

# REFERENCE MANUAL



> Matrix 300N™



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Matrix 300N™ Reference Manual

Ed.: 05/2017

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03/05/17

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# REFERENCES

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## 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 .zip 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 **SUPPORT** > **Unattended Scanning Systems** category link. From this page you can select your product model from the dropdown list which gives you access to:

- **Downloads** including Data Sheets, Manuals, Software & Utilities, and Drawings;
- **Repair Program** for On-Line Return Material Authorizations (RMAs) plus Repair Center contact information;
- **Service Program** containing details about Maintenance Agreements;
- **Technical Support** through email or phone.

## 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, JP1521956, JP1522252, USD765755, ZL201330393980.2

Utility patents: EP0996284B1, EP0999514B1, EP1014292B1, EP1128315B1, EP1396811B1, EP1413971B1, EP2517148B1, EP2649555B1, JP4435343B2, JP4571258B2, US6512218, US6616039, US6808114, US6997385, US7053954, US7387246, US8058600, US8368000, US8743263, US8888003, US8915443, US9268982, US9482793, ZL200880132595.9, ZL200980163411.X

# COMPLIANCE

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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

CE marking states the compliance of the product with essential requirements listed in the applicable European directive. Since the directives and applicable standards are subject to continuous updates, and since Datalogic promptly adopts these updates, therefore the EU declaration of conformity is a living document. The EU declaration of conformity is available for competent authorities and customers through Datalogic commercial reference contacts. Since April 20<sup>th</sup>, 2016 the main European directives applicable to Datalogic products require inclusion of an adequate analysis and assessment of the risk(s). This evaluation was carried out in relation to the applicable points of the standards listed in the Declaration of Conformity. Datalogic products are mainly designed for integration purposes into more complex systems. For this reason it is under the responsibility of the system integrator to do a new risk assessment regarding the final installation.

### 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.

## EAC COMPLIANCE

Customs Union:

The CU Conformity certification has been achieved; this allows the Product to bear the Eurasian mark of conformity.

## 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

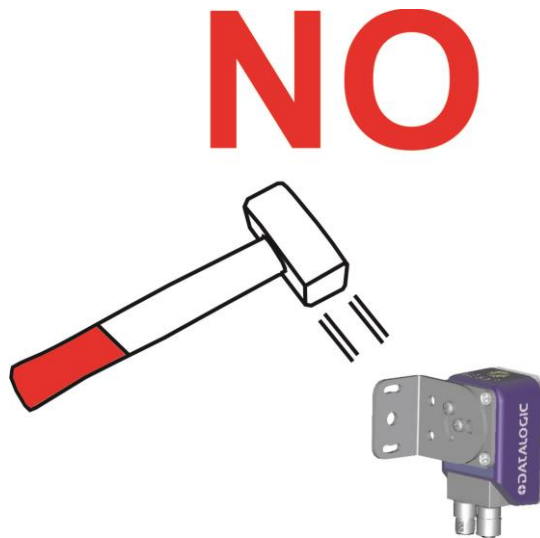
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The Matrix 300N is designed to be used in an industrial environment and is built to withstand vibration and shock when correctly installed, however it is also a precision product and therefore before and during installation it must be handled correctly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

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

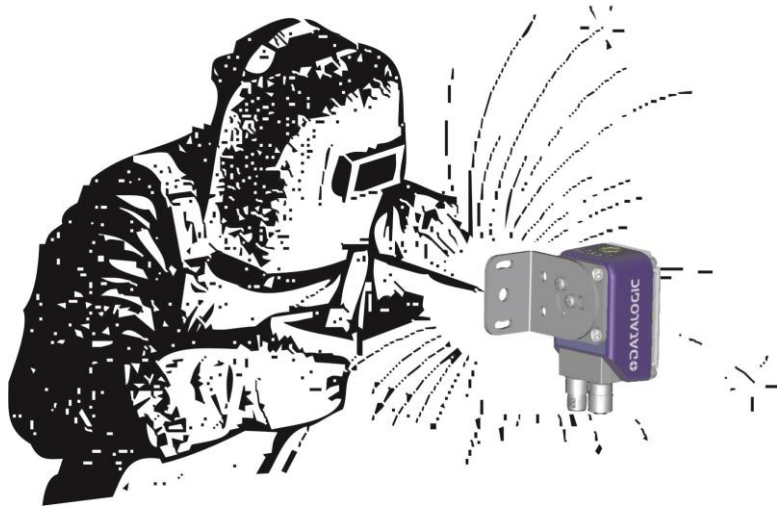


- do not fine tune the positioning by striking the reader or bracket.



- 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

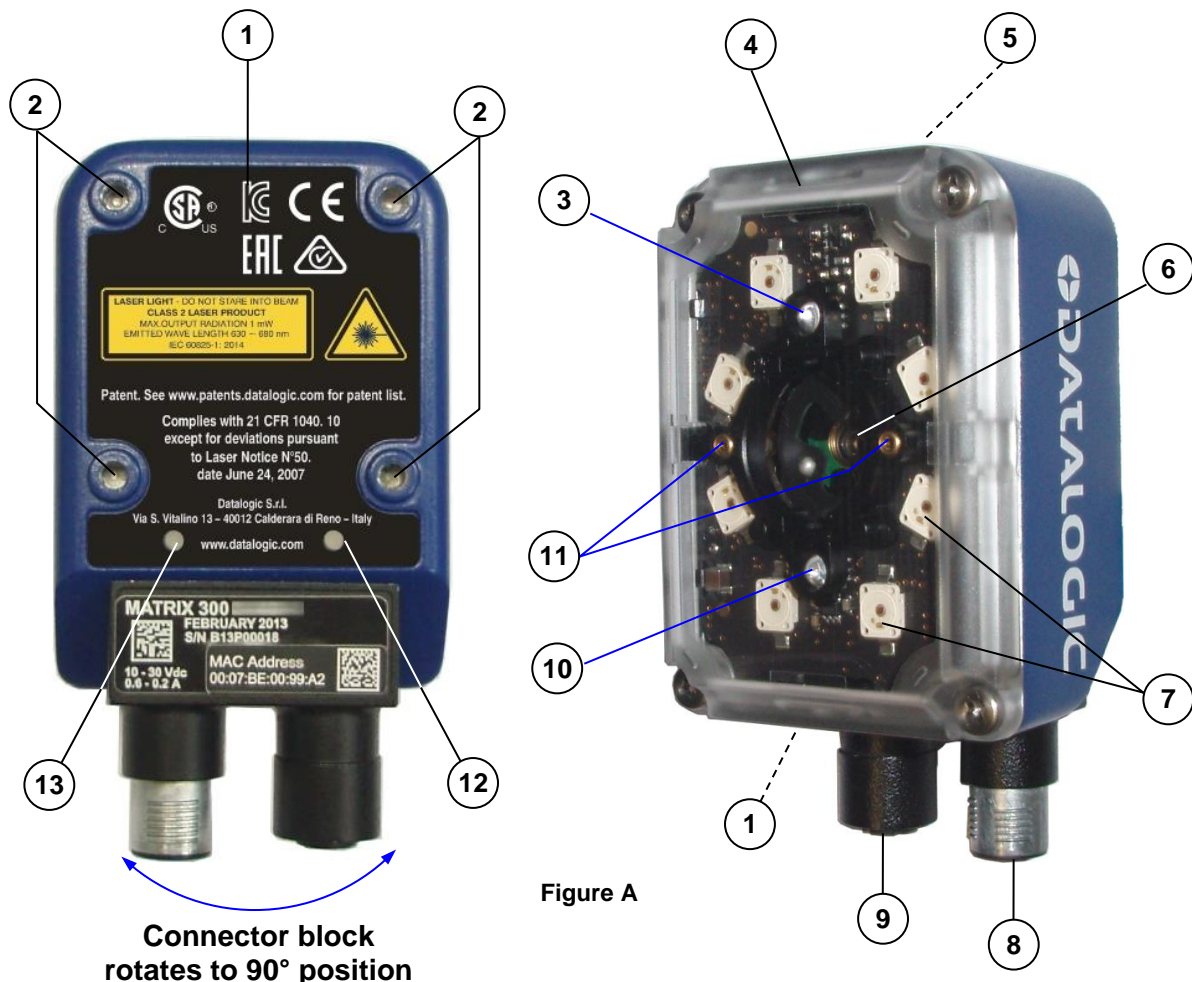


Figure A

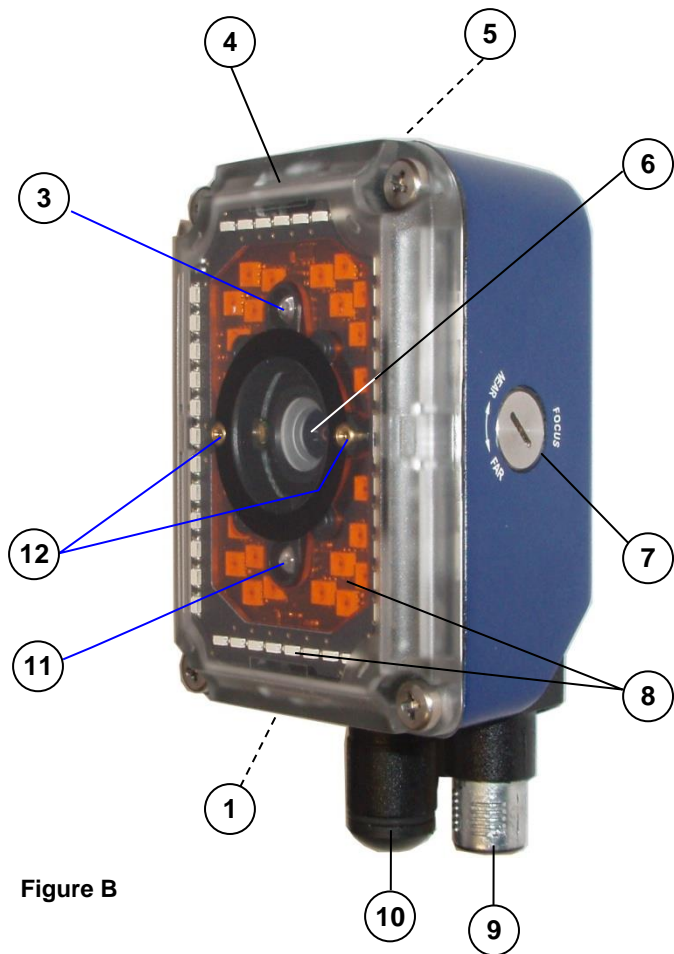
- |                                   |                                             |
|-----------------------------------|---------------------------------------------|
| ① Device Class and Warning Labels | ⑧ Power - Serial Interfaces - I/O Connector |
| ② Bracket Mounting Holes (4)      | ⑨ Ethernet 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



**Connector block  
rotates to 90° position**



**Figure B**

- |                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>① Device Class and Warning Labels</li> <li>② Bracket Mounting Holes (4)</li> <li>③ Good Read LED (green)</li> <li>④ Lens Cover</li> <li>⑤ HMI X-PRESS Interface</li> <li>⑥ Lens</li> <li>⑦ Focus Adjustment Screw</li> </ul> | <ul style="list-style-type: none"> <li>⑧ Internal Illuminator</li> <li>⑨ Power - Serial Interfaces - I/O Connector</li> <li>⑩ Ethernet Connector</li> <li>⑪ No Read LED (red)</li> <li>⑫ Aiming System Laser Pointers</li> <li>⑬ Ethernet Connection LED</li> <li>⑭ Power On LED</li> </ul> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

# 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.

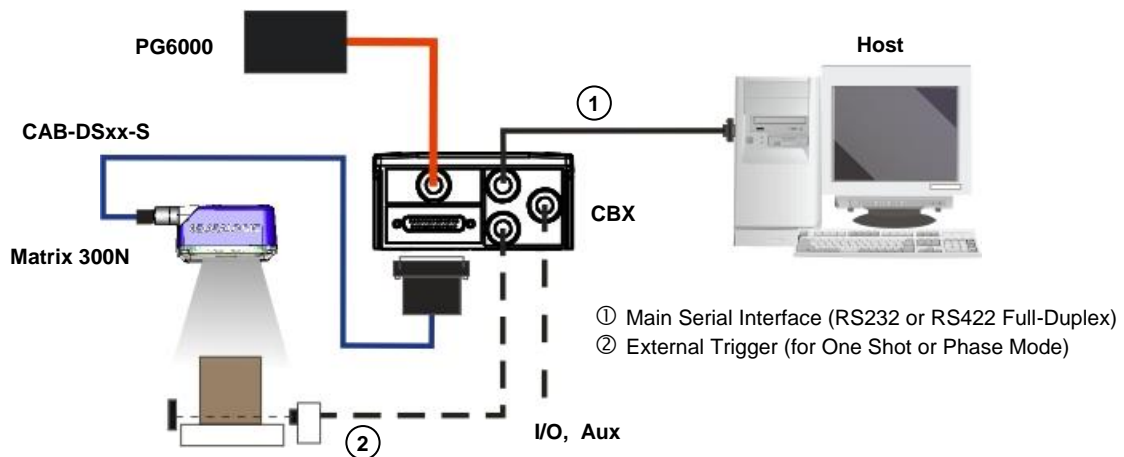


Figure 1 – Matrix 300N in Stand Alone Layout

## 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.

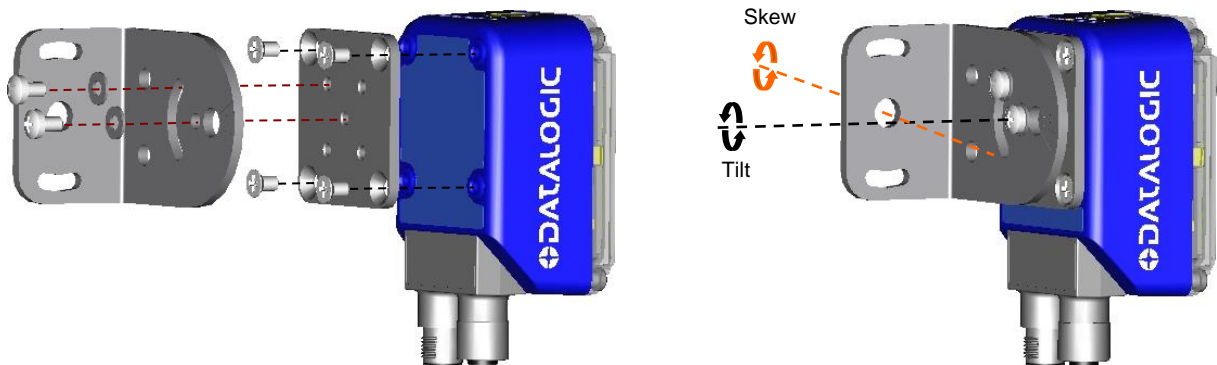


Figure 2 –Positioning with Mounting Bracket

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).

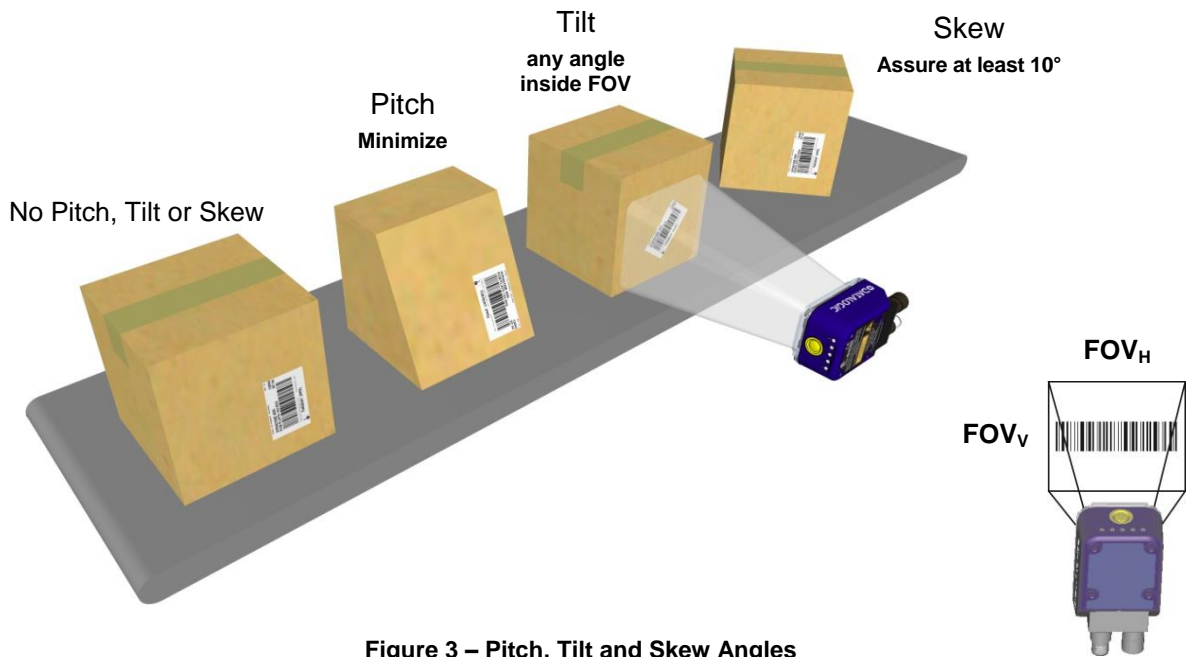


Figure 3 – Pitch, Tilt and Skew Angles

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 Configuration Program (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 Global FOV Diagrams in par. 6.2.2 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.

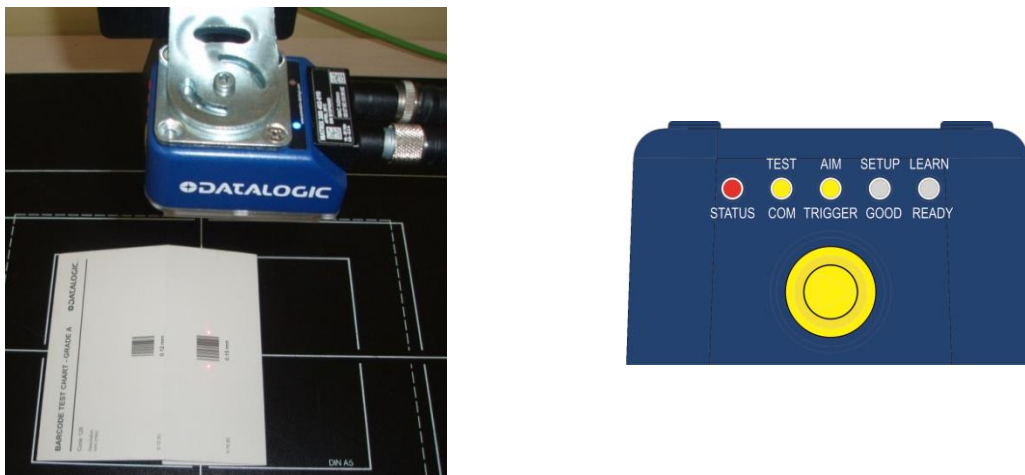


Figure 4 – X-PRESS Interface: Aim/Autofocus Function



**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”**.



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

Matrix 300N 4x1-0xx 6 mm lens = **85 mm**

Matrix 300N 4x4-0xx 12 mm lens = **250 mm**

Matrix 300N 4x3-0xx 9 mm lens = **180 mm**

Matrix 300N 4x5-0xx 16 mm lens = **320 mm**

## 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.

### Aim

- Enter the Aim function by pressing and holding the X-PRESS push button until the Aim LED is on.
- Release the button to enter the Aim function. The laser pointers turn on.
- 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

- Enter the Setup function by pressing and holding the X-PRESS push button until the Setup LED is on.
- 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.

