

# REFERENCE MANUAL



> Matrix 300N™



Datalogic Automation s.r.l.  
Via Lavino, 265  
40050 - Monte S. Pietro  
Bologna - Italy

Matrix 300N™ Reference Manual

Ed.: 02/2015

© 2015 Datalogic Automation S.r.l. ♦ ALL RIGHTS RESERVED. ♦ Protected to the fullest extent under U.S. and international laws. Copying, or altering of this document is prohibited without express written consent from Datalogic Automation S.r.l.

Datalogic and the Datalogic logo are registered trademarks of Datalogic S.p.A. in many countries, including the U.S.A. and the E.U.

Matrix 300N, ID-NET, DL.CODE and X-PRESS are trademarks of Datalogic Automation S.r.l. All other brand and product names mentioned herein are for identification purposes only and may be trademarks or registered trademarks of their respective owners.

Datalogic shall not be liable for technical or editorial errors or omissions contained herein, nor for incidental or consequential damages resulting from the use of this material.

11/02/15

# CONTENTS

---

	<b>REFERENCES .....</b>	<b>vi</b>
	Conventions .....	vi
	Reference Documentation .....	vi
	Support Through the Website .....	vi
	Patents .....	vi
	<b>COMPLIANCE .....</b>	<b>vii</b>
	EMC Compliance .....	vii
	Power Supply .....	vii
	CE Compliance .....	vii
	FCC Compliance .....	vii
	Laser Safety .....	viii
	LED Safety .....	viii
	<b>HANDLING .....</b>	<b>ix</b>
	<b>GENERAL VIEW .....</b>	<b>xi</b>
<b>1</b>	<b>RAPID CONFIGURATION .....</b>	<b>1</b>
	Step 1 – Connect the System .....	1
	Step 2 – Mount and Position the Reader .....	3
	Step 3 – Aim And Autofocus the Reader .....	4
	Step 4 – X-PRESS™ Configuration .....	5
	Step 5 – Installing DL.CODE™ Configuration Program .....	7
	Step 6 – Device Configuration .....	10
	Step 7 – Test Mode .....	25
	Advanced Reader Configuration .....	26
<b>2</b>	<b>INTRODUCTION .....</b>	<b>27</b>
2.1	Product Description .....	27
2.2	Indicators and Keypad Button .....	30
2.3	ID-NET™ .....	31
2.3.1	How To Setup/Configure the Reader Network .....	32
2.3.2	Master Configuration .....	33
2.3.3	Slave Configuration .....	37
2.3.4	Verify Master/Slave Setup .....	41
2.4	Backup and Restore Through DL.CODE™ .....	43
2.4.1	Backup .....	44
2.4.2	Restore .....	45
2.4.3	Replacement .....	45
2.5	X-PRESS™ Human Machine Interface .....	46
2.5.1	X-PRESS™ Functions .....	46
2.5.2	Diagnostic Indication .....	48
2.6	Model Description .....	48
2.6.1	Lighting System Notes .....	49
2.7	Accessories .....	49
2.8	Application Examples .....	50
2.8.1	Document Handling .....	50
2.8.2	Deformed or Overprinted Code Reading .....	50
2.8.3	Direct Part Marking .....	51
2.8.4	Ink-Jet Printing Technology .....	52

2.8.5	Laser Marking/Etching Technology .....	52
<b>3</b>	<b>INSTALLATION .....</b>	<b>53</b>
3.1	Package Contents .....	53
3.2	Mechanical Dimensions.....	54
3.3	Mounting and Positioning Matrix 300N™ .....	57
<b>4</b>	<b>CBX ELECTRICAL CONNECTIONS.....</b>	<b>60</b>
4.1	Power Supply.....	61
4.1.1	Standard Models.....	61
4.1.2	Power over Ethernet (PoE) Models .....	61
4.2	Main Serial Interface.....	63
4.2.1	RS232 Interface.....	64
4.2.2	RS422 Full-Duplex Interface.....	65
4.3	ID-NET™ Interface .....	66
4.3.1	ID-NET™ Cables .....	66
4.3.2	ID-NET™ Response Time .....	67
4.3.3	ID-NET™ Network Termination .....	67
4.4	Auxiliary RS232 Interface .....	71
4.5	Inputs .....	72
4.6	Outputs .....	76
4.7	On-Board Ethernet Interface.....	79
4.8	User Interface - Serial Host .....	79
<b>5</b>	<b>TYPICAL LAYOUTS .....</b>	<b>80</b>
5.1	Ethernet Connection .....	80
5.2	Serial Connection .....	82
5.3	Fieldbus Connection .....	83
5.4	ID-NET™ Synchronized Network .....	84
<b>6</b>	<b>READING FEATURES.....</b>	<b>87</b>
6.1	FOV Calculation.....	87
6.2	Global FOV Diagrams.....	88
6.2.1	Manual Adjustable Focus Models 6 mm .....	89
6.2.2	Software Adjustable Liquid Lens Models 9 mm .....	90
6.2.3	Manual Adjustable Focus Models 9 mm .....	91
6.2.4	Manual Adjustable Focus Models 12 mm .....	92
6.2.5	Manual Adjustable Focus Models 16 mm .....	93
6.3	Reading Diagrams .....	94
6.3.1	Matrix 300 4x1 (6 mm models) 1D Codes .....	95
6.3.2	Matrix 300 4x1 (6 mm models) 2D Codes .....	101
6.3.3	Matrix 300 4x3 (9 mm models) 1D Codes .....	104
6.3.4	Matrix 300 4x3 (9 mm models) 2D Codes .....	105
6.3.5	Matrix 300 4x4 (12 mm models) 1D Codes .....	106
6.3.6	Matrix 300 4x4 (12 mm models) 2D Codes .....	107
6.3.7	Matrix 300 4x5 (16 mm models) 1D Codes .....	108
6.3.8	Matrix 300 4x5 (16 mm models) 2D Codes .....	109
6.4	Maximum Line Speed and Exposure Time Calculations .....	110
<b>7</b>	<b>SOFTWARE CONFIGURATION.....</b>	<b>112</b>
7.1	DL.CODE™ System Requirements.....	112
7.2	Reader Configuration.....	112
7.2.1	Restore Configuration.....	113
7.2.2	Restore Defaults .....	113
7.2.3	Auto Calibration .....	115



7.2.4	Manual Calibration.....	116
7.2.5	Multi Image Acquisition Setups.....	119
7.2.6	Extending DOF Using Internal Image Settings Selection .....	120
7.2.7	Extending DOF Using External Image Settings Selection .....	121
7.2.8	Image Cropping .....	123
7.2.9	Direct Part Marking Applications.....	126
7.3	Diagnostics .....	131
7.4	Statistics .....	132
<b>8</b>	<b>MAINTENANCE .....</b>	<b>133</b>
8.1	Cleaning.....	133
<b>9</b>	<b>TROUBLESHOOTING .....</b>	<b>134</b>
9.1	General Guidelines .....	134
<b>10</b>	<b>TECHNICAL FEATURES.....</b>	<b>137</b>
<b>A</b>	<b>ALTERNATIVE CONNECTIONS .....</b>	<b>139</b>
	Power, COM and I/O Connector.....	139
	On-Board Ethernet Connector.....	140
	ID-NET™ Network Termination.....	142
	Inputs .....	142
	Outputs .....	143
	User Interface - Serial Host .....	145
	<b>GLOSSARY.....</b>	<b>146</b>
	<b>INDEX.....</b>	<b>149</b>

## REFERENCES

---

### CONVENTIONS

This manual uses the following conventions:

"User" refers to anyone using a Matrix 300N™ reader.

"Reader" refers to the Matrix 300N™ reader.

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

### REFERENCE DOCUMENTATION

For further details refer to: the DL.CODE™ Help On Line, DL.CODE™ User's Guide, Matrix Reading Methods, provided as supplementary documentation on the DL.CODE™ mini-DVD (downloaded ISO file or mini-DVD accessory).

### SUPPORT THROUGH THE WEBSITE

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

- **PRODUCTS – FIXED INDUSTRIAL BARCODE READERS**

Select your product from the links on the **Fixed Industrial Barcode Readers** page. The product page describes specific Info, Features, Applications, Models, Accessories, and Downloads including documentation, software drivers, and utility programs.

- **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; Downloads for additional downloads.

### PATENTS

See [www.patents.datalogic.com](http://www.patents.datalogic.com) for patent list.

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

Design patents: EP002197715

Utility patents: EP0996284B1, EP0999514B1, EP1014292B1, EP1128315B1, EP1396811B1, EP1413971B1, JP4435343B2, JP4571258B2, US6512218, US6616039, US6808114, US6997385, US7053954, US7387246, US8058600, US8368000, US8743263

# 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 300N™ 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.



**WARNING:** 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.



Matrix 300N™ Warning Labels



Produit(s) conforme selon 21CFR 1040.10 sauf des dérogations relatives à la Laser Notice N° 50, date Juin 24, 2007.

Dans le paquet il y a l'étiquette(s) pour les pays où le texte d'avertissement en français sont obligatoires. Le(s) mettre sur le produit à la place de la version anglaise.



Exemple d'étiquettes d'avertissement laser

## LED SAFETY

LED emission according to EN 62471.

## HANDLING

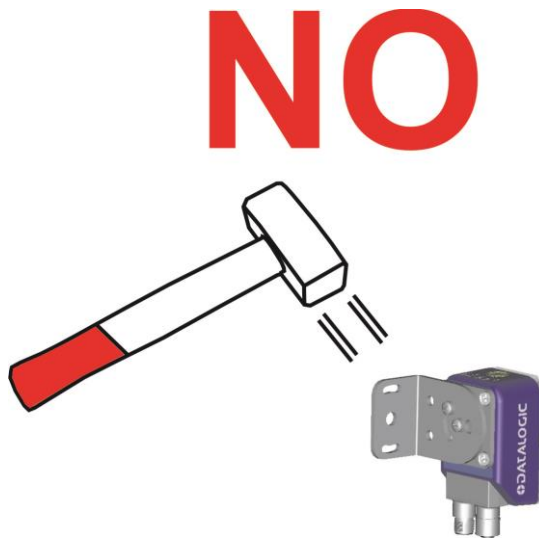
---

The Matrix 300N™ 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).

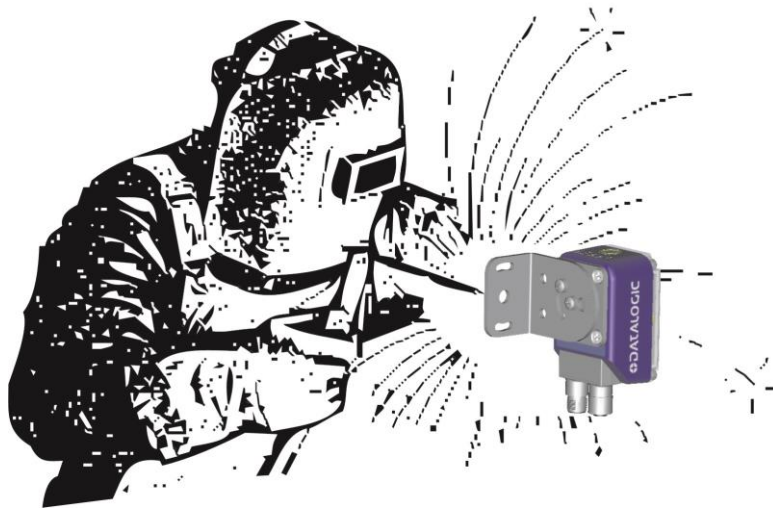


- do not fine tune the positioning by striking the reader or bracket.



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

# NO



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

# NO



## GENERAL VIEW

### Matrix 300N™

#### Software Adjustable Focus (Liquid Lens) Models

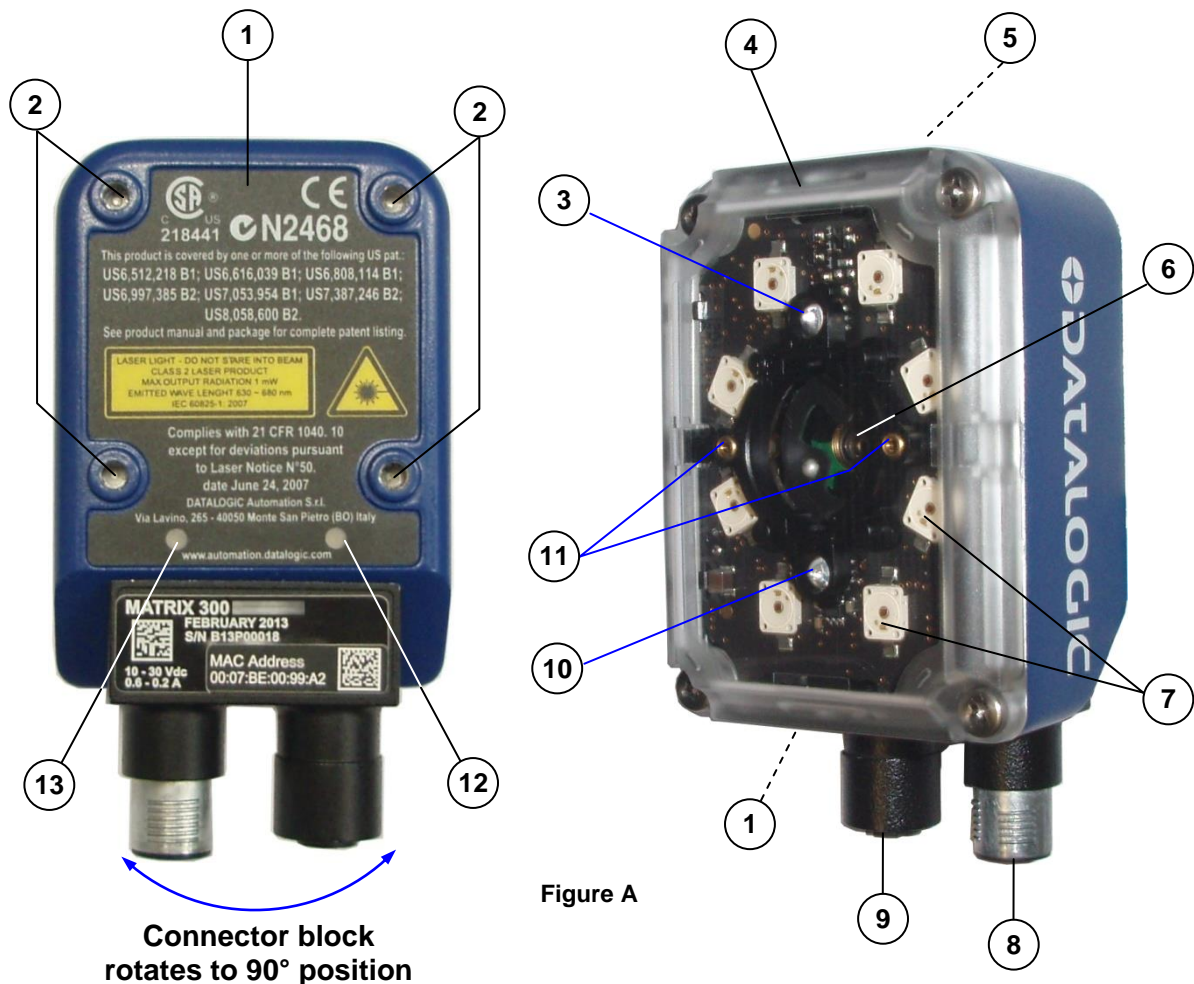


Figure A

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



# Matrix 300N™

## Manual Adjustable Focus Models

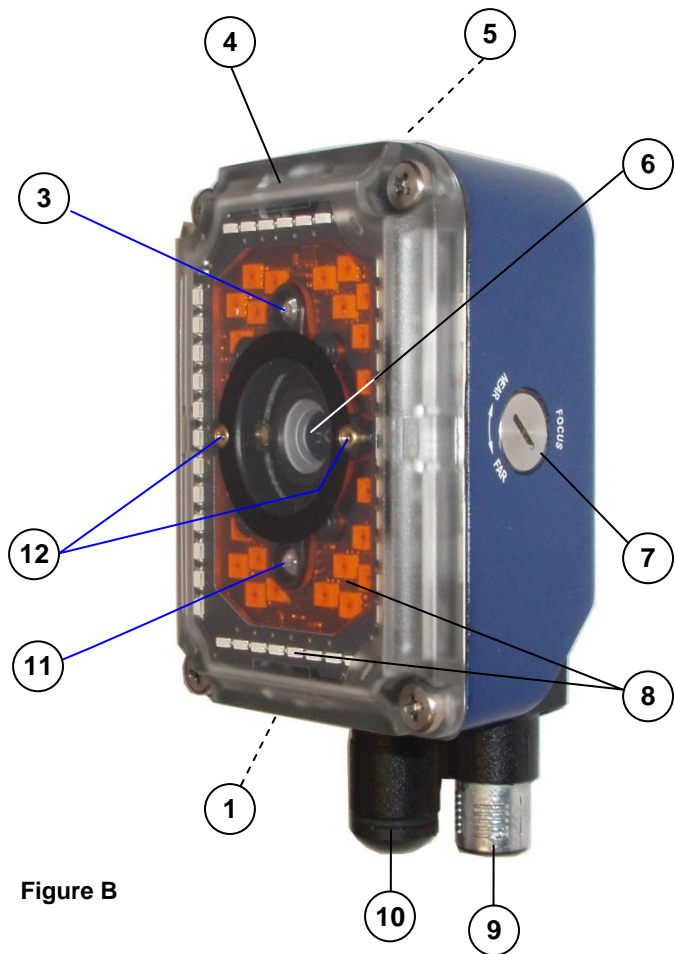


Figure B

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

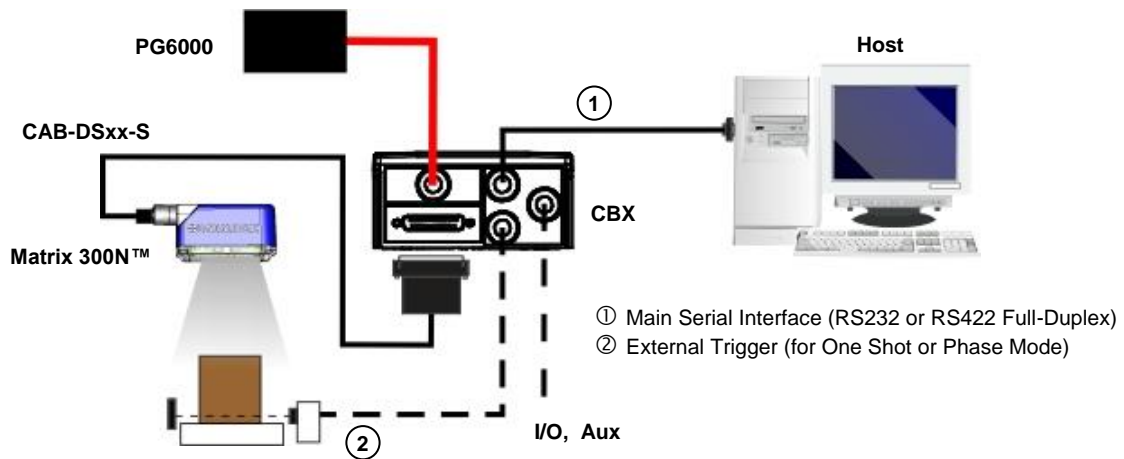


Figure 1 – Matrix 300N™ in Stand Alone Layout

## CBX100/CBX500 Pinout for Matrix 300N™

The table below gives the pinout of the CBX100/CBX500 terminal block connectors. Use this pinout when the Matrix 300N™ 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	Auxiliary Interface	
+V	Power Source – Inputs	TX	Auxiliary Interface TX
I2A	Input 2 A (polarity insensitive)	RX	Auxiliary Interface RX
I2B	Input 2 B (polarity insensitive)	SGND	Auxiliary Interface Reference
-V	Power Reference – Inputs	ID-NET™	
Shield		REF	Network Reference
Shield	Network Cable Shield	ID+	ID-NET™ network +
		ID-	ID-NET™ network -
Main Interface			
RS232		RS422 Full-Duplex	
	TX	TX+	
		TX-	
	RX	*RX+	
		*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 300N™, 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 300N™ 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).

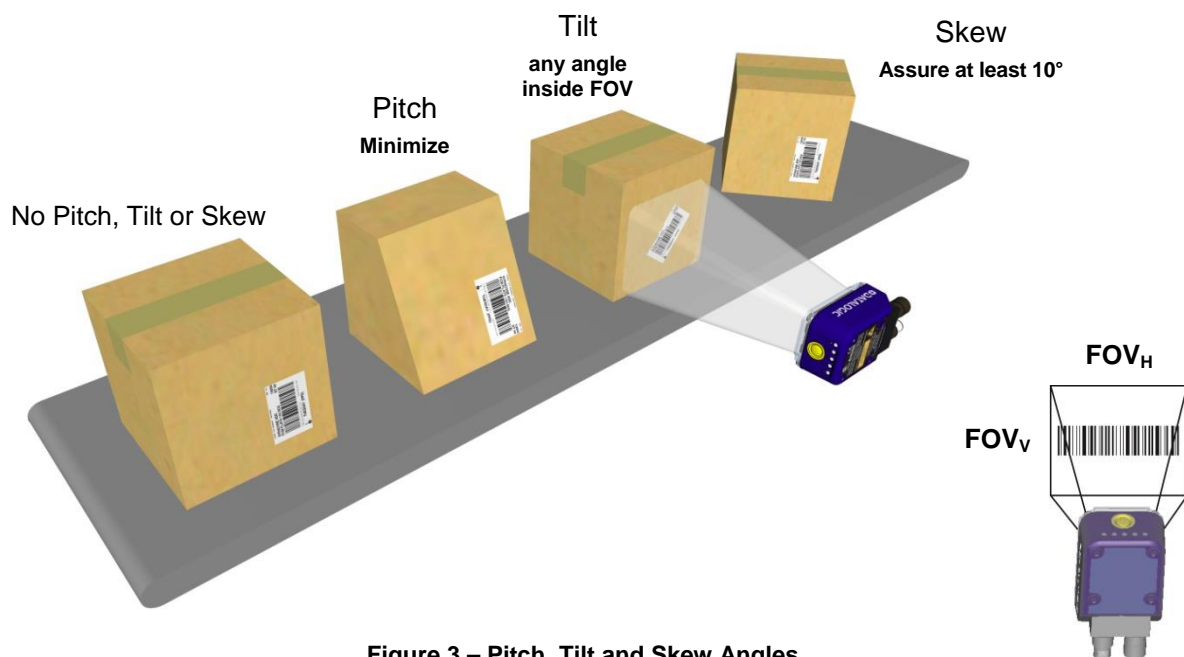


Figure 3 – Pitch, Tilt and Skew Angles

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 300N™ reader can be made **either** through the X-PRESS™ interface (steps 3-4) which requires no PC connection, **or** by using the DL.CODE™ Setup Wizard (steps 5-6). Select the procedure according to your needs.

## STEP 3 – AIM AND AUTOFOCUS THE READER

### (Liquid Lens Models only)

Matrix 300N™ 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 300N™ emits 3 high pitched beeps.

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

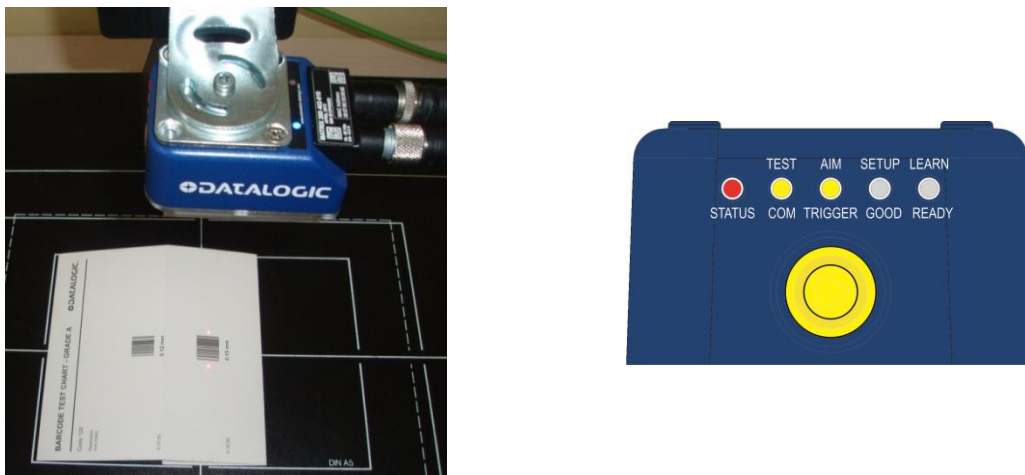


Figure 4 – X-PRESS™ Interface: Aim/Autofocus Function



**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.

### (Manual Adjustable Focus Models only)

The Matrix 300N™ manual adjustable focus 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 DL.CODE™ procedure described in step 6 “**Image Setup for Manual Adjustable Focus Models**”.

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

Matrix 300 4x1-0xx 6 mm lens = <b>85 mm</b>	Matrix 300 4x4-0xx 12 mm lens = <b>250 mm</b>
Matrix 300 4x3-0xx 9 mm lens = <b>180 mm</b>	Matrix 300 4x5-0xx 16 mm lens = <b>320 mm</b>

## STEP 4 – X-PRESS™ CONFIGURATION

Once Matrix 300N™ is 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 DL.CODE™ 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.

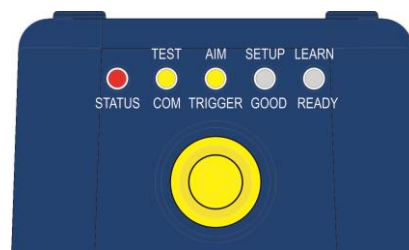


Figure 5 – X-PRESS™ Interface: Aim Function

### 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 300N™ emits 3 high pitched beeps.

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

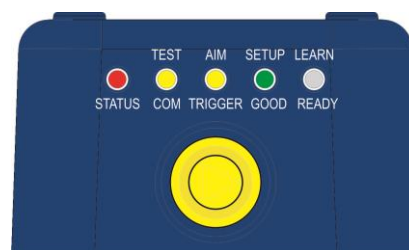


Figure 6 – X-PRESS™ Interface: Setup Function

## 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 300N™ emits 3 high pitched beeps<sup>1</sup>.

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

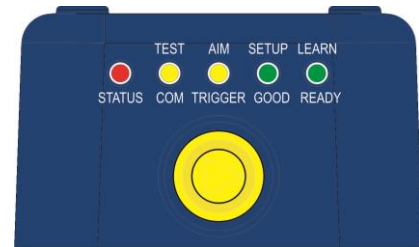


Figure 7 – X-PRESS™ Interface: Learn Function



**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 300N™ 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 all LEDs blink simultaneously for about 3 seconds. Release and re-press the button during this LED blinking sequence.**

The Configuration and Environment parameters are reset. The Matrix 300N™ emits 3 high pitched beeps and after a few seconds enters run mode.



**NOTE:** If you release the button while the LEDs are all on continuously (after the blinking phase), the reader will enter the Loader program sequence and the LEDs will begin to cycle through various patterns. Just cycle power to return to run mode.

<sup>1</sup> The Learn procedure will not recognize the following symbologies: Postal Codes, Pharmacode, MSI, Standard 2 of 5, Matrix 2 of 5.

## STEP 5 – INSTALLING DL.CODE™ CONFIGURATION PROGRAM

DL.CODE™ is a Datalogic reader configuration tool providing several important advantages:

- Intuitive Graphical User Interface for rapid configuration;
- Defined configuration directly stored in the reader;
- Discovery and IP address setting features to facilitate remote configuration
- Device Monitoring

### To install DL.Code™:

1. On the PC that will be used for configuration, (running Windows XP, Vista, or 7), download the DL.CODE™ installer (**DL.CODE X.x\_Setup.exe**) from the website and run it following the installation procedure.
2. When the installation is complete the DL.CODE™ entry is created in the Start>Programs bar under “Datalogic” as well as a desktop icon. Double-click the desktop icon to run it.

This configuration procedure assumes a laptop computer, running DL.CODE™, is connected to a factory default reader through the Ethernet port.

## Device Discovery

The User Interface opens and displays a list of all the devices belonging to the Local Area Network. DL.CODE™ has a discovery feature to accomplish this task.

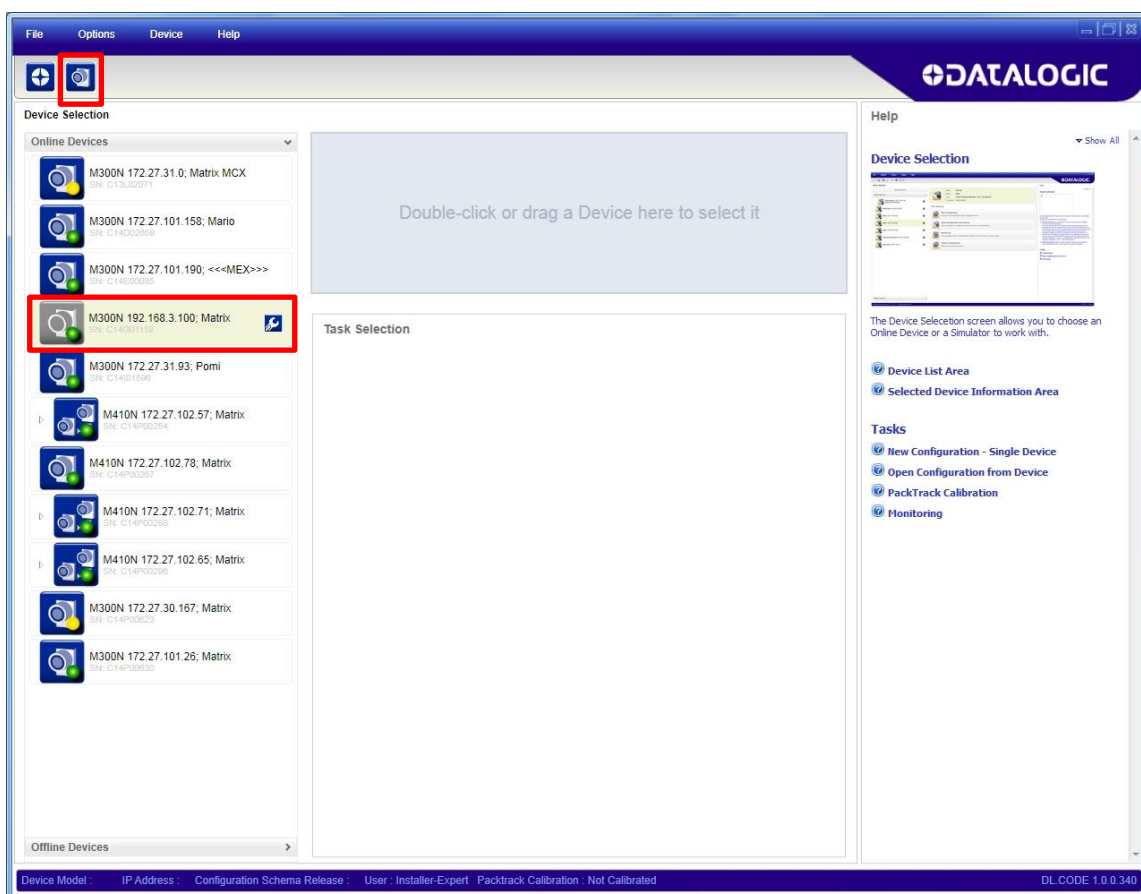



Figure 8 – Device Discovery



The discovery feature will also show devices not belonging to the LAN and display them in grey (see Figure 8).

3. First the device must be added to the LAN by aligning its IP Address to the network. The network administrator should provide valid LAN address(es).
4. Click on the device wrench icon  (or the Device>Settings>Settings menu) to open the Device Environment Configuration window.
5. Change the Ethernet Settings (IP Address, Subnet Mask, Gateway Address etc.) according to the network requirements.

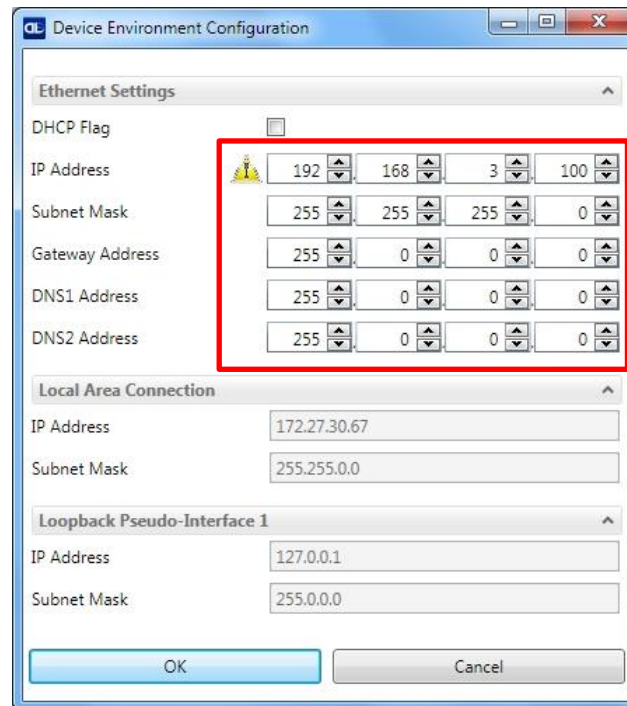
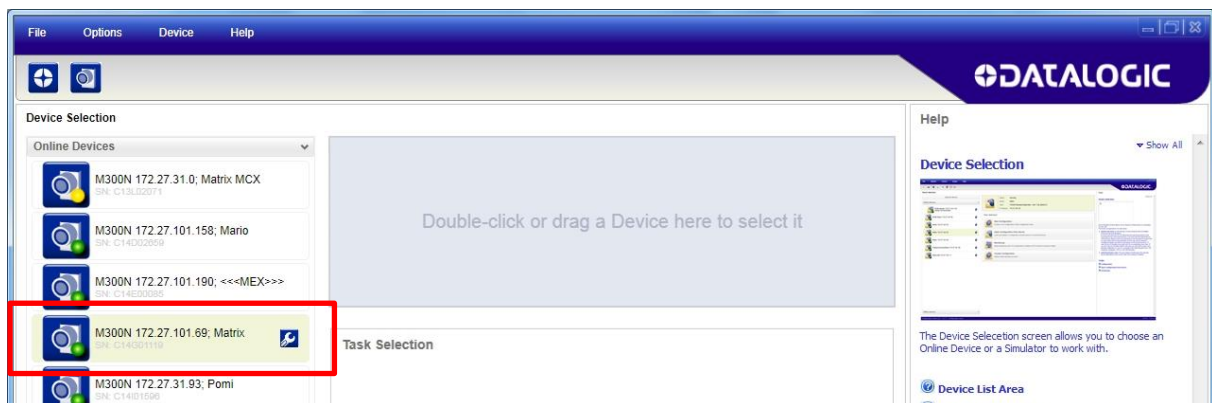


Figure 9 Device Environment Configuration Window

6. Click OK; the device will be reset.
7. Click the Discovery icon and the device will reappear in the list of Online Devices (in color) meaning it is now part of the LAN and can be configured. The new IP address will also be displayed.





8. Double-click on or drag the device icon into the Selected Device Information Area. Details about the device will be displayed in this area.

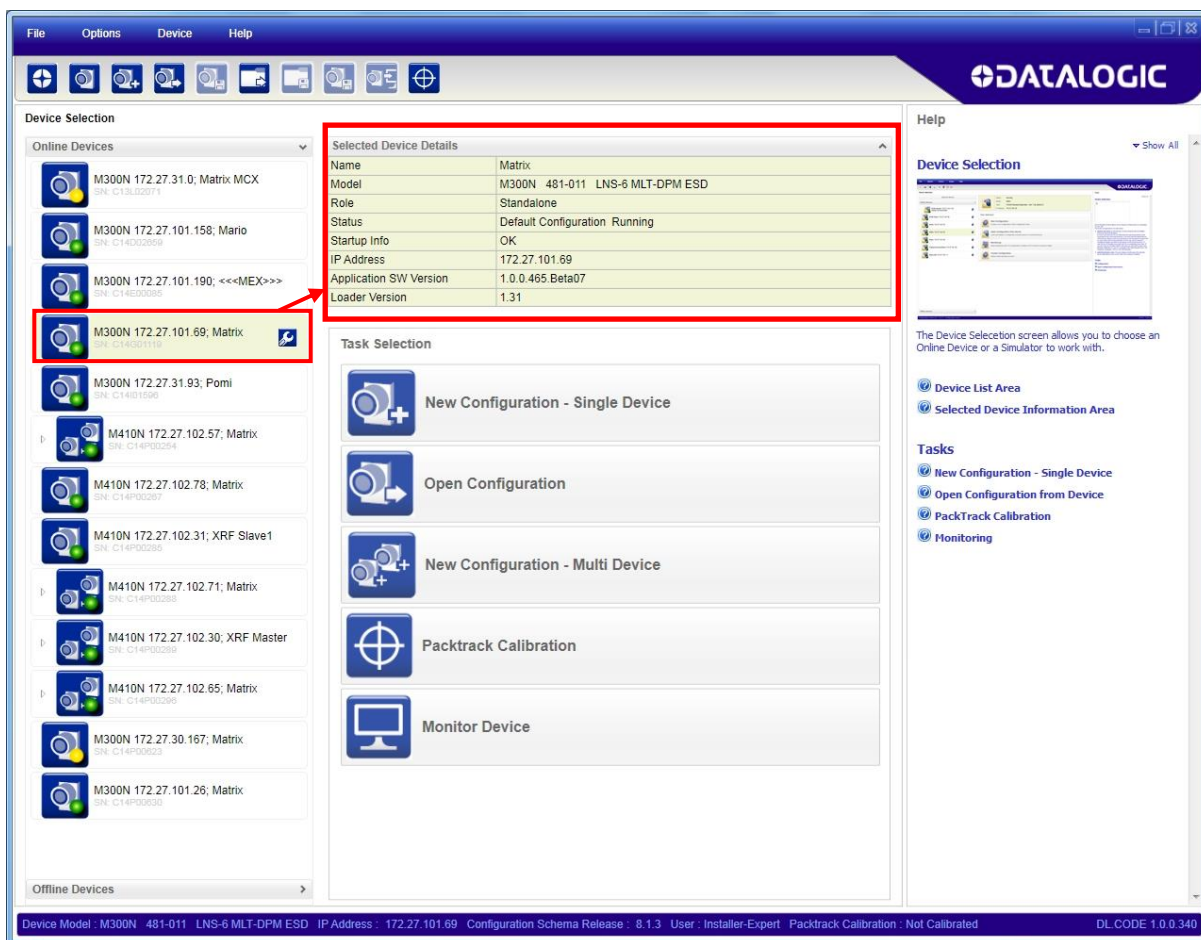


Figure 10 – DL.CODE™ Opening Window



**CAUTION:** In order for DL.CODE™ to correctly manage the illuminator parameters, in the DL.CODE™ Device menu click the Settings > Settings > Maintenance Settings > Current Illuminator Model item and select the Illuminator being used from the list.

Click OK and at the device reset prompt click Yes and wait until the device resets. You can confirm by reopening this item from the same menu.

## STEP 6 – DEVICE CONFIGURATION

### Image Setup for Software Adjustable Focus Models (Liquid Lens)



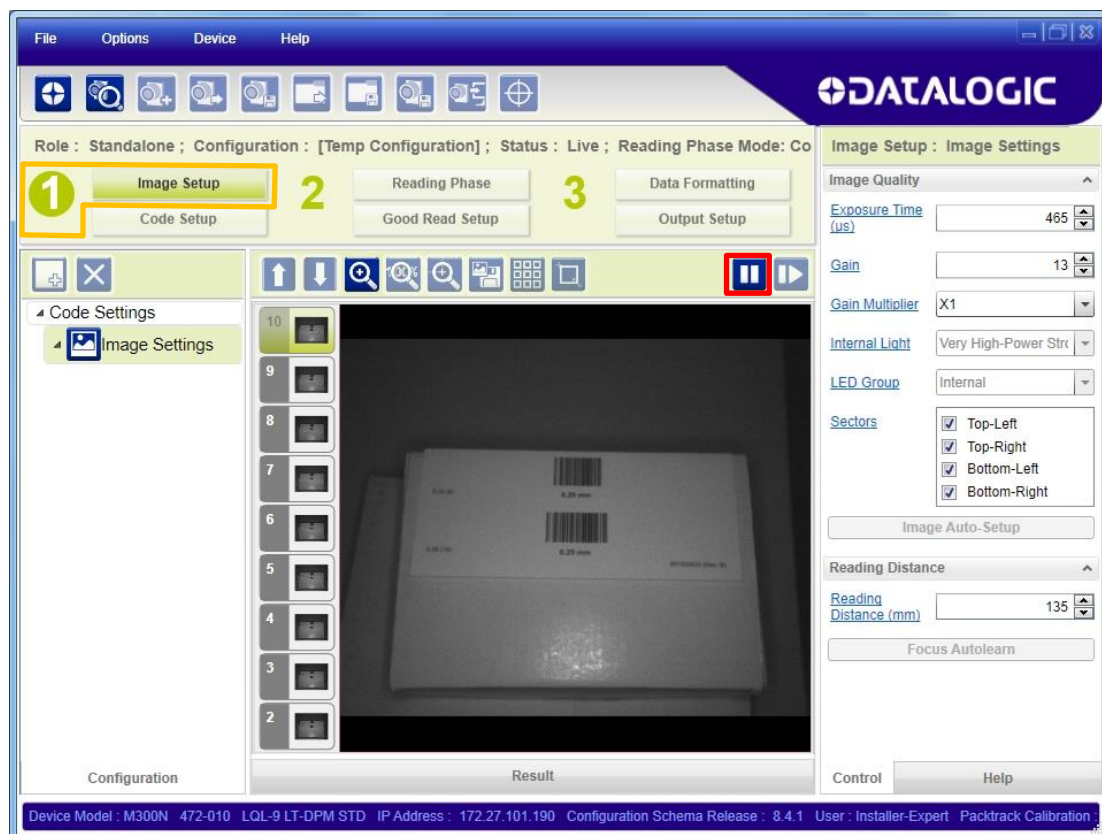
**NOTE:** For Manual Adjustable Focus models go to page 15 then continue with **Code Setup** on page 20.

To begin configuration, the reader must be correctly mounted at the correct reading distance for your application so that its Field of View covers the application reading area.

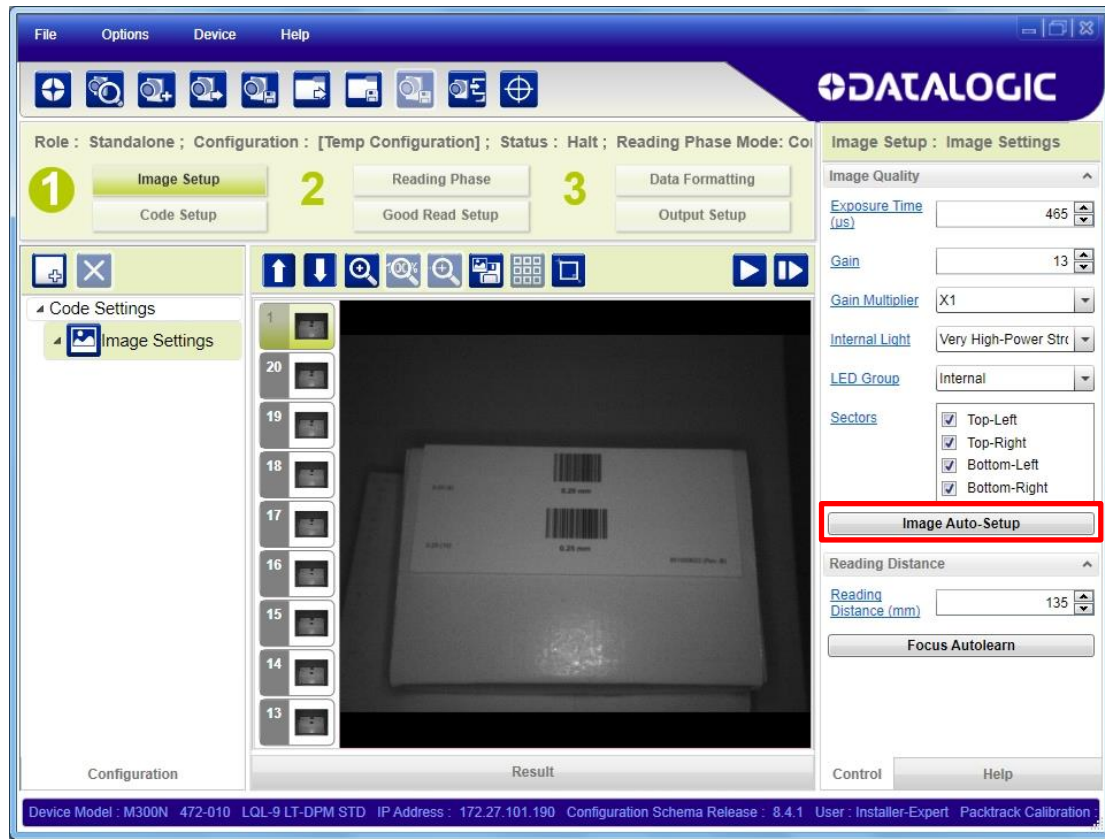
1. From the Task Area select New Configuration – Single Device. The device enters run mode and begins acquiring images.



2. Place the **Grade A Barcode Test Chart** in the reading area. Once positioned, stop image acquisition by clicking on the Pause button.



- Click the Image Auto Setup button to automatically acquire the best exposure time and gain values.



Select the Static or Dynamic Self-Tuning option; Start Autolearn and Apply to the Image Setup.

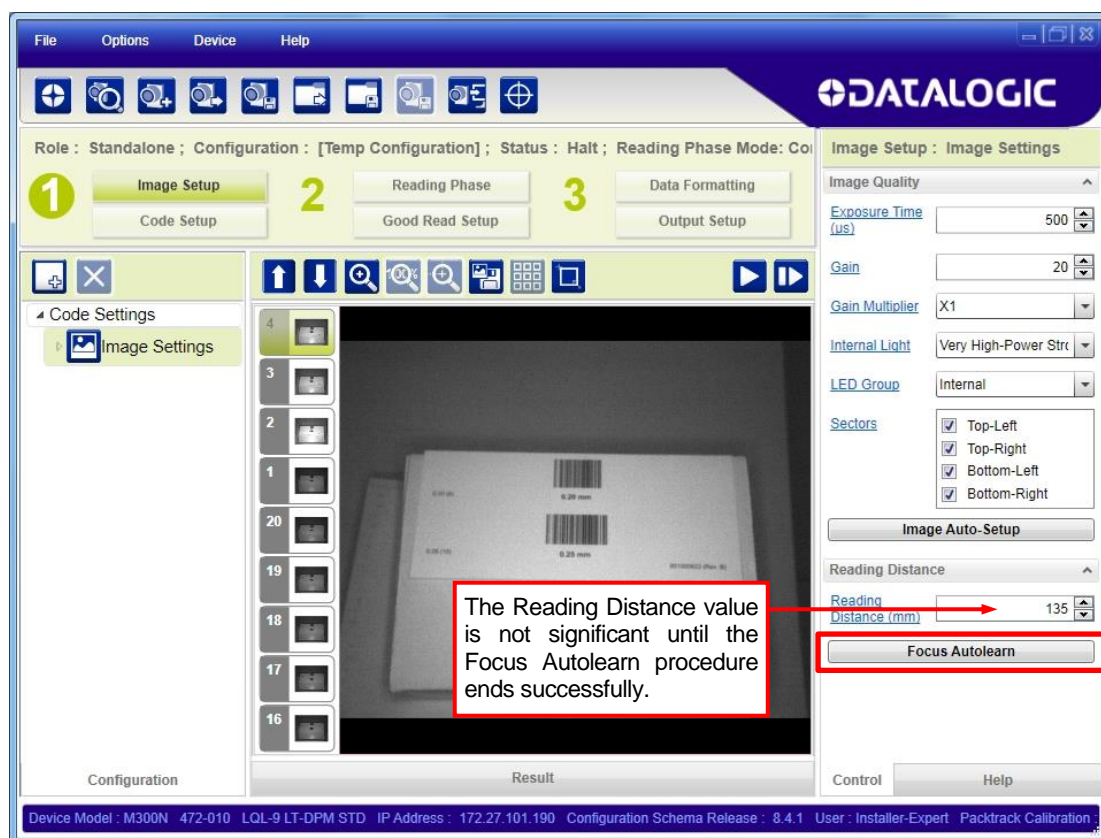


**NOTE:** For applications having multiple lighting or code reading conditions, up to 10 different Image Setups can be configured by adding them with the

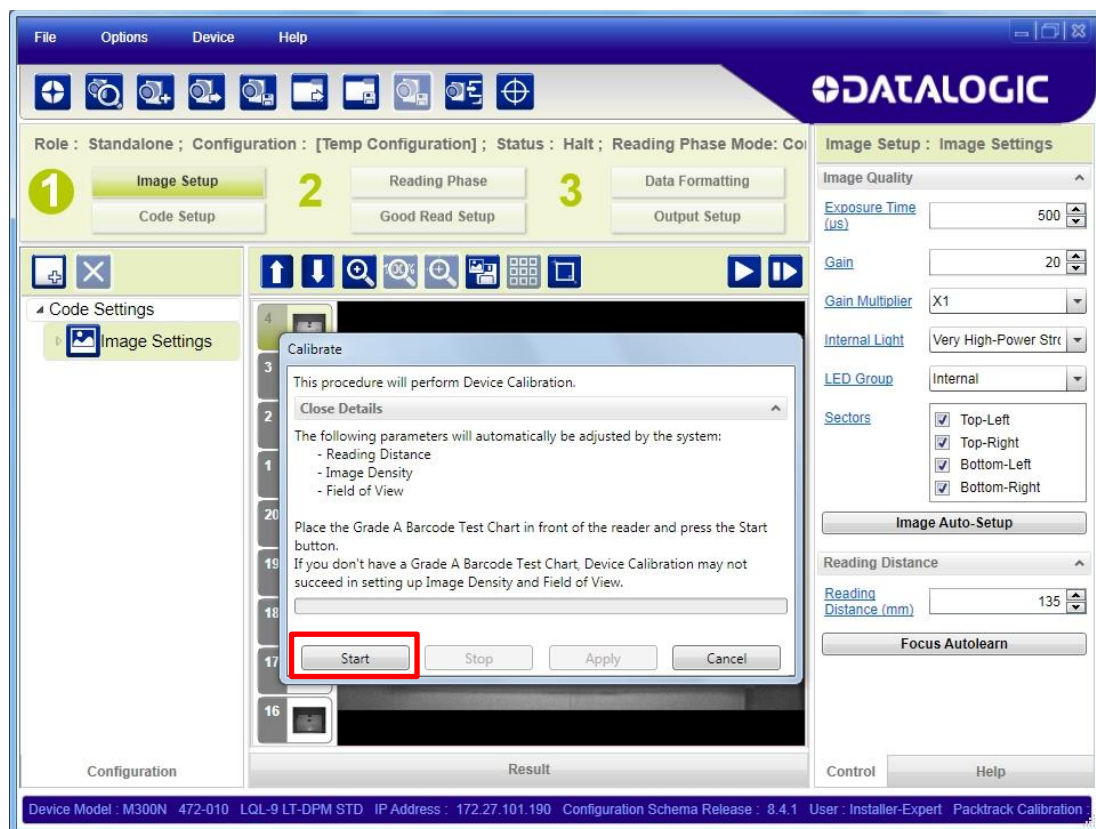


icon.

