
- ❑ Quick Reference Guide
- ❑ Test Charts (2)
- ❑ Matrix family Mini-DVD
- ❑ Mounting Kit
  - Mounting Screws (4 + 2)
  - Washers (2)
  - Mounting Brackets (2)

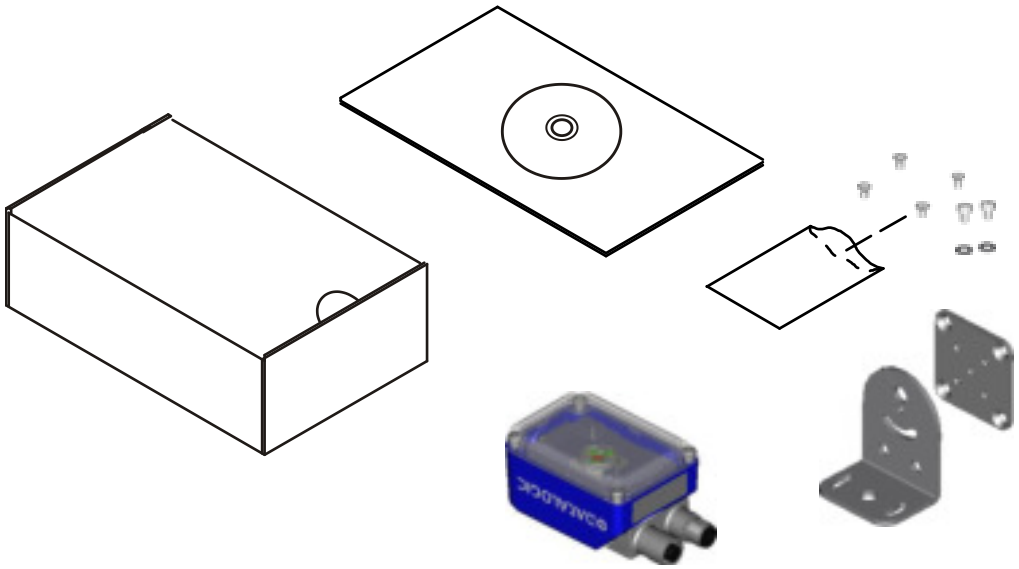


Figure 23 - Package Contents

3.2 MECHANICAL DIMENSIONS

Matrix 300™ can be installed to operate in different positions. The twelve screw holes (M4 x 5) on the body of the reader are for mechanical fixture (Figure 24).

The diagram below gives the overall dimensions of the reader and may be used for its installation.

Refer to par. 3.3 for various mounting solutions and correct positioning and chp. 6 for FOV vs. Reading Distance considerations.

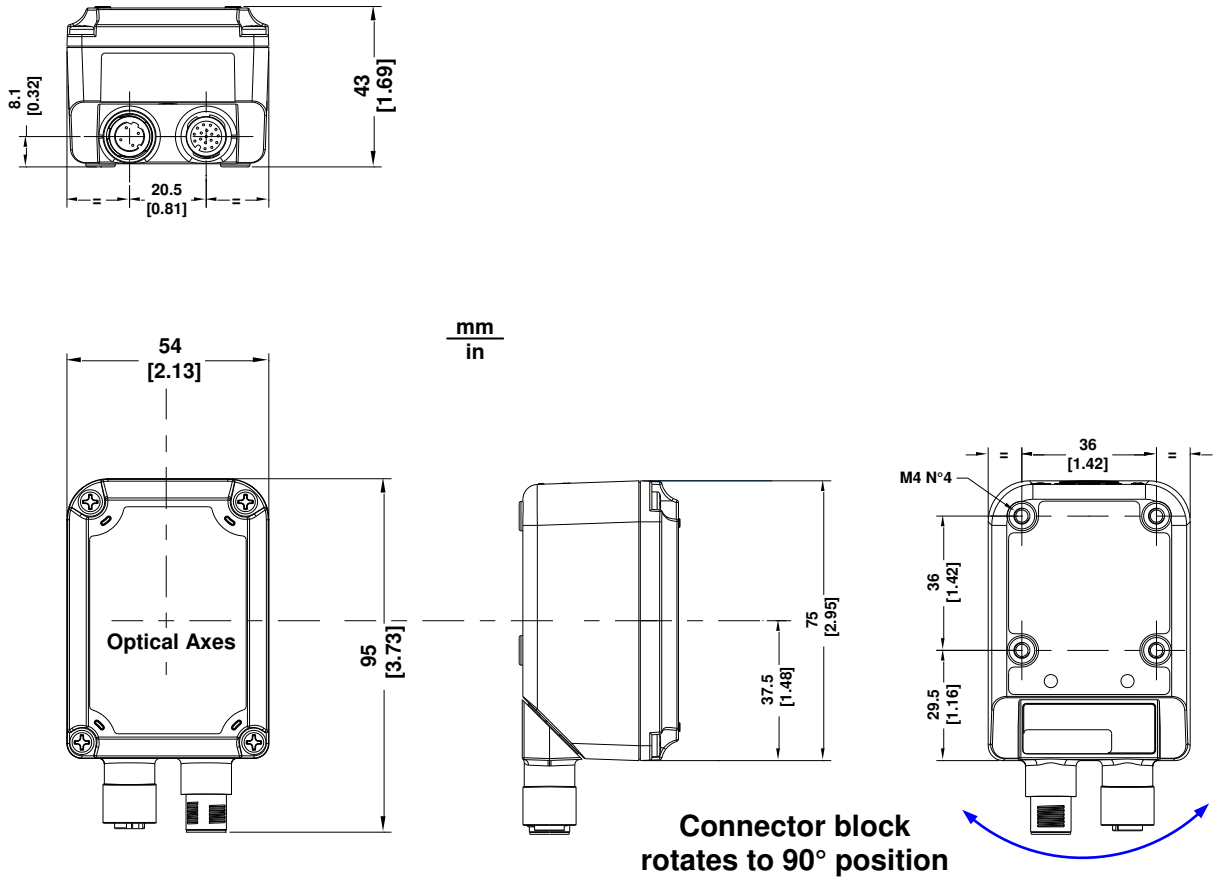


Figure 24 - Overall Dimensions with Connector at 0°

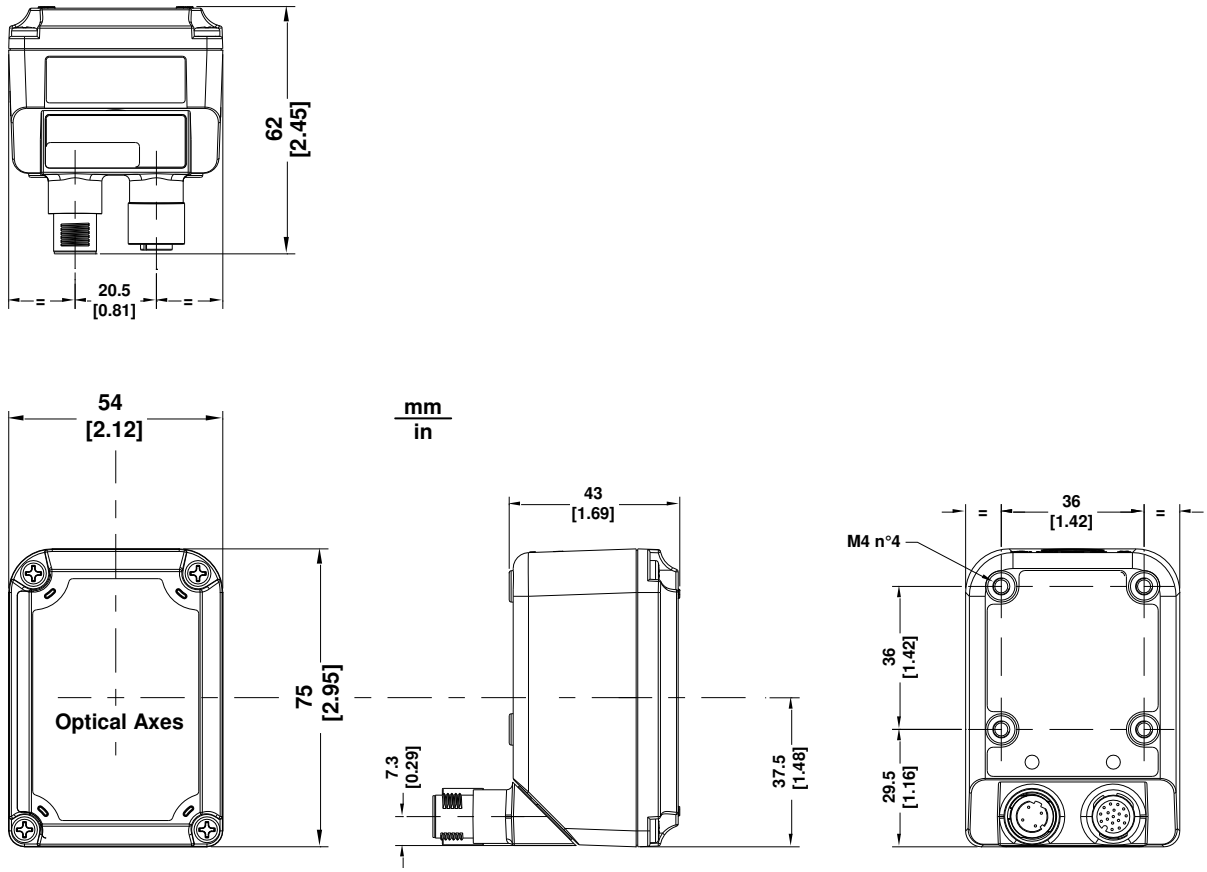


Figure 25 - Overall Dimensions with Connector at 90°

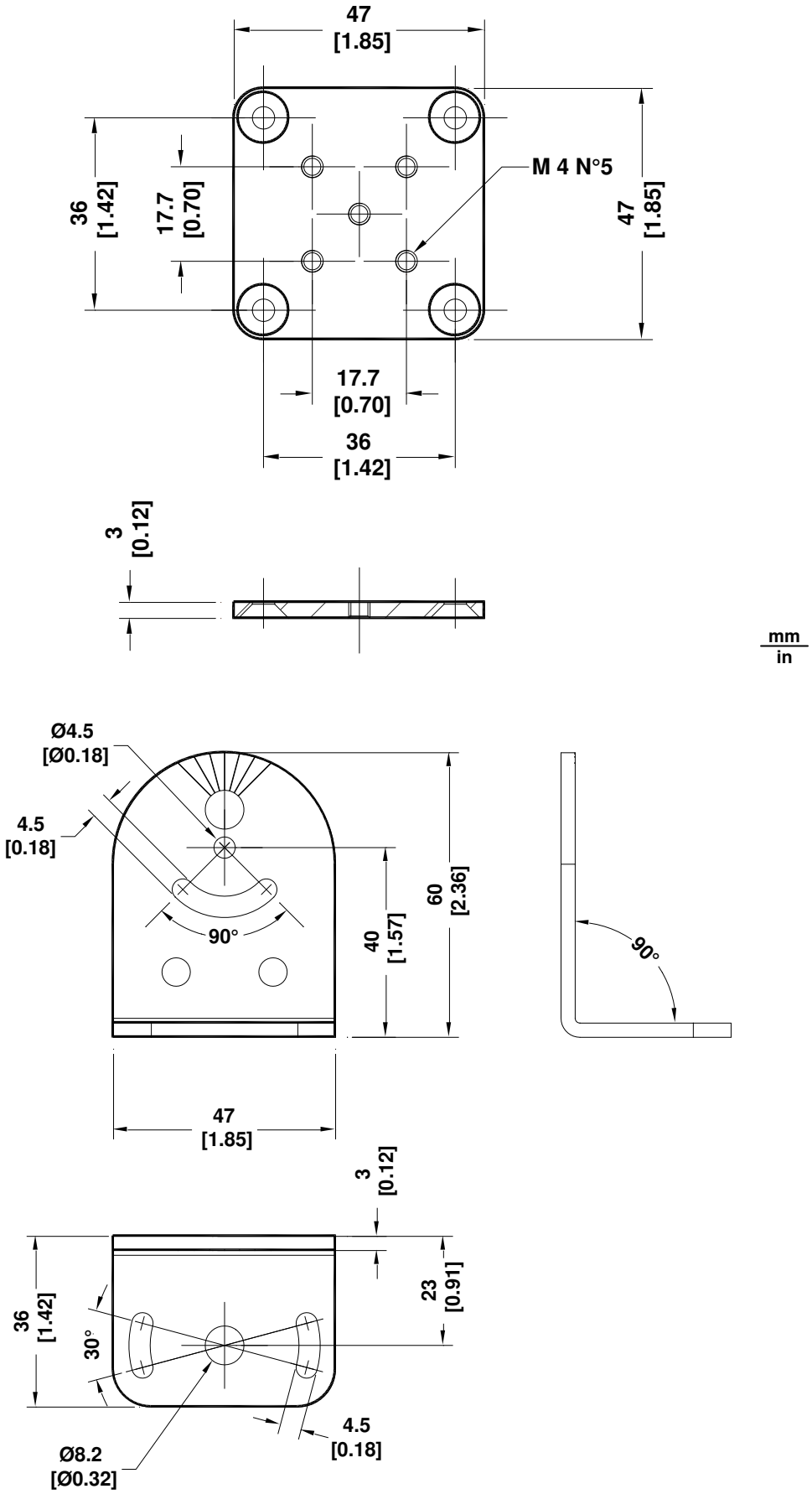


Figure 26 - Mounting Bracket Overall Dimensions

3.3 MOUNTING AND POSITIONING MATRIX 300™

Using the Matrix 300™ mounting brackets you can obtain rotation on the various axes of the reader as shown in the diagram below:

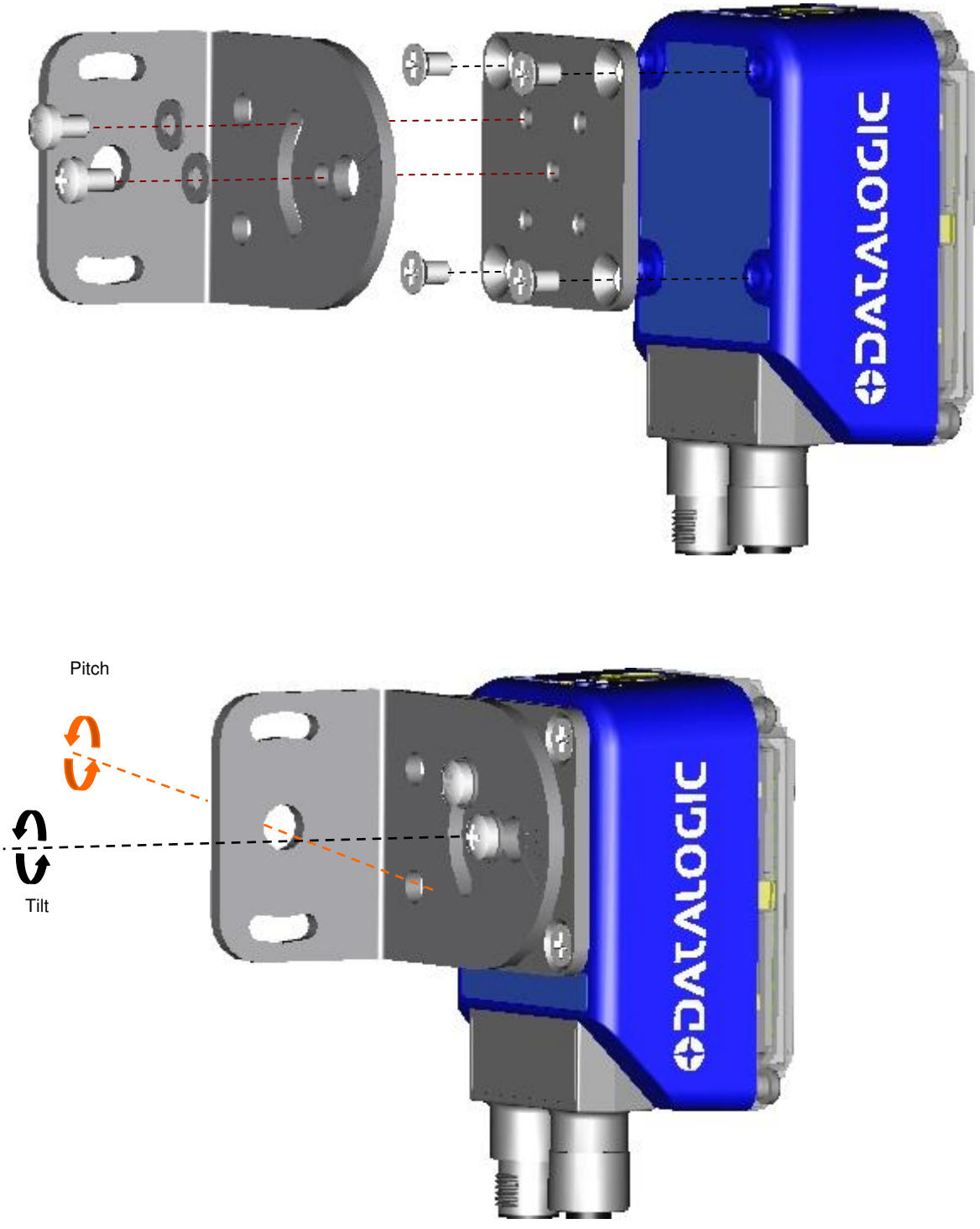


Figure 27 –Positioning with Mounting Bracket

Matrix 300™ is able to decode code labels at a variety of angles; however significant angular distortion may degrade reading performance.

When mounting Matrix 300™, take into consideration these **ideal** label position angles: **Pitch or Skew 10° to 20° and Tilt 0°**.

Note: Since Matrix 300™ is omni-directional on the code plane, the Pitch and Skew angles have the same significance with respect to the code plane. However in some advanced code reading applications performance can be improved by modifying the Skew angle.

The **Pitch, Skew and Tilt** angles are represented in Figure 28. Follow the suggestions below for the best orientation:

Position the reader in order to avoid the direct reflection of the light emitted by the Matrix 300™ reader; it is advised to **assure at least 10°** for the Skew angle.

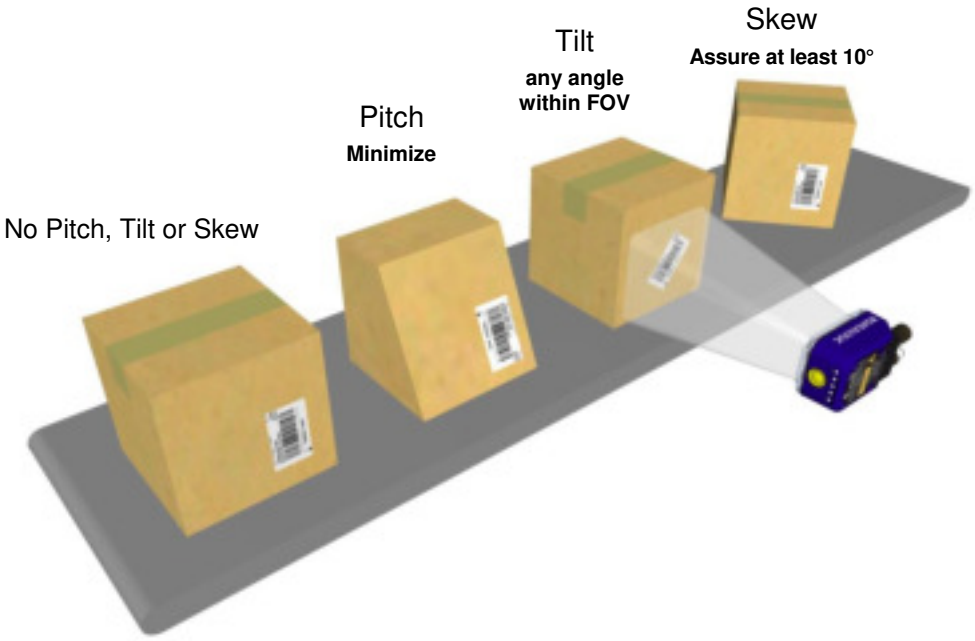


Figure 28 - Code Reading Orientation

In some cases, such as low contrast or low illumination, it can be useful to use a **Pitch or Skew** angle = 0°.

The **Tilt** angle is also represented in Figure 29. Matrix 300™ can read labels with any tilt angle. Keep in mind however, that since linear barcodes are rectangular, the reader should be aligned to fit them into the horizontal FOV.

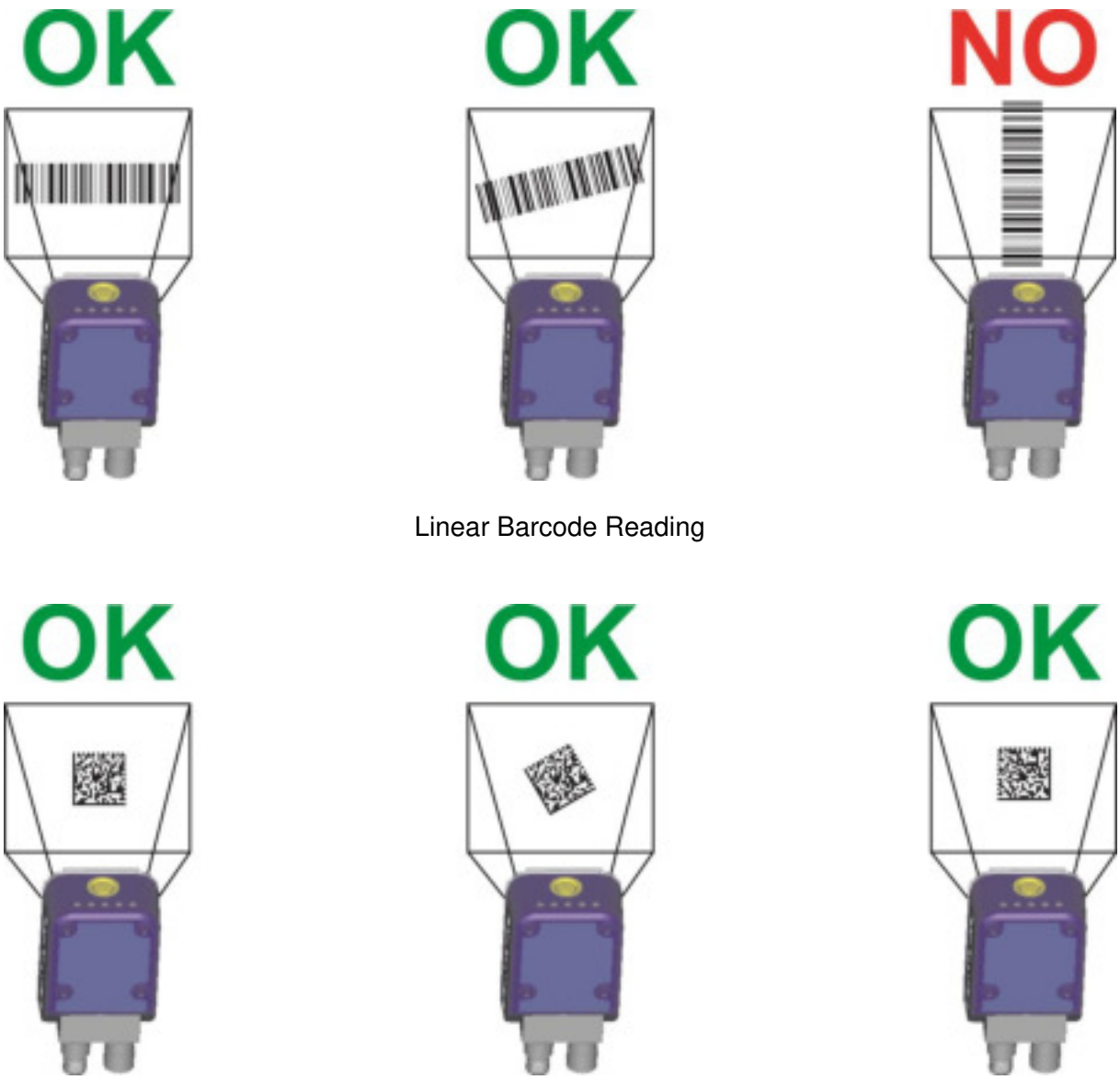


Figure 29 - Tilt Angle Considerations

See chp. 6 for FOV vs. Reading Distance considerations.

4 CBX ELECTRICAL CONNECTIONS

All Matrix 300™ models can be connected to a CBX connection box through one of the available **CAB-DSxx-S** accessory cables. These accessory cables terminate in an M12 17-pin connector on the Matrix 300™ side and in a 25-pin male D-sub connector on the CBX side.

We recommend making system connections through one of the CBX connection boxes since they offer the advantages of easy connection, easy device replacement, opto-isolated outputs (Outputs 1 and 2), and filtered reference signals.

NOTE: If you require direct wiring to the reader the connections are the same as shown in this chapter with the exception of the digital Outputs. Direct wiring details are indicated in Appendix A

The table below gives the pinout of the CBX100/500 terminal block connectors. Use this pinout when the Matrix 300™ reader is connected by means of the CBX100/500:

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 + opto-isolated and polarity sensitive	
O1-	Output 1 - opto-isolated and polarity sensitive	
O2+	Output 2 + opto-isolated and polarity sensitive	
O2-	Output 2 - opto-isolated and polarity sensitive	
03A	Output 3 non opto-isolated (only available on CBX500)	
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	**RS485/422 Full-Duplex**
	TX	TX+
	RX	*RX+
	RTS	TX-
	CTS	*RX-
	SGND	SGND

***** Do not leave floating, see par. 4.2.2 for connection details.

NOTE: To avoid electromagnetic interference when the reader is connected to a CBX connection box, verify the jumper positions in the CBX as indicated in its Installation Manual.

4.1 POWER SUPPLY

Power requirements and conditions depend on the Matrix 300™ model: Standard or PoE (Power over Ethernet).

4.1.1 Standard Models

For these models power can be supplied to the reader through the CBX100/500 spring clamp terminal pins as shown in Figure 30:

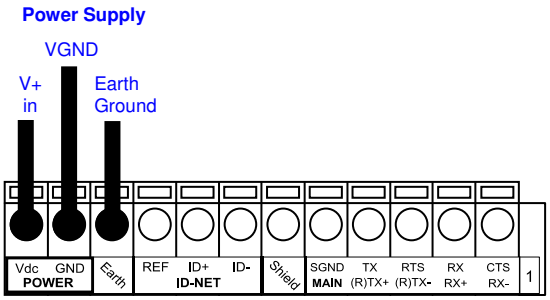


Figure 30 - Power Supply Connections

The power must be between 10 and 30 Vdc only.

It is recommended to connect the device CHASSIS to earth ground (Earth) by setting the appropriate jumper in the CBX connection box. See the CBX Installation Manual for details.

4.1.2 Power over Ethernet (PoE) Models

The Ethernet pinout is as follows:

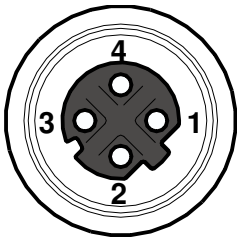


Figure 31 - M12 D-Coded Female Ethernet Network Connector

Power over Ethernet Network Connector Pinout		
Pin	**Name**	**Function**
1	TX +/DC-	Transmitted data (+) DC power (-)
2	RX +/DC+	Received data (+) DC power (+)
3	TX -/DC-	Transmitted data (-) DC power (-)
4	RX -/DC+	Received data (-) DC power (+)

CAUTION: Matrix 300™ PoE models only accept Alternative A (power over RJ45 pins 1, 2, 3, 6), Class 0 power levels. Use an Endspan or Midspan PSE device that supports this configuration (i.e. PoE switch or Power over Ethernet Adapter).

Alternative B (power over RJ45 pins 4, 5, 7, 8) using an Endspan or Midspan PSE device is not supported.

Figure 32 – Matrix 300™ PoE PSE Endspan Alternative A Connections OK

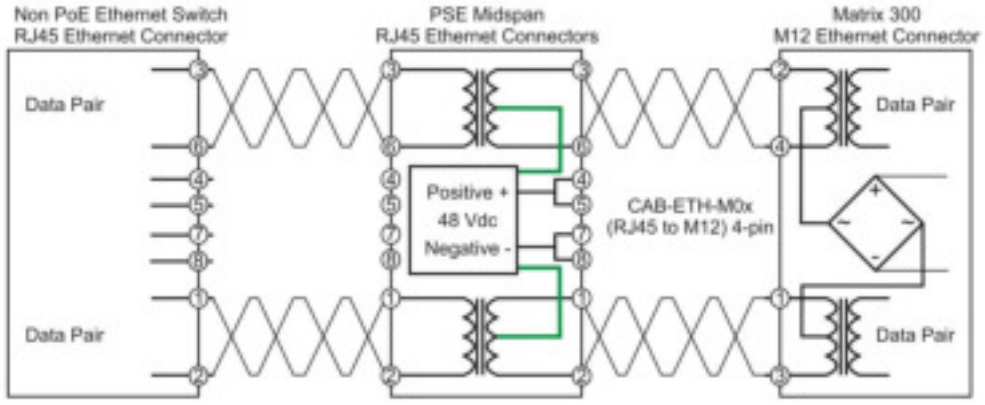


Figure 33 – Matrix 300™ PoE PSE Midspan Alternative A Connections OK

Figure 34 – Matrix 300™ PoE PSE Endspan Alternative B Connections NOT SUPPORTED

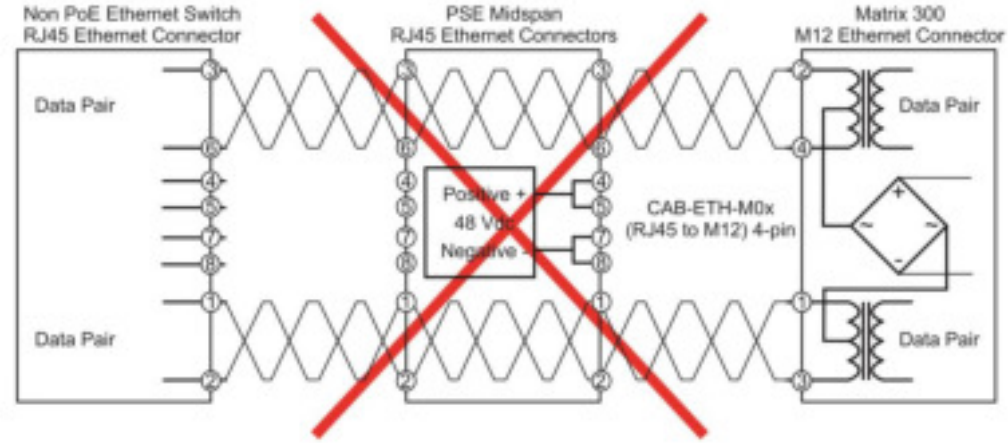


Figure 35 – Matrix 300™ PoE PSE Midspan Alternative B Connections NOT SUPPORTED

CAUTION: For Matrix 300™ PoE models, the internal Digital Output circuitry is not powered and supply power is not available to any Input/Output devices (Vdc=0). Only input device signals can be accepted directly on the M12 17-pin connector without power.

For these models, if it is necessary to use Input/Output devices, we recommend connecting them through the CBX, which must be powered separately.

See par. 4.7 for further details.

4.2 MAIN SERIAL INTERFACE

CAUTION: Do not connect to the Main Interface spring clamp terminals if using Host Interface Modules (Fieldbus) with the CBX500.

The signals relative to the following serial interface types are available on the CBX spring clamp terminal blocks.

The main serial interface type and its parameters (baud rate, data bits, etc.) can be defined by the user via VisiSet™ software. For more details refer to the "Communication" folder in the VisiSet™ Help On Line.

Details regarding the connections and use of the interfaces are given in the next paragraphs.

4.2.1 RS232 Interface

The RS232 interface can be used for Point-to-Point, Pass Through or Master/Slave connections. When it is connected to the host computer it allows both transmission of code data and reader configuration by VisiSet™.

The following pins are used for RS232 interface connection:

CBX100/500	Function
TX	Transmit Data
RX	Receive Data
RTS	Request To Send
CTS	Clear To Send
SGND	Signal Ground

It is always advisable to use shielded cables. The overall maximum cable length must be less than 15 m (49.2 ft).

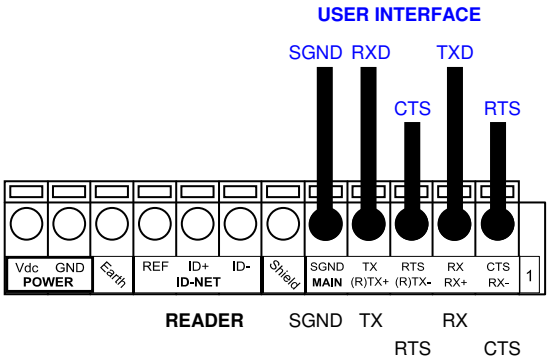


Figure 36 – RS232 Main Interface Connections Using Hardware Handshaking

The RTS and CTS signals control data transmission and synchronize the connected devices.

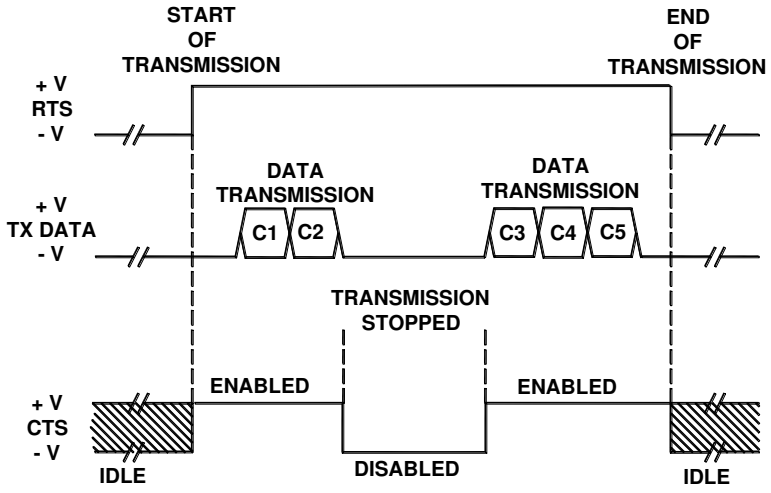


Figure 37 - RS232 Control Signals

If the RTS/CTS handshaking protocol is enabled, the Matrix 300™ activates the RTS output to indicate a message is to be transmitted. The receiving unit activates the CTS input to enable the transmission.

4.2.2 RS485/422 Full-Duplex Interface

The RS485/422 full-duplex (5 wires + shield) interface is used for non-polled communication protocols in point-to-point connections over longer distances (max 1200 m / 3940 ft) than those acceptable for RS232 communications or in electrically noisy environments.