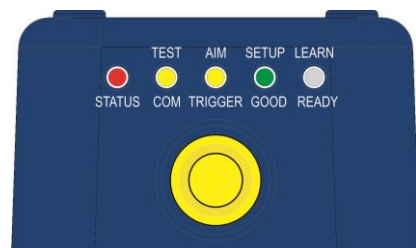


Figure 6 – X-PRESS Interface: Setup Function

## 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 for **a single code** 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:** When using X-PRESS or the BM150 menu to perform the Auto-learn, only **a single code** can be configured (successive Learns will substitute the current code). To configure multiple codes, use the DL.CODE Auto-learn procedure.



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



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

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

## Reset Reader to Factory Default Environment (Optional)

If it ever becomes necessary to reset the reader's Environment parameters to their 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.**

All the device's Environment parameters are reset including the default IP Address. The Matrix 300N emits 3 high pitched beeps and after a few seconds enters run mode.

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



**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.

## STEP 5 – INSTALLING DL.CODE CONFIGURATION PROGRAM



**CAUTION:** DL.CODE does not currently support Windows Embedded (often used in industrial PCs and/or PLCs).

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, 7, 8, or 10), download the DL.CODE mini-DVD .zip file. Extract the files maintaining the folder structure and run the **start.hta** file to access the installation pop-up. Click on the **Install DL.CODE** link to run the installation program and follow the installation procedure.



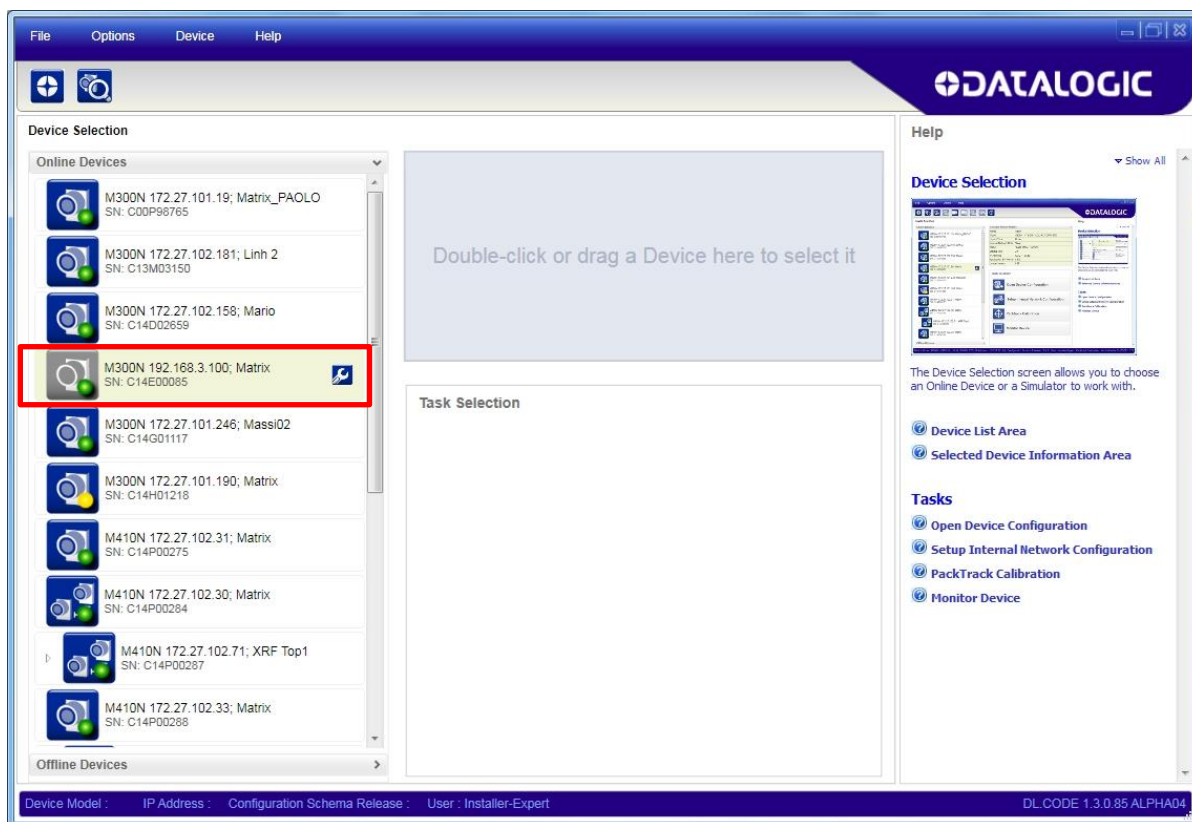
**NOTE:** To perform a “silent” installation (without user input), see the DL.CODE User’s Guide.

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. Find your device in the list by matching its serial number (SN) then click on the device wrench icon  to open the Device Environment Configuration window.
5. Change the Ethernet Settings (IP Address, Subnet Mask, Gateway Address etc.) according to the network requirements.

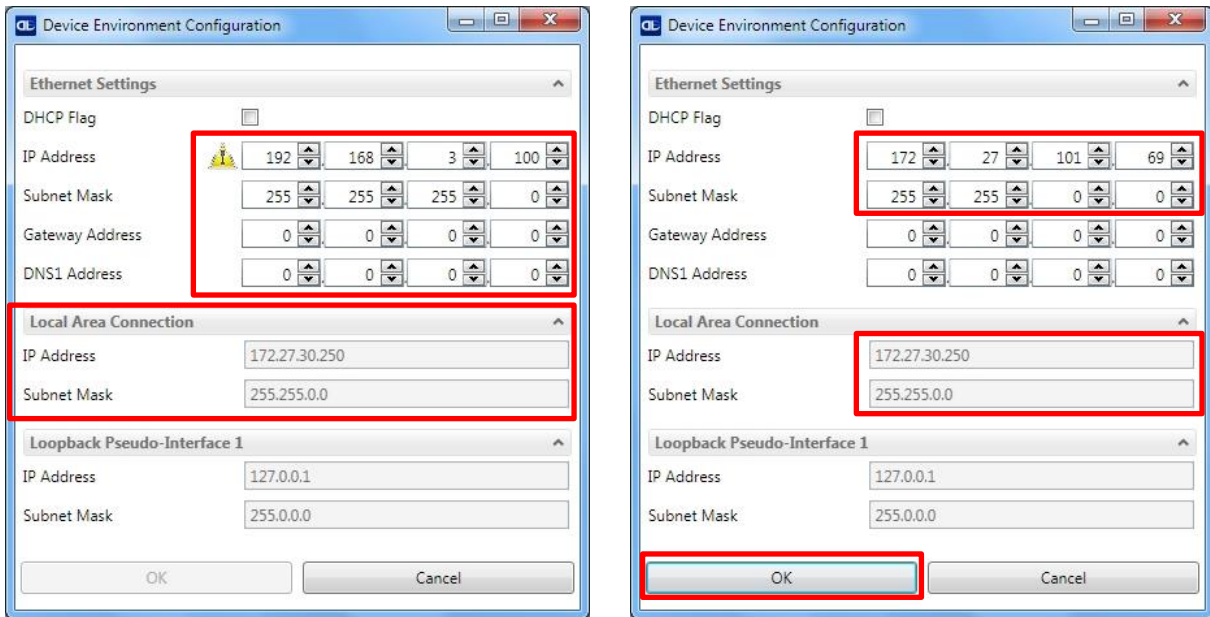
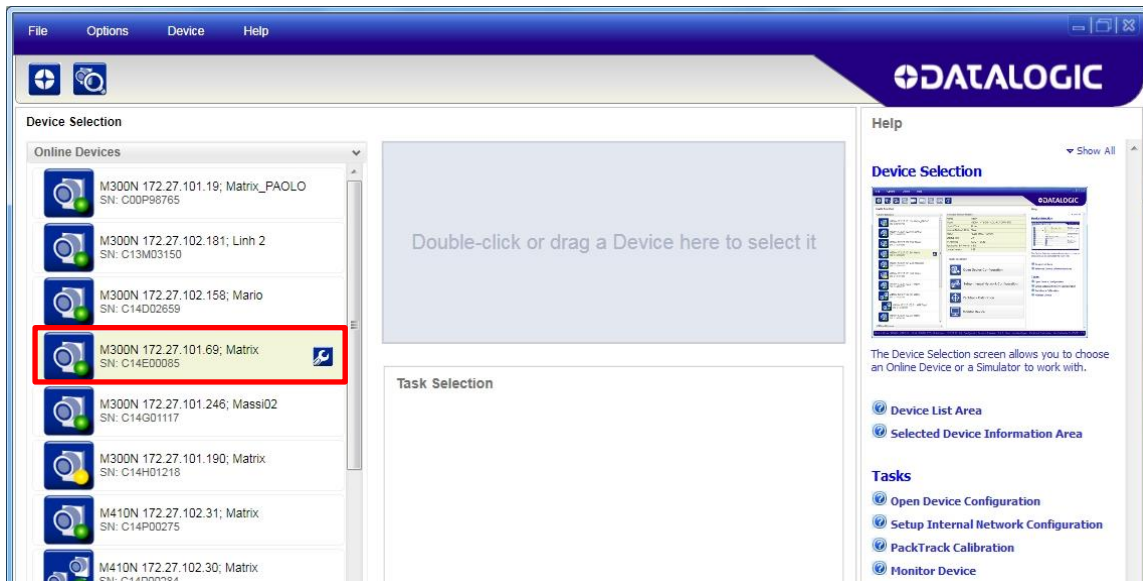


Figure 9 Device Environment Configuration Window

- Click OK; 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.



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

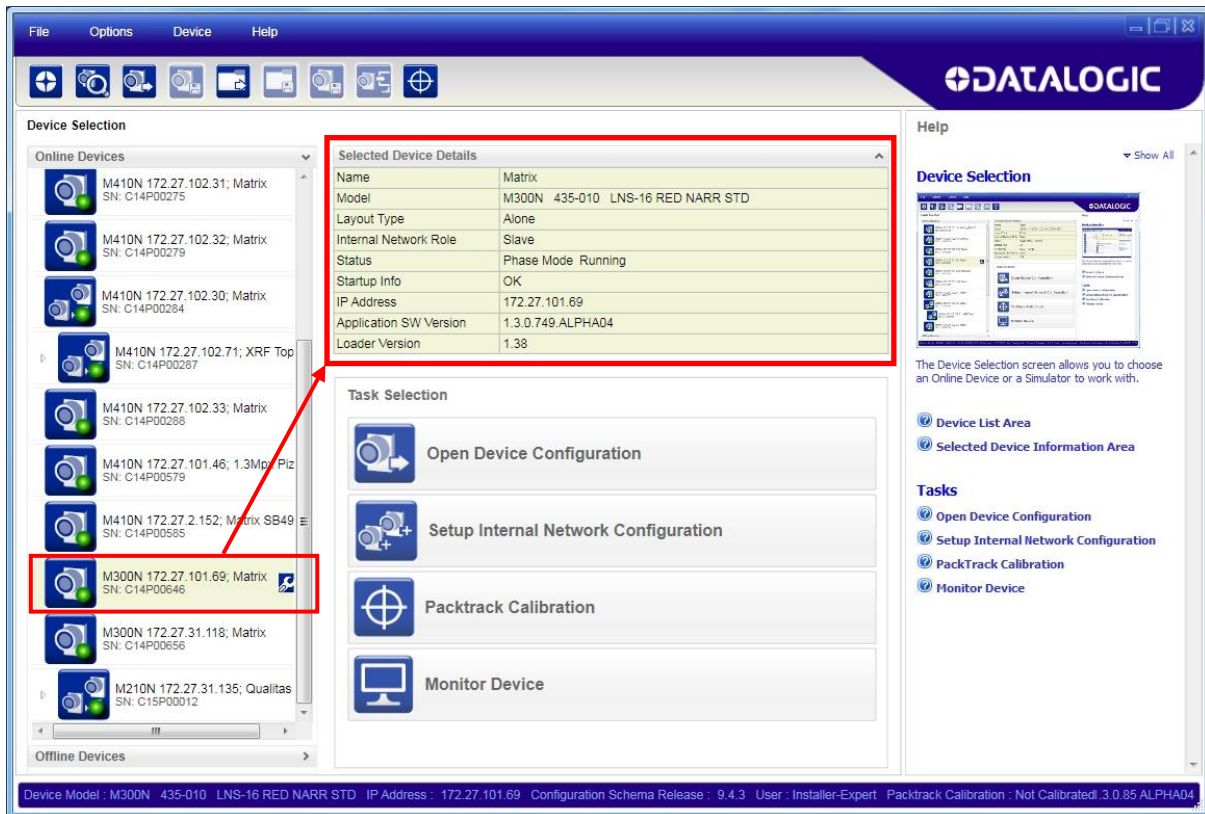


Figure 10 – DL.CODE Opening Window

## STEP 6 – DEVICE CONFIGURATION

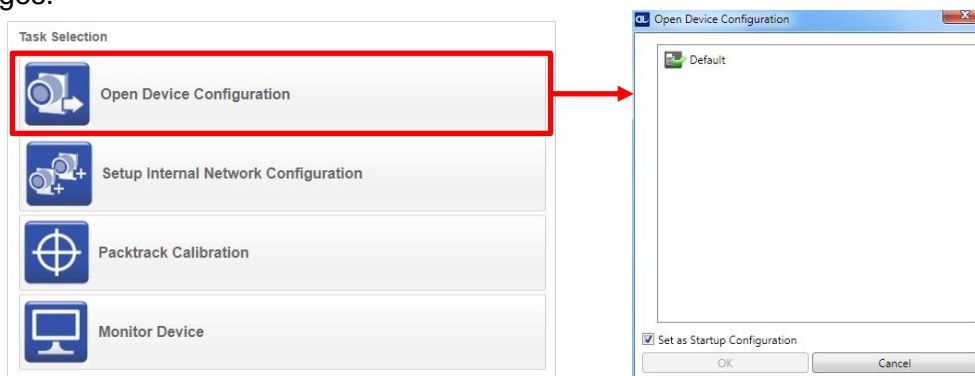
### Image Setup for Software Adjustable Focus Models (Liquid Lens)



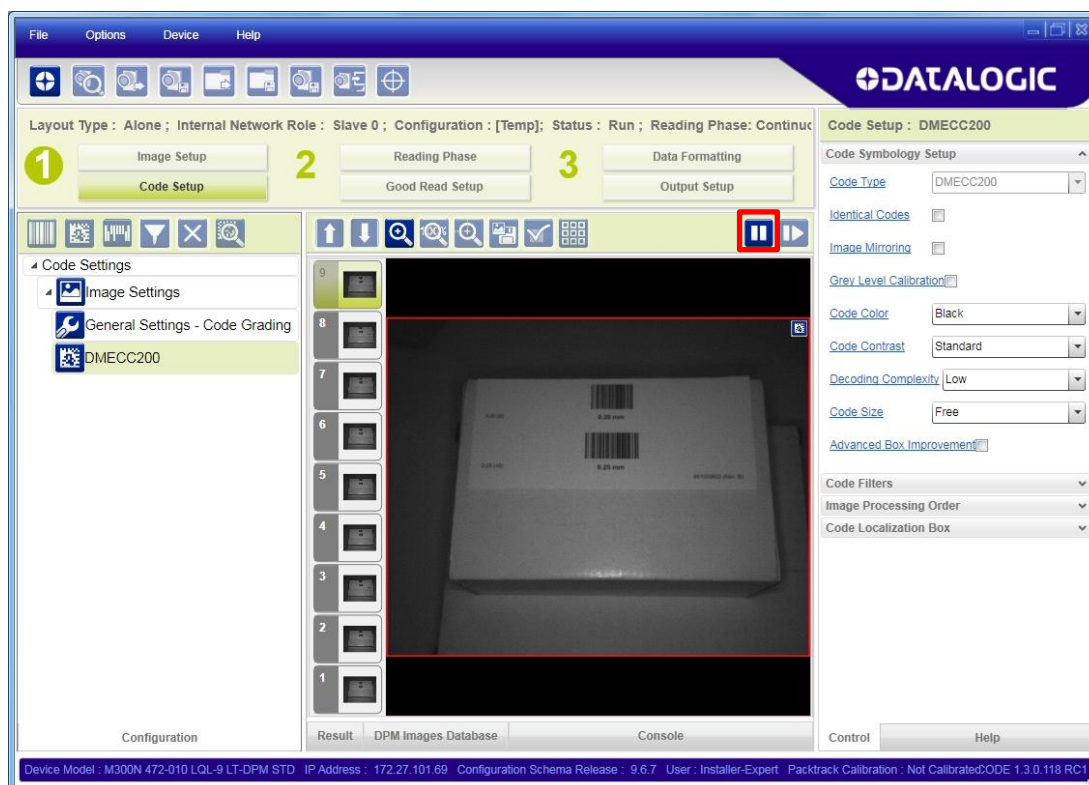
**NOTE:** For Manual Adjustable Focus models go to page 18 then continue with **Code Setup** on page 24.

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 Open Device Configuration.
2. The Open Device Configuration window opens showing the list of currently saved configurations (jobs) saved on the device. For new devices, the only saved job is the Default configuration. Click OK. The device enters run mode and begins acquiring images.