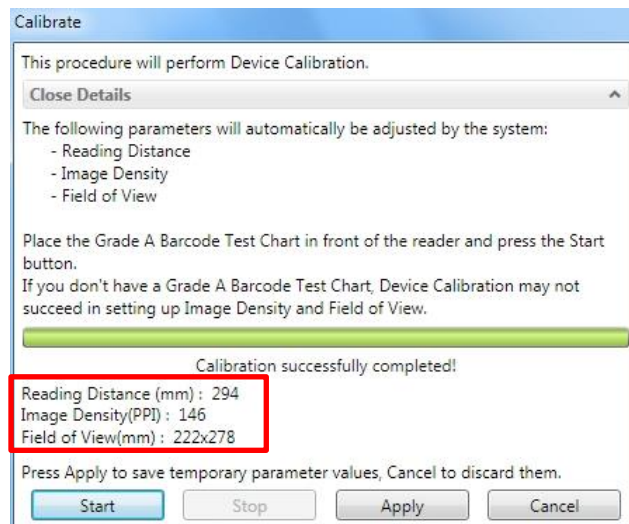
4. Now click on the Focus Autolearn button.



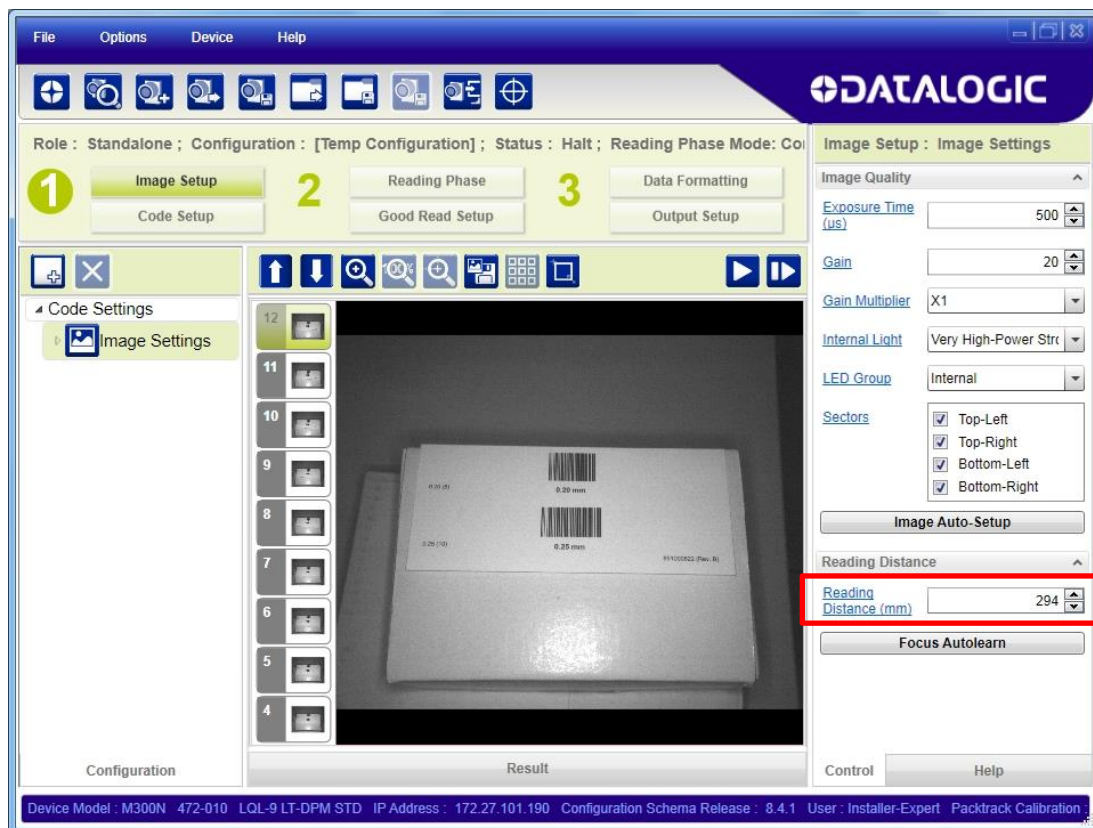
The Calibrate dialog box opens allowing you to start the procedure. Click Start.








At the end of the calibration you can see the new Reading Distance and Image Density (PPI) values as well as the FOV dimensions. Click Apply.



**NOTE:** To enlarge the visual image of the code view, you can click on the zoom image icon  repositioning it on the code.



**NOTE:** At this point it is probably a good idea to save the configuration from temporary memory to permanent memory giving it a specific name.



- Now place an **application specific code** in front of the reader and repeat the Image Auto-Setup.



## Image Setup for Manual Adjustable Focus Models



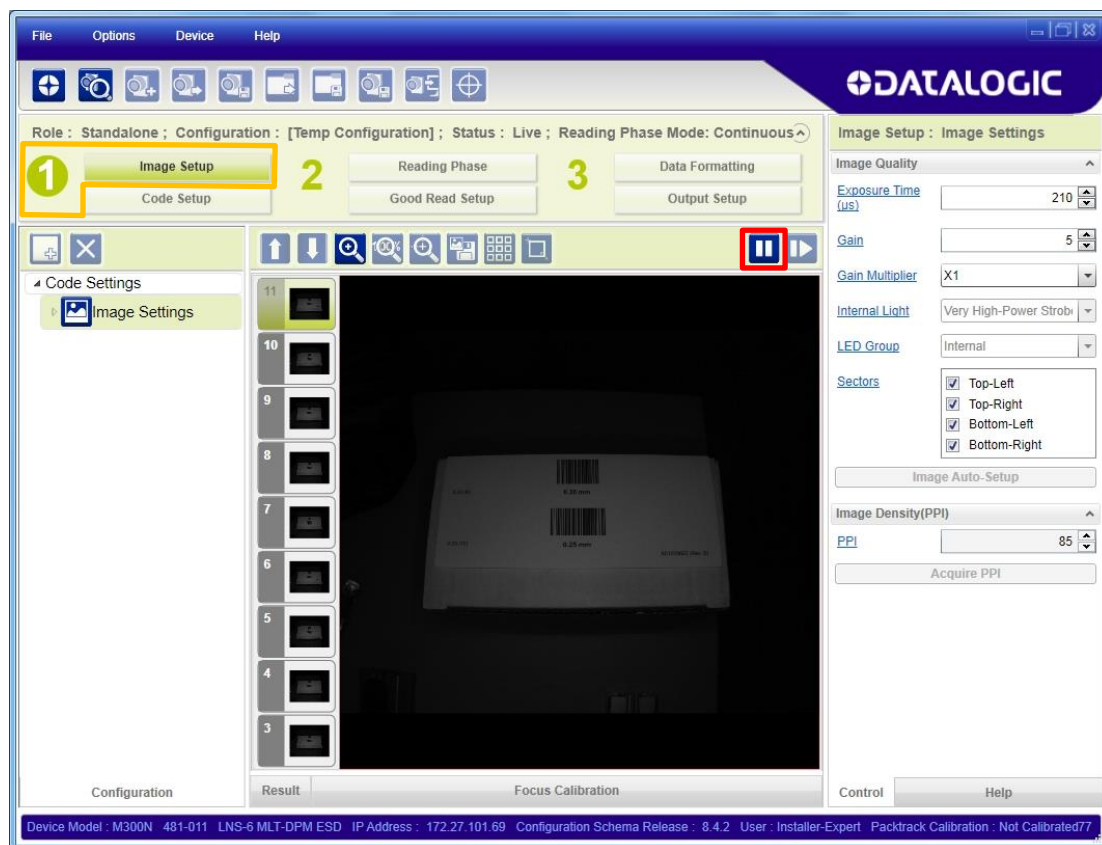
**NOTE:** For Software Adjustable Focus models go to page 10 then continue with **Code Setup** on page 20.

To begin configuration, the reader must be correctly mounted so that its Field of View covers the application reading area.

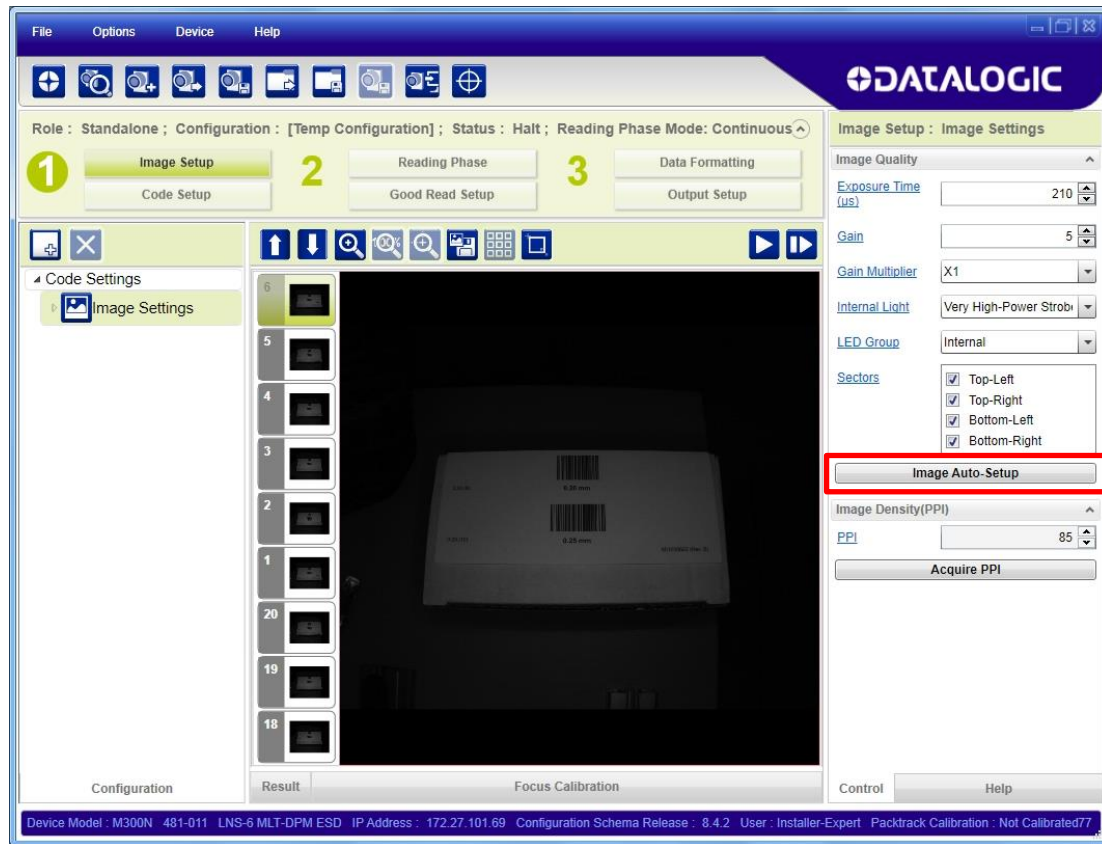
- From the Task Area select New Configuration – Single Device. The device enters run mode and begins acquiring images.



- Place the **Grade A Barcode Test Chart** in the reading area. Once positioned, stop image acquisition by clicking on the Pause button.




- Click the Image Auto Setup button to automatically acquire the best exposure time and gain values.



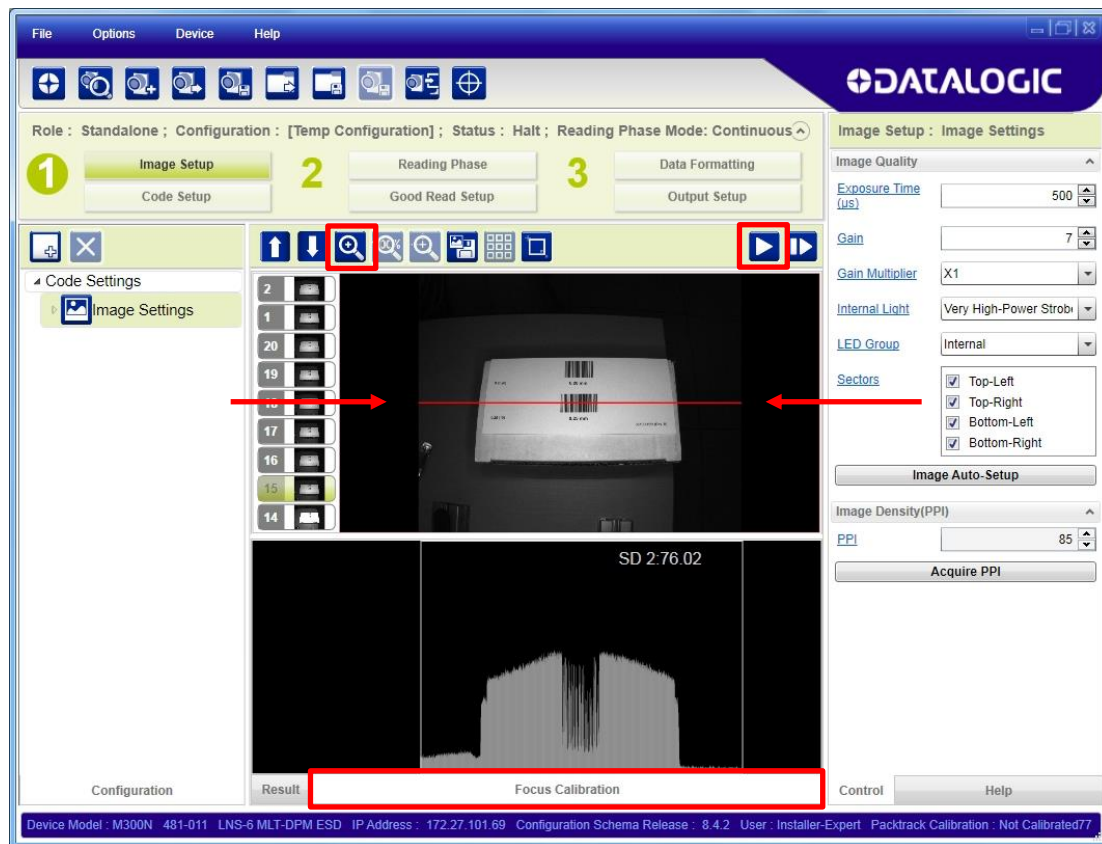
Select the Static or Dynamic Self-Tuning option; Start Autolearn and Apply to the Image Setup.



**NOTE:** For applications having multiple lighting or code reading conditions, up to 10 different Image Setups can be configured by adding them with the  icon.




6. Now click on the Focus Calibration tab at the bottom of the window. The oscilloscope view is shown in the bottom panel and can be used for manual focus adjustment.



The red line in the image panel above the oscilloscope must pass through the code. Click Play to enter run mode and reposition the code.

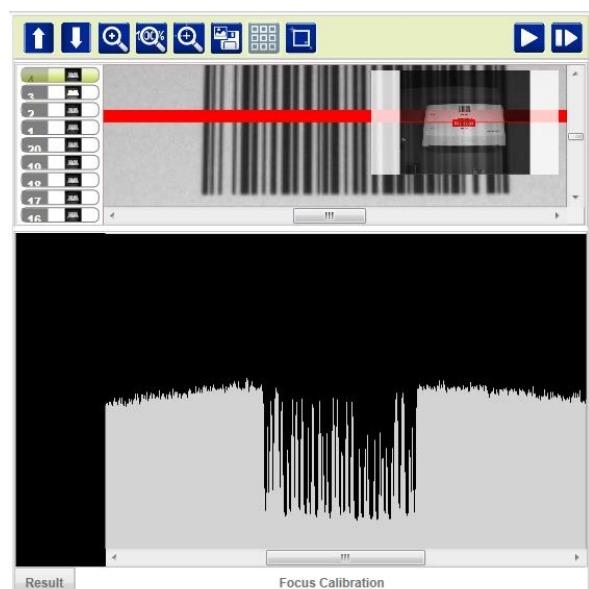


**NOTE:** To enlarge the visual image of the code and the oscilloscope views, you can drag the Focus Calibration window up and click on the zoom image icon  repositioning it on the code.

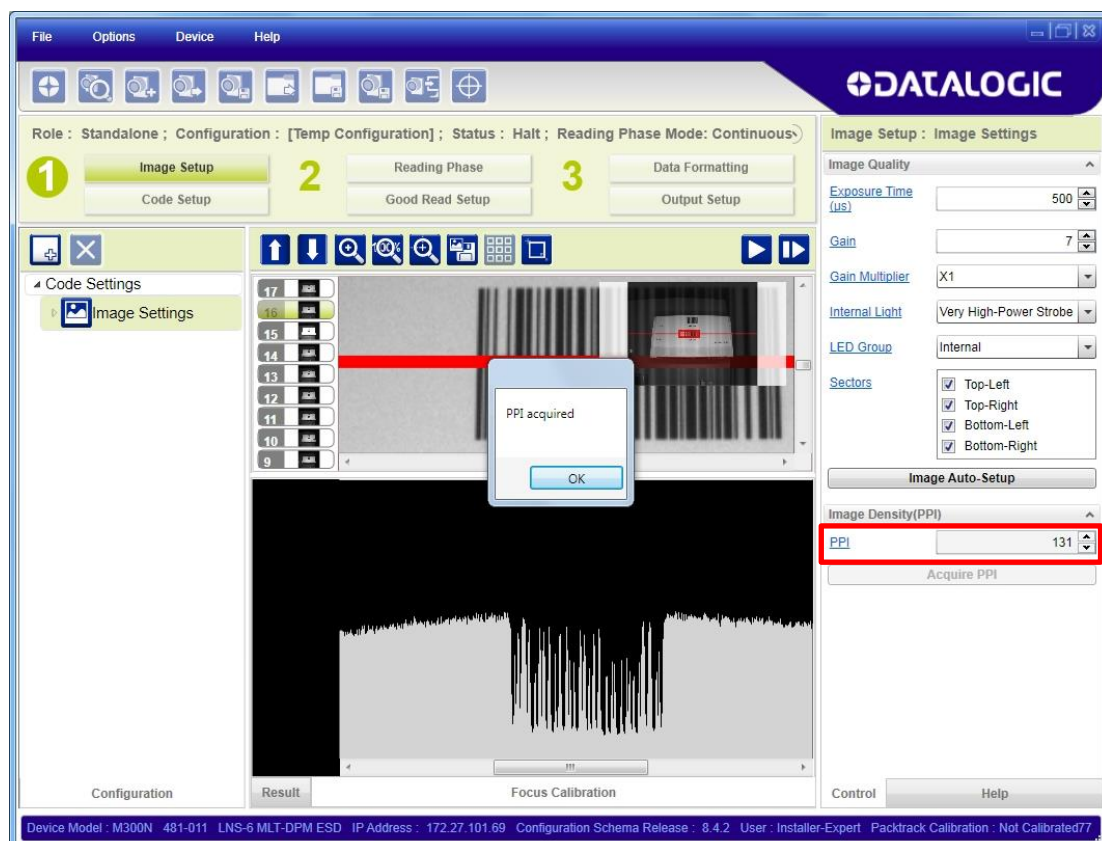
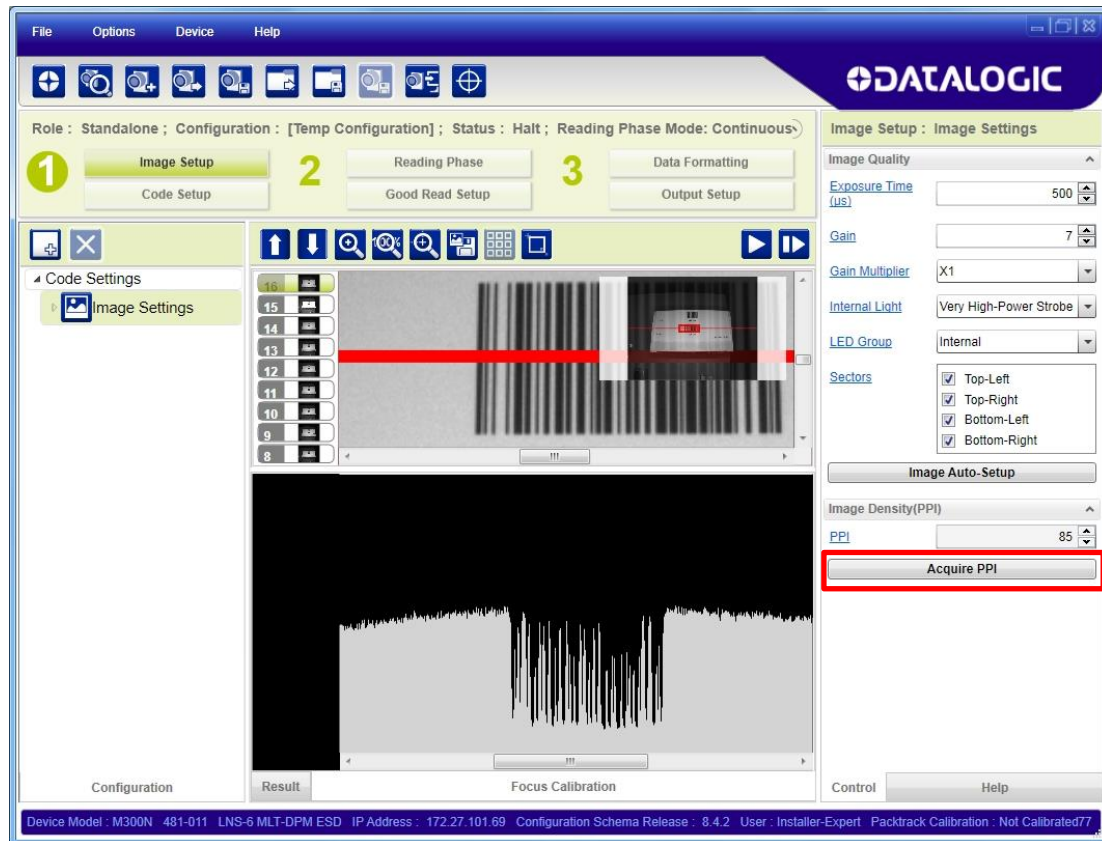
While in run mode, manually adjust the focus until the bars relative to the code in the oscilloscope demonstrate their maximum length (focus).

You can also see the visual focus on the code view.

When focused, click Pause to stop image acquisition.

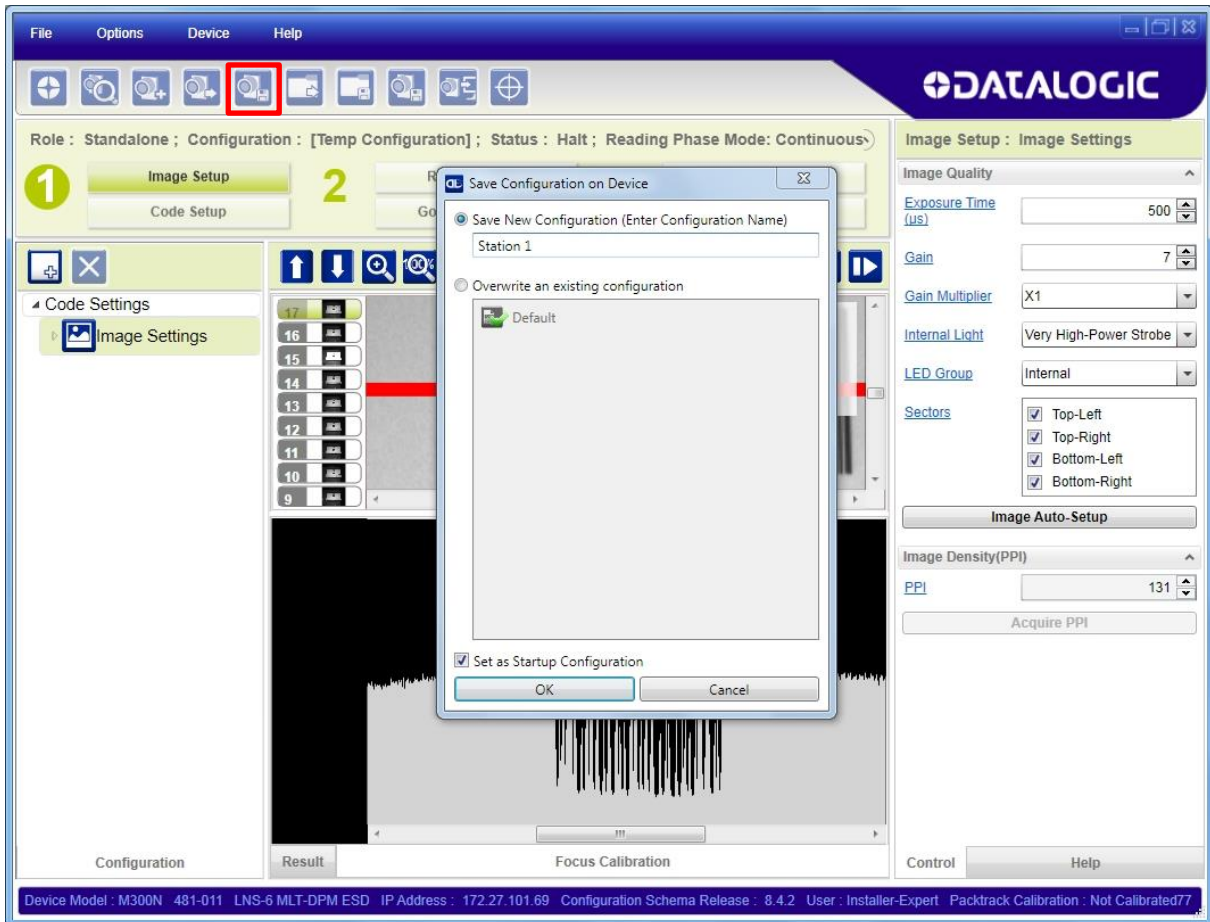


6. Click the **Acquire PPI** button to automatically set Image Density so that Matrix 300N™ will function correctly and to the fullest extent of its capabilities. This procedure is necessary for first time installations, or if the focal distance is changed.





**NOTE:** At this point it is probably a good idea to save the configuration from temporary memory to permanent memory giving it a specific name.

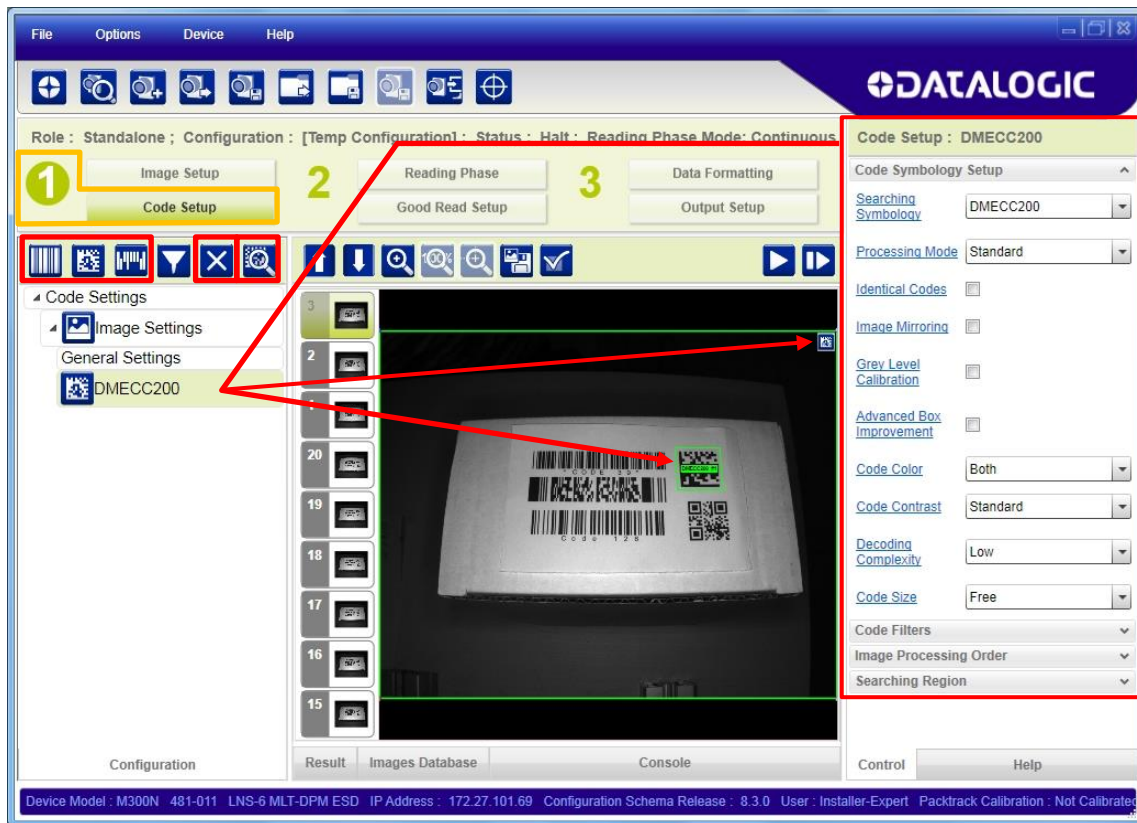


7. Now place **an application specific code** in front of the reader and **only** click the **Image Auto-Setup** button to register any changes in lighting or code surface contrast.


**Do not repeat Focus Calibration or PPI.**


## Code Setup

1. Click on the Code Setup button. By default, the Data Matrix ECC 200 symbology is enabled. If this symbology is among those in your application it will be shown in the image display with its code symbology name and a small green box around it indicating it is decoded.



**NOTE:** The large green box for each symbol indicates the code locator area which by default is equal to the maximum FoV. It can be resized and moved by dragging its borders with the mouse. The code must be found within this area in order to be decoded.

2. Add your application specific codes to the Code Settings by selecting them from the icons over the Configuration Parameters tree area. If the Data Matrix symbology is not used, then delete it from the Code Settings with the  icon.

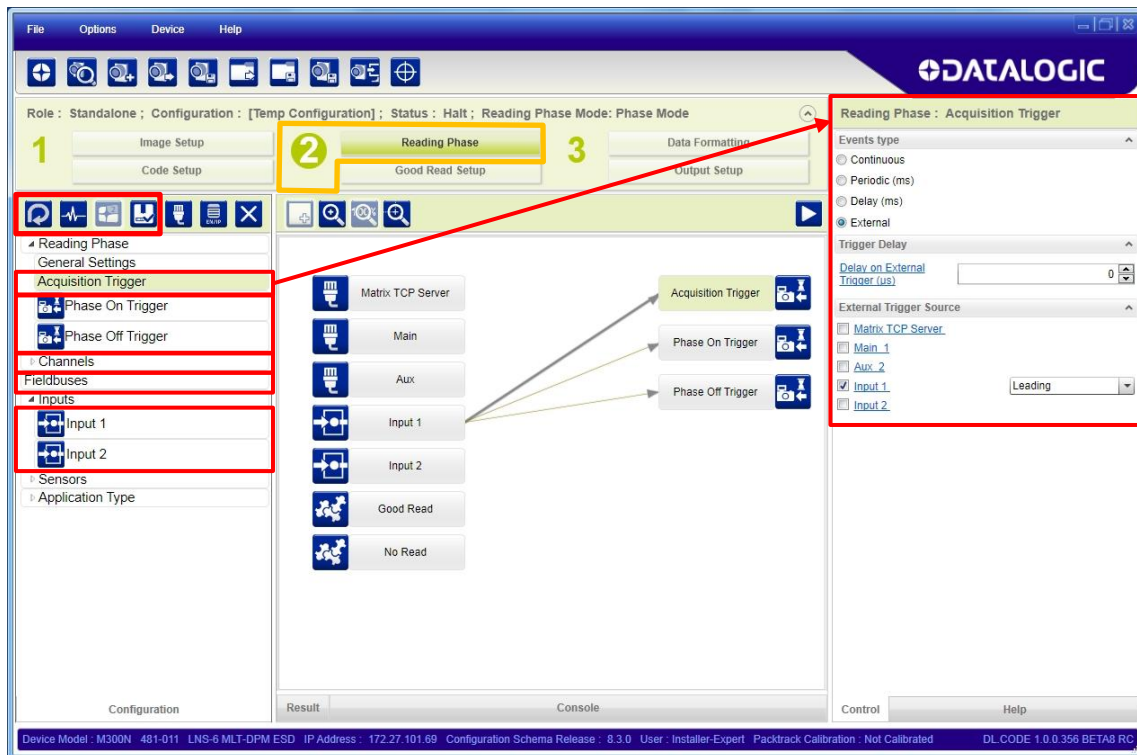
If you don't know the code type, you can use the Code Autolearn feature by clicking on the  icon.<sup>2</sup>

3. For each code symbology set the relative parameters according to your application.

<sup>2</sup> The Code Autolearn procedure will not recognize the following symbologies: Pharmacode, MSI, Standard 2 of 5, Matrix 2 of 5.

## Reading Phase

1. Select your application specific Operating Mode from the icons over the Configuration Parameters tree area: Continuous, One Shot, Phase Mode or PackTrack.



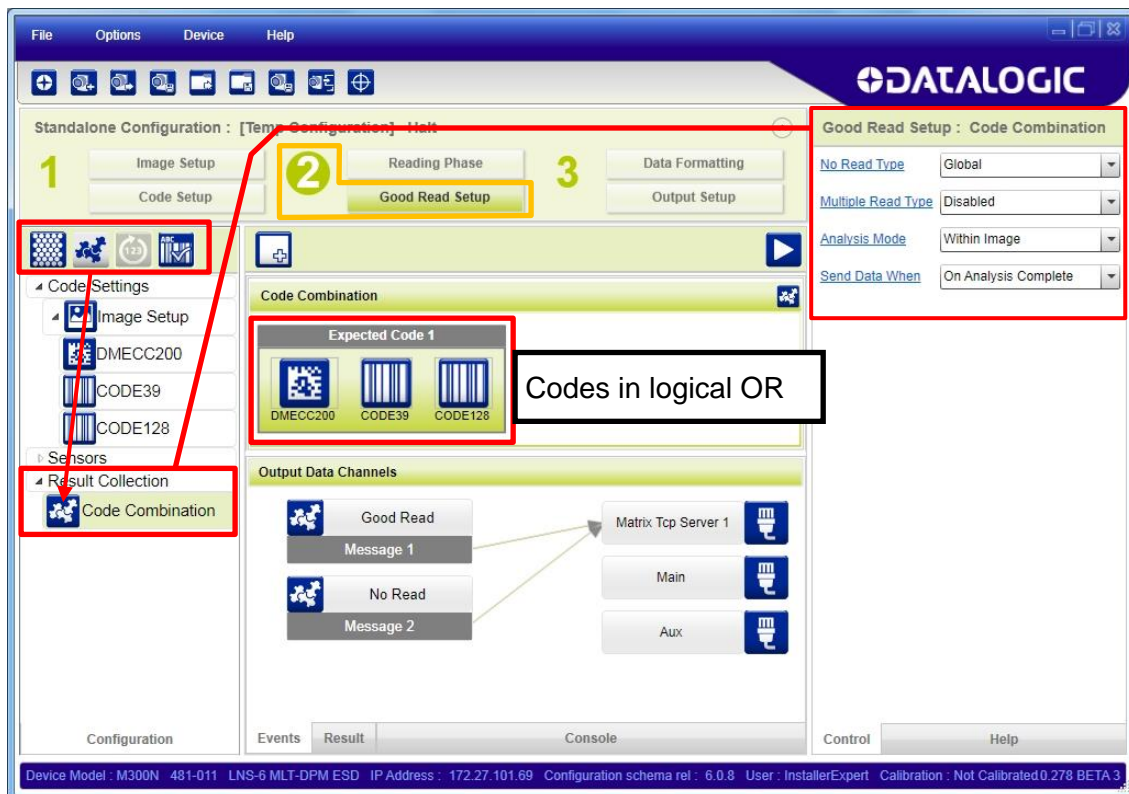
2. Configure the relative Operating Mode parameters from the Reading Phase parameters panel. Different groups will appear in the panel depending on the selected icons over the Configuration Parameters tree area.




## Good Read Setup

1. Select your specific data collection type from the icons over the Configuration Parameters tree area: Code Collection, Code Combination, Presentation or Match Code. Not all data collection types are available for all Operating Modes; for example PackTrack Operating Mode only supports Code Combination. Incompatible data collection types will be shown in grey and cannot be selected.

The following example shows Code Combination. By default, the Expected Codes are in logical OR, which means that any single decoded code will produce a Good Read condition independent from the other codes being decoded or not.



2. If all codes are required to be decoded to produce a Good Read condition, then they need to be combined in logical AND. To do this, create a new Expected Code box using the  icon. Then drag the Code icon from one box to the other.

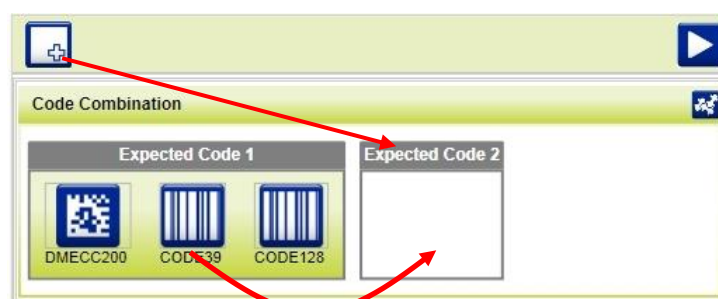
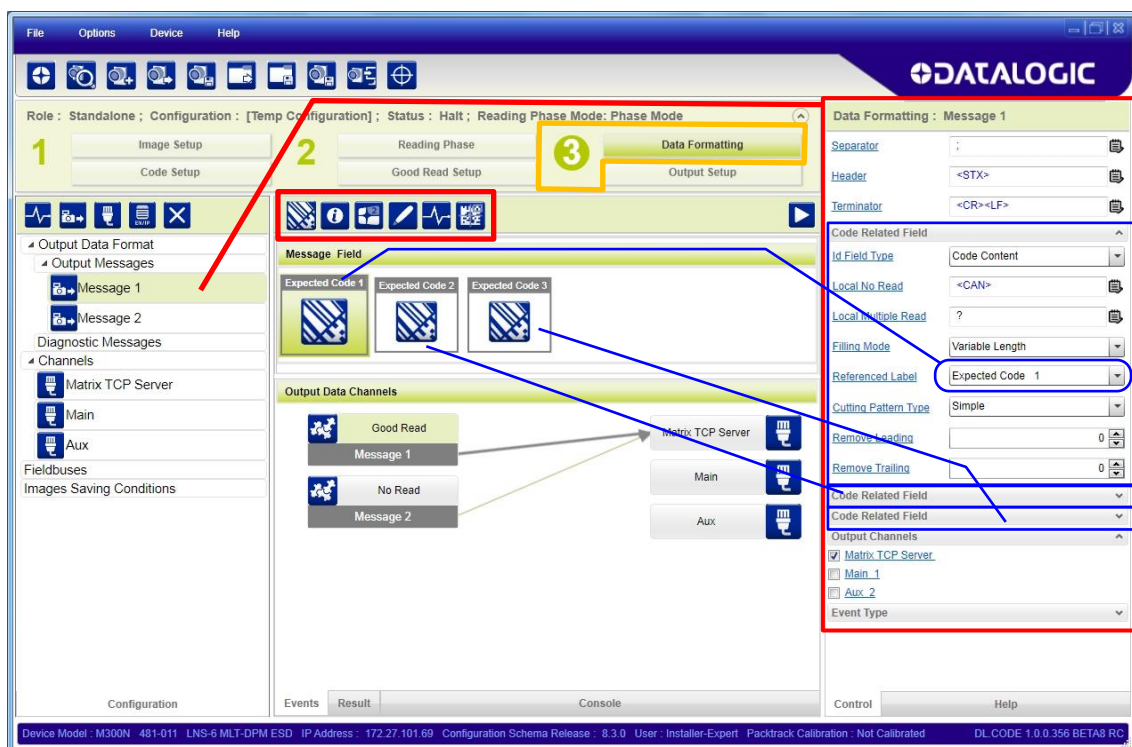




Figure 11 Codes in Logical AND

## Data Formatting

1. Configure your application specific Data Formatting Message(s) from the Configuration Parameters tree area: Message 1, Message 2, etc.



You can add fields to the output message by clicking on the icons above the Message Field area. They will be appended to the message. You can drag them to position them between other fields in the message so that the output message is ordered according to your application requirements.

Each field has its own relative configuration parameters in the parameters panel.

## Output Setup

1. Configure your application specific Digital Output(s) and Green/Red Spots (if used) from the Configuration Parameters tree area: Output 1, Output 2, etc.



**NOTE:** Save the configuration from temporary memory to permanent memory, overwriting the previously saved 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.



Figure 12 – 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:

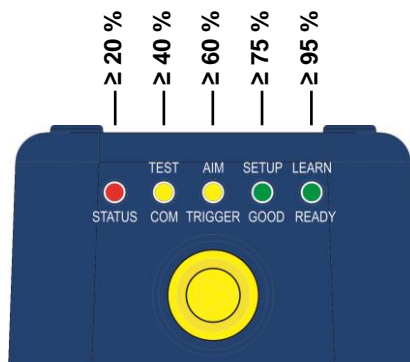


Figure 13 – Test Function Bar Graph

In case of No Read condition, only the STATUS LED is on and blinks.

## **ADVANCED READER CONFIGURATION**

For further details on advanced product configuration, refer to the DL.CODE™ User's Guide available in the DL.CODE™ Help menu.

### **Host Mode Programming**

The reader can also be configured from a host computer using the Host Mode programming procedure.

## 2 INTRODUCTION

---

### 2.1 PRODUCT DESCRIPTION

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

Matrix 300N™ 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 300N™ the ideal product for industrial applications.

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

#### Automotive

- DPM (Direct Part Marked) Reading
- 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 300N™. 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 DL.CODE™, provided on the DL.CODE™ mini-DVD (downloaded ISO file or mini-DVD accessory).

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 DL.CODE™ which includes visual feedback from the reader. This allows verification of 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 DL.CODE™.

## 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 Lens models
- 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
- Image Cropping 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
- Visual Feedback to verify exact code positioning in the Field of View and to maximize the reading performance
- Windows-based DL.CODE™ software to configure the reader parameters via PC 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
- Image saving and storage with buffering capability
- Diagnostic software tools

**Flexible Solution**

- Software Focused 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™)
- 2 General purpose optocoupled Inputs
- 3 General purpose optocoupled Outputs (when using the CBX connection box)

**Versatility**

- Excellent reading performance on Direct Part Marked (DPM) symbols
- Code Quality Metrics according to ISO/IEC 16022, ISO/IEC 18004, ISO/IEC 15416 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 M12 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, 8). A standard M12 D-Coded (IP67) Ethernet connector is also present (Figure A, 9).

## 2.2 INDICATORS AND KEYPAD BUTTON

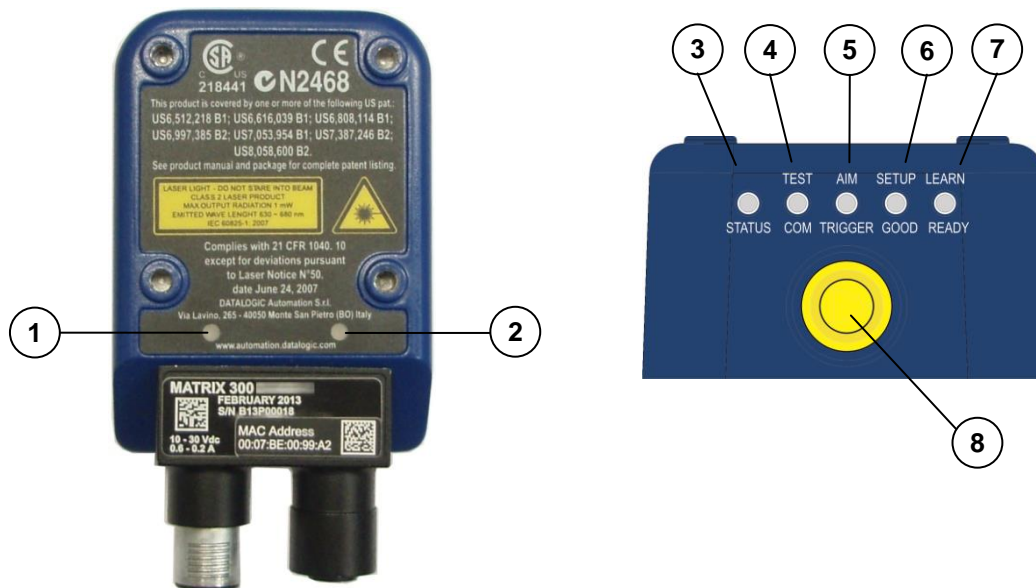


Figure 14 - Indicators

The following LED indicators are located on the reader:

<b>PWR</b>	blue LED indicates that the reader is connected to the power supply (Figure 14, 1)
<b>NET</b>	yellow LED indicates connection to the on-board Ethernet network (Figure 14, 2)



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

<b>STATUS</b>	red LED indicates a NO READ result (Figure 14, 3)
<b>COM</b>	yellow LED indicates active communication on the main serial port * (Figure 14, 4)
<b>TRIGGER</b>	yellow LED indicates the status of the reading phase (Figure 14, 5)
<b>GOOD</b>	green LED confirms successful reading (Figure 14, 6)
<b>READY</b>	green LED indicates that the reader is ready to operate (Figure 14, 7)

\* 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. 2.5.

The keypad button (Figure 14, 8), is software programmable. By default it starts the X-PRESS™ interface for quick installation without using a PC (see chp. 1).