The CBX pinout follows:

CBX100/500	Function
TX+	RS485/422 Transmit Data +
RX+	RS485/422 Receive Data +
TX-	RS485/422 Transmit Data -
RX-	RS485/422 Receive Data -
SGND	Signal Ground

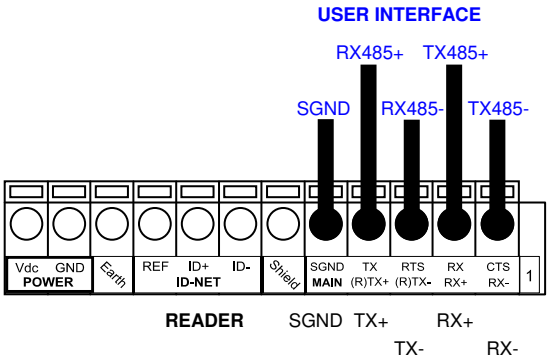


Figure 38 - RS485/422 Full-duplex Connections

NOTE: For applications that do not use RX signals, do not leave these lines floating but connect them to SGND as shown below.

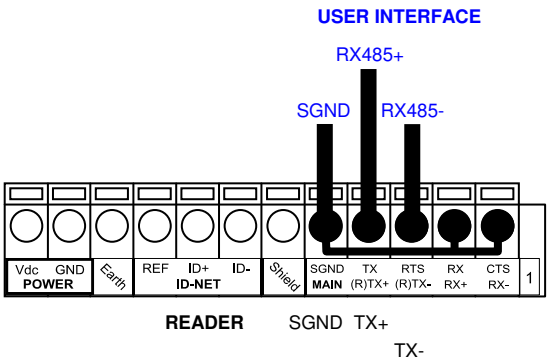


Figure 39 - RS485/422 Full-duplex Connections using Only TX Signals

4.3 ID-NET™ INTERFACE

CBX100/500	Function
Shield	Network Cable Shield
ID+	ID-NET™ network +
ID-	ID-NET™ network -
REF	Network Reference

4.3.1 ID-NET™ Cables

The following instructions are referred to Figure 41, Figure 42 and Figure 43.

- The general cable type specifications are: CAT5 twisted pair + additional CAT5 twisted pair, shielded cable AWG 24 (or AWG 22) stranded flexible.

  We recommend using DeviceNet cables (drop or trunk type) to the following reference standards:

  AN50325 – IEC 62026

  UL STYLE 2502 80°C 30V
- Cable Shield MUST be connected to earth ground ONLY at the Master.
- NEVER use ID-NET™ cable shield as common reference.
- The ID-NET™ max cable length depends on the baudrate used, (see the Baudrate Table below).
- For Common Power Connections use only 2 wires (ID+ and ID-).
  - DC Voltage Power cable (Vdc – GND) should be handled as a signal cable (i.e. do not put it together with AC cable):
  - Wire dimensioning must be checked in order to avoid voltage drops greater than 0.8 Volts.
  - Cable should lie down as near as possible to the ID-NET™ cable (avoiding wide loops between them).
- Reader's chassis may be connected to earth.
- Network inside the same building.

Baudrate Table				
Baud Rate	125 kbps	250 kbps	**500 kbps**	1Mbps
Cable Length	1200 m	900 m	**700 m**	*

* Application dependent, contact your Datalogic Automation representative for details.

NOTE: The default ID-NET™ baudrate is 500 kbps. Lower ID-NET™ baudrates allow longer cable lengths. The baudrate is software configurable by authorized Datalogic Automation personnel only.

4.3.2 ID-NET™ Response Time

The following figure shows the response time of the ID-NET™ network. This time is defined as the period between the Trigger activation and the beginning of data transmission to the Host.

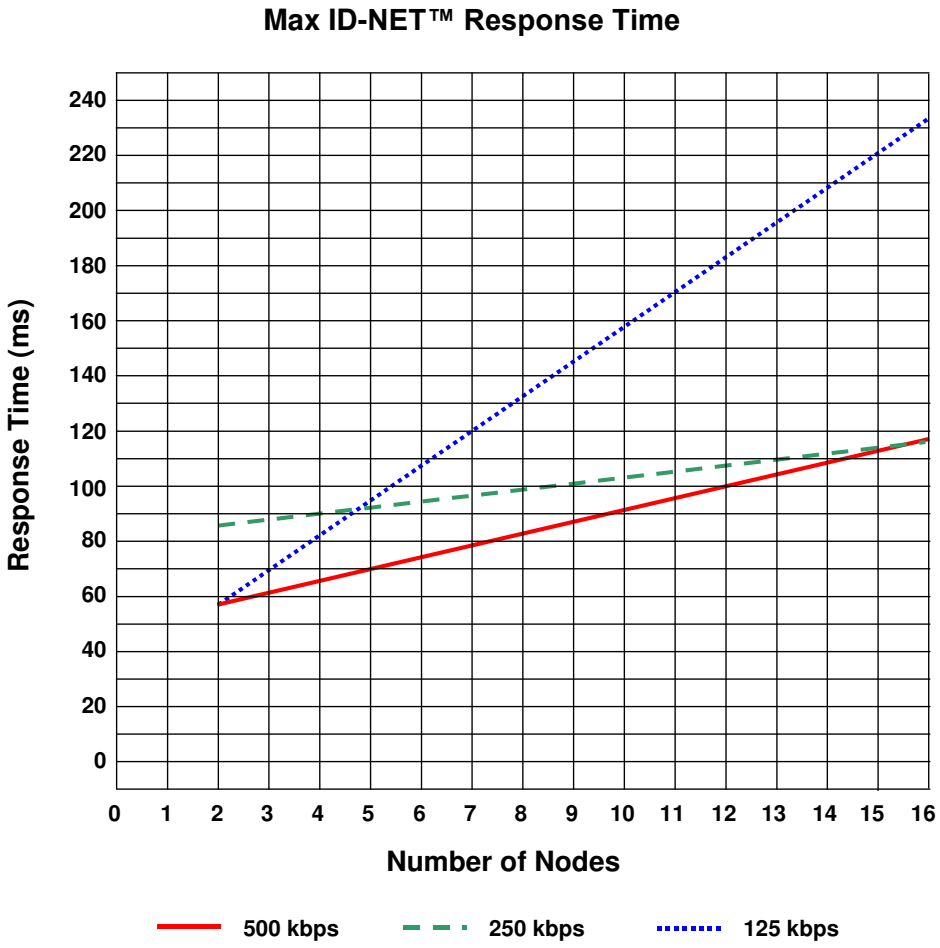


Figure 40 – ID-NET™ Response Time

CONDITIONS:

- ID-NET™ M/S Synchronized layout
- message length = 50 bytes per node

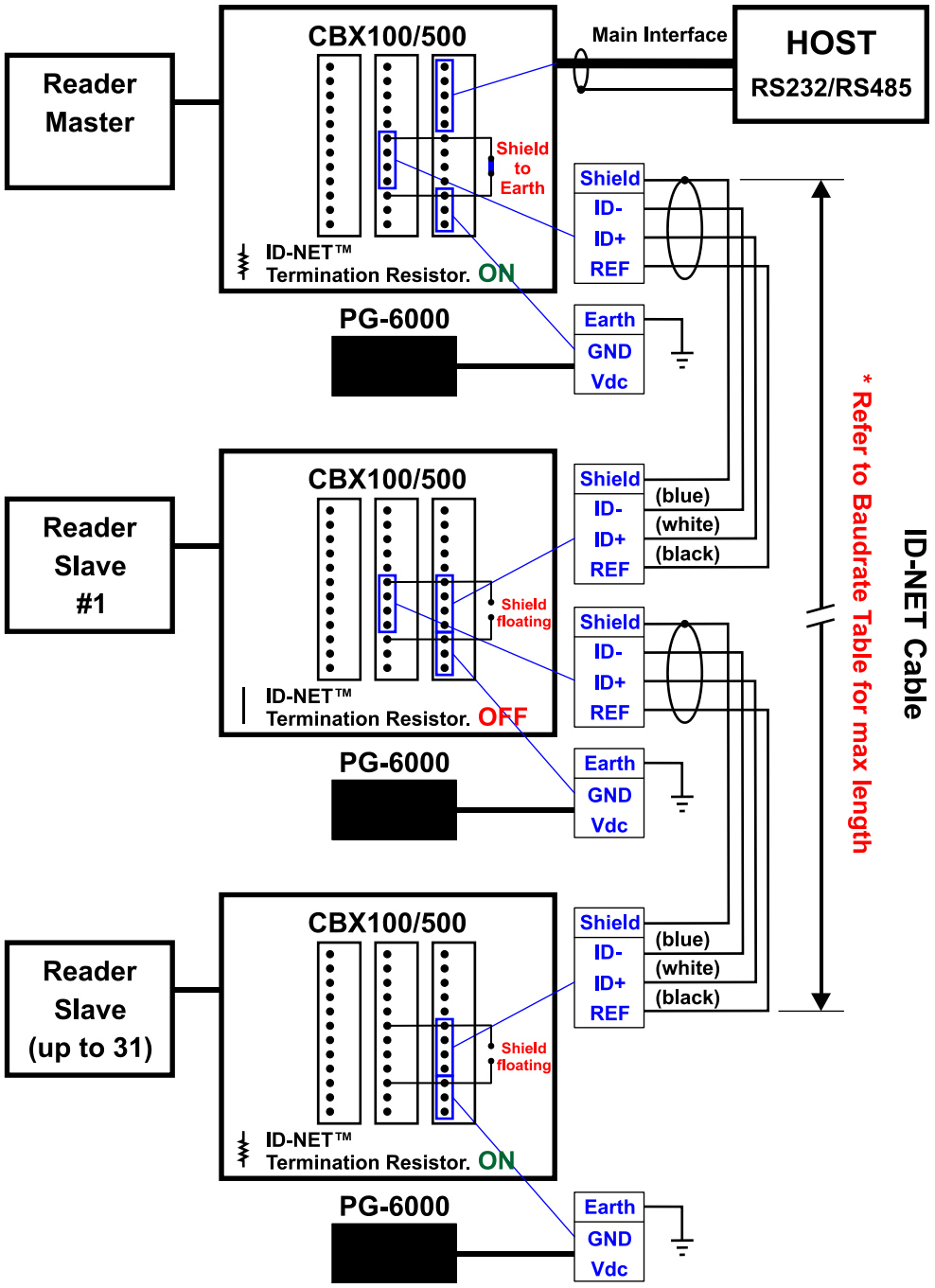


Figure 41 – ID-NET™ Network Connections with isolated power blocks

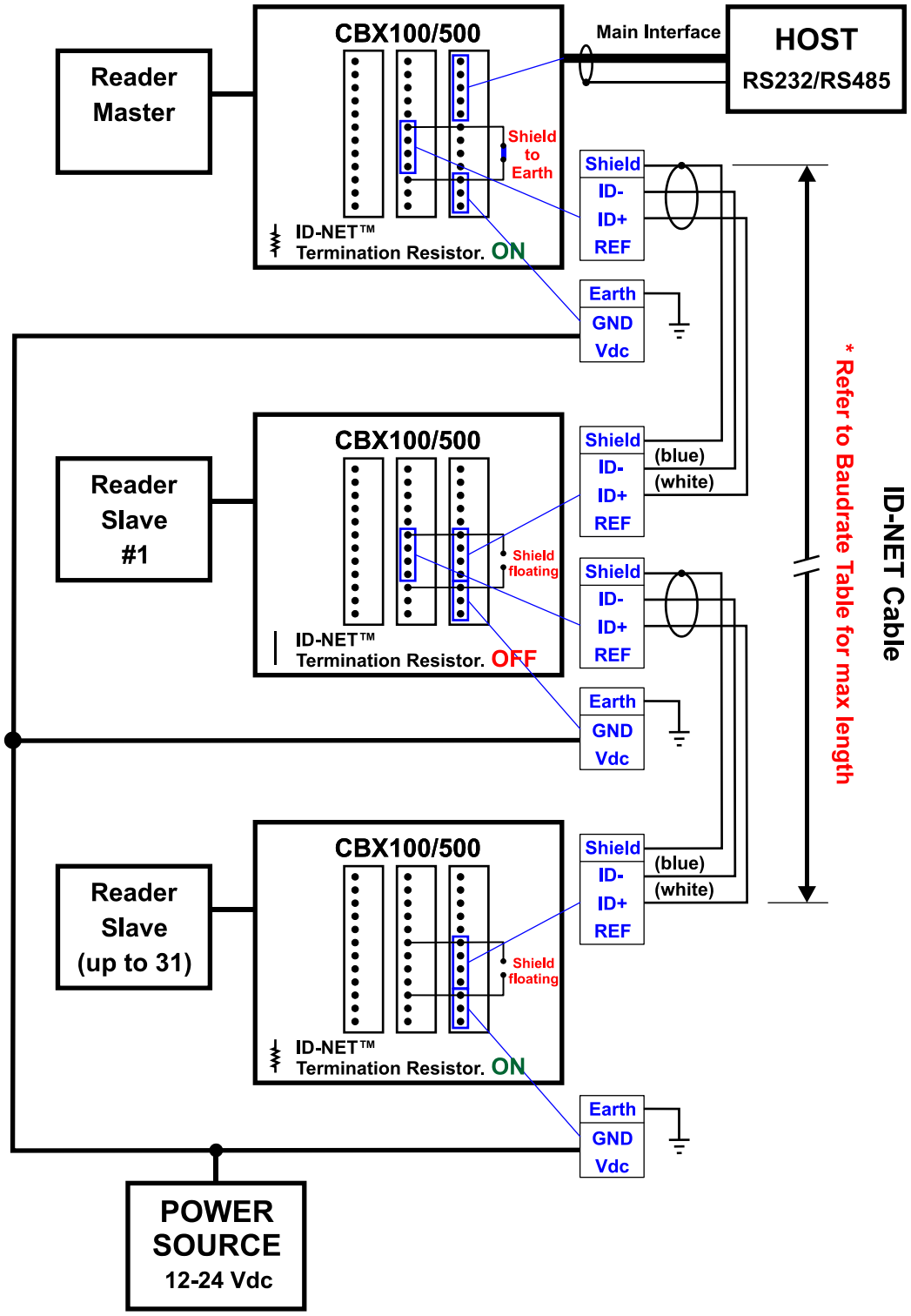


Figure 42 - ID-NET™ Network Connections with Common Power Branch Network

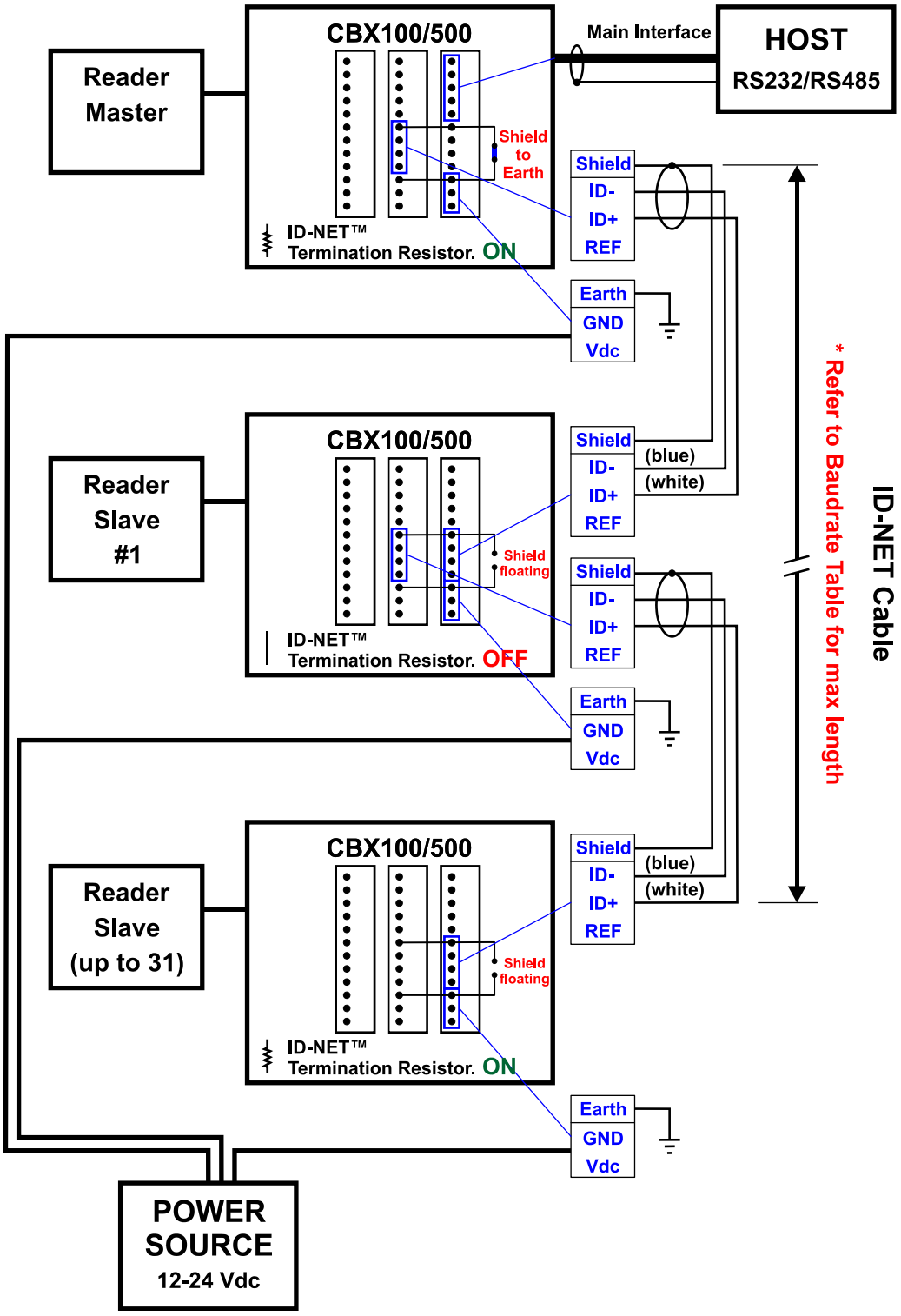


Figure 43 – ID-NET™ Network Connections with Common Power Star Network

4.3.3 ID-NET™ Network Termination

The network must be properly terminated in the first and last reader of the network. This is done by setting the ID-NET™ Termination Resistance Switch in the CBX100/500 to ON.

4.4 AUXILIARY RS232 INTERFACE

The RS232 auxiliary interface is available for Point-to-Point, Pass Through or Master/Slave connections. When it is connected to the host computer it allows both transmission of code data and reader configuration by VisiSet™.

The parameters relative to the aux interface (baud rate, data bits, etc.) as well as particular communication modes such as LOCAL ECHO can be defined through the Communication folder of the VisiSet™ utility program.

The 9-pin female Auxiliary Interface connector inside the CBX is the preferred connector for device configuration or communication monitoring.

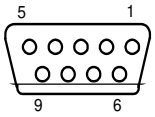


Figure 44 - 9-pin female connector

If permanent system wiring is required, the following pins are used to connect the RS232 auxiliary interface:

CBX100/500	Function
RX	Auxiliary Interface Receive Data
TX	Auxiliary Interface Transmit Data
SGND	Auxiliary Interface Reference

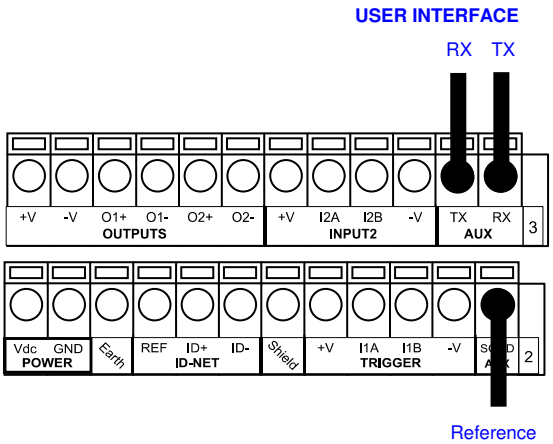


Figure 45 - RS232 Auxiliary Interface Connections

NOTE: Do not connect the Aux Interface to the CBX spring clamp connectors and the 9-pin connector simultaneously.

4.5 INPUTS

There are two optocoupled polarity insensitive inputs available on the reader: Input 1 (External Trigger) and Input 2, a generic input:

The External Trigger can be used in One Shot Mode or in Phase Mode. Its main functions are:

- acquisition trigger in One Shot Mode
- reading phase-ON/reading phase-OFF command in Phase Mode

The main functions of the general purpose Input 2 are:

- second external trigger in Phase Mode
- match code storage command when the Match Code option is enabled

The electrical features of both inputs are:

V_{AB} = 30 Vdc max.

I_{IN} = 10 mA (reader) + 12 mA (CBX) max.

The active state of these inputs are selected in software. Refer to the VisiSet™ Help On Line.

An anti-disturbance filter is implemented in software on both inputs so that the default minimum pulse duration is ≅ 0.5 milliseconds. This value can be increased or decreased through the software parameter Debounce Filter, see the Digital I/O folder in the VisiSet™ Help On Line for further details.

These inputs are optocoupled and can be driven by both NPN and PNP type commands.

NOTE: Polarity insensitive inputs assure full functionality even if pins A and B are exchanged.

The connections are indicated in the following diagrams:

CBX100/500	Function
+V	Power Source - External Trigger
I1A	External Trigger A (polarity insensitive)
I1B	External Trigger B (polarity insensitive)
-V	Power Reference - External Trigger

The yellow Trigger LED (Figure 13, 5) is on when the active state of the External Trigger corresponds to ON.

EXTERNAL TRIGGER INPUT CONNECTIONS USING MATRIX 300™ POWER

CAUTION: Power from the Vdc/GND spring clamps is available directly to the Input Device on the +V/-V spring clamps, and does not pass through the Power Switch (ON/OFF) inside the CBX. Disconnect the power supply when working inside the CBX.

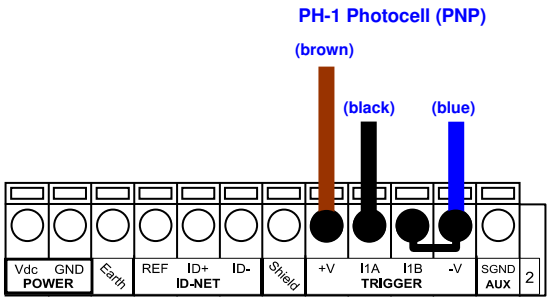


Figure 46 – PH-1 External Trigger Using Matrix 300™ Power

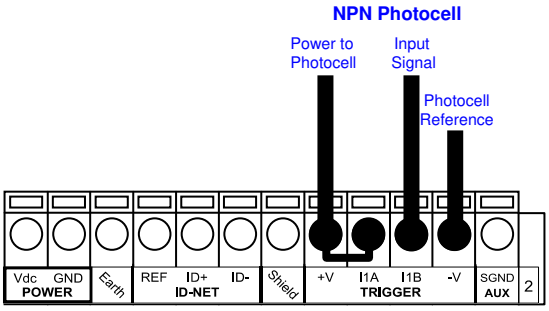


Figure 47 - NPN External Trigger Using Matrix 300™ Power

EXTERNAL TRIGGER INPUT CONNECTIONS USING EXTERNAL POWER

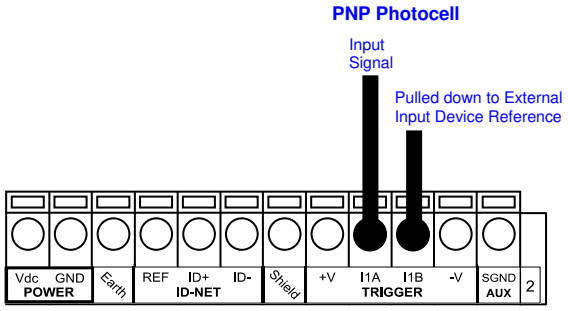


Figure 48 - PNP External Trigger Using External Power

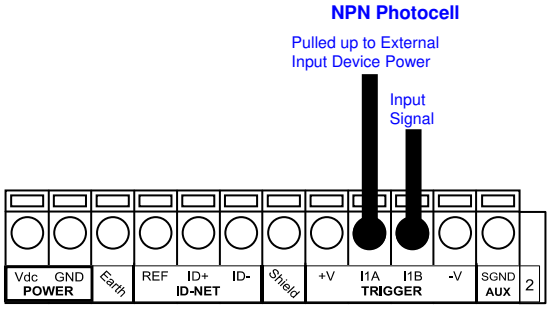
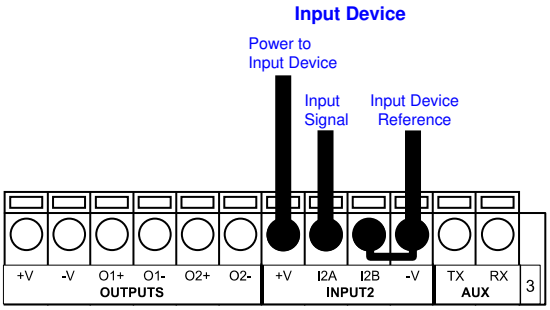


Figure 49 - NPN External Trigger Using External Power

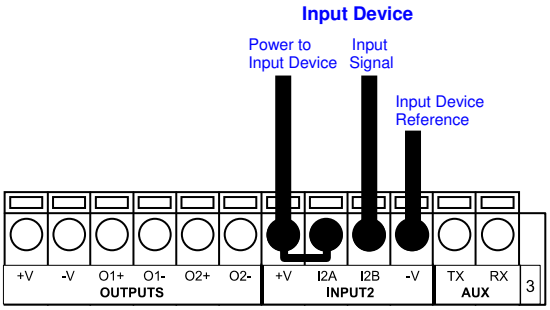
CBX100/500	Function
+V	Power Source - Inputs
I2A	Input 2 A (polarity insensitive)
I2B	Input 2 B (polarity insensitive)
-V	Power Reference - Inputs

INPUT 2 CONNECTIONS USING MATRIX 300™ POWER

CAUTION: Power from the Vdc/GND spring clamps is available directly to the Input Device on the +V/-V spring clamps, and does not pass through the Power Switch (ON/OFF) inside the CBX. Disconnect the power supply when working inside the CBX.



PNP Input 2 Using MATRIX 300™ Power



NPN Input 2 Using MATRIX 300™ Power

INPUT 2 CONNECTIONS USING EXTERNAL POWER

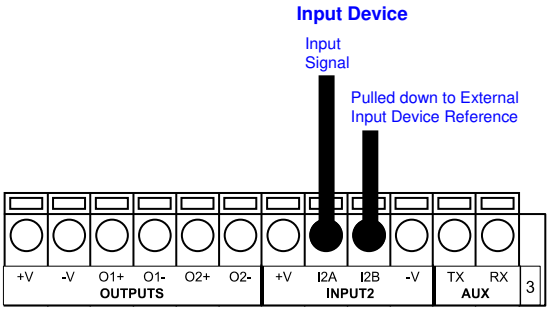


Figure 50 - PNP Input 2 Using External Power

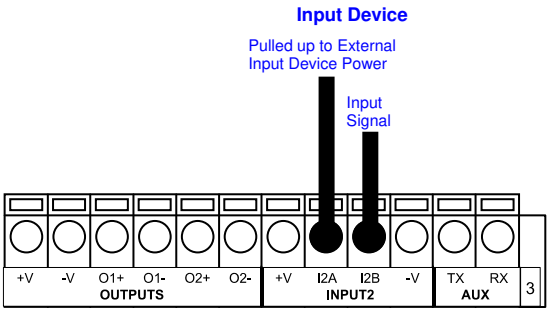


Figure 51 - NPN Input 2 Using External Power

INPUT 3 CONNECTIONS (CBX500 Only)

RESERVED

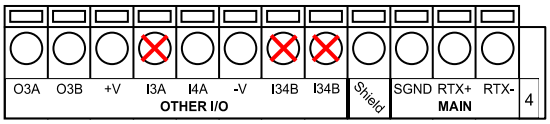


Figure 52 - Input 3 Using External Power

CAUTION: Do not connect to I3A or I34B signals, they are reserved.

4.6 OUTPUTS

CAUTION: When **Outputs 1** and **2** are connected through the CBX connection box, they become opto-isolated and polarity sensitive and acquire the electrical characteristics listed below. To function correctly, they require setting the Output Type configuration parameters to NPN for the respective output in.

Three general purpose outputs are available and their meaning can be defined by the user. They are typically used either to signal the data collection result or to control an external lighting system.

CBX100/500	Function
+V	Power Source - Outputs
O1+	Output 1 + opto-isolated and polarity sensitive
O1-	Output 1 - opto-isolated and polarity sensitive
O2+	Output 2 + opto-isolated and polarity sensitive
O2-	Output 2 - opto-isolated and polarity sensitive
O3A	Output 3 non opto-isolated (only available on CBX500)
-V	Power Reference Outputs

The electrical features of the outputs are the following:

Outputs 1 and 2	Output 3
V_{CE} = 30 Vdc max.	Reverse-Polarity and Short-Circuit Protected
I_{CE} = 40 mA continuous max.; 130 mA pulsed max.	V_{OUT} (I_{LOAD} = 0 mA) max = 30 Vdc
$V_{CE\ saturation}$ = 1 Vdc max. @ 10 mA	V_{OUT} (I_{LOAD} = 100 mA) max = 3 Vdc
P_D = 90 mW Max. @ 50 °C ambient temp.	I_{LOAD} max = 100 mA

By default, Output 1 is associated with the Partial Read and No Read events, which activates when the code(s) signaled by the external trigger are not decoded, and Output 2 is associated with the Complete Read event, which activates when all the selected codes are correctly decoded.

The output signals are fully programmable being determined by the configured Activation/Deactivation events, Deactivation Timeout or a combination of the two. Refer to the Digital I/O folder in the VisiSet™ Help On Line for further details.

OUTPUT 1 AND 2 CONNECTIONS USING MATRIX 300™ POWER

CAUTION: Power from the Vdc/GND spring clamps is available directly to the Output Device on the +V/-V spring clamps, and does not pass through the Power Switch (ON/OFF) inside the CBX. Disconnect the power supply when working inside the CBX.

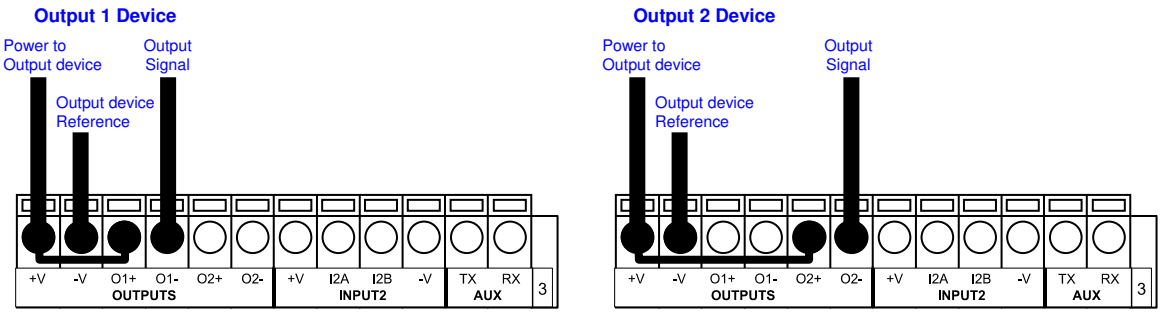


Figure 53 - PNP/Open Emitter Output Using MATRIX 300™ Power

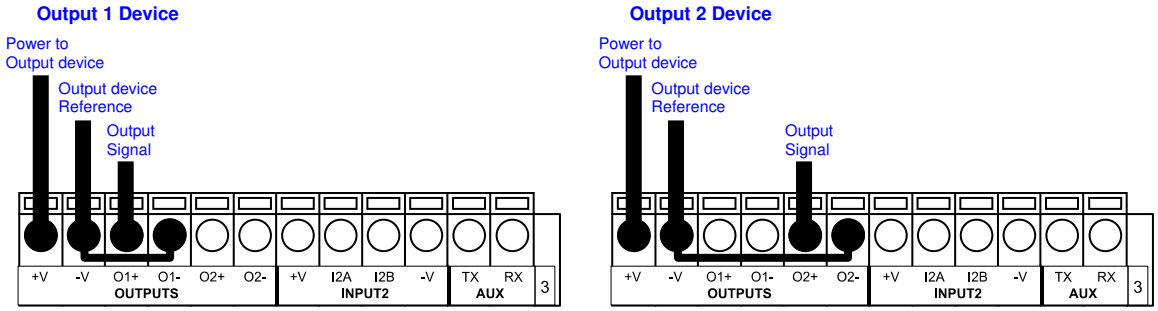


Figure 54 - NPN/Open Collector Output Using MATRIX 300™ Power

OUTPUT 1 AND 2 CONNECTIONS USING EXTERNAL POWER

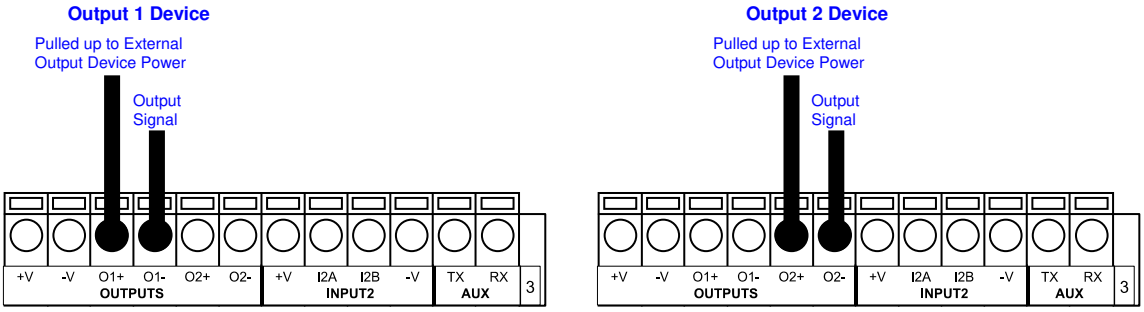


Figure 55 - PNP/Output Open Emitter Using External Power

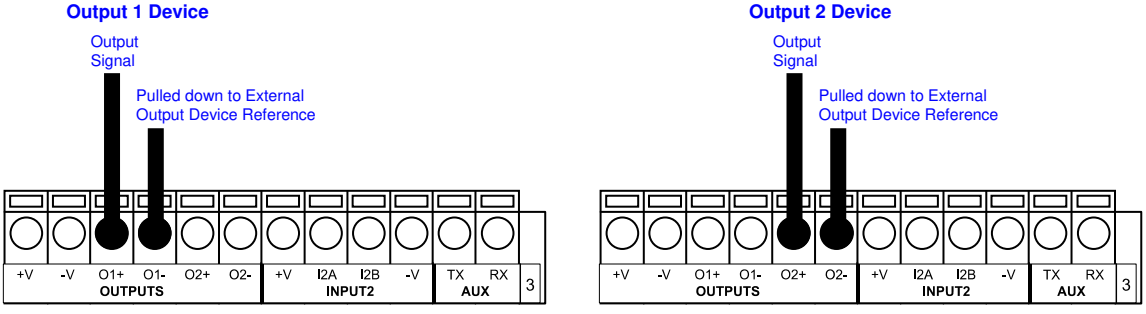


Figure 56 - NPN/Output Open Collector Using External Power

Output 3 is **not opto-isolated** but can be assigned to the same events. By default it is not assigned to any event. The CBX500 must be used to connect this output.