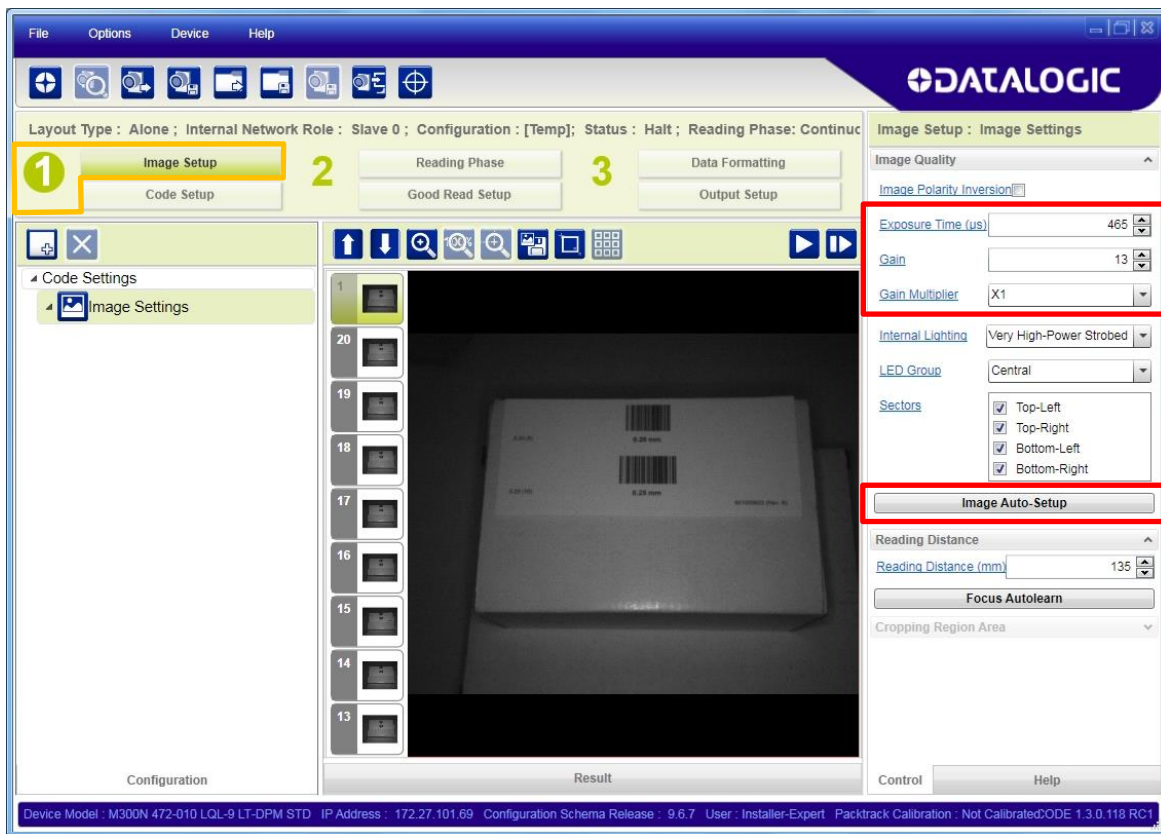


3. Place the **Grade A Barcode Test Chart** in the reading area. Once positioned, stop image acquisition by clicking on the Pause button.

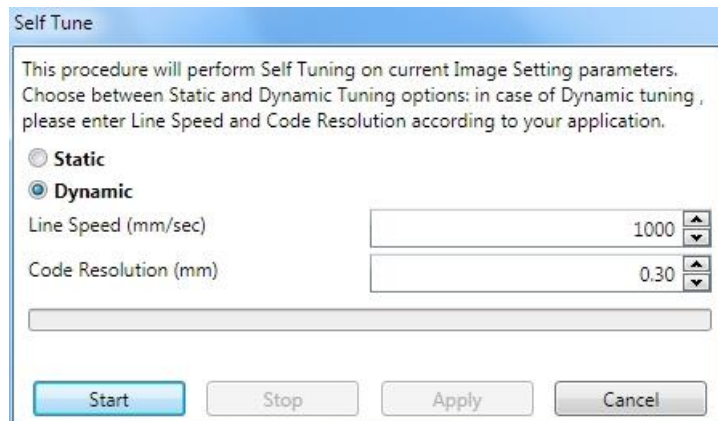


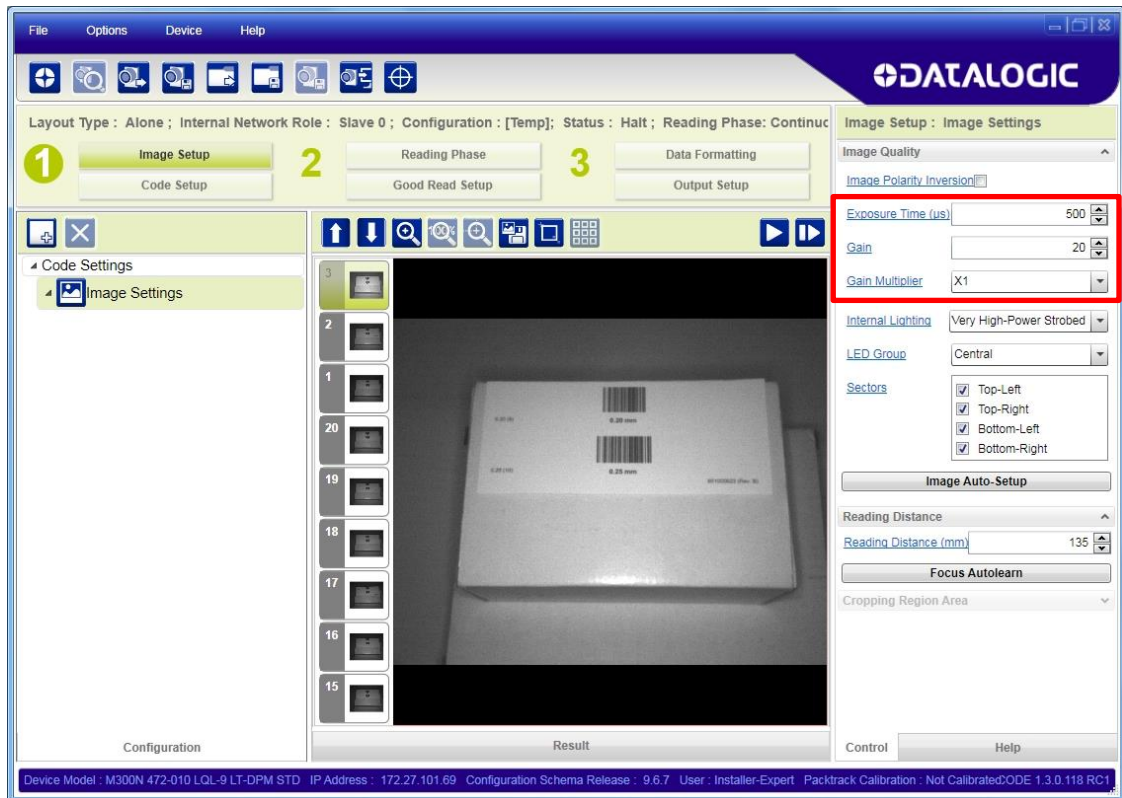



- Click the Image Setup button and then click the Image Auto Setup button to automatically acquire the best exposure time and gain values.



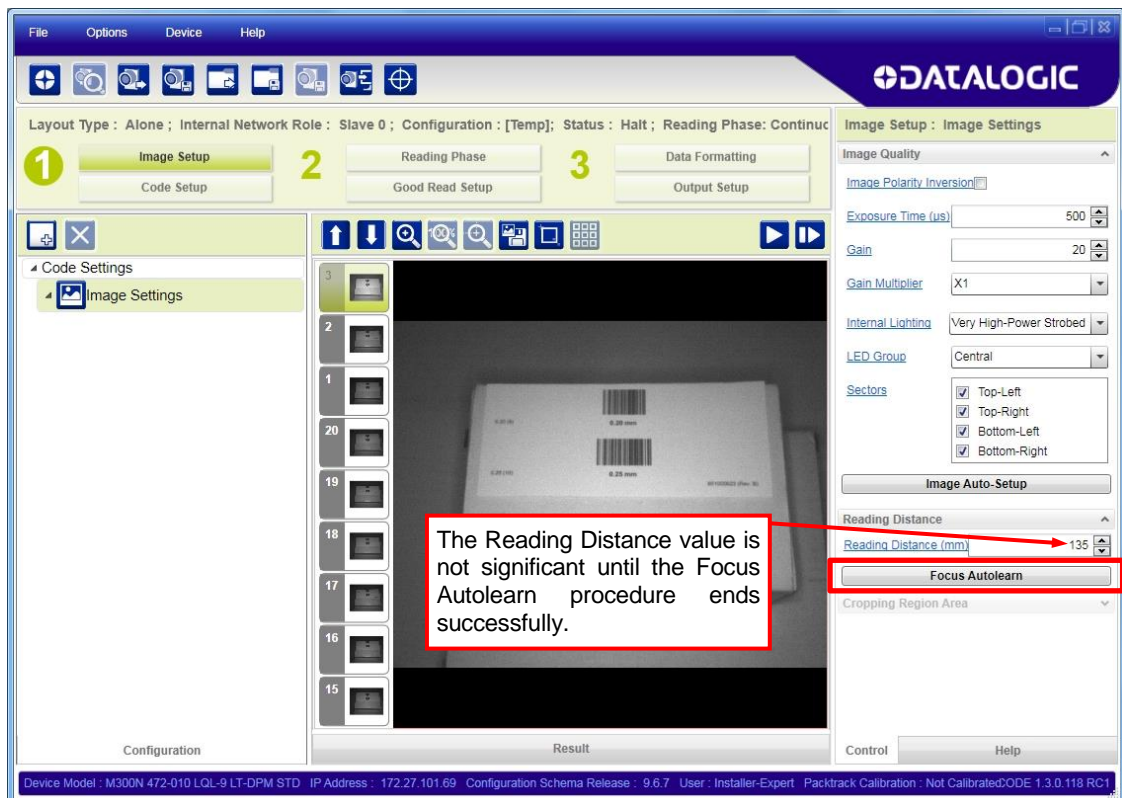
- Select the Static or Dynamic Self-Tuning option; Start Autolearn and Apply to the Image Setup.



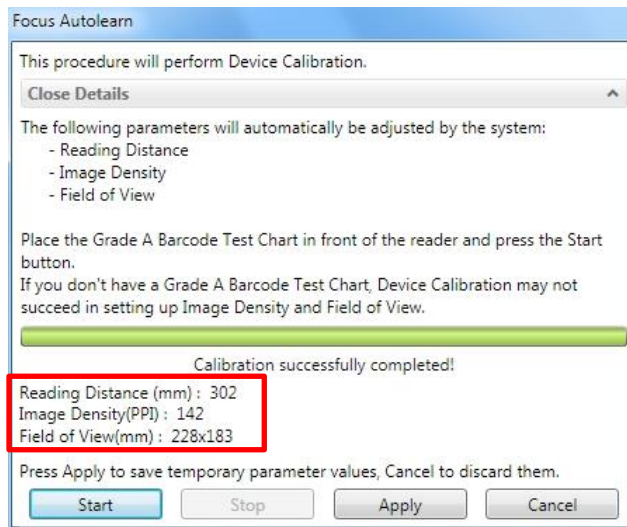
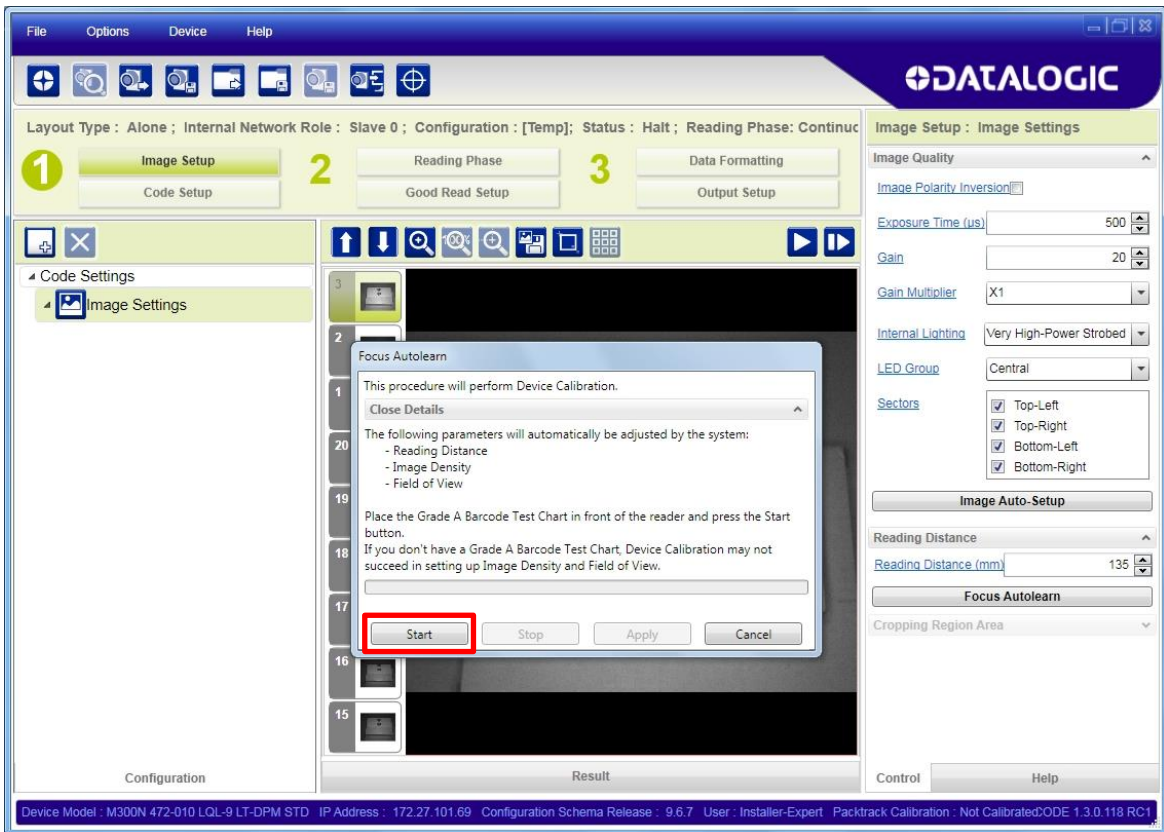


**NOTE:** For applications having multiple lighting or code reading conditions, up to 10 different Image Setups can be configured by adding them with the  icon.

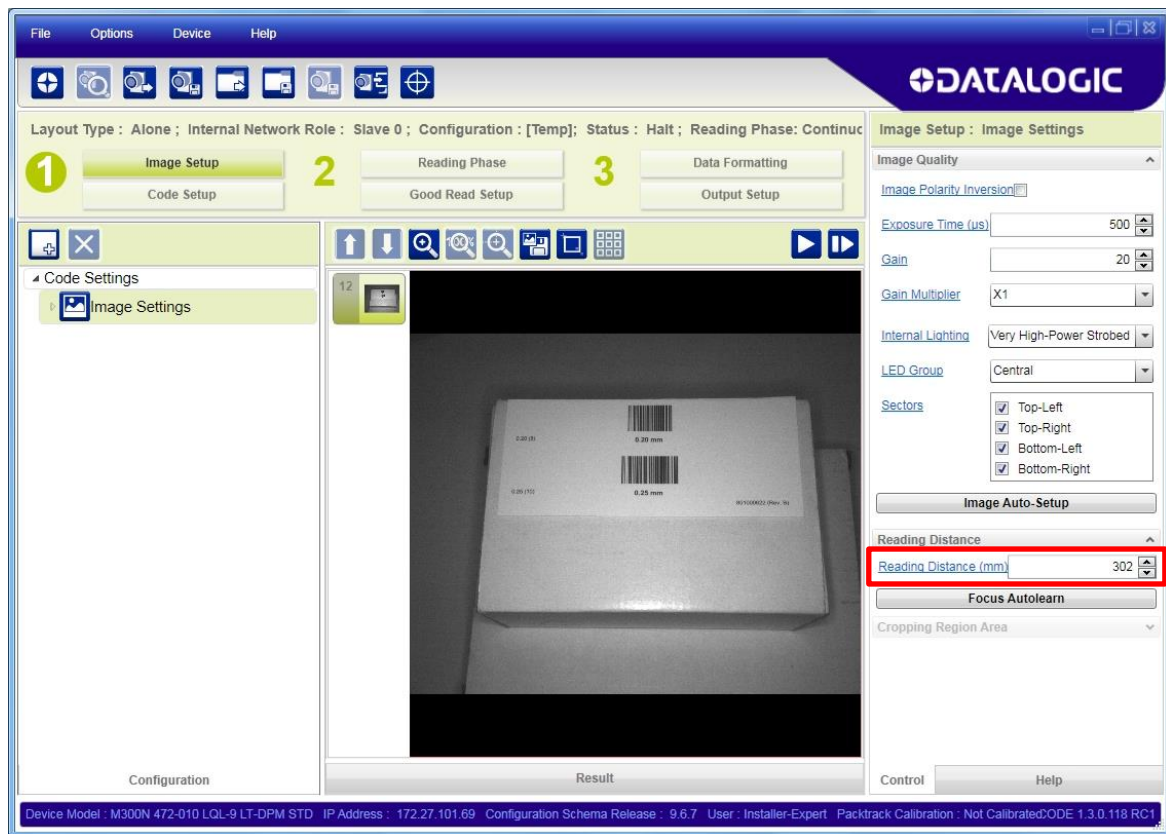
6. Now click on the Focus Autolearn button.




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



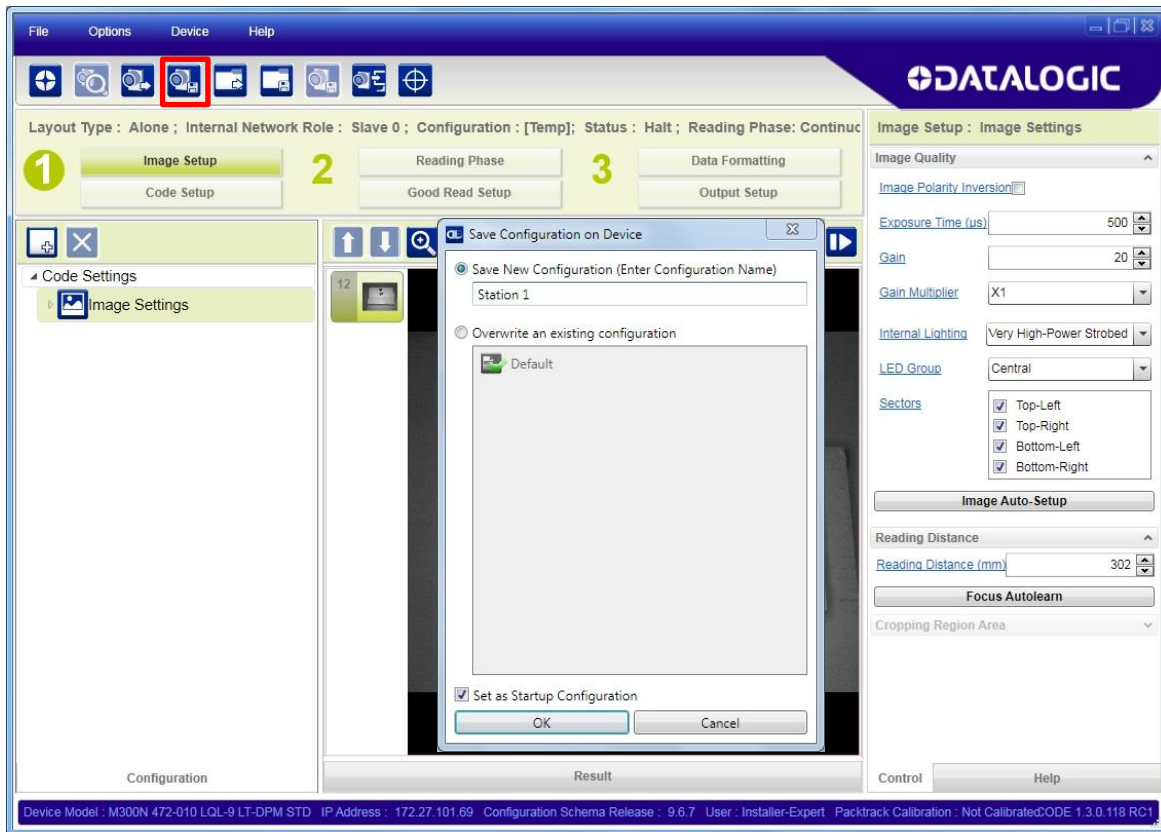
At the end of the calibration you can see the new Reading Distance and Image Density (PPI) values as well as the FOV dimensions. Click Apply.