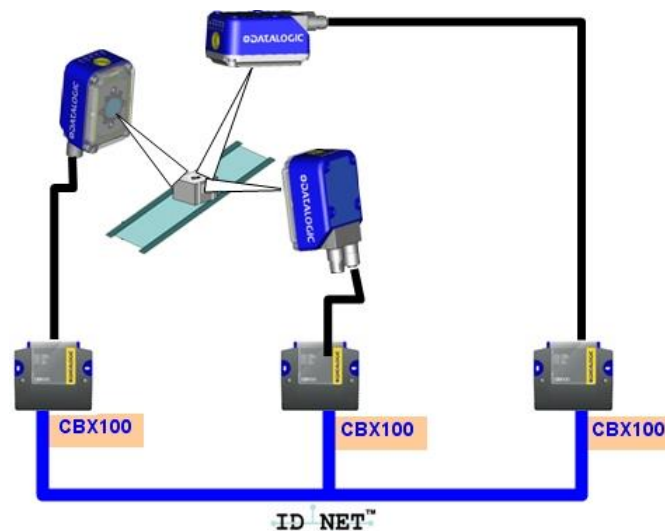
## 2.3 ID-NET™

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 configuration is available:

- **ID-NET™ 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.

### 2.3.1 How To Setup/Configure the Reader Network

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

Multi Device configurations (also called Master/Slave configurations), are designed to collect data from several devices connected together in an ID-NET™ network and send data output to the Host system.



**NOTE:** DL.CODE™ only supports Master/Slave SYNCHRONIZED ID-NET™ network configurations.

The general procedure (also detailed in the following paragraphs) is to:

1. Mount all the readers mechanically (refer to par. 3.2 and 3.3) and electrically (refer to par. 4.3) with factory default settings (Stand Alone).

In order to automatically recognize the ID-NET™ Slaves, all devices must be physically installed and electrically connected (including ID-NET™ network wiring). Run DL.CODE™ and verify that all the devices are discovered and shown in the device list area.

2. Connect to the designated Master device in DL.CODE and open New Configuration - Multi Device. You will be prompted to change the device to Master. Click Yes. The device will be reset. See par. 2.3.2.
3. The Slave units will automatically be recognized. Then **Apply** the changes.
4. Select Phase Mode or PackTrack Configuration and complete the configuration of all the application parameters (including Image Setup) and save them to the Master with the option to **Clone Master configuration on Slaves**.
5. Connect to each Slave reader via Ethernet and set the photometric parameters (**Image Setup**) of each Slave device and save them, overwriting the configuration previously saved by the Master. See par. 2.3.3.

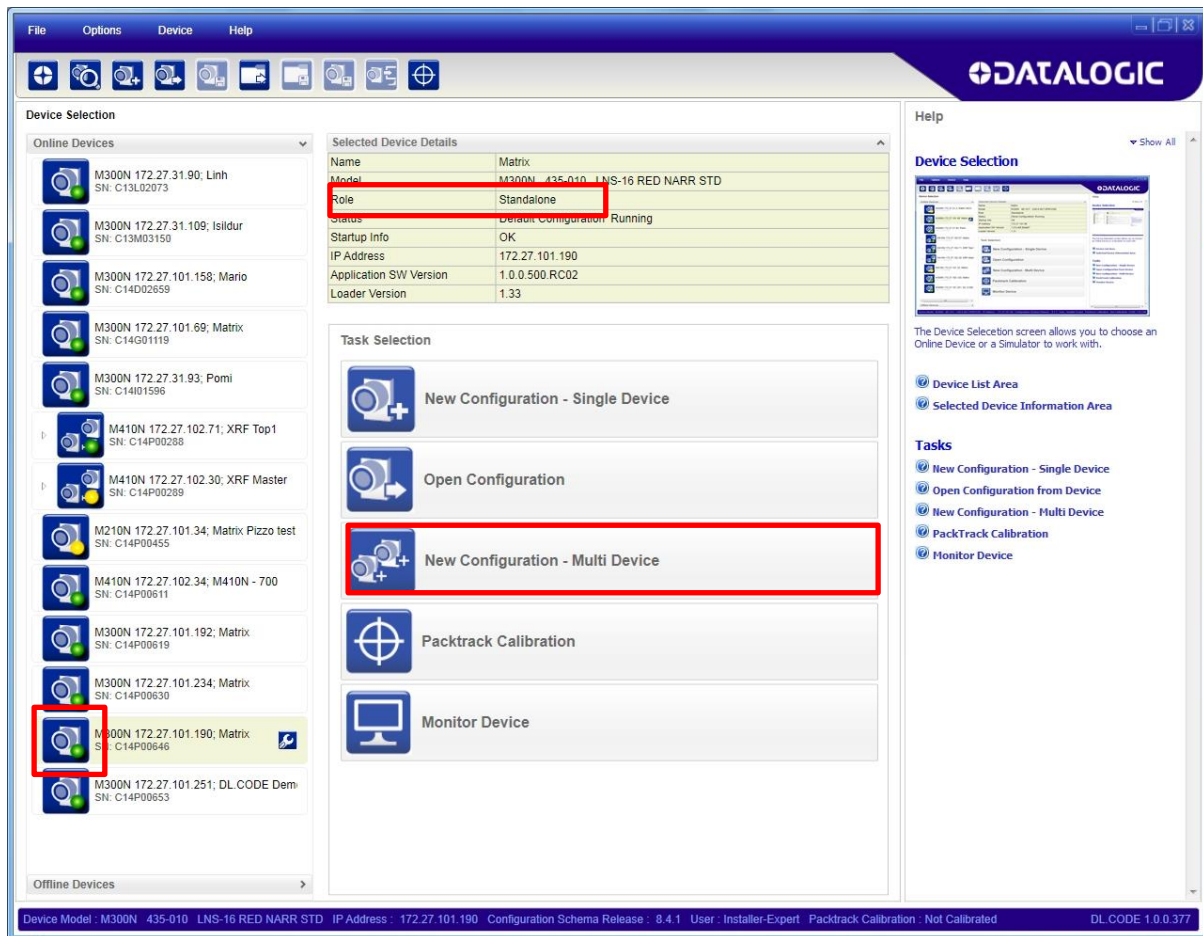


**NOTE:** When the Slaves are not positioned on the same plane or side as the Master, you must configure the Slave device photometric parameters (Image Setup) in DL.CODE™ through its Ethernet connection. If Slave devices do not have an individual Ethernet connection you must temporarily (manually) connect them one by one to perform Image Setup.

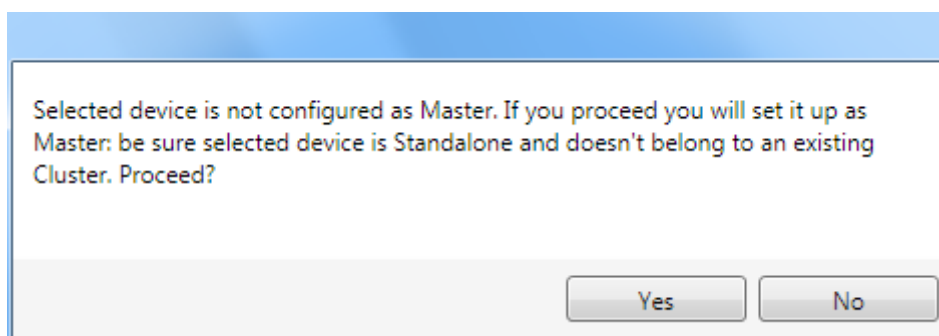
6. Verify/Test network performance. See par. 2.3.4.
7. Perform the **Backup Current Cluster Configuration** procedure. See par. 2.4.

## 2.3.2 Master Configuration

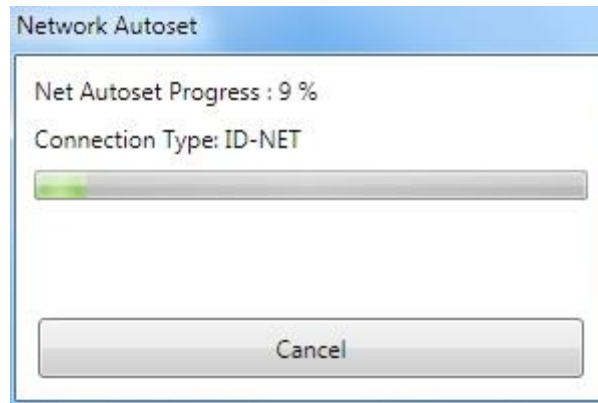
First start with the desired device to assign as ID-NET™ Master (current default setting is Standalone).



Select New Configuration – Multi Device from the Task area.

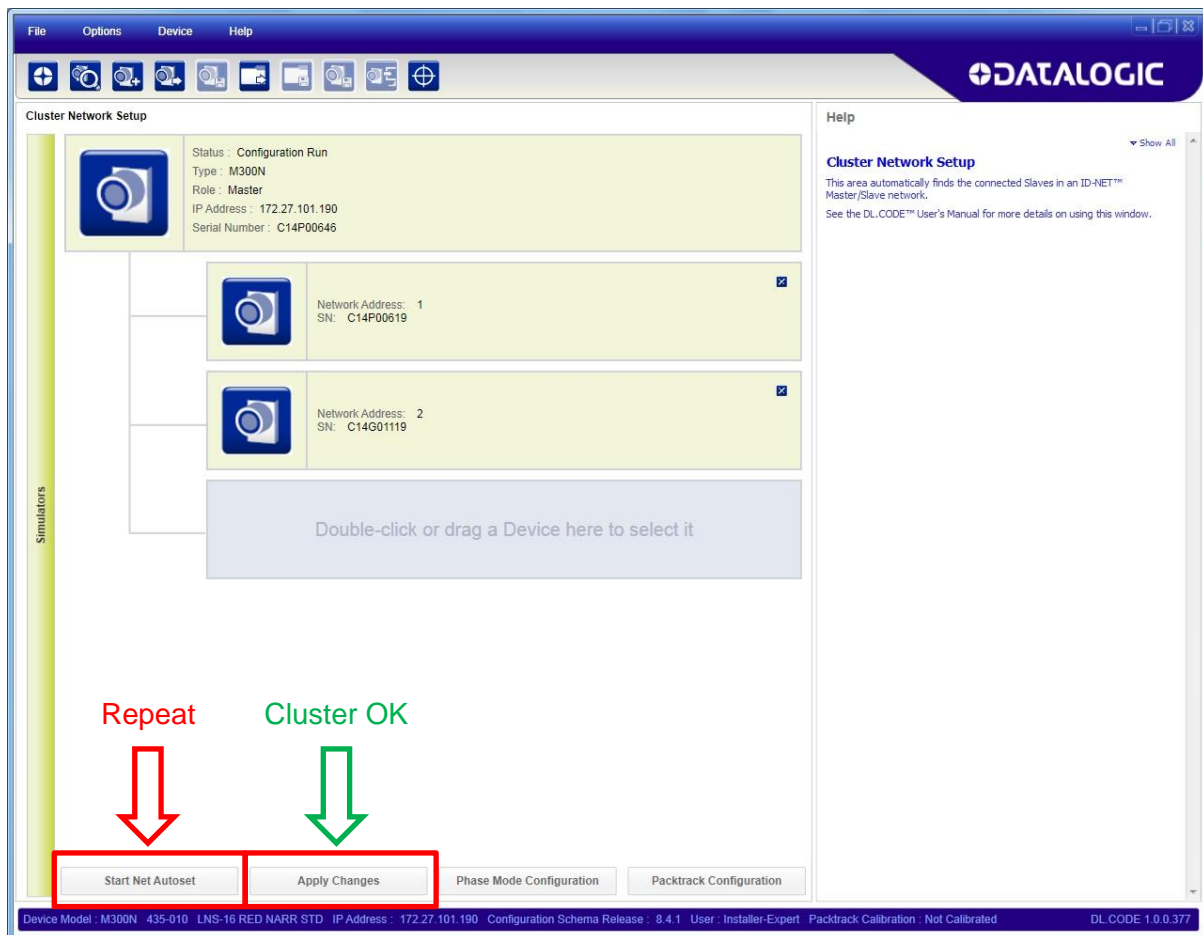


The Net Autoset feature automatically starts to find Slave devices connected to the ID-NET™ network of the Master.



When finished, if all the Slaves have been correctly recognized click on the **Apply Changes** button.

If not, verify all device connections and power, then repeat the operation by clicking on the Start Net Autoset button.

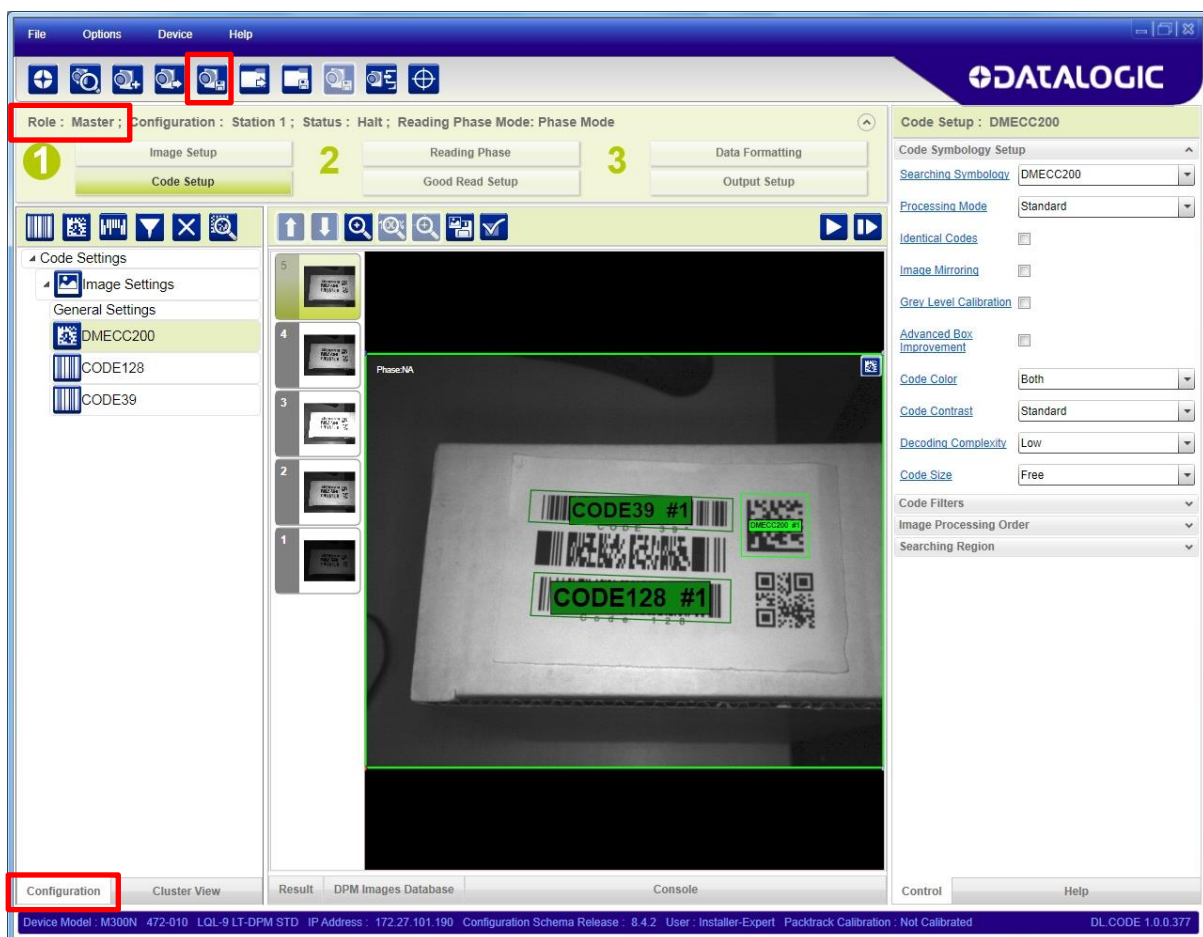




Click Yes to store the Slave table on the Master.

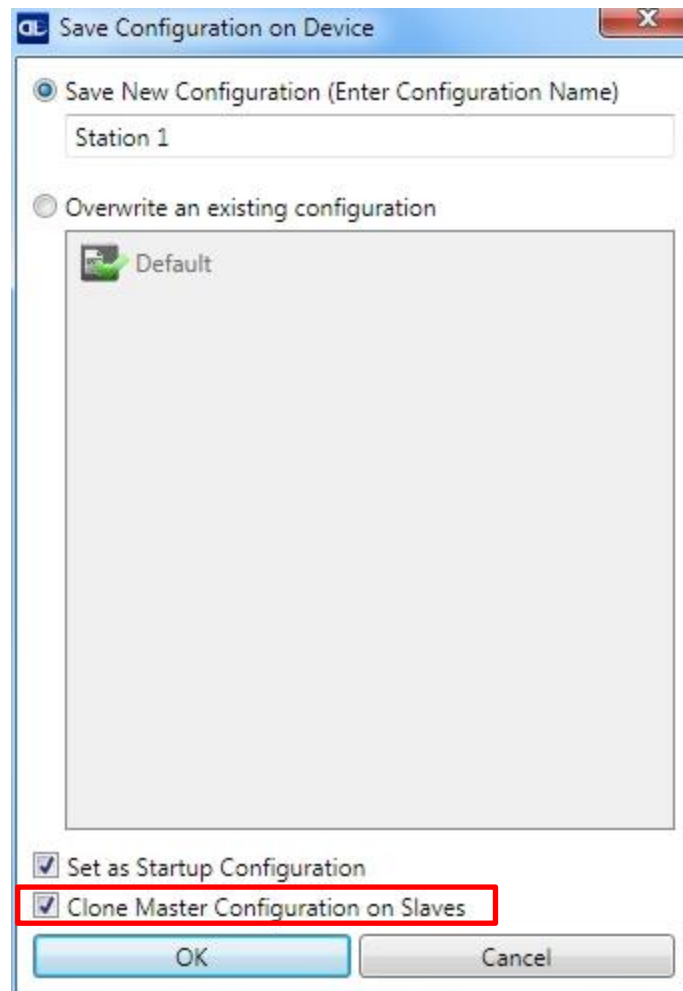
Depending on the application type, click on either the **Phase Mode Configuration** or the **PackTrack Configuration** button to start the configuration. This will perform a pre-configuration of the operating mode. Wait until the Master configuration page is displayed.

You can now complete the configuration of the Master including all the application specific parameters.



Now save the new configuration (job) to the Master Device using a name relative to the Application (i.e. Station 1) making sure to check the **Clone Master Configuration on Slaves**.

This will save a configuration with the same name and content on each device (Master and all Slaves).





### 2.3.3 Slave Configuration

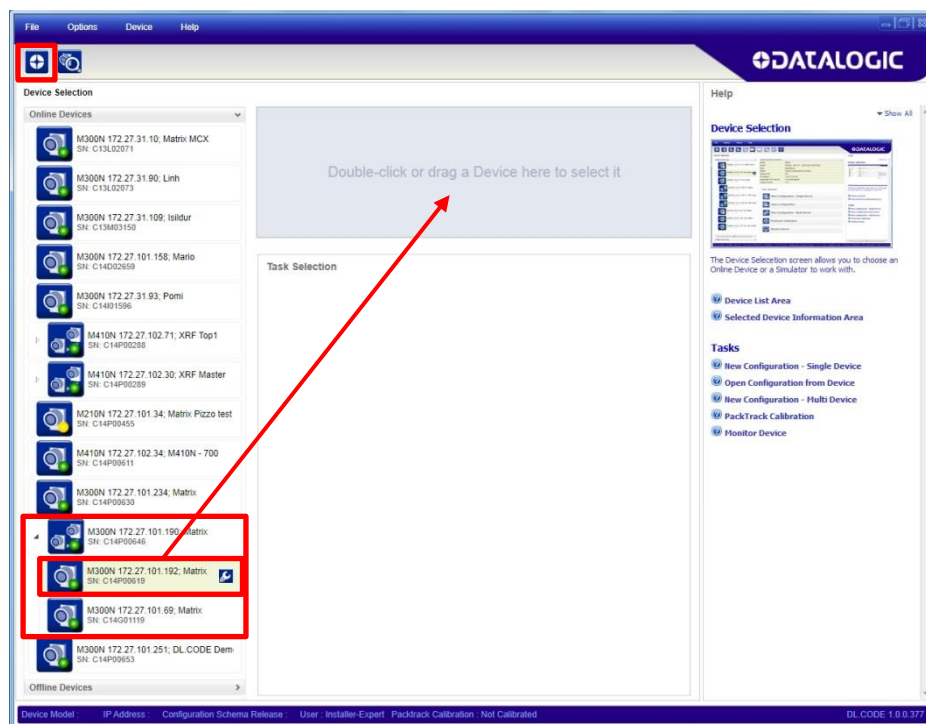


**NOTE:** When the Slaves are not positioned on the same plane or side as the Master, you must configure the Slave device photometric parameters (Image Setup) in DL.CODE™ through its Ethernet connection. If Slave devices do not have an individual Ethernet connection you must temporarily (manually) connect them one by one to perform Image Setup.

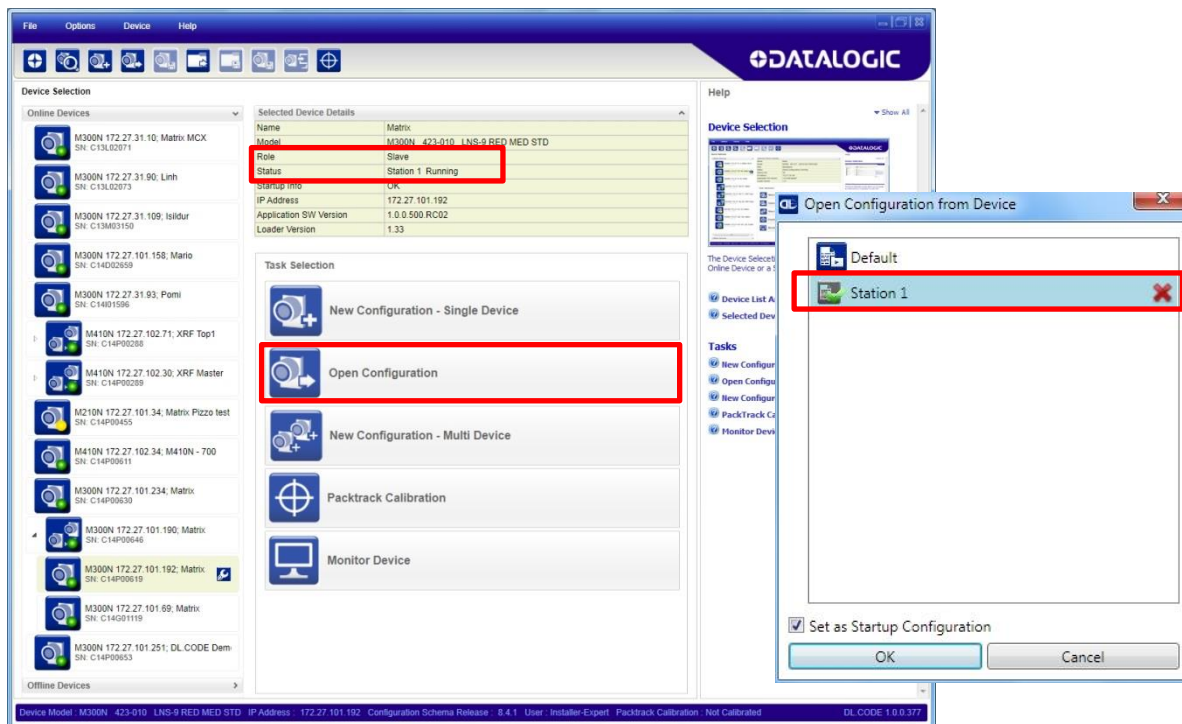
Now that the ID-NET™ network is configured, the Slave specific parameters need to be set. These depend on the application and include the following:

- photometric parameters (Image Setup step)
- Acquisition Trigger Delays necessary to avoid lighting interference between adjacent or oppositely positioned readers (Reading Phase step)
- Images Saving if used (Data Formatting step)
- Encoder Sensor: if used, (for all Slaves, the Encoder Type must be set to **Internal**)

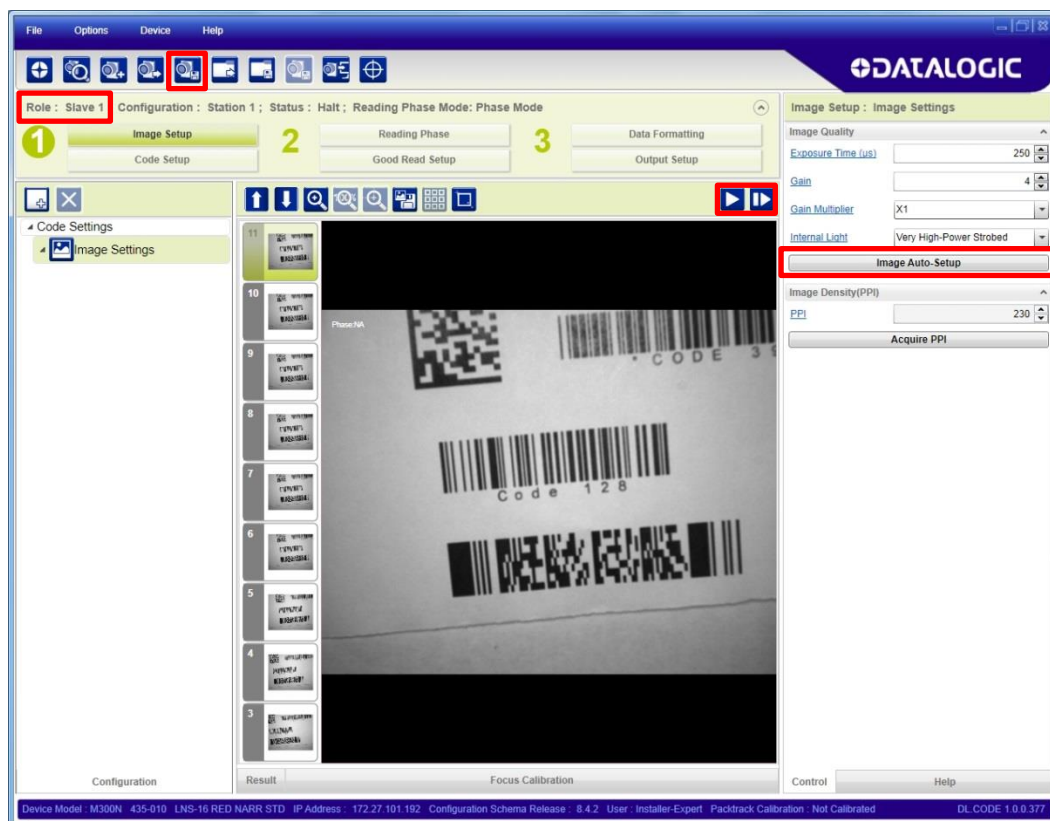
To do this, click on the Getting started icon and open the Master branch to see the connected Slaves. Each Slave can be connected to through its Ethernet interface.




Open the configuration named “Station 1” from the Slave reader.



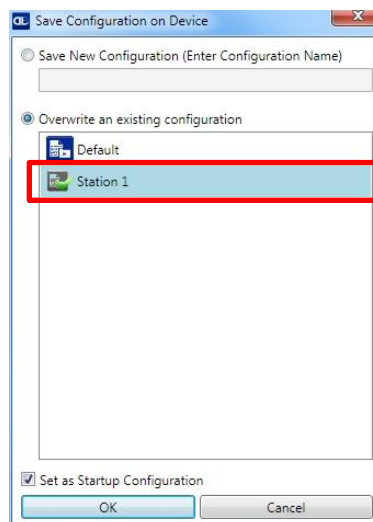
When the configuration opens, pause run mode and execute the Image Auto-Setup feature to adjust the photometry of the Slave reader.



Verify the focus and decoding with the capture image  and Code Setup page.

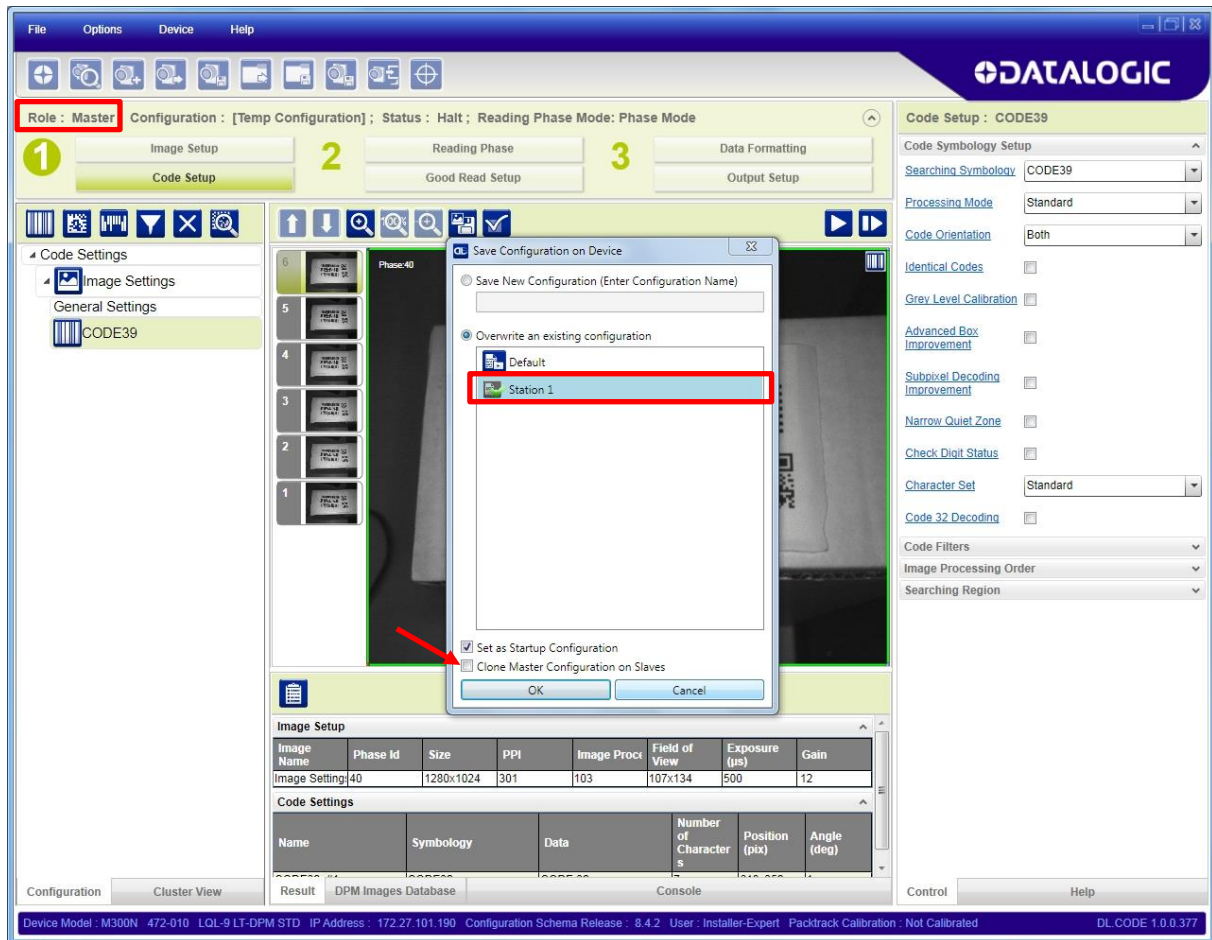


Now save the configuration to the Slave device by overwriting its existing one (i.e. Station 1).



Repeat this procedure for each Slave device until the entire network is configured.

Return to the Master device and open the configuration (Station 1). **Now Save on device overwriting Station 1 with Clone Master Configuration on Slaves DISABLED!**. This step will Save all Master and Slave jobs maintaining the individual settings.

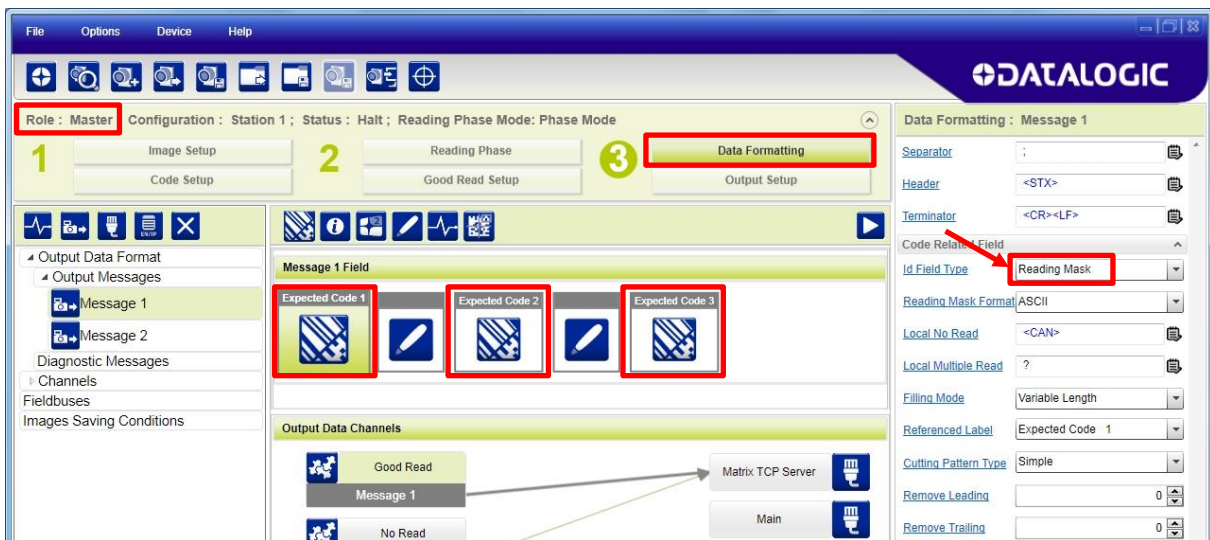


### 2.3.4 Verify Master/Slave Setup

From the Master Station 1 configuration, run the application and monitor the output data from the DL.CODE™ Console or a configured channel terminal.

You can also temporarily apply the **Reading Mask** field in place of each Code Content field to verify if all devices are reading. To do this:

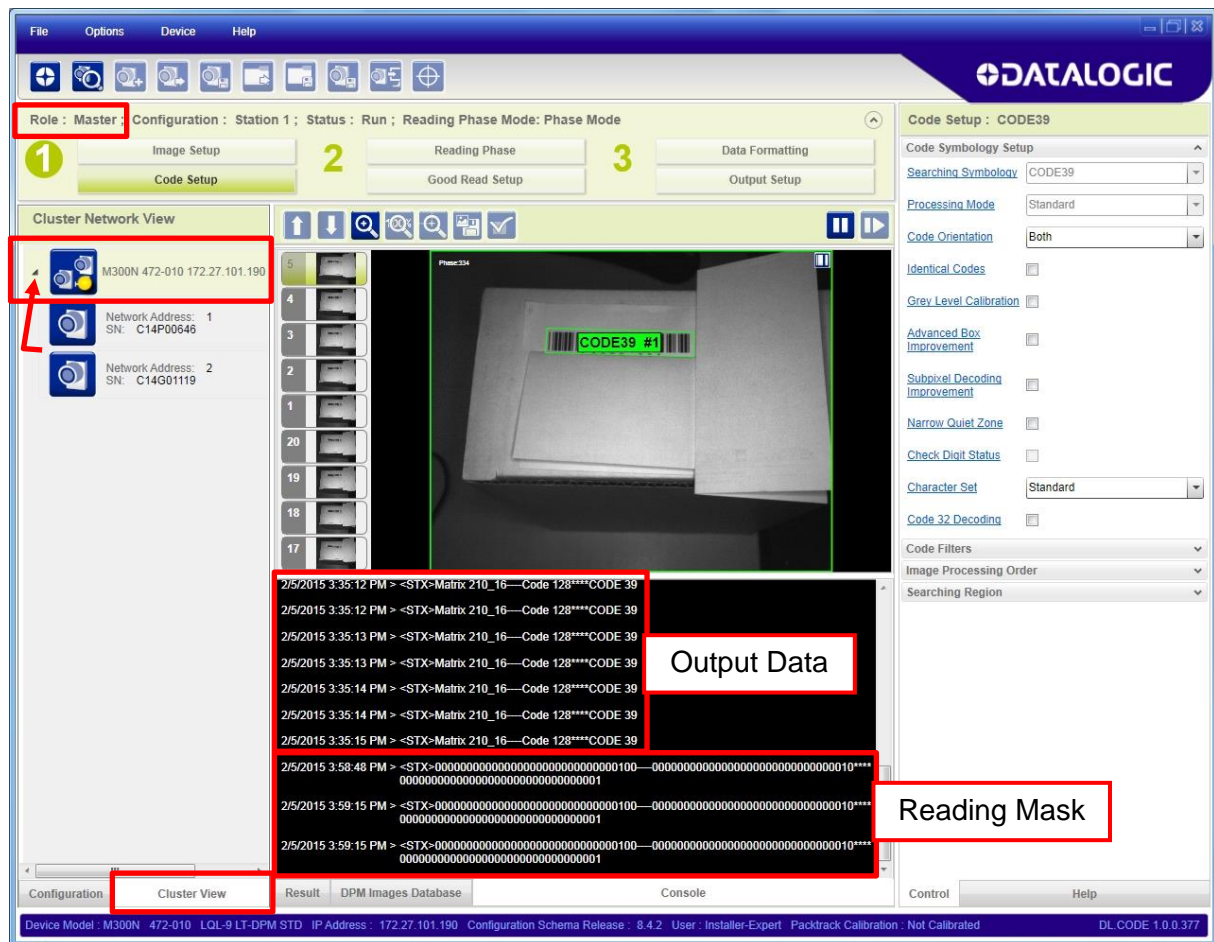
- a) from the Master, change each Expected Code field from Code Content to Reading Mask.



- b) **Save on device overwriting Station 1 with Clone Master Configuration on Slaves DISABLED!**



Run the application and monitor the output data from the DL.CODE™ Console or a configured channel terminal.



The Reading Mask shows which device reads which Expected Code. The mask is composed of a fixed 32-character string (0=No Read or 1=Read) representing the 32 possible readers in an ID-NET™ network. The Master is the last character in the string (first character to the right). The Slaves are shown in order from right to left (1 to 31).

**Example:** Master + Slave 2 = 00000000000000000000000000000000101

After verifying correct functioning of the reading devices, return the Expected Code fields from Reading Mask to Code Content and **Save on device overwriting Station 1 with Clone Master Configuration on Slaves DISABLED!** again.

To view the connected Slaves configurations, click on the Cluster View tab at the bottom of the screen and open the Master branch. Select any slave and then click The Configuration tab at the bottom of the screen. By selecting the various configuration steps above you can visualize the slave configuration.



## 2.4 BACKUP AND RESTORE THROUGH DL.CODE™

DL.CODE™ allows Backup and Restore to be performed to/from the configuration PC via file or to an external storage device such as BM100.

It can be performed for Stand Alone and Cluster (Master/Slave) configurations.

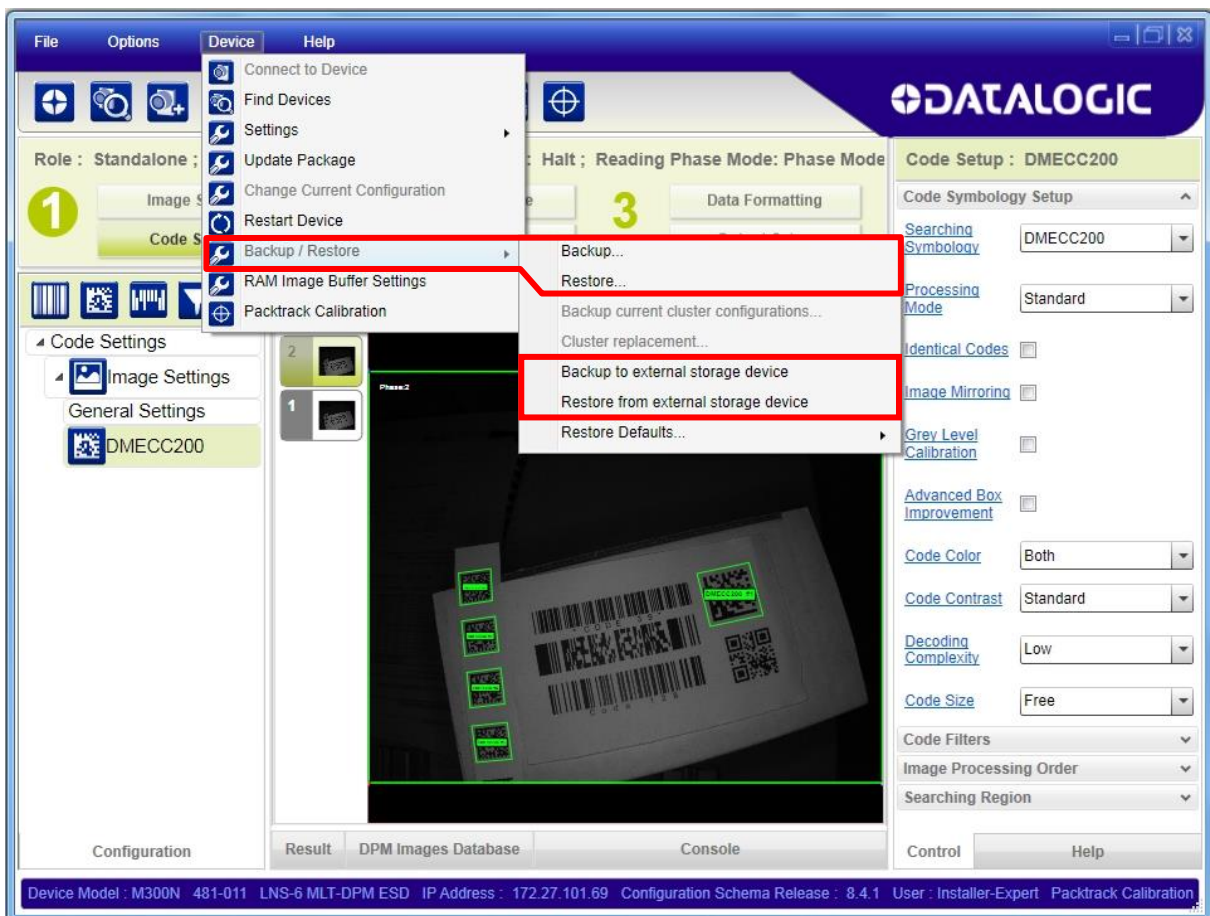
Backup and Restore functions allow performing Complete Configuration and Environment parameter storage for Stand Alone and ID-NET (Master/Slave) network devices as well as device firmware. Backup and Restore can be applied to any reader connected through a device having external backup memory, regardless of the reader's network configuration.

Backup and Restore to external device is supported by DL.CODE™ for all reading devices when connected to:

- CBX + BM100
- QLM-Series Gateways



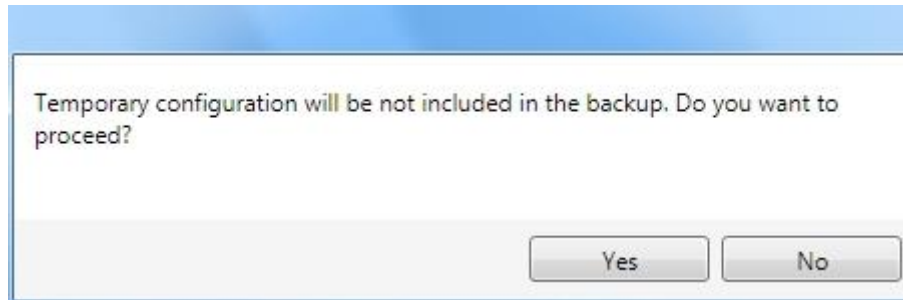
**NOTE:** Before executing a Backup on a BM100 backup module make sure the Write Protection switch is set to Unlocked.



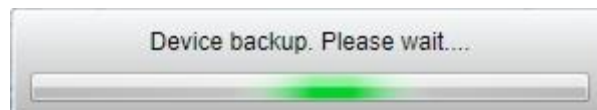
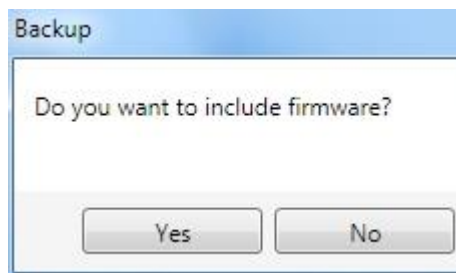
### 2.4.1 Backup

To perform a **Backup**:

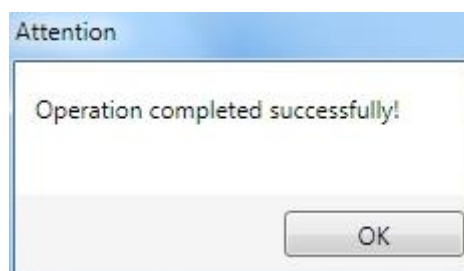
1. Select either “Backup” (to file on PC) or “Backup to external storage device” from the DL.CODE™ Device menu. You will be reminded that configuration in temporary memory will not be saved so you should save the configuration to the reader before performing Backup.



If you are performing a backup to a file you will be asked whether to include the firmware or not.



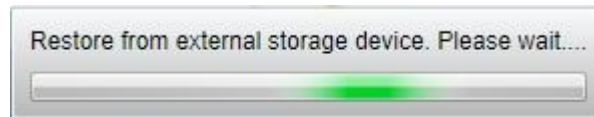
At the end of the backup, DL.CODE™ shows a message indicating successful completion.



### 2.4.2 Restore

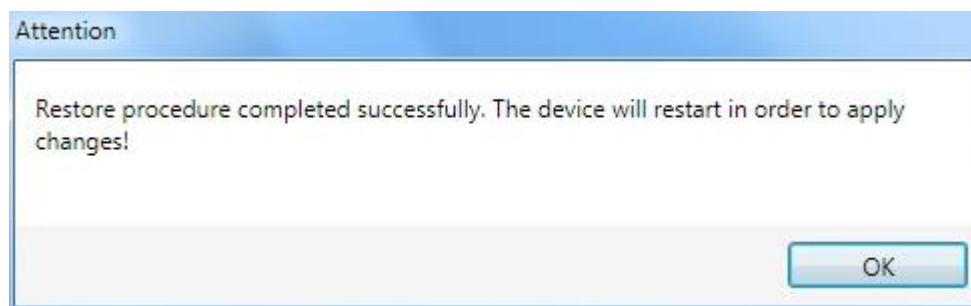
To perform a **Restore**:

1. Select either "Restore" (from file on PC) or "Restore from external storage device" from the DL.CODE™ Device menu



If restoring an ID-NET™ network through the Master, this may take a few minutes.

At the end of the restore, DL.CODE™ shows a message indicating successful completion.



### 2.4.3 Replacement



**CAUTION:** The replacement device **must be the exact same model** as the device it is replacing.

The **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 factory default).
3. Run the Restore procedure by selecting either "Restore" (from file on PC) or "Restore from external storage device" item (see: Restore procedure).



**NOTE:** For ID-NET™ network Backup and Restore, select the **Backup Current Cluster Configuration** and **Cluster Replacement** selections.



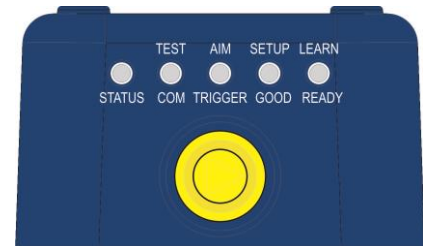
**NOTE:** In case of Backup or Restore operation failures, error messages will be displayed in the Monitor Diagnostic page.