OUTPUT 3 CONNECTIONS USING MATRIX 300™ POWER (CBX500 Only)

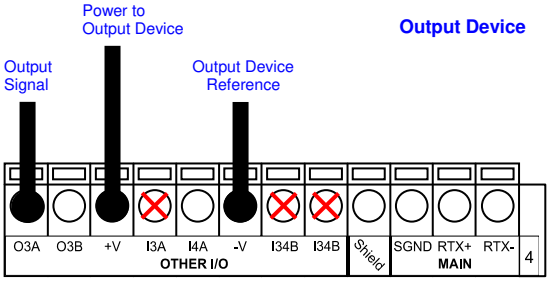


Figure 57 - Output 3 Using Matrix 300™ Power

OUTPUT 3 CONNECTIONS USING EXTERNAL POWER (CBX500 Only)

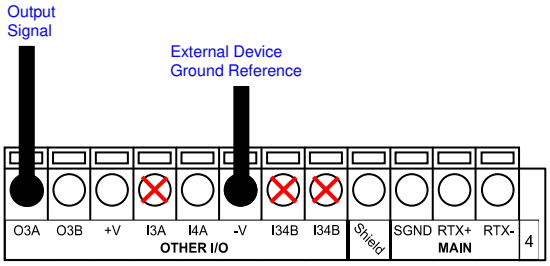


Figure 58 - Output 3 Using External Power

CAUTION: Do not connect to I3A or I34B signals, they are reserved.

4.7 ON-BOARD ETHERNET INTERFACE

The on-board Ethernet Interface can be used for TCP/IP communication with a remote or local host computer by connecting the reader to either a LAN or directly to a host PC. There is no need to use a crossover adapter since Matrix 300™ incorporates an auto-cross function.

A **CAB-ETH-M0x** cable can be used to connect to a LAN.

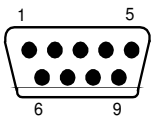
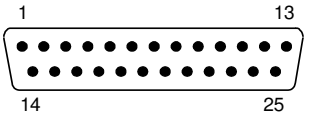
On the Matrix 300™ Ethernet interface the following communication channels are available:

- Data Socket
- Image Socket
- WebSentinel Socket
- Image FTP Client
- HTTP Server
- EtherNet/IP
- Profinet IO
- Modbus TCP

For further details refer to the Ethernet Folder in the VisiSet™ Help On Line and to the "Matrix Ethernet Service Guide.pdf" document provided as supplementary documentation.

4.8 USER INTERFACE - SERIAL HOST

The following table contains the pinout for standard RS232 PC Host interface. For other user interface types please refer to their own manual.

RS232 PC-side connections			
 9-pin male connector		 25-pin male connector	
Pin	**Name**	**Pin**	**Name**
2	RX	3	RX
3	TX	2	TX
5	GND	7	GND
7	RTS	4	RTS
8	CTS	5	CTS

5 TYPICAL LAYOUTS

The following typical layouts refer to system hardware configurations. However, they also require the correct setup of the software configuration parameters. Dotted lines in the figures refer to optional hardware configurations within the particular layout.

5.1 POINT-TO-POINT

In this layout the data is transmitted to the Host on the main serial interface. The RS232 auxiliary interface can be used for reader configuration by connecting a laptop computer running VisiSet™. Host Mode programming can be accomplished either through the main interface or the Auxiliary interface.

In Local Echo communication mode, data is transmitted on the RS232 auxiliary interface independently from the main interface selection.

When One Shot or Phase Mode operating mode is used, the reader can be activated by an External Trigger (for example a pulse from a photoelectric sensor) when the object enters its reading zone.

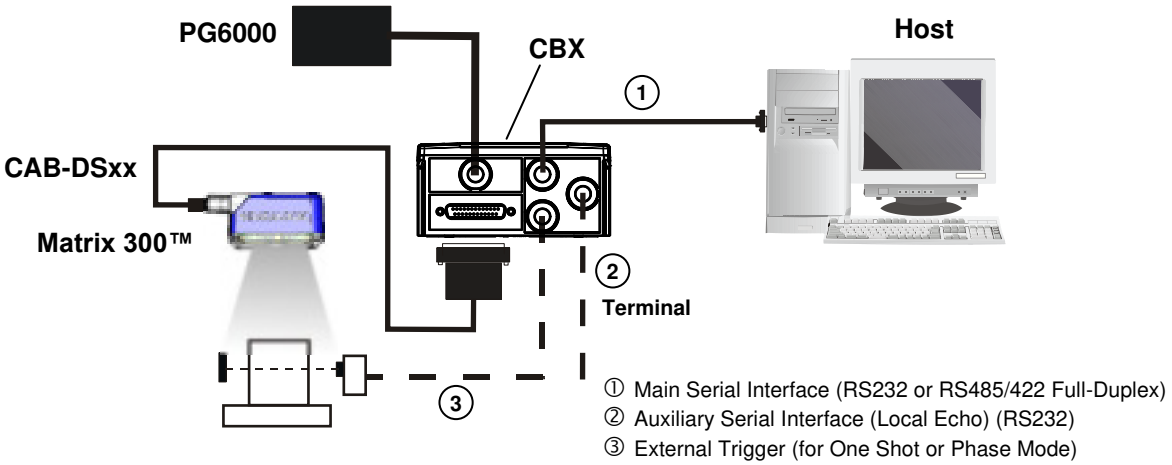


Figure 59 – Serial Interface Point-to-Point Layout

In this layout the data is transmitted to the Host on the TCP/IP Ethernet interface (CBX500 with BM200/210 Host Interface Module installed). The RS232 auxiliary interface can be used for reader configuration by connecting a laptop computer running VisiSet™. Host Mode programming can be accomplished either through the TCP/IP Ethernet interface or the Auxiliary interface.

In Local Echo communication mode, data is transmitted on the RS232 auxiliary interface independently from the TCP/IP Ethernet selection.

When One Shot or Phase Mode operating mode is used, the reader can be activated by an External Trigger (for example a pulse from a photoelectric sensor) when the object enters its reading zone.

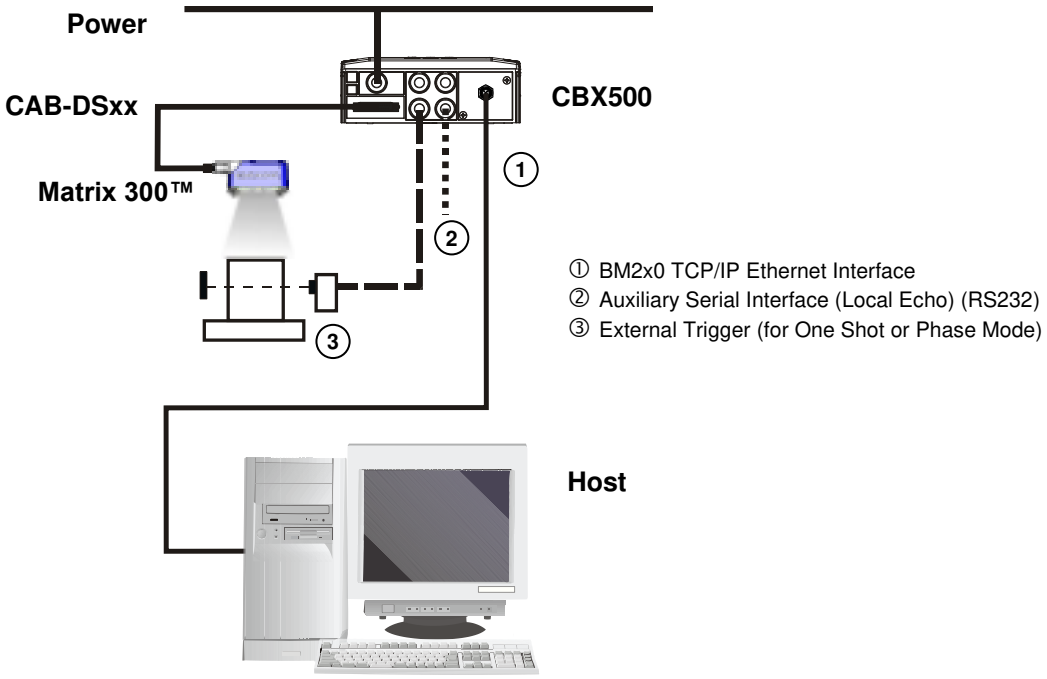


Figure 60 – BM200/210 TCP/IP Ethernet Interface Point-to-Point Layout

In this layout a single reader functions as a Slave node on a Fieldbus network. The data is transmitted to the Host through an accessory Fieldbus interface board installed inside the CBX500 connection box.

Reader configuration can be accomplished through the Auxiliary interface using the VisiSet™ configuration program or Host Mode programming.

In Local Echo communication mode, data is transmitted on the RS232 auxiliary interface independently from the Fieldbus interface selection.

When One Shot or Phase Mode operating mode is used, the reader can be activated by an External Trigger (photoelectric sensor) when the object enters its reading zone.

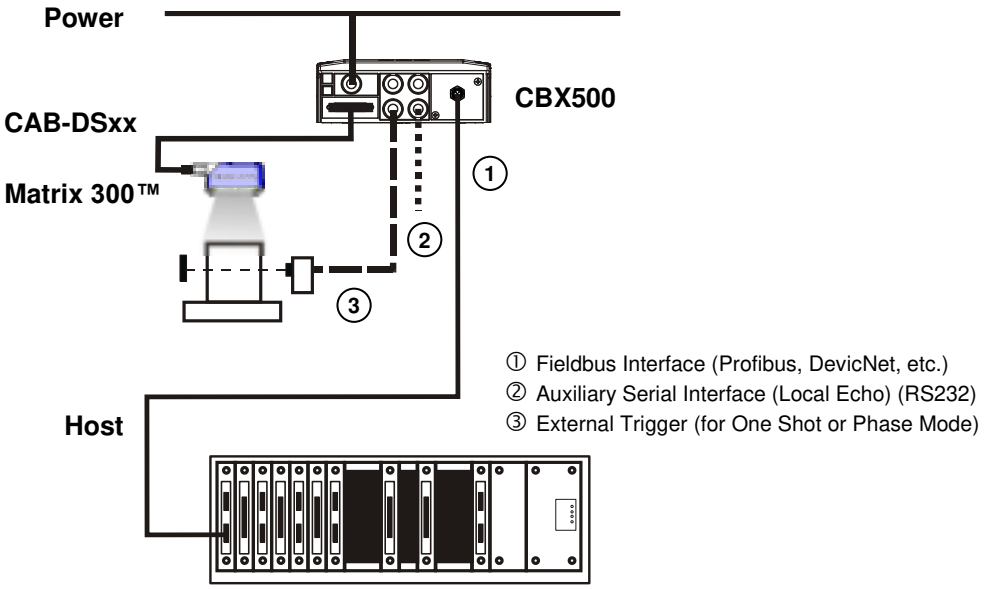


Figure 61 – Fieldbus Interface Point-to-Point Layout

5.2 ID-NET™ SYNCHRONIZED NETWORK

The ID-NET™ connection is used to collect data from several readers to build a multi-point or a multi-sided reading system; there can be one master and up to 31 slaves connected together.

The slave readers are connected together using the ID-NET™ interface. Every slave reader must have an ID-NET™ address in the range 1-31.

The master reader is also connected to the Host on the RS232/RS485/422 main serial interface.

For a Master/Slave Synchronized layout the External Trigger signal is unique to the system; there is a single reading phase and a single message from the master reader to the Host computer. **It is not necessary to bring the External Trigger signal to all the readers.**

In the Master/Slave Synchronized layout the Master operating mode can only be set to Phase Mode.

The main, auxiliary, and ID-NET™ interfaces are connected as shown in the following figures.

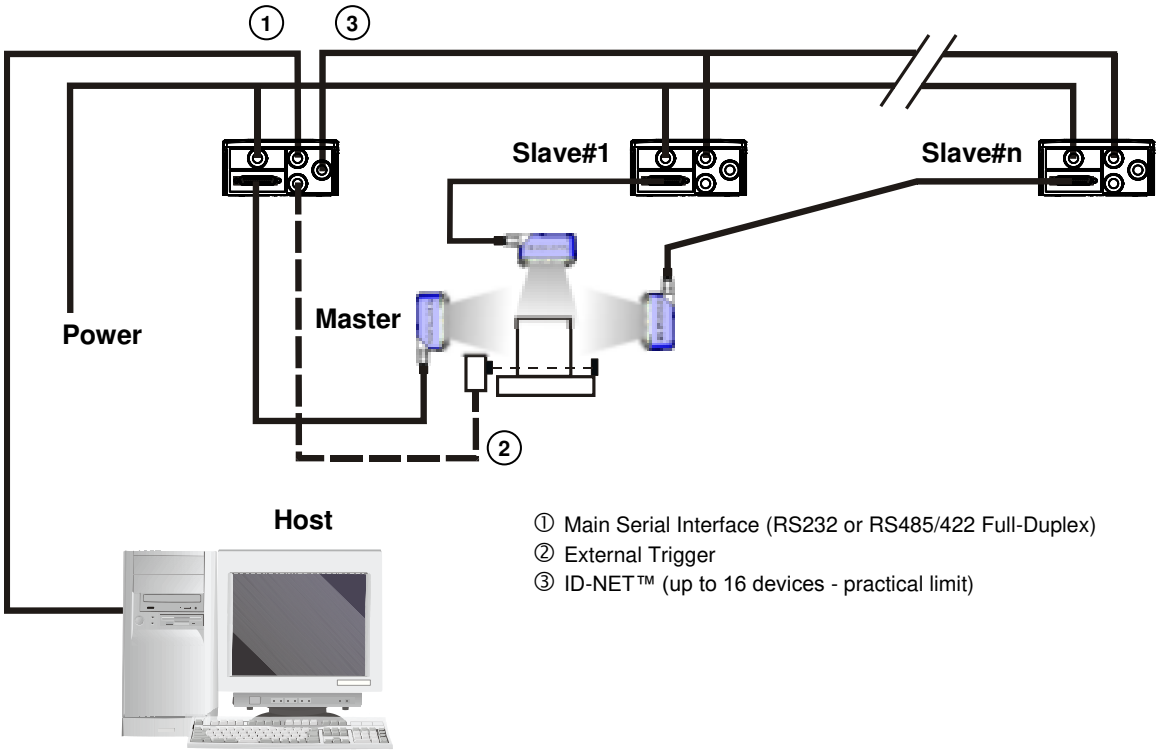


Figure 62 – ID-NET™ M/S Synchronized Layout

The Master reader can be connected to the CBX series connection box with the advantage of the Backup and Restore configuration function (CBX + BM100 module).

If the Backup and Restore function is not required, then a QL300 or QL500 can be used to connect the master reader.

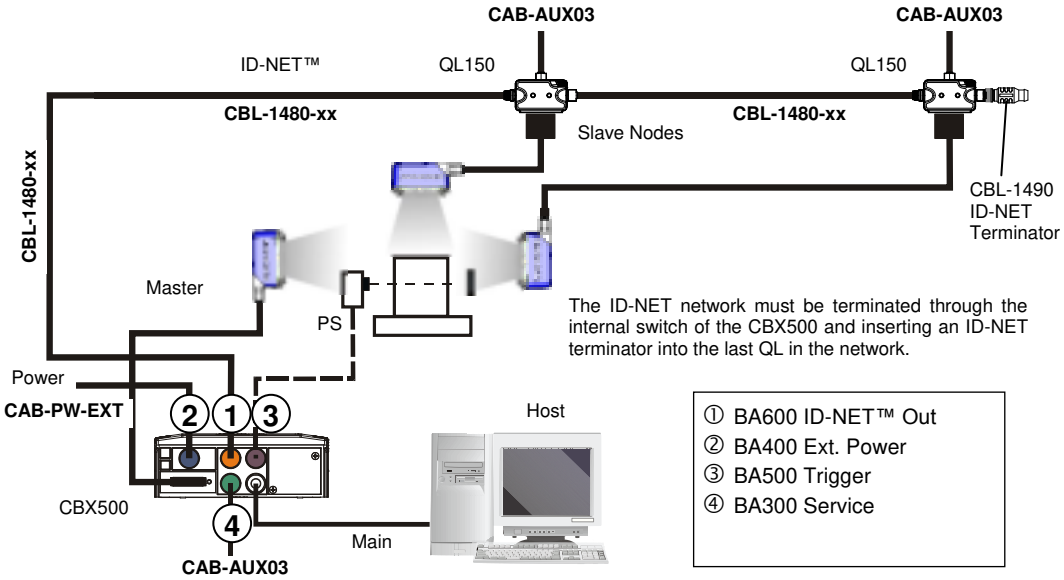


Figure 63 - ID-NET™ Synchronized Layout
Matrix 300™ Master with CBX500 + Matrix 300™ Slaves with QL150

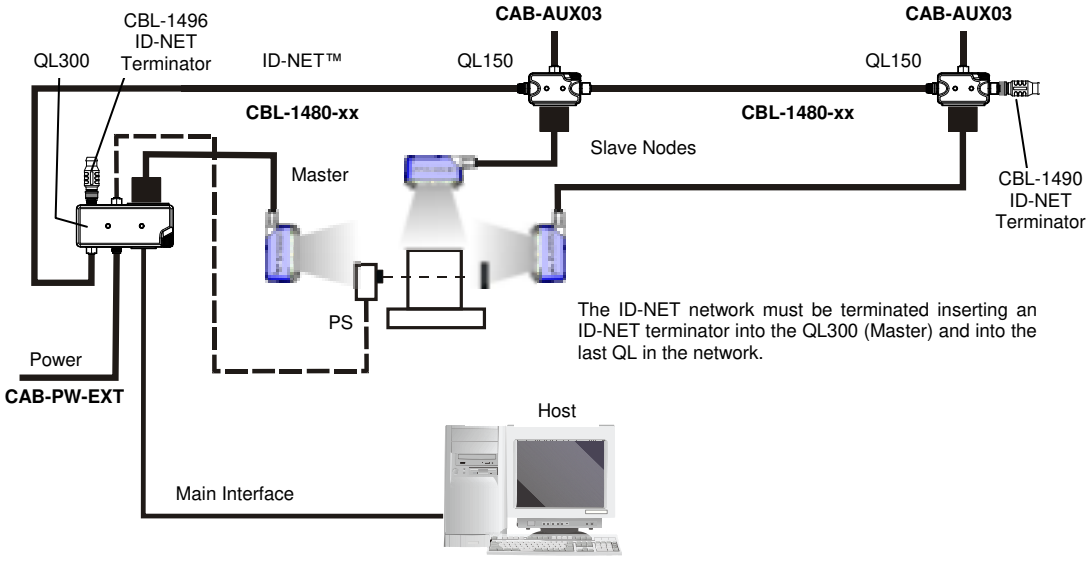


Figure 64 - ID-NET™ Synchronized Layout
Matrix 300™ Master with QL300 + Matrix 300™ Slaves with QL150

The same configuration can be made to a Host using a TCP/IP Ethernet interface. In this case the Master is connected to a CBX500 with BM200/210 Host Interface Module installed.

The TCP/IP Ethernet, auxiliary, and ID-NET™ interfaces are connected as shown in the figure below.

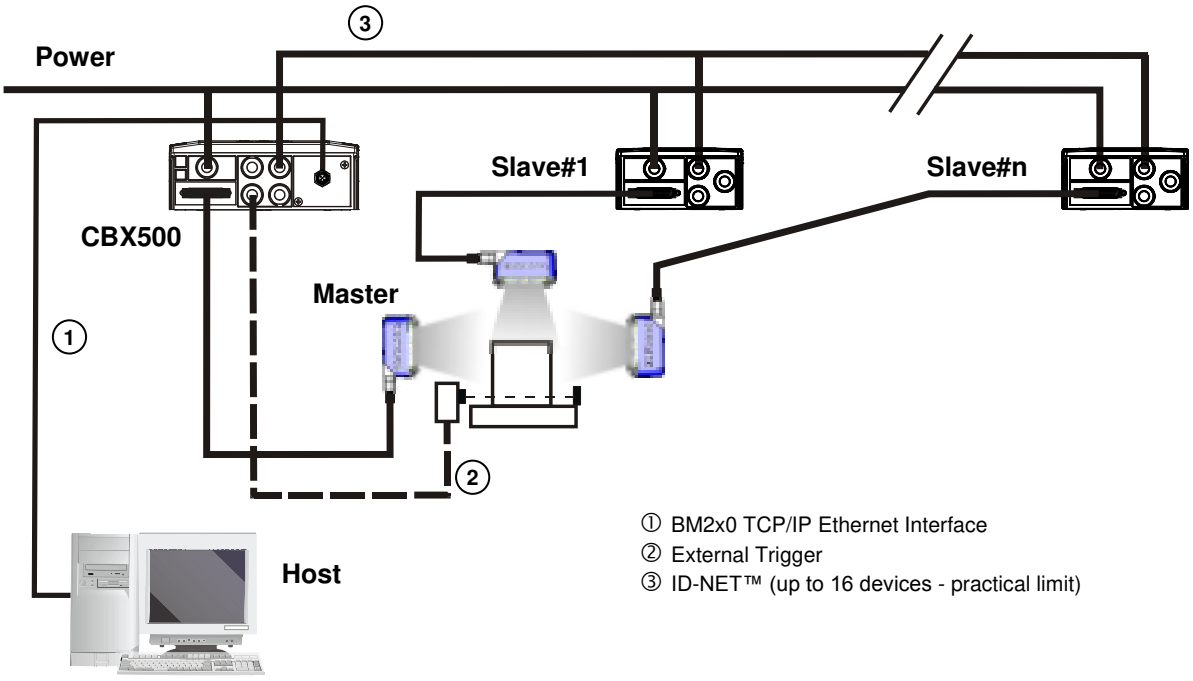


Figure 65 – ID-NET™ M/S Synchronized Layout with BM200/210 TCP/IP Ethernet Interface to Host

Alternatively, the Master reader can communicate to the Host as a Slave node on a Fieldbus network. This requires using an accessory Fieldbus interface board installed inside the CBX500 connection box.

System configuration can be accomplished through the Auxiliary interface of each individual reader (internal CBX500 9-pin connector) using the VisiSet™ configuration program or Host Mode programming. See par. 2.3.1 for details.

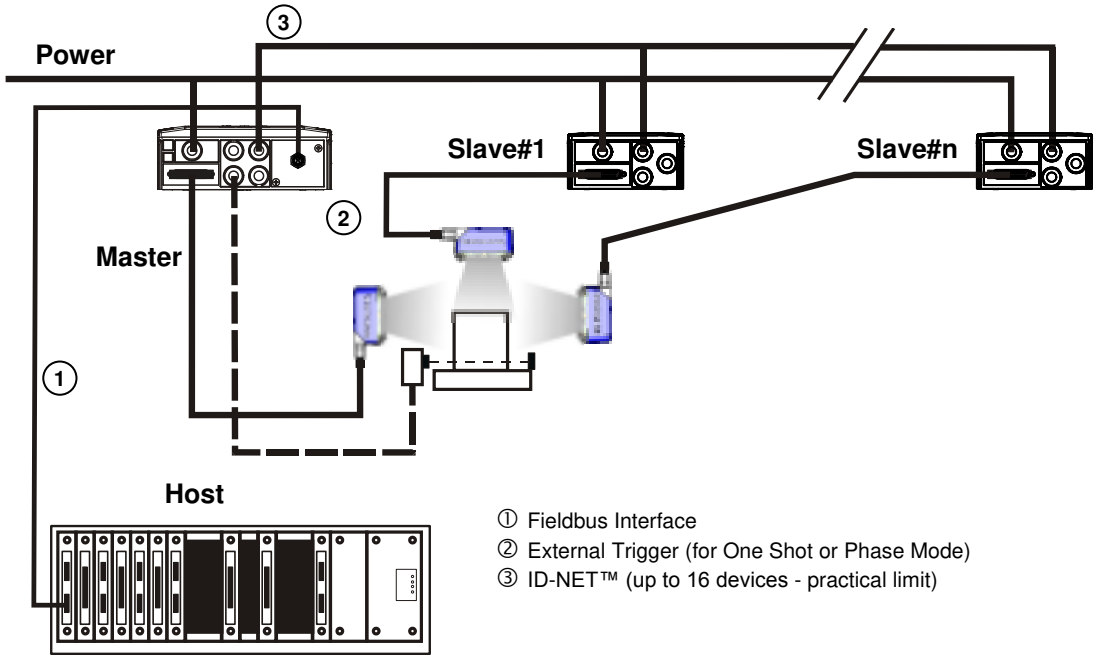


Figure 66 – ID-NET™ Fieldbus M/S Synchronized Layout

5.3 ID-NET™ MULTIDATA NETWORK

For a Master/Slave Multidata layout each reader has its own reading phase independent from the others; each single message is sent from the master reader to the Host computer.

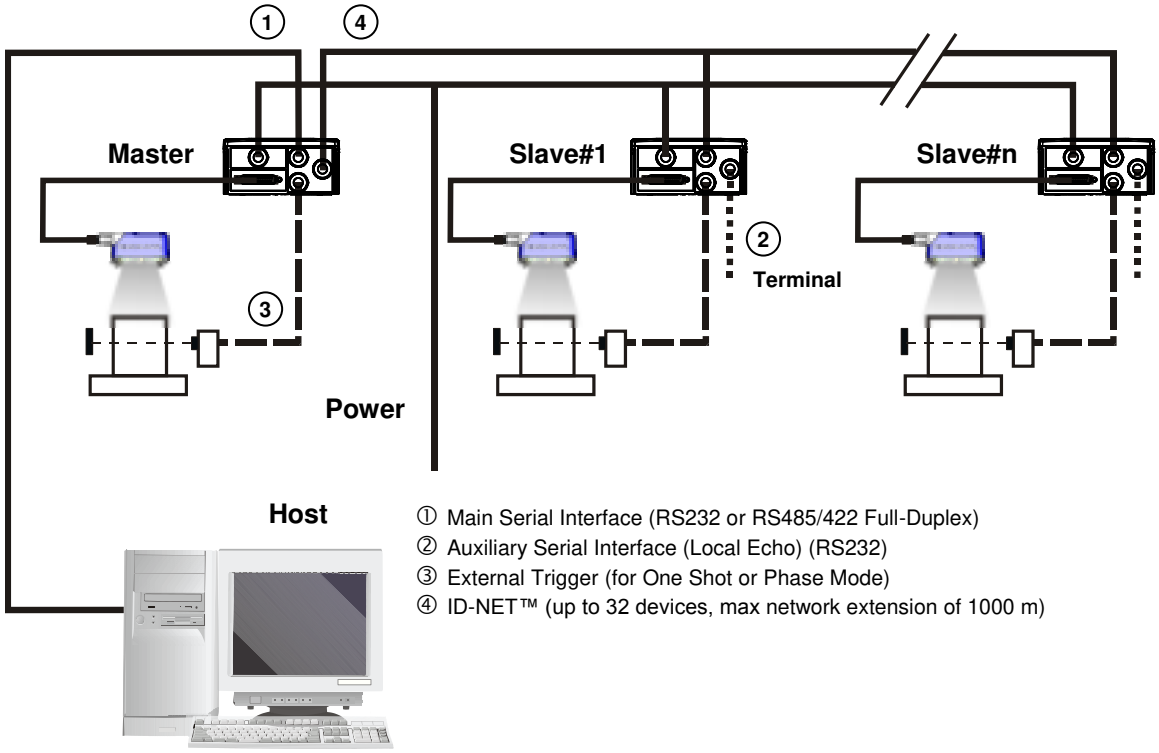


Figure 67 – ID-NET™ M/S Multidata

NOTE: The auxiliary serial interface of the slave readers can be used in Local Echo communication mode to control any single reader (visualize collected data) or to configure it using the VisiSet™ utility.

The ID-NET™ termination resistor switches must be set to ON only in the first and last CBX connection box.

The same configuration can be made to a Host using a TCP/IP Ethernet interface. In this case the Master is connected to a CBX500 with BM200/210 Host Interface Module installed.

The TCP/IP Ethernet, auxiliary, and ID-NET™ interfaces are connected as shown in the figure below.

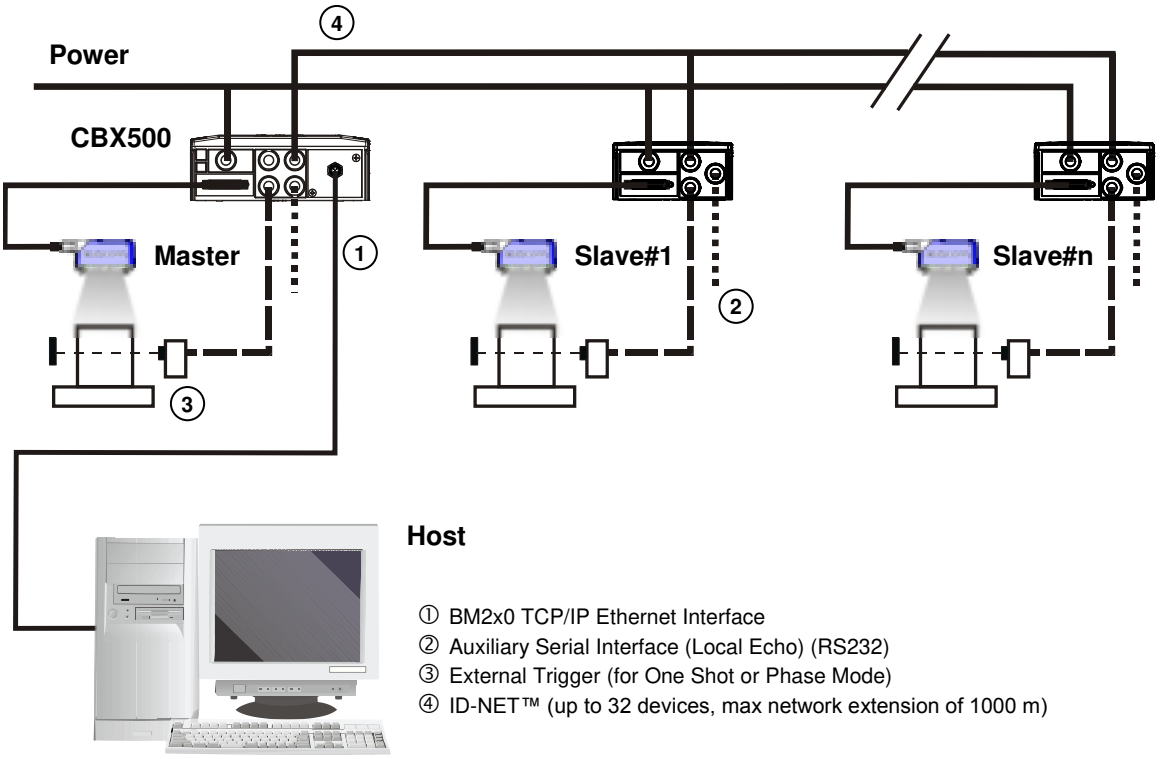


Figure 68 – ID-NET™ M/S Multidata Layout with BM200/210 TCP/IP Ethernet Interface to Host

NOTE: The auxiliary serial interface of the slave readers can be used in Local Echo communication mode to control any single reader (visualize collected data) or to configure it using the VisiSet™ utility.

The ID-NET™ termination resistor switches must be set to ON only in the first and last CBX connection box.

Alternatively, the Master reader can communicate to the Host as a Slave node on a Fieldbus network. This requires using an accessory Fieldbus interface board installed inside the CBX500 connection box.

System configuration can be accomplished through the Auxiliary interface of each individual reader (internal CBX500 9-pin connector) using the VisiSet™ configuration program or Host Mode programming. See par. 2.3.1 for details.

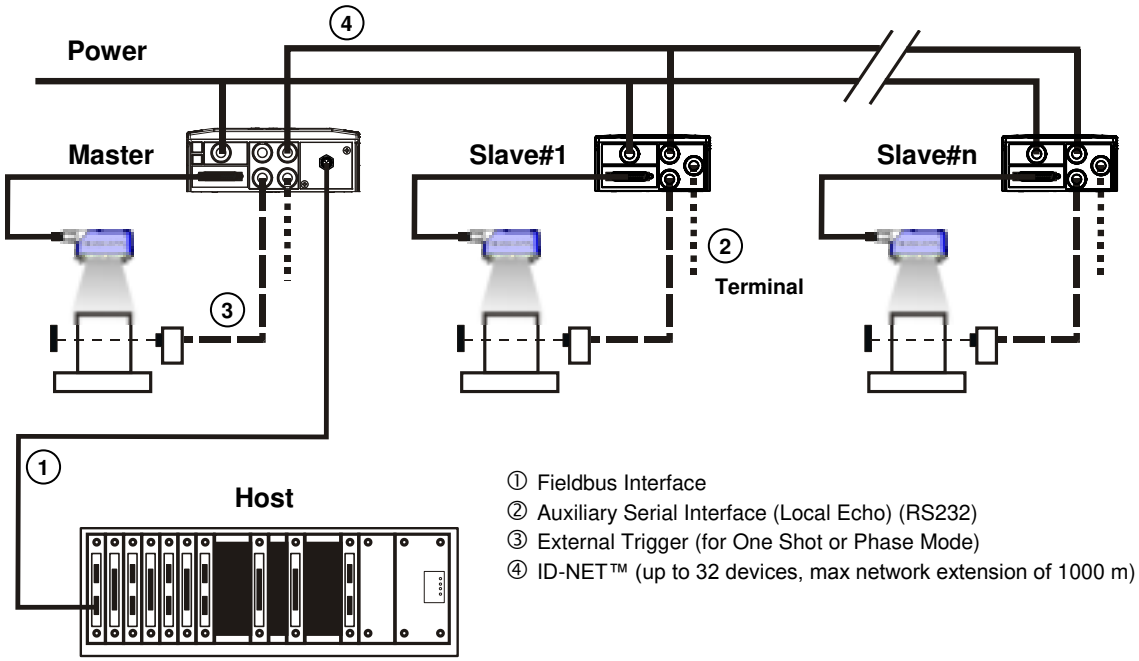


Figure 69 – ID-NET™ Fieldbus M/S Multidata

5.4 PASS-THROUGH

An alternative Pass-Through layout allows the more efficient ID-NET™ network to be used. This layout is really an ID-NET Master/Slave Multidata layout which also allows **each** reader (Master and Slaves) to accept input on the Auxiliary interface, for example to connect a device such as a hand-held reader for manual code reading capability.

Each Matrix 300™ transmits its own messages plus any messages received by its Auxiliary interface onto the ID-NET™ interface. The Master passes all messages to the Host.