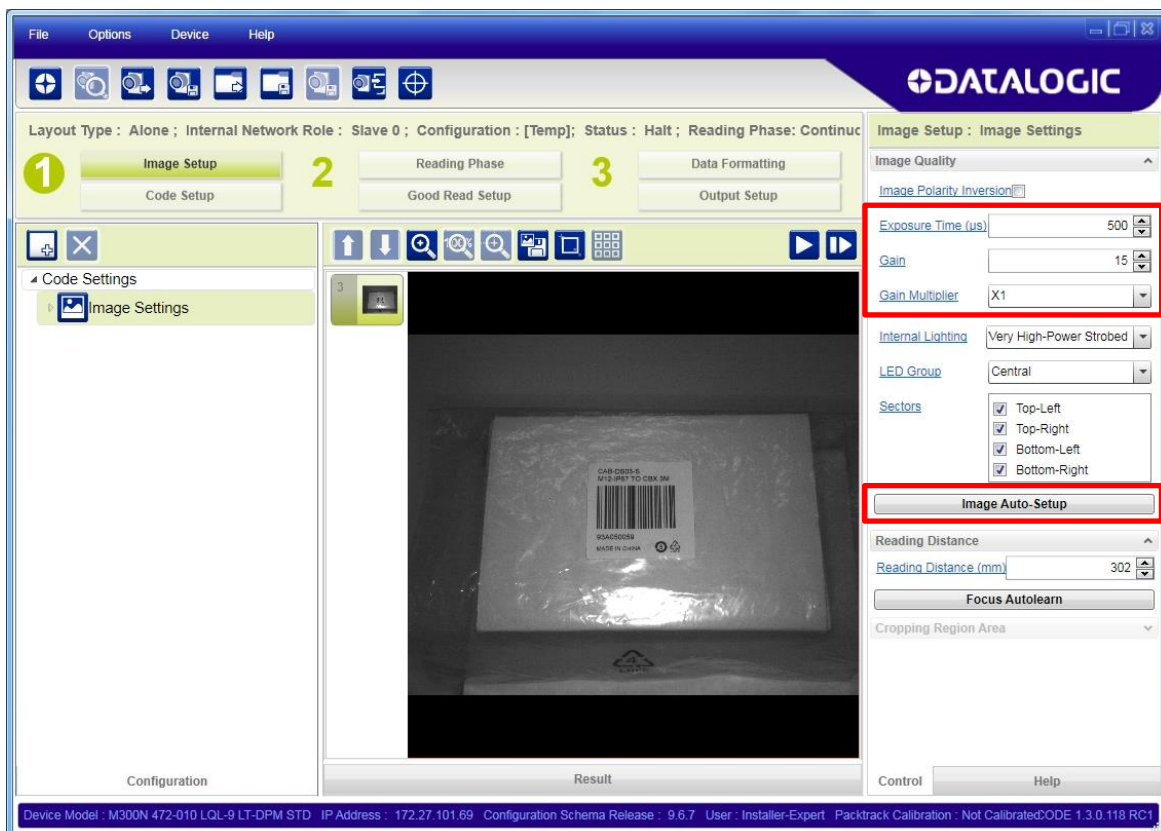
**NOTE:** To enlarge the visual image of the code view, you can click on the zoom image icon  repositioning it on the code.



**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 **only** the Image Auto-Setup to register any changes in lighting or code surface contrast.



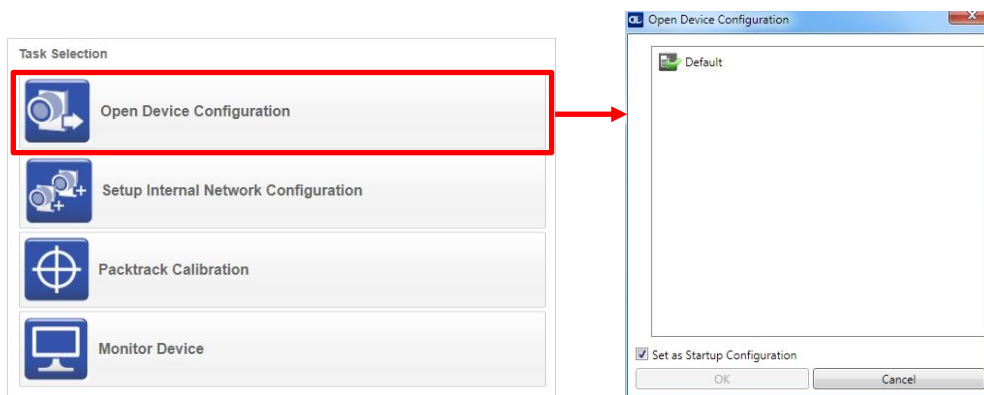
## Image Setup for Manual Adjustable Focus Models



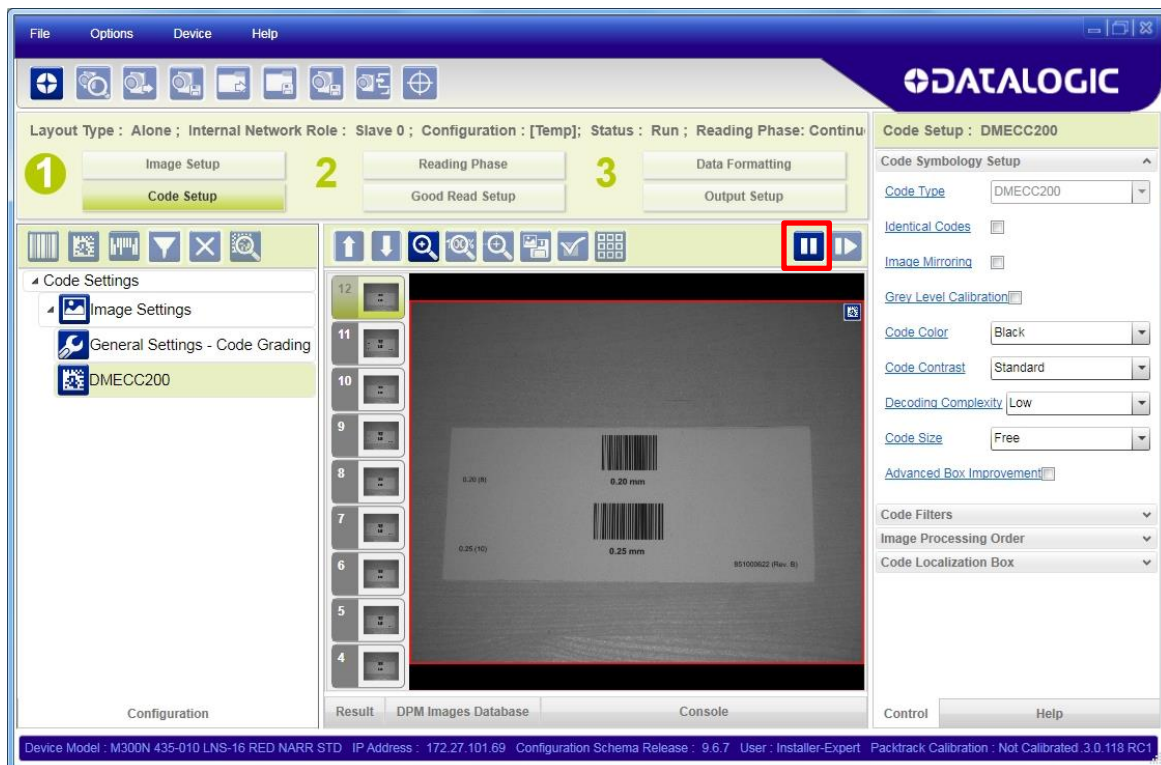
**NOTE:** For Software Adjustable Focus models go to page 12 then continue with **Code Setup** on page 24.

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.

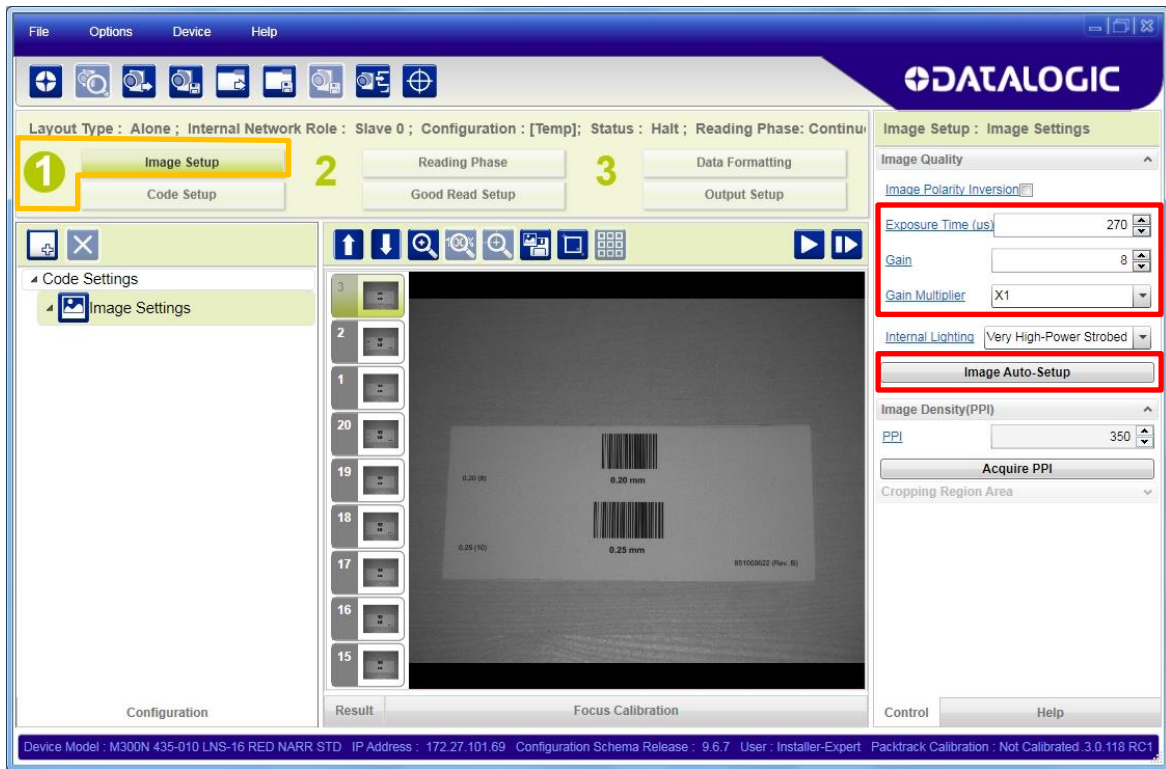
1. From the Task Area select Open Device Configuration.
2. The Open Device Configuration window opens showing the list of currently saved configurations (jobs) saved on the device. For new devices, the only saved job is the Default configuration. Click OK. The device enters run mode and begins acquiring images.



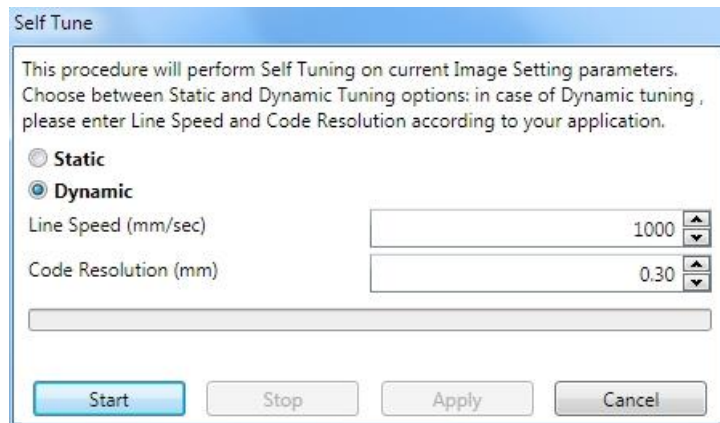
3. Place the **Grade A Barcode Test Chart** in the reading area. Once positioned, stop image acquisition by clicking on the Pause button.

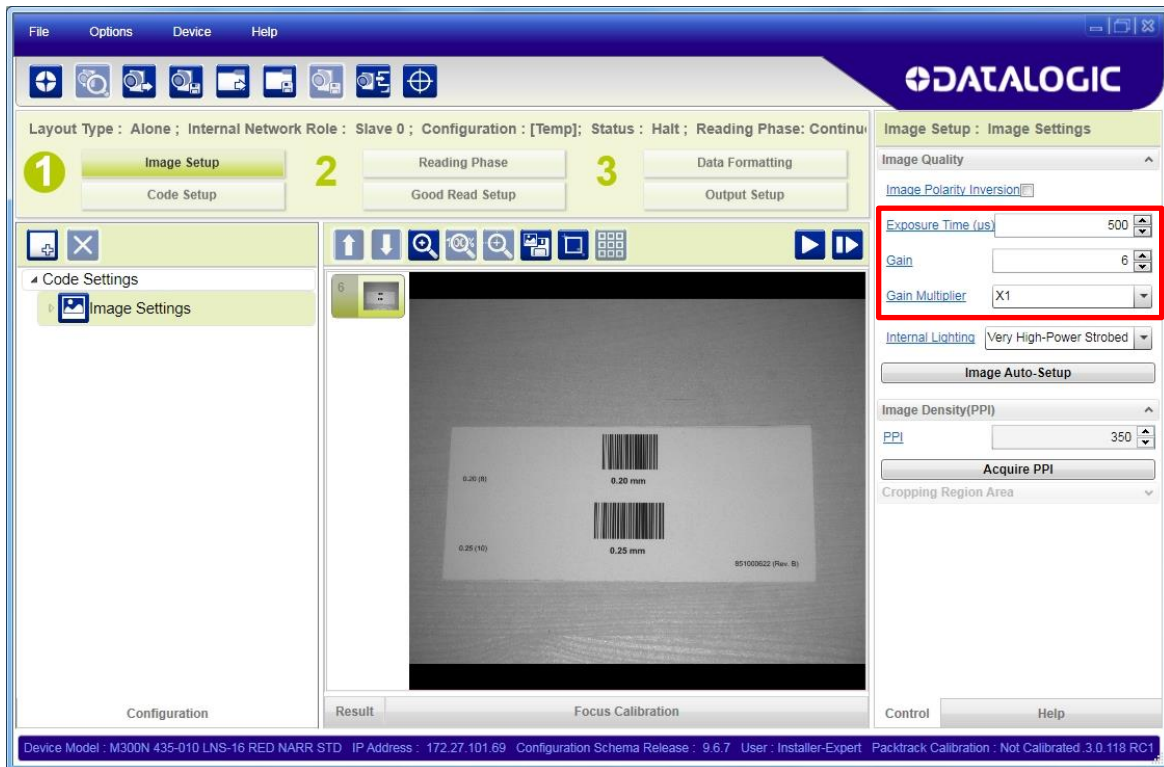



- Click the Image Setup button and then click the Image Auto Setup button to automatically acquire the best exposure time and gain values.



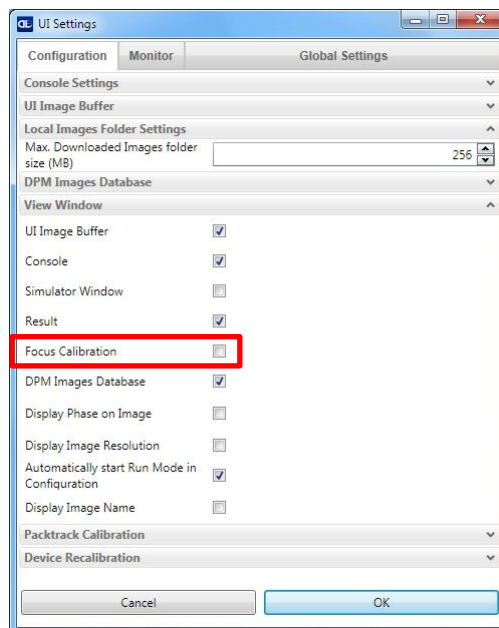
- Select the Static or Dynamic Self-Tuning option; Start Autolearn and Apply to the Image Setup.





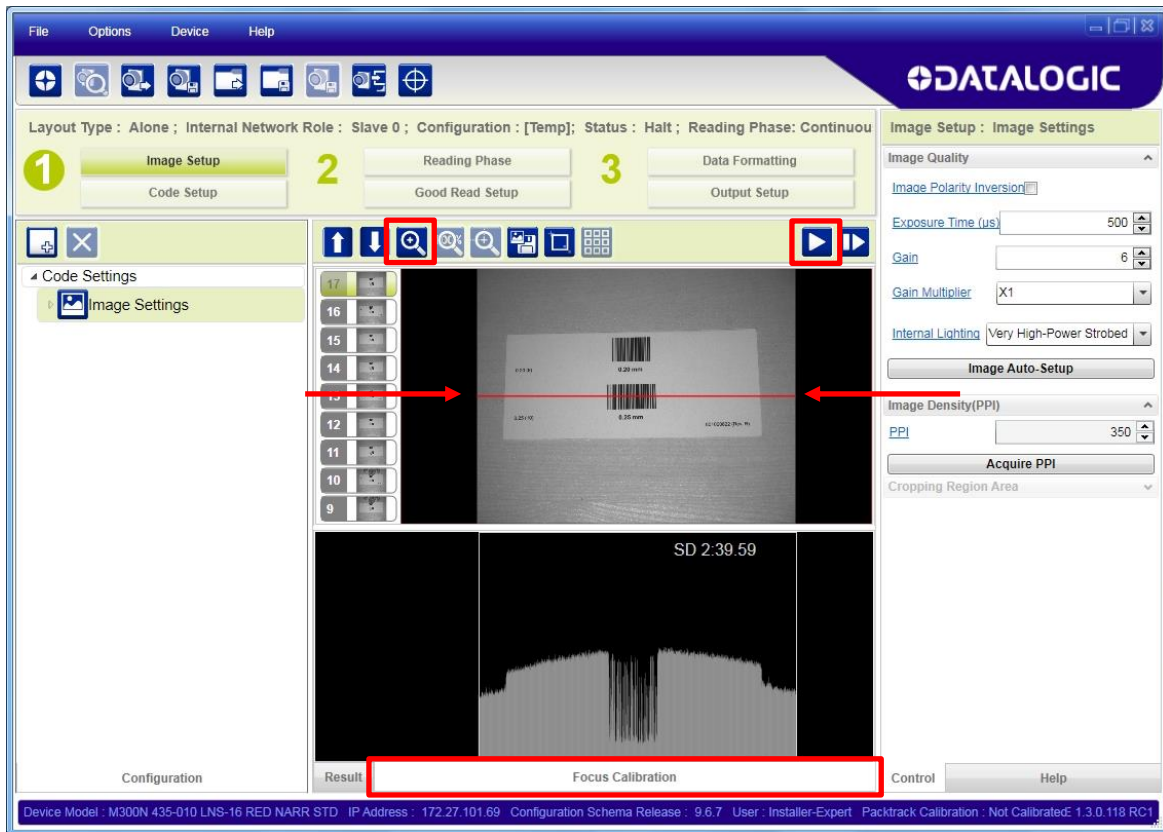
**NOTE:** For applications having multiple lighting or code reading conditions, up to 10 different Image Setups can be configured by adding them with the  icon.