## 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:

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

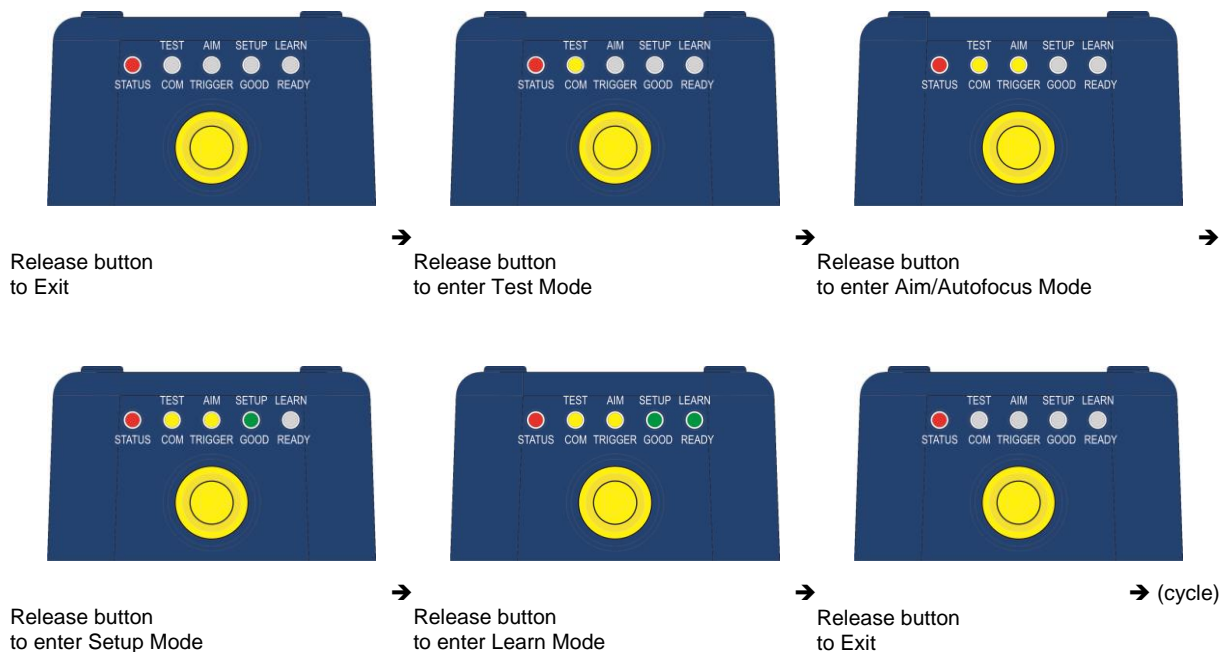


### 2.5.1 X-PRESS™ Functions

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

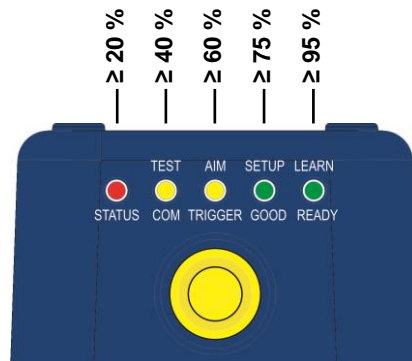
- 1 – **Press** the button (the Status LED will give a visual feedback).
- 2 – **Hold** the button until the specific function LED is on (Test, Aim, Setup or Learn).
- 3 – **Release** the button to enter the specific function.

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



## 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. The Bar Graph has the following meaning:



In case of a NO READ condition, only the Status LED is on and blinks.

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 300N™ emits 3 high pitched beeps.

If the calibration cannot be reached after a timeout of about 5 (five) seconds Matrix 300N™ will exit without saving the parameters to memory, the Setup LED will stop blinking and in this case Matrix 300N™ 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 300N™ emits 3 high pitched beeps.

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

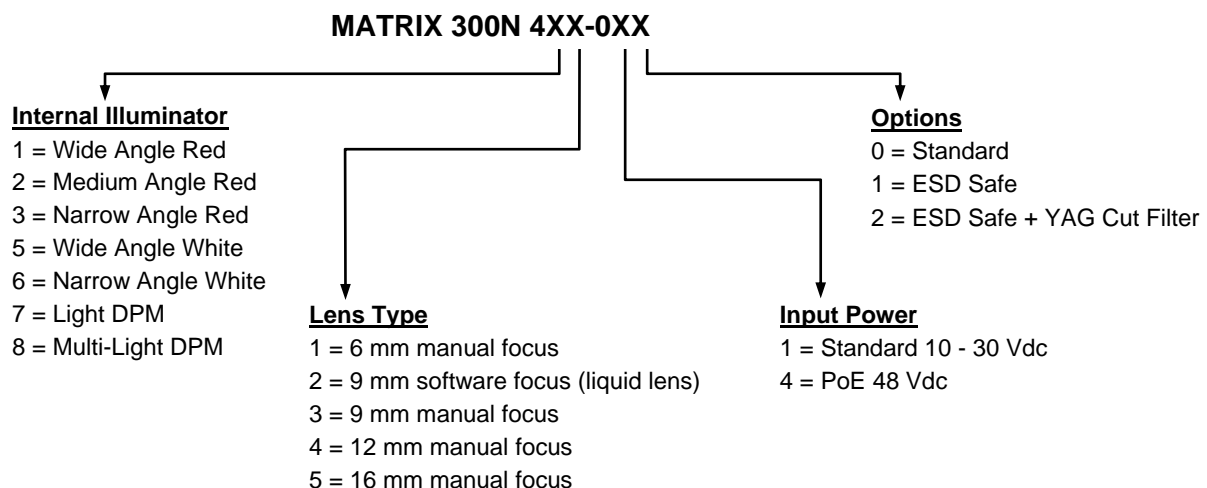
The “STATUS” and “READY” LEDs blink simultaneously to signal the presence of an error. Diagnostic message transmission on interfaces can be enabled to provide details about specific error conditions. See the Diagnostic Error Conditions chart in the Diagnostic page of the DL.CODE™ Monitor.



LED	STATUS
READY	BLINK
GOOD	
TRIGGER	
COM	
STATUS	BLINK

## 2.6 MODEL DESCRIPTION

Matrix 300N™ 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.





## 2.6.1 Lighting System Notes

The following table shows the Matrix 300N™ lens/illuminator combinations. For more information see the Application Note on illuminator selection on the DL.CODE™ mini-DVD (downloaded ISO file or mini-DVD accessory).

Matrix 300 Models		Internal Illuminators	
Model	Lens Type	LEDs	Type
Matrix 300 411-0xx Matrix 300 481-0xx	6 mm Manual Focus Lens	8 24/39	Red Wide Angle Red Bright/Blue Dark Field DPM (sw configurable sectors)
Matrix 300 412-0xx Matrix 300 452-0xx Matrix 300 472-0xx Matrix 300 482-0xx	9 mm Software Focus (Liquid Lens)	8 8 24/26 24/39	Red Wide Angle White Wide Angle Red Bright Field DPM (sw configurable sectors) Red Bright/Blue Dark Field DPM (sw configurable sectors)
Matrix 300 423-0xx Matrix 300 453-0xx Matrix 300 473-0xx Matrix 300 483-0xx	9 mm Manual Focus Lens	8 8 24/26 24/39	Red Medium Angle White Wide Angle Red Bright Field DPM (sw configurable sectors) Red Bright/Blue Dark Field DPM (sw configurable sectors)
Matrix 300 434-0xx Matrix 300 464-0xx	12 mm Manual Focus Lens	8 8	Red Narrow Angle White Narrow Angle
Matrix 300 435-0xx Matrix 300 465-0xx	16 mm Manual Focus Lens	8 8	Red Narrow Angle White Narrow Angle

## 2.7 ACCESSORIES

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

Accessory	Description	Order No.
<b>Cables</b>		
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
<b>Connectivity</b>		
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 Host Interface Modules and All-In-One Connection Box Kits are available		
BA100	DIN Rail Adapters	93ACC1821
BA200	Bosch and 80/20 Profile 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
QLM500	Quick Link Metal Master ID-NET - Ethernet/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		

Accessory	Description	Order No.
<b>Power Supplies</b>		
PG6002	AC/DC Power Supply Unit (US)	93ACC1718
PG6001	AC/DC Power Supply Unit (UK)	93ACC1719
PG6000	AC/DC Power Supply Unit (EU)	93ACC1720
<b>Sensors</b>		
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 300N™ 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 15).



Figure 15 - Address Coded in Data Matrix Symbology for Automated Mail Processing

### 2.8.2 Deformed or Overprinted Code Reading

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



Figure 16 - Unidose Flow-Pack with PDF417 Code



Figure 17 - Overprinted Barcode Readable by Matrix 300N™ also Through the Envelope Window Film



**Figure 18 - Barcode Printed on Curved Surface Readable by Matrix 300N™ in spite of Image Optical Distortion**

### **2.8.3 Direct Part Marking**

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



**Figure 19 - Dot Matrix Code Directly Marked on Metal Surface by Using Dot Peening Technology**



**Figure 20 - Dot Peening Marking on Metal Surface with Multi-dot per Code Element**



**Figure 21 - Directly Marked Dot Matrix Code Characterized by Outstanding Separation Distance between Adjacent Code Elements**

### 2.8.4 Ink-Jet Printing Technology

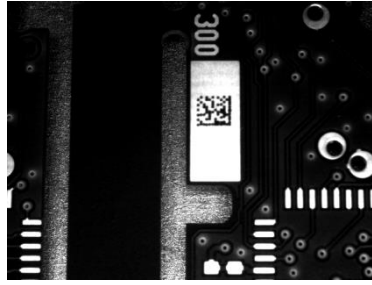


Figure 22 - Dot Matrix Code Directly Marked on PCB Copper Pad by Using Ink-Jet Technology

### 2.8.5 Laser Marking/Etching Technology



Figure 23 - 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 300N™ models incorporating YAG Filters in order to avoid burning the CMOS sensor.

## 3 INSTALLATION

### 3.1 PACKAGE CONTENTS

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

- ☐ Matrix 300N™ reader
- ☐ Quick Reference Guide
- ☐ Test Charts (2)
- ☐ Mounting Kit
  - Mounting Screws (4 + 2)
  - Washers (2)
  - Mounting Brackets (2)

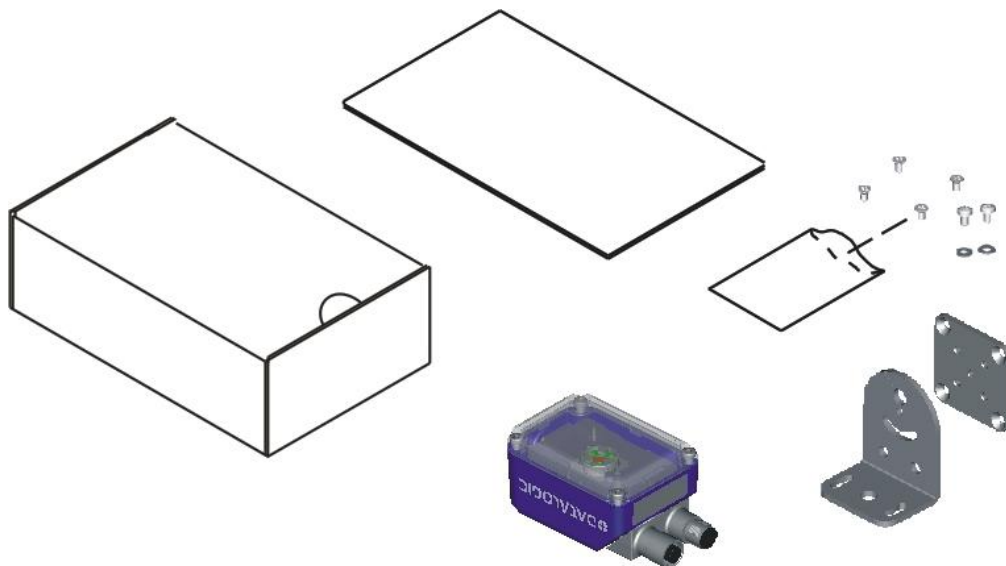


Figure 24 - Package Contents

### 3.2 MECHANICAL DIMENSIONS

Matrix 300N™ can be installed to operate in different positions. The four screw holes (M4 x 5) on the body of the reader are for mechanical fixture (Figure 25).

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.

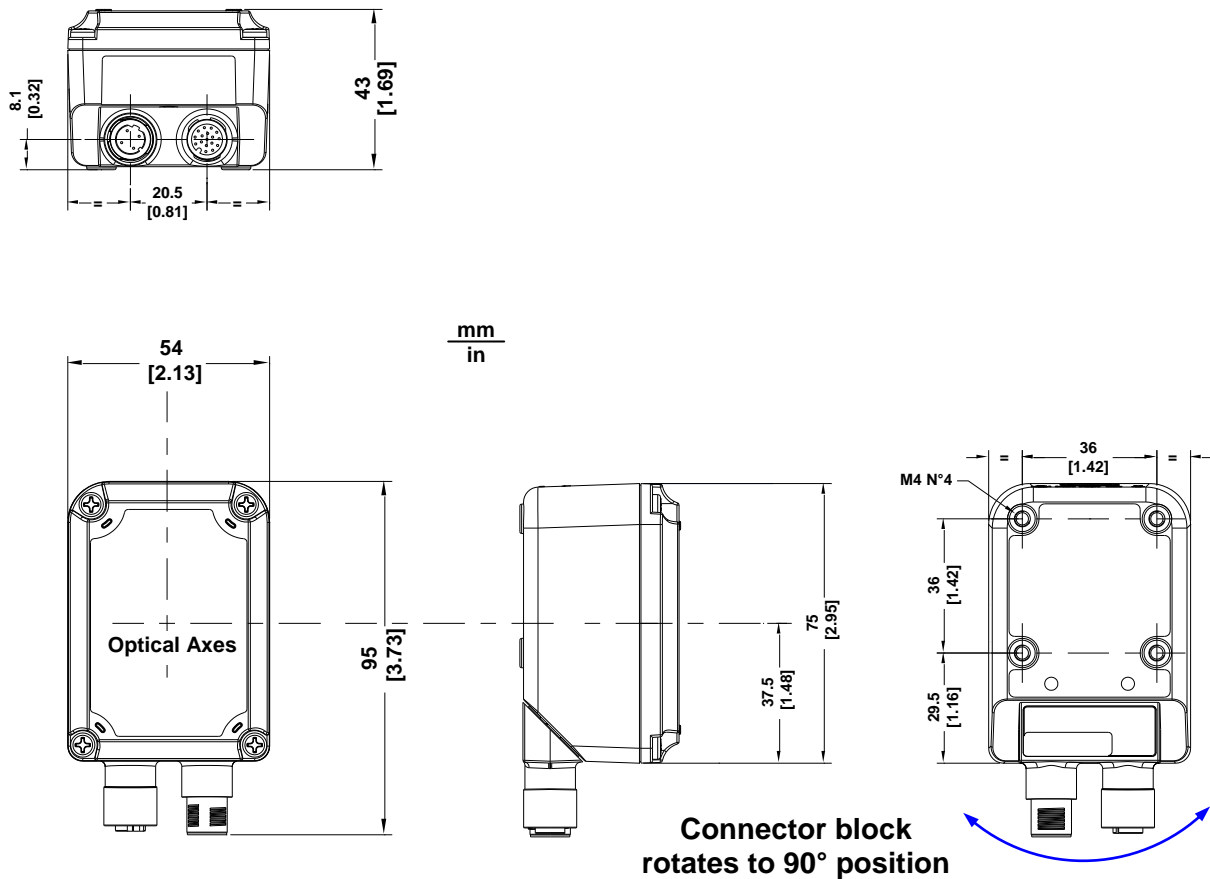


Figure 25 - Overall Dimensions with Connector at 0°



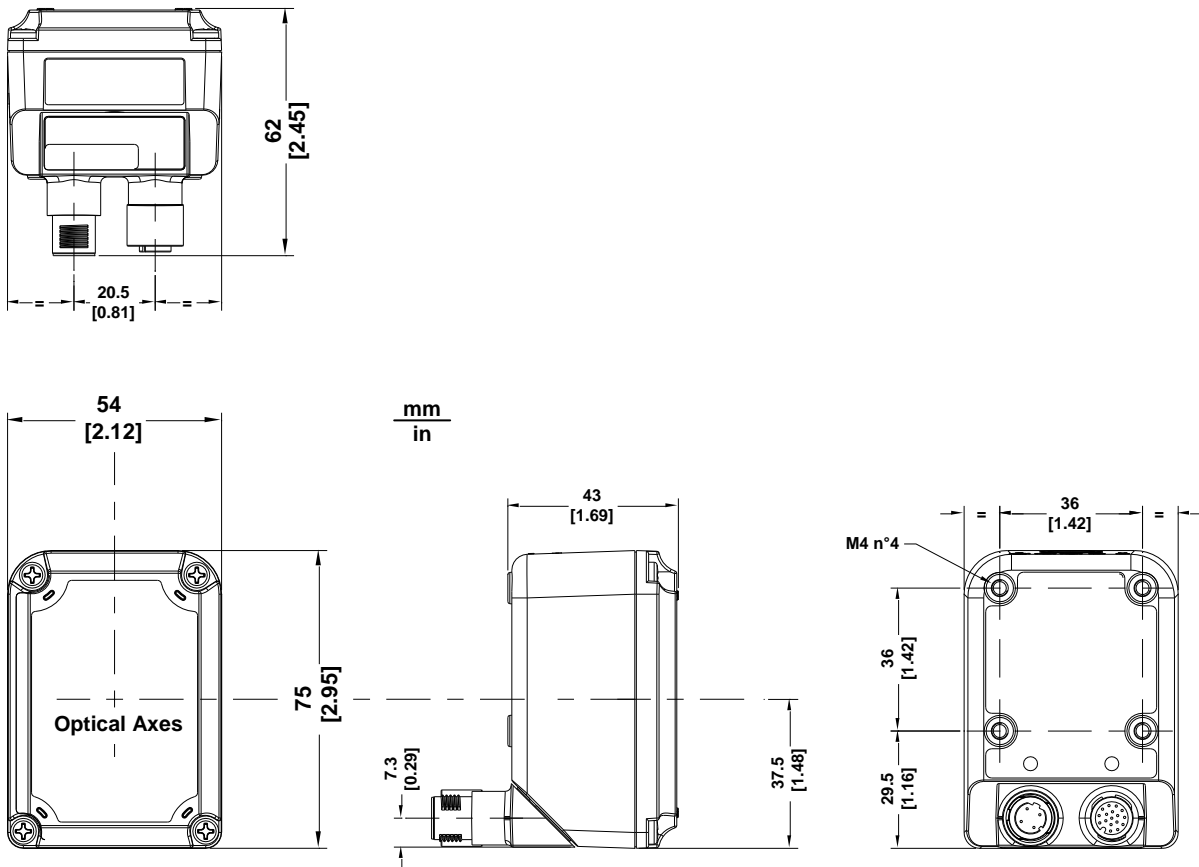


Figure 26 - Overall Dimensions with Connector at 90°

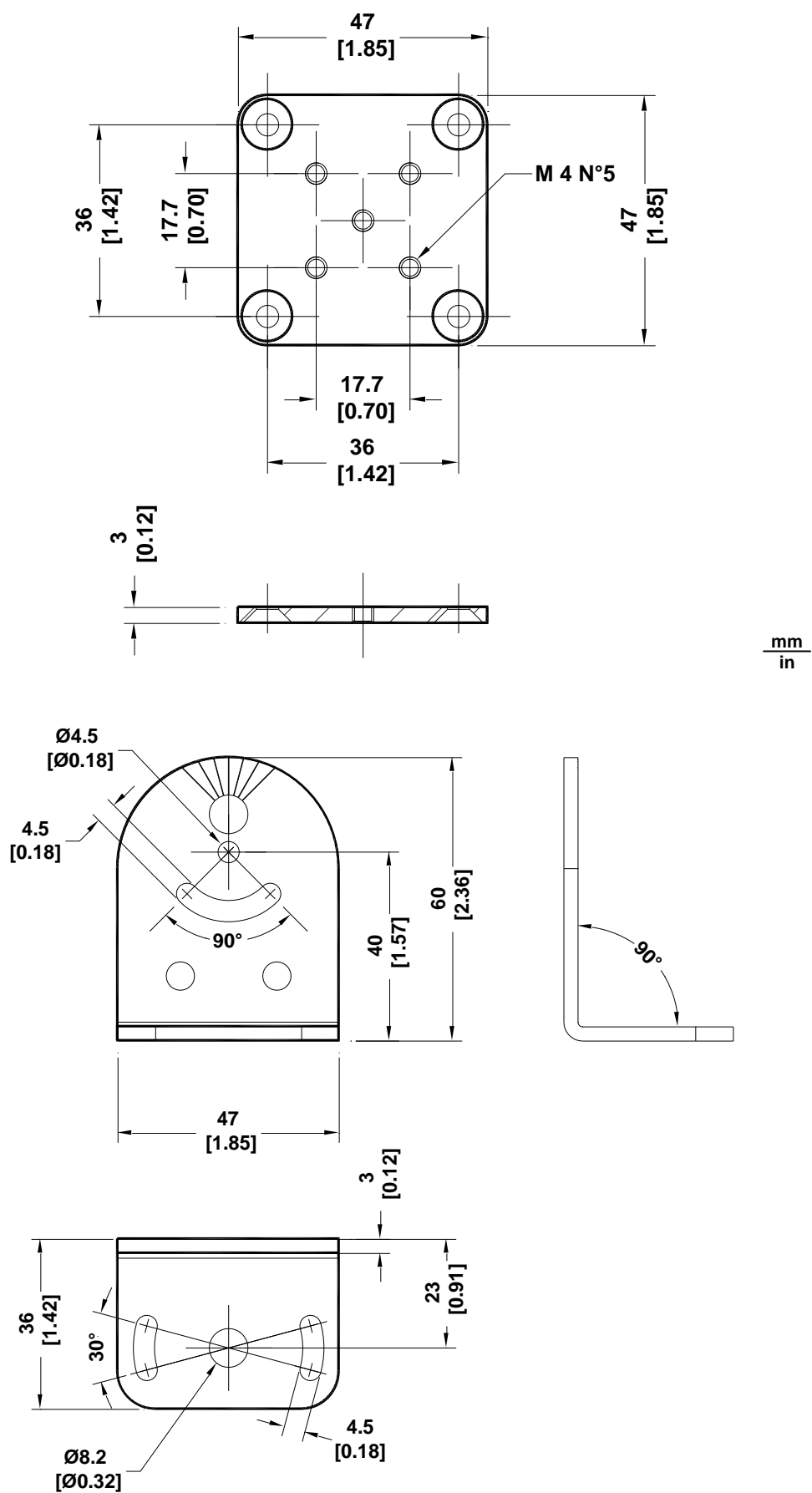


Figure 27 - Mounting Bracket Overall Dimensions

### 3.3 MOUNTING AND POSITIONING MATRIX 300N™

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

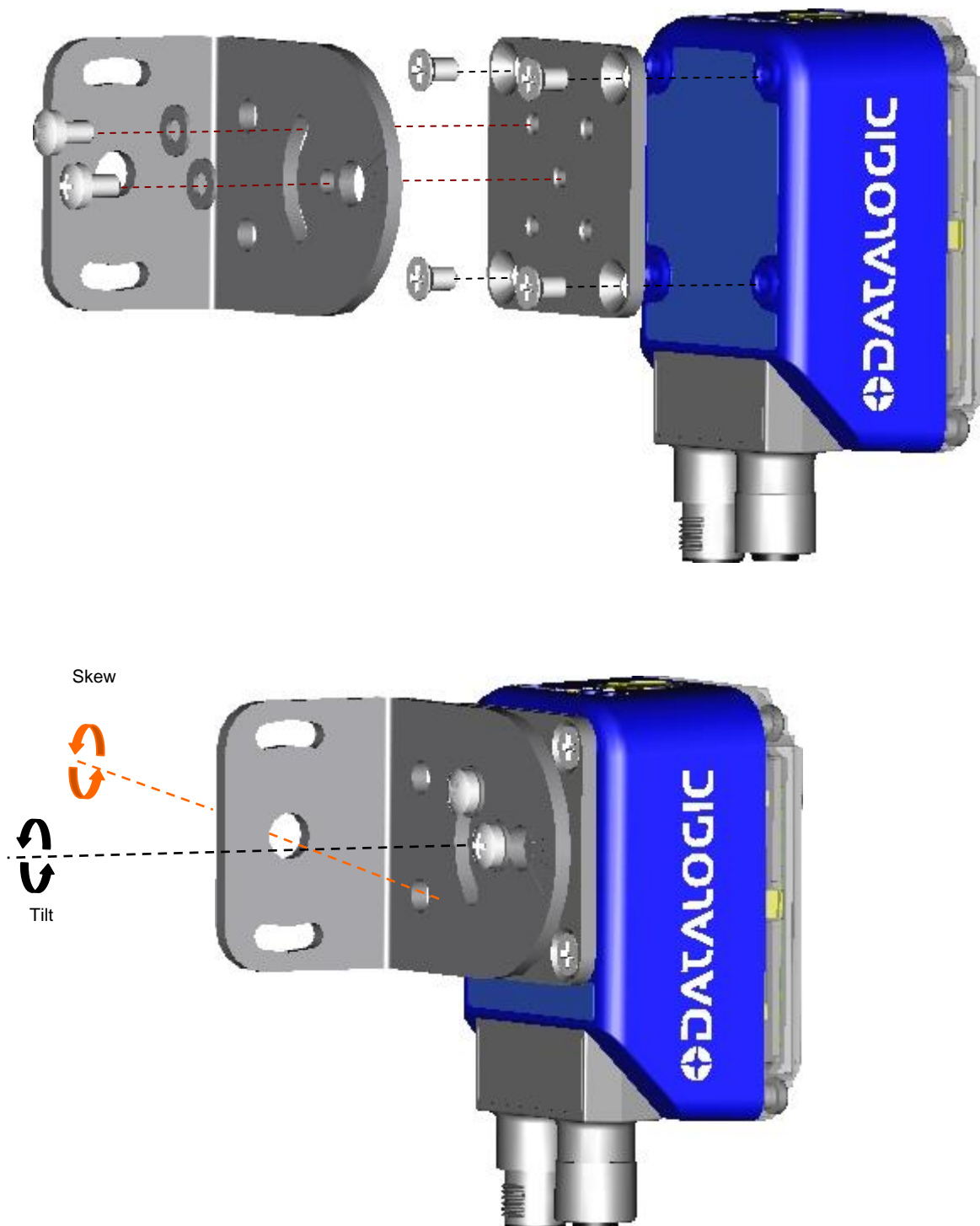


Figure 28 –Positioning with Mounting Bracket

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

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

**Note:** Since Matrix 300N™ 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 29. 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 300N™ reader; it is advised to **assure at least 10°** for the Skew angle.

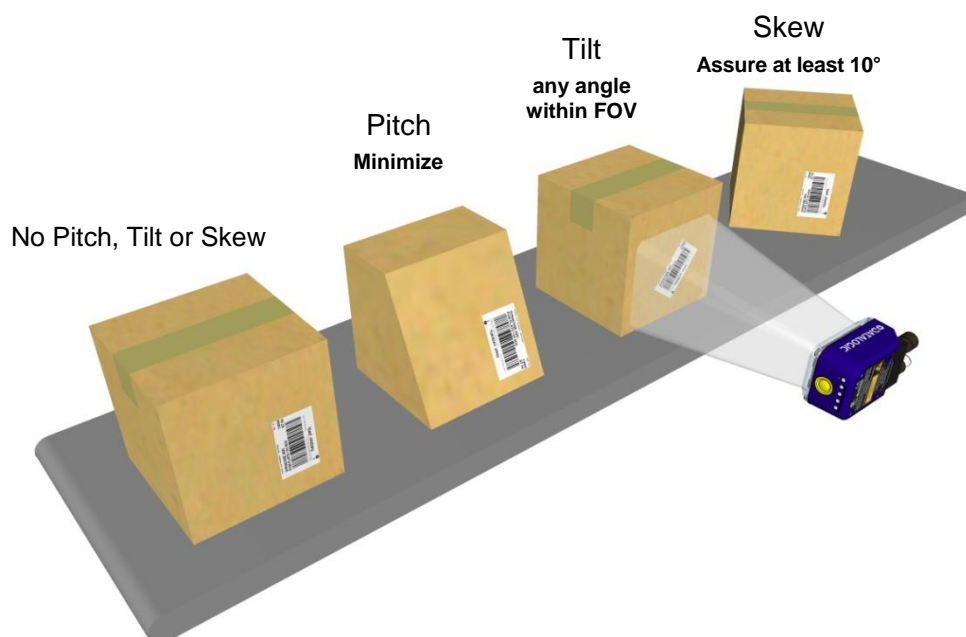
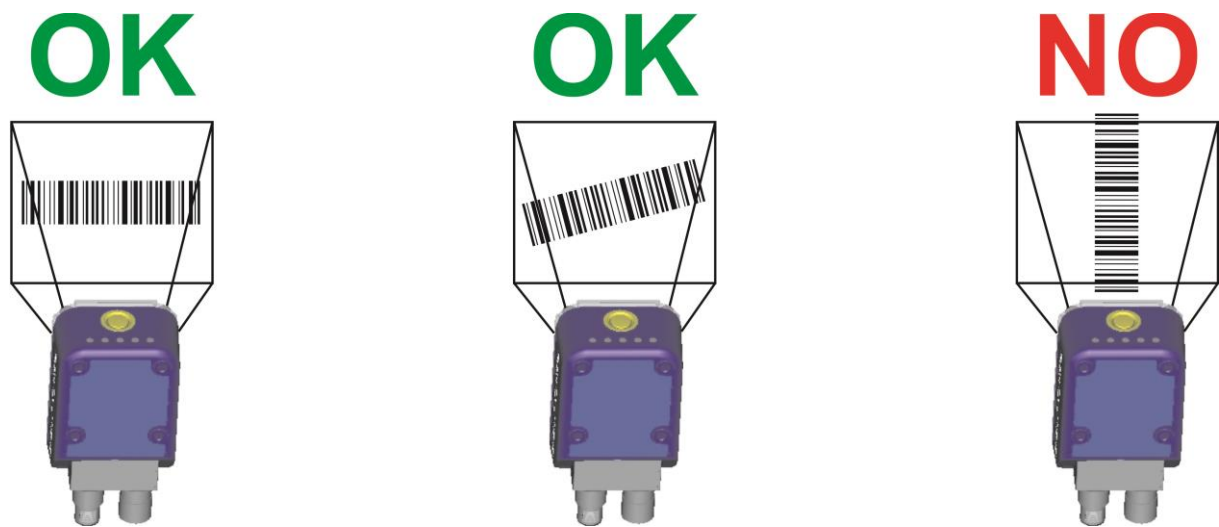


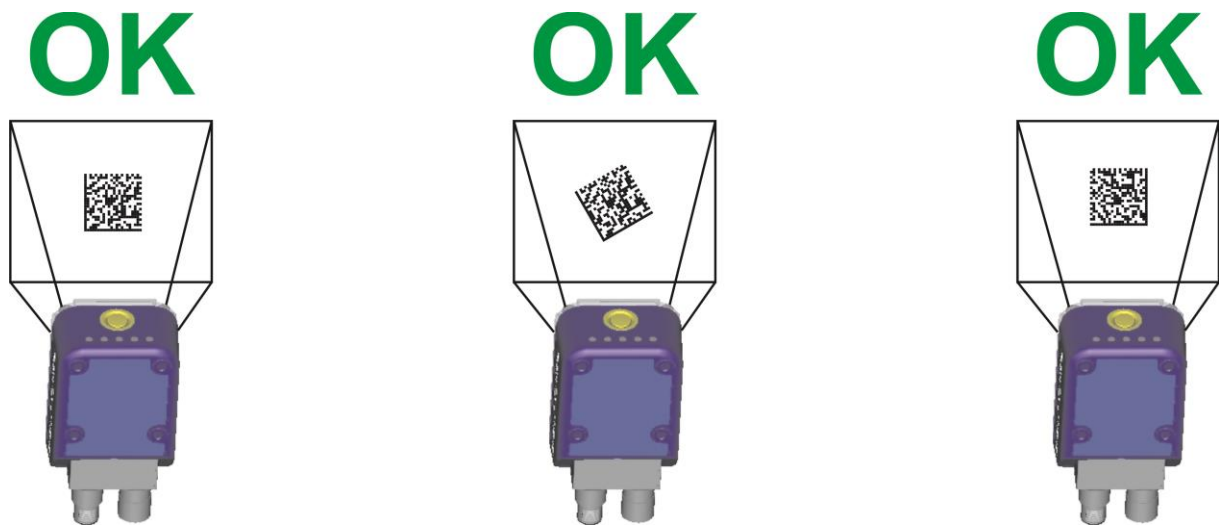
Figure 29 - Code Reading Orientation

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 30. Matrix 300N™ 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.



Linear Barcode Reading



2D Code Reading

**Figure 30 - Tilt Angle Considerations**

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

## 4 CBX ELECTRICAL CONNECTIONS

All Matrix 300N™ 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 300N™ 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 300N™ 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	
O3A	Output 3 non opto-isolated (only available through 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	RS422 Full-Duplex
	TX	TX+
	RX	*RX+
	-	TX-
	-	*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 300N™ 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 31:

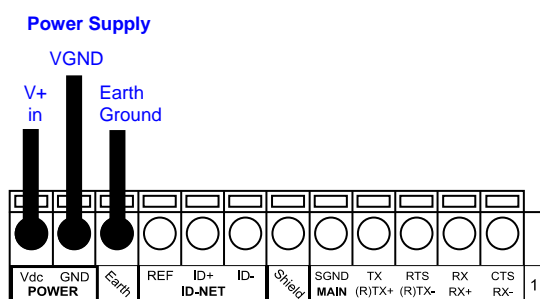


Figure 31 - Power Supply Connections

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:

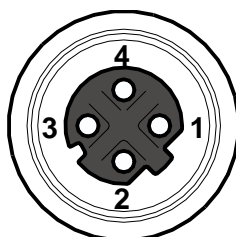


Figure 32 - M12 D-Coded Female Ethernet Network Connector

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 300N™ 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.

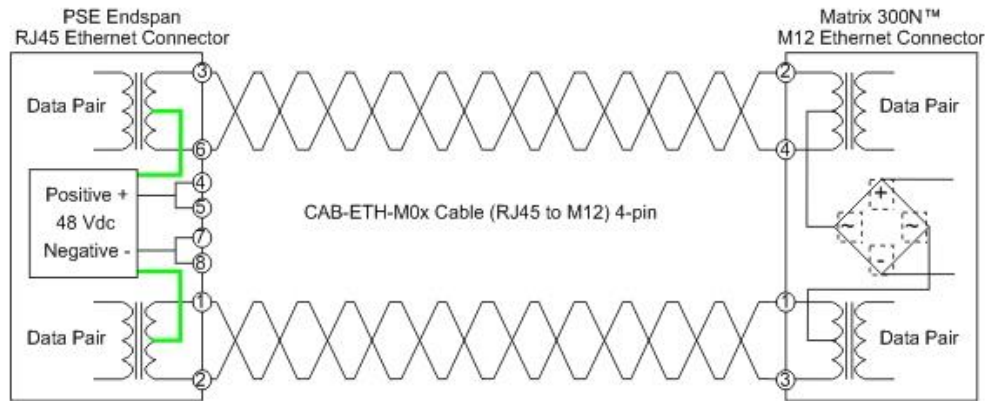


Figure 33 – Matrix 300N™ PoE PSE Endspan Alternative A Connections OK

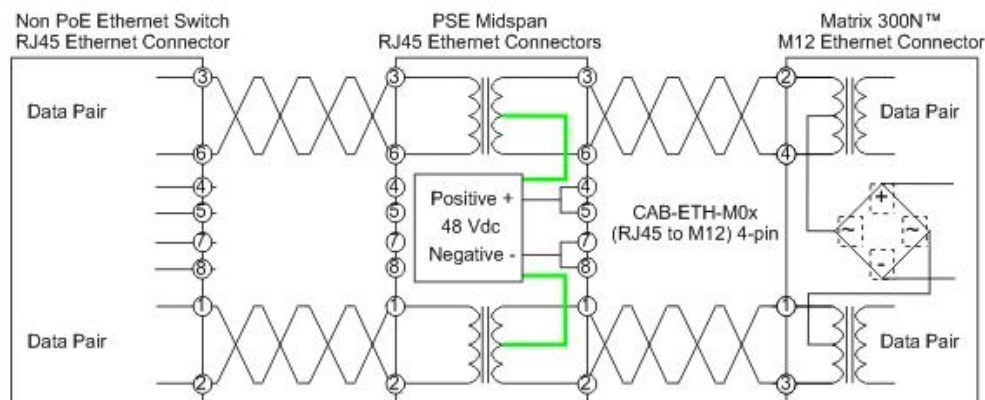


Figure 34 – Matrix 300N™ PoE PSE Midspan Alternative A Connections OK

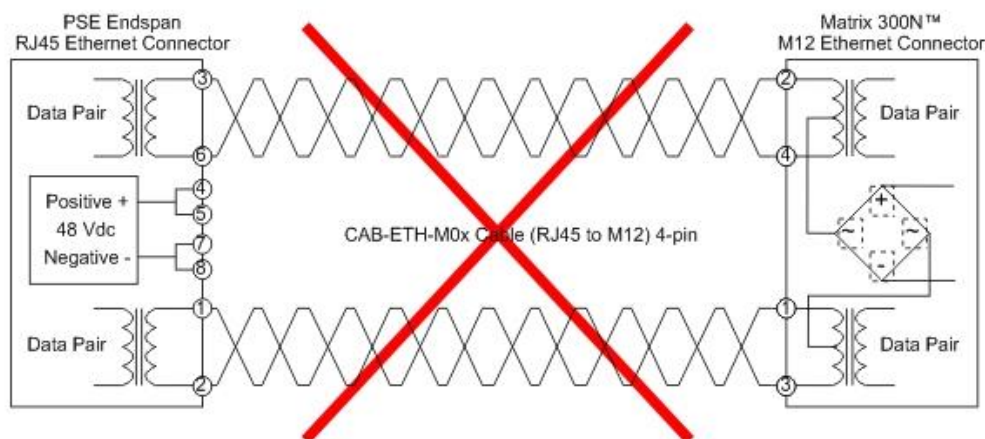


Figure 35 – Matrix 300N™ PoE PSE Endspan Alternative B Connections NOT SUPPORTED

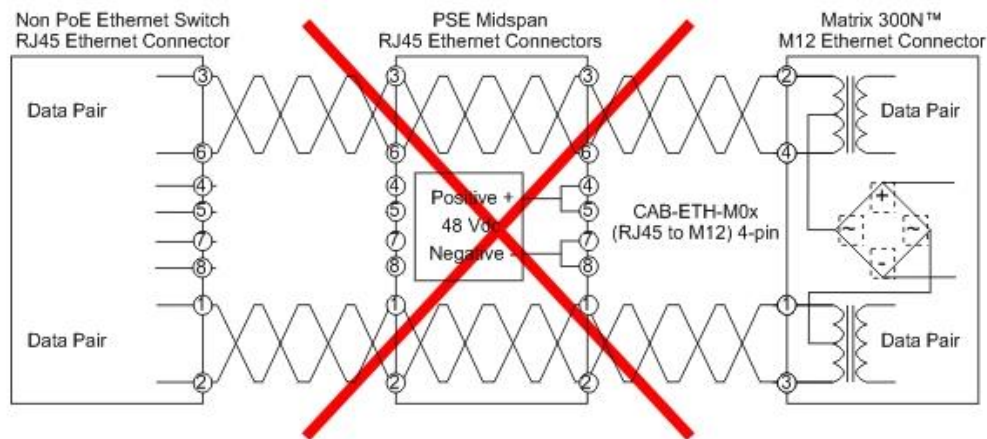


Figure 36 – Matrix 300N™ PoE PSE Midspan Alternative B Connections NOT SUPPORTED



**CAUTION:** For Matrix 300N™ PoE models, the internal Digital Output circuitry is not powered and supply power is not available to any Input/Output devices ( $V_{dc}=0$ ). 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 DL.CODE™ software. For more details refer to the Help On Line page of the Reading Phase step (Channels) in DL.CODE™.**

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

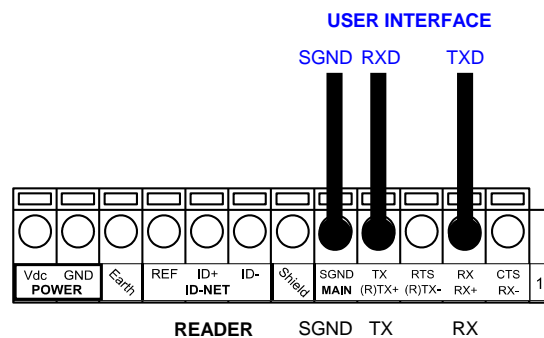
### 4.2.1 RS232 Interface

The RS232 interface is generally used for Point-to-Point connections. When it is connected to the host computer it allows transmission of code data.

The following pins are used for RS232 interface connection:

CBX100/500	Function
TX	Transmit Data
RX	Receive Data
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 37 – RS232 Main Interface Connections**

### 4.2.2 RS422 Full-Duplex Interface

The RS422 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+	RS422 Transmit Data +
RX+	RS422 Receive Data +
TX-	RS422 Transmit Data -
RX-	RS422 Receive Data -
SGND	Signal Ground

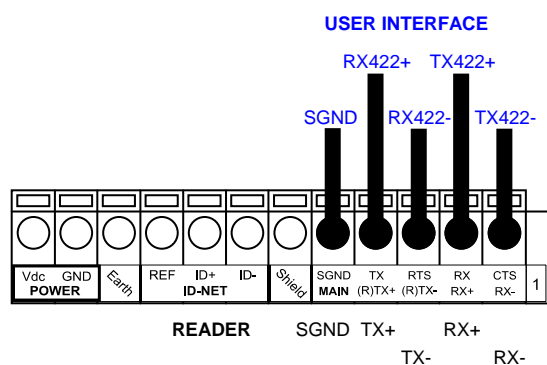


Figure 38 - RS422 Full-duplex Connections



**NOTE:** For applications that do not use RX422 signals, do not leave these lines floating but connect them to SGND as shown below.

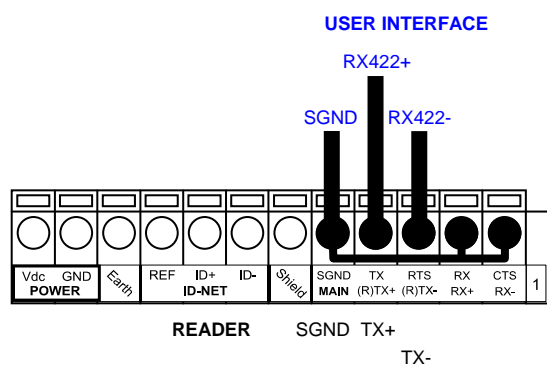


Figure 39 - RS422 Full-duplex Connections using Only TX Signals

### 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	<b>500 kbps</b>	1Mbps
Cable Length	1200 m	900 m	<b>700 m</b>	*

\* 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.



### 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.

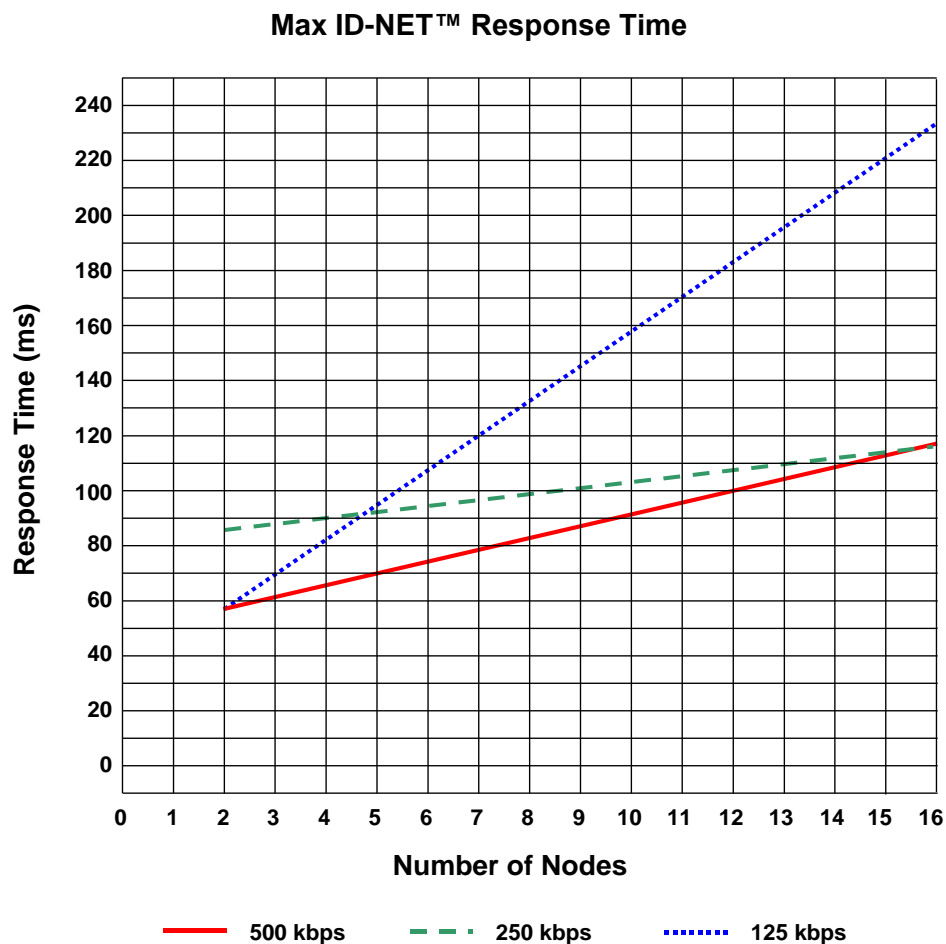


Figure 40 – ID-NET™ Response Time

#### CONDITIONS:

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

### 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.

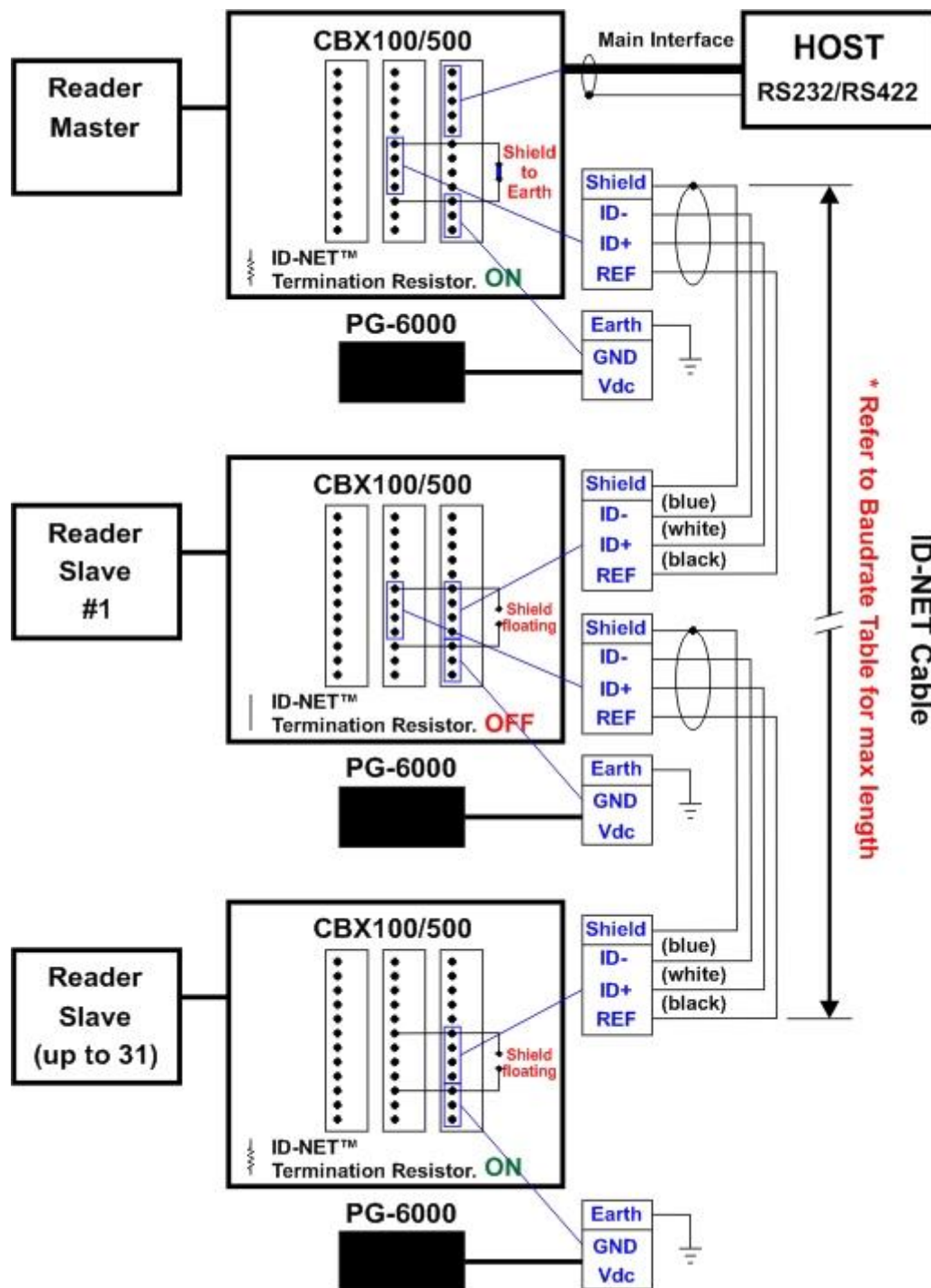


Figure 41 – ID-NET™ Network Connections with isolated power blocks

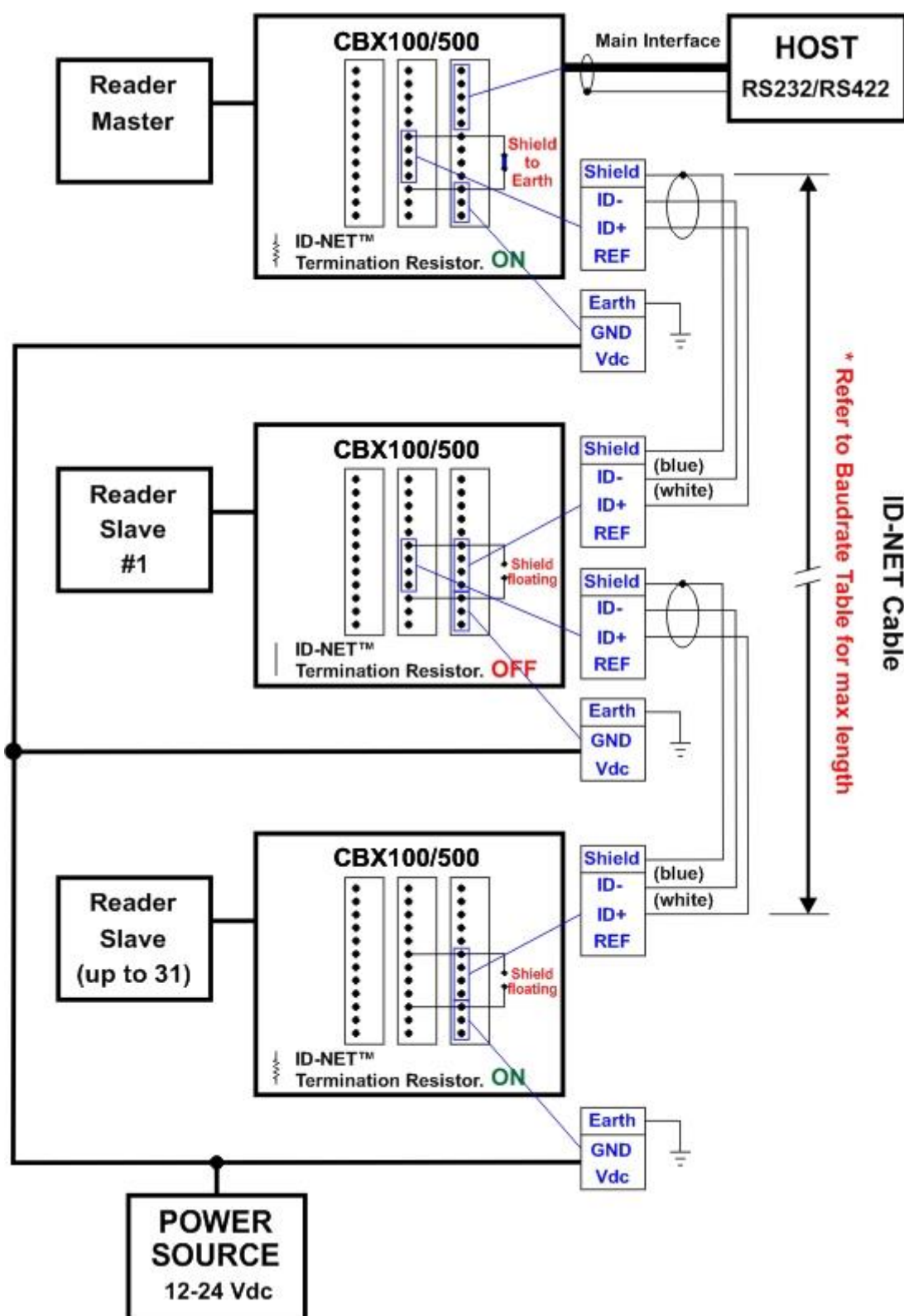


Figure 42 - ID-NET™ Network Connections with Common Power Branch Network



4.4 AUXILIARY RS232 INTERFACE

The RS232 auxiliary interface is available for Point-to-Point connections. When it is connected to the host computer it allows transmission of code data.