When One Shot or Phase Mode operating mode is used, the reader can be activated by an External Trigger (photoelectric sensor) when the object enters its reading zone.

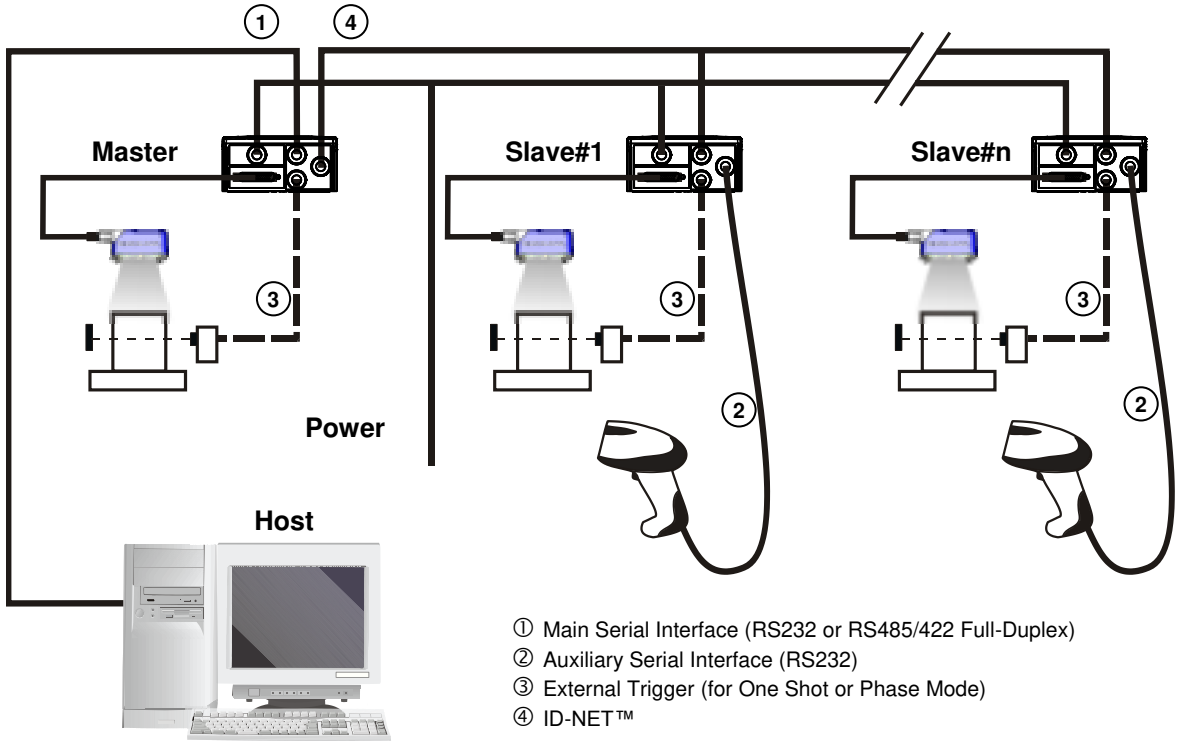


Figure 70 – Pass-Through On ID-NET™ Layout

NOTE: The reading device connected to the Host can be connected to a Fieldbus network using a Host Interface module through a CBX500 connection box.

5.5 ETHERNET CONNECTION

The Ethernet connection is possible in two different layouts. In both layouts, before proceeding with the connection, it is necessary to configure the reader Ethernet parameters via VisiSet™. For further details, see the Ethernet Folder in the VisiSet™ Help On Line.

In a Point-to-Point layout the reader is connected to a local host by using a **CAB-ETH-M0x** cable. There is no need to use a crossover adapter since Matrix 300™ incorporates an autocross function.

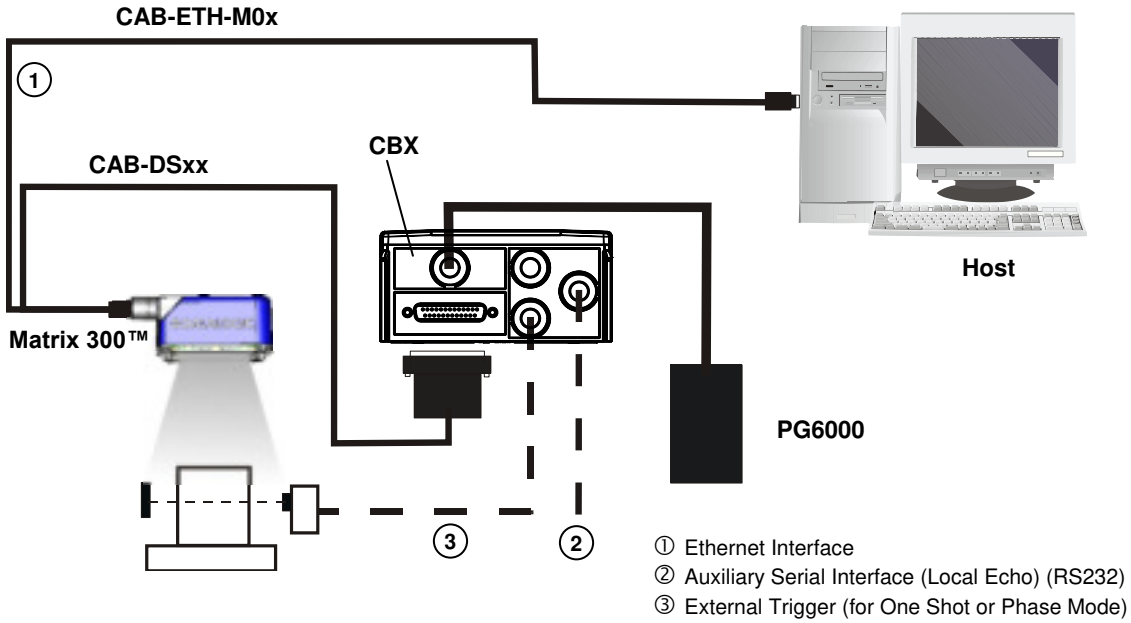


Figure 71 - Ethernet Point-to-Point Layout

When using a Local Area Network (LAN), one or more Matrix 300s can be connected to the network by using **CAB-ETH-M0x** cables:

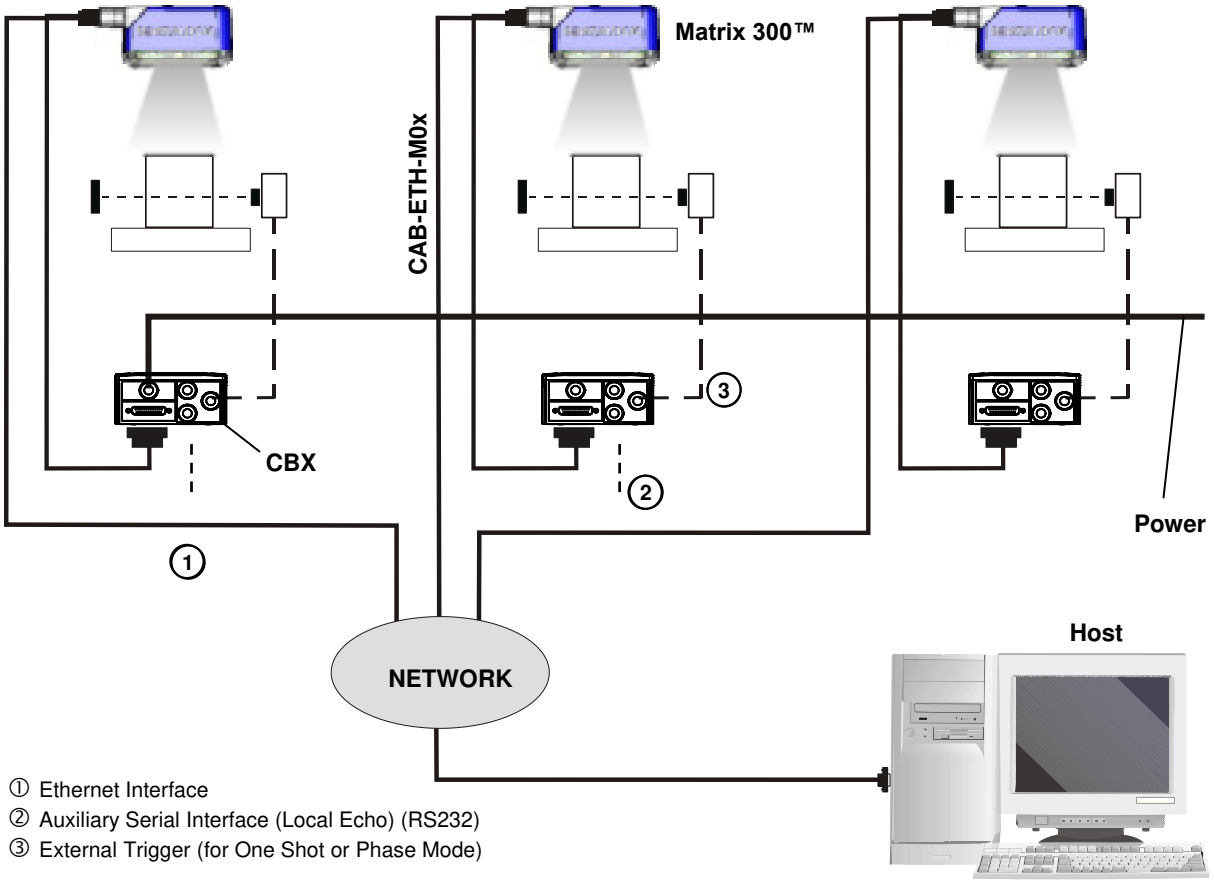


Figure 72 - Ethernet Network Layout

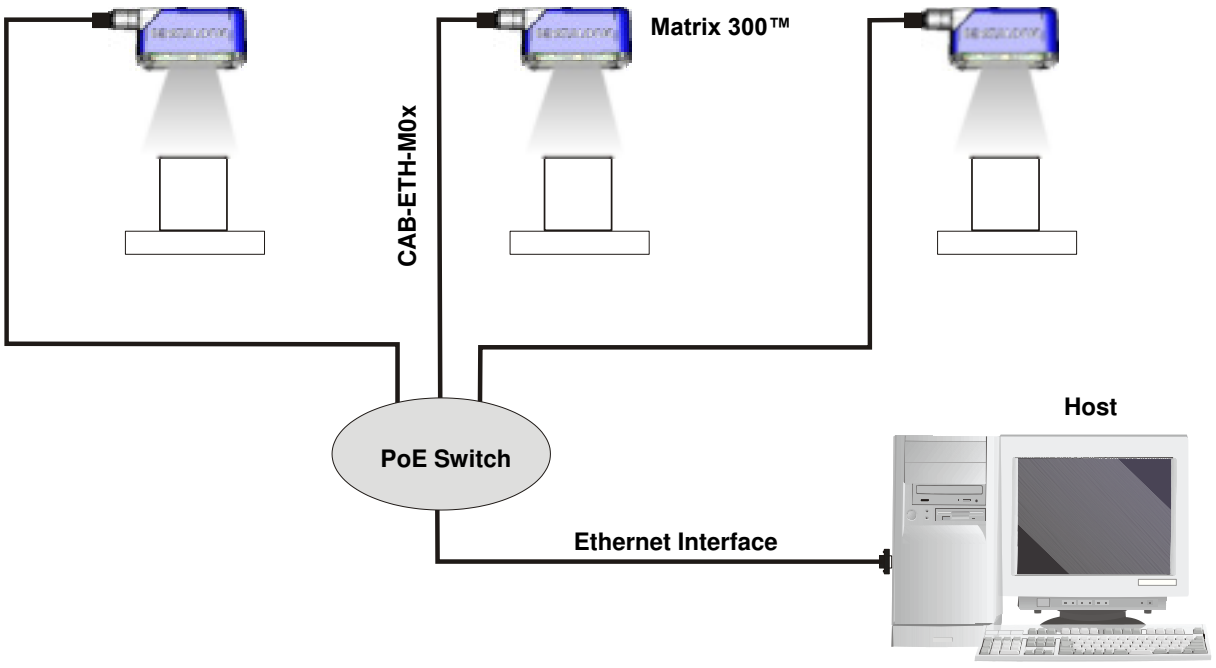


Figure 73 - POE Ethernet Network Layout

6 READING FEATURES

6.1 FOV CALCULATION

Referring to Figure 74 and the formula below, use the data in the following table to calculate the FOV for your application.

Model	Lens	d_0	Viewing Angle **Horizontal**	Viewing Angle **Vertical**	Viewing Angle **Diagonal**	**Min Reading Distance** mm
Matrix 300 4x2-0xx	9 mm liquid	14 mm	40°	32°	50°	**22**
Matrix 300 4x1-0xx	6 mm fixed	7 mm	66°	55°	80°	**35**

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

$$FOV_x = 2\left[(d + d_0)\tan(\alpha_x/2)\right]$$

where:

FOV_x = horizontal, vertical or diagonal FOV

α_x = horizontal, vertical or diagonal viewing angles.

d = reading distance (from window surface to code surface)

d_0 = reading distance offset (from center of lens to window surface)

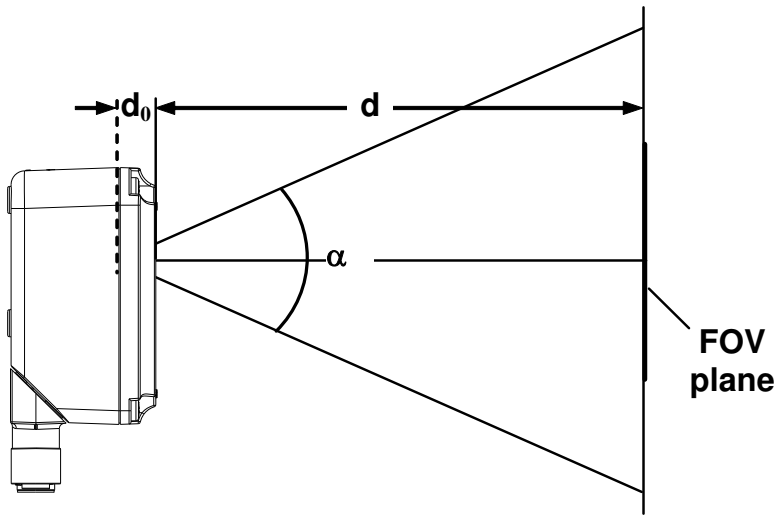


Figure 74 – Reading Distance References

Example:

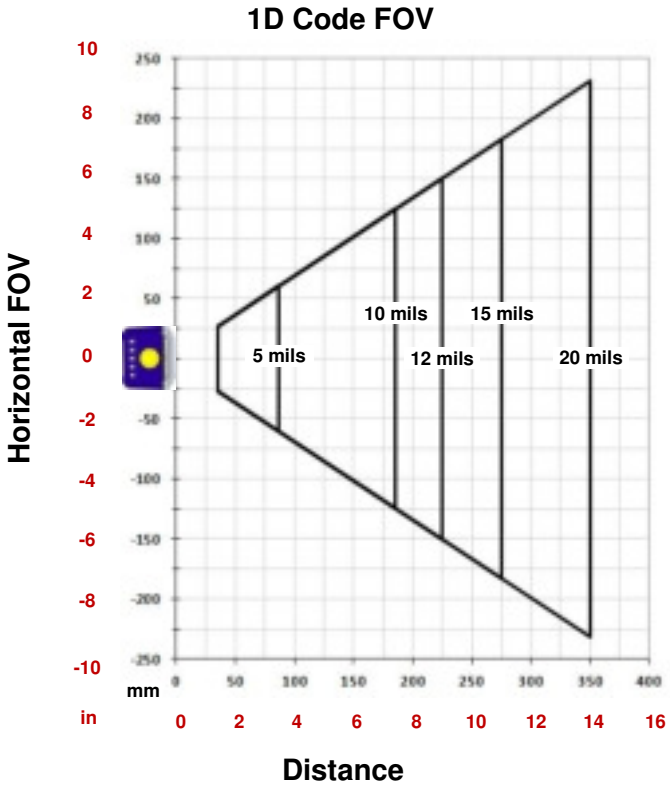
The FOV for a **Matrix 300 412-0xx** at a **reading distance of 200 mm** is:

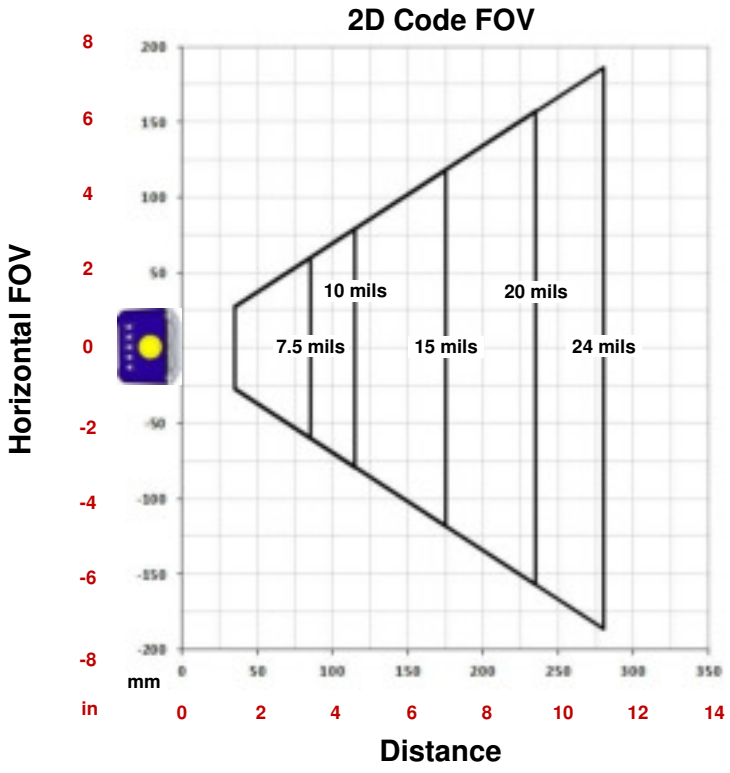
$FOV_H = 2\ [(200\ mm + 14\ mm)\ \tan\ (40°/2)] \cong$ **156 mm**
$FOV_V = 2\ [(200\ mm + 14\ mm)\ \tan\ (32°/2)] \cong$ **123 mm**

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.

6.1.1 Global FOV Diagrams for 6 mm Manual Adjustable Focus Models

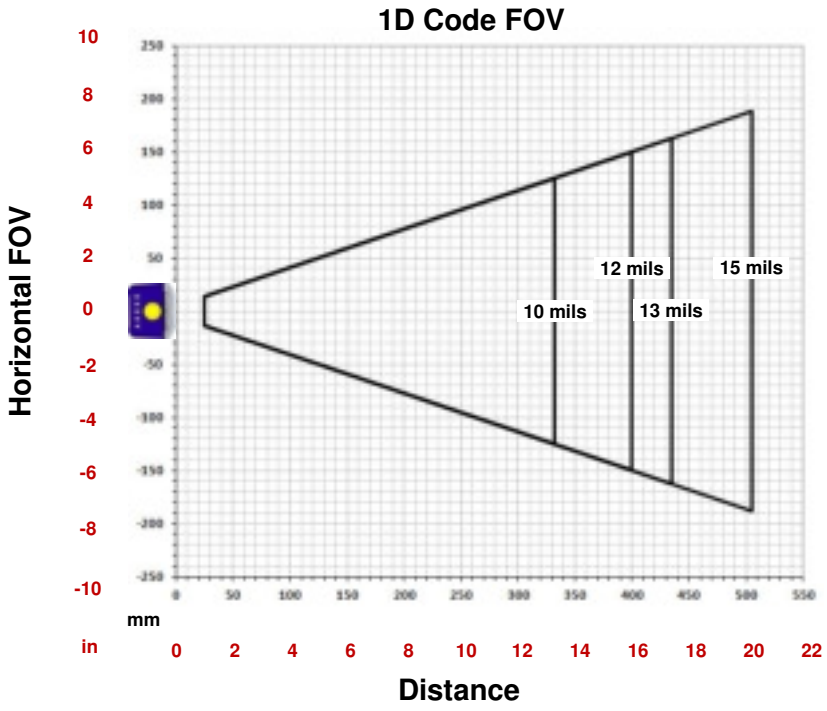
The following diagrams show the **maximum obtainable** Field of View for 1D and 2D codes using Processing Mode = Advanced Code Setting. **Depending on the code resolution, symbology, and number of characters in the code, the Reading Area can be different from the FOV**. See the reference Reading Diagrams in par. 6.3 for reading area examples.

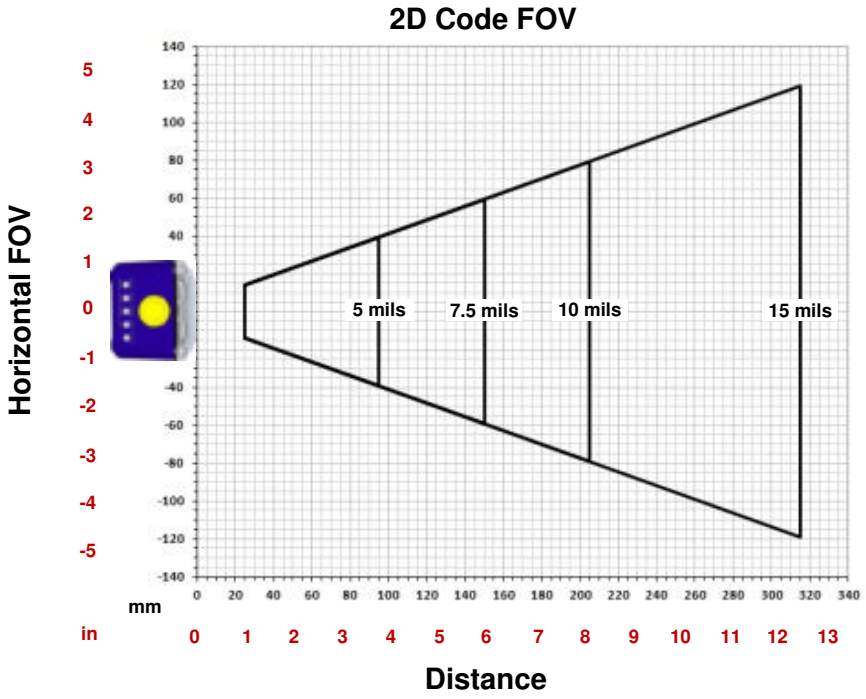




6.1.2 Matrix 300 4x2 9 mm Liquid Lens Global FOV Diagrams

The following diagrams show the **maximum obtainable** Field of View for 1D and 2D codes using Processing Mode = Advanced Code Setting. **Depending on the code resolution, symbology, and number of characters in the code, the Reading Area can be different from the FOV**. See the reference Reading Diagrams in par. 6.4 for reading area examples.





6.2 READING DIAGRAMS

- The following reading diagrams are to be considered as references and are given for typical performance at 25°C using high quality grade A symbols: Code 128 (1D code) and Data Matrix ECC 200 (2D code) from the Test Charts provided with the reader.
- Testing should be performed with the actual Matrix 300™ using application codes in order to evaluate whether maximizing application performance requires adjustments to the HW/SW configuration with respect to the Reference Conditions given under each diagram.
- The ratio of the Vertical FOV width with respect to the Horizontal FOV width in the diagrams is about equal to 0.8; specifically 1024/1280. (i.e. $FOV_{V.} \cong FOV_H$ x 0.8).
- The reading distance ranges are measured from the reading window surface.
- The max theoretical Line Speed values for each diagram can be calculated using the formula in par. 6.5.
- Common software parameter settings for all 6 mm models reading all code symbologies, and all 9 mm models reading 1D code symbologies are: Processing Mode=Advanced Code Setting; Self Tuning=Disabled.
  For 9 mm models reading 2D code symbologies: Processing Mode=Standard; Self Tuning=Enabled; Self Tuning Mode=Processing Modes Only.
- When defining a HW/SW configuration for the Matrix 300™ for conditions different from those of the reference diagrams, it is suggested to keep in mind the following rules:
  - Changes in *Exposure Time* act directly proportional to the luminosity of the image and inversely proportional to the maximum code reading movement speed. Consequently, reducing the *Exposure Time* by half, reduces the luminosity of the image by half but doubles the theoretical code reading movement speed.
  - Changes in *Gain* act directly proportional to the luminosity of the image. Increasing the *Gain* value however, can reduce the quality of the acquired image.
  - At the center of the field of view, the lighting power of the “RED WIDE” illuminator is about equal to twice that of the “WHITE WIDE” illuminator, 1.5 times that of the “MLT-DPM” illuminator, and 2.9 times that of the “LT-DPM” illuminator.
  - For the two DPM illuminators, the overall lighting power being considered is from the four Central LED chains, unless specified otherwise.

6.2.1 Pre-Configured .INI Files

Each depth of field (DOF) range shown in the various Reading Diagrams can be obtained by loading a pre-configured .ini file that already contains the parameter settings necessary to replicate the reading diagram results.

These .ini files are provided with and can be loaded from the VisiSet™ installation directory as in the following example:

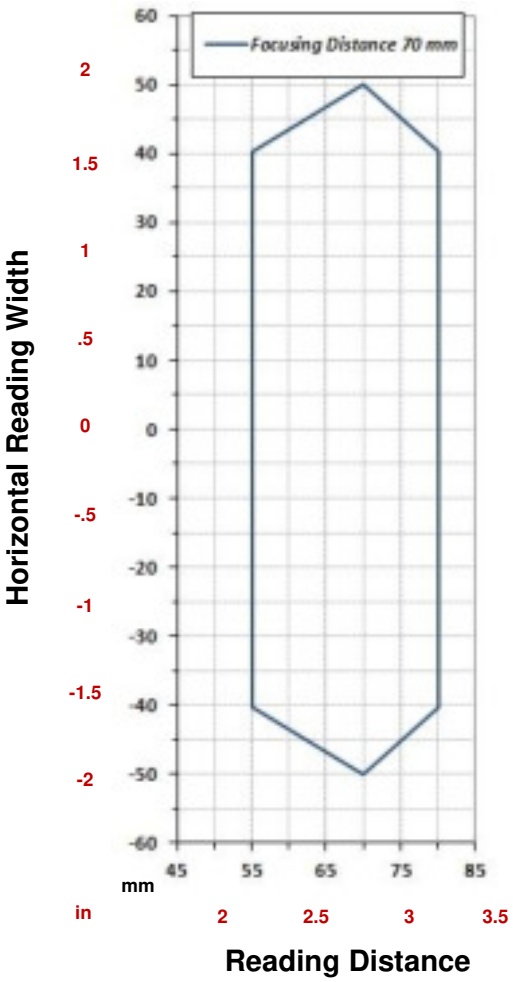
C:\Program Files\Datalogic\VisiSet2\Std_660\Reading Diagram Configuration Files\412-xxx RED Wide

The names of the .ini files correspond to the specific Reading Diagrams; they indicate the Code Type, Code Resolution, Reading Distance, and Luminosity variable settings (A or B if any). These can be directly matched to the relative Reading Diagram to obtain the desired DOF.

6.3 MATRIX 300 4X1 (6 MM MODELS)

6.3.1 1D (Linear) Codes

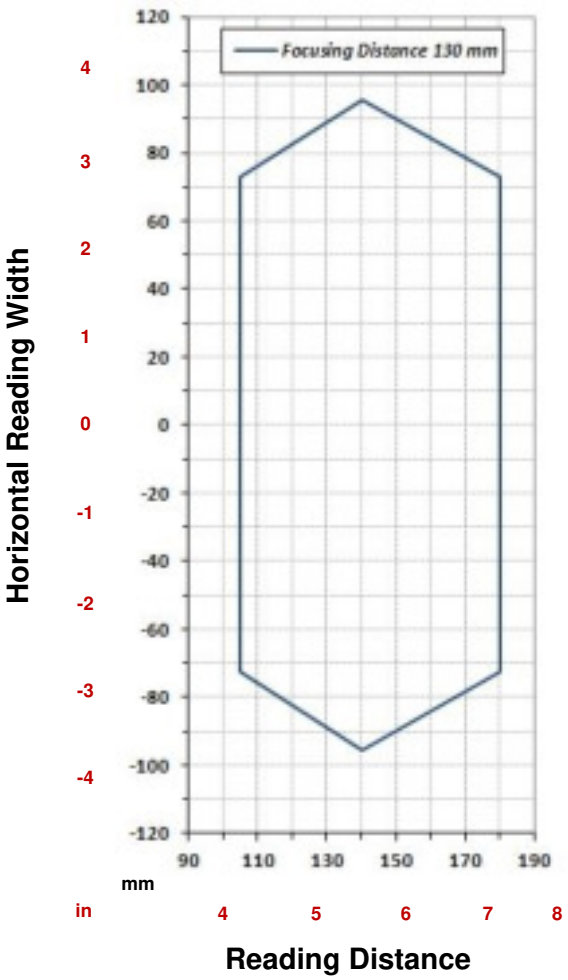
Code 128 0.12 mm (5 mils)



CONDITIONS:

Hardware Settings	
Code Symbology	Code 128
Code Resolution	0.12 mm (5 mils)
Tilt Angle	0°
Skew Angle	15°
Focusing Distance (mm)	70
Software Parameters	
411-xxx RED Wide	
Exposure Time (µs)	90
Gain	5
Illuminator Lighting Mode	Very High Power Strobed

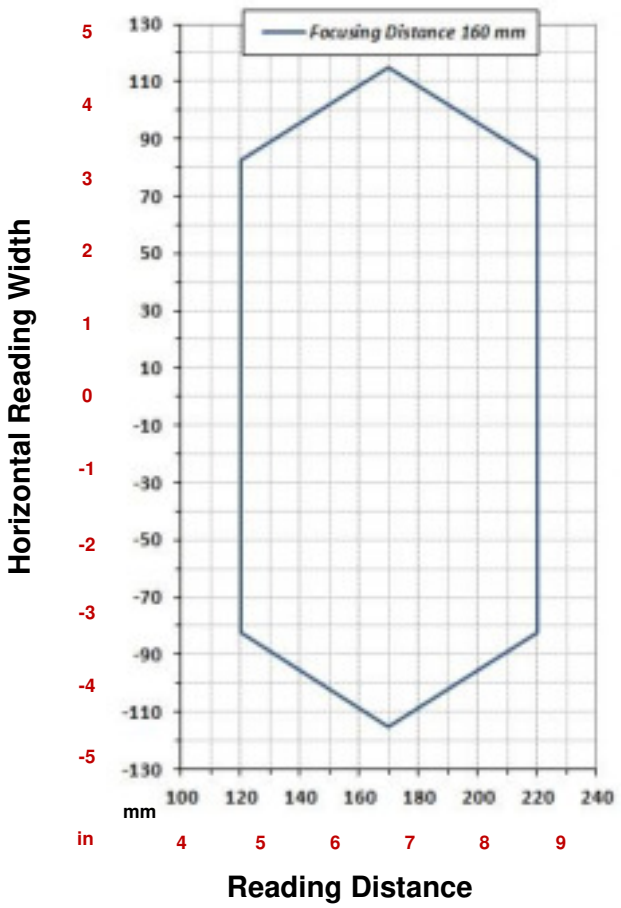
Code 128 0.25 mm (10 mils)



CONDITIONS:

Hardware Settings	
Code Symbology	Code 128
Code Resolution	0.25 mm (10 mils)
Tilt Angle	0°
Skew Angle	15°
Focusing Distance (mm)	130
Software Parameters	
411-xxx RED Wide	
Exposure Time (µs)	80
Gain	20
Illuminator Lighting Mode	Very High Power Strobed

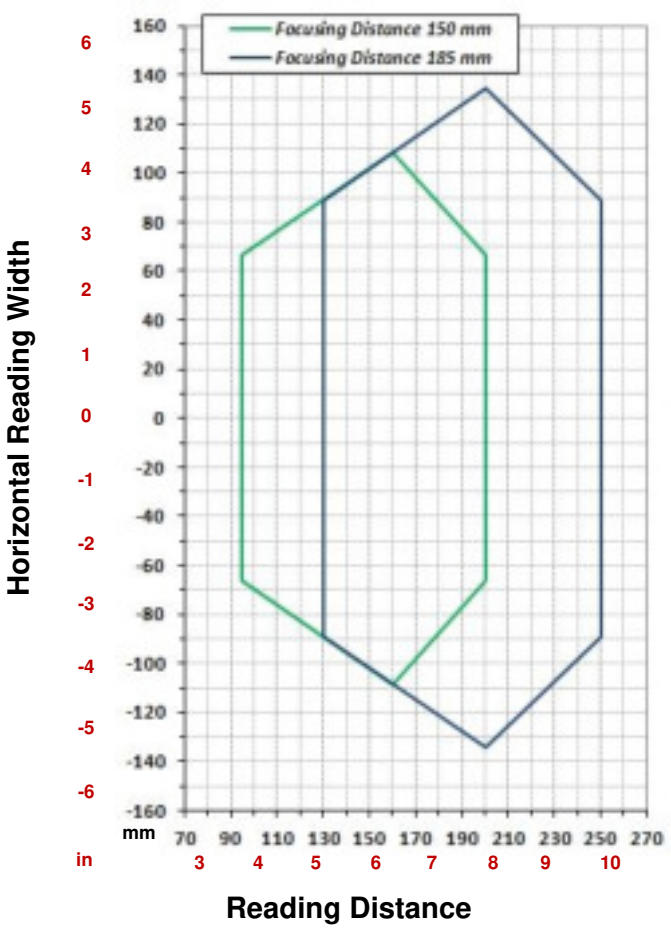
Code 128 0.30 mm (12 mils)



CONDITIONS:

Hardware Settings	
Code Symbology	Code 128
Code Resolution	0.30 mm (12 mils)
Tilt Angle	0°
Skew Angle	15°
Focusing Distance (mm)	160
Software Parameters	
411-xxx RED Wide	
Exposure Time (µs)	100
Gain	20
Illuminator Lighting Mode	Very High Power Strobed