For the next step you need to enable the Focus Calibration Tool from the Options>UI Settings Configuration tab if not already enabled.






- 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.

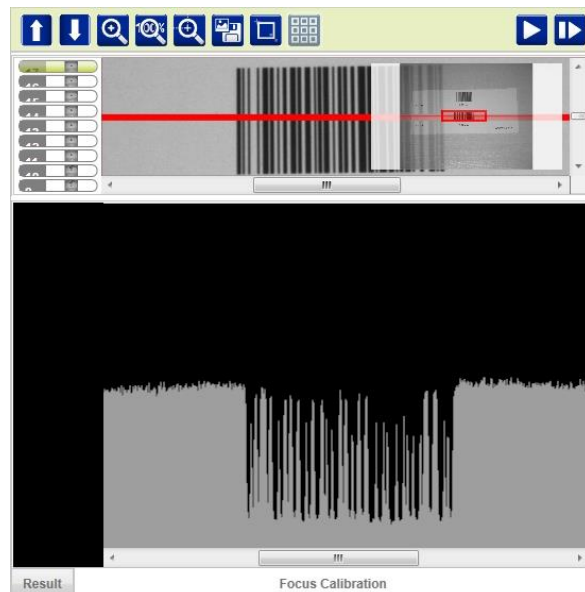


**NOTE:** To enlarge the visual image of the code and the oscilloscope views, you can drag the Focus Calibration window up and click on the zoom image icon  repositioning it on the code.

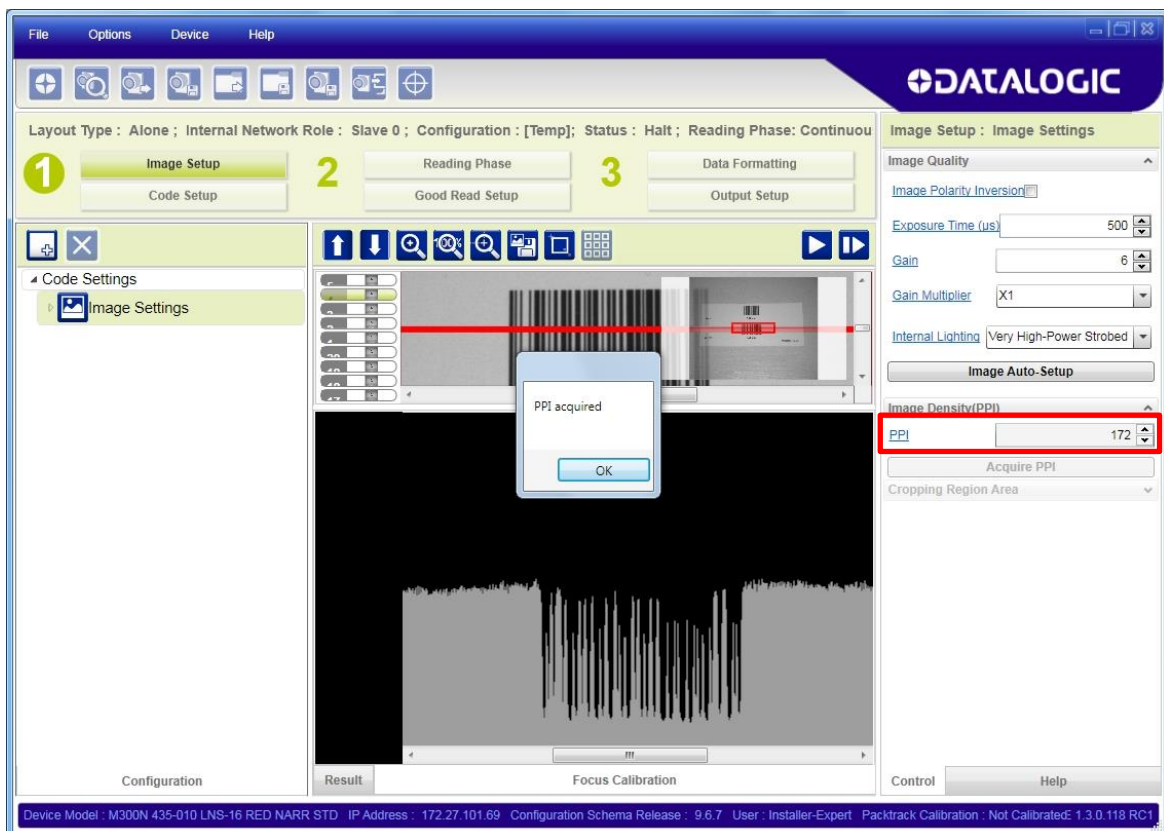
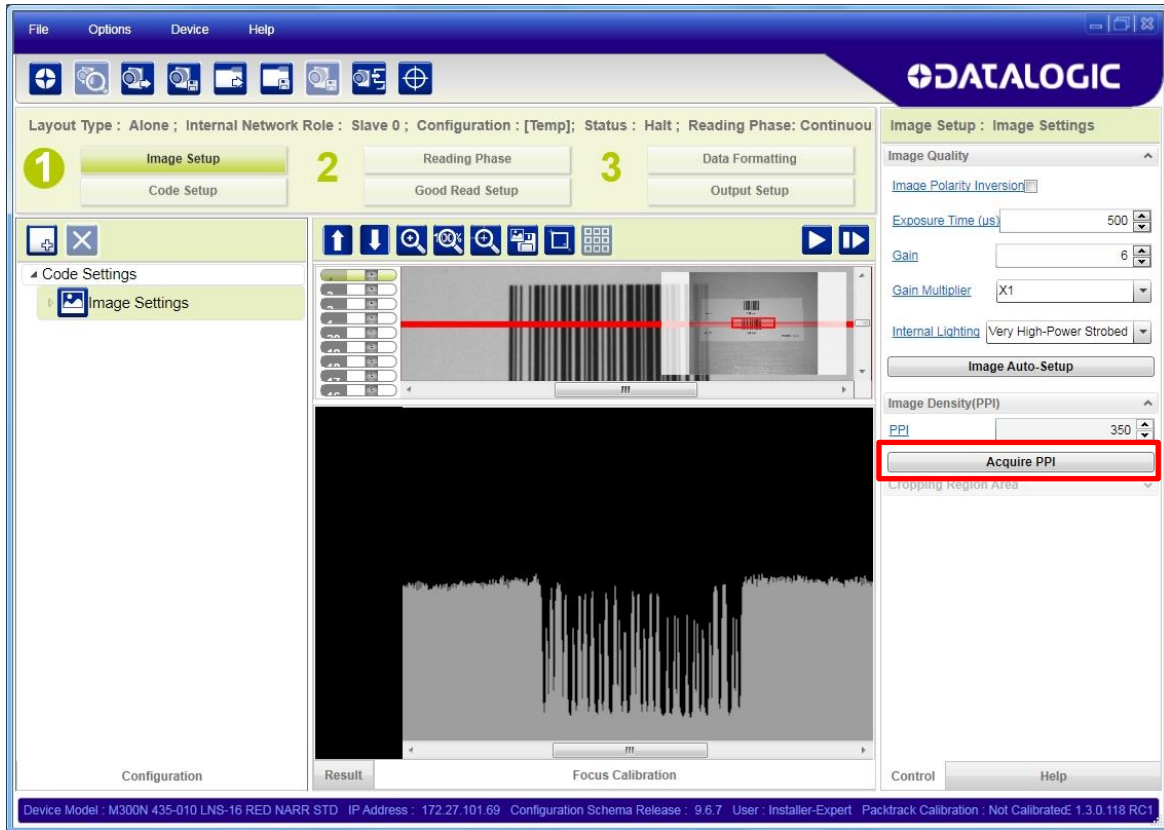
While in run mode, manually adjust the focus until the bars relative to the code in the oscilloscope demonstrate their maximum length (focus).

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

When focused, click Pause to stop image acquisition.

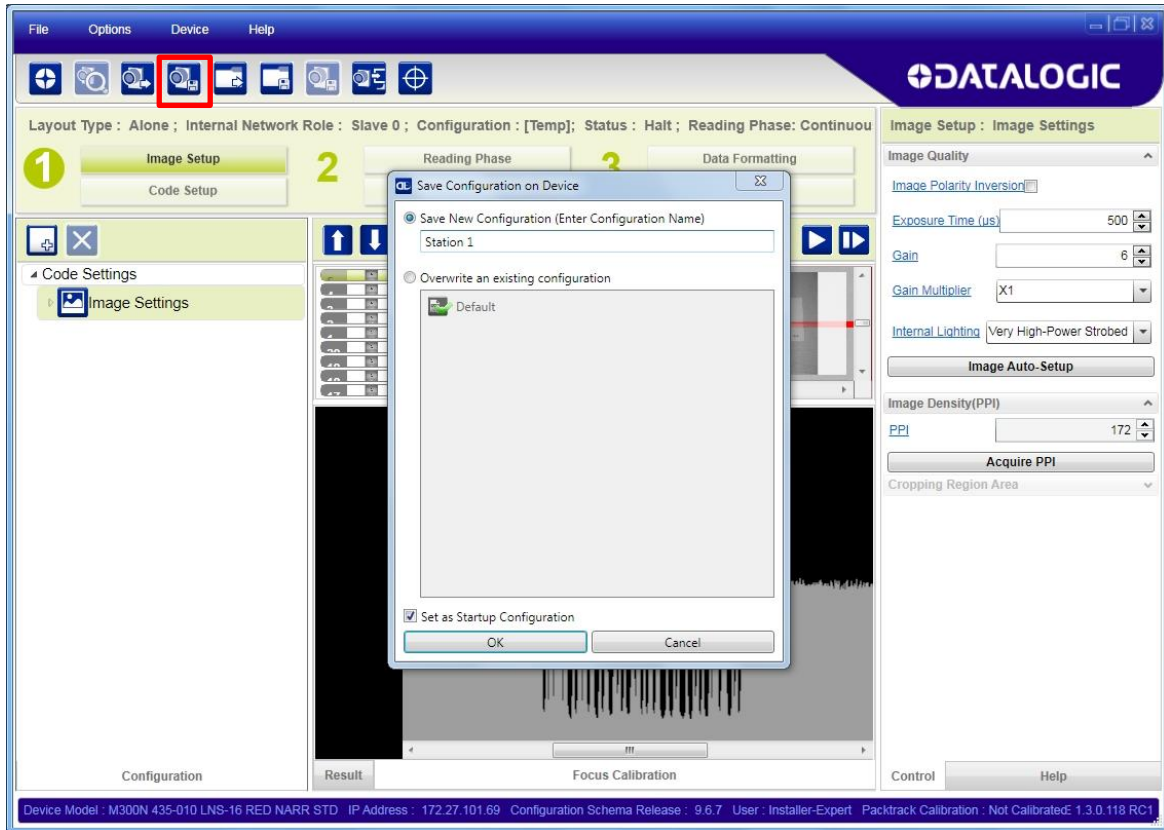


- Click the **Acquire PPI** button to automatically set Image Density so that Matrix 300N will function correctly and to the fullest extent of its capabilities. This procedure is necessary for first time installations, or if the focal distance is changed.





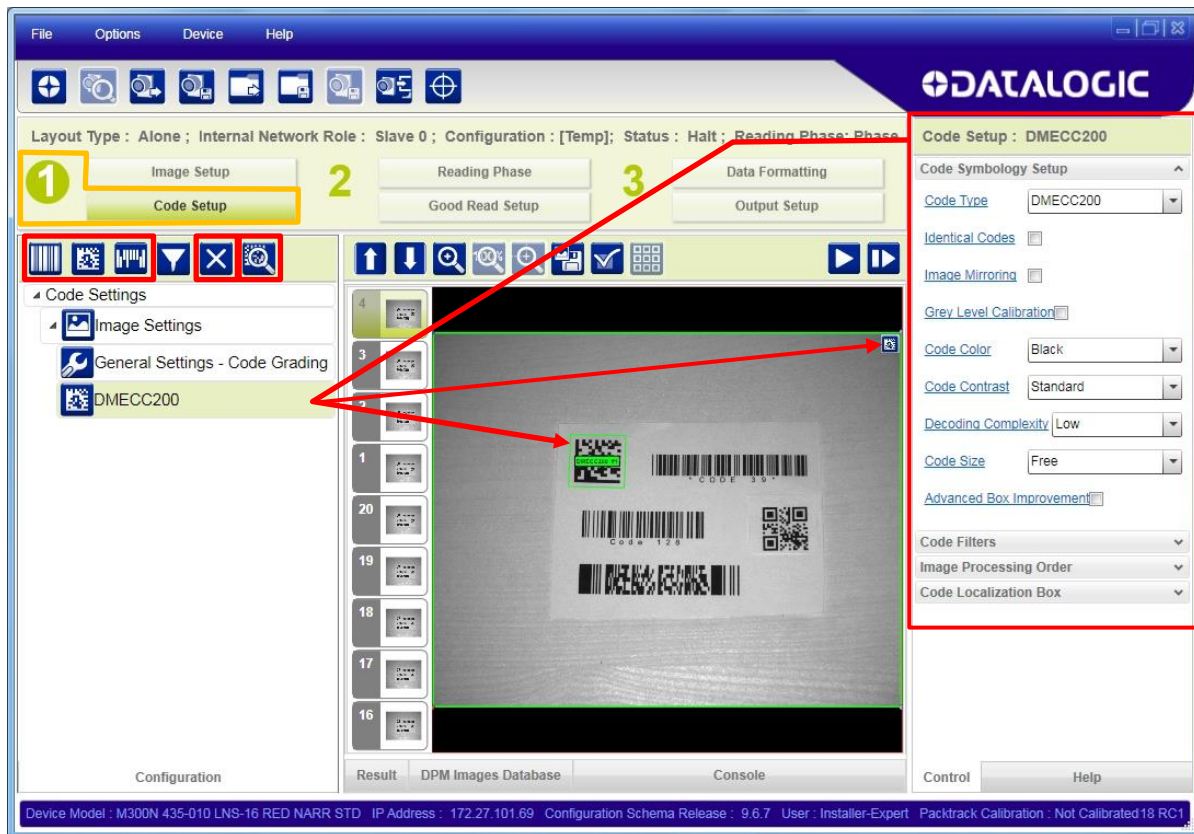
**NOTE:** At this point it is probably a good idea to save the configuration from temporary memory to permanent memory giving it a specific name.




8. 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 localization 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.

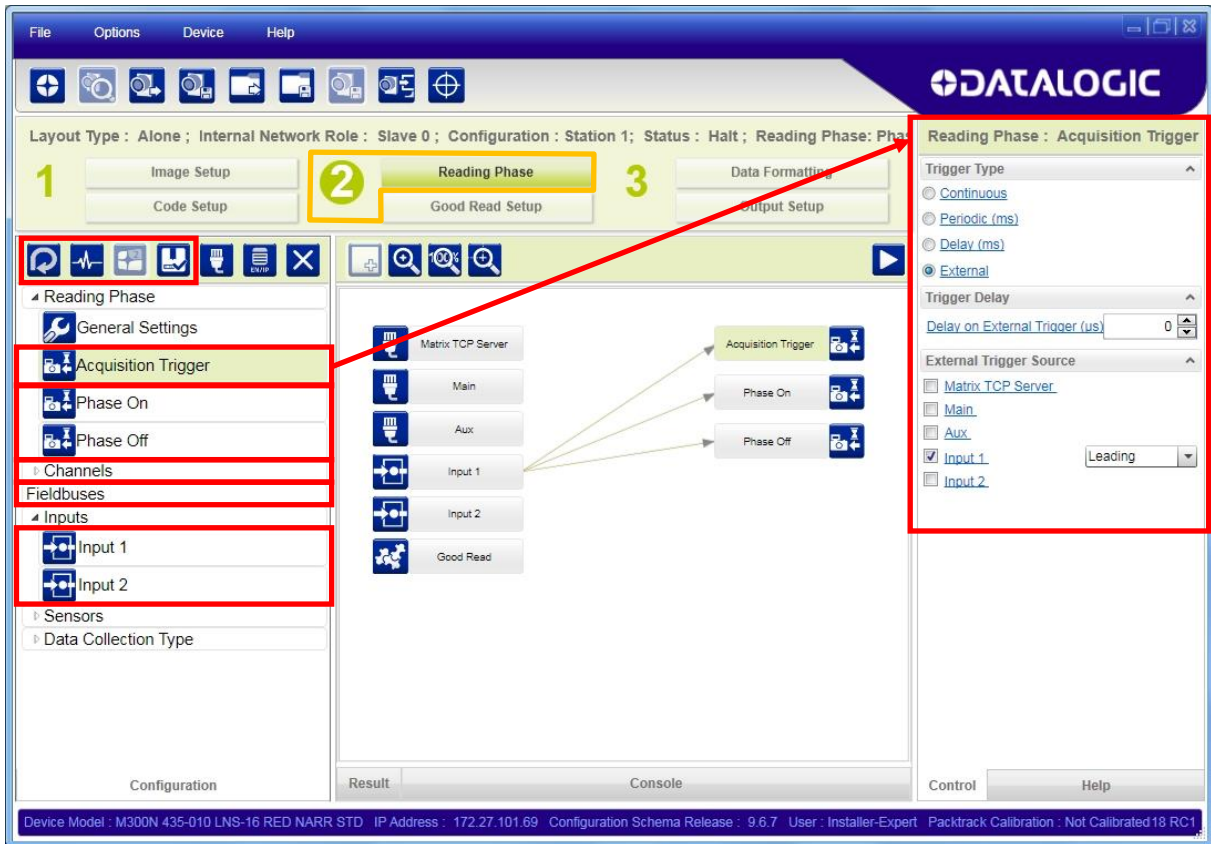
If you don't know the code type, you can use the Code Autolearn feature by clicking on the  icon.<sup>2</sup> See the DL.CODE User's Manual for details.

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.