The parameters relative to the aux interface (baud rate, data bits, etc.) can be defined through the Reading Phase step (Channels) in DL.CODE™.

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

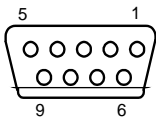


Figure 44 - 9-pin female connector

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

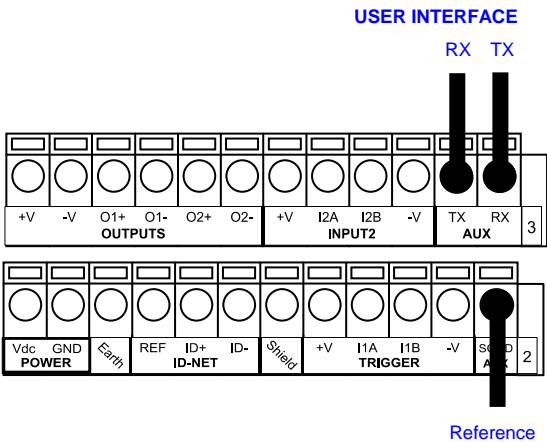


Figure 45 - RS232 Auxiliary Interface Connections



**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:

$$V_{AB} = 30 \text{ Vdc max.}$$

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

The active state of these inputs are selected in software.

An anti-disturbance filter is implemented in software on both inputs so that the default minimum pulse duration is  $\cong 0.5$  milliseconds. This value can be increased through the software parameter Debouncing Time. See the Help On Line page of the Reading Phase step (Inputs) in DL.CODE™ for further details on these parameters.

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 14, 5) is on when the active state of the External Trigger corresponds to ON.



## EXTERNAL TRIGGER INPUT CONNECTIONS USING MATRIX 300N™ 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.

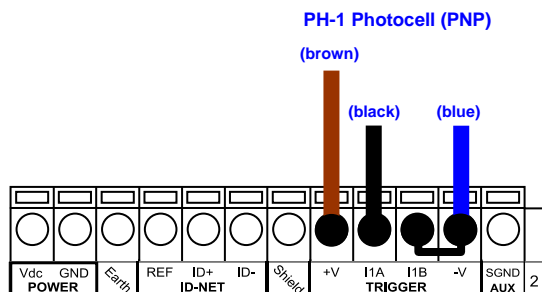


Figure 46 – PH-1 External Trigger Using Matrix 300N™ Power

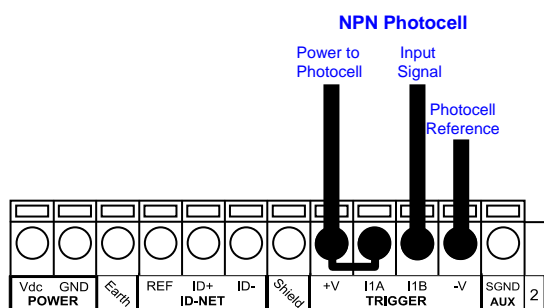


Figure 47 - NPN External Trigger Using Matrix 300N™ Power

## EXTERNAL TRIGGER INPUT CONNECTIONS USING EXTERNAL POWER

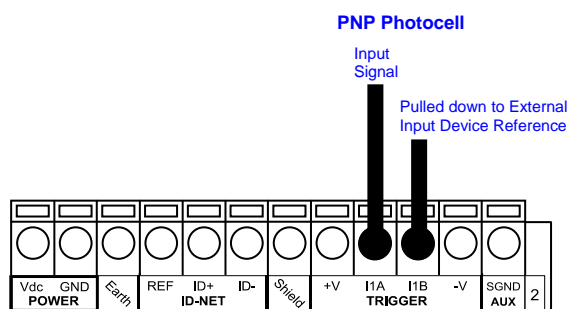


Figure 48 - PNP External Trigger Using External Power

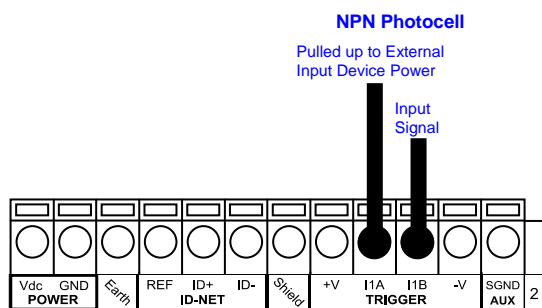


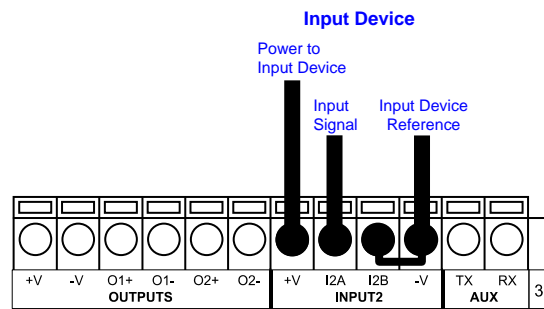
Figure 49 - NPN External Trigger Using External Power

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

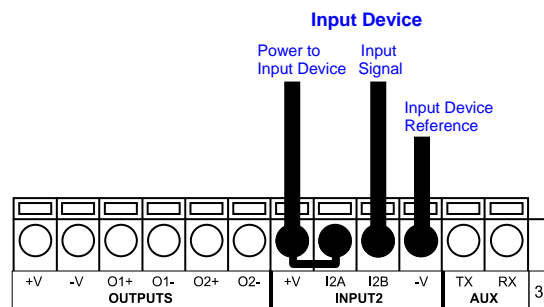
## INPUT 2 CONNECTIONS USING MATRIX 300N™ POWER



**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 300N™ Power



NPN Input 2 Using MATRIX 300N™ Power

## INPUT 2 CONNECTIONS USING EXTERNAL POWER

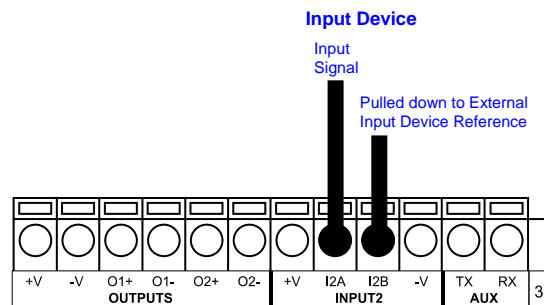


Figure 50 - PNP Input 2 Using External Power

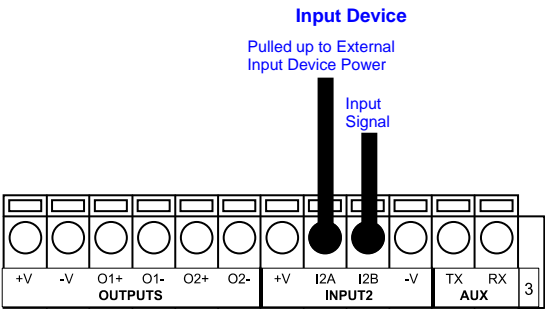


Figure 51 - NPN Input 2 Using External Power

INPUT 3 CONNECTIONS (CBX500 Only)

RESERVED

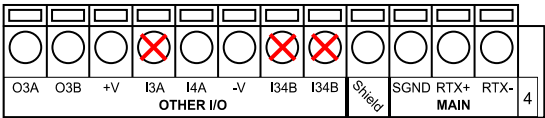


Figure 52 - Input 3 Using External Power



**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 Line Type configuration parameters to NPN for the respective output. The hardware connection to the CBX can be either NPN or PNP.

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

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 DL.CODE™ parameters Help On Line for further details.

## OUTPUT 1 AND 2 CONNECTIONS USING MATRIX 300N™ 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.

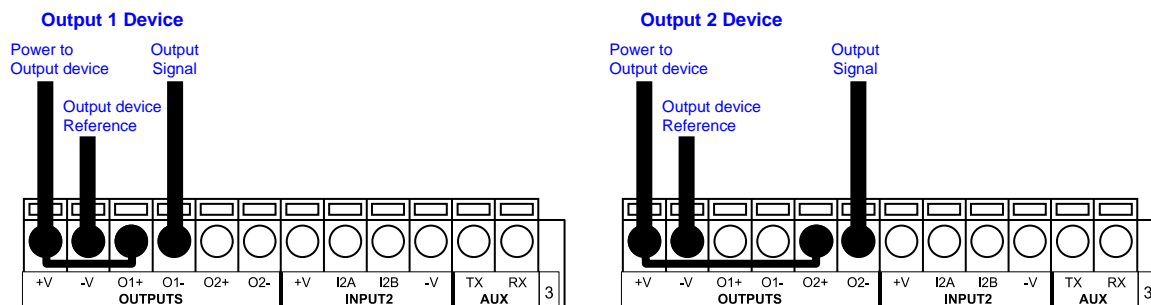


Figure 53 - PNP/Open Emitter Output Using MATRIX 300N™ Power

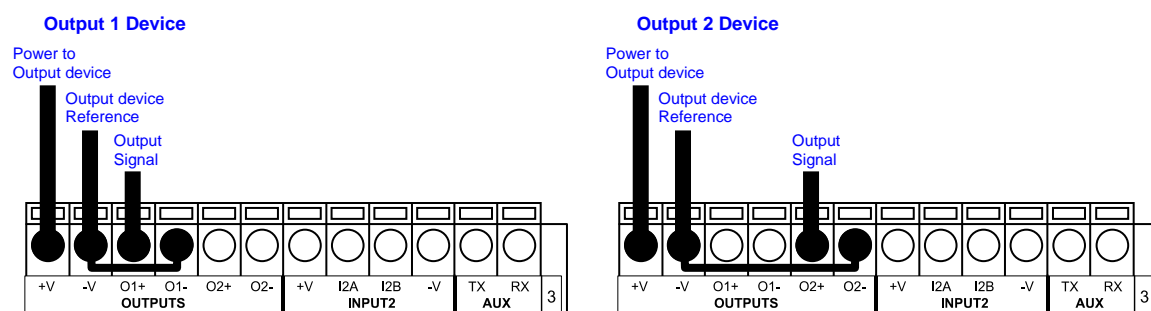


Figure 54 - NPN/Open Collector Output Using MATRIX 300N™ Power

## OUTPUT 1 AND 2 CONNECTIONS USING EXTERNAL POWER

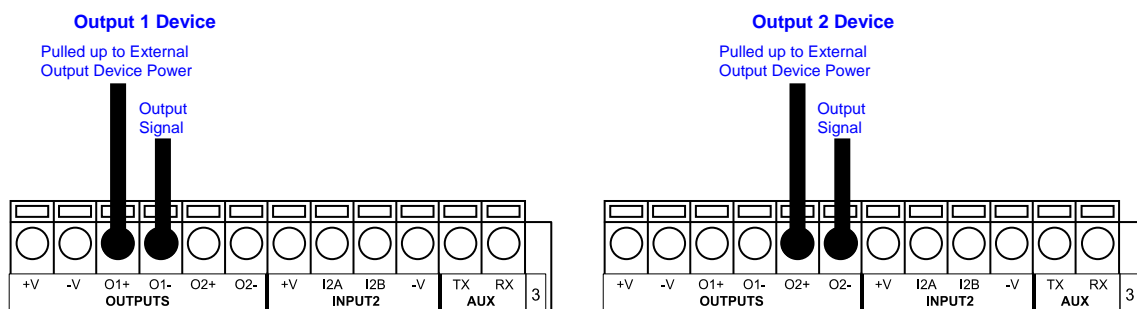


Figure 55 - PNP/Output Open Emitter Using External Power

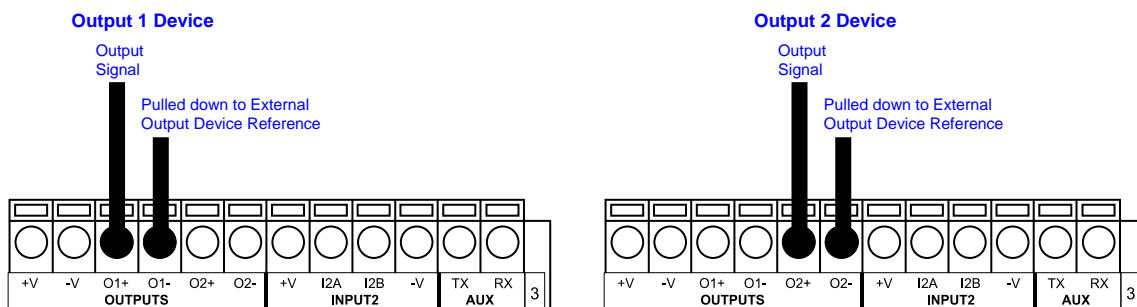


Figure 56 - NPN/Output Open Collector Using External Power

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.



**NOTE:** For this output, set the Line Type configuration parameter according to the hardware connection to the CBX: NPN, PNP or Push-Pull.

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

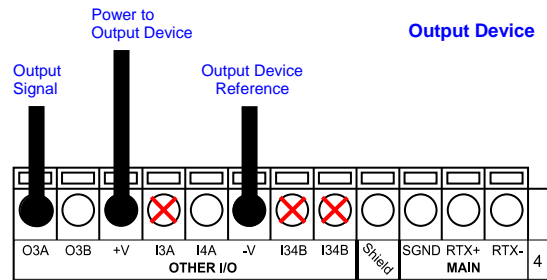


Figure 57 - Output 3 Using Matrix 300N™ Power

### OUTPUT 3 CONNECTIONS USING EXTERNAL POWER (CBX500 Only)

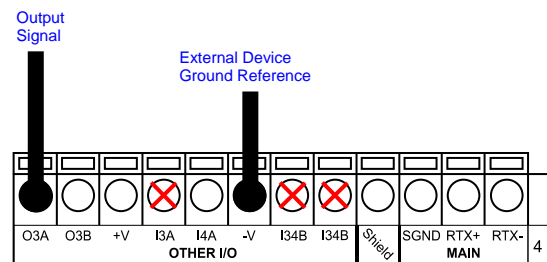


Figure 58 - Output 3 Using External Power



**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 300N™ incorporates an auto-cross function.

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

On the Matrix 300N™ on-board Ethernet interface the following communication channels are available:

- TCP Client
- TCP Server
- UDP Client
- FTP Client

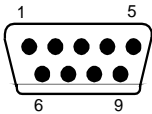
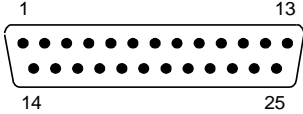
The following Fieldbus protocols are also available over the on-board Ethernet interface:

- EtherNet/IP
- PROFINET IO
- Modbus TCP Client

For further details refer to the Help On Line page of the Reading Phase step (Channels) and (Fieldbuses) in DL.CODE™ 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			
 <p>9-pin male connector</p>		 <p>25-pin male connector</p>	
Pin	Name	Pin	Name
2	RX	3	RX
3	TX	2	TX
5	GND	7	GND



## 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.



**NOTE:** All software configurations are made through DL.CODE™ which connects to the reader through the on-board Ethernet interface.

### 5.1 ETHERNET CONNECTION

The Ethernet connection is possible in two different layouts.

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 300N™ incorporates an autocross function.

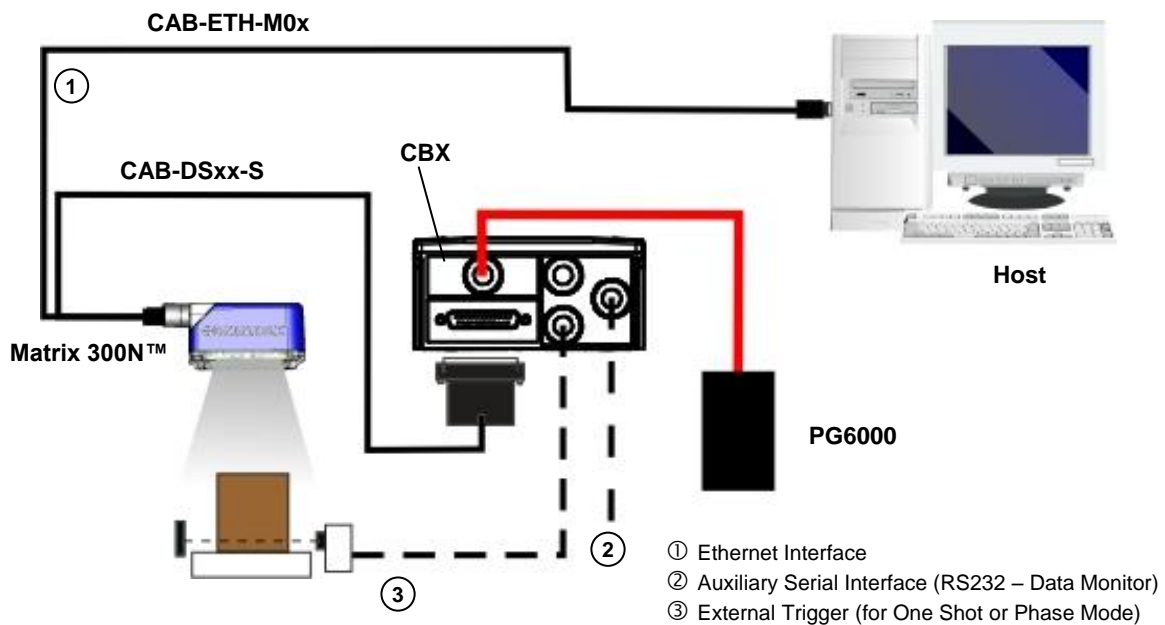


Figure 59 - Ethernet Point-to-Point Layout

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

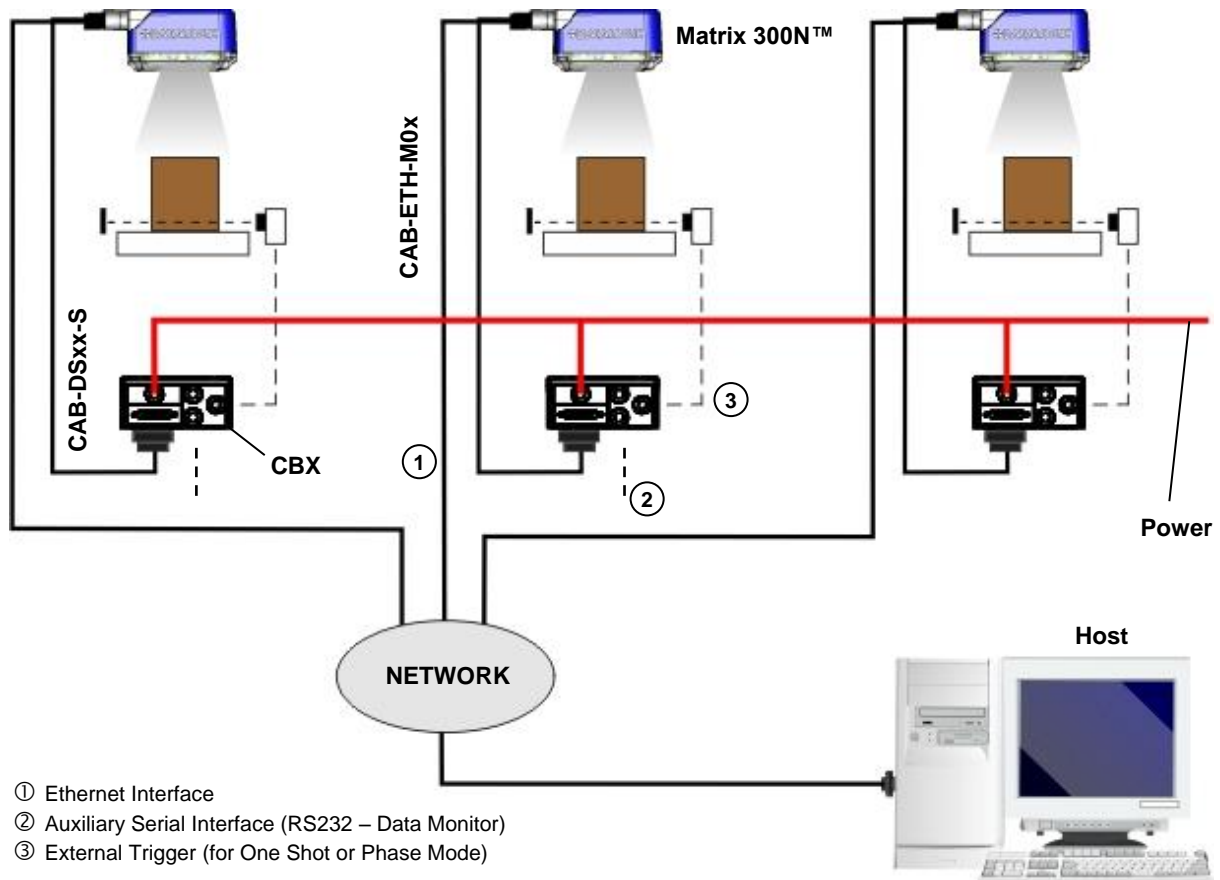


Figure 60 - Ethernet Network Layout

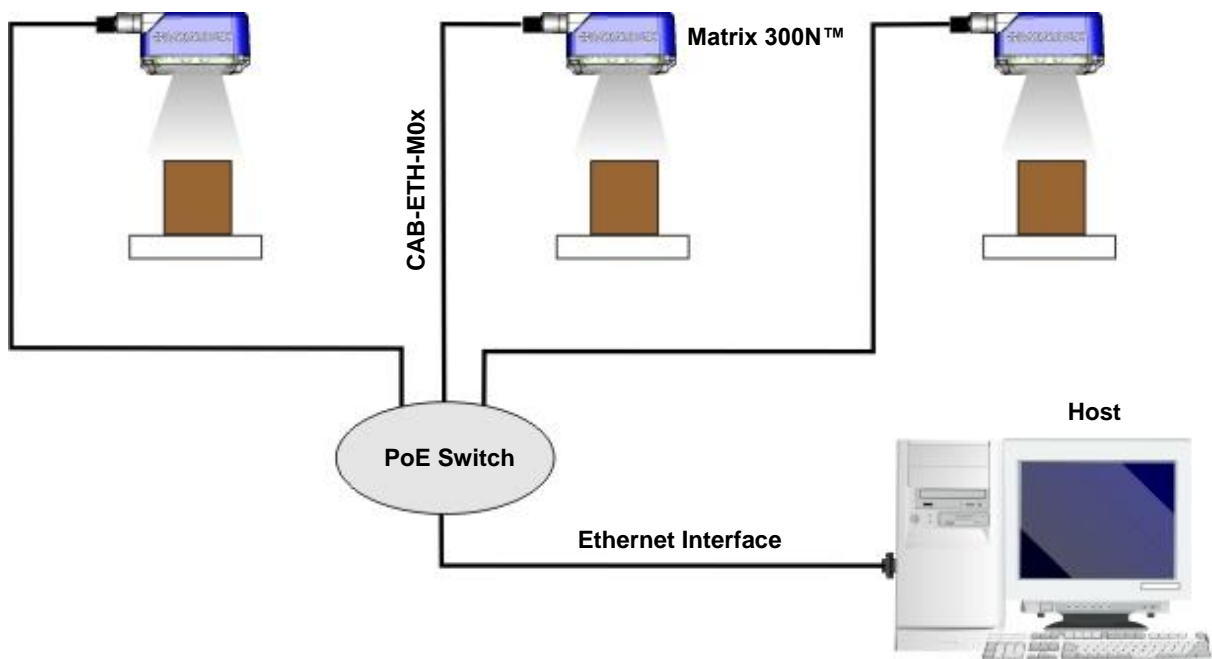


Figure 61 - POE Ethernet Network Layout

## 5.2 SERIAL CONNECTION

In this layout the data is transmitted to the Host on the main serial interface. The Ethernet interface can be used for reader configuration by connecting a laptop computer running DL.CODE™.

Data can be transmitted on the RS232 auxiliary interface independently from the main interface selection to monitor data.

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.

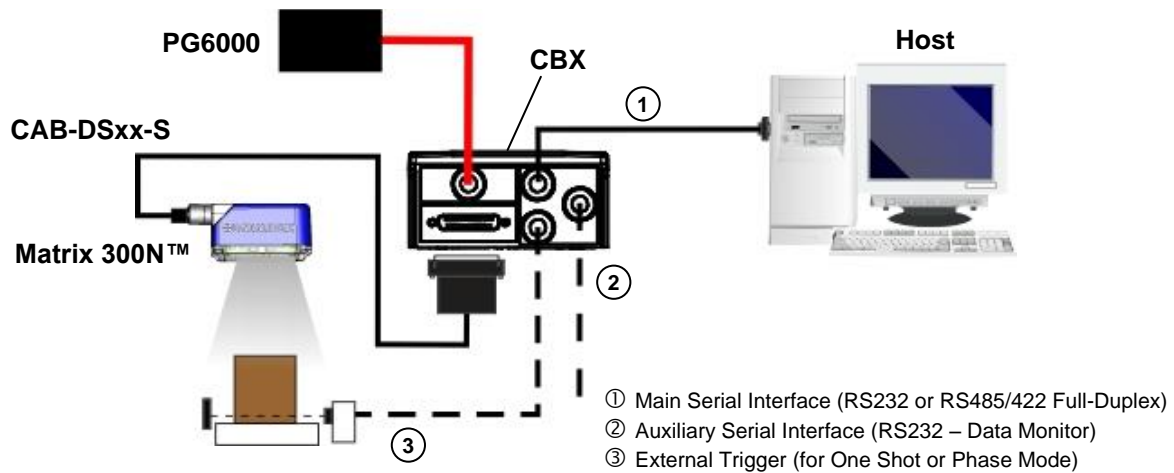


Figure 62 – Serial Interface Point-to-Point Layout

### 5.3 FIELDBUS CONNECTION

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 Ethernet interface using the DL.CODE™ configuration program.

Data can be transmitted on the RS232 auxiliary interface independently from the Fieldbus interface selection to monitor data.

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.

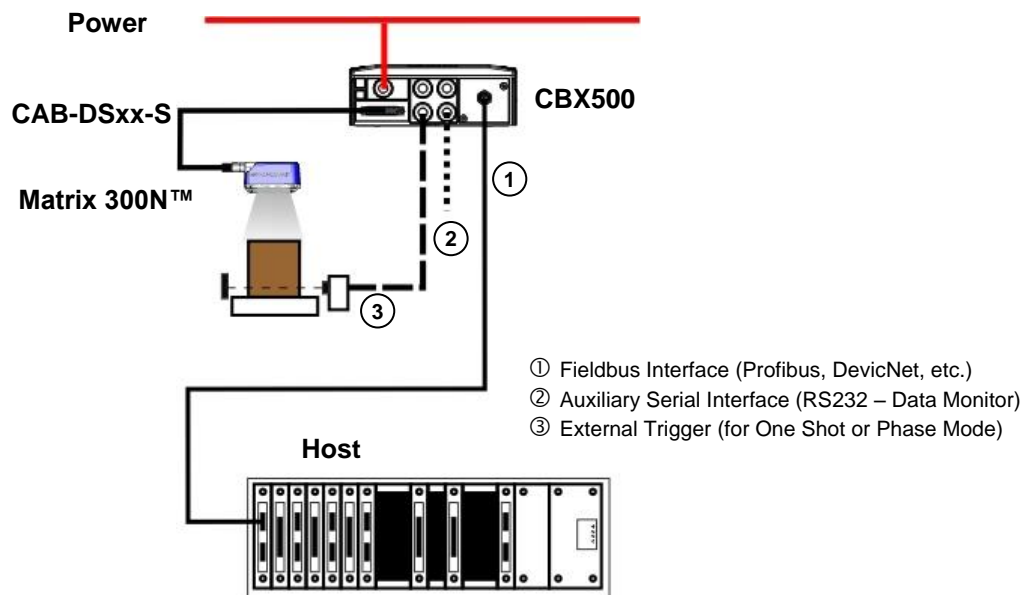


Figure 63 – Fieldbus Interface Point-to-Point Layout

## 5.4 ID-NET™ SYNCHRONIZED NETWORK



**NOTE:** DL.CODE™ only supports Master/Slave SYNCHRONIZED ID-NET™ network configurations.

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/RS422 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 PackTrack or Phase Mode.

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

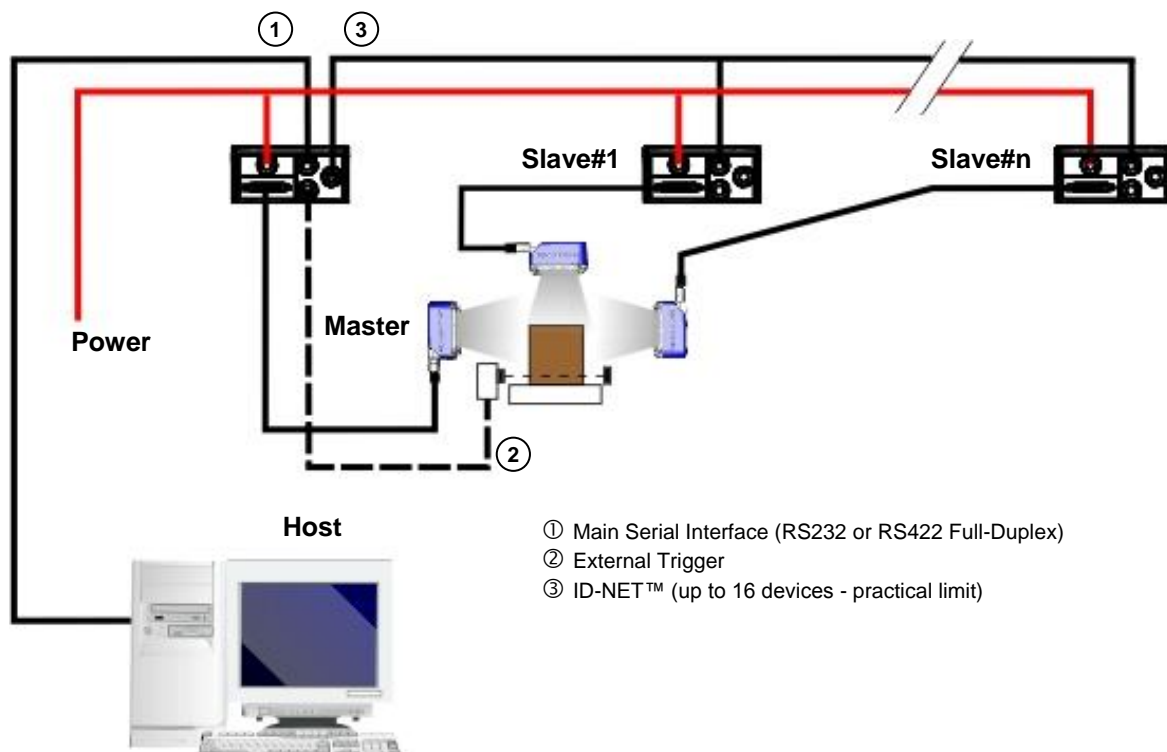
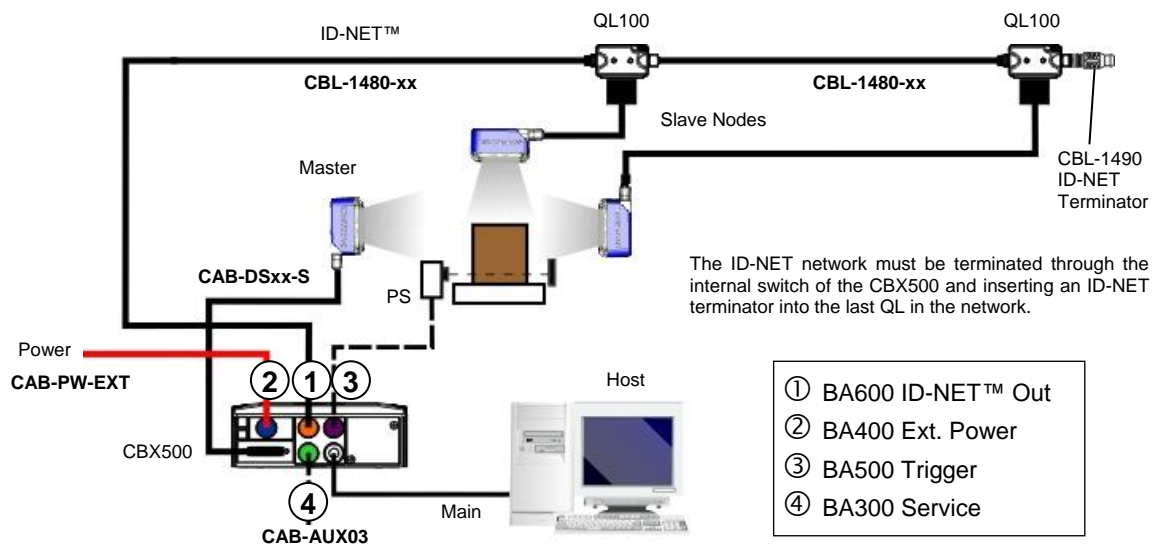


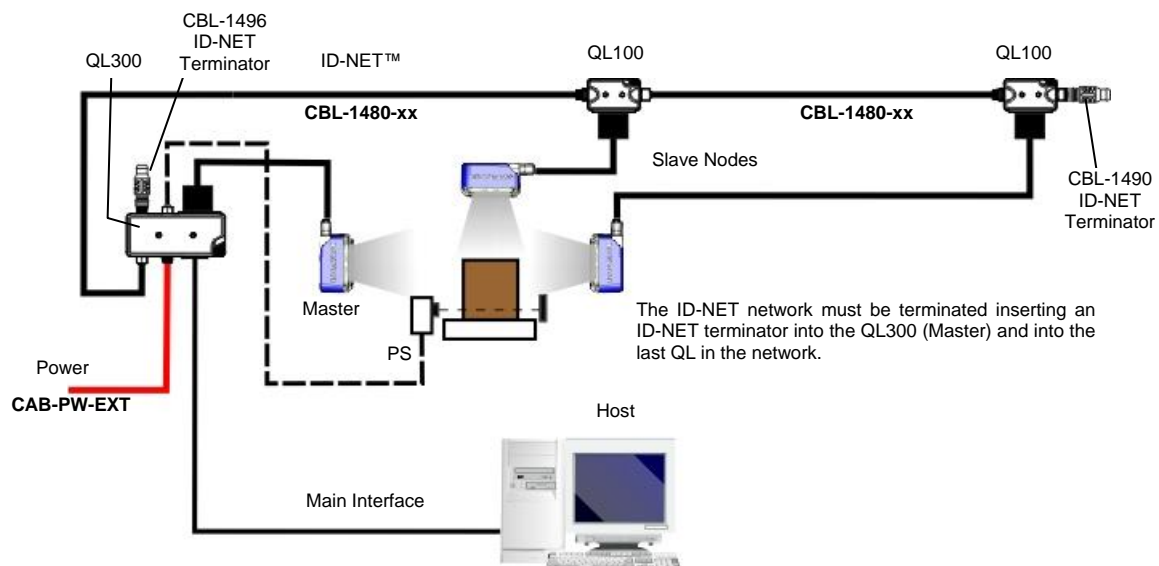
Figure 64 – ID-NET™ M/S Synchronized Layout

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).



**Figure 65 - ID-NET™ Synchronized Layout**  
**Matrix 300N™ Master with CBX500 + Matrix 300N™ Slaves with QL100**

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



**Figure 66 - ID-NET™ Synchronized Layout**  
**Matrix 300N™ Master with QL300 + Matrix 300N™ Slaves with QL100**

The same configuration can be made to a Host using the on-board Ethernet interface to the Master. The TCP/IP Ethernet and ID-NET™ interfaces are connected as shown in the figure below.

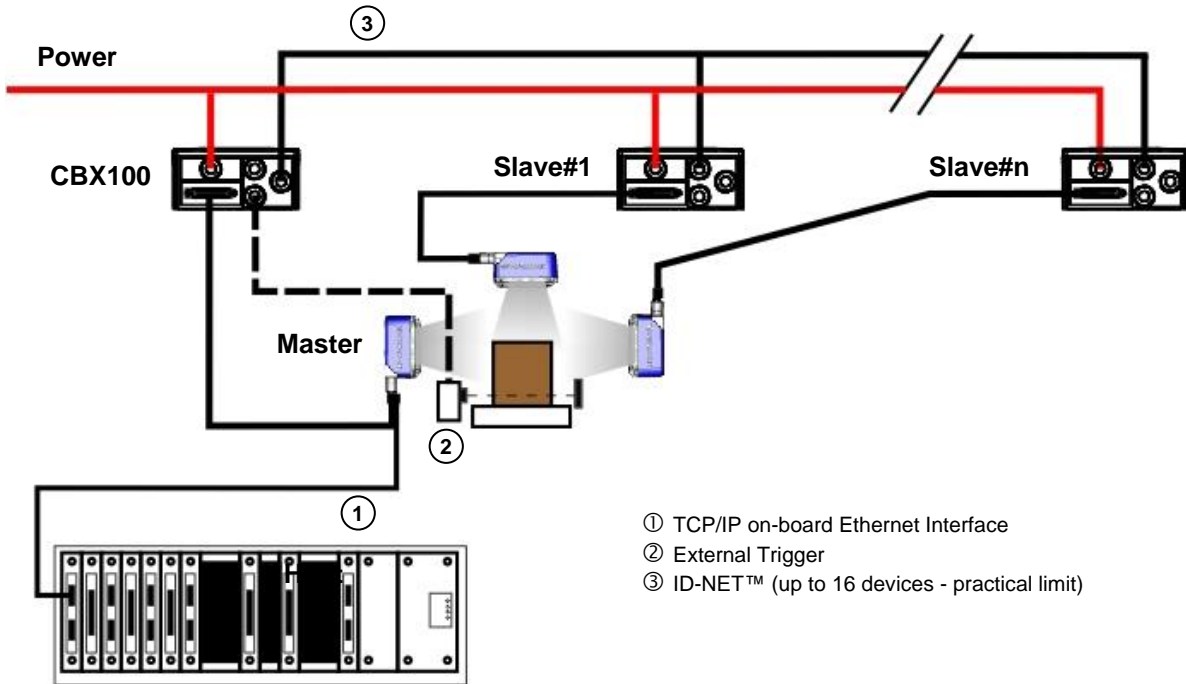


Figure 67 – ID-NET™ M/S Synchronized Layout with on-board TCP/IP Ethernet Interface to Host

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 Ethernet interface of each individual reader using the DL.CODE™ configuration program or Host Mode programming.

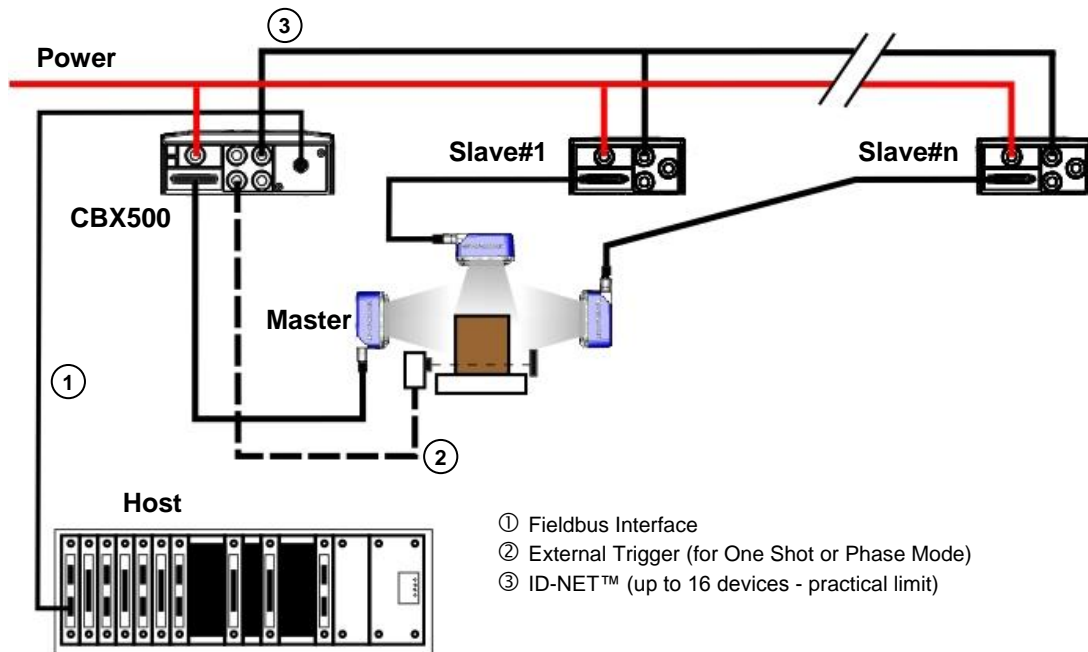


Figure 68 – ID-NET™ Fieldbus M/S Synchronized Layout



## 6 READING FEATURES

### 6.1 FOV CALCULATION

Use the data in the following table to calculate the FOV for your application, referring to Figure 69 and the formula below.

Model	Lens Focus Type	$d_0$	Viewing Angle Horizontal	Viewing Angle Vertical	Viewing Angle Diagonal	Min Reading Distance mm
Matrix 300 4x1-0xx	6 mm manual	7 mm	66°	55°	80°	35
Matrix 300 4x2-0xx	9 mm software	14 mm	40°	32°	50°	22
Matrix 300 4x3-0xx	9 mm manual	11 mm	41°	34°	52°	70
Matrix 300 4x4-0xx	12 mm manual	4 mm	32°	26°	40°	70
Matrix 300 4x5-0xx	16 mm manual	5 mm	24°	19°	30°	80

The viewing angle has a tolerance of  $\pm 1^\circ$  depending on the reading distance.

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

where:

**FOV<sub>x</sub>** = horizontal, vertical or diagonal FOV

$\alpha_x$  = horizontal, vertical or diagonal viewing angles.