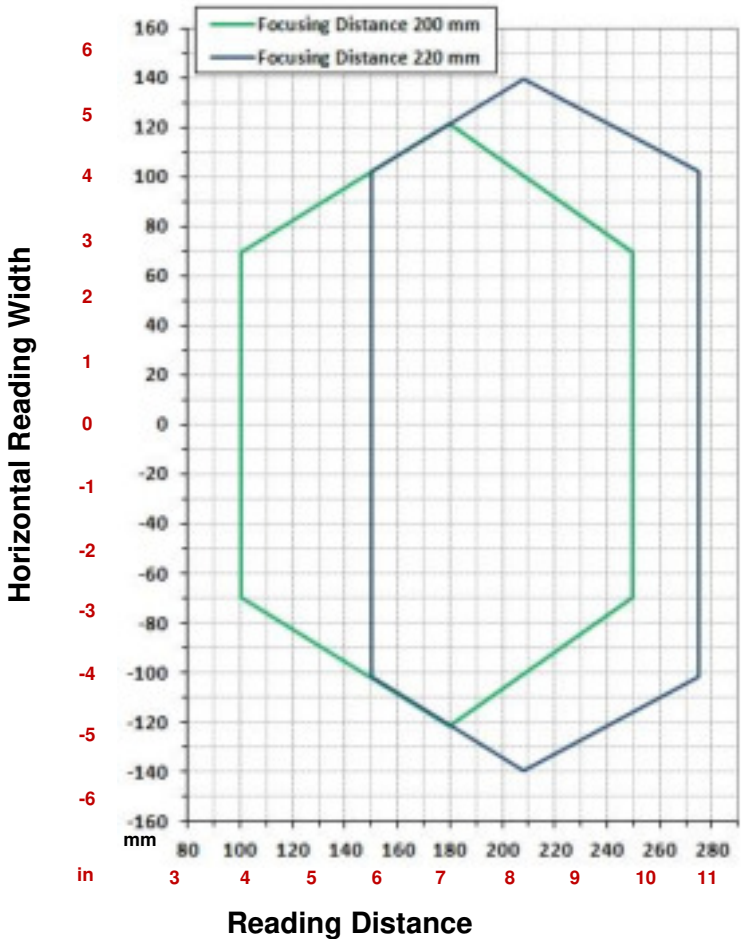
Code 128 0.33 mm (13 mils)



CONDITIONS:

Hardware Settings		
Code Symbology	Code 128	
Code Resolution	0.33 mm (13 mils)	
Tilt Angle	0°	
Skew Angle	15°	
Focusing Distance (mm)	150	185
Software Parameters		
411-xxx RED Wide		
Exposure Time (µs)	150	175
Gain	13	20
Illuminator Lighting Mode	Very High Power Strobed	

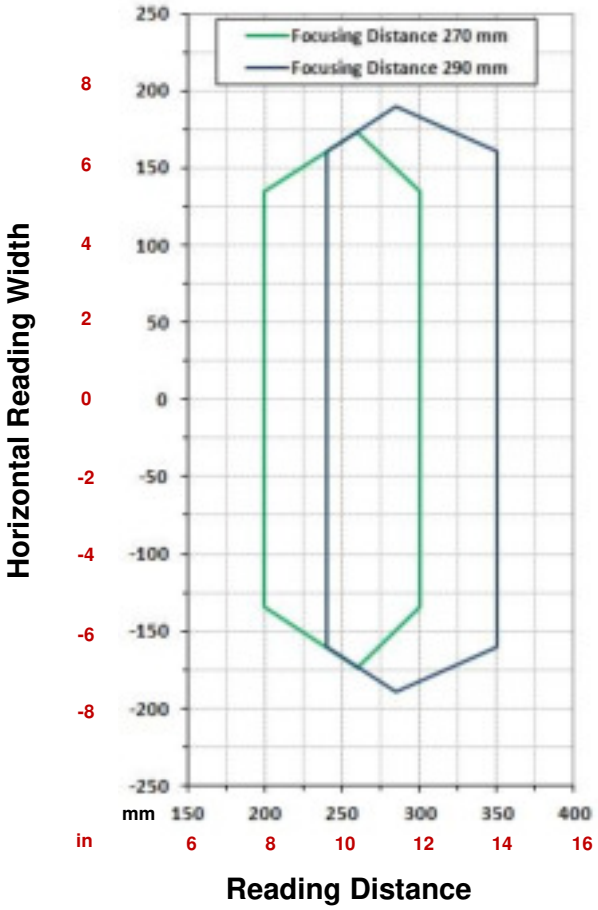
Code 128 0.38 mm (15 mils)



CONDITIONS:

Hardware Settings		
Code Symbology	Code 128	
Code Resolution	0.38 mm (15 mils)	
Tilt Angle	0°	
Skew Angle	15°	
Focusing Distance (mm)	200	220
Software Parameters		
411-xxx RED Wide		
Exposure Time (µs)	250	250
Gain	6	15
Illuminator Lighting Mode	Very High Power Strobed	

Code 128 0.50 mm (20 mils)

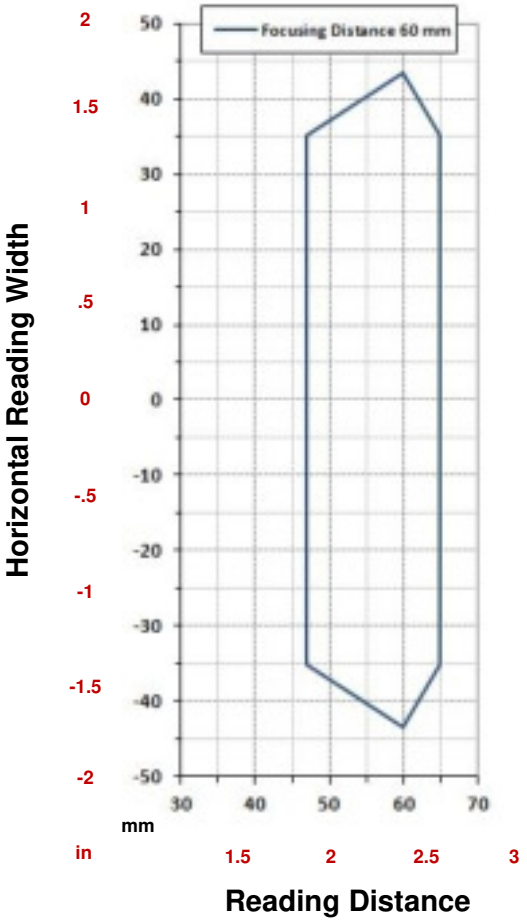


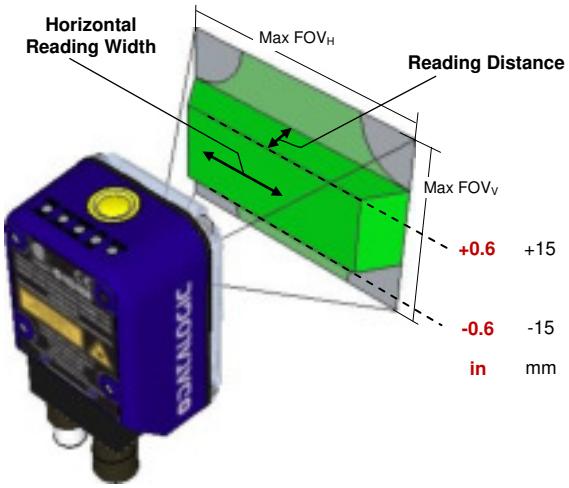
CONDITIONS:

Hardware Settings		
Code Symbology	Code 128	
Code Resolution	0.50 mm (20 mils)	
Tilt Angle	0°	
Skew Angle	15°	
Focusing Distance (mm)	270	290
Software Parameters		
411-xxx RED Wide		
Exposure Time (µs)	330	330
Gain	23	25
Illuminator Lighting Mode	Very High Power Strobed	

6.3.2 2D (Bi-dimensional) Codes

Data Matrix 0.19 mm (7.5 mils)





Due to the "fisheye" effect of the wide angle 6 mm lens, the reading area for higher resolution codes is limited to the central zone of the Vertical Field of View.

For these applications, window cropping is recommended above and below the central zone of the Vertical FOV, limiting image acquisition to the effective reading area and therefore increasing frame rate and reducing overall image processing time. See par. 7.5.8.

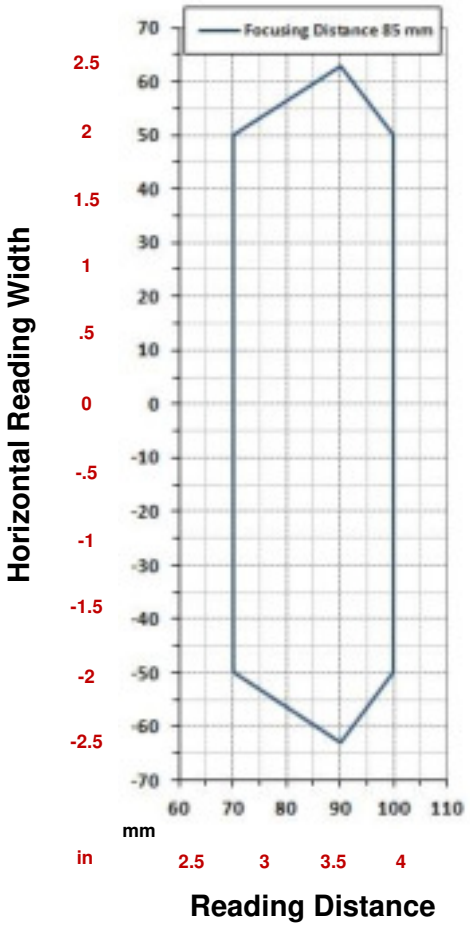
± 15 mm ≈ 550 pixels

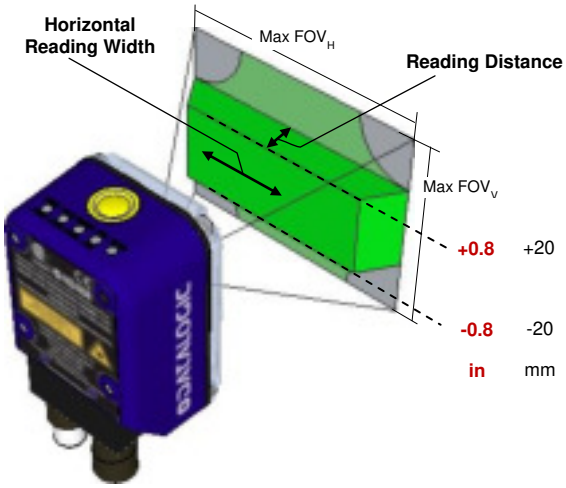
Region of Interest Top = 236
Region of Interest Bottom = 786

CONDITIONS:

Hardware Settings	
Code Symbology	Data Matrix ECC 200
Code Resolution	0.19 mm (7.5 mils)
Tilt Angle	45°
Skew Angle	0°
Focusing Distance (mm)	60
Software Parameters	
481-xxx MLT-DPM	
LED Chain Type	Peripheral
Exposure Time (µs)	380
Gain	23
Illuminator Lighting Mode	Very High Power Strobed

Data Matrix 0.25 mm (10 mils)





Due to the "fisheye" effect of the wide angle 6 mm lens, the reading area for higher resolution codes is limited to the central zone of the Vertical Field of View.

For these applications, window cropping is recommended above and below the central zone of the Vertical FOV, limiting image acquisition to the effective reading area and therefore increasing frame rate and reducing overall image processing time. See par. 7.5.8.

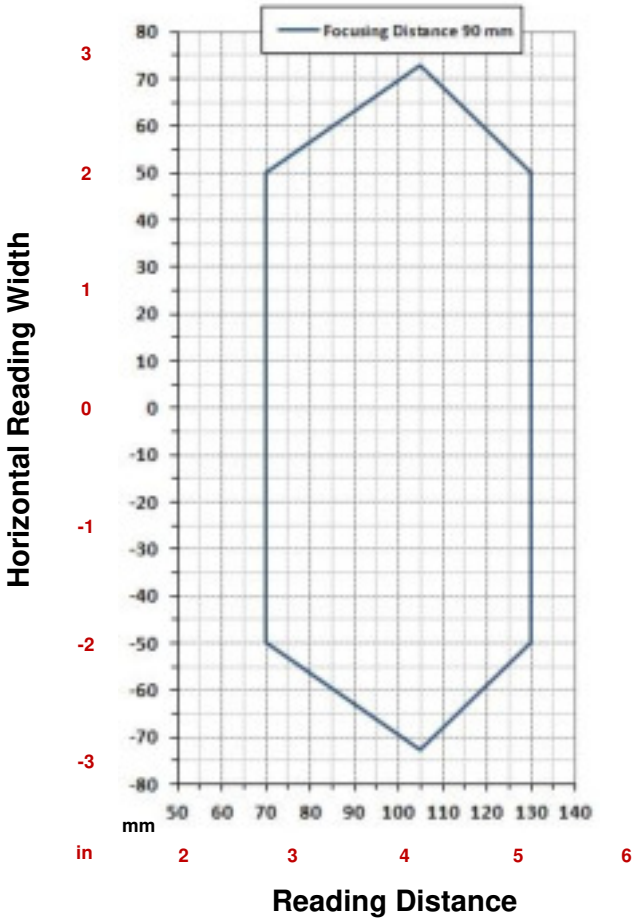
± 20 mm = 512 pixels

Region of Interest Top = 255
Region of Interest Bottom = 767

CONDITIONS:

Hardware Settings	
Code Symbology	Data Matrix ECC 200
Code Resolution	0.25 mm (10 mils)
Tilt Angle	45°
Skew Angle	10°
Focusing Distance (mm)	85
Software Parameters	
411-xxx RED Wide	
Exposure Time (µs)	170
Gain	4
Illuminator Lighting Mode	Very High Power Strobed
481-xxx MLT-DPM	
Exposure Time (µs)	170
Gain	6
Illuminator Lighting Mode	Very High Power Strobed

Data Matrix 0.38 mm (15 mils)



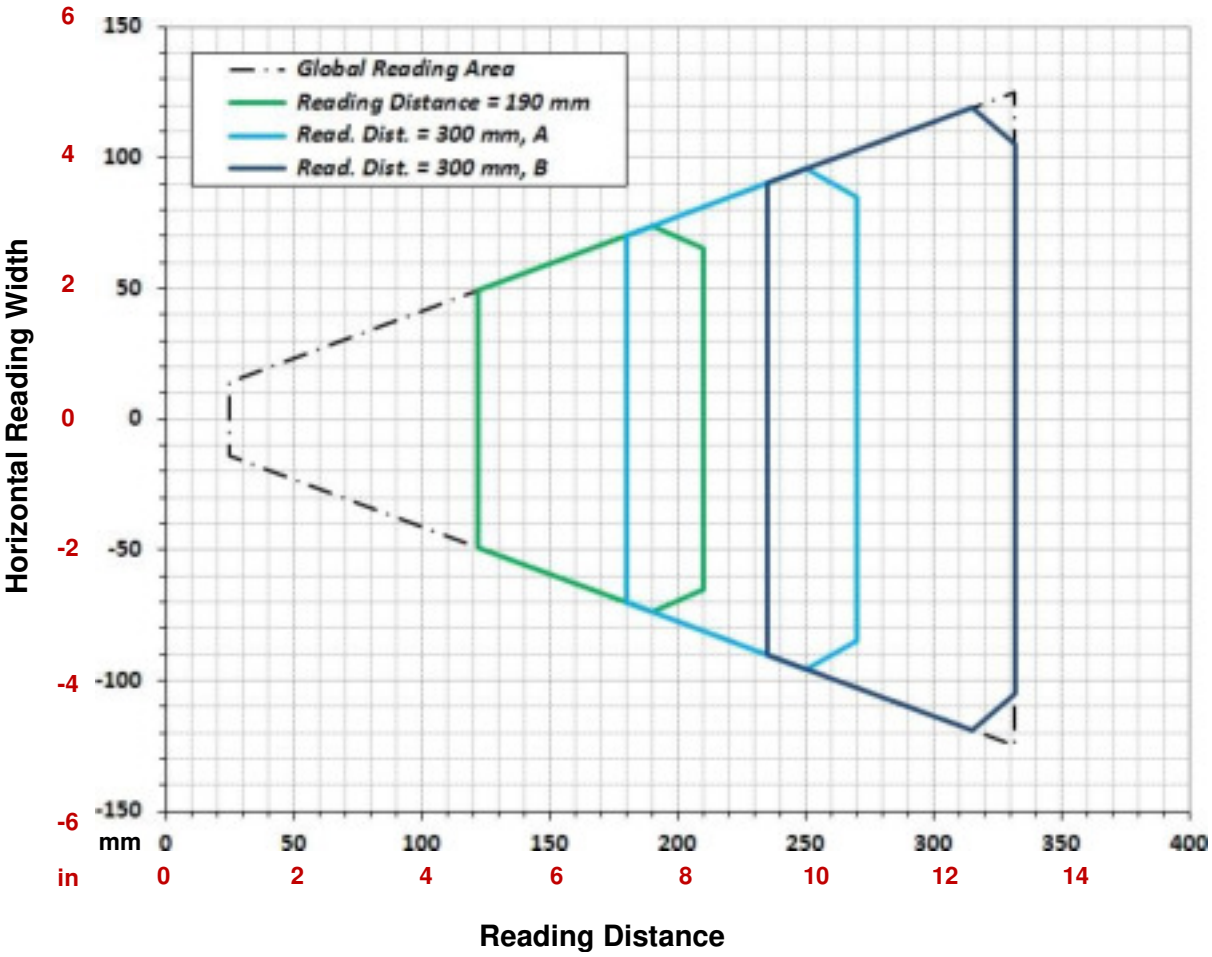
CONDITIONS:

Hardware Settings	
Code Symbology	Data Matrix ECC 200
Code Resolution	0.38 mm (15 mils)
Tilt Angle	45°
Skew Angle	10°
Focusing Distance (mm)	90
Software Parameters	
411-xxx RED Wide	
Exposure Time (µs)	80
Gain	8
Illuminator Lighting Mode	Very High Power Strobed
481-xxx MLT-DPM	
Exposure Time (µs)	80
Gain	12
Illuminator Lighting Mode	Very High Power Strobed

6.4 MATRIX 300 4X2 (9 MM MODELS)

6.4.1 1D (Linear) Codes

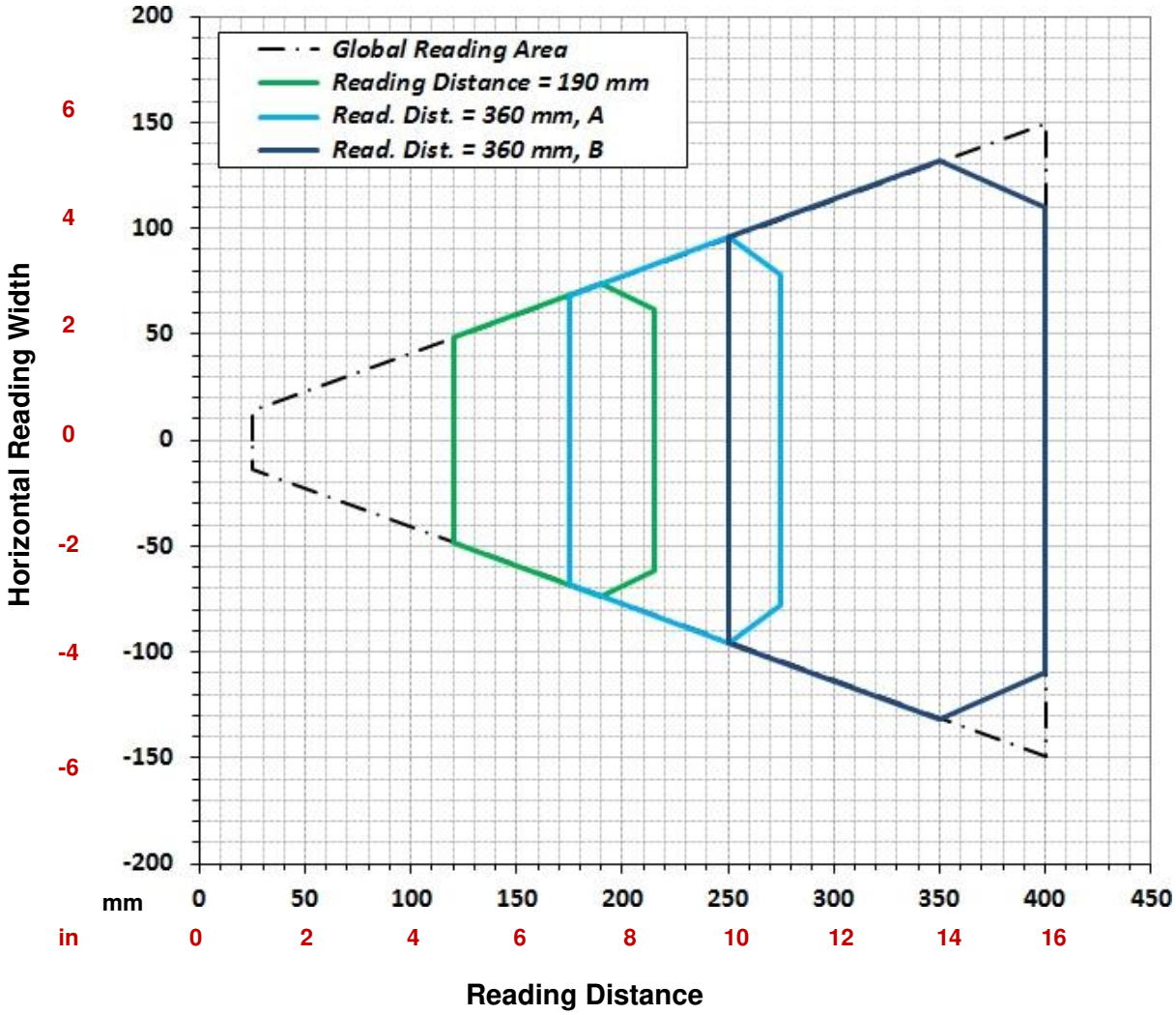
Code 128 0.25 mm (10 mils)



CONDITIONS:

Hardware Settings			
Code Symbology	Code 128		
Code Resolution	0.25 mm (10 mils)		
Tilt Angle	45°		
Skew Angle	15°		
Software Parameters			
Reading Distance (mm)	190	300	300
412-xxx RED Wide		A	B
Exposure Time (µs)	130	230	500
Gain	25	25	25
Illuminator Lighting Mode	Very High Power Strobed		

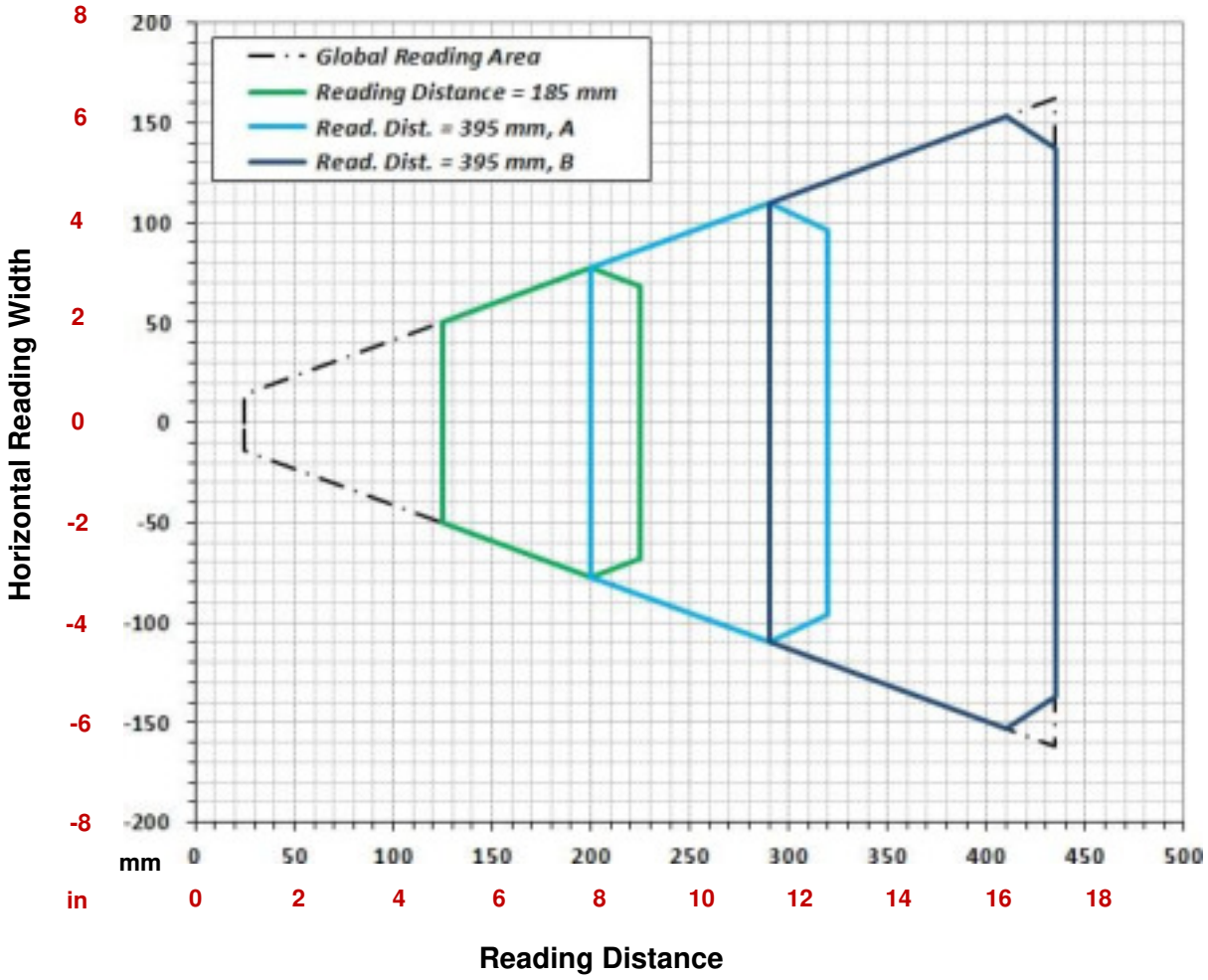
Code 128 0.30 mm (12 mils)



CONDITIONS:

Hardware Settings			
Code Symbology	Code 128		
Code Resolution	0.30 mm (12 mils)		
Tilt Angle	45°		
Skew Angle	15°		
Software Parameters			
Reading Distance (mm)	190	360	360
412-xxx RED Wide		A	B
Exposure Time (µs)	150	230	500
Gain	20	25	25
Illuminator Lighting Mode	Very High Power Strobed		

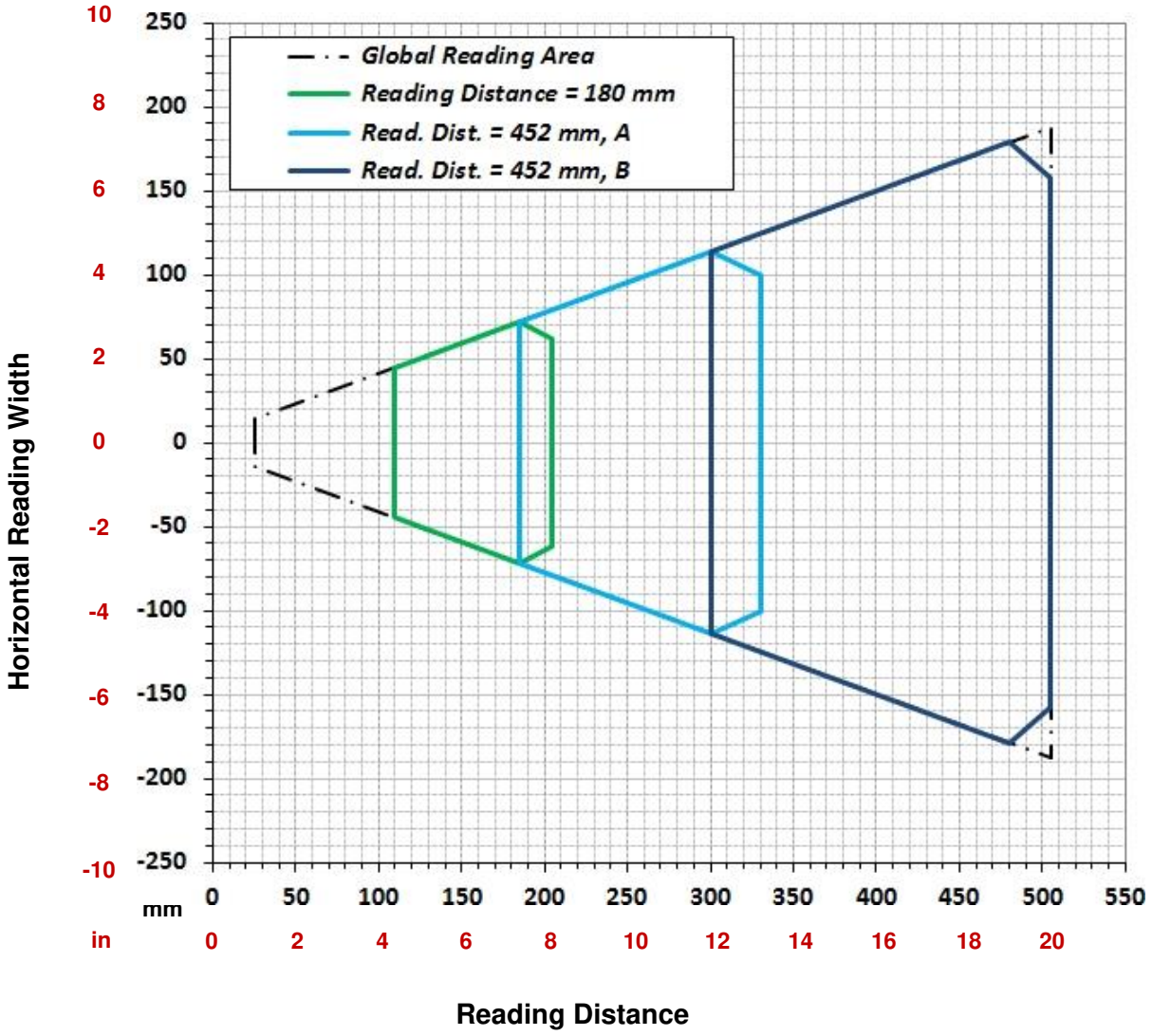
Code 128 0.33 mm (13 mils)



CONDITIONS:

Hardware Settings			
Code Symbology	Code 128		
Code Resolution	0.33 mm (13 mils)		
Tilt Angle	45°		
Skew Angle	15°		
Software Parameters			
Reading Distance (mm)	185	395	395
412-xxx RED Wide		A	B
Exposure Time (µs)	150	300	3300
Gain	25	25	15
Illuminator Lighting Mode	Very High Power Strobed		High Power Strobed

Code 128 0.38 mm (15 mils)

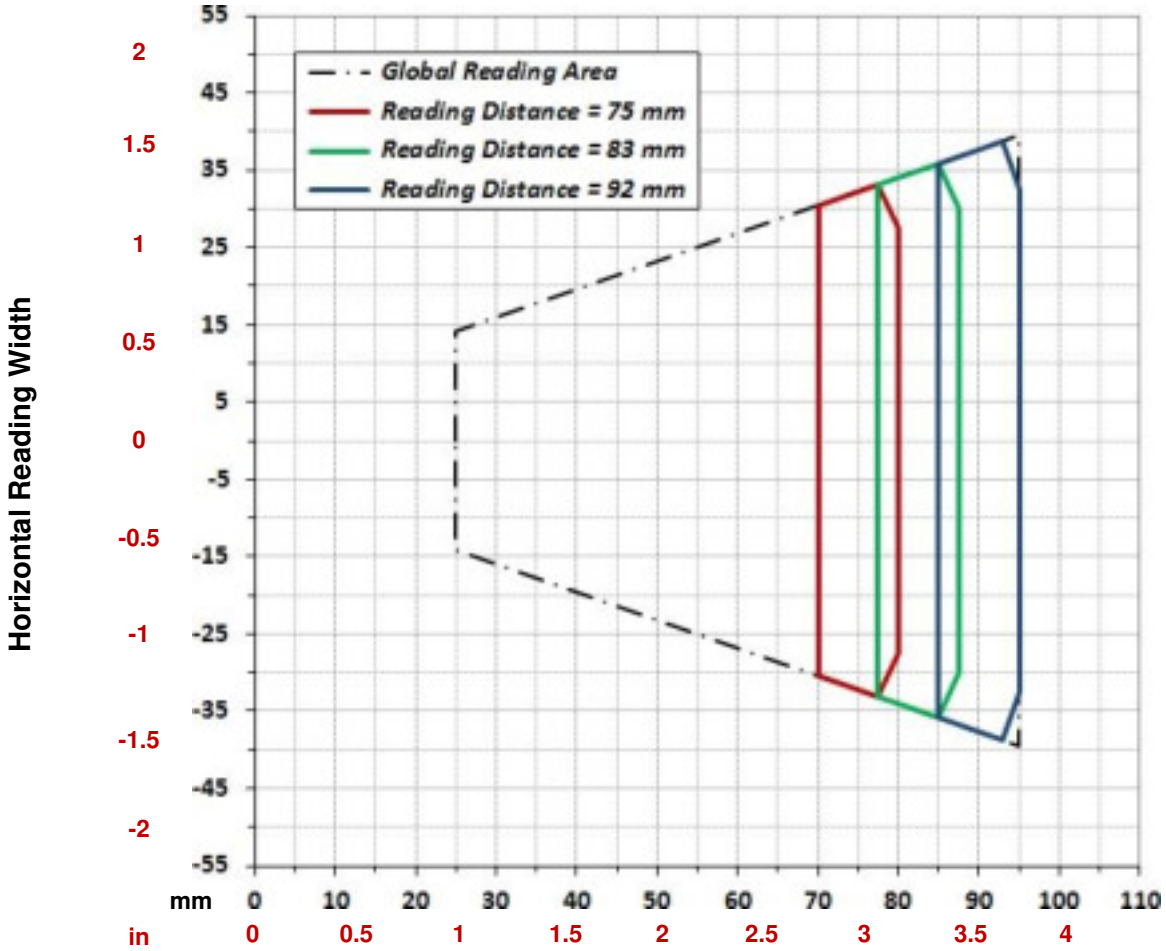


CONDITIONS:

Hardware Settings			
Code Symbology	Code 128		
Code Resolution	0.38 mm (15 mils)		
Tilt Angle	45°		
Skew Angle	15°		
Software Parameters			
Reading Distance (mm)	180	452	452
412-xxx RED Wide		A	B
Exposure Time (µs)	140	320	3300
Gain	25	25	15
Illuminator Lighting Mode	Very High Power Strobed		High Power Strobed