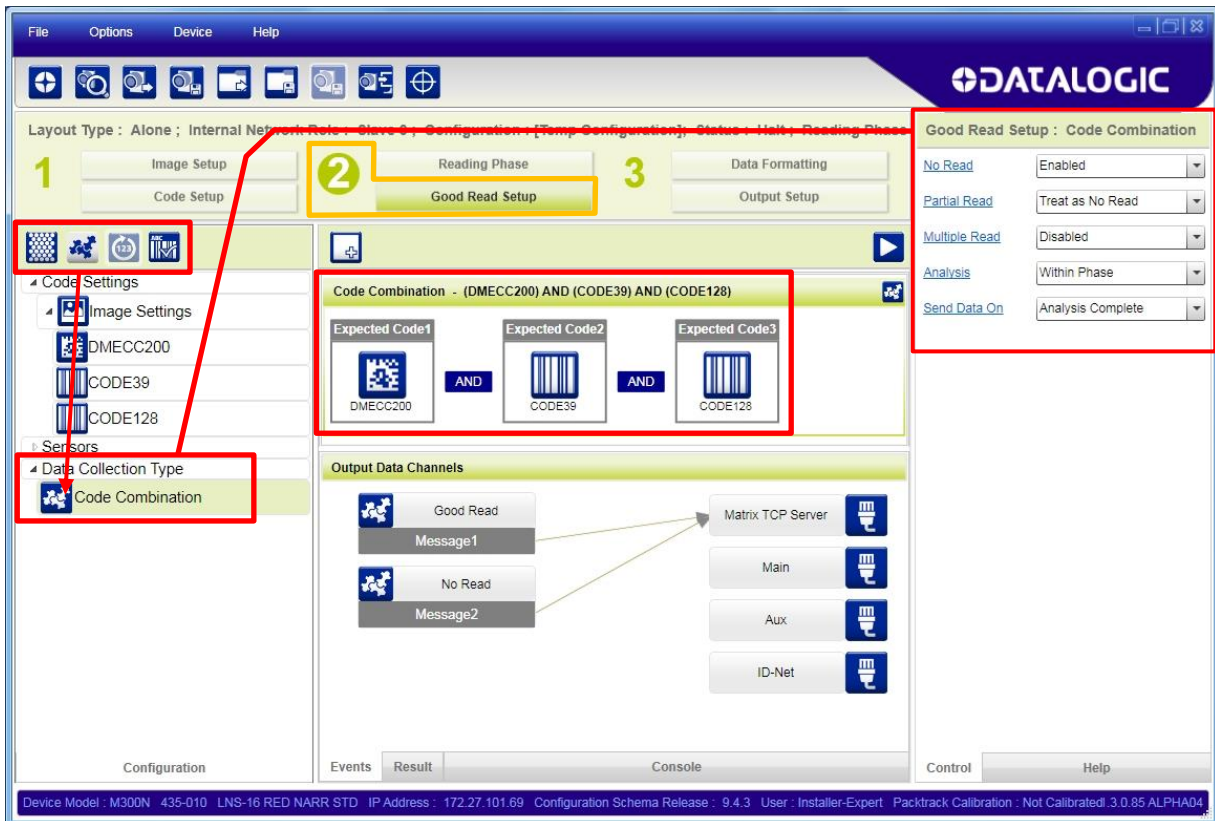


2. Configure the relative Operating Mode parameters from the Reading Phase parameters panel. Different groups will appear in the panel depending on the selected icons over the Configuration Parameters tree area.

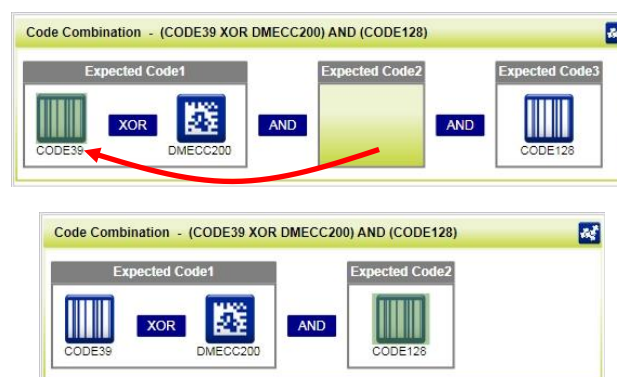
## Good Read Setup


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 (when more than one code type is selected), are in logical AND, which means that all codes are required to be decoded to produce a Good Read condition.



2. If a Good Read condition should be produced when any single code is decoded, independent from the others, then they need to be combined in logical XOR. To do this, drag the code icon(s) from their relative Expected Code box into the Expected Code box of the XOR combination you wish to create. Then delete the empty box by selecting it with the mouse (highlighted) and pressing the delete key on your keyboard.

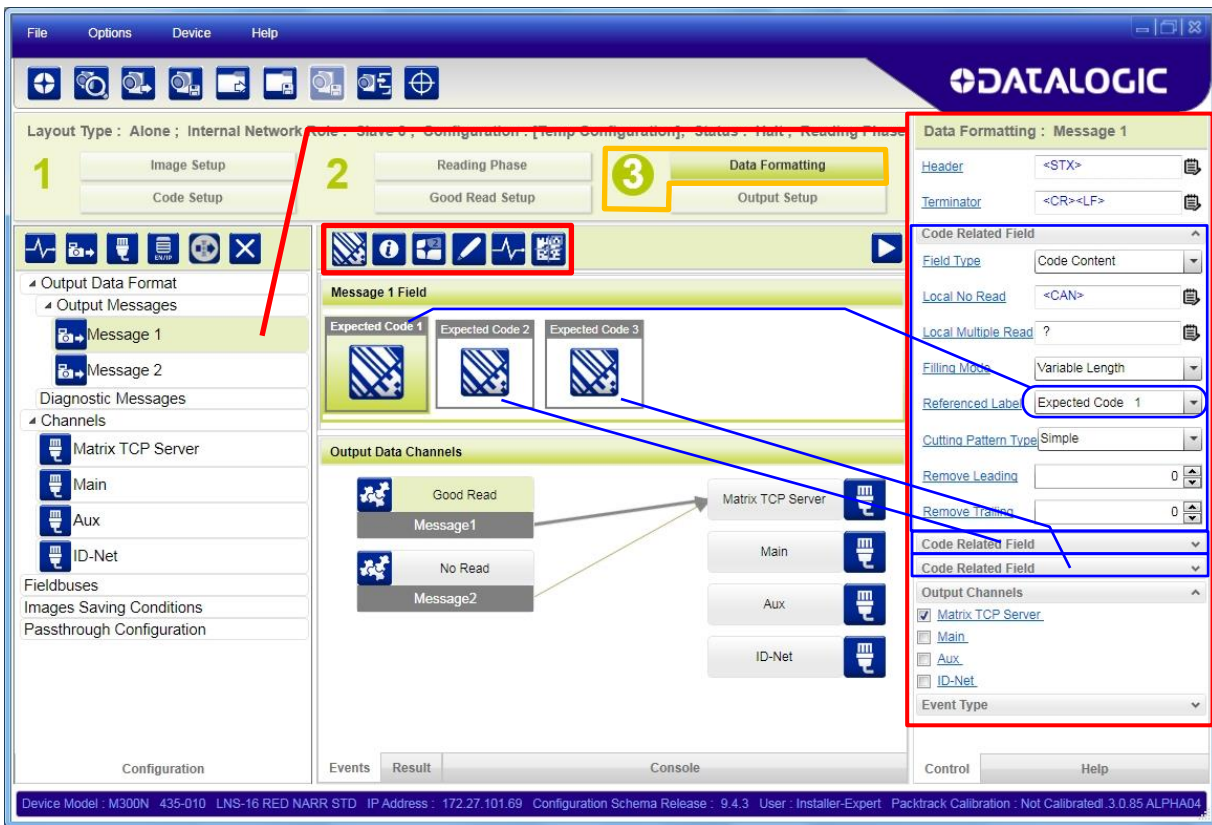


To create a logical AND condition from a logical XOR, create a new Expected Code box using the  icon. Then drag the desired code icon from one box to the other.



### Data Formatting

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

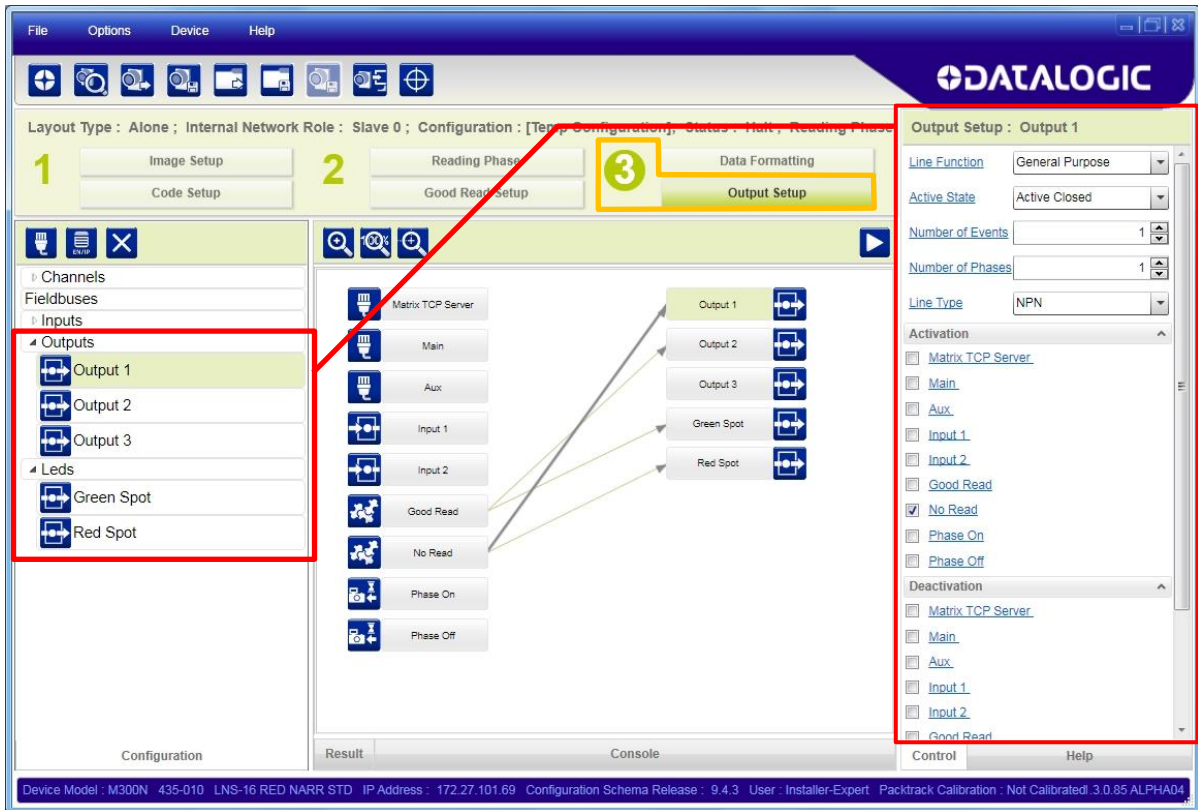


You can add fields to the output message by clicking on the icons above the Message Field area. They will be appended to the message. You can drag them to position them between other fields in the message so that the output message is ordered according to your application requirements.

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 11 – 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:

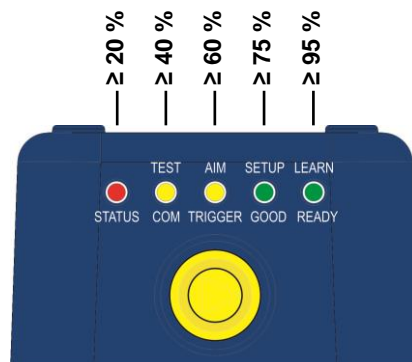


Figure 12 – Test Function Bar Graph

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 partially configured from a host computer using the Host Mode programming procedure.

## 2 INTRODUCTION

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### 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 .zip 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

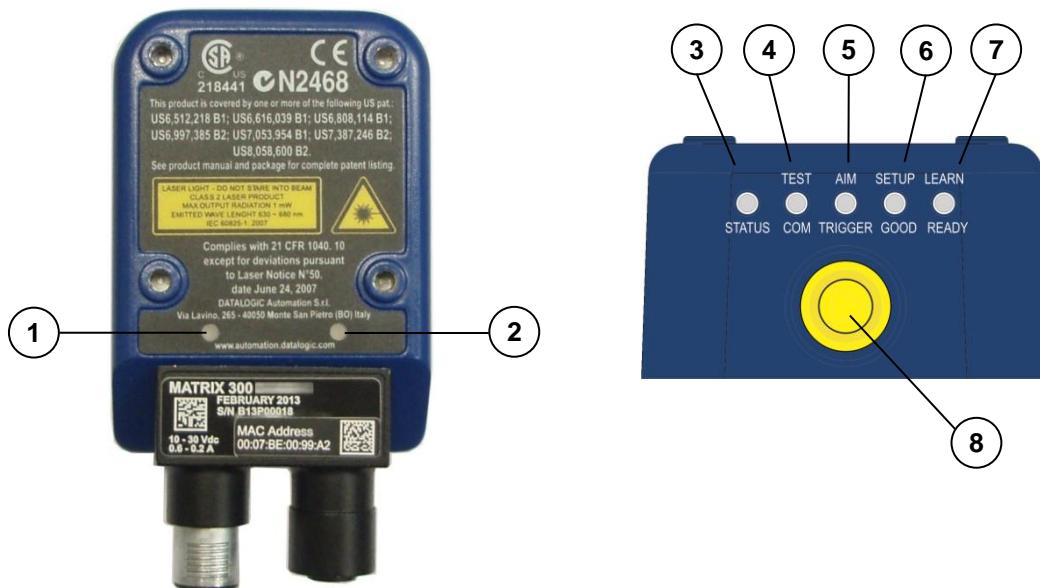


Figure 13 - Indicators

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 13, 1) |
| <b>NET</b> | yellow LED indicates connection to the on-board Ethernet network (Figure 13, 2)    |

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

|                |                                                                                    |
|----------------|------------------------------------------------------------------------------------|
| <b>STATUS</b>  | red LED indicates a NO READ result (Figure 13, 3)                                  |
| <b>COM</b>     | yellow LED indicates active communication on the main serial port * (Figure 13, 4) |
| <b>TRIGGER</b> | yellow LED indicates the status of the reading phase (Figure 13, 5)                |
| <b>GOOD</b>    | green LED confirms successful reading (Figure 13, 6)                               |
| <b>READY</b>   | green LED indicates that the reader is ready to operate (Figure 13, 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. 2.4.

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

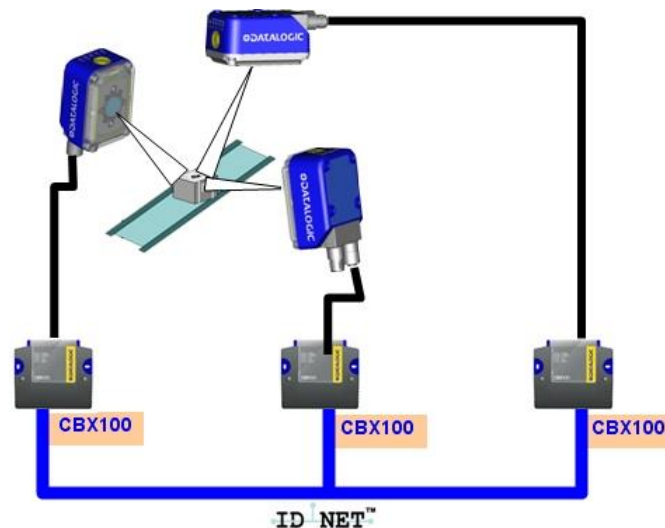
## 2.3 ID-NET

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



The following network configurations are available:

- **ID-NET Synchronized:** Single station – multiple readers

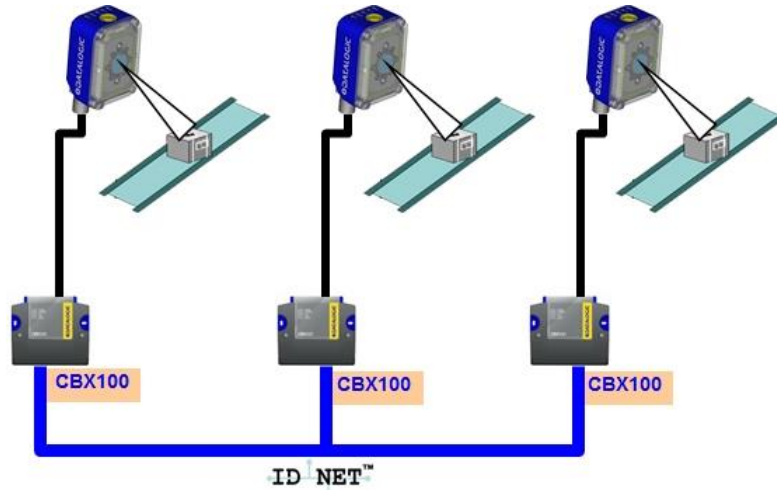


ID-NET interface allows local connection of multiple readers reading different sides of the same target. All readers share a single presence sensor and activate/deactivate simultaneously.

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.

See par. 4.3 for connection details and par. 7.4 for configuration details.

- **ID-NET Multidata:** Multiple stations – single reader



ID-NET interface allows connection of readers reading objects placed on independent conveyors. All readers are typically located far away from each other and they can have different operating modes from each other.

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

See par. 4.3 for connection details and par. 7.4 for configuration details.