**d** = reading distance (in mm) from window surface to code surface

**d<sub>0</sub>** = offset (in mm) from center of lens to external window surface

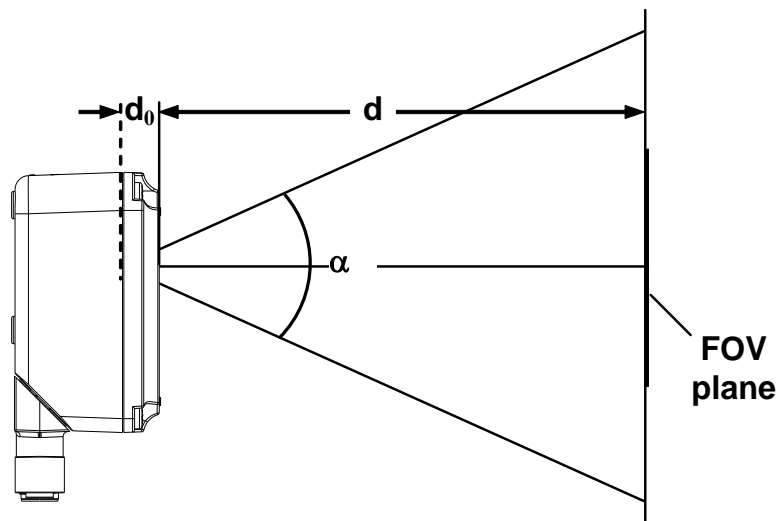


Figure 69 – Reading Distance References

**Example:**

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

$$FOV_H = 2 \left[ (200 \text{ mm} + 14 \text{ mm}) \tan (40^\circ/2) \right] \cong 156 \text{ mm}$$

$$FOV_V = 2 \left[ (200 \text{ mm} + 14 \text{ mm}) \tan (32^\circ/2) \right] \cong 123 \text{ mm}$$

## 6.2 GLOBAL FOV DIAGRAMS

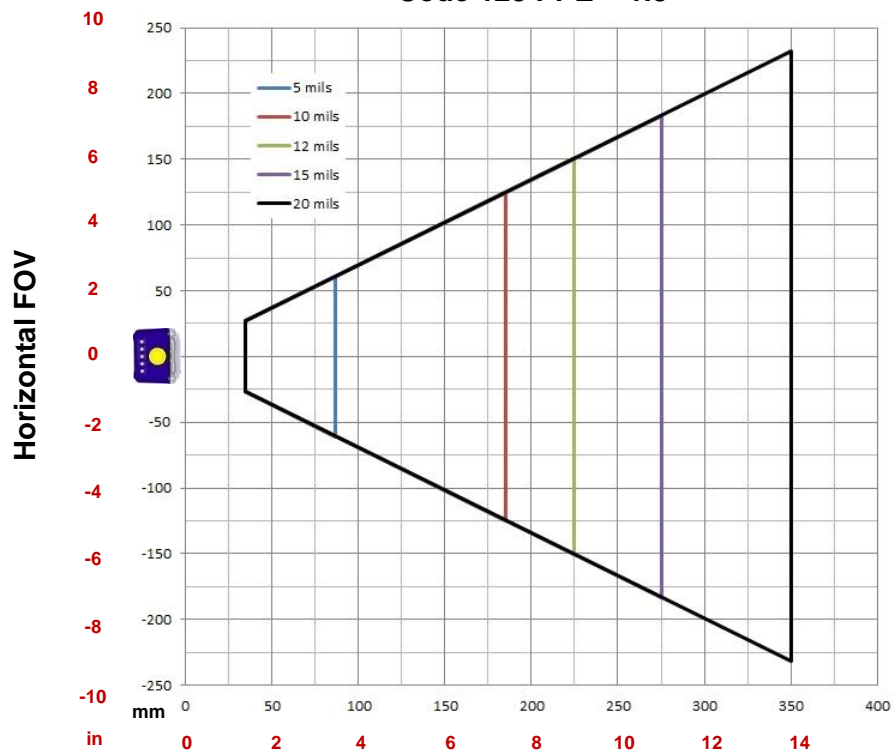


**NOTE:** The following diagrams are given for typical performance at 25°C using high quality grade A symbols according to ISO/IEC 15416 (1D code) and ISO/IEC 15415 (2D code) print quality test specifications. Testing should be performed with actual application codes in order to maximize the application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

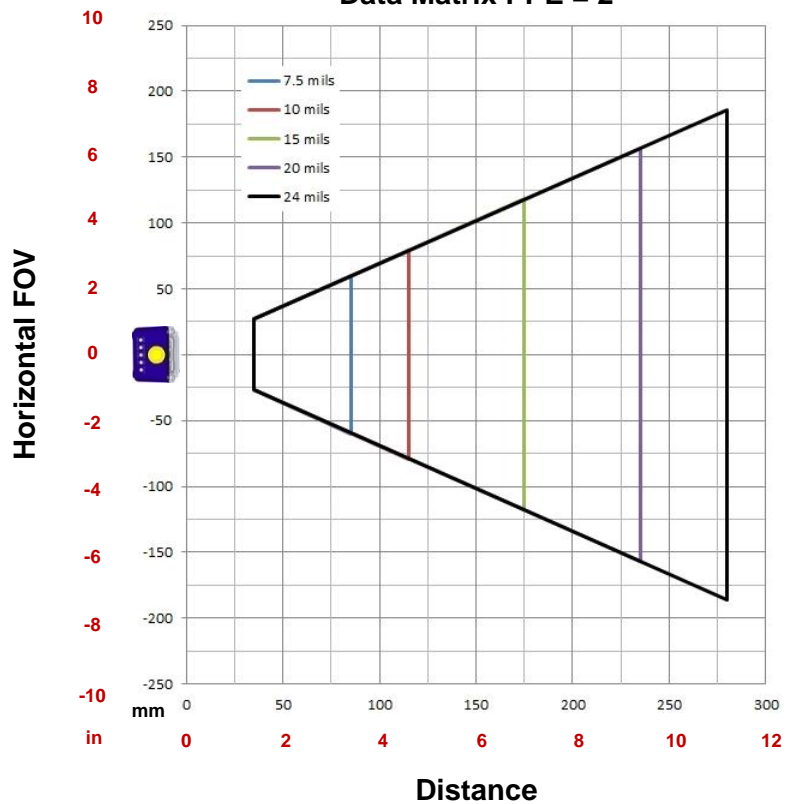
The following diagrams show the **maximum obtainable** Field of View for 1D and 2D codes using Processing Mode = Advanced Code Setting. **Depending on the code resolution, symbology, and number of characters in the code, the Reading Area can be different from the FOV.** See the reference Reading Diagrams starting from par. 6.3.1 for reading area examples.

## 6.2.1 Manual Adjustable Focus Models 6 mm

Code 128 PPE = 1.3

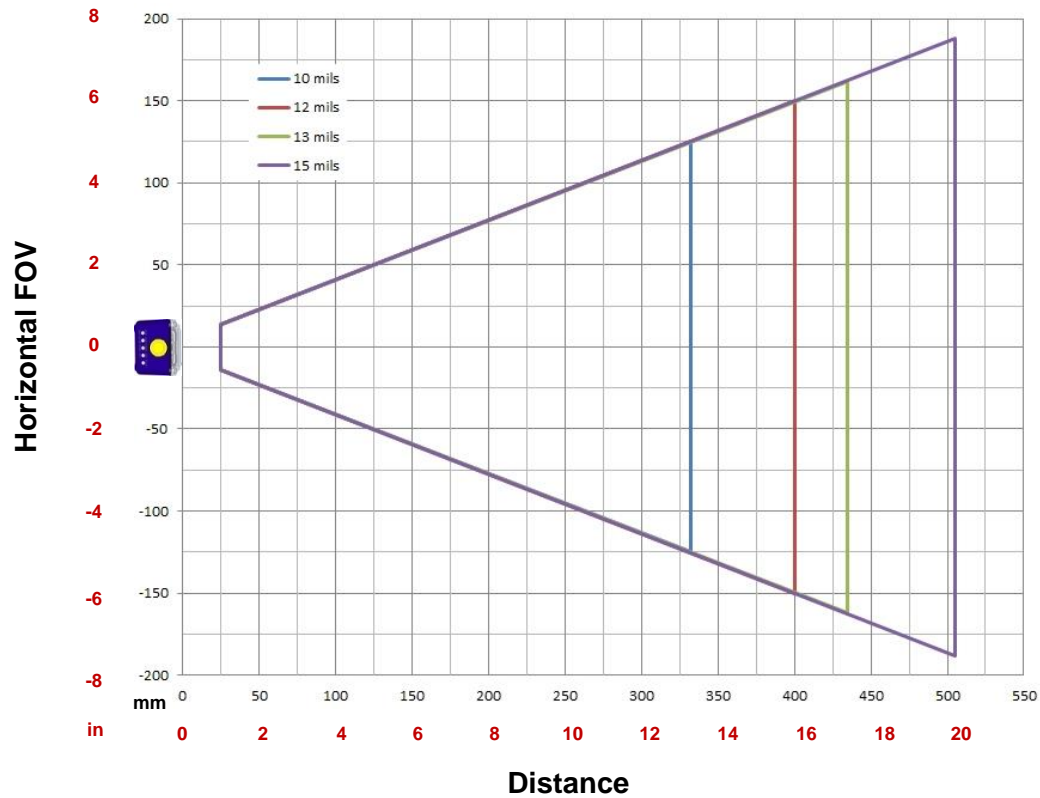


Data Matrix PPE = 2

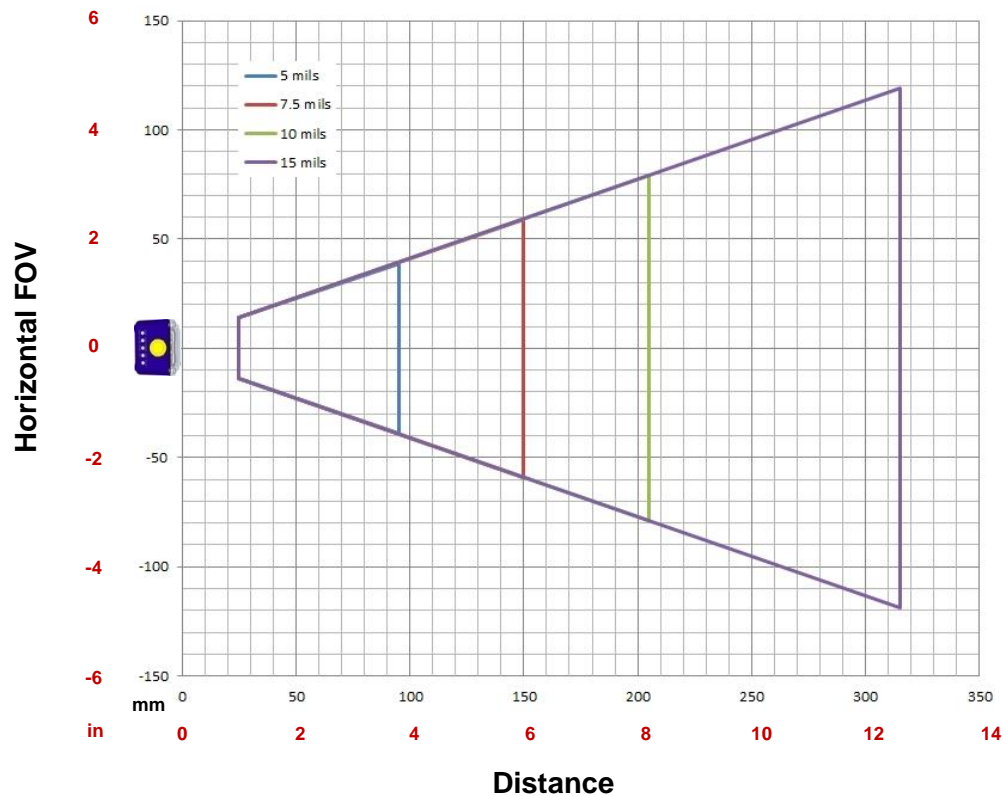


### 6.2.2 Software Adjustable Liquid Lens Models 9 mm

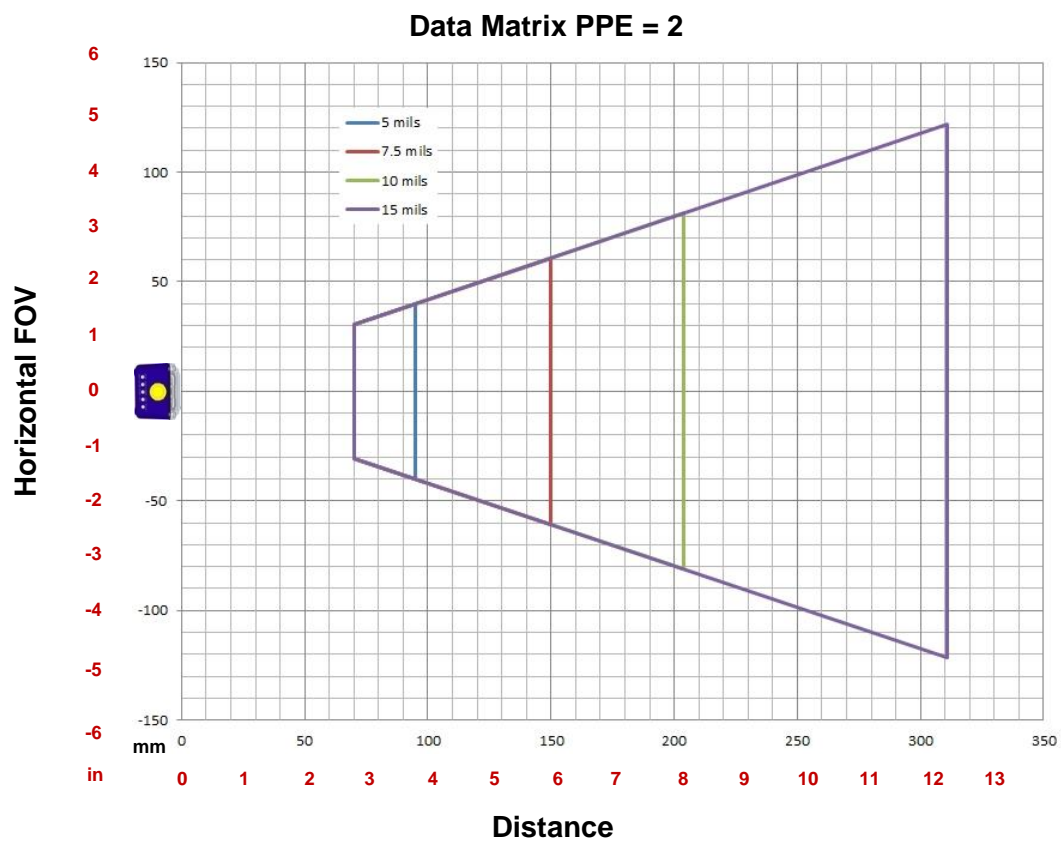
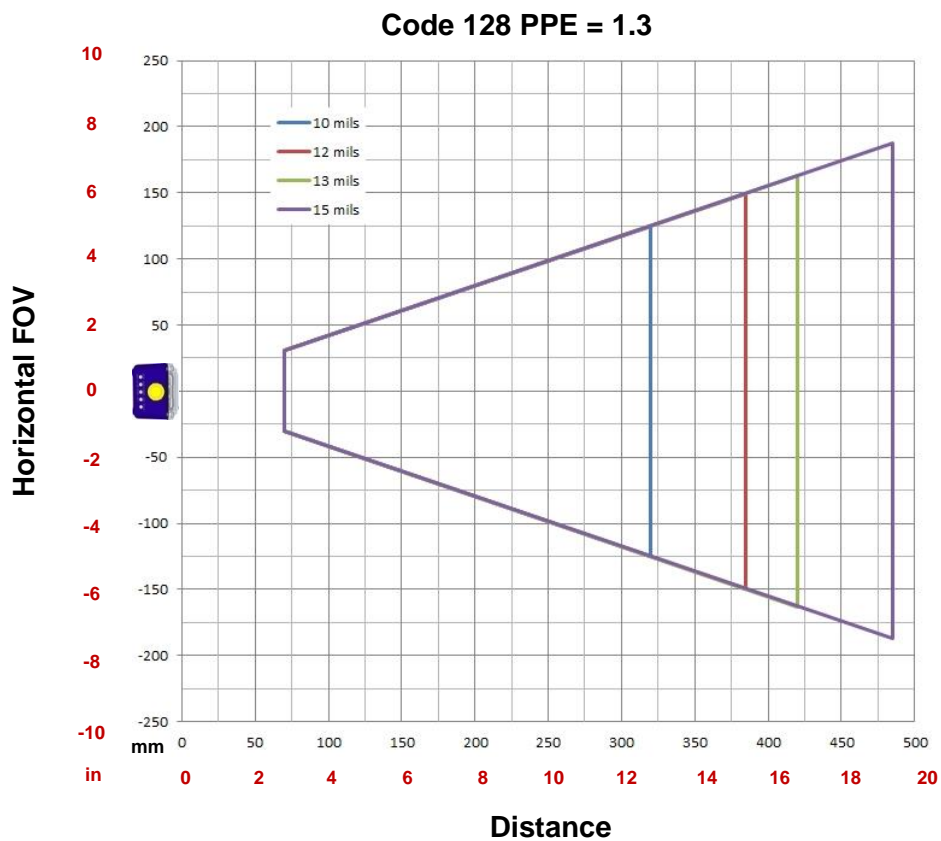
Code 128 PPE = 1.3



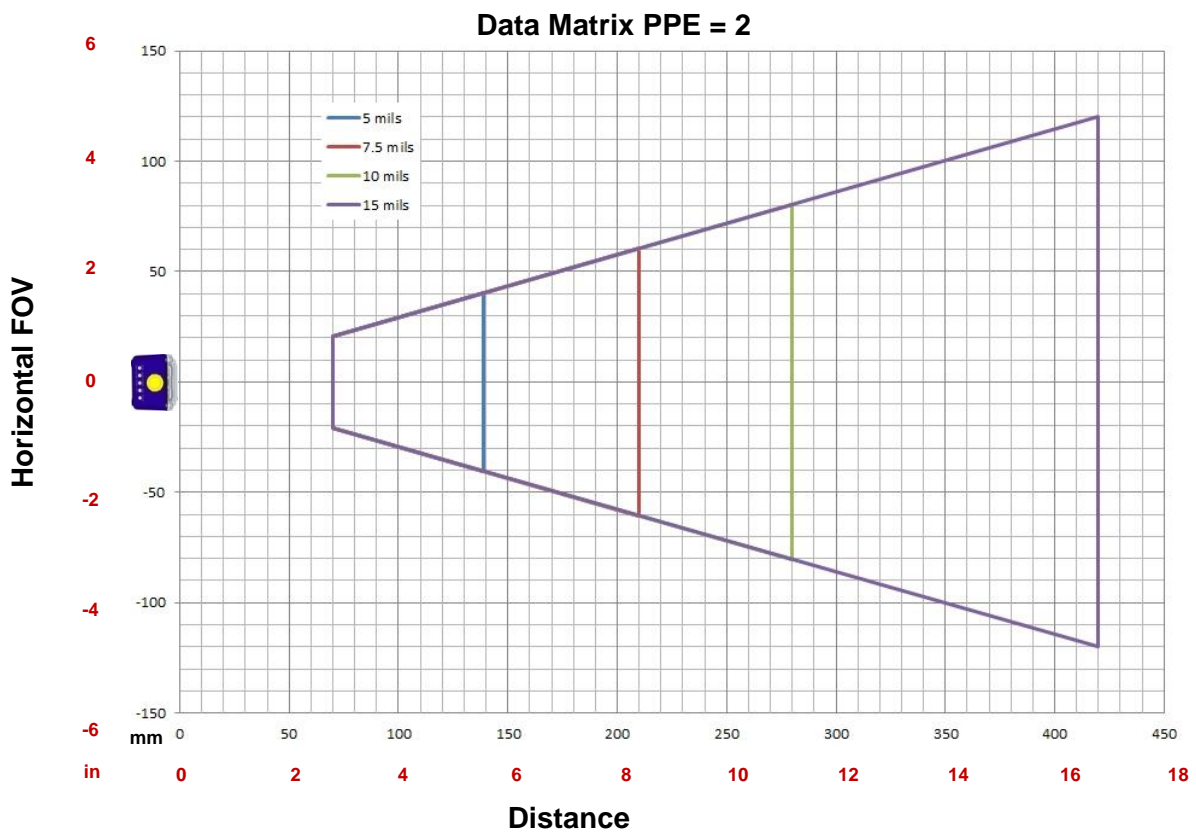
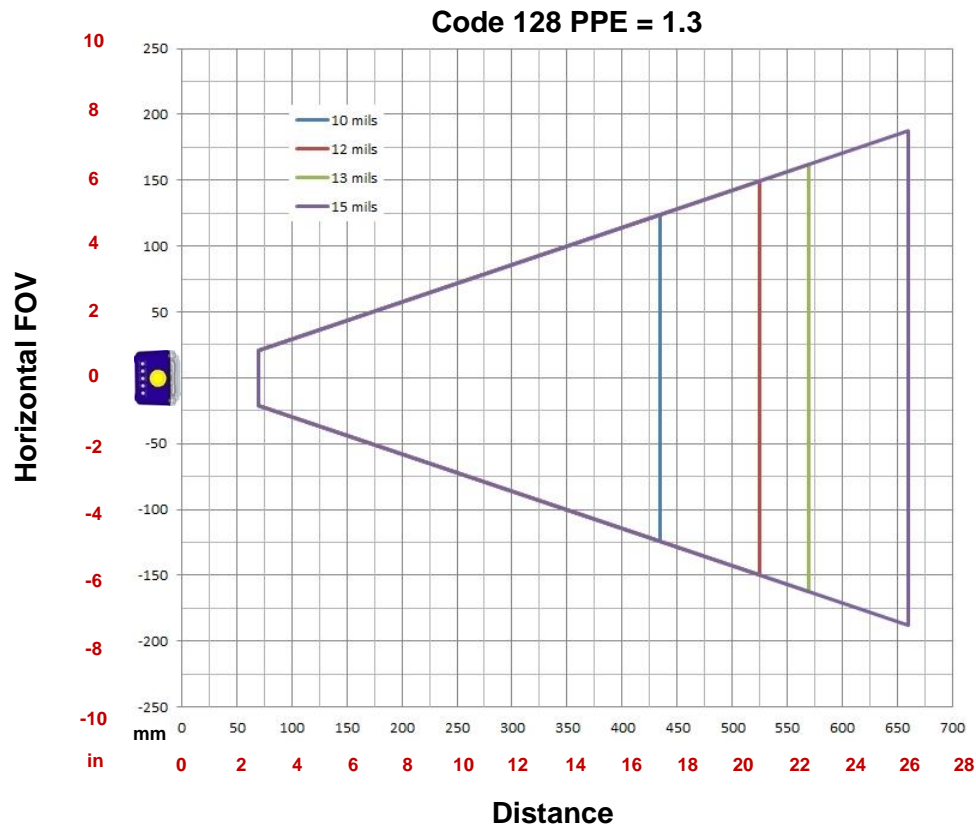
Data Matrix PPE = 2



### 6.2.3 Manual Adjustable Focus Models 9 mm

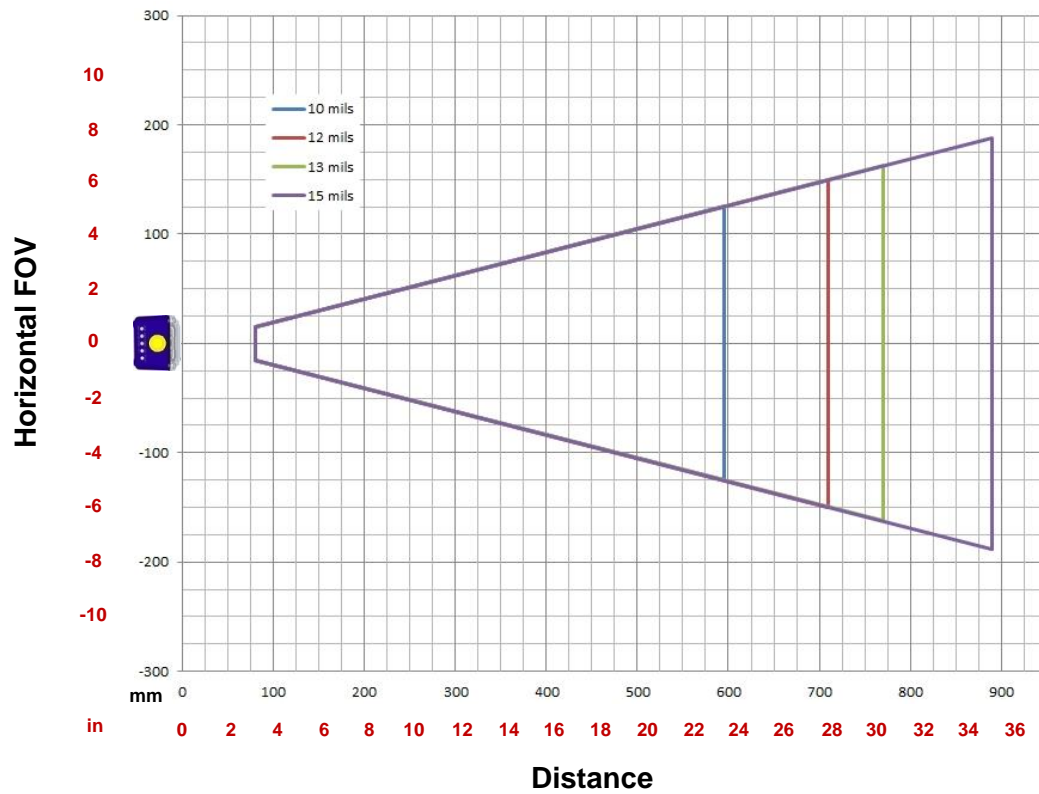


### 6.2.4 Manual Adjustable Focus Models 12 mm

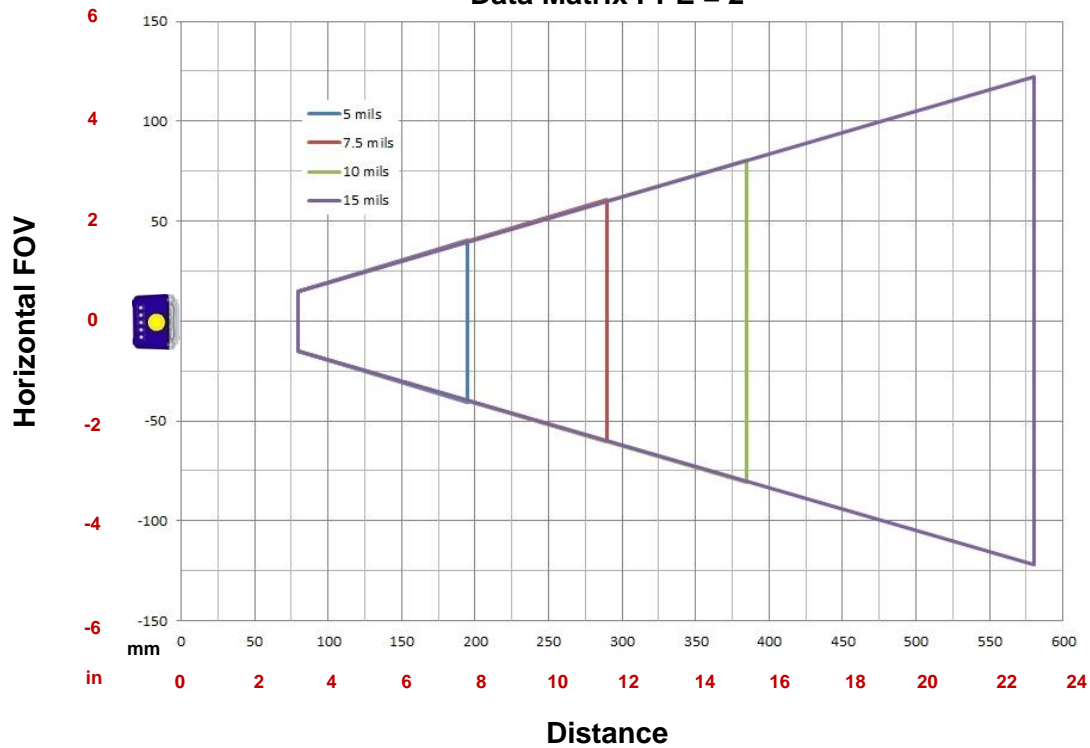


## 6.2.5 Manual Adjustable Focus Models 16 mm

Code 128 PPE = 1.3



Data Matrix PPE = 2



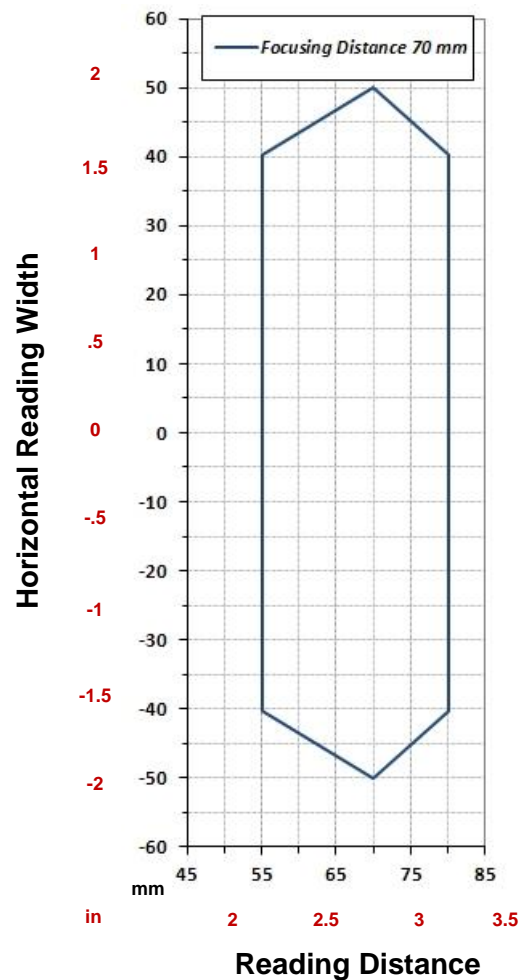


### 6.3 READING DIAGRAMS

- 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 300N™ 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.  $FOV_V \cong FOV_H \times 0.8$ ).
- 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. 6.4.
- Common software parameter settings for all 6 mm models reading all code symbologies, and all 9 mm, 12 mm and 16 mm models reading 1D code symbologies are: Processing Mode=Advanced Code Setting;  
For 9 mm, 12 mm and 16 mm models reading 2D code symbologies: Processing Mode=Standard; Code Contrast=Low; Decoding Complexity=Very High.
- When defining a HW/SW configuration for the Matrix 300N™ 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 all Sectors ON from the **Internal LED Group**, unless specified otherwise.

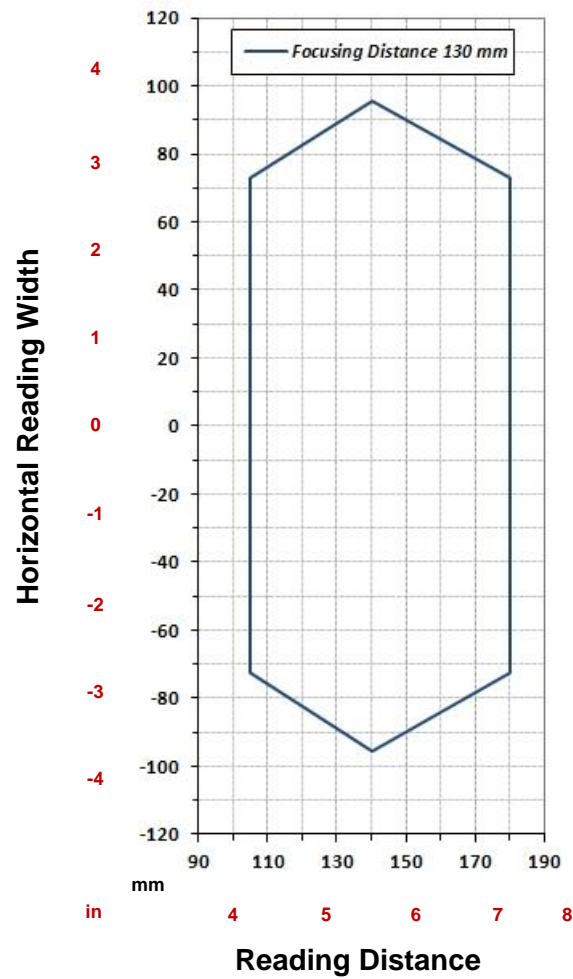
### 6.3.1 Matrix 300 4x1 (6 mm models) 1D Codes

Code 128 0.12 mm (5 mils)



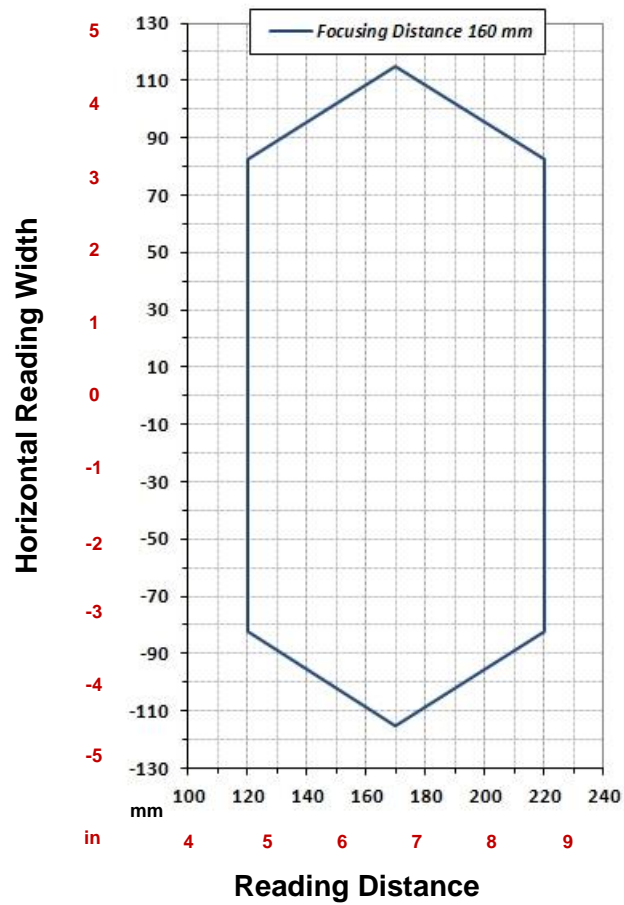
#### CONDITIONS:

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	
Illuminator Lighting Mode	Very High Power Strobed
<b>411-xxx RED Wide</b>	
Exposure Time (μs)	90
Gain	5

**Code 128 0.25 mm (10 mils)****CONDITIONS:**

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

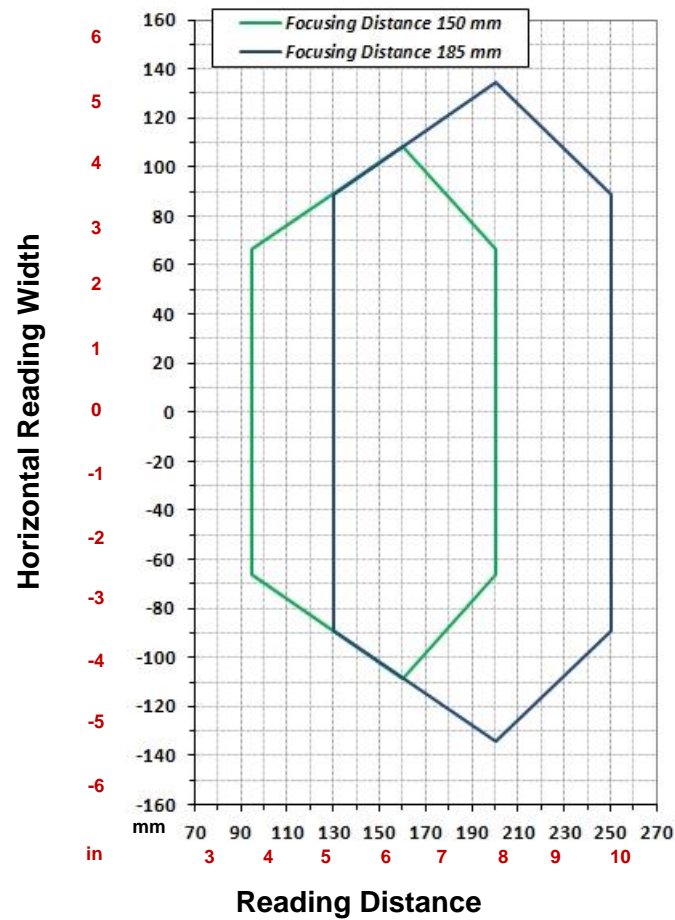
# Code 128 0.30 mm (12 mils)



## 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	
Illuminator Lighting Mode	Very High Power Strobed
411-xxx RED Wide	
Exposure Time (µs)	100
Gain	20

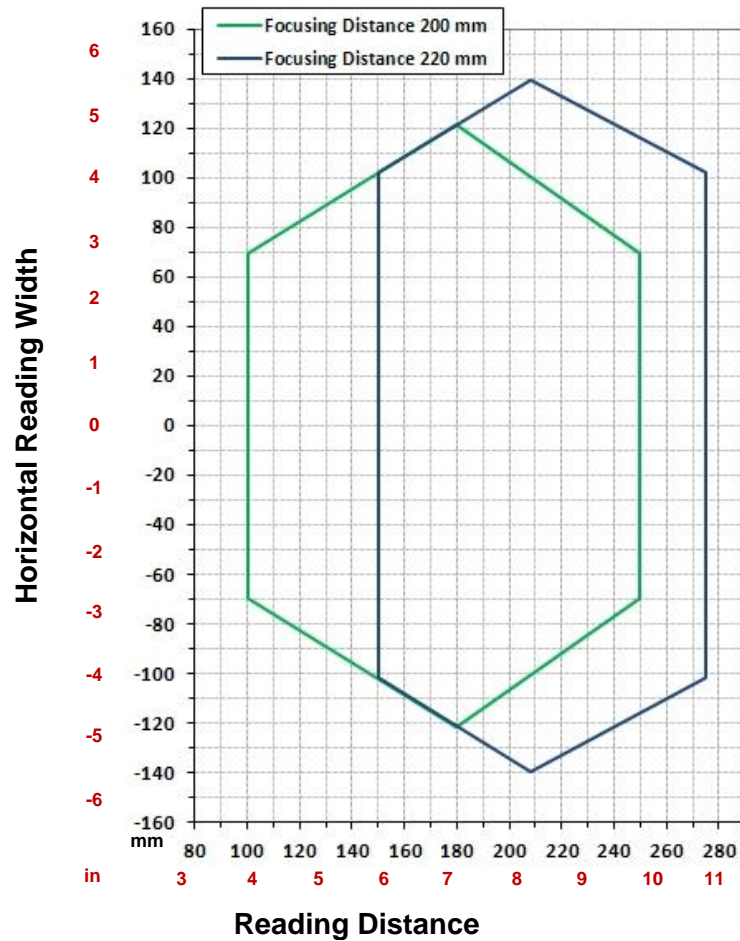
## Code 128 0.33 mm (13 mils)



## CONDITIONS:

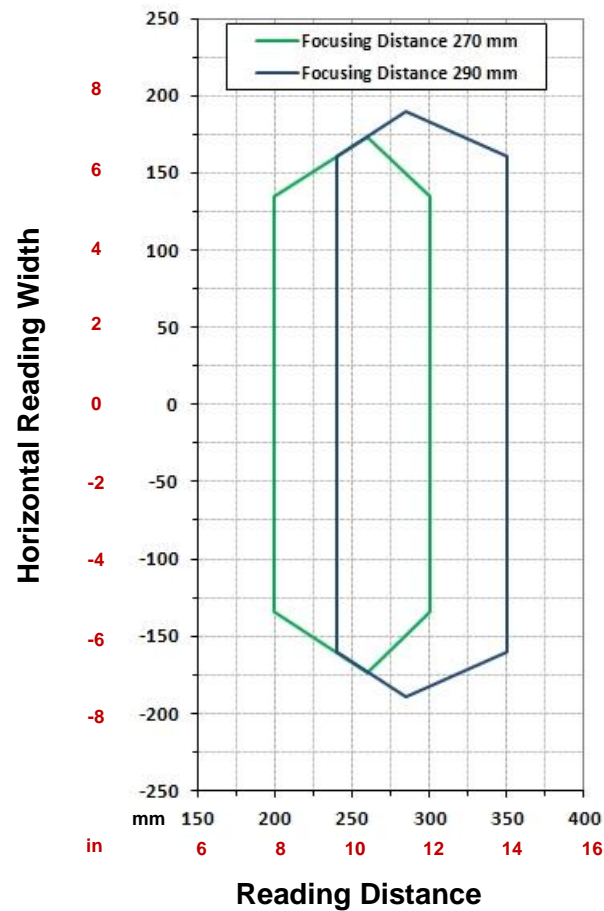
Hardware Settings		
Code Symbology	Code 128	
Code Resolution	0.33 mm (13 mils)	
Tilt Angle	0°	
Skew Angle	15°	
Focusing Distance (mm)	150	185
Software Parameters		
Illuminator Lighting Mode	Very High Power Strobed	
411-xxx RED Wide		
Exposure Time (µs)	150	175
Gain	13	20

### 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		
Illuminator Lighting Mode	Very High Power Strobed	
411-xxx RED Wide		
Exposure Time (μs)	250	250
Gain	6	15

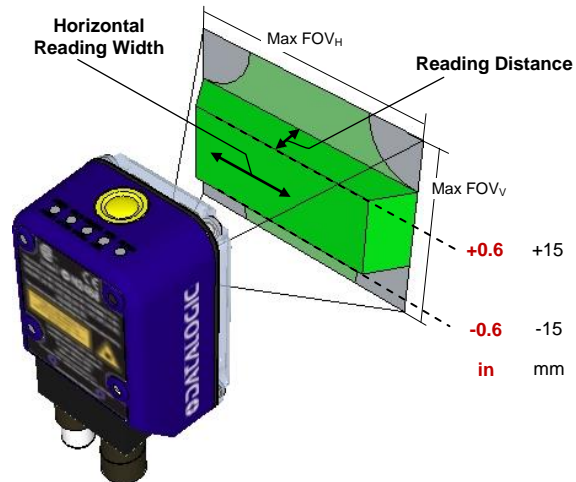
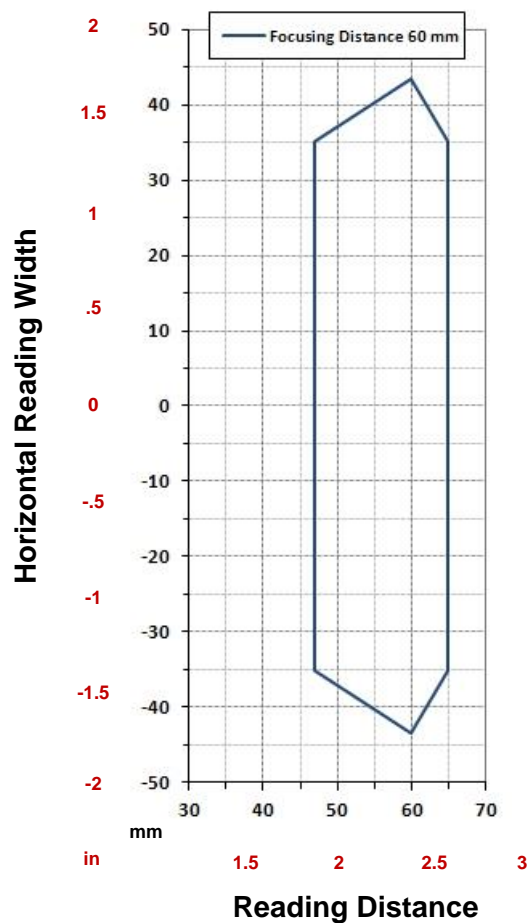
**Code 128 0.50 mm (20 mils)****CONDITIONS:**

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		
Illuminator Lighting Mode	Very High Power Strobed	
411-xxx RED Wide		
Exposure Time (μs)	330	330
Gain	23	25



### 6.3.2 Matrix 300 4x1 (6 mm models) 2D 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, **Image 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. 7.2.8.

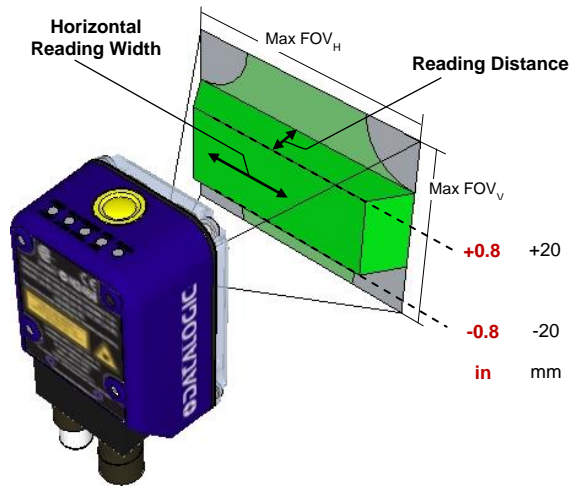
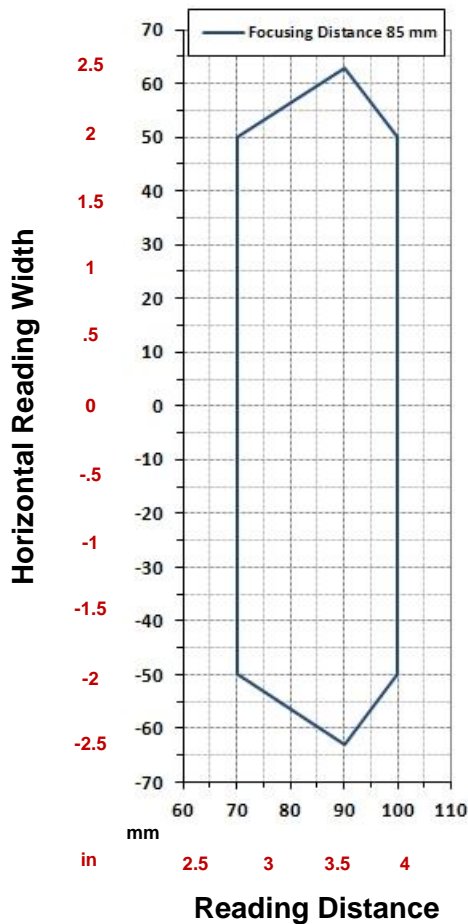
$\pm 15 \text{ mm} \approx 550 \text{ pixels}$

1. Drag top of box to set **x,y coordinates  $\cong 0,236$**
2. Drag bottom of box to set **vertical window dimensions  $\cong 550 \text{ pixels}$**

#### 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	
Illuminator Lighting Mode	Very High Power Strobed
<b>481-xxx MLT-DPM</b>	
LED Group	Peripheral
Exposure Time (μs)	380
Gain	23

## 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, **Image 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. 7.2.8.