6.4.2 2D (Bi-dimensional) Codes

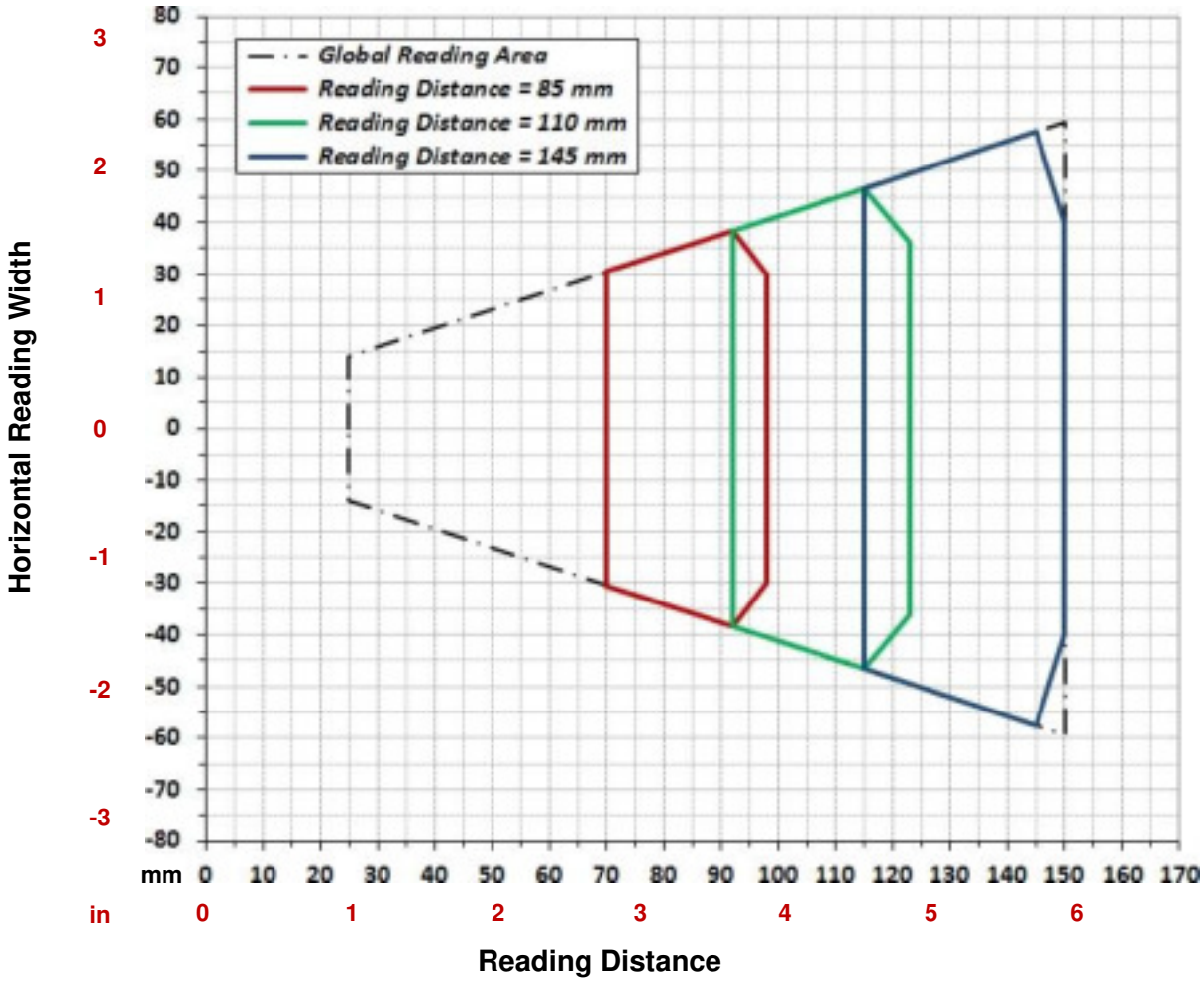
Data Matrix 0.13 mm (5 mils)



CONDITIONS:

Hardware Settings			
Code Symbology	Data Matrix ECC 200		
Code Resolution	0.13 mm (5 mils)		
Tilt Angle	45°		
Skew Angle	20°		
Software Parameters			
Reading Distance (mm)	75	83	92
412-xxx RED Wide			
Exposure Time (µs)	60	80	100
Gain	15	12	10
Illuminator Lighting Mode	Very High Power Strobed		
472-xxx LT-DPM			
Exposure Time (µs)	175	235	290
Gain	15	12	10
Illuminator Lighting Mode	Very High Power Strobed		
482-xxx MLT-DPM			
Exposure Time (µs)	90	120	150
Gain	15	12	10
Illuminator Lighting Mode	Very High Power Strobed		

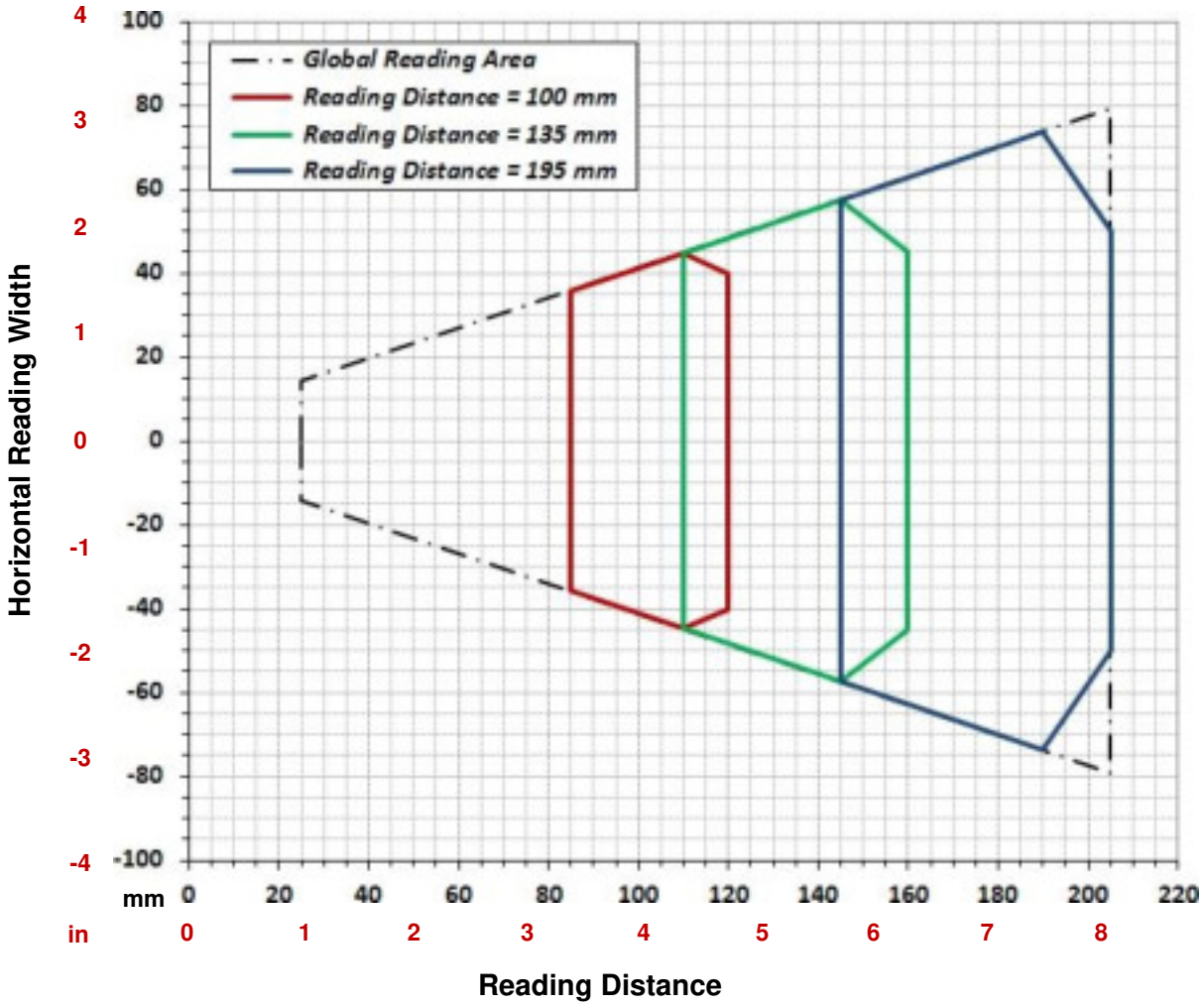
Data Matrix 0.19 mm (7.5 mils)



CONDITIONS:

Hardware Settings			
Code Symbology	Data Matrix ECC 200		
Code Resolution	0.19 mm (7.5 mils)		
Tilt Angle	45°		
Skew Angle	15°		
Software Parameters			
Reading Distance (mm)	85	110	145
412-xxx RED Wide			
Exposure Time (µs)	85	110	150
Gain	12	12	12
Illuminator Lighting Mode	Very High Power Strobed		
472-xxx LT-DPM			
Exposure Time (µs)	247	310	435
Gain	12	12	12
Illuminator Lighting Mode	Very High Power Strobed		
482-xxx MLT-DPM			
Exposure Time (µs)	128	165	225
Gain	12	12	12
Illuminator Lighting Mode	Very High Power Strobed		

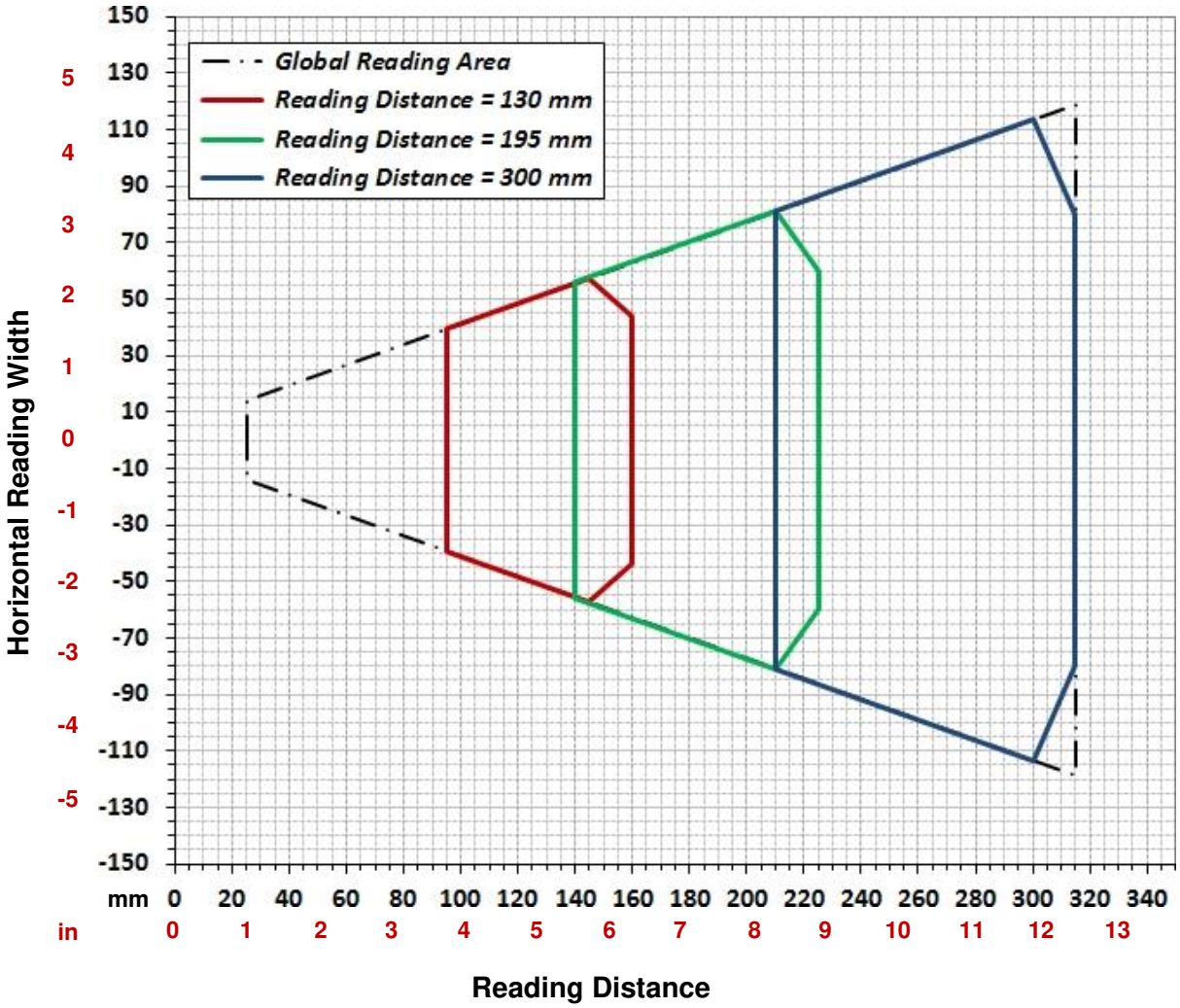
Data Matrix 0.25 mm (10 mils)



CONDITIONS:

Hardware Settings			
Code Symbology	Data Matrix ECC 200		
Code Resolution	0.25 mm (10 mils)		
Tilt Angle	45°		
Skew Angle	15°		
Software Parameters			
Reading Distance (mm)	100	135	195
412-xxx RED Wide			
Exposure Time (µs)	100	160	200
Gain	13	13	19
Illuminator Lighting Mode	Very High Power Strobed		
472-xxx LT-DPM			
Exposure Time (µs)	290	465	500
Gain	13	13	22
Illuminator Lighting Mode	Very High Power Strobed		
482-xxx MLT-DPM			
Exposure Time (µs)	150	240	300
Gain	13	13	19
Illuminator Lighting Mode	Very High Power Strobed		

Data Matrix 0.38 mm (15 mils)



CONDITIONS:

Hardware Settings			
Code Symbology	Data Matrix ECC 200		
Code Resolution	0.38 mm (15 mils)		
Tilt Angle	45°		
Skew Angle	15°		
Software Parameters			
Reading Distance (mm)	130	195	300
412-xxx RED Wide			
Exposure Time (µs)	250	250	380
Gain	8	17	22
Illuminator Lighting Mode	Very High Power Strobed		

6.5 MAXIMUM LINE SPEED AND EXPOSURE TIME CALCULATIONS

The ***Exposure Time*** (or **Shutter**) parameter defines the time during which the image will be exposed to the reader sensor to be acquired. This parameter depends heavily on the environmental conditions (external lighting system, image contrast etc.).

In general, a longer time corresponds to a lighter image but is susceptible to blurring due to the code movement; a shorter exposure time corresponds to a darker image.

NOTE: The following considerations must be applied only when the internal lighting system and **2D codes** are used. The Maximum line speed allowed for linear codes or postal code reading applications heavily depends on the direction of symbol movement. When the direction of movement is parallel to the elements of the code, the maximum speed is greater.

Assuming:

- **X**: Code Resolution (mm)
- $\mathbf{T_{exp}}$: Exposure Time (s)
- **LS**: Line Speed (mm/s)

The essential condition to avoid blurring effects between two adjacent elements in a dynamic reading application is:

$$\mathbf{LS * T_{exp} \leq X}$$

The maximum (theoretical) line speed **LS** can be calculated as follows:

$$\mathbf{X / T_{exp\ (max)} = LS_{\ (max)}}$$

Example:

A Matrix 300™ using:

Internal Lighting Mode = Very High Power Strobe
Exposure Time (x1 μs) = 100 (100 μs)
Code Resolution (X) = 0.254 mm (10 mils)

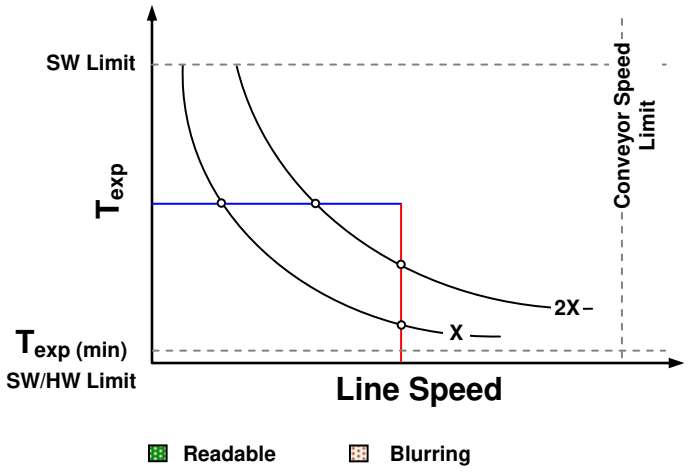
has a maximum line speed of:

0.254 (mm) / 0.0001 (s) = 2540 mm/s

Likewise, $\mathbf{T_{exp\ (max)}}$ is the maximum ***Exposure Time*** value that can be used without blurring for the given application line speed and code resolution. Therefore:

$$\mathbf{X / LS_{\ (max)} = T_{exp\ (max)}}$$

$T_{exp\ (max)}$ and $LS_{(max)}$ are represented in the graph below as the curved line for **X** (code resolution). Values above the curve result in blurring. In practice, the application values are somewhere below the theoretical line, (in the green area), due to environmental and other conditions.



For example, the maximum target speed in the application is also affected by these conditions:

- **Code/Background Contrast**: maximum speed decreases when decreasing image contrast (poor quality codes, reflective transparent coverings, different supports and printing techniques).
- **Code Resolution**: maximum speed increases when decreasing code resolution, (i.e. **2X)**. There is a decrement of overlapping effects between two adjacent elements.
- **Tilt Angle**: maximum speed decreases when increasing Tilt angle (from 0 to 45 degrees).

$T_{exp\ (min)}$ is the minimum ***Exposure Time*** value obtainable for the specific application. It can be evaluated in static reading conditions and depends on the Matrix reader hardware selected for the application (internal lighting system, optical lens, reading distance) and on any external lighting system. It may also depend on code printing quality, and reader position.

The ***Internal Lighting Mode*** parameter allows setting the operating mode of the internal lighting system. The possible values are:

- *Disabled*: the built-in LED array is turned off all the time. This option can be useful if using an external lighting system;
- *Always ON*: the built-in LED array is turned on all the time at the lowest power level. This option is useful if the LED-array blinking (Strobed operating mode) disturbs the operator.
- *Very High/High-Power Strobed*: the built-in LED array is on only during the image exposure time. Two different lighting levels can be set.

NOTE: To avoid LED array overheating, for Power Strobed settings, the program automatically limits the range of allowed values for the **Exposure Time** parameter. Therefore, after changes to Internal Lighting Mode, recheck **Exposure Time**.

7 SOFTWARE CONFIGURATION

Software configuration of your Matrix 300™ for static reading or simple code reading applications can be accomplished by the Rapid Configuration procedure using the X-PRESS™ HMI (which requires no external configuration program) or by using the VisiSet™ Setup Wizard for easy setup. These procedures are described in chapter 1.

For other applications use VisiSet™, connecting to the reader through one of the serial ports.

NOTE: For Ethernet applications, connections to VisiSet™ can be made directly through the Ethernet port of the reader, or QL500 or BM2x0 Host Interface module. See the "Configuration Through Ethernet" page in the VisiSet™ Help On-Line, or the "Matrix Family Setup Procedure Using Programming Barcodes" document on the Mini-DVD.

7.1 VISISET™ SYSTEM REQUIREMENTS

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

- Pentium processor
- Windows: 98/2000, NT 4.0, XP, Vista, 7 or 8
- 32 MB Ram
- 5 MB free HD space
- one free RS232 serial port with 115 Kbaud (or USB-Serial adapter)
- one Ethernet TCP/IP port
- Video Adapter (1024 x 768) or better using more than 256 colors

7.2 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 300™ communication ports).
2. After Windows finishes booting, insert the Mini-DVD provided.
3. Launch VisiSet™ installation by clicking Install.
4. Follow the instructions in the installation procedure.

7.3 STARTUP

After completing the mechanical and electrical connections to Matrix 300™, you can begin software configuration as follows:

1. Power on the Matrix 300™ 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 300™ reader.

   Upon connection, Matrix 300™ 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 75.

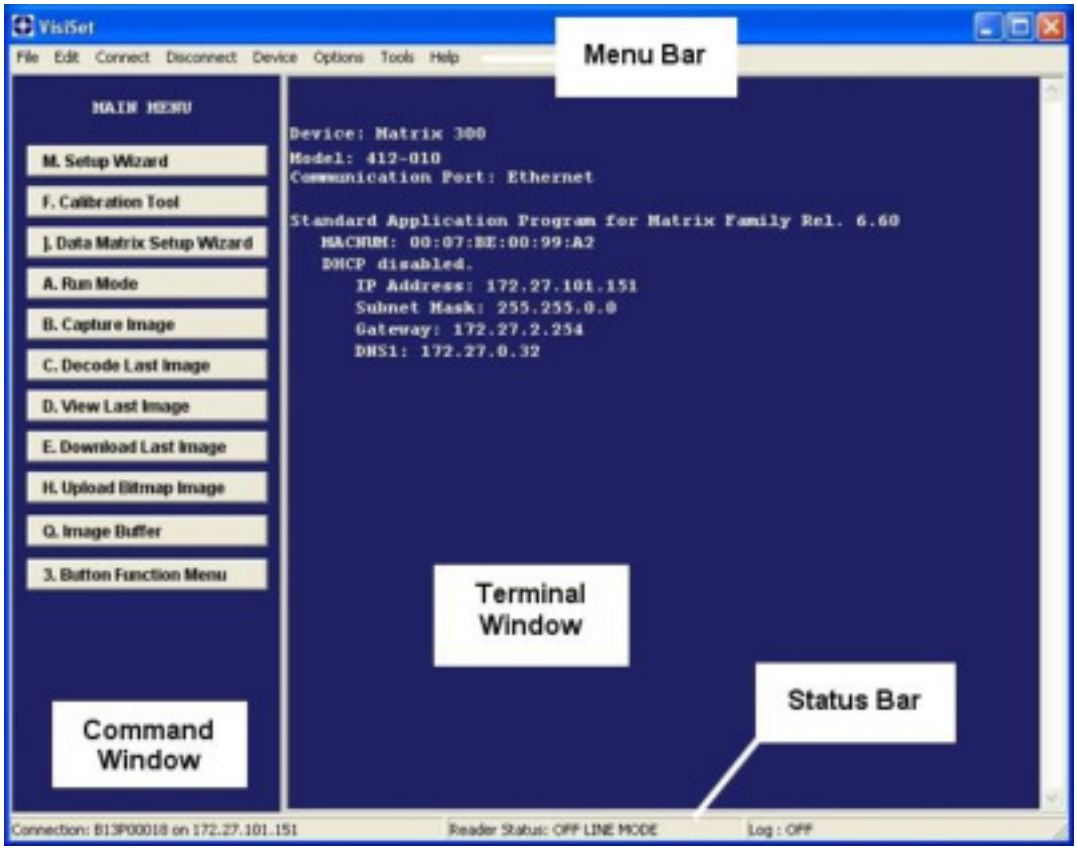


Figure 75 - Main Window

7.3.1 VisiSet™ Options

The **Options** item from the VisiSet™ menu (see Figure 75) presents a window allowing you to configure:

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

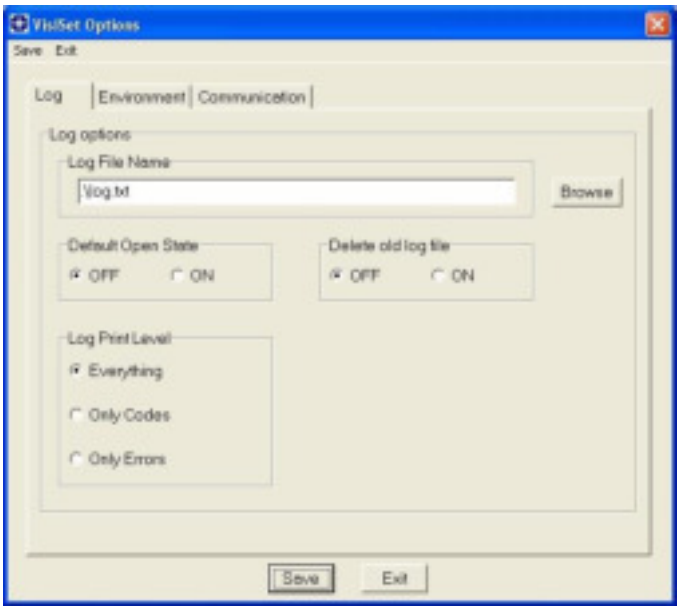


Figure 76 - Options - Log

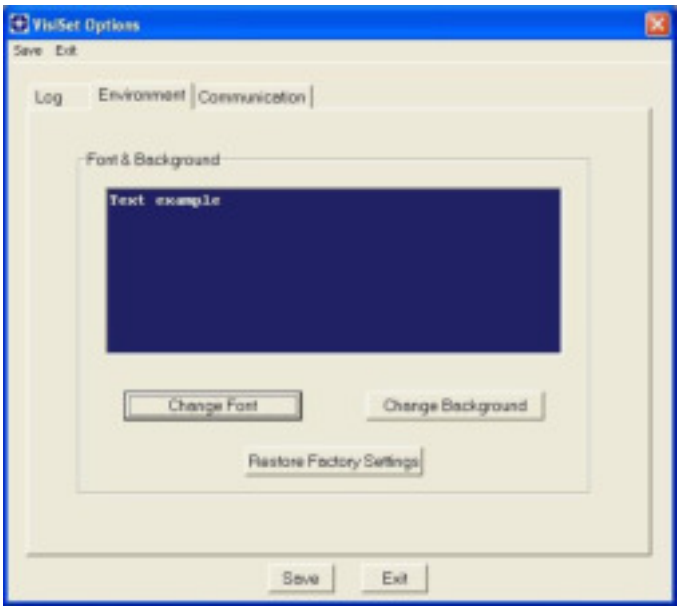


Figure 77 - Options - Environment

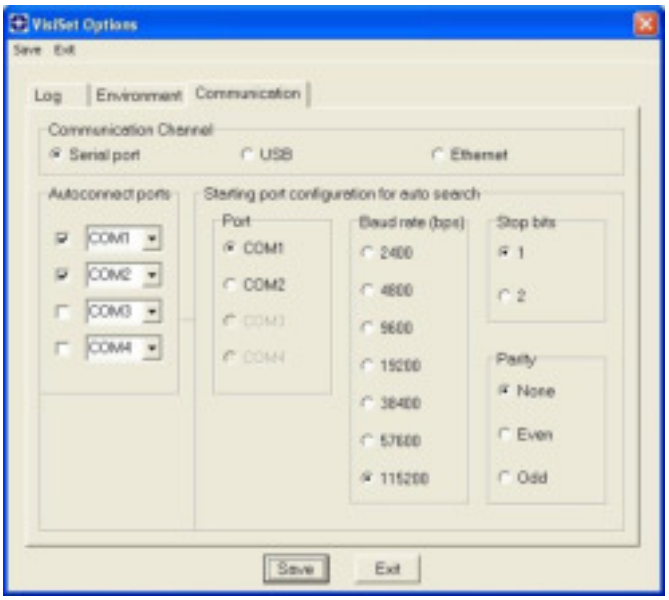


Figure 78 - Options – Communication: Serial Port

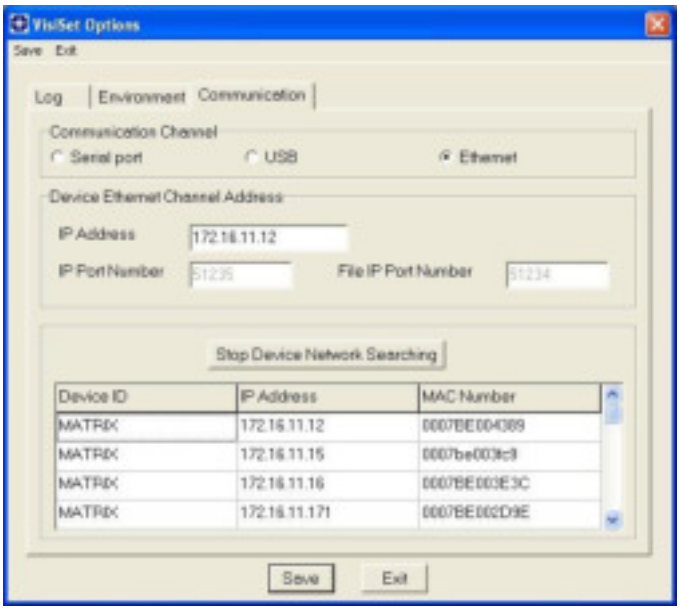


Figure 79 - Options – Communication: Ethernet

7.4 ETHERNET CONFIGURATION (STATIC IP ADDRESSING)

If you want to connect to VisiSet™ using Ethernet then follow the procedure below.

In order to find the reader using the VisiSet™ Look For Devices On Network tool, the reader and VisiSet™ must be on the same network (not through a sub-network or router).

The Factory Default static IP address parameter settings for all Matrix Family readers are:

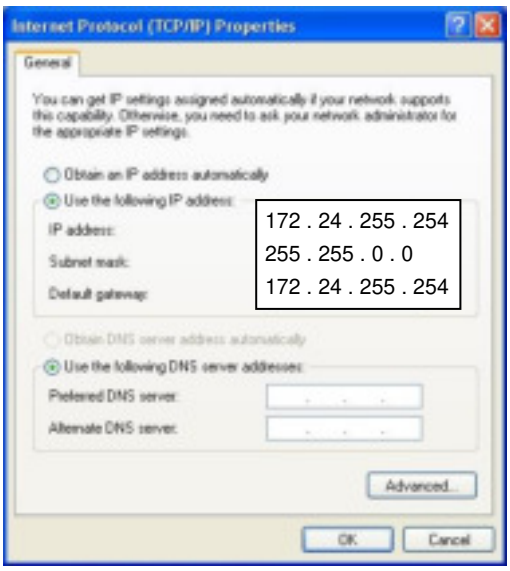
- IP Address = 172.24.24.1
- Subnet Mask = 255.255.0.0
- Gateway Address = 172.24.255.254

1. Before changing the Ethernet network settings on the PC running VisiSet™, close any open applications which use network resources (i.e. Outlook, or Web browser).

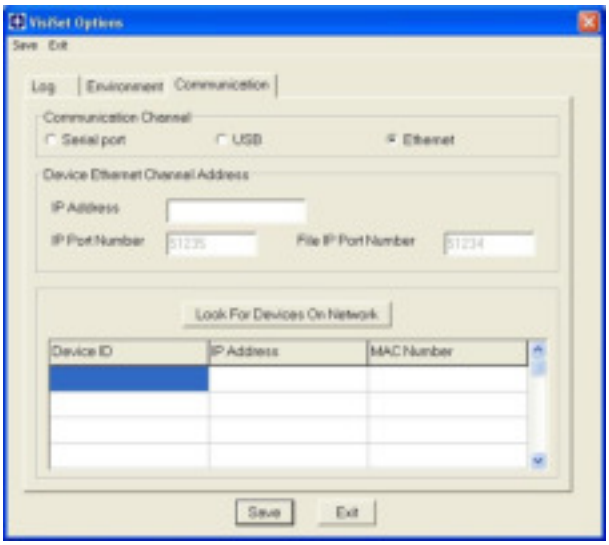
2. On the Configuration PC, from the Control Panel> Network Connections, right-click on the LAN connection icon and open the properties window.

3. Select the Internet Protocol (TCP/IP) item and open the properties window.

4. Set the IP Address fields as shown in the figure and click OK to save.



5. In VisiSet select the Ethernet Communication Channel in the Options> Communication window. Then press the **Look For Devices On Network** button. The Matrix reader will appear with its default IP Address in the list.



6. Input the IP address from the list in the **IP Address** field of the Device Ethernet Channel Address section of the VisiSet™ Options> Communication window (or double-click on the device in the list). The IP port number is 51235. Then click **Save**.

7. Perform a Connect (to device) from VisiSet™.

7.5 CONFIGURATION

Once connected to Matrix 300™ as described in par. 7.3 or 7.4, you can modify the configuration parameters as follows:

1. Press the Calibration Tool button from the Main Menu. Matrix 300™ will download its permanent memory configuration parameters with the default values (if it is the first time) to VisiSet™. The Calibration Tool window will be displayed together with the Parameter Setup window working in Interactive Mode (see par. 7.5.1 and par. 7.5.3).

2. Edit the Matrix 300™ configuration parameters according to your application requirements.

3. Use the **Calibration Tool** to fine tune the reading performance. See par. 7.5.3.

4. Close the Calibration Tool window and disable the Interactive Mode by pressing the interactive button.

5. Save the new configuration to the reader permanent memory by pressing the Send button.

NOTE: Especially for lengthy configurations in Interactive Mode, it is always good practice to periodically send the configuration to **Permanent Memory** to avoid losing the configuration in Temporary Memory.

6. Close the Parameter Setup window and press **Disconnect** on the VisiSet™ menu bar (see Figure 75) or launch **Run** Mode from the VisiSet™ Main menu.

Disconnect exits closing communication between Matrix 300™ and VisiSet™, and causes Matrix 300™ to enter Run Mode. The disconnected reader serial port is now available.

Run command does not close communication between Matrix 300™ and VisiSet™, and causes Matrix 300™ to enter Run Mode. In this case the reader output messages are displayed on the VisiSet™ terminal and the statistics are displayed in the Statistics window (Statistics enabled).

7.5.1 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.

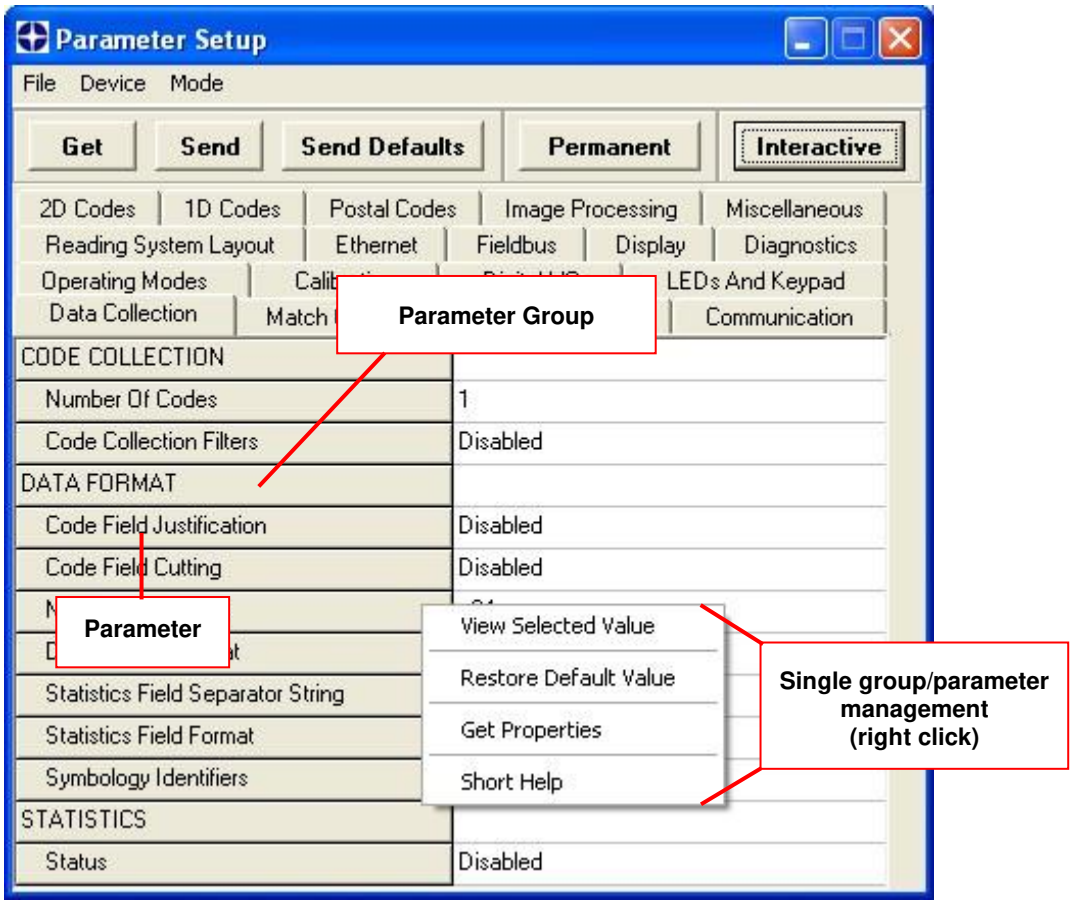


Figure 80 - Editing Parameters

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 (see par. 7.5.3).
❑ 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™.
❑ Reading System Layout	Allows configuring the device according to the desired layout: Standalone or ID-NET™
❑ WebSentinel	Enables the Ethernet WebSentinel Agent for communication with the Datalogic WebSentinel™ plant array monitor.
❑ Ethernet	Sets the parameters related to the on board Ethernet interface and to its communication channels. Supports application protocols: TCP/IP, EtherNet/IP, Profinet IO and Modbus TCP
❑ CBX Gateway	Sets the parameters related to the External Host Interface Module through the CBX500 and to its communication channels.
❑ 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, Setup, Positioning, etc.
❑ Display	Sets the Display language and Layout of the BM150 Display when using the CBX500 connection box.
❑ Diagnostics	Enables various diagnostic messages, formatting and actions.