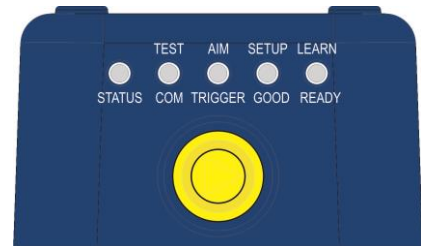


## 2.4 X-PRESS HUMAN MACHINE INTERFACE

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

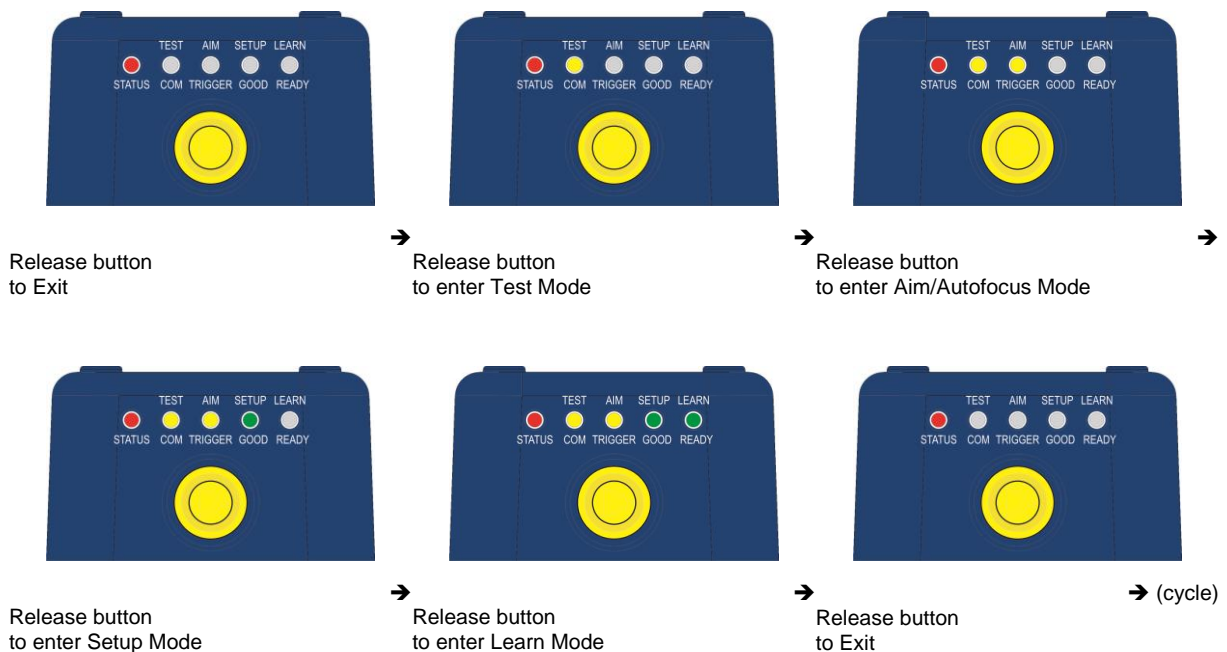


### 2.4.1 X-PRESS Functions

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

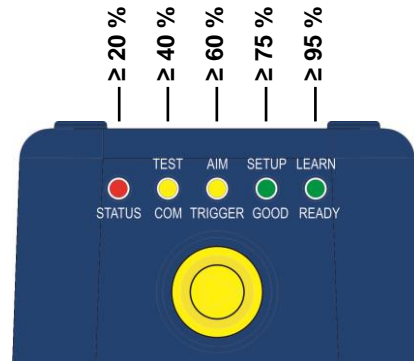
- 1 – **Press** the button (the Status LED will give a visual feedback).
- 2 – **Hold** the button until the specific function LED is on (Test, Aim, Setup or Learn).
- 3 – **Release** the button to enter the specific function.

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



## Test Mode

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

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

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

Once entered, the imager starts a procedure to automatically detect and recognize a **single code** which is presented to it. Successive Learns will substitute the current code.

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.

### 2.4.2 Diagnostic Indication

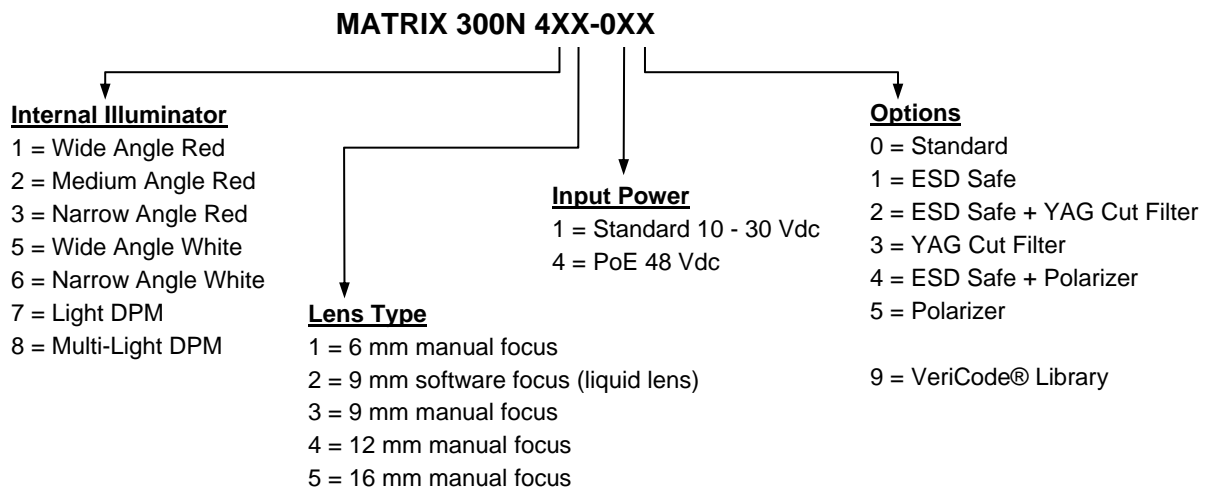
The “STATUS” and “READY” LEDs blink simultaneously to signal the presence of an error. Diagnostic message transmission on interfaces can be enabled to provide details about specific error conditions. See the Diagnostic Error Conditions chart in the Diagnostic page of the DL.CODE Monitor.



| LED     | STATUS |
|---------|--------|
| READY   | BLINK  |
| GOOD    |        |
| TRIGGER |        |
| COM     |        |
| STATUS  | BLINK  |

## 2.5 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.



## 2.5.1 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 .zip file or mini-DVD accessory).

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

## 2.6 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 - EthernNet/IP Gateway | 93ACC0037 |
| QLM600                                                                                               | Quick Link Metal Master ID-NET - Profibus Gateway     | 93ACC0033 |
| QLM700                                                                                               | Quick Link Metal Master ID-NET - Profinet I/O Gateway | 93ACC0038 |
| Various M12 Service Cables and Field Mount Connectors are available for Quick Link Series Connectors |                                                       |           |

| 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 |
| <b>Bracket</b>        |                              |           |
| BK-30-010             | Fixing Bracket Kit           | 93ACC0201 |

## 2.7 APPLICATION EXAMPLES

### 2.7.1 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 14).



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

### 2.7.2 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 15 - Unidose Flow-Pack with PDF417 Code



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



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

### **2.7.3 Direct Part Marking**

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



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



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



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

## 2.7.4 Ink-Jet Printing Technology

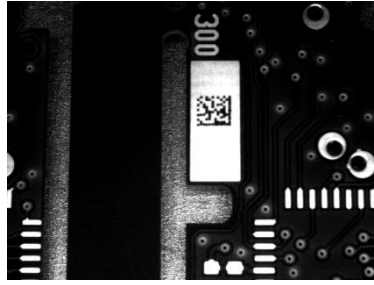


Figure 21 - Dot Matrix Code Directly Marked on PCB Copper Pad by Using Ink-Jet Technology

## 2.7.5 Laser Marking/Etching Technology

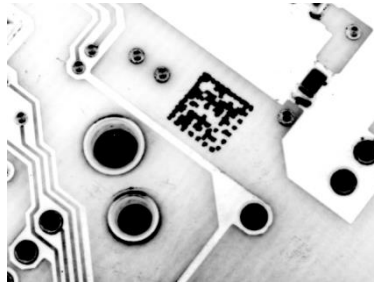


Figure 22 - Data Matrix Code Directly Marked on PCB Surface by Using Laser Etching Technology



**CAUTION:** If application codes must be read which are produced by Laser Marking in real time, use Matrix 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)