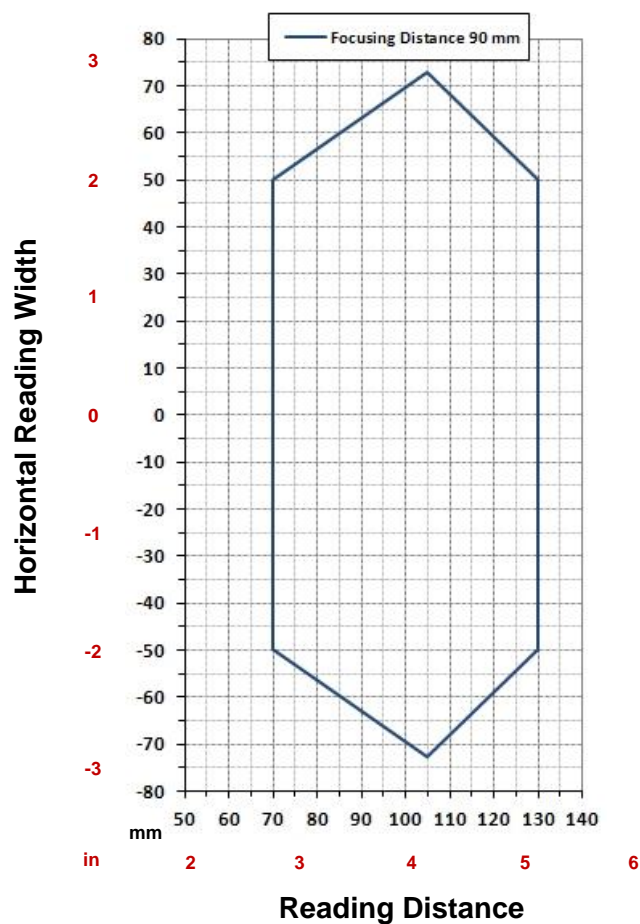
$$\pm 20 \text{ mm} = 512 \text{ pixels}$$

1. Drag top of box to set  
**x,y coordinates  $\cong 0,255$**
2. Drag bottom of box to set  
**vertical window dimensions  $\cong 512$  pixels**

## 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	
Illuminator Lighting Mode	Very High Power Strobed
411-xxx RED Wide	
Exposure Time (μs)	170
Gain	4
481-xxx MLT-DPM	
Exposure Time (μs)	170
Gain	6

# Data Matrix 0.38 mm (15 mils)

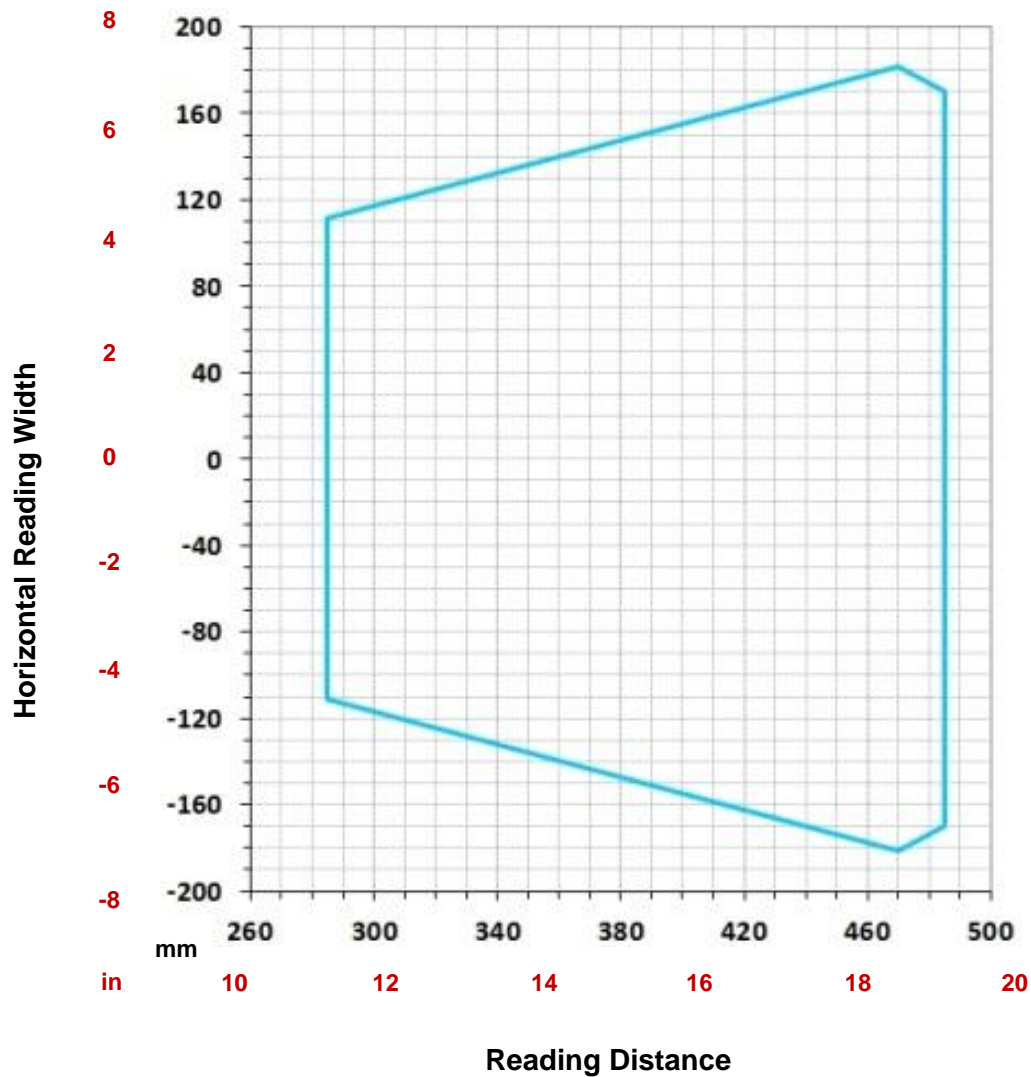


## CONDITIONS:

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	
Illuminator Lighting Mode	Very High Power Strobed
411-xxx RED Wide	
Exposure Time (µs)	80
Gain	8
481-xxx MLT-DPM	
Exposure Time (µs)	80
Gain	12

### 6.3.3 Matrix 300 4x3 (9 mm models) 1D Codes

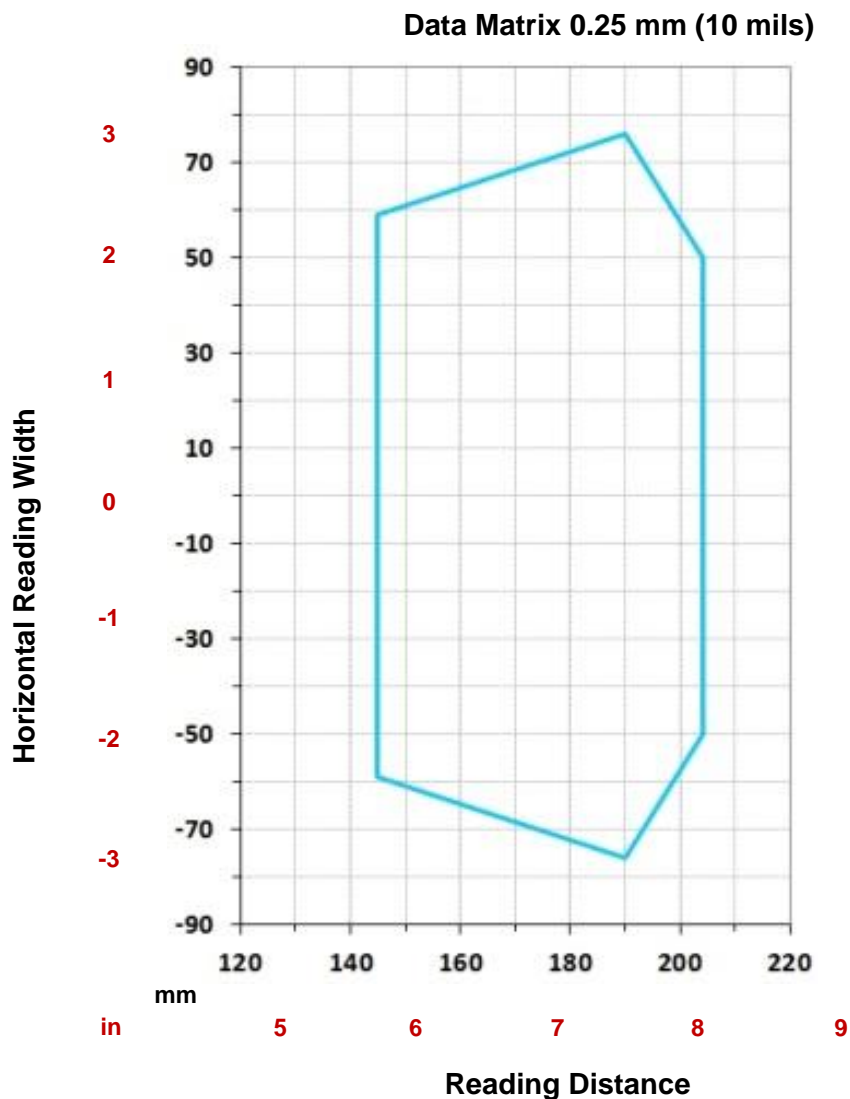
Code 128 0.38 mm (15 mils)



#### CONDITIONS:

Hardware Settings	
Code Symbology	Code 128
Code Resolution	0.38 mm (15 mils)
Tilt Angle	45°
Skew Angle	15°
Focusing Distance (mm)	430
Software Parameters	
Illuminator Lighting Mode	Very High Power Strobed
<b>423-xxx RED Medium</b>	
Exposure Time (μs)	305
Gain	20

### 6.3.4 Matrix 300 4x3 (9 mm models) 2D Codes

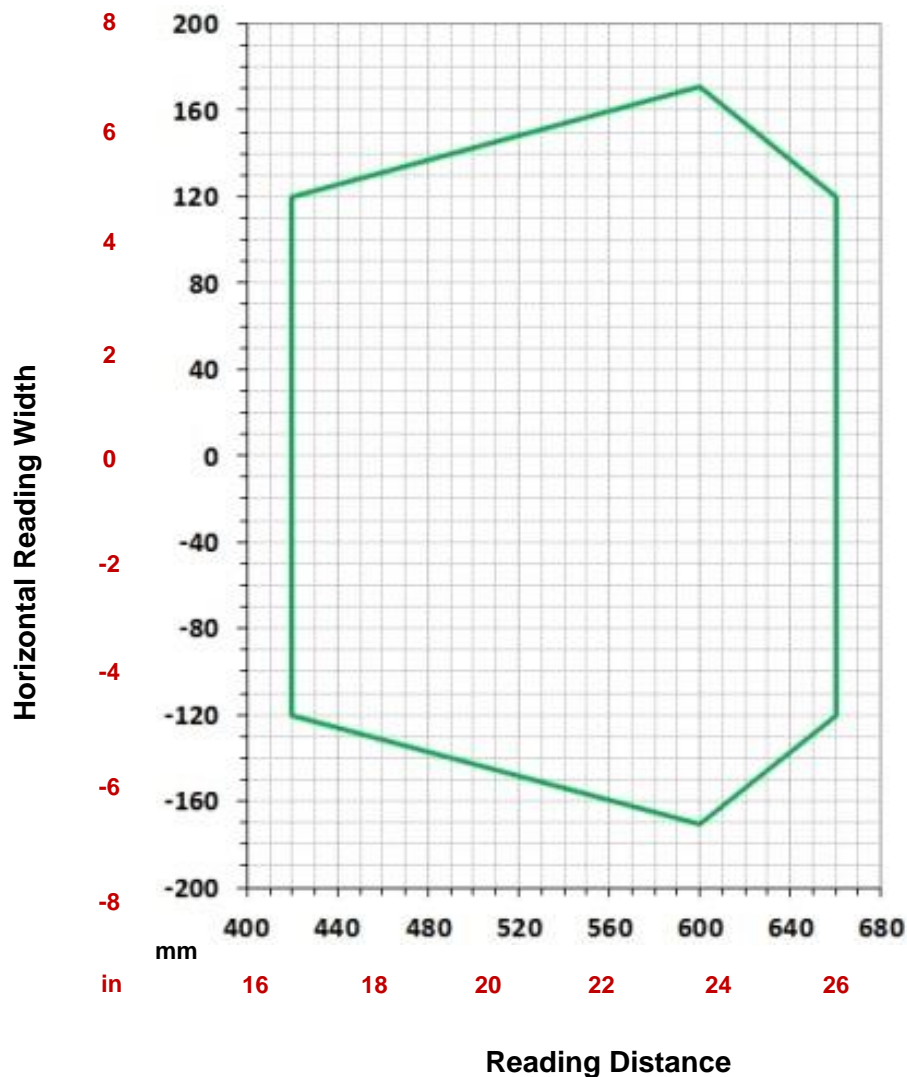


#### CONDITIONS:

Hardware Settings	
Code Symbology	Data Matrix ECC 200
Code Resolution	0.25 mm (10 mils)
Tilt Angle	45°
Skew Angle	15°
Focusing Distance (mm)	180
Software Parameters	
Illuminator Lighting Mode	Very High Power Strobed
<b>423-xxx RED Medium</b>	
Exposure Time (µs)	155
Gain	8
<b>453-xxx WHITE Wide</b>	
Exposure Time (µs)	230
Gain	12
<b>473-xxx LT-DPM</b>	
Exposure Time (µs)	330
Gain	12
<b>483-xxx MLT-DPM</b>	
Exposure Time (µs)	310
Gain	8

### 6.3.5 Matrix 300 4x4 (12 mm models) 1D Codes

Code 128 0.38 mm (15 mils)

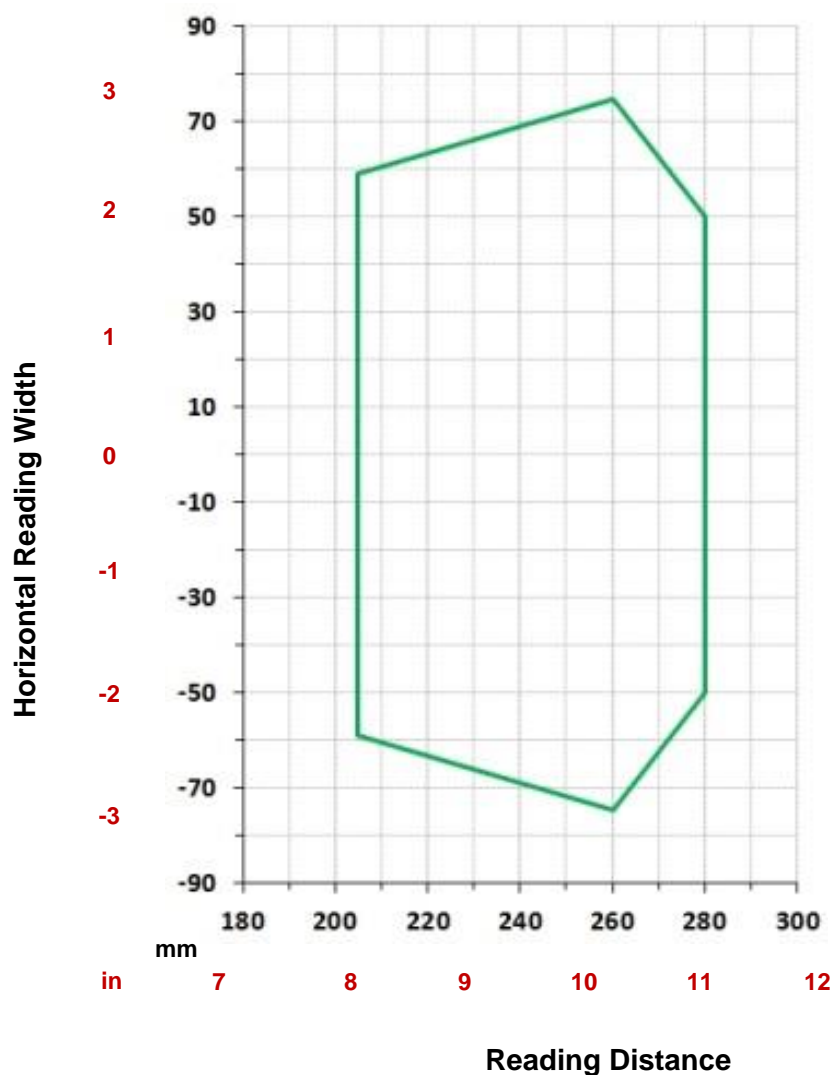


#### CONDITIONS:

Hardware Settings	
Code Symbology	Code 128
Code Resolution	0.38 mm (15 mils)
Tilt Angle	45°
Skew Angle	15°
Focusing Distance (mm)	600
Software Parameters	
Illuminator Lighting Mode	Very High Power Strobed
<b>434-xxx RED Narrow</b>	
Exposure Time (μs)	1000
Gain	16

### 6.3.6 Matrix 300 4x4 (12 mm models) 2D Codes

Data Matrix 0.25 mm (10 mils)



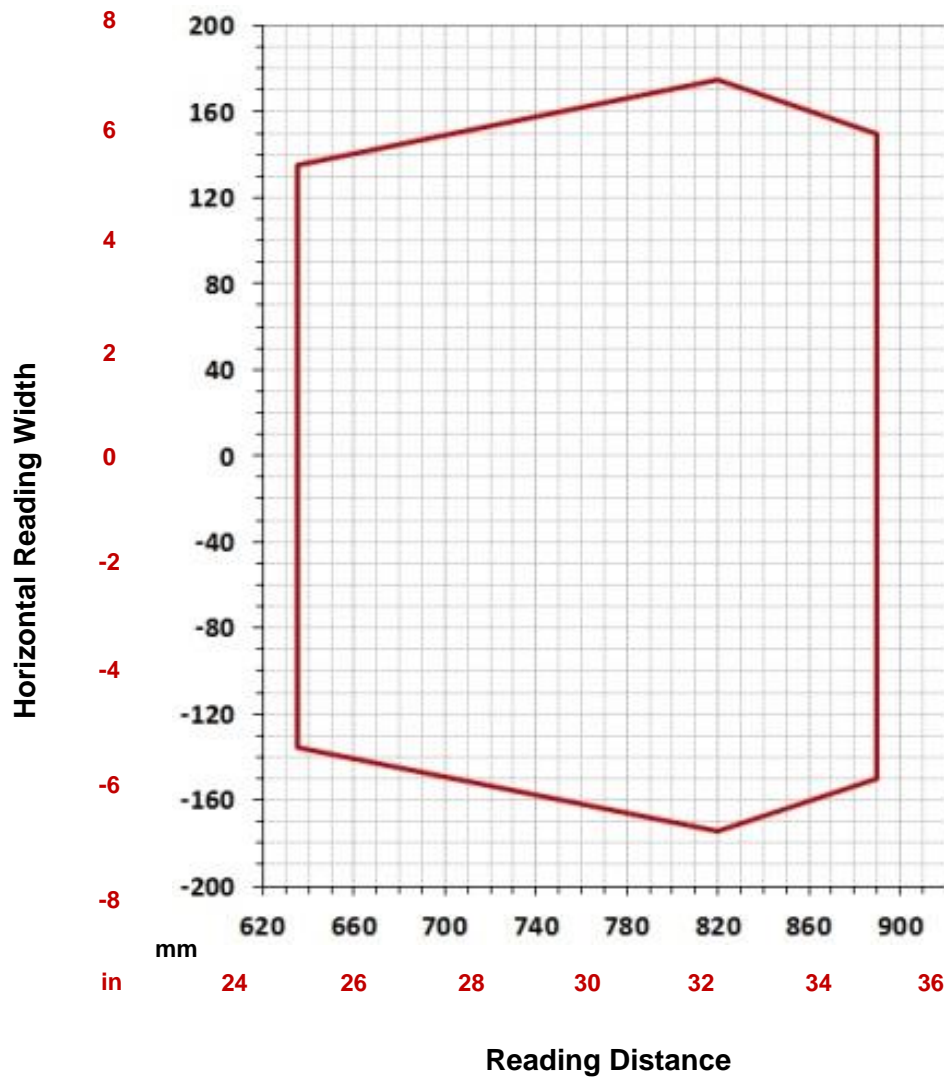
#### CONDITIONS:

Hardware Settings	
Code Symbology	Data Matrix ECC 200
Code Resolution	0.25 mm (10 mils)
Tilt Angle	45°
Skew Angle	15°
Focusing Distance (mm)	250
Software Parameters	
Illuminator Lighting Mode	Very High Power Strobed
<b>434-xxx RED Narrow</b>	
Exposure Time (μs)	150
Gain	8
<b>464-xxx WHITE Narrow</b>	
Exposure Time (μs)	150
Gain	12



### 6.3.7 Matrix 300 4x5 (16 mm models) 1D Codes

Code 128 0.38 mm (15 mils)

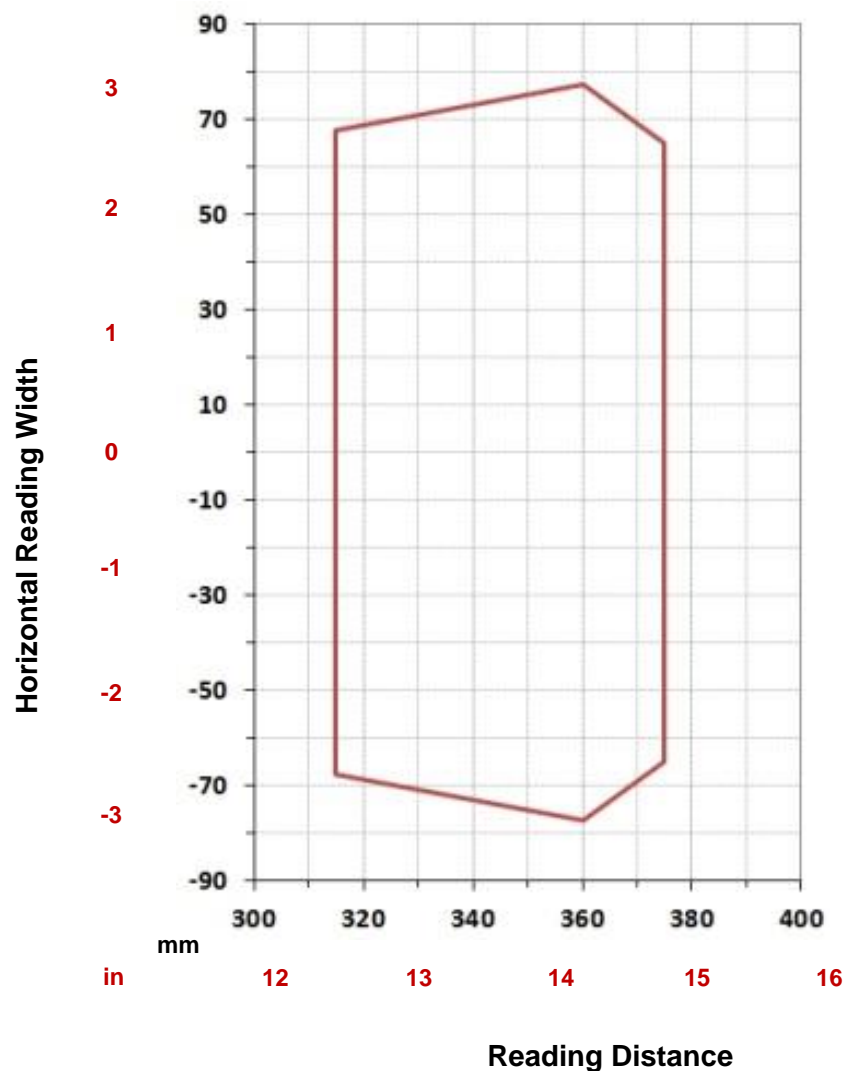


#### CONDITIONS:

Hardware Settings	
Code Symbology	Code 128
Code Resolution	0.38 mm (15 mils)
Tilt Angle	45°
Skew Angle	15°
Focusing Distance (mm)	700
Software Parameters	
Illuminator Lighting Mode	Very High Power Strobed
<b>435-xxx RED Narrow</b>	
Exposure Time (µs)	500
Gain	24

### 6.3.8 Matrix 300 4x5 (16 mm models) 2D Codes

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°
Focusing Distance (mm)	320
Software Parameters	
Illuminator Lighting Mode	Very High Power Strobed
<b>435-xxx RED Narrow</b>	
Exposure Time (μs)	270
Gain	8
<b>465-xxx WHITE Narrow</b>	
Exposure Time (μs)	270
Gain	14

## 6.4 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)
- **T<sub>exp</sub>**: 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:

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

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

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

### Example:

A Matrix 300N™ using:

*Internal Lighting Mode = Very High Power Strobe*

*Exposure Time (μs) = 100 μs*

*Code Resolution (X) = 0.254 mm (10 mils)*

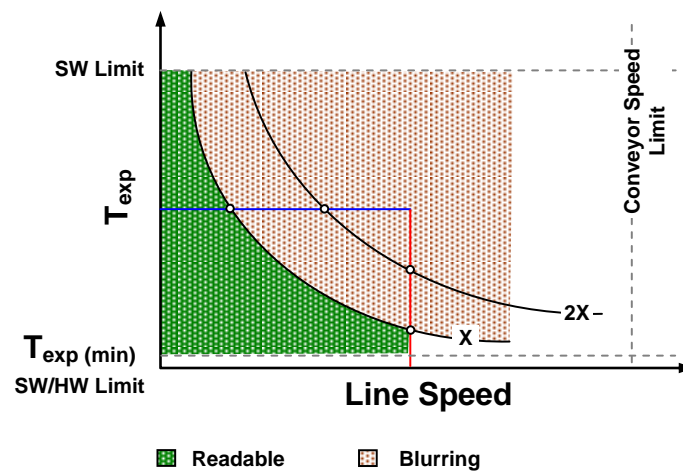
has a maximum line speed of:

$$0.254 \text{ (mm)} / 0.0001 \text{ (s)} = 2540 \text{ mm/s}$$

Likewise, **T<sub>exp (max)</sub>** is the maximum **Exposure Time** value that can be used without blurring for the given application line speed and code resolution. Therefore:

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

$T_{exp (max)}$  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 model 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 300N™ 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). This procedure is described in chapter 1 Steps 3-4.

For the majority of applications however you will use DL.CODE™, connecting to the reader through the on-board Ethernet interface. See chapter 1 Steps 5-6.

### 7.1 DL.CODE™ SYSTEM REQUIREMENTS

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

- 2.00 GHz or faster microprocessor
- Windows: XP, Vista, or 7
- 1 GB RAM
- 2 GB hard disk for 64-bit machines; 1 GB hard disk for 32-bit machines
- 100 Base-T Ethernet
- One 19" or larger monitor (optimized for 1280x1024 resolution)

### 7.2 READER CONFIGURATION

For an example of Matrix device configuration see the example in chapter 1 Steps 5-6.



**NOTE:** Especially for lengthy configurations, it is always good practice to periodically save the configuration to permanent memory (**Save on Device**)



to avoid losing the configuration in Temporary Memory. You must give a name to the new configuration or overwrite an existing one (except for Default which cannot be modified).

When all the configuration parameters are set correctly and saved to the device, you can perform a Backup to File and/or to an External storage device (BM100, etc.). See par. 2.4.



**NOTE:** An improvement in the Matrix N Family readers allows them to contain several configurations or jobs in permanent memory.

This means that in addition to your application configuration(s), the Default configuration is always present on the reader and in fact it is not modifiable and cannot be deleted.

### 7.2.1 Restore Configuration

You can load/restore a previously saved configuration from file or external storage device to your reader by using the Restore commands. See par. 2.4.

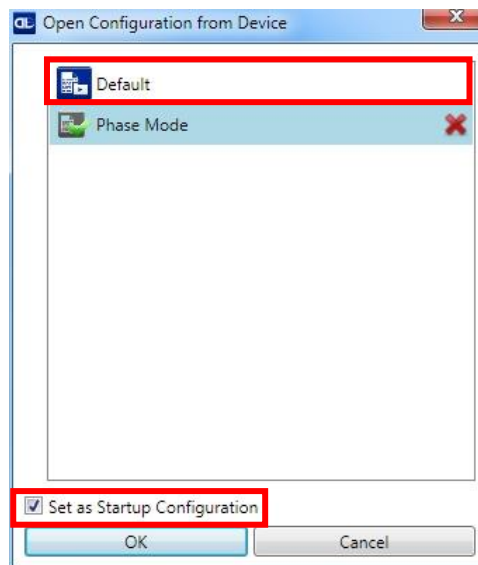
### 7.2.2 Restore Defaults

The device parameters are divided into two main classes, Configuration and Environment which are affected differently by the Restore Defaults commands.

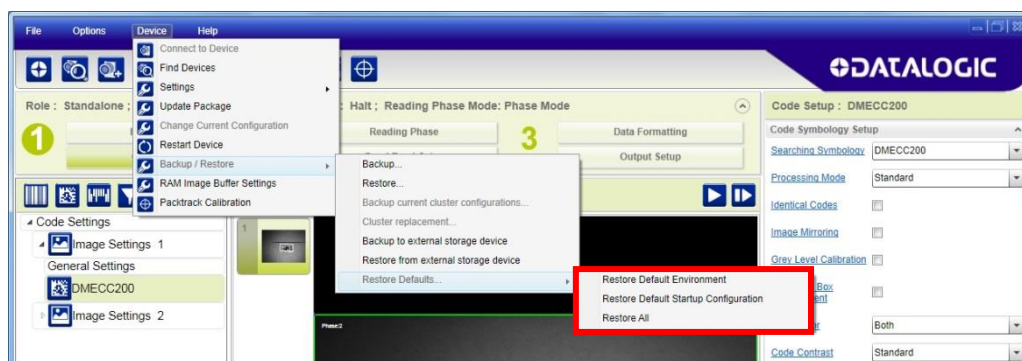
- The Configuration parameters are the ones set in the various steps of the configuration process and are specific to each application. When multiple configurations (jobs) are saved on a single device, these parameters can be different from one configuration to the next.
- Environment parameters regard the device Identity and Position in a Network (Ethernet, ID-NET™, etc.) and are not influenced by the Default (or any other) Configuration present in memory.

### Restore Default Startup Configuration

The Default configuration is always present on the reader and in fact it is not modifiable and cannot be deleted. It can always be restored by simply selecting it from the Open from Device configuration list.



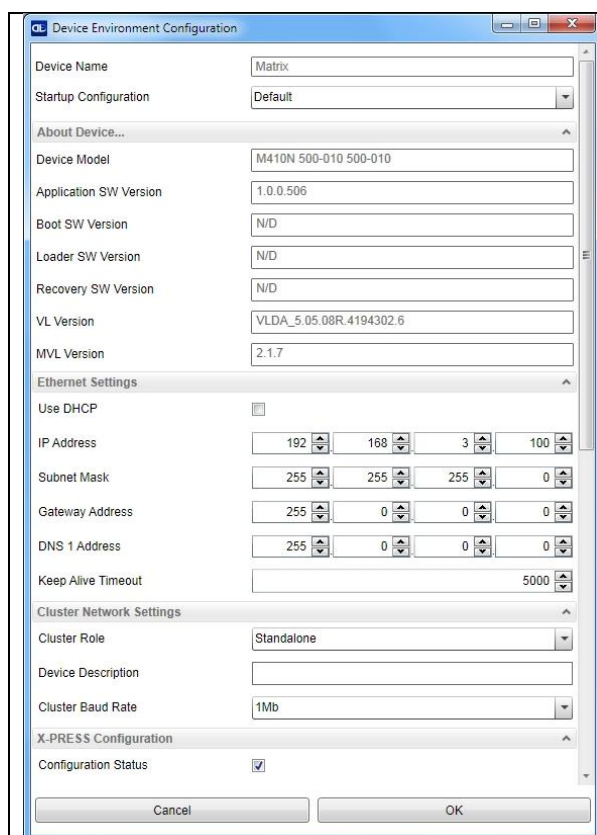
The same action can be performed from the Device menu >Settings > Restore Defaults > **Restore Default Startup Configuration**. The Default Configuration will be set to run at startup and the reader will be reset.



Any previously saved configurations on the device will remain in memory, but the Default configuration is set as the startup configuration.

## Restore Default Environment

**Restore Default Environment** returns all Environment parameters to their factory default settings. The default IP address will be restored as well as all the parameters managed in the Device Environment Configuration window.



The Factory Default static IP address for all Matrix N Family readers is:

**IP Address = 192.168.3.100**

Any previously saved configurations on the device will remain in memory, but the Default configuration is set as the startup configuration.



## Restore All

In order to return a device to its absolute Factory default parameters (for example device replacement) it is necessary to use the **Restore All** command. You will be prompted to confirm.

All Environment parameters will be restored to Factory default values **and any existing configurations stored on the device will be erased**. The device will be reset and therefore start in run mode with the factory default configuration.

### 7.2.3 Auto Calibration

DL.CODE™ provides the **Image Auto-Setup** tool to maximize the reading performance by tuning the acquisition parameters (photometry) automatically. By selecting the **Image Auto-Setup** tool from the Image Setup step, the following window appears:

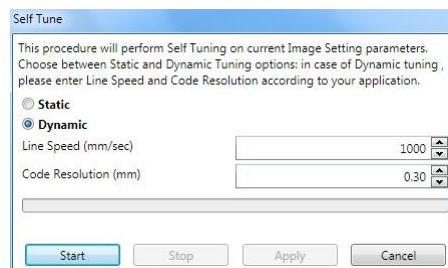


Figure 70 – Image Auto-Setup

Select the Static or Dynamic Self-Tuning option; Start Autolearn and Apply to the Image Setup. The Image Setup window works interactively so that you can see the results of the parameter setting changes as well as the decoding results (Results panel). When switching to the Code Setup step you can also see the decoding results displayed on the image.

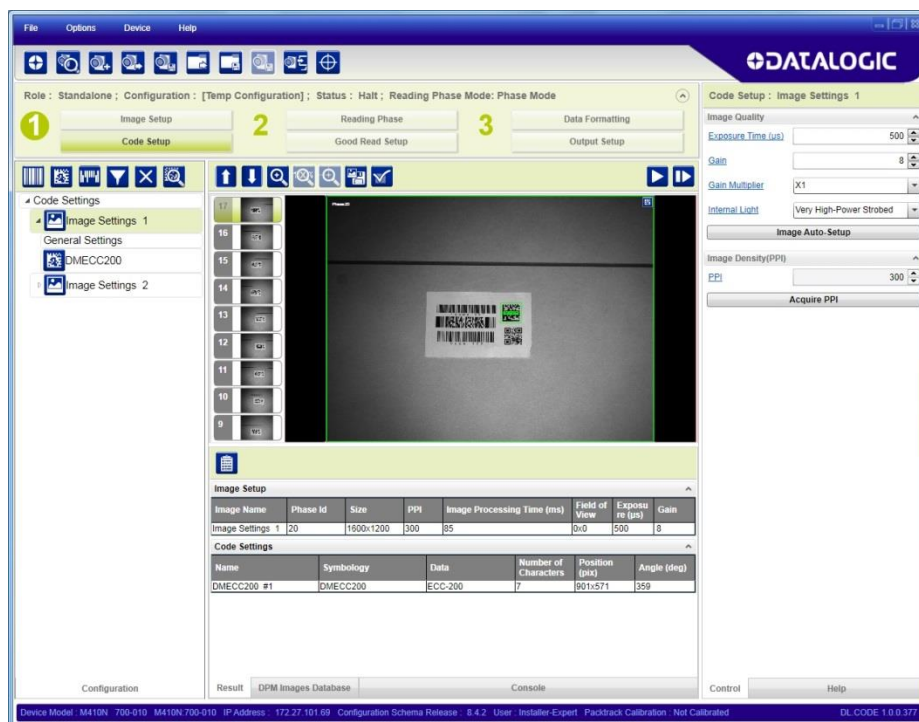


Figure 71 – Decoding Results OK

## 7.2.4 Manual Calibration

The following examples show some of the typical conditions occurring during the installation and how they can be tuned manually:

### 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.

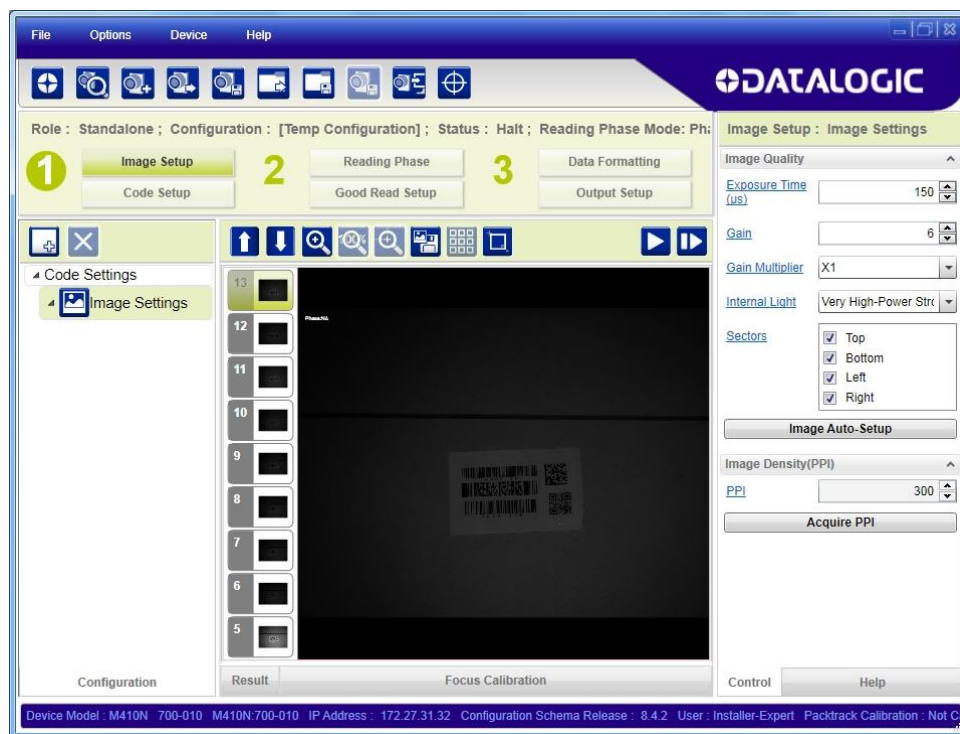


Figure 72 - Example Under Exposure: Too Dark

## 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 73 - Example Over Exposure: Too Light

## Moving code out of the Field of View:

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

- reposition the reader
- use the **Delay on Trigger** and set the time value ( $\mu$ s).

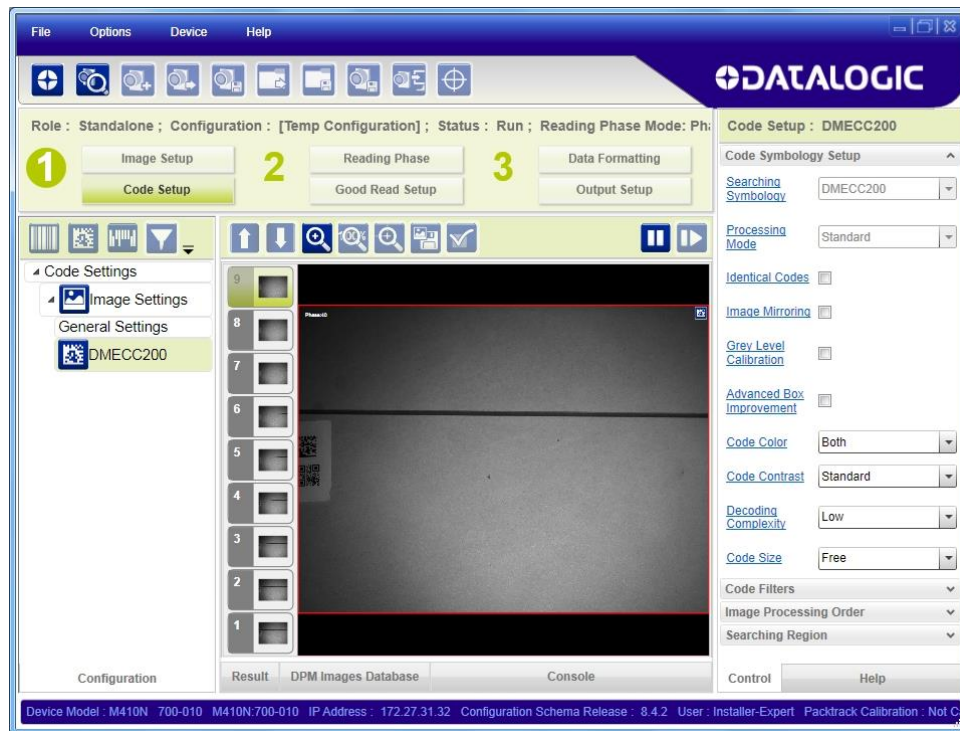



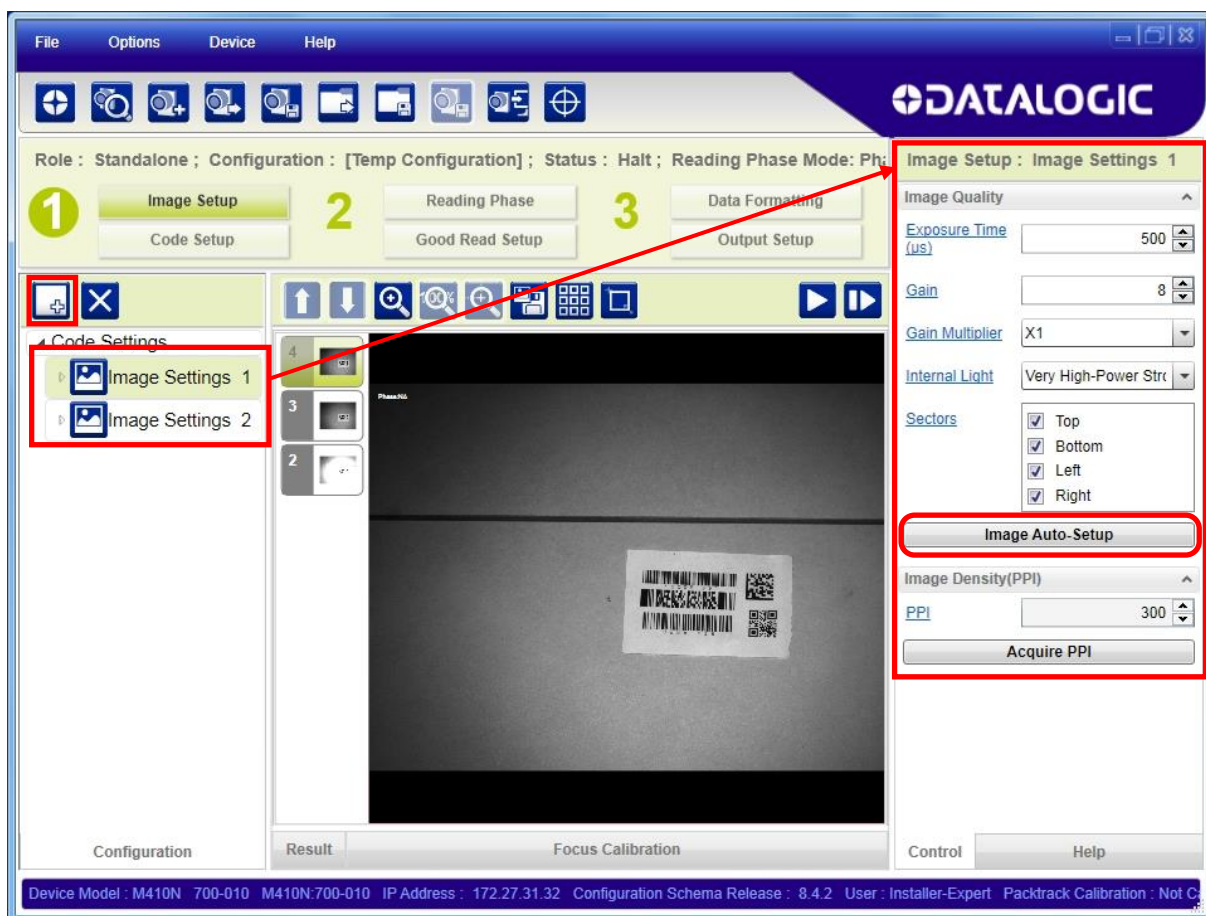
Figure 74 - Example out of FOV

### 7.2.5 Multi Image Acquisition Setups

When controlled variable conditions occur in the application, Multiple **Image Acquisition Setups** 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 an 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.

**Image Setups** are found in the DL.CODE™ **Image Setup** step. Up to 10 different Image Setups can be configured by adding them with the  icon.



For each Image Setup condition start **Image Auto Setup**, select the Static or Dynamic Self-Tuning option; and Apply it.

### 7.2.6 Extending DOF Using Internal Image Settings Selection (Cycle All In Same Phase) for Liquid Lens Models

For Liquid Lens models, multiple Image Acquisition Settings can be configured and enabled internally through the application software 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. 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 External Image Settings Selection (Input Select) feature described in par. 0. 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 DL.CODE™ Image Auto-Setup and Focus Autolearn tools to set the different acquisitions settings.



**NOTE:** By default the **Image Settings Selection** parameter is set to Internal.

#### Multi Image Acquisition Settings Procedure using Internal Image Settings Selection:

1. Using the DL.CODE™ Image Auto-Setup and Focus Autolearn tools, set the first acquisition setting (default) for the 195 mm Reading Distance. Then **Save on Device**.
2. Add another Image Setting, and using the DL.CODE™ Image Auto-Setup and Focus Autolearn tools, set the second acquisition setting for the 300 mm Reading Distance. Then **Save on Device**.
3. On the Reading Phase step > General Settings > Acquisition Settings, set the **Image Settings Selection** to **Internal** (default). Then **Save on Device**.
4. Verify that the reader decodes at both distances with the DL.CODE™ Monitor.



### 7.2.7 Extending DOF Using External Image Settings Selection Sequence (Input Select) for Liquid Lens Models

For Liquid Lens models, multiple Image Acquisition Settings can be configured and enabled externally through a distance sensor to extend the reader's depth of field. The specific Image Acquisition Setting Sequence is selected prior to the reading phase so that only the correct setting (or group of settings) will be applied to the entire reading phase.

When only two Image Acquisition Settings are used to extend DOF, (one in each sequence), 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 sequence, if more than one Image Acquisition Setting is enabled they will be cycled as in the case where **Image Settings Selection** is **Internal**.

#### Example:

Read a 15 mil Data Matrix ECC 200 code covering a range from 140 to 320 mm 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 **Image Settings #1**, and the second has a *Reading Distance of 300 mm* and is assigned to **Image Settings #2**.

By assigning the **Image Settings Selection** to **External**, 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 sequence.

As an example, for a conveyor speed of 1 meter/second the **Activation Event Trigger** (Input 2 sensor) 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 select the Sequence with **Image Settings #1** (the Image Acquisition Setting relative to the 195 mm Reading Distance). Packs farther away do not trigger the proximity sensor and so the Sequence with **Image Settings #2** is selected with the Image Acquisition 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.



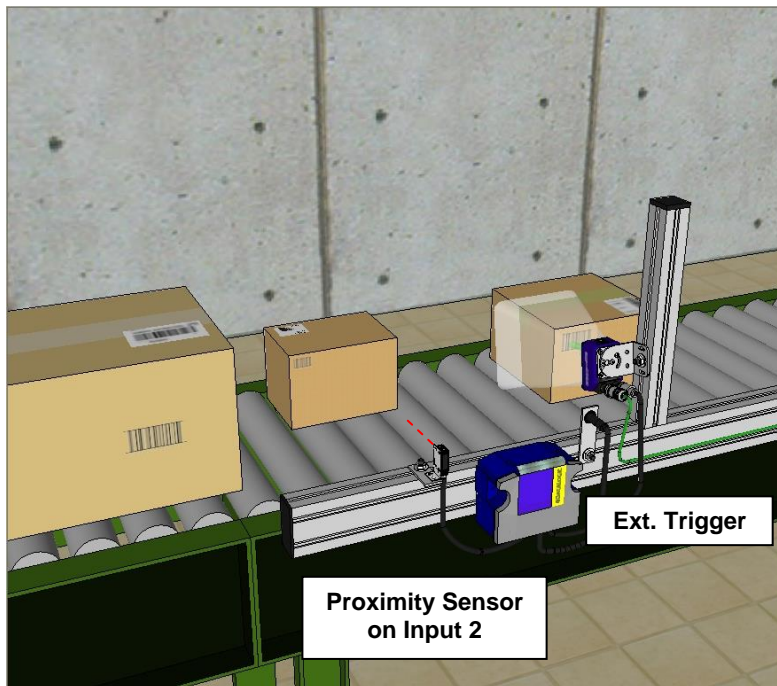


Figure 75 - Example Extending DOF Using External Image Settings Selection

Since many factors and parameters contribute to maximizing the reading process, it is suggested to use the DL.CODE™ Image Auto-Setup and Focus Autolearn tools to set the different acquisitions settings.

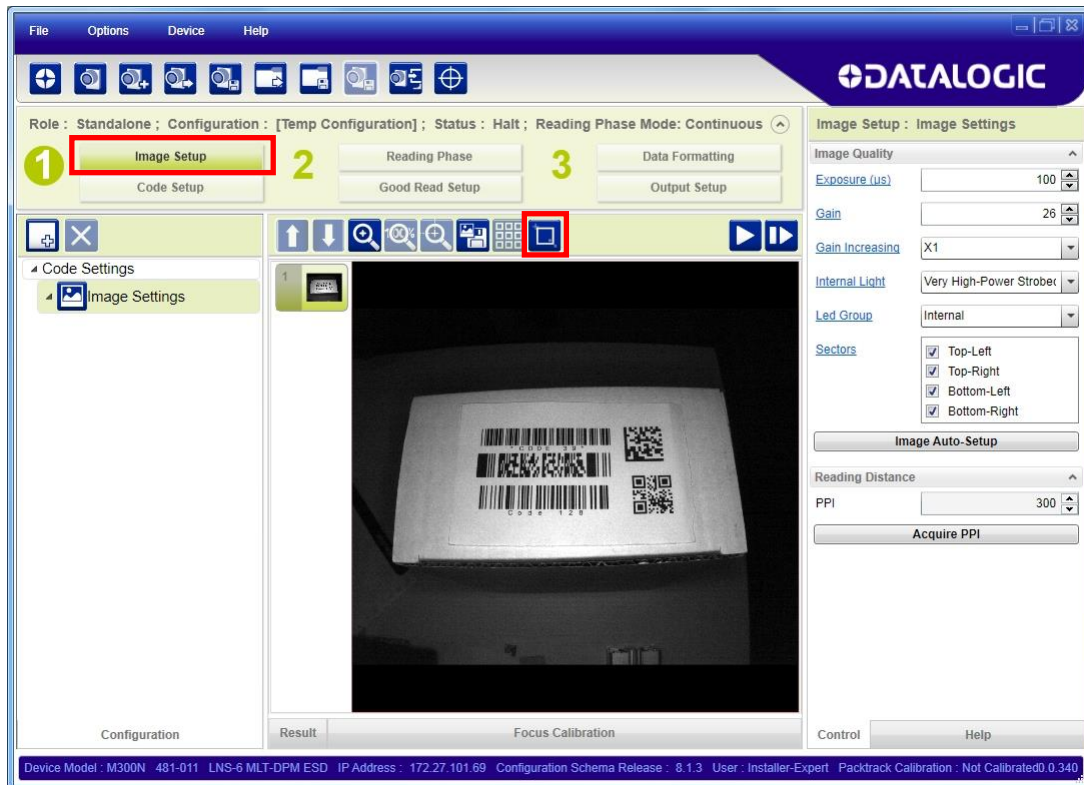
**Multi Image Acquisition Settings Procedure using External Image Settings Selection:**

1. Using the DL.CODE™ Image Auto-Setup and Focus Autolearn tools, set the first acquisition setting (default) for the 195 mm Reading Distance. Then **Save on Device**.
2. Add another Image Setting, and using the DL.CODE™ Image Auto-Setup and Focus Autolearn tools, set the second acquisition setting for the 300 mm Reading Distance. Then **Save on Device**.
3. On the Reading Phase step > General Settings > Acquisition Settings, set the **Image Settings Selection** to **External**.
4. You will now see the Sequences appear in the DL.CODE™ display area. Click on the sequence with **Image Settings #1** and select the **Input 2** Activation Event to **High**. Then **Save on Device**.
5. Verify that the reader decodes at both distances with the DL.CODE™ Monitor.