When all the configuration parameters are set correctly, save them to the Matrix 300™ reader by pressing the Send button. See Figure 80.

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.

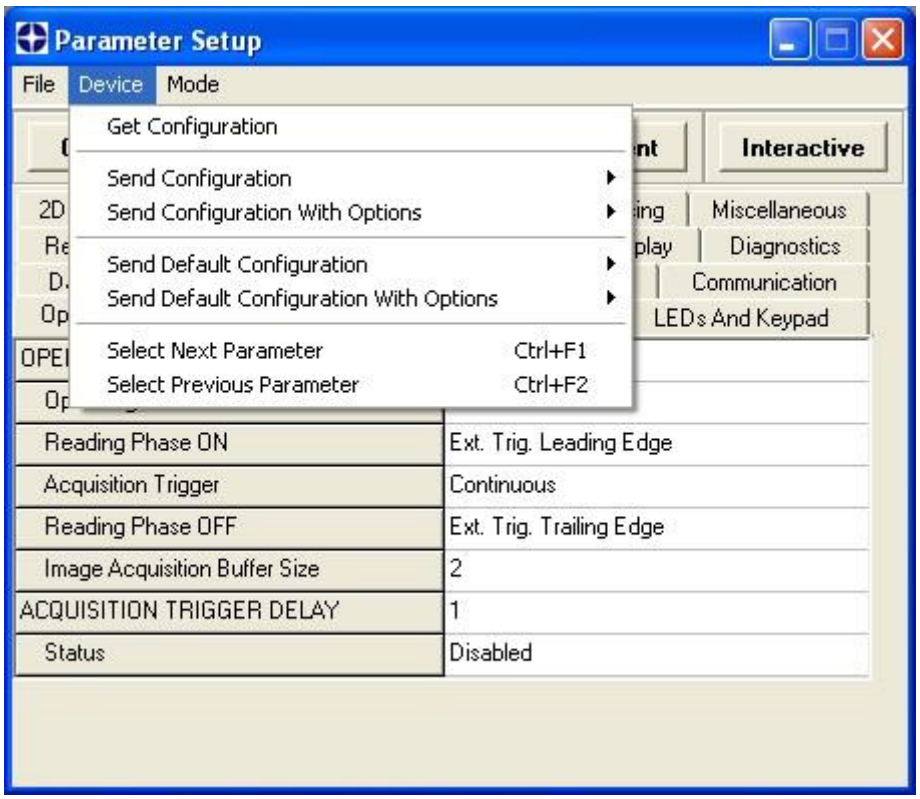
From the **File** menu, you can also **Save Configuration As Text File** for a human readable version.

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

7.5.2 Send Configuration Options

The device parameters are divided into two main classes, Configuration and Environmental which are affected 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:



Environmental Parameters regard the device Identity and Position in a Network (ID-NET™, Ethernet, Fieldbus) 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.

The following is a list of the Environmental Parameters:

READING SYSTEM LAYOUT
- Device Network Setting
- Number of Slaves

DEVICE NETWORK SETTINGS
- Topology Role
- ID-NET Slave Address
- Network Baud Rate
- Acquisition Trigger String (available only in Multidata configuration)
- Reading Phase ON String (available only in Multidata configuration)
- Reading Phase OFF String (available only in Multidata configuration)
- Header String (available only in Slave Multidata configuration)
- Terminator String (available only in Slave Multidata configuration)
- Link Failure String (available only in Master Synchronized configuration)
- Link Failure Timeout (ms) (available only in Master Synchronized configuration)

EXPECTED SLAVE DEVICES
- Status
- Device Description
- Device Network Name

MAIN PORT
- Communication Protocol

ETHERNET SYSTEM (on board)
- Status
- DHCP Client
- IP Address
- Subnet Mask
- Gateway Address
- DNS1 Address

HOST INTERFACE
- Host Interface Type

CBX ETHERNET SYSTEM (CBX with Host Interface Modules)
- Status
- DHCP Client
- IP Address
- Subnet Mask
- Gateway Address

PROFIBUS
- Node Address

DEVICENET
- Node Address

ETHERNET-IP
- IP Addressing Mode
- IP Address
- Subnet Mask
- Gateway Address

PROFINET IO
- IP Addressing Mode
- IP Address
- Subnet Mask
- Gateway Address

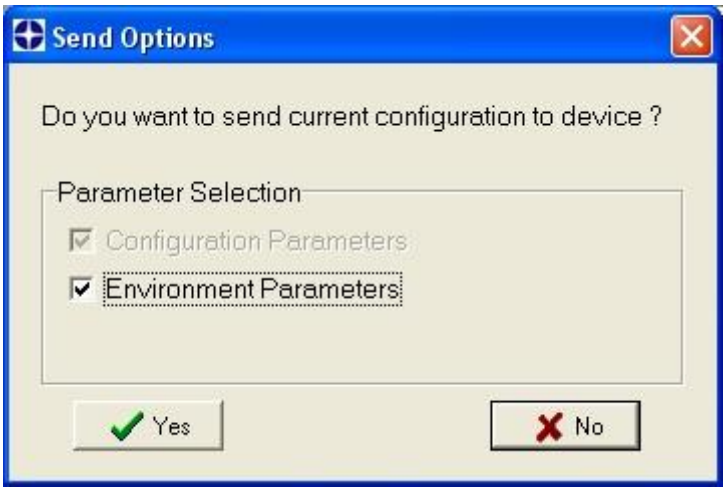
CANOPEN
- Node Address

CC-LINK
- Node Address

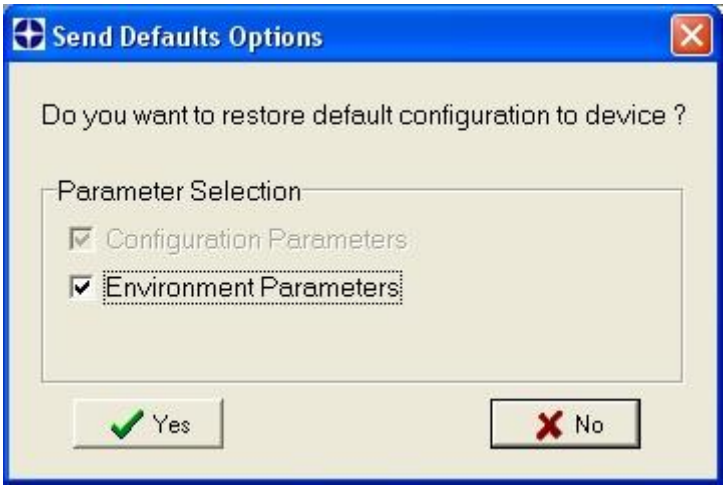
MODBUS TCP
- IP Addressing Mode
- IP Address
- Subnet Mask
- Gateway Address

MISCELLANEOUS
- Reader Name
- User Name
- Line Name

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:



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:



7.5.3 Calibration

VisiSet™ provides a Calibration Tool to maximize the reading performance by tuning the acquisition parameters and the time of the delayed triggers.

By selecting the Calibration Tool from the VisiSet™ Main Menu (***F***), the following window appears together with the Parameter Setup window:

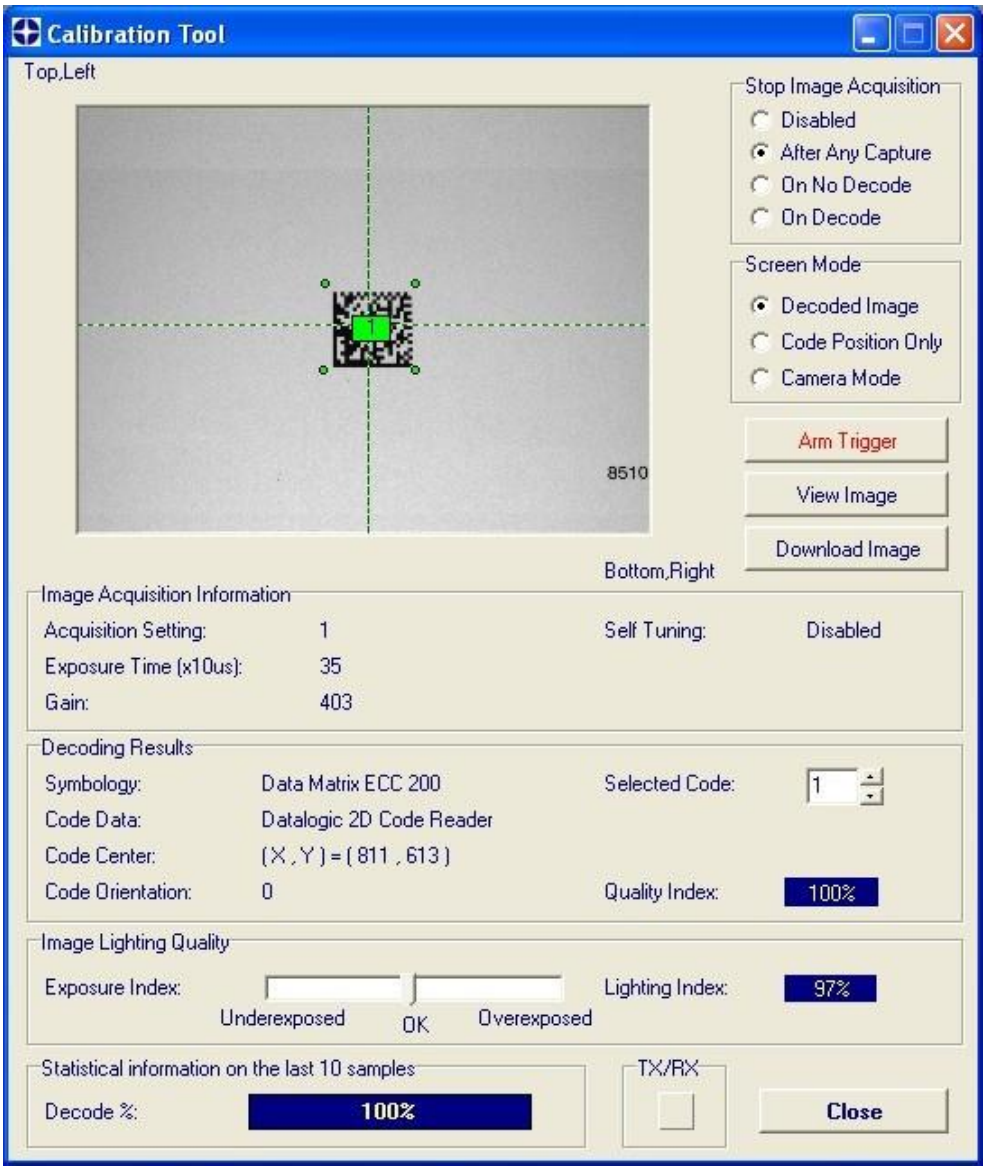


Figure 81 - Calibration OK

This tool provides a "real-time" image display while Matrix 300™ is reading. It also gives immediate results on the performance of the installed Matrix 300™ reader.

If Self Tuning is enabled, the Calibration Tool window indicates the region where the calibration algorithm is performed: it is within the central box delimited by four red dots.

NOTE: If using Region Of Interest windowing, some or all of the four red dots delimiting the calibration algorithm area may be located outside the VisiSet™ display area (not visible).

The Parameter Setup window works in Interactive Mode in order to cause each parameter setting to be immediately effective.

NOTE: If you want to save the temporary configuration to permanent memory, you must first close the Calibration Tool window. Then, you must disable the Interactive Mode and select the **Permanent Memory** option from the **Send Configuration** item in the Device menu.

The following examples show some of the typical conditions occurring during the installation:

Under-exposure:

To correct this result it is recommended to change the following parameters in their order of appearance:

1. increase the **Exposure Time**
2. increase the **Gain**

NOTE: In general, a longer exposure time corresponds to a lighter image but is susceptible to blurring due to code movement. Exposure time is also limited by the Internal Lighting mode parameter. **Longer exposure times can be set if the power strobe level is lowered.**

High gain settings may produce a grainy image that may affect the decoding process.

Figure 82 - Example Under Exposure: Too Dark

Over-exposure:

To correct this result it is recommended to change the following parameters in their order of appearance:

1. decrease the **Gain**
2. decrease the **Exposure Time**

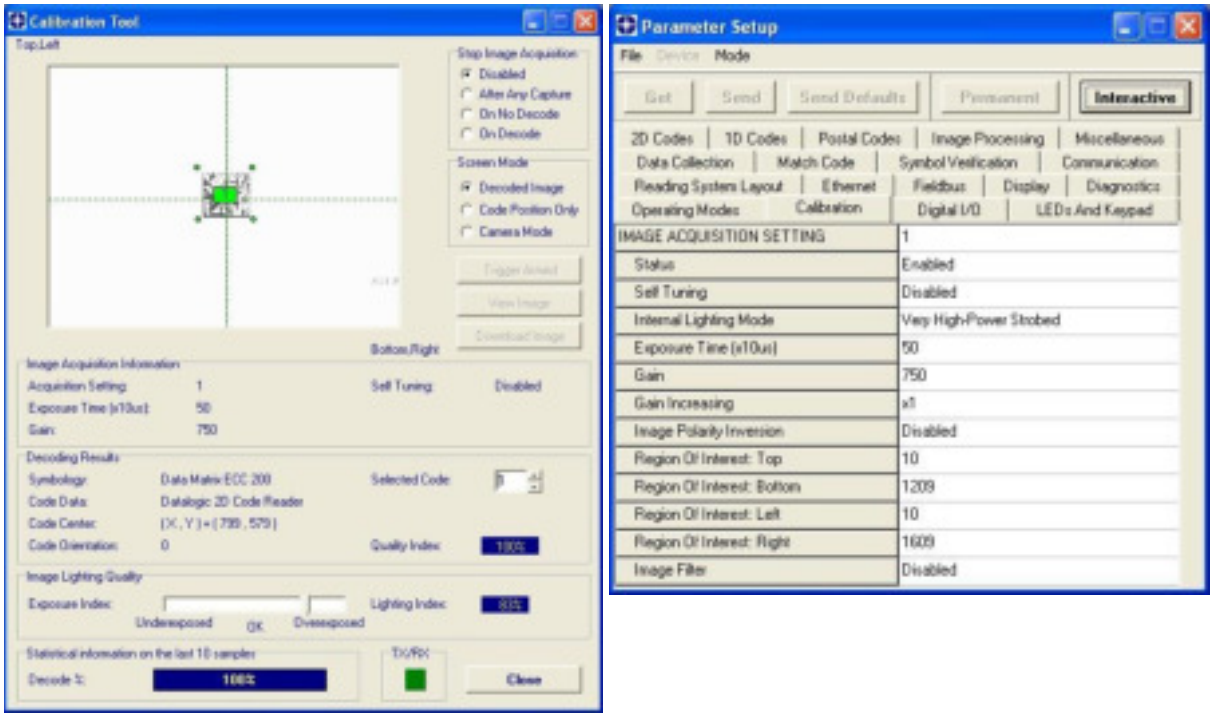


Figure 83 - Example Over Exposure: Too Light

Moving code out of the Field of View:

To correct this result and have the code completely visible in F.O.V., it is possible to follow one or both the procedures listed below:

- reposition the reader
- use the **Acquisition Trigger Delay** by tuning the **Delay Time (x100µs)**

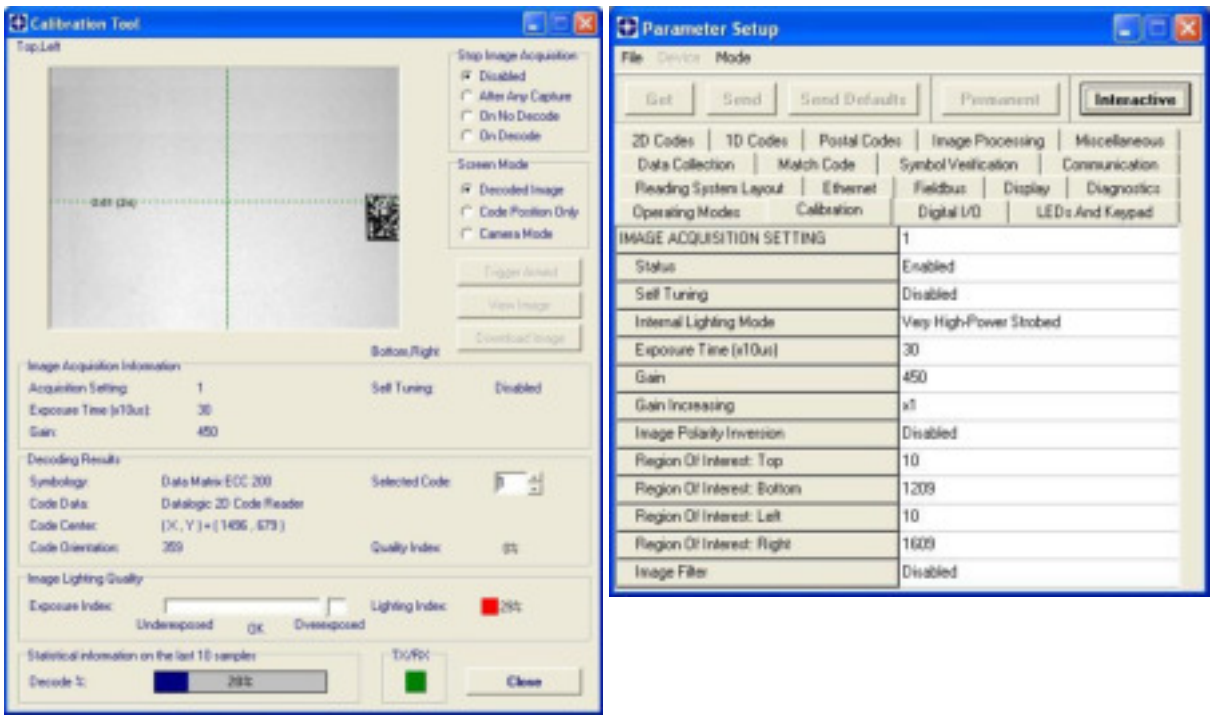


Figure 84 - Example out of FOV

7.5.4 Multi Image Acquisition Settings

When controlled variable conditions occur in the application, Multiple ***Image Acquisition Settings*** (up to 10), can be defined to create a database of parameter groups that handle each specific application condition. This database of pre-defined settings functions cyclically and therefore automatically improves system flexibility and readiness.

For example, an application may have two stable but different lighting conditions which require different lighting options. One Image Acquisition Setting could enable and use the internal illuminator and a second setting could enable and use an external lighting system. These two groups will be used cyclically on each acquisition in order to automatically capture the correctly lighted image.

One of the most useful cases for Multiple Image Acquisition Settings is to extend the reader's depth of field (DOF). Some applications may require reading at more than one discrete reading distance or an extended range of reading distances. See the methods described in par. 7.5.5 and 7.5.6.

Image Acquisition Settings are found in the VisiSet™ **Calibration** parameter setup menu. By selecting a different number and enabling its ***Status*** you can define the parameters for a new group.

7.5.5 Extending DOF Using Standard Acquisition Group (Cycle All In Same Phase)

Multiple Image Acquisition Settings assigned to the same Acquisition Group (*Standard*), can be configured and enabled to extend the reader's depth of field. During each reading phase, decoding will be attempted by applying each enabled Image Acquisition Setting (cyclically).

Example:

Read a 15 mil Data Matrix ECC 200 code covering a range from 140 to 320 mm (see 15 mil reading diagram). The reading distance range is too long to be covered by a single acquisition setting, so two acquisition settings could be used in which the first has a *Reading Distance of 195 mm* and the second has a *Reading Distance of 300 mm*. When both are enabled, the reader cycles through the two settings effectively producing the extended DOF.

NOTE: Cycling through Image Acquisition Settings that require changing the Reading Distance parameter (for liquid lens models), drastically reduces the frame rate due to the liquid lens refocusing delay as well as by the number of settings simultaneously enabled. Therefore this may not be the best solution for high speed applications. For high speed applications it is best to use the Alternative Acquisition Groups (Input Select) feature described in par. 7.5.6. Otherwise use multiple readers set to different reading distances.

Since many factors and parameters contribute to maximizing the reading process, it is suggested to use the VisiSet™ Standard Setup Wizard to set the different acquisitions settings.

NOTE: By default the **Alternative Acquisition Group Select** parameter is disabled.

Multi Image Acquisition Settings Procedure using Standard Setup Wizard:

1. Using the Standard Setup Wizard set the first acquisition setting (default) for the 195 mm Reading Distance. Save the setting **to Permanent Memory**.

2. Through the Calibration Tool (Interactive Mode):
   a. Set Calibration>Image Acquisition Setting 1 - Status to **Disabled**
   b. Set Calibration>Image Acquisition Setting 2 - Status to **Enabled**
   c. Set LEDs And Keypad>Autolearning Setup>Image Acquisition Setting to **2**
   d. Close the Calibration Tool

3. Using the Standard Setup Wizard set the second acquisition setting for the 300 mm Reading Distance. Save the setting **to Permanent Memory**.

4. Through the Calibration Tool (Interactive Mode):
   a. Set Calibration>Image Acquisition Setting 1 and 2 - Status to Enabled
   b. Verify that the reader decodes at both distances then Close the Calibration Tool
   c. Send Configuration to Permanent Memory

7.5.6 Extending DOF Using Alternative Acquisition Group (Input Select)

NOTE: Do not use Interactive mode in VisiSet™ to set this feature.

Multiple Image Acquisition Settings assigned to different Acquisition Groups (*Standard* and *Alternative*) can be configured and enabled to extend the reader's depth of field. The specific Acquisition Group (*Standard* or *Alternative*) is selected prior to the reading phase so that only the correct group setting will be applied to the entire reading phase.

When only two Image Acquisition Settings are used to extend DOF, (one in each group), this effectively allows switching DOF while keeping the lens refocusing delay outside the reading phase.

This feature is recommended for high speed applications.

NOTE: Within each group, if more than one Image Acquisition Setting is enabled they will be cycled as in the case where **Alternative Group Select** is disabled.

Example:

Read a 15 mil Data Matrix ECC 200 code covering a range from 140 to 320 mm (see 15 mil reading diagram) at an application speed of 1 m/s. The reading distance range is too long to be covered by a single acquisition setting, so two acquisition settings could be used in which the first has a *Reading Distance of 195 mm* and is assigned to the **Alternative Acquisition Group**, and the second has a *Reading Distance of 300 mm* and is assigned to the **Standard Acquisition Group**.

By assigning the **Alternative Group Select** parameter to a proximity sensor (i.e. S3Z) mounted at least 150 ms before the **Acquisition Trigger** and connected to an input (i.e. Input 2), the correct DOF can be selected by enabling the correct group.

As an example, for a conveyor speed of 1 meter/second the **Alternative Group Select** trigger must be placed at least 150 mm before the reading phase start (Ext. Trigger).

The proximity sensor must be calibrated to trigger on packs in the near zone (140-215 mm) and therefore selects the **Alternative Group** with the Image Acquistion setting relative to the 195 mm Reading Distance. Packs farther away do not trigger the proximity sensor and so the **Standard Group** is selected with the Image Acquistion setting relative to the 300 mm Reading Distance.

The settings overlap in the range 210-220 mm and can be read by either one.

In this way the effective reading DOF covers the 140 -320 mm distance.

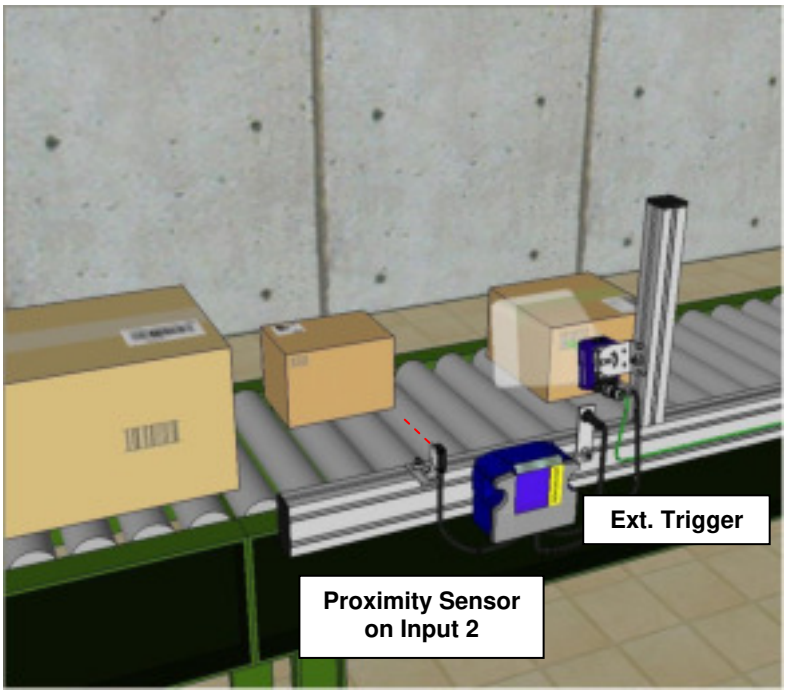


Figure 85 - Example Extending DOF Using Alternative Acquisition Group

Since many factors and parameters contribute to maximizing the reading process, it is suggested to use the VisiSet™ Standard Setup Wizard to set the different acquisitions settings.

Multi Image Acquisition Settings Procedure using Standard Setup Wizard:

1. Using the Standard Setup Wizard set the first acquisition setting (default) for the 195 mm Reading Distance. Save the setting **to Permanent Memory**.

2. Through the Calibration Tool (Interactive Mode):
   a. Set Calibration>Image Acquisition Setting 1 - Status to **Disabled**
   b. Set Calibration>Image Acquisition Setting 2 - Status to **Enabled**
   c. Set LEDs And Keypad>Autolearning Setup>Image Acquisition Setting to **2**
   d. Close the Calibration Tool

3. Using the Standard Setup Wizard set the second acquisition setting for the 300 mm Reading Distance. Save the setting **to Permanent Memory**.

4. Get the Configuration from the Device Memory (**do not use Interactive mode**):
   a. Set Operating Mode>Alternative Acquisition Group Select to **Input 2 Leading Edge**
   b. Set Calibration>Image Acquisition Setting 1 > Status to **Enabled**
   c. Set Calibration>Image Acquisition Setting 1 > Acquisition Group to **Alternative**
   d. Set Calibration>Image Acquisition Setting 2 > Status to **Enabled**
   e. Set Calibration>Image Acquisition Setting 2 > Acquisition Group to **Standard**
   f. Send Configuration to Permanent Memory

5. Verify that the reader decodes at both distances with the Calibration Tool.

7.5.7 Run Time Self Tuning (RTST)

Run Time Self-Tuning (RTST) increases Matrix's flexibility in the presence of uncontrolled variable conditions (lighting, code contrast, etc.) by automatically adjusting its acquisition parameters.

Self Tuning Calibration

In the **Calibration** parameter setup menu, the ***Self Tuning*** parameters manage the Image Acquisition Setting parameters dynamically. Self Tuning provides automatic adjustment in run time of different acquisition parameters (*Exposure Time* and/or *Gain*) for each captured image based on calculations performed on previous acquisitions. These dynamic settings will be used instead of the static settings saved in memory.

For more details see the Matrix 300™ Help On-Line.

Self Tuning Image Processing

In the **Image Processing** parameter setup menu, the ***Self Tuning*** parameters manage the Image Processing and Symbology related parameters. They perform different processing attempts on the same captured image according to the selected Self Tuning Mode parameter value: (*Symbologies Only, Processing Modes Only, Decoding Methods Only, Code Contrast Levels Only, Image Mirroring Only, or General Purpose*).

For more details see the Matrix 300™ Help On-Line.

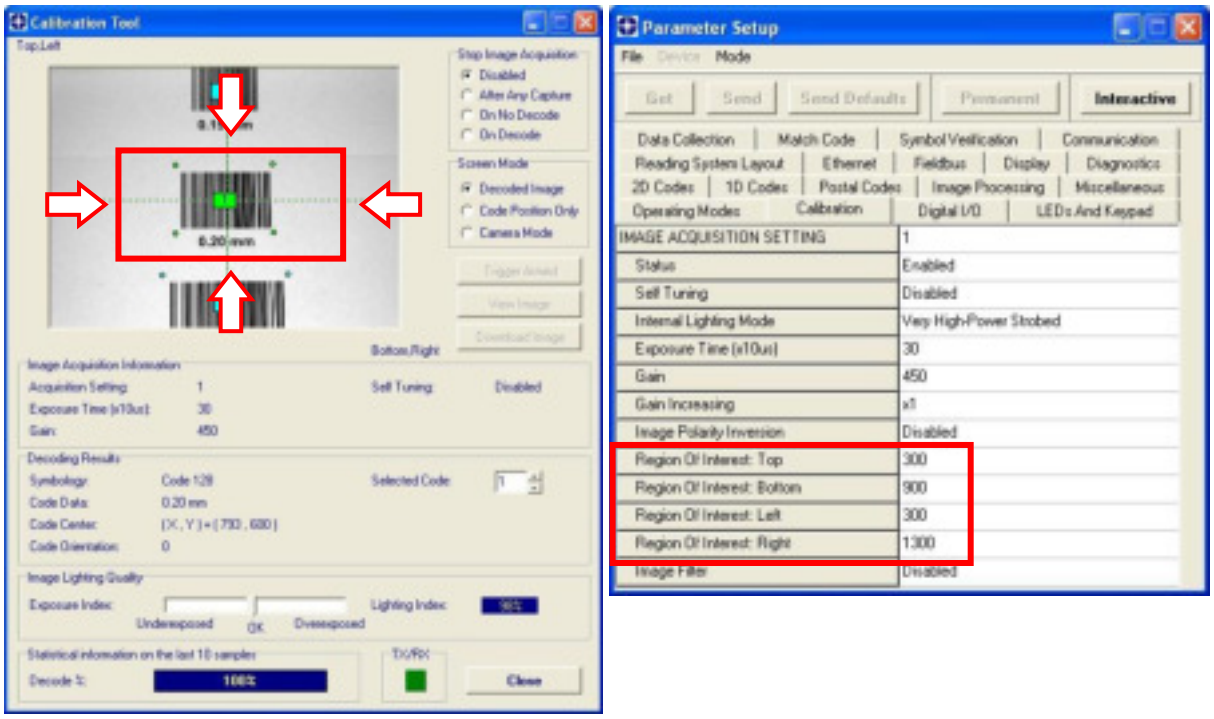
7.5.8 Region Of Interest Windowing

In order to satisfy very high throughput applications, higher frame rates can be achieved using the powerful ***Region Of Interest Windowing*** parameters in the Calibration parameter setup menu.

Region Of Interest Windowing allows defining a region or window within the reader FOV. The Top, Bottom, Left and Right parameters allow to precisely define the image window to be processed, visualized and saved.

In all Matrix 300™ models the frame rate is dependent on the number of lines (or rows) in the defined window.

The smaller the window, the lower the frame period and consequently the higher the frame rate. In general the Image Processing time can be reduced by reducing the window dimensions.



NOTE: If using Region Of Interest windowing, some or all of the four red dots delimiting the calibration algorithm area may be located outside the VisiSet™ display area (not visible).

7.5.9 Direct Part Marking Applications

Decoding Method: Direct Marking

For **Data Matrix** codes the ***Decoding Method*** parameter selects the decoding algorithm according to the printing/marking technique used to create the symbol and on the overall printing/marking quality. The ***Direct Marking*** selection improves the decode rate for low quality Direct Part Mark codes and in general for Direct Part Mark codes with dot peening type module shapes.

Washed out and Axial Distortion

Dot Peening On Scratched Surface

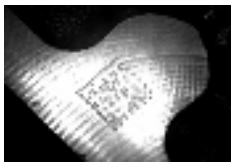
Low Contrast Problem

Background Problems

Marked On Curved Shiny Surface

Axial distortion

Half moon effects



Shiny surface, noisy background

Low contrast, noisy background

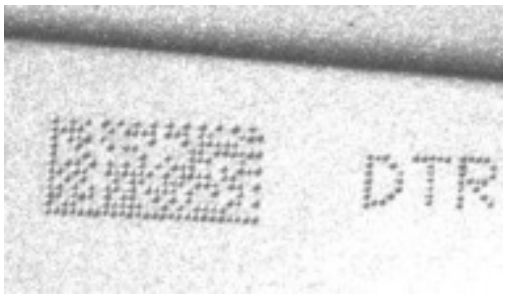
All the previous examples are successfully read selecting the ***Direct Marking Decoding Method***.

Image Filter

Sets the filter to be applied to the image before being processed. This parameter can be used to successfully decode particular ink-spread printed codes (ex. Direct part mark codes).

A different filter can be applied to each ***Image Acquisition Setting***.

The ***Erode*** Filter enlarges the image dark zones to increase readability.

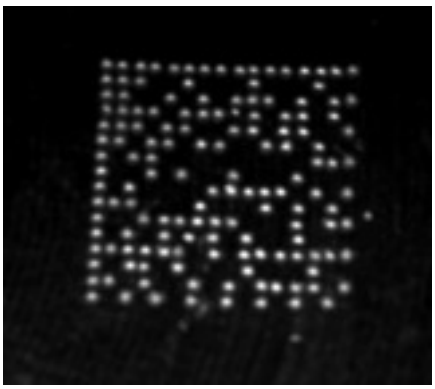


Before - No Read

After - Readable

Erode

The ***Dilate*** Filter enlarges the image white zones to increase readability.



Before - No Read

After - Readable

Dilate

The ***Close*** filter eliminates dark areas (defects) in the white zones of the image.

Before - No Read

After - Readable

Close

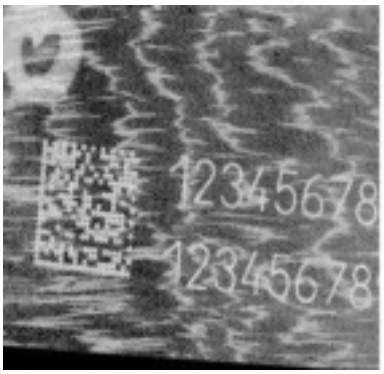
The ***Open*** filter eliminates white areas (defects) in the dark zones of the image.

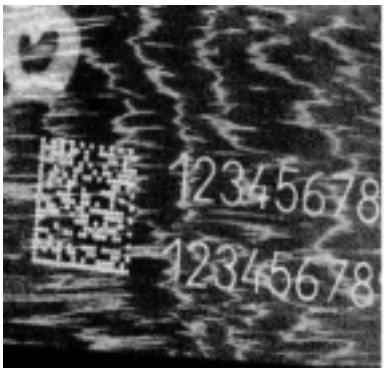
Before - No Read

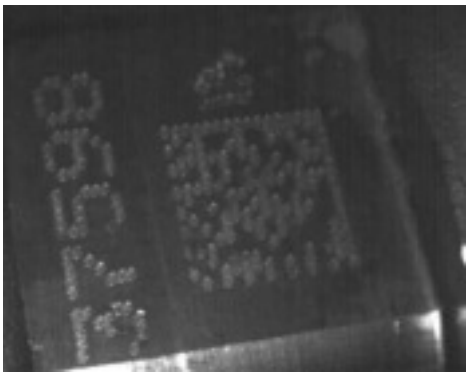
After - Readable

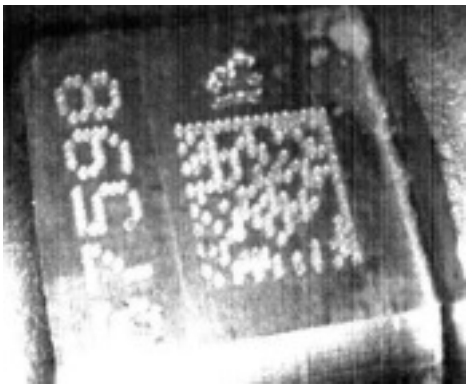
Open

The ***Contrast Stretching*** filter maximizes image contrast.









Before - No Read

After - Readable

Contrast Stretching

The ***Histogram Equalization*** filter makes the gray level distribution uniform.

Before - No Read

After - Readable

Histogram Equalization

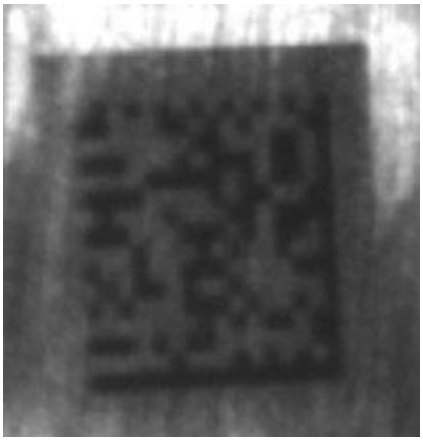
The ***Smoothing*** filter deletes small (insignificant) details in the center of the image.

Before - No Read

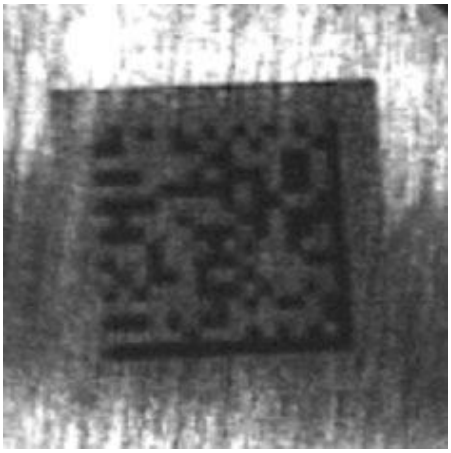
After - Readable

Smoothing

The ***Sharpening*** filter improves out of focus images.



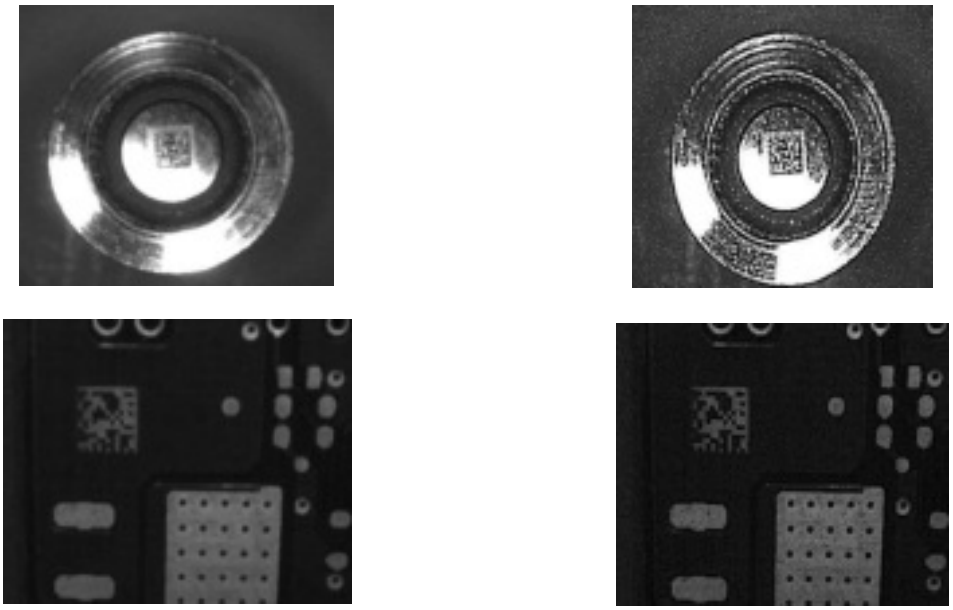
Before - No Read



After - Readable

Sharpening

The ***Deblurring*** filter improves blurred images.



Before - No Read

After - Readable

Deblurring

The ***Black Enhancement*** filter produces a nonlinear increase in the black level for light images.

Before - No Read

After - Readable

Black Enhancement

The ***White Enhancement*** filter produces a nonlinear increase in the white level for dark images.

Before - No Read

After - Readable

White Enhancement

7.6 IMAGE CAPTURE AND DECODING

By using the **Capture Image** and **Decode Last Image** functions from the VisiSet™ Main menu, you can get information about the image decodable codes in terms of Symbology, encoded Data, Position and Orientation, Decode Time and Code Quality Assessment Metrics.

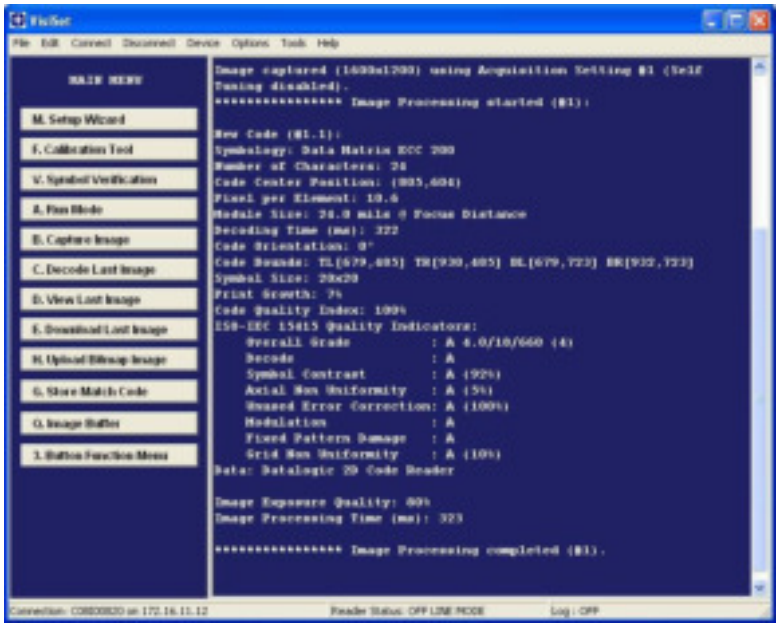


Figure 86 - Capture and Decoding Functions

7.7 STATISTICS

Statistics on the reading performance can be viewed by enabling the Statistics parameter and selecting the **View Statistics** item in the **File** menu. One of three different windows appears depending on the operating mode.
Refer to the VisiSet™ Help On Line for more details.

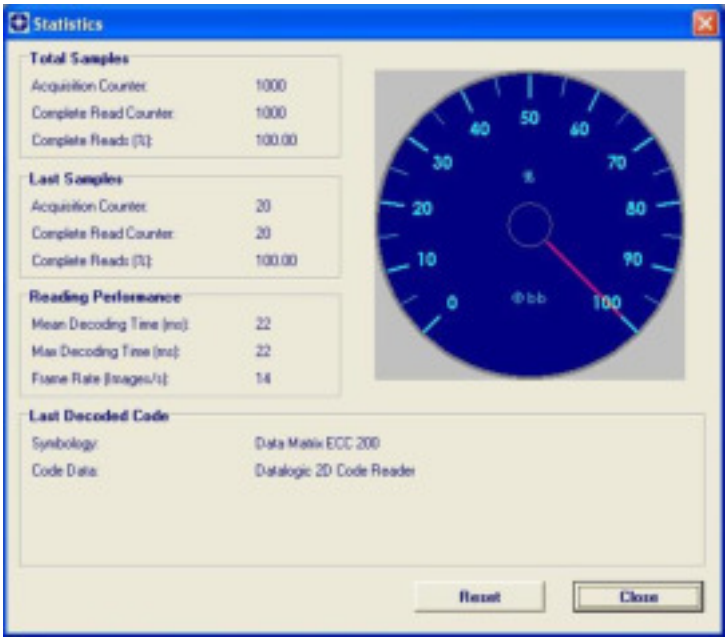


Figure 87 - Code Statistics

8 MAINTENANCE

8.1 CLEANING

Clean the reading window (see Figure A, 1) periodically for continued correct operation of the reader.

Dust, dirt, etc. on the window may alter the reading performance.

Repeat the operation frequently in particularly dirty environments.

Use soft material and alcohol to clean the window and avoid any abrasive substances.

9 TROUBLESHOOTING

9.1 GENERAL GUIDELINES

- When wiring the device, pay careful attention to the signal name (acronym) on the CBX100/500 spring clamp connectors (chp. 4). If you are connecting directly to the Matrix 300™ M16 19-pin connector pay attention to the pin number of the signals (chp. **Error! Reference source not found.**).
- If you need information about a certain reader parameter you can refer to the VisiSet™ program help files. Either connect the device and select the parameter you're interested in by pressing the F1 key, or select **Help>Paramters Help** from the command menu.
- If you're unable to fix the problem and you're going to contact your local Datalogic office or Datalogic Partner or ARC, we suggest providing (if possible): Application Program version, Parameter Configuration file, Serial Number and Order Number of your reader. You can get this information while VisiSet™ is connected to the reader: the Application Program version is shown in the Terminal Window; the Parameter Configuration can be saved to an .ini file applying the **File>Save Configuration File** command in the Parameter Setup window; Serial Number and Order Number can be obtained by applying the respective command in the **Tools** menu.

TROUBLESHOOTING GUIDE	
Problem	**Suggestion**
Power ON: the "POWER" LED is not lit.	• Is power connected? • If using a power adapter (like PG6000), is it connected to wall outlet? • If using rail power, does rail have power? • If using CBX, does it have power (check switch and LED)? • Check if you are referring to the M16 19-pin connector or to the CBX spring clamp connectors. • Measure Voltage either at pin **A** and pin **L** (for 19-pin connector) or at spring clamp **Vdc** and **GND** (for CBX).
One Shot or Phase Mode using the Input 1 (External Trigger) or Input 2: the "TRIGGER" LED is not blinking while the External Trigger is switching.	• Check if you are referring to the 19-pin connector or to the CBX spring clamp connectors. • Is the sensor connected to the Input 1 or Input 2? • Is power supplied to the photo sensor? • For NPN configuration, is power supplied to one of the two I1 or I2 signals (A or B)? • For PNP configuration, is one of the two I1 or I2 signals grounded (A or B)? • Are the photo sensor LEDS (if any) working correctly? • Is the sensor/reflector system aligned (if present)? • In the Digital I/O folder check the EXTERNAL TRIGGER or INPUT 2***Debounce Filter*** parameter setting. • In the Operating Mode folder check the settings for ***Reading Phase-ON, Acquisition Trigger*** and ***Reading Phase-OFF*** parameters.

TROUBLESHOOTING GUIDE	
Problem	**Suggestion**
One Shot or Phase Mode using serial trigger source: the ”TRIGGER” LED is not blinking.	• In the Operating Mode folder check the settings for ***Reading Phase-ON, Acquisition Trigger*** and ***Reading Phase-OFF*** parameters. • Are the COM port parameters (***Baud Rate, Parity, Data Bits, Stop Bits, Handshake***) correctly assigned? • In the communication folder, check the settings of ***Reading Phase-ON String, Acquisition Trigger String*** and ***Reading Phase-OFF String*** parameters. • Is the serial trigger source correctly connected?
Phase Mode: the ”TRIGGER" LED is correctly blinking but no image is displayed in VisiSet™ Calibration Tool window.	• Is the Phase frequency lower than the maximum frame rate?
Continuous Mode: the ”TRIGGER” LED is not blinking.	• Verify the correct software configuration settings.
Any Operating Mode: the ”TRIGGER” LED is correctly blinking but no result is transmitted by the reader at the end of the reading phase collection.	• In the Data Collection folder check the settings for the CODE COLLECTION, DATA FORMAT and STATISTICS parameter groups.
Image not clear:	• verify the Focus procedure
Image focused but not decoded:	• verify the Calibrate Image Density prodcedure.
Reading: the reader always transmits the ***No Read Message***	• Run the Rapid Configuration procedure in chapter 1. • Position the reader as described in par. 3.3 and through the VisiSet™ Calibration Tool: – Tune the ACQUISITION TRIGGER DELAY, if the moving code is out of the reader field of view; – Set the Continuous Operating Mode if no external trigger source is available; – Tune the IMAGE ACQUISITION SETTING to improve the code image quality; – Check the parameter setting in Decoding, 2D Codes, 1D Codes, and Postal Codes folders; – View the full resolution code image to check the printing or marking quality.
Communication: reader is not transmitting anything to the host.	• Is the serial cable wiring correct? • If using CBX, be sure the RS485/422 termination switch is OFF. • Are the host serial port settings the same as the reader serial port settings? • In VisiSet™ Digital I/O folder, "COM" LED can be configured to indicate MAIN COM port TX or MAIN COM port RX.

TROUBLESHOOTING GUIDE	
Problem	**Suggestion**
Communication: data transferred to the host are incorrect, corrupted or incomplete.	• Are the host serial port settings the same as the reader serial port settings? • In VisiSet™ Communication folder check the settings of Header and Terminator String parameters. • In VisiSet™ Data Collection folder, check the settings of DATA FORMAT parameter group.
How do I obtain my reader Serial Number?	• The reader Serial Number consists of 9 characters: one letter, 2 numbers, another letter followed by 5 numbers. • The reader Serial Number is printed on a label that is affixed on the bottom case near the reading window. • The Serial Number can also be obtained by selecting Tools/Get Reader Serial Number from the command menu in VisiSet™. A dedicated window will appear.
How do I obtain my reader Order Number?	• The reader Order Number consists of 9 numbers. • The reader Order Number can be obtained by selecting the Tools/Get Reader Order Number from the command menu in VisiSet™. A dedicated window will appear.

10 TECHNICAL FEATURES

ELECTRICAL FEATURES		
Power Supply Voltage Consumption	**4xx-01x models** 10 to 30 Vdc 0.7 to 0.2 A	**4xx-04x models** PoE Device 48 Vdc 13 W max.
Communication Interfaces Main - RS232 - RS485/422 full-duplex	 2400 to 115200 bit/s 2400 to 115200 bit/s	
Auxiliary - RS232	2400 to 115200 bit/s	
ID-NET™	Up to 1Mbaud	
Ethernet	10/100 Mbit/s (supports application protocols: TCP/IP, EtherNet/IP, Profinet IO, Modbus TCP)	
Inputs Input 1(External Trigger) and Input 2	Opto-coupled and polarity insensitive; see note for PoE models	
Max. Voltage	30 Vdc	
Max. Input Current	10 mA	
Outputs * Output 1, 2 and 3	NPN or PNP short circuit protected; see note for PoE models	
Vout (Iload = 0 mA) Max.	30 Vdc	
Vout (Iload = 100 mA) Max.	3 Vdc	
Iload Max	100 mA	
OPTICAL FEATURES		
Image Sensor	CMOS sensor with Global Shutter	
Image Format	SXGA (1280x1024) pixels	
Frame Rate	60 frames/sec.	
Pitch	± 35°	
Tilt	0° - 360°	
LED Safety	to EN 62471	
Laser Safety (pointers)	IEC60825-1 2007	
Lens Focal Length Focus Control	**4x1-0xx models** 6 mm via adjusting screw	**4x2-0xx models** 9 mm via software
Lighting System	Internal Illuminator	
Aiming System	Laser Pointers	
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	IP65/IP67 ***	
PHYSICAL FEATURES	**Connector position 0°**	**Connector position 90°**
Dimensions	95 x 54 x 43 mm (3.7 x 2.1 x 1.7 in.)	75 x 54 x 62 mm (3.0 x 2.1 x 2.4 in.)
Weight	about 238 g. (8.4 oz.)	
Material	Aluminium	

* when connected to the CBX connection boxes the electrical features for Output 1 and 2 become the following: V_{CE} = 30 Vdc max.; I_{CE} = 40 mA continuous max.; 130 mA pulsed max.; $V_{CE\ saturation}$ = 1 Vdc max. @ 10 mA; P_D = 90 mW Max. @ 50 °C ambient temp.

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

*** when correctly connected to IP67 cables with seals.

SOFTWARE FEATURES

Readable Code Symbologies

1-D and stacked	2-D	POSTAL
• PDF417 Standard and Micro PDF417 • Code 128 (GS1-128) • 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 METRICS

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); Good Read (Green Spot), No Read (Red Spot)
Keypad Button	Configurable via VisiSet™
Beeper	Configurable via VisiSet™

A ALTERNATIVE CONNECTIONS

The connector pinouts and notes given in this appendix are for custom cabling applications.

POWER, COM AND I/O CONNECTOR

The Matrix 300™ reader is equipped with an M12 17-pin male connector for connection to the power supply, serial interfaces and input/output signals. The details of the connector pins are indicated in the following table:

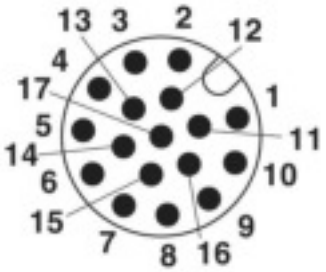


Figure 88 – M12 17-pin male COM, I/O and Power Connector

Power, COM and I/O Connector Pinout			
Pin	**Name**	**Function**	
1 2 Connector case	Vdc GND CHASSIS	Power supply input voltage + Power supply input voltage - Connector case provides electrical connection to the chassis	
6 5 13 3	I1A I1B I2A I2B	External Trigger A (polarity insensitive) External Trigger B (polarity insensitive) Input 2 A (polarity insensitive) Input 2 B (polarity insensitive)	
9 8 16	O1 O2 O3	Output 1 Output 2 Output 3	(NPN or PNP short circuit protected and software programmable)
14 4	RX TX	Auxiliary RS232 RX Auxiliary RS232 TX	
7 15	ID+ ID-	ID-NET™ network + ID-NET™ network -	
Pin	**Name**	**RS232**	**RS485/422 Full-Duplex**
17 11 12 10	MAIN INTERFACE (SW SELECTABLE)	TX RX RTS CTS	TX+ *RX+ TX- *RX-

* Do not leave floating, see par. 4.2.2 for connection details.

In order to meet EMC requirements:

- connect the reader chassis to the plant earth ground by means of a flat copper braid shorter than 100 mm;
- connect your cable shield to the locking ring nut of the connector.

ON-BOARD ETHERNET CONNECTOR

A Standard M12 D-Coded female connector is provided for the on-board Ethernet connection. This interface is IEEE 802.3 10 BaseT and IEEE 802.3u 100 BaseTx compliant.

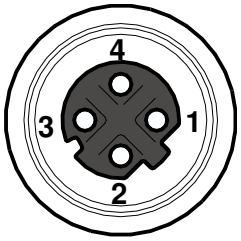


Figure 89 - M12 D-Coded Female Ethernet Network Connector

On-Board Ethernet Network Connector Pinout		
Pin	**Name**	**Function**
1	TX +	Transmitted data (+)
2	RX +	Received data (+)
3	TX -	Transmitted data (-)
4	RX -	Received data (-)

Power over Ethernet (PoE) Models

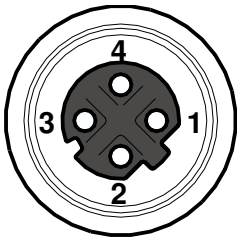


Figure 90 - M12 D-Coded Female Ethernet Network Connector

Power over Ethernet Network Connector Pinout		
Pin	**Name**	**Function**
1	TX +/DC-	Transmitted data (+) DC power (-)
2	RX +/DC+	Received data (+) DC power (+)
3	TX -/DC-	Transmitted data (-) DC power (-)
4	RX -/DC+	Received data (-) DC power (+)

CAUTION: Matrix 300™ PoE models only accept Alternative A (power over RJ45 pins 1, 2, 3, 6), Class 0 power levels. Use an Endspan or Midspan PSE device that supports this configuration (i.e. PoE switch or Power over Ethernet Adapter).

Alternative B (power over RJ45 pins 4, 5, 7, 8) using an Endspan or Midspan PSE device is not supported.

Figure 91 – Matrix 300™ PoE PSE Endspan Alternative A Connections OK

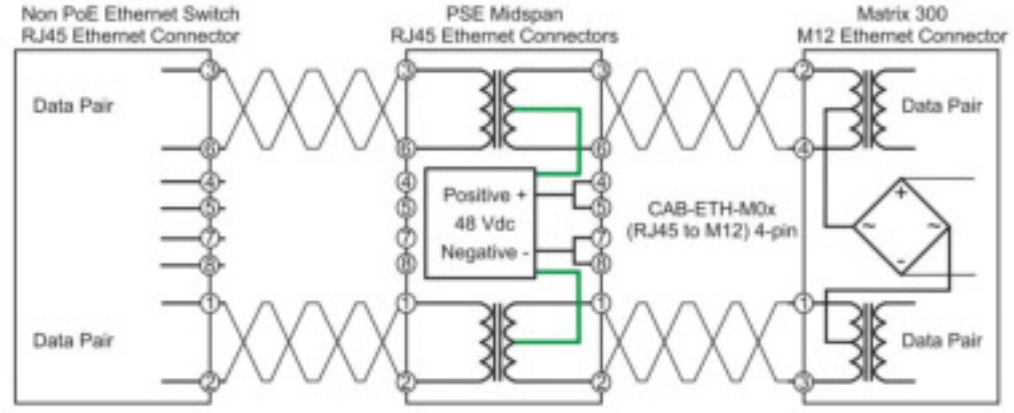


Figure 92 – Matrix 300™ PoE PSE Midspan Alternative A Connections OK

Figure 93 – Matrix 300™ PoE PSE Endspan Alternative B Connections NOT SUPPORTED

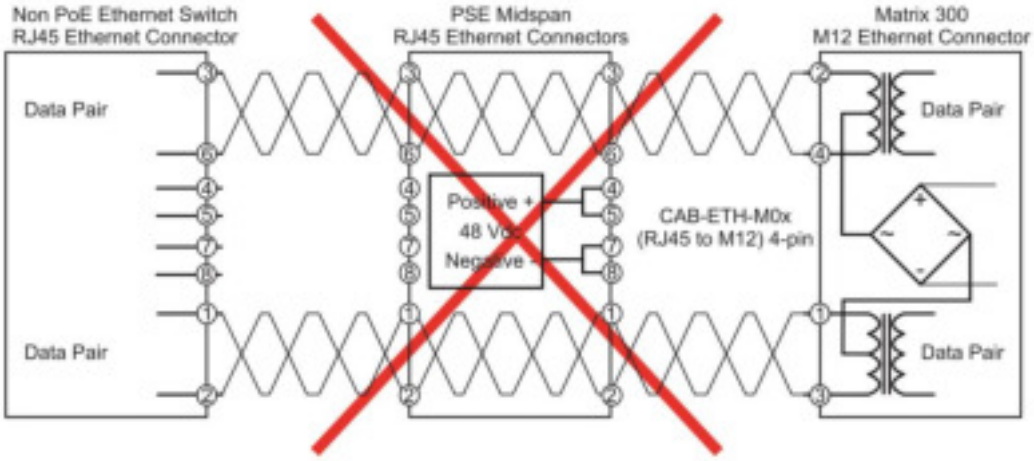


Figure 94 – Matrix 300™ PoE PSE Midspan Alternative B Connections NOT SUPPORTED

CAUTION: For Matrix 300™ PoE models, the internal Digital Output circuitry is not powered and supply power is not available to any Input/Output devices (Vdc=0). Only input device signals can be accepted directly on the M12 17-pin connector without power.

For these models, if it is necessary to use Input/Output devices, we recommend connecting them through the CBX, which must be powered separately.

ID-NET™ NETWORK TERMINATION

The network must be properly terminated by a 120 Ohm resistor at the first and last reader of the network.

INPUTS

There are two optocoupled polarity insensitive inputs available on the M12 17-pin connector of the reader: Input 1 (External Trigger) and Input 2, a generic input. See par. 4.5 for more details.

The electrical features of both inputs are:

INPUT	$\lvert V_{AB} \rvert$ Min.	$\lvert V_{AB} \rvert$ Max.	I_{IN} Max.
Open	0 V	2 V	0 mA
Closed	4.5 V	30 V	10 mA

The relative pins on the M12 17-pin connector are:

Pin	Name	Function
1	Vdc	Power Supply input voltage +
6	I1A	External Trigger A (polarity insensitive)
5	I1B	External Trigger B (polarity insensitive)
13	I2A	Input 2 A (polarity insensitive)
3	I2B	Input 2 B (polarity insensitive)
2	GND	Power Supply input voltage -

OUTPUTS

Three general purpose **non opto-isolated** but short circuit protected outputs are available on the M12 17-pin connector. See par. 4.6 for more details.

The pinout is the following:

Pin	Name	Function
9	O1	Configurable digital output 1
8	O2	Configurable digital output 2
16	O3	Configurable digital output 3
2	GND	Ouptut reference signal

The electrical features of the three outputs are the following:

Reverse-Polarity and Short-Circuit Protected

V_{OUT} (I_{LOAD} = 0 mA) max = 30 Vdc

V_{OUT} (I_{LOAD} = 100 mA) max = 3 Vdc

I_{LOAD} max = 100 mA

The output signals are fully programmable being determined by the configured Activation/Deactivation events, Deactivation Timeout or a combination of the two. Refer to the Digital I/O folder in the VisiSet™ Help On Line for further details.

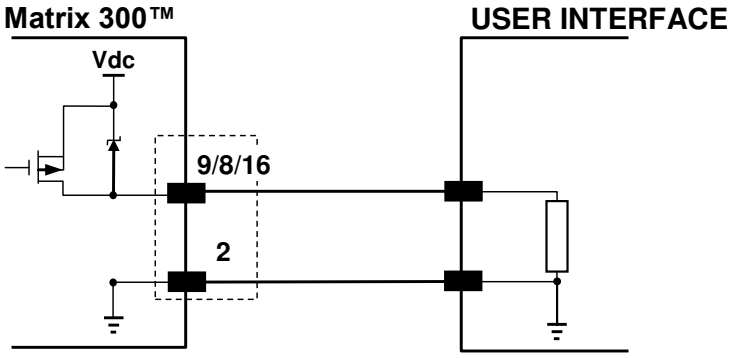


Figure 95 - PNP Output Connection

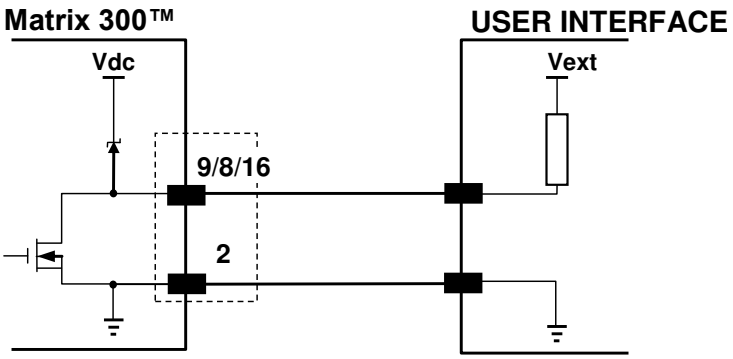


Figure 96 - NPN Output Connection

CAUTION: For NPN output connections, the external interface voltage (Vext) must not exceed the Matrix 300™ power supply source voltage (Vdc) otherwise correct output functioning cannot be guaranteed.

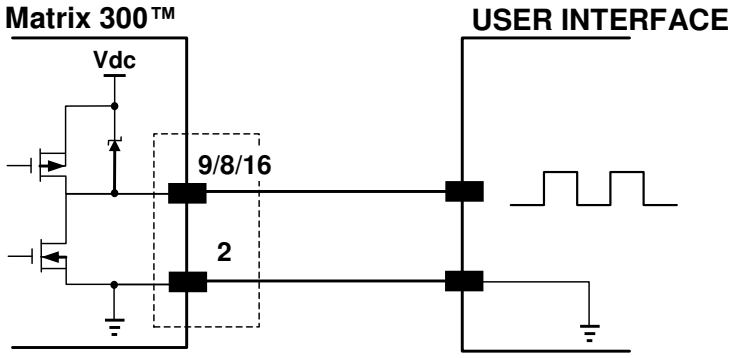
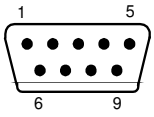
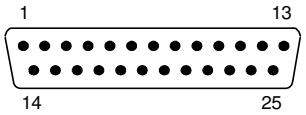


Figure 97 - Push-Pull Output Connection

CAUTION: For Matrix 300™ PoE models, the internal Digital Output circuitry is not powered and supply power is not available to any Input/Output devices (Vdc=0). Only input device signals can be accepted directly on the M12 17-pin connector without power.

For these models, if it is necessary to use Input/Output devices, we recommend connecting them through the CBX, which must be powered separately.

USER INTERFACE - SERIAL HOST

RS232 PC-side connections			
 9-pin male connector		 25-pin male connector	
Pin	**Name**	**Pin**	**Name**
2	RX	3	RX
3	TX	2	TX
5	GND	7	GND
7	RTS	4	RTS
8	CTS	5	CTS

How To Build A Simple Interface Test Cable:

The following wiring diagram shows a simple test cable including power, external (push-button) trigger and PC RS232 COM port connections.

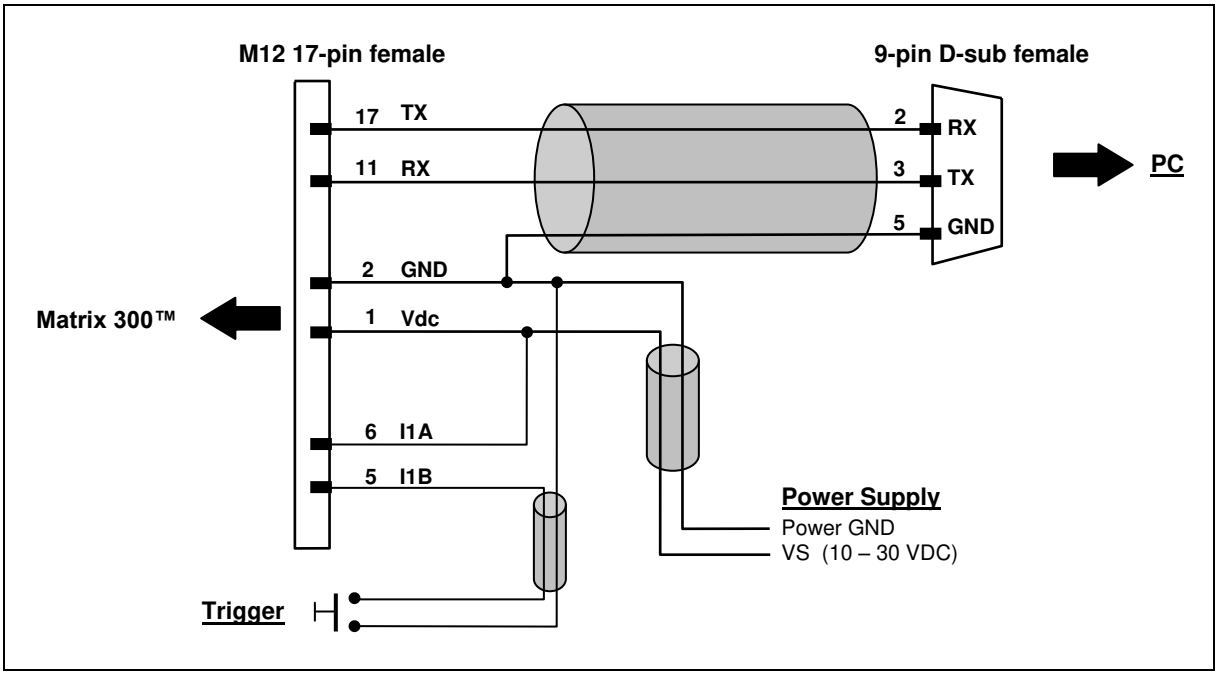


Figure 98- Test Cable for Matrix 300™

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.

Bright Field Illumination
Lighting of surfaces at high (narrow) angles used to provide maximum reflection of the light to the reader's lens. This is effective on surfaces that absorb light or are not highly reflective and also on low contrast codes.

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 wide angles used to avoid direct reflection of the light into the reader's lens. Typically this type of lighting is used in DPM solutions to enhance reflectance of the uneven surface do to the symbol marking technique. It is also used with very reflective surfaces.

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.

Exposure Time
For digital cameras based on image sensors equipped with an electronic shutter, it defines the time during which the image will be exposed to the sensor to be acquired.

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.

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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Datalogic Automation S.r.l.
Via Lavino 265
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Bologna - Italy

declares that the

MATRIX 300 ; Compact 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), DECEMBER 2010:	*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, April 3rd, 2013

Paolo Morselli
Quality Manager

Morselli Paolo

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