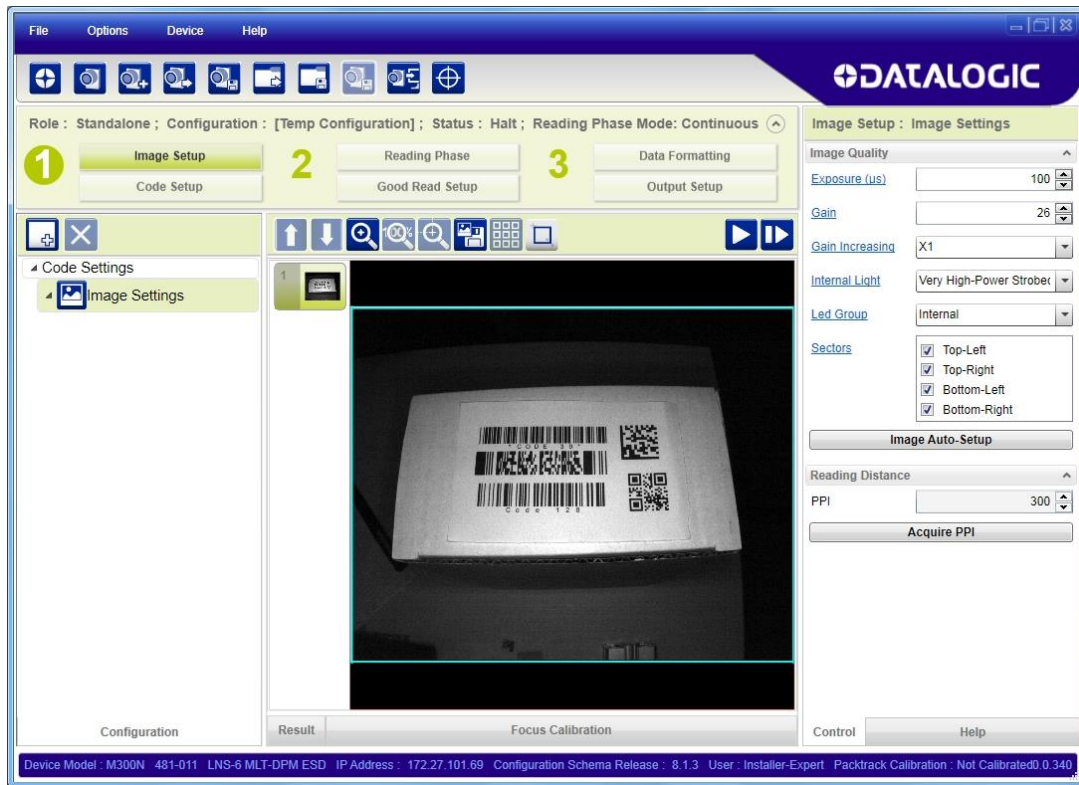
## 7.2.8 Image Cropping

In some applications, the Image Cropping feature in DL.CODE™ can help to increase decoding and result performance. Image cropping is performed from the Image Setup tab by clicking on the Add Cropping Region icon as shown below.

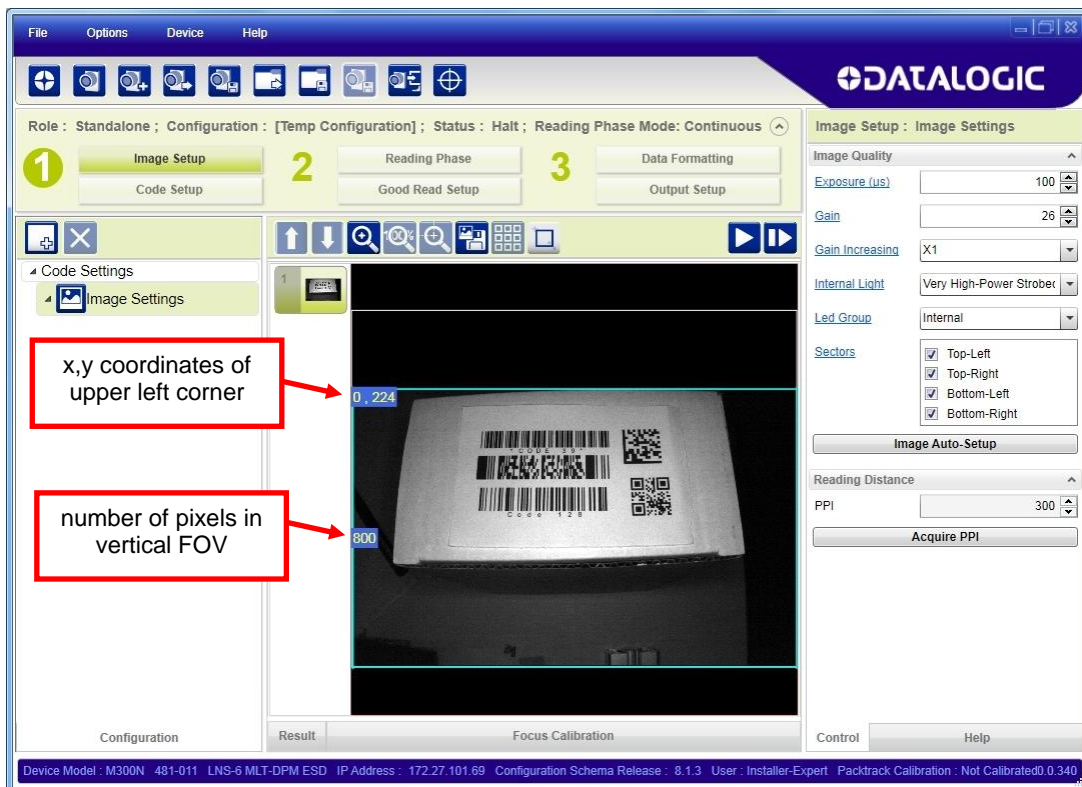
In Matrix 300N™ the frame rate is dependent on the number of rows and columns in the defined window. Image cropping allows reducing the Image processing area from the full FoV to a smaller area where codes are present. By excluding portions of the FoV, processing time is reduced.



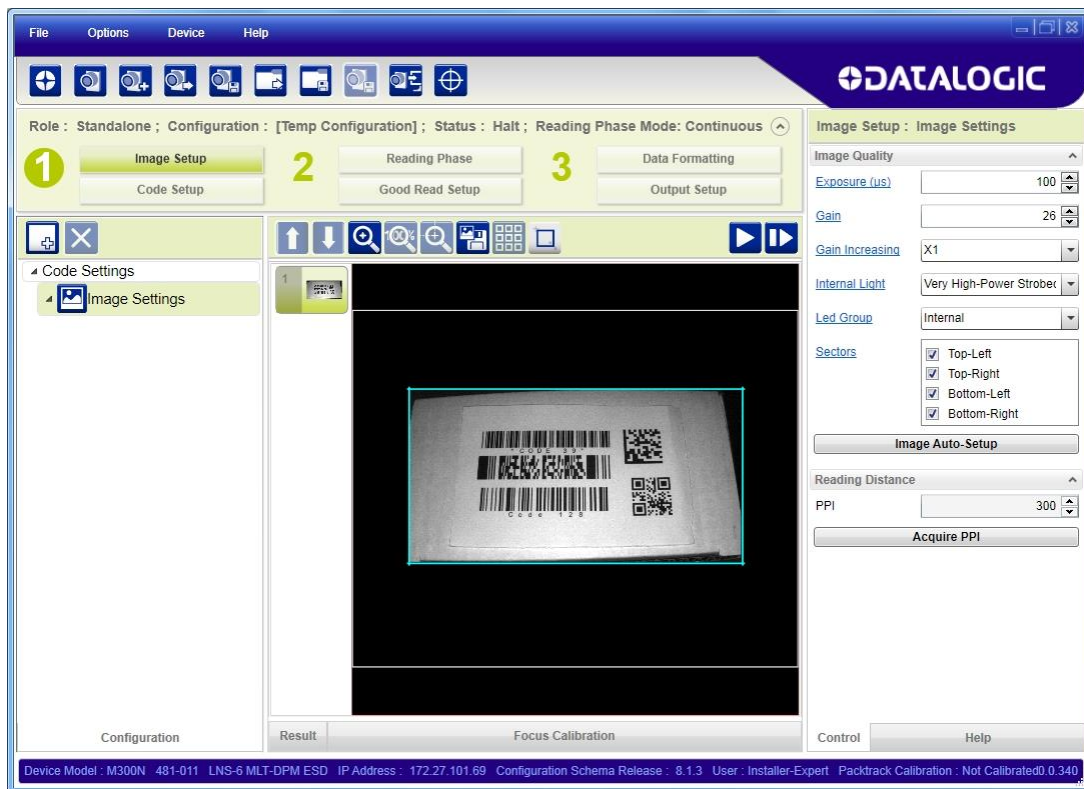
After clicking the Add Cropping Region icon, a blue border appears which by default is equal to the FoV.



By dragging the edges with the mouse (resizing) you can crop the image to a specific location where codes are present. The numbers in the blue boxes refer to pixel references.



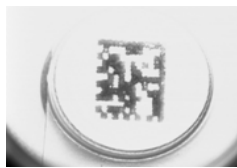
The cropped area can also be moved by dragging the center.



### 7.2.9 Direct Part Marking Applications

For **Data Matrix** family codes the **Decoding Complexity** parameter is available when Processing Mode is set to Standard and selects the decoding algorithm according to the printing/marking technique used to create the symbol and on the overall printing/marking quality.

The possible selections progress from Low to Very High where Low can improve decoding time for good print/mark quality and/or relatively normal size codes. This is the default setting. Very High can improve the decode rate for low print/mark quality and/or small size codes. This algorithm is much more aggressive but in general it may have longer decoding times than the lower complexity algorithms. **To minimize decoding time it is better to select the lowest value that still guarantees good decoding.**



Washed out and Axial Distortion



Dot Peening On Scratched Surface



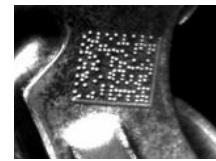
Low Contrast Problem



Background Problems



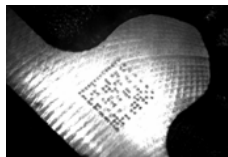
Marked On Curved Shiny Surface



Axial distortion



Half moon effects



Shiny surface, noisy background



Low contrast, noisy background

Figure 76 – Problematic Direct Part Marking Examples

For **QR** code the **Decoding Method** parameter allows the Dot Peen Decoding algorithm to be selected which 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.

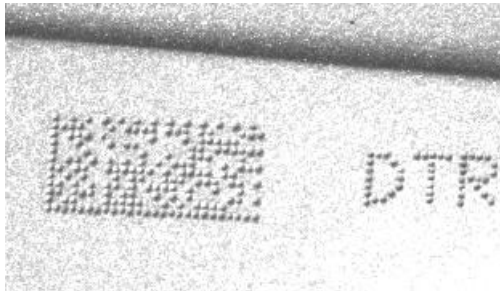


## Image Filter

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 Setup**.

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



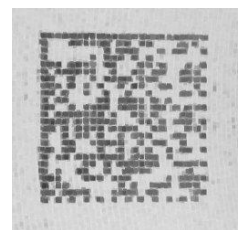
After - Readable

### Dilate

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



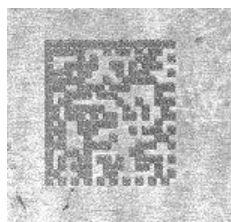
Before - No Read



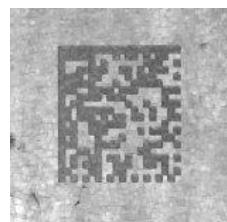
After - Readable

### Close

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



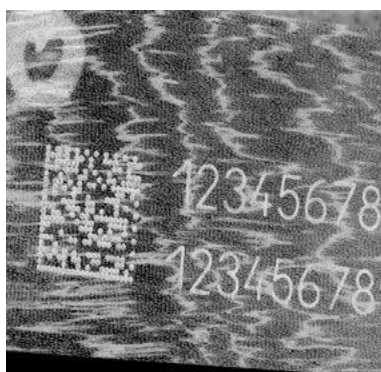
Before - No Read



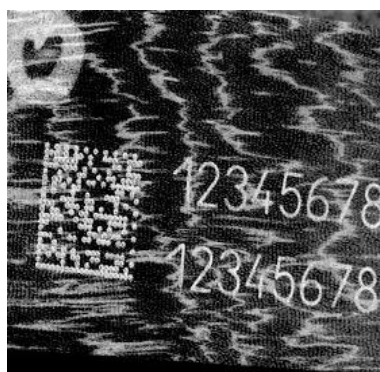
After - Readable

### 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.



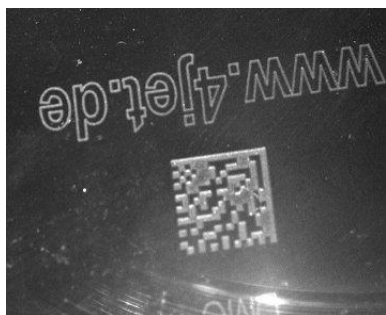
Before - No Read



After - Readable

### Histogram Equalization

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



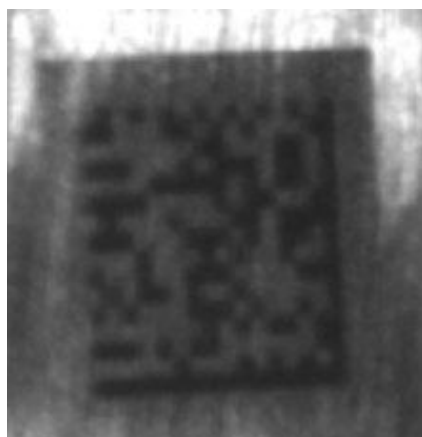
Before - No Read



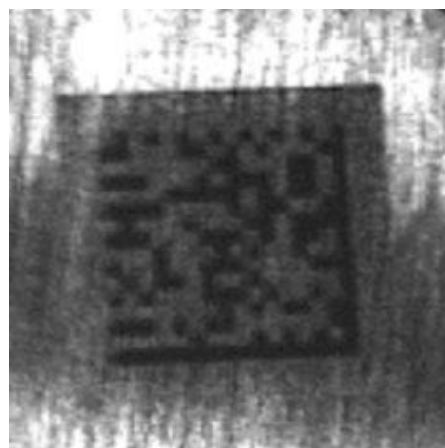
After - Readable

### Smoothing

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



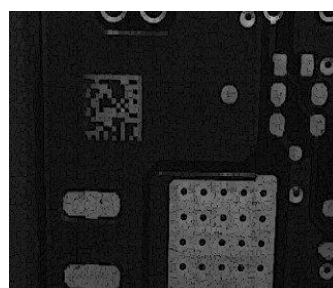
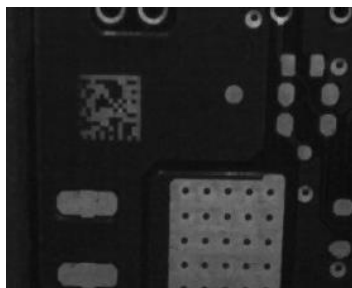
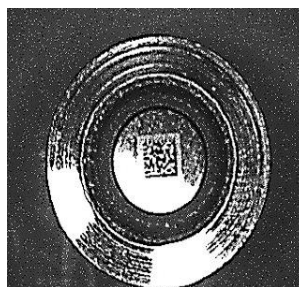
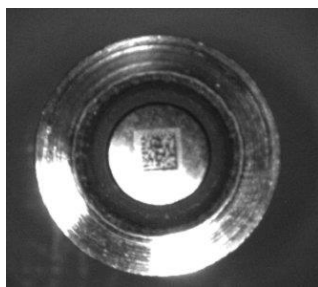
Before - No Read



After - Readable

### Sharpening

The **Deblurring** filter improves blurred images.

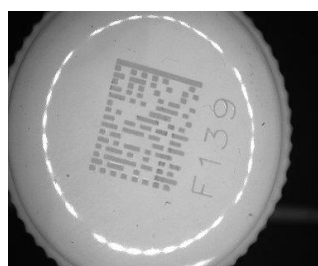


Before - No Read

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

## 7.3 DIAGNOSTICS

By using the **DL.CODE™ Monitor** functions from the File menu (or Monitor icon), you can get information about the state of the ID-NET™ network.

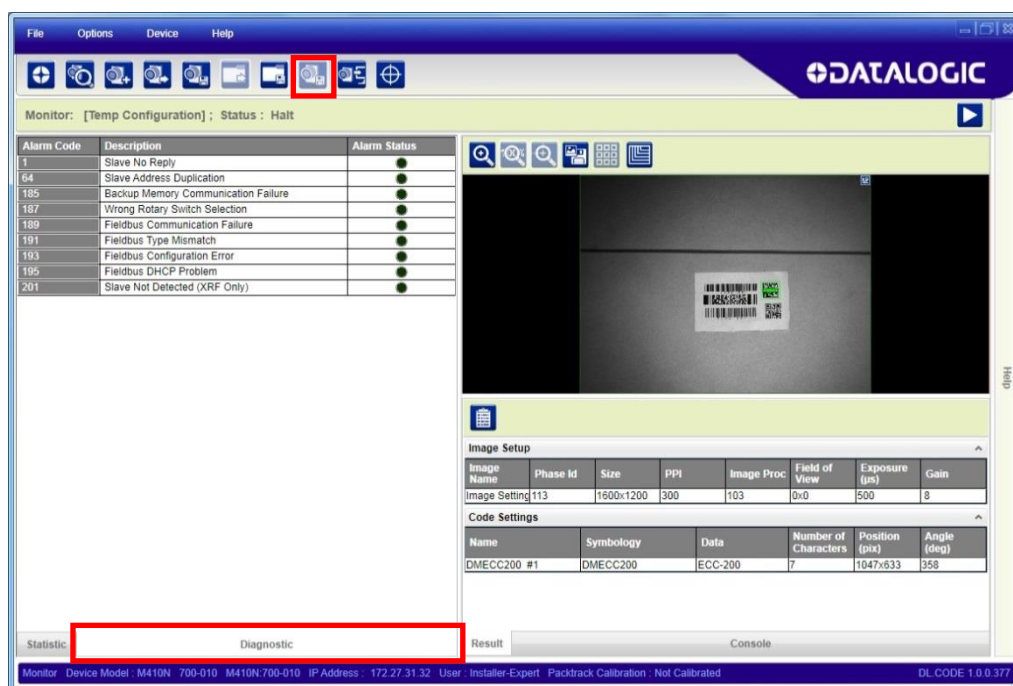


Figure 77 - Diagnostic Functions

## 7.4 STATISTICS

Statistics on the reading performance can be viewed by enabling the Statistics panel from the **DL.CODE™ Monitor** item selected from the File menu (or Monitor icon).

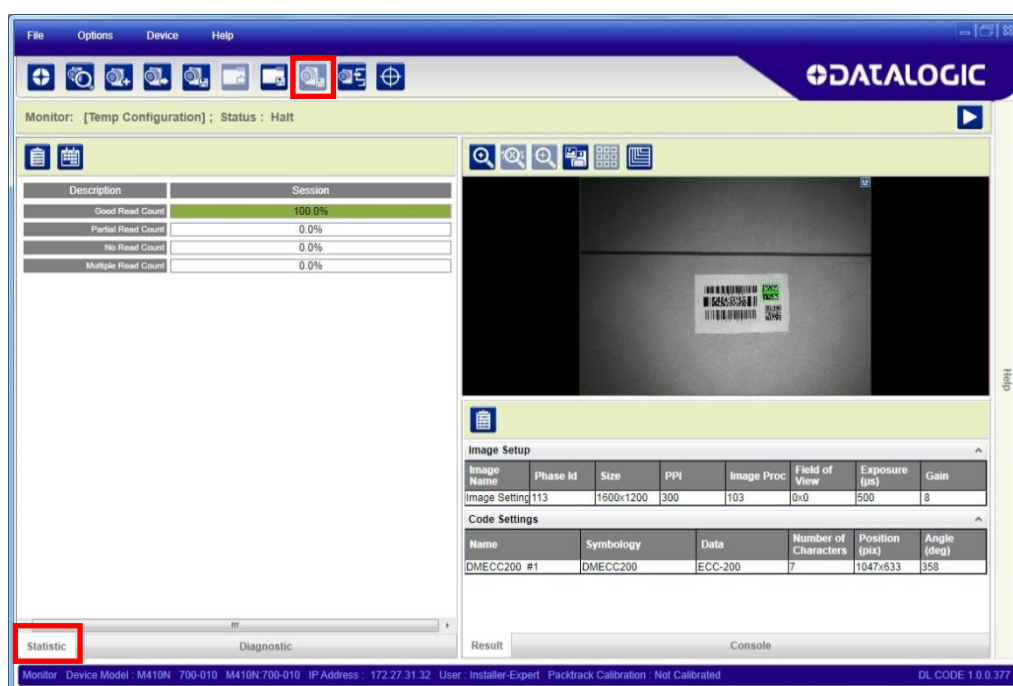
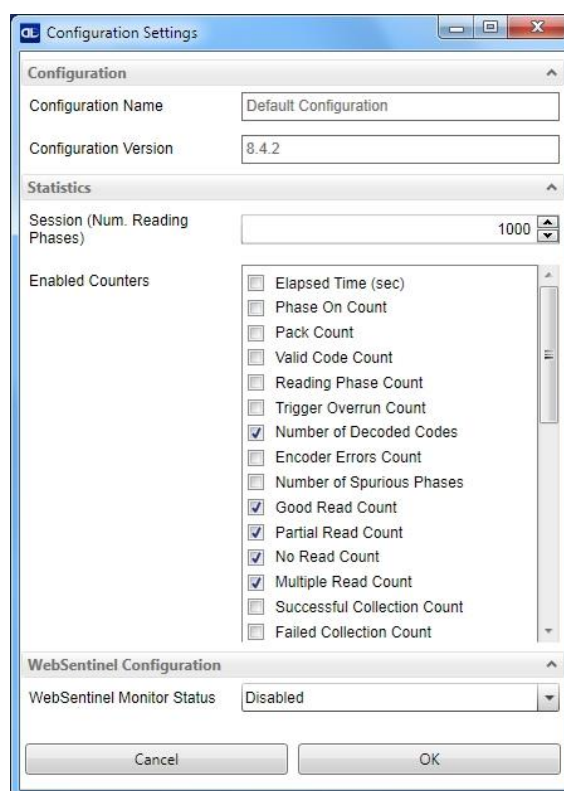


Figure 78 - Reading Statistics

The enabled Statistical Counters can be selected from the Device>Settings>Configuration Settings menu.



## **8 MAINTENANCE**

---

### **8.1 CLEANING**

Clean the lens cover see Figure A, 4 periodically for continued correct operation of the reader.

Dust, dirt, etc. on the lens cover may alter the reading performance.

Repeat the operation frequently in particularly dirty environments.

Use soft material and alcohol to clean the lens cover 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 300N™ M12 17-pin connector pay attention to the pin number of the signals (Appendix A).
- If you need information about a certain reader parameter you can refer to the DL.CODE™ help on line. Connect the device and click on the link to the parameter you're interested in.
- 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 most of this information while DL.CODE™ is connected to the reader.

TROUBLESHOOTING GUIDE	
Problem	Suggestion
<b>Power ON:</b> the "POWER" LED is not lit.	<ul style="list-style-type: none"> <li>• Is power connected?</li> <li>• If using a power adapter (like PG6000), is it connected to wall outlet?</li> <li>• If using rail power, does rail have power?</li> <li>• If using CBX, does it have power (check switch and LED)?</li> <li>• Check if you are referring to the M12 17-pin connector or to the CBX spring clamp connectors.</li> <li>• Measure Voltage either at pin <b>1</b> and pin <b>2</b> (for 17-pin connector) or at spring clamp <b>Vdc</b> and <b>GND</b> (for CBX).</li> </ul>
<b>One Shot or Phase Mode using the Input 1 (External Trigger) or Input 2:</b> the "TRIGGER" LED is not blinking while the External Trigger is switching.	<ul style="list-style-type: none"> <li>• Check if you are referring to the 17-pin connector or to the CBX spring clamp connectors.</li> <li>• Is the sensor connected to the Input 1 or Input 2?</li> <li>• Is power supplied to the photo sensor?</li> <li>• For NPN configuration, is power supplied to one of the two I1 or I2 signals (A or B)?</li> <li>• For PNP configuration, is one of the two I1 or I2 signals grounded (A or B)?</li> <li>• Are the photo sensor LEDS (if any) working correctly?</li> <li>• Is the sensor/reflector system aligned (if present)?</li> <li>• On the Reading Phase step check the Input 1 or Input 2 <b>Debouncing Time</b> parameter setting.</li> <li>• On the Reading Phase step check the settings for <b>Acquisition Trigger</b>, <b>Reading Phase-ON</b>, and <b>Reading Phase-OFF</b> parameters.</li> </ul>

TROUBLESHOOTING GUIDE	
Problem	Suggestion
<b>One Shot or Phase Mode using serial trigger source:</b> the "TRIGGER" LED is not blinking.	<ul style="list-style-type: none"> <li>On the Reading Phase step check the settings for <b>Acquisition Trigger</b>, <b>Reading Phase-ON</b>, and <b>Reading Phase-OFF</b> parameters.</li> <li>Are the COM port parameters (<b>Baud Rate</b>, <b>Parity</b>, <b>Data Bits</b>, <b>Stop Bits</b>) correctly assigned?</li> <li>On the Reading Phase step check the settings of <b>Acquisition Trigger String</b>, <b>Reading Phase-ON String</b>, and <b>Reading Phase-OFF String</b> parameters.</li> <li>Is the serial trigger source correctly connected?</li> </ul>
<b>Phase Mode:</b> the "TRIGGER" LED is correctly blinking but no image is displayed in the DL.CODE™ window.	<ul style="list-style-type: none"> <li>Is the Phase frequency lower than the maximum frame rate?</li> </ul>
<b>Continuous Mode:</b> the "TRIGGER" LED is not blinking.	<ul style="list-style-type: none"> <li>Verify the correct software configuration settings.</li> </ul>
<b>Any Operating Mode:</b> the "TRIGGER" LED is correctly blinking but no result is transmitted by the reader at the end of the reading phase collection.	<ul style="list-style-type: none"> <li>Check the Code Collection parameters on the Reading Phase step and the Data Formatting parameters on the Data Formatting step.</li> </ul>
<b>Image not clear:</b>	<ul style="list-style-type: none"> <li>verify the Focus procedure</li> </ul>
<b>Image focused but not decoded:</b>	<ul style="list-style-type: none"> <li>verify the Calibrate Image Density procedure.</li> </ul>
<b>Reading:</b> the reader always transmits the <b>No Read Message</b>	<ul style="list-style-type: none"> <li>Run the Rapid Configuration procedure in chapter 1.</li> <li>Position the reader as described in par. 3.3 and through DL.CODE™: <ul style="list-style-type: none"> <li>Tune the Acquisition Delay on Trigger, if the moving code is out of the reader field of view;</li> <li>Set the Continuous Operating Mode if no external trigger source is available;</li> <li>Tune the Image Setup to improve the code image quality;</li> <li>Check the parameter settings in the Code Setup step: 2D Codes, 1D Codes, and Postal Codes;</li> <li>View the full resolution code image to check the printing or marking quality.</li> </ul> </li> </ul>
<b>Communication:</b> reader is not transmitting anything to the host.	<ul style="list-style-type: none"> <li>Is the serial cable wiring correct?</li> <li>If using CBX, be sure the RS422 termination switch is OFF.</li> <li>Are the host serial port settings the same as the reader serial port settings?</li> <li>In DL.CODE™ Device menu &gt; Settings &gt; Settings &gt; LED Configuration, the COM LED Function can be configured to indicate Main Serial Port TX or Main Serial Port RX.</li> </ul>



TROUBLESHOOTING GUIDE	
Problem	Suggestion
<b>Communication:</b> data transferred to the host are incorrect, corrupted or incomplete.	<ul style="list-style-type: none"> <li>• Are the host serial port settings the same as the reader serial port settings?</li> <li>• In the DL.CODE™ Data Formatting step check the settings of Header and Terminator String parameters.</li> <li>• In the DL.CODE™ Data Formatting step, check the various Message Field parameter settings.</li> </ul>
<b>How do I obtain my reader Serial Number?</b>	<ul style="list-style-type: none"> <li>• The reader Serial Number consists of 9 characters: one letter, 2 numbers, another letter followed by 5 numbers.</li> <li>• The reader Serial Number is printed on a label that is affixed on the bottom case near the reading window.</li> <li>• The Serial Number is also visible from the DL.CODE™ Device List Area.</li> </ul>
<b>How do I obtain my reader Order Number?</b>	<ul style="list-style-type: none"> <li>• The reader Order Number consists of 9 numbers.</li> <li>• The reader Order Number can be obtained by comparing the Device Model (in DL.CODE™ Device Menu &gt; Settings &gt; Settings &gt; About Device) with the product models page on the Datalogic website.</li> </ul>

## 10 TECHNICAL FEATURES

ELECTRICAL FEATURES		
<b>Power</b>	<b>4xx-01x models</b>	<b>4xx-04x models</b>
Supply Voltage	10 to 30 Vdc	PoE Device 48 Vdc
Consumption	0.7 to 0.2 A	13 W max.
<b>Communication Interfaces</b>		
Main		
- RS232	2400 to 115200 bit/s	
- RS422 full-duplex	2400 to 115200 bit/s	
Auxiliary - RS232	2400 to 115200 bit/s	
ID-NET™	Up to 1Mbaud	
Ethernet (Built-in)	10/100 Mbit/s	
supported application protocols	TCP/IP, EtherNet/IP, Modbus TCP, PROFINET-IO	
<b>Inputs</b>		
Input 1(External Trigger) and Input 2	Opto-coupled and polarity insensitive; <a href="#">see note for PoE models</a>	
Max. Voltage	30 Vdc	
Max. Input Current	10 mA	
<b>Outputs *</b>		
Output 1, 2 and 3	NPN or PNP short circuit protected; <a href="#">see note for PoE models</a>	
V <sub>OUT</sub> (I <sub>LOAD</sub> = 0 mA) Max.	30 Vdc	
V <sub>OUT</sub> (I <sub>LOAD</sub> = 100 mA) Max.	3 Vdc	
I <sub>LOAD</sub> Max.	100 mA	
OPTICAL FEATURES		
Image Sensor	CMOS sensor with Global Shutter	
Image Format	1.3 M pixels SXGA (1280x1024) pixels	
Frame Rate	60 frames/sec.	
Pitch	± 35°	
Tilt	0° - 360°	
LED Safety	to EN 62471	
Laser Safety (pointers)	IEC60825-1 2007	
<b>Lenses</b>	<b>Manual Adjustable Focus</b>	<b>Software Adjustable Focus</b>
Focal Length	4x1-0xx models = 6 mm 4x3-0xx models = 9 mm 4x4-0xx models = 12 mm 4x5-0xx models = 16 mm	4x2-0xx models = 9 mm
Lighting System	Internal Illuminator	
Aiming System	Laser Pointers	
ENVIRONMENTAL FEATURES		
Operating Temperature **	0 to 50 °C (32 to 122 °F) for liquid lens models: 0 to 45 °C (32 to 113 °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 500 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 and IP67	

\* when connected to the CBX connection boxes the electrical features for Output 1 and 2 become the following:  
Opto-isolated; V<sub>CE</sub> = 30 Vdc max.; I<sub>CE</sub> = 40 mA continuous max.; 130 mA pulsed max.;  
V<sub>CE</sub> saturation = 1 Vdc max. @ 10 mA; P<sub>D</sub> = 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.

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		
SOFTWARE FEATURES		
Readable Code Symbologies		
1-D and stacked	2-D	POSTAL
<ul style="list-style-type: none"><li>• PDF417 Standard and Micro PDF417</li><li>• Code 128 (GS1-128)</li><li>• Code 39 (Standard and Full ASCII)</li><li>• Code 32</li><li>• MSI</li><li>• Standard 2 of 5</li><li>• Matrix 2 of 5</li><li>• Interleaved 2 of 5</li><li>• Codabar</li><li>• Code 93</li><li>• Pharmacode</li><li>• EAN-8/13 - UPC-A/E (including Addon 2 and Addon 5)</li><li>• GS1 DataBar Family</li><li>• Composite Symbologies</li></ul>	<ul style="list-style-type: none"><li>• Data Matrix ECC 200 (Standard, GS1 and Direct Marking)</li><li>• QR Code (Standard and Direct Marking)</li><li>• Micro QR Code</li><li>• MAXICODE</li><li>• Aztec Code</li></ul>	<ul style="list-style-type: none"><li>• Australia Post</li><li>• Royal Mail 4 State Customer</li><li>• Kix Code</li><li>• Japan Post</li><li>• PLANET</li><li>• POSTNET</li><li>• POSTNET (+BB)</li><li>• Intelligent Mail</li><li>• Swedish Post</li></ul>
Operating Mode	CONTINUOUS, ONE SHOT, PHASE MODE, PACKTRACK	
Configuration Methods	X-PRESS™ Human Machine Interface Windows-based SW (DL.CODE™) via 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	
AIM DPM	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	
USER INTERFACE		
LED Indicators	Power, Ready, Good; Trigger; Com, Status, (Ethernet Network); Good Read (Green Spot), No Read (Red Spot)	
Keypad Button	Configurable via DL.CODE™	
Beeper	Configurable via DL.CODE™	

## 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 300N™ 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:

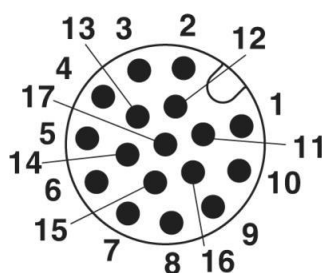


Figure 79 – M12 17-pin male COM, I/O and Power Connector

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	RS422 Full-Duplex
17	MAIN	TX	TX+
11	INTERFACE	RX	*RX+
12	(SW	-	TX-
10	SELECTABLE)	-	*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.

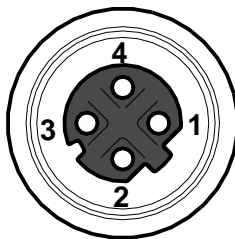


Figure 80 - M12 D-Coded Female Ethernet Network Connector

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

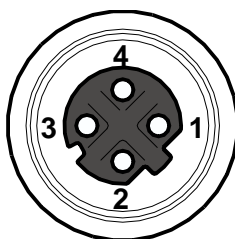


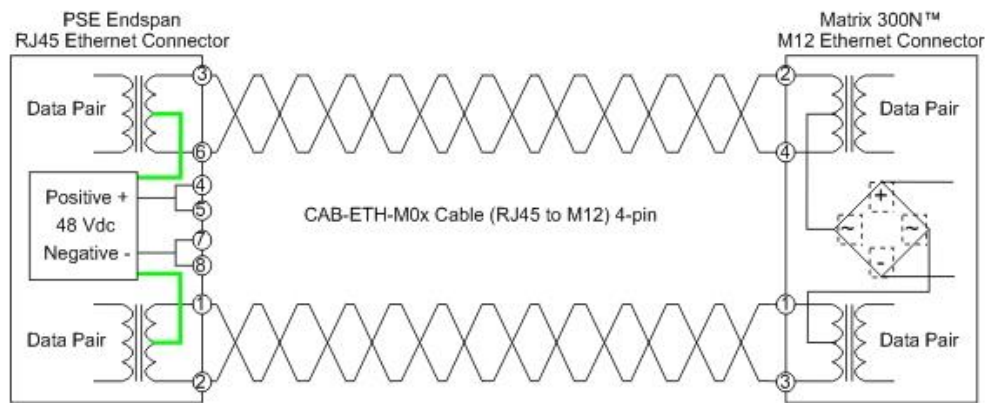
Figure 81 - M12 D-Coded Female Ethernet Network Connector

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 (+)

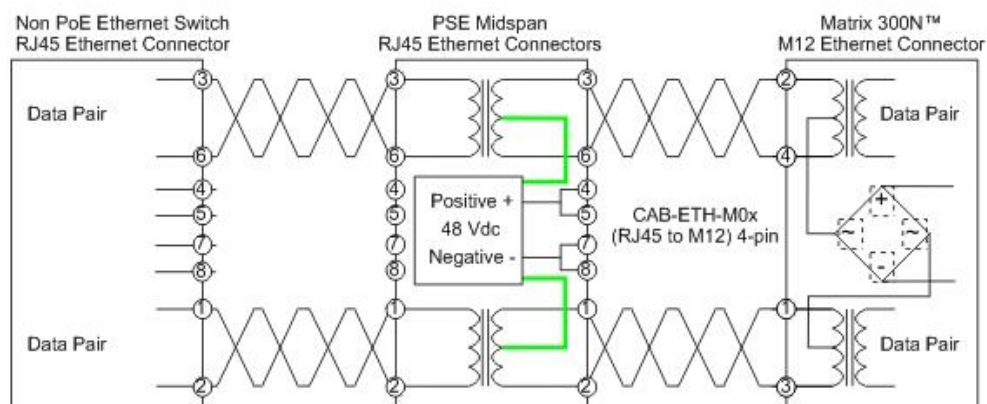


**CAUTION:** Matrix 300N™ PoE models only accept Alternative A (power over RJ45 pins 1, 2, 3, 6), Class 0 power levels. Use an Endspan or Midspan PSE device that supports this configuration (i.e. PoE switch or Power over Ethernet Adapter).

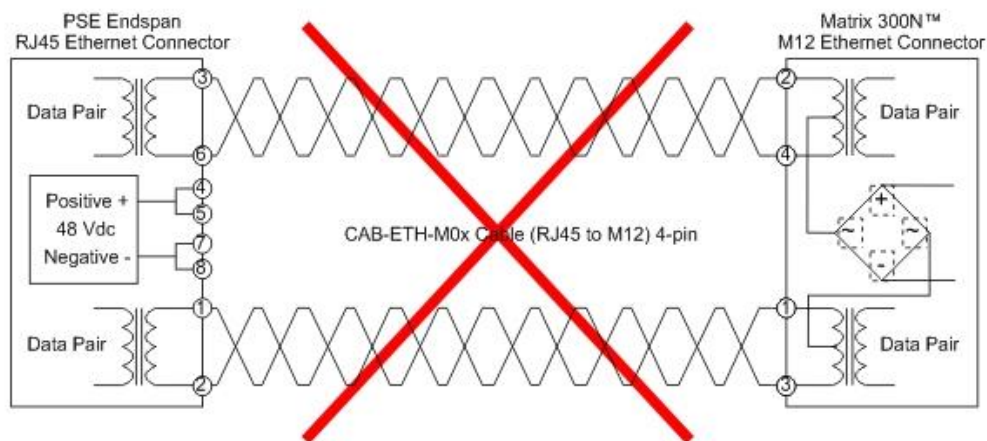
Alternative B (power over RJ45 pins 4, 5, 7, 8) using an Endspan or Midspan PSE device is not supported.



**Figure 82 – Matrix 300N™ PoE PSE Endspan Alternative A Connections OK**



**Figure 83 – Matrix 300N™ PoE PSE Midspan Alternative A Connections OK**



**Figure 84 – Matrix 300N™ PoE PSE Endspan Alternative B Connections NOT SUPPORTED**

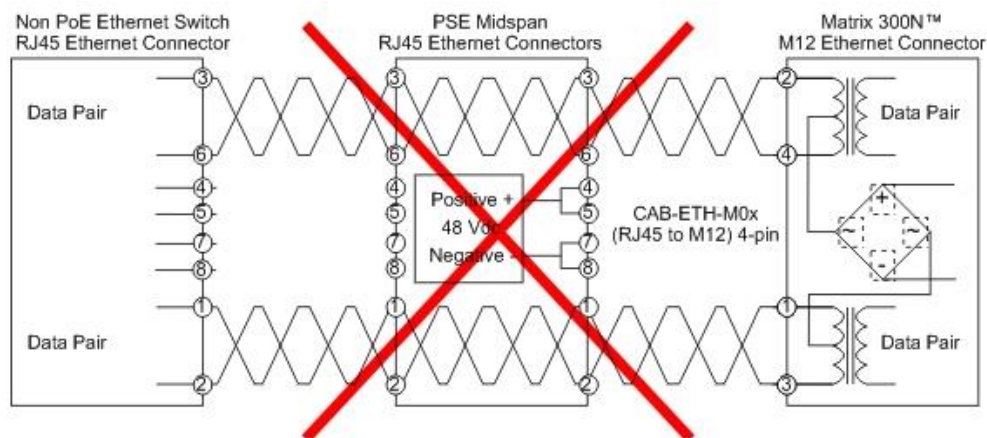


Figure 85 – Matrix 300N™ PoE PSE Midspan Alternative B Connections NOT SUPPORTED



**CAUTION:** For Matrix 300N™ PoE models, the internal Digital Output circuitry is not powered and supply power is not available to any Input/Output devices ( $V_{dc}=0$ ). 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. 0 for more details.

The electrical features of both inputs are:

INPUT	$ V_{AB} $ Min.	$ V_{AB} $ 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.

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	Output 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. For further details refer to the Help On Line page for the Output Setup step in DL.CODE™.

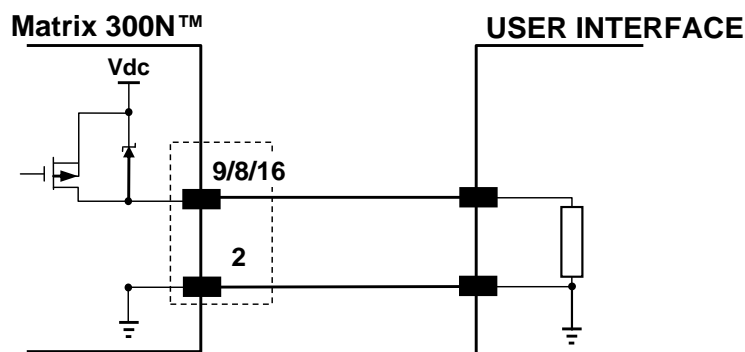


Figure 86 - PNP Output Connection

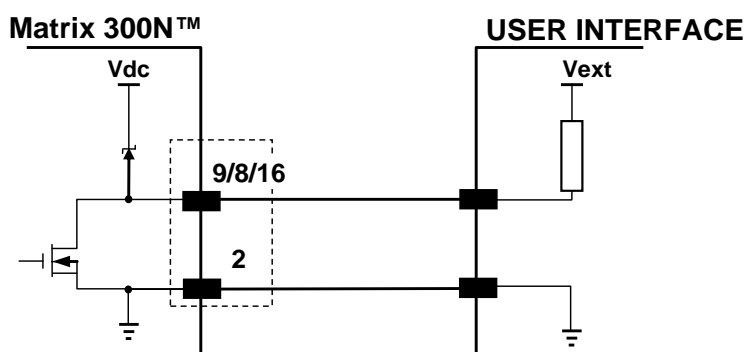


Figure 87 - NPN Output Connection



**CAUTION:** For NPN output connections, the external interface voltage ( $V_{ext}$ ) must not exceed the Matrix 300N™ power supply source voltage ( $V_{dc}$ ) otherwise correct output functioning cannot be guaranteed.

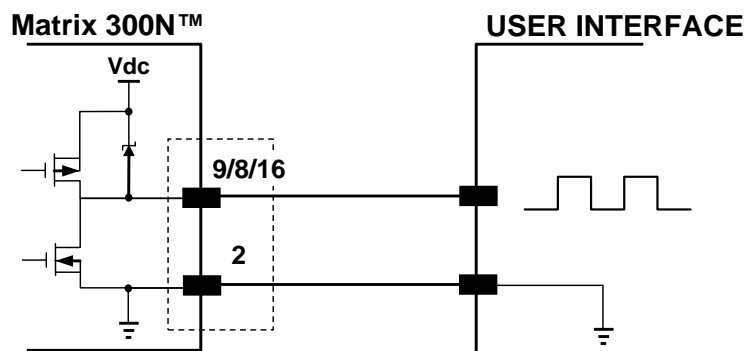


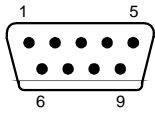
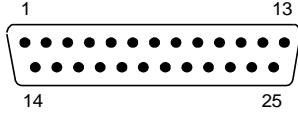
Figure 88 - Push-Pull Output Connection



**CAUTION:** For Matrix 300N™ PoE models, the internal Digital Output circuitry is not powered and supply power is not available to any Input/Output devices ( $V_{dc}=0$ ). 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

### 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.

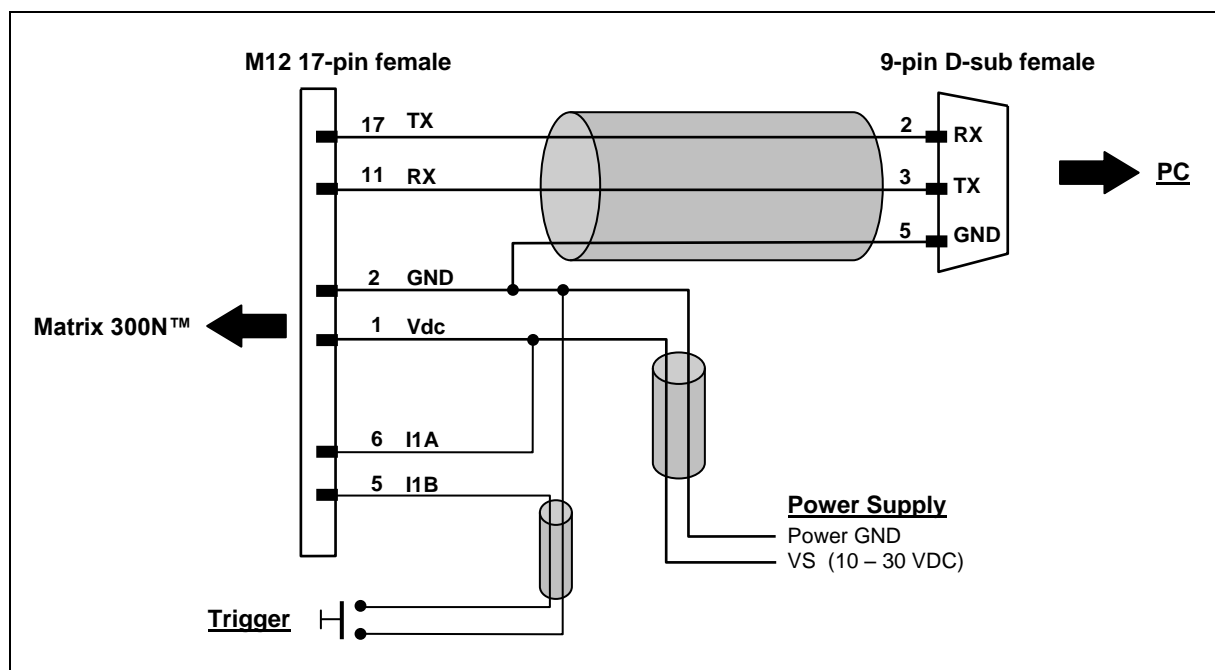


Figure 89- Test Cable for Matrix 300N™

## 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.

### **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 due 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.

# INDEX

---

## A

Accessories, 49  
Alternative Connections, 139  
Application Examples, 50  
Auto Calibration, 115  
Auxiliary RS232 Interface, 71

## C

CBX Electrical Connections, 60  
Connector  
    COM, I/O and Power, 139  
    On-board Ethernet, 140

## D

Diagnostics, 131  
Direct Part Marking Applications, 126

## E

Ethernet Connection, 80  
Extending DOF Using External Image Settings  
    Selection, 121  
Extending DOF Using Internal Image Settings  
    Selection, 120

## F

Fieldbus Connection, 83  
FOV Calculation, 87

## G

General View, xi  
Glossary, 146

## H

Handling, ix

## I

ID-NET™ Cables, 66  
ID-NET™ Interface, 66  
ID-NET™ Network Termination, 67, 142  
ID-NET™ Response Time, 67  
ID-NET™ Synchronized Network, 84

Image Cropping, 123  
Inputs, 72, 142

## L

Layouts, 80

## M

Maintenance, 133  
Manual Calibration, 116  
Mechanical Dimensions, 54  
Model Description, 48  
Mounting and Positioning Matrix 300N™, 57  
Multi Image Acquisition Setups, 119

## O

On-Board Ethernet Interface, 79  
Outputs, 76, 143

## P

Package Contents, 53  
Patents, vi  
Power Supply, vii, 61

## R

Rapid Configuration, 1  
Reader Configuration, 112  
Reading Features, 87  
References, vi  
Restore Defaults, 113  
RS232 Interface, 64  
RS422 Full-Duplex, 65

## S

Serial Connection, 82  
Software Configuration, 112  
Statistics, 132  
Support Through The Website, vi

## T

Technical Features, 137  
Troubleshooting, 134





**Datalogic Automation S.r.l.**

Via Lavino 265  
40050 Monte San Pietro  
Bologna - Italy

*declares that the*

**MATRIX 300 ; Compact 2D Imager  
MATRIX 300N ; 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, January 30th, 2015

Paolo Morselli  
Quality Manager



**KUMAI****IDENT**  
Immer eine ID besser  
 **+49 711 90 11 88-0**  
**[www.kumaident.de](http://www.kumaident.de)**



 **DATALOGIC**

[www.datalogic.com](http://www.datalogic.com)