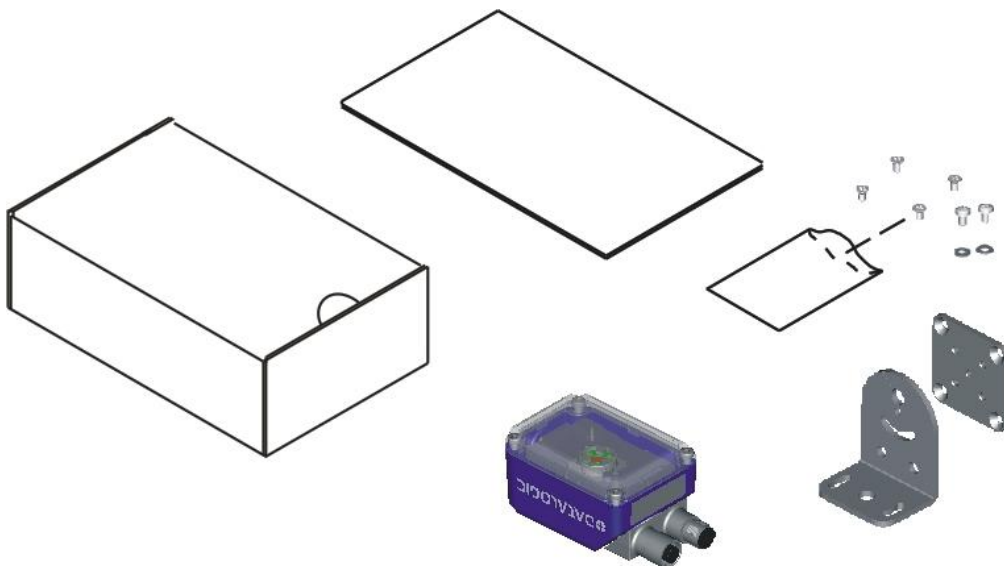


Figure 23 - Package Contents



### 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 24).

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

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

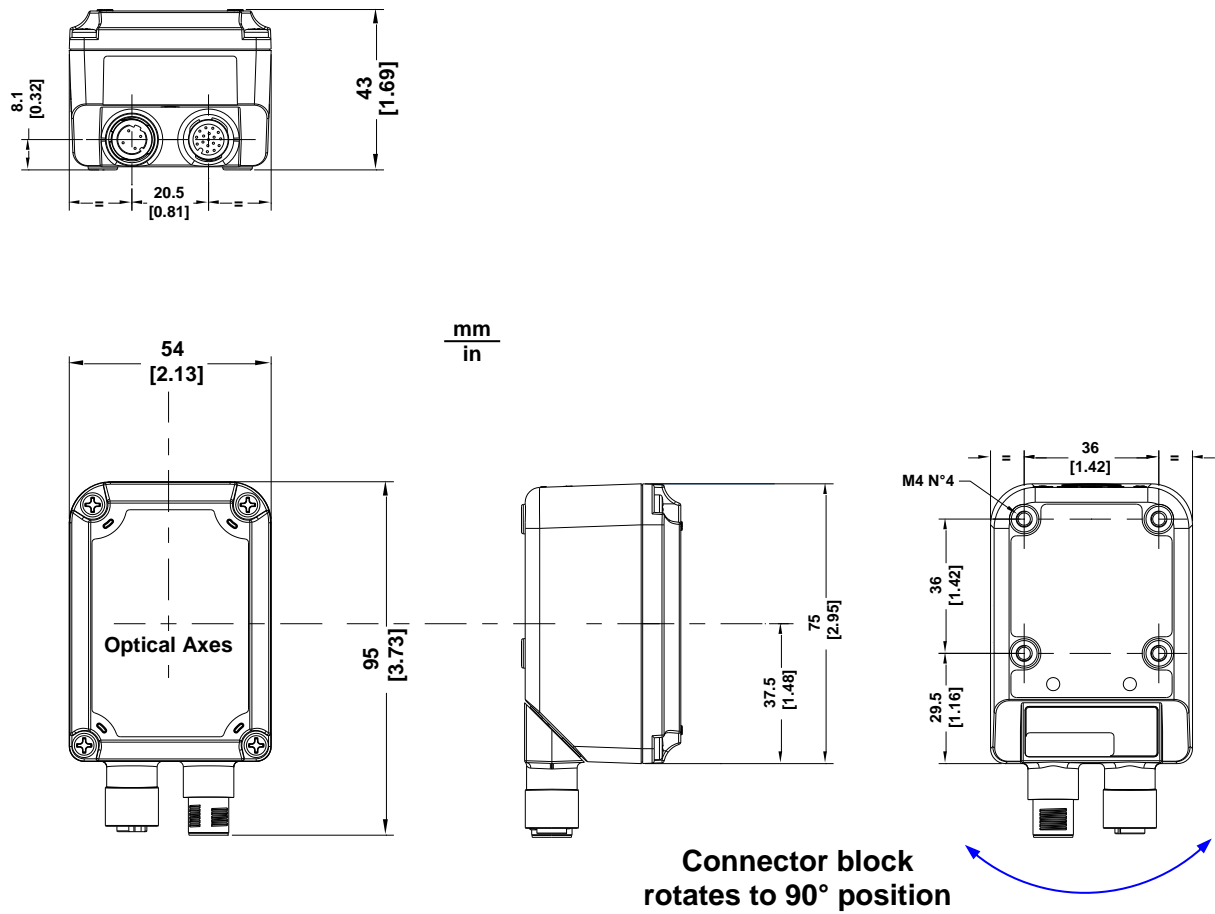


Figure 24 - Overall Dimensions with Connector at 0°

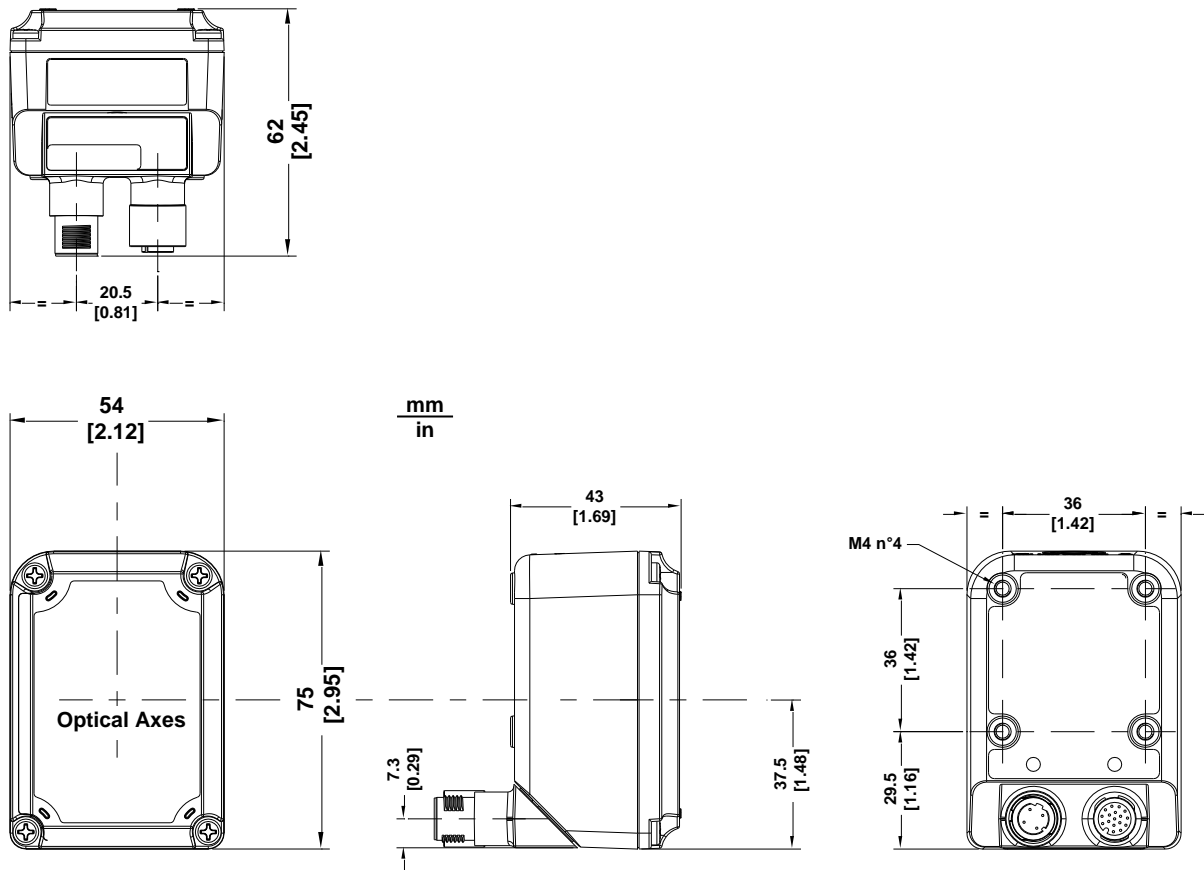


Figure 25 - Overall Dimensions with Connector at 90°

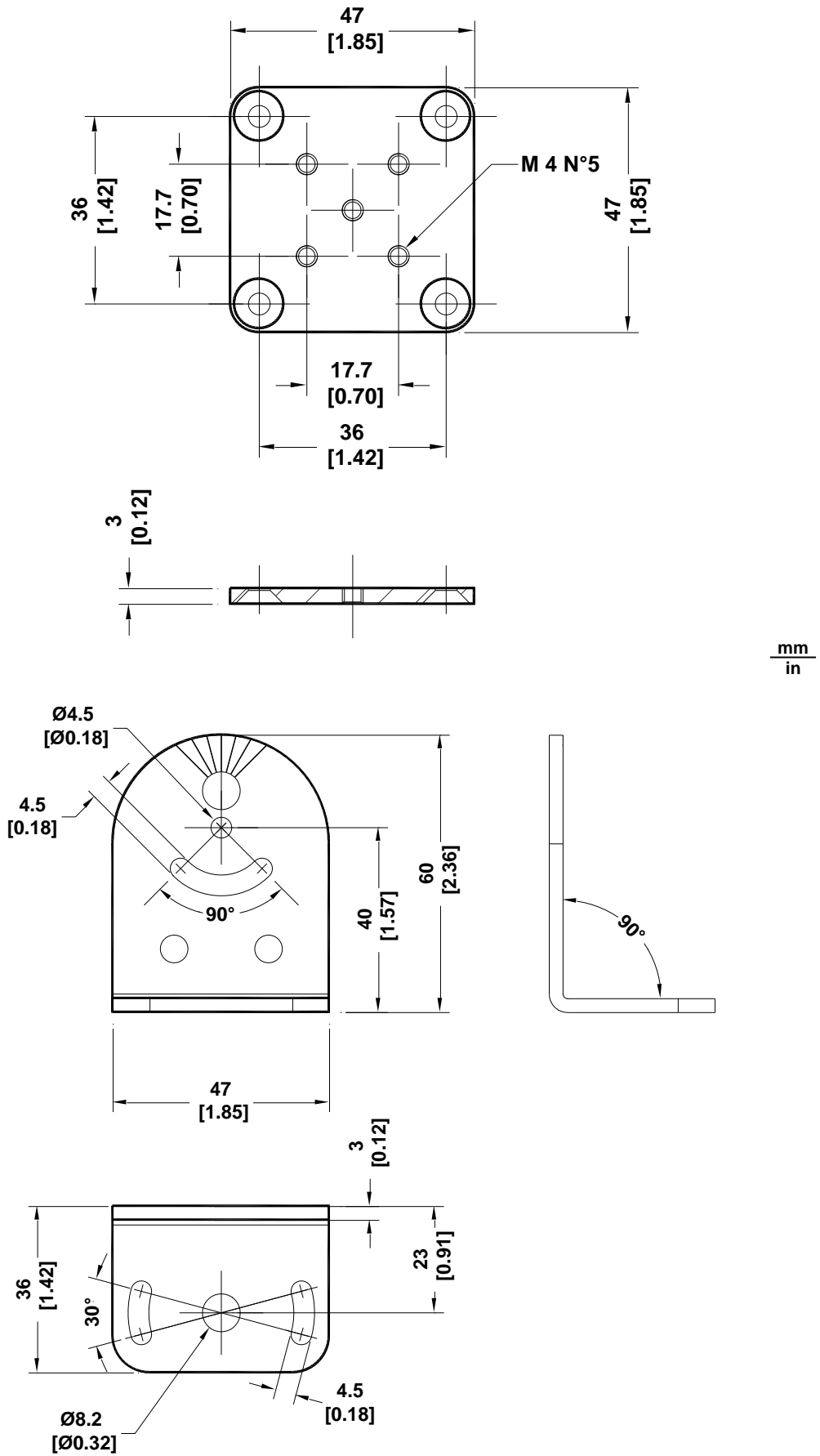


Figure 26 - Mounting Bracket Overall Dimensions

### 3.3 MOUNTING AND POSITIONING MATRIX 300N

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

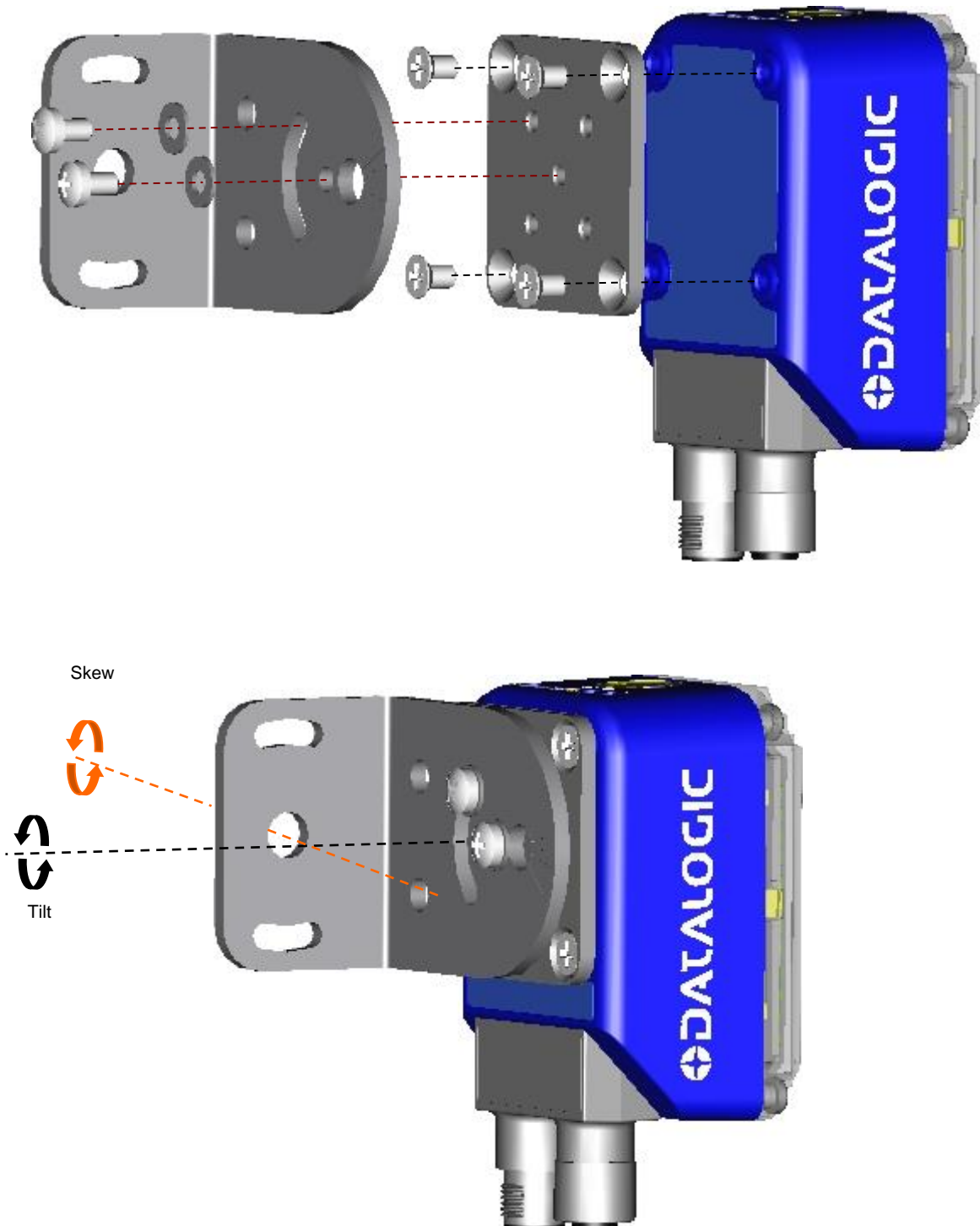


Figure 27 –Positioning with Mounting Bracket

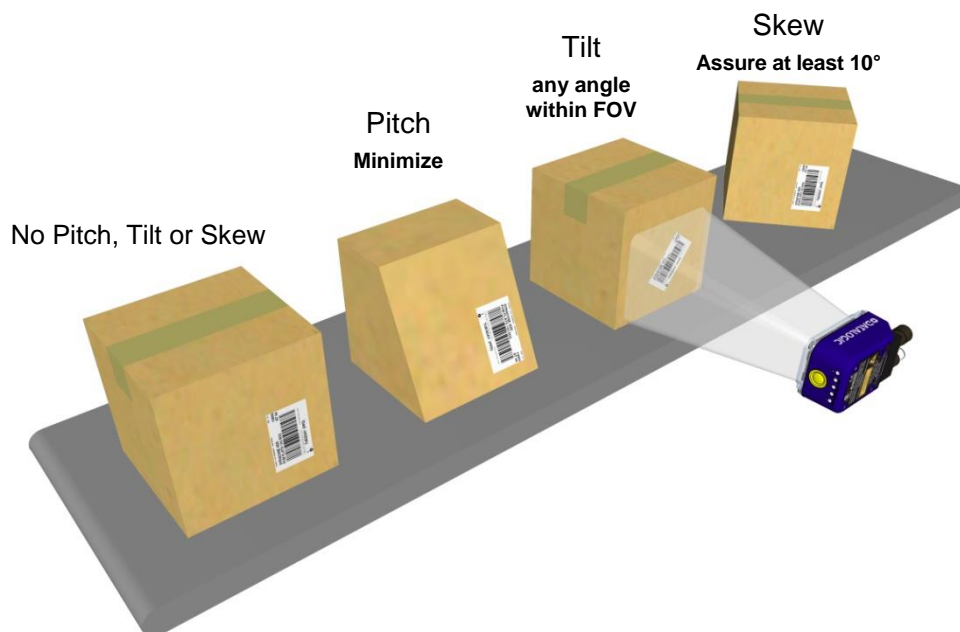
Matrix 300N is able to decode code labels at a variety of angles; however significant angular distortion may degrade reading performance.

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 28. Follow the suggestions below for the best orientation:

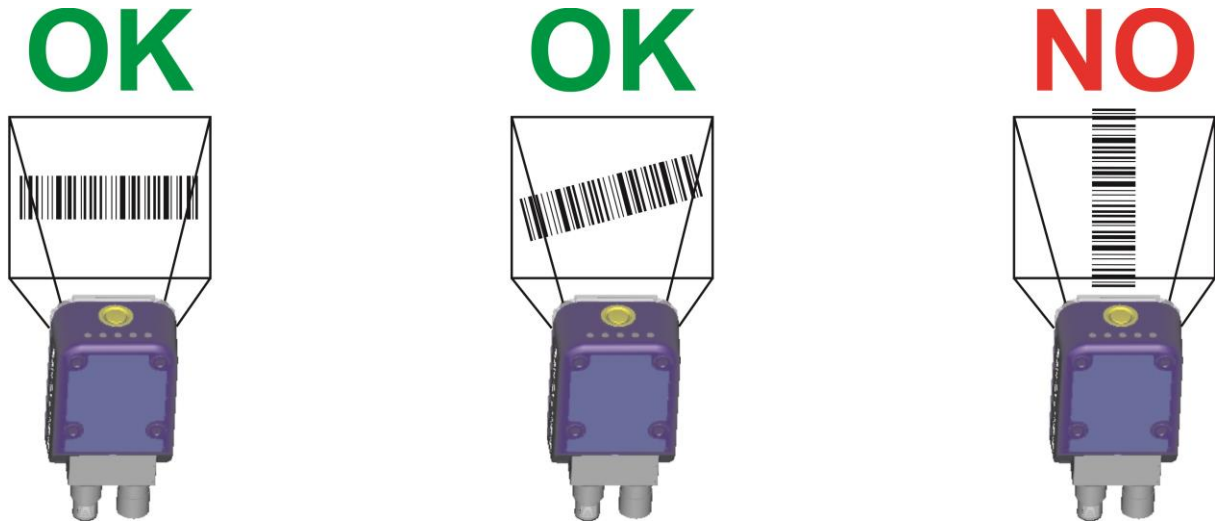
Position the reader in order to avoid the direct reflection of the light emitted by the Matrix 300N reader; it is advised to **assure at least 10°** for the Skew angle.



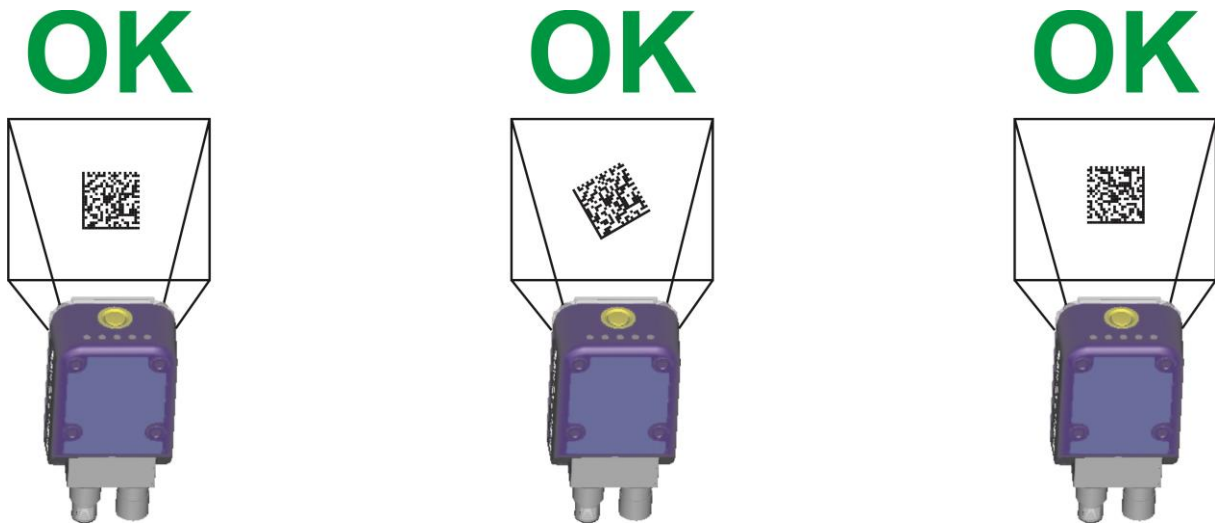
**Figure 28 - Code Reading Orientation**

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

The **Tilt** angle is also represented in Figure 29. Matrix 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 29 - 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 |                                                            |                          |
|--------------------------------------|------------------------------------------------------------|--------------------------|
| <b>Input Power</b>                   |                                                            |                          |
| Vdc                                  | Power Supply Input Voltage +                               |                          |
| GND                                  | Power Supply Input Voltage -                               |                          |
| Earth                                | Protection Earth Ground                                    |                          |
| <b>Inputs</b>                        |                                                            |                          |
| +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                                   |                          |
| <b>Outputs</b>                       |                                                            |                          |
| +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) |                          |
| <b>Auxiliary Interface</b>           |                                                            |                          |
| TX                                   | Auxiliary Interface TX                                     |                          |
| RX                                   | Auxiliary Interface RX                                     |                          |
| SGND                                 | Auxiliary Interface Reference                              |                          |
| <b>ID-NET</b>                        |                                                            |                          |
| REF                                  | Network Reference                                          |                          |
| ID+                                  | ID-NET network +                                           |                          |
| ID-                                  | ID-NET network -                                           |                          |
| Shield                               | Network Cable Shield                                       |                          |
| <b>Main Interface</b>                |                                                            |                          |
|                                      | <b>RS232</b>                                               | <b>RS422 Full-Duplex</b> |
|                                      | 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 30:

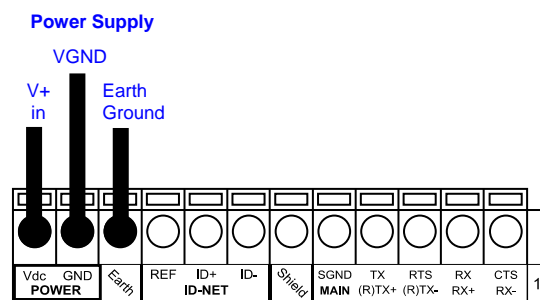


Figure 30 - Power Supply Connections

The power must be between 10 and 30 Vdc only.

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

### 4.1.2 Power over Ethernet (PoE) Models

The Ethernet pinout is as follows:

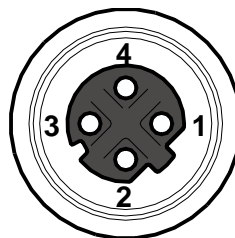


Figure 31 - M12 D-Coded Female Ethernet Network Connector

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





**CAUTION:** Matrix 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.

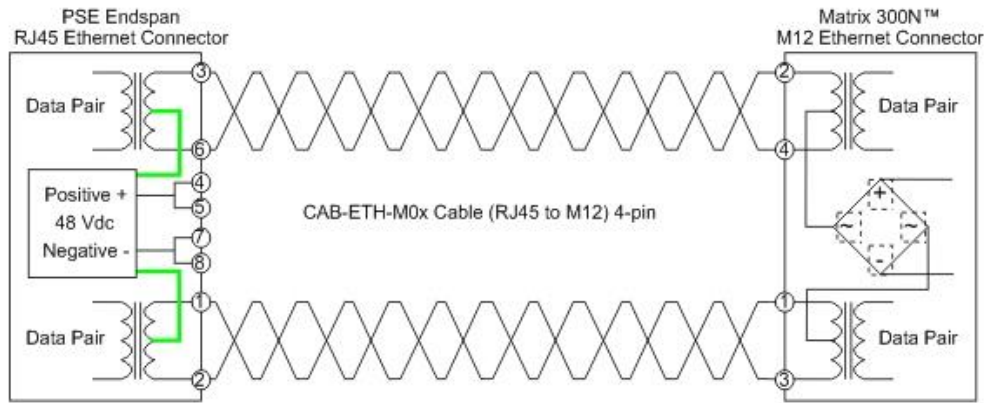


Figure 32 – Matrix 300N PoE PSE Endspan Alternative A Connections OK

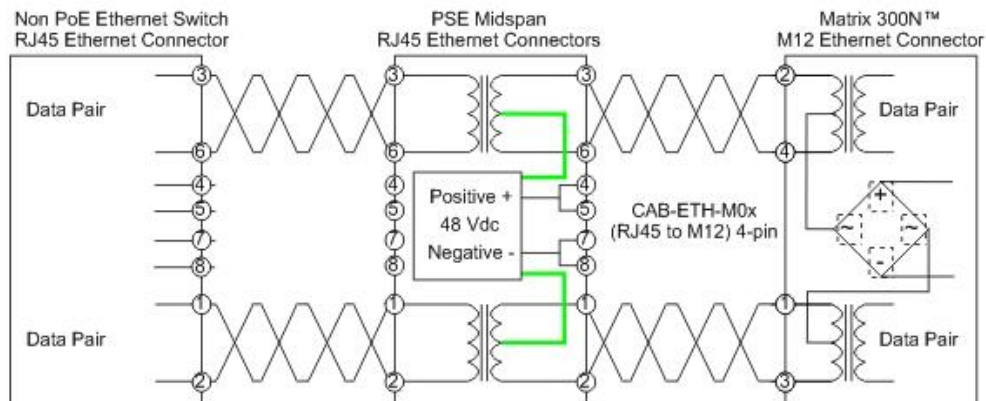


Figure 33 – Matrix 300N PoE PSE Midspan Alternative A Connections OK

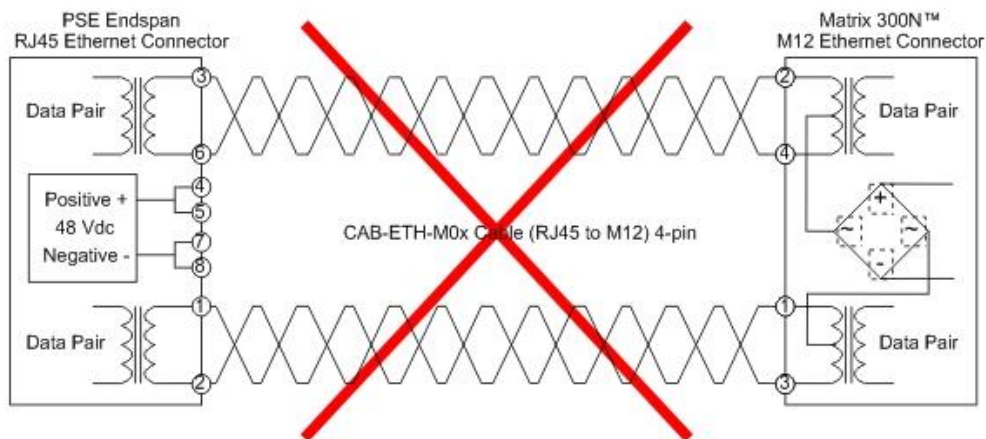


Figure 34 – Matrix 300N PoE PSE Endspan Alternative B Connections NOT SUPPORTED

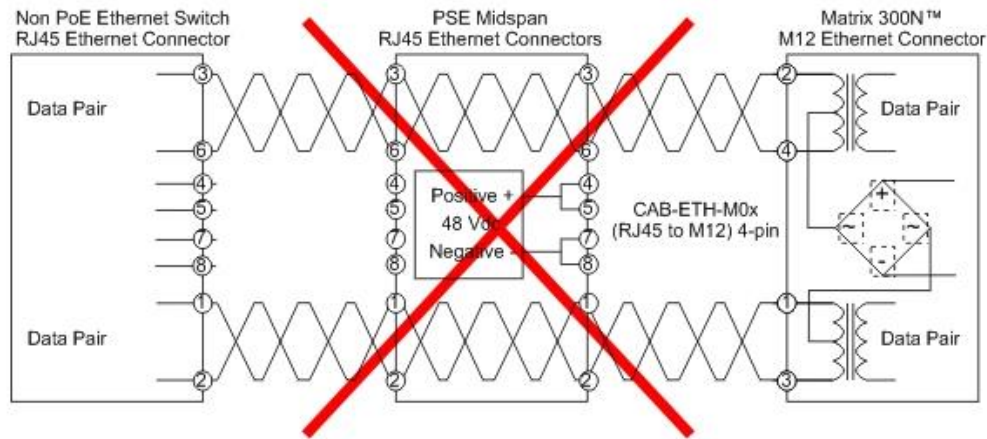


Figure 35 – Matrix 300N PoE PSE Midspan Alternative B Connections NOT SUPPORTED



**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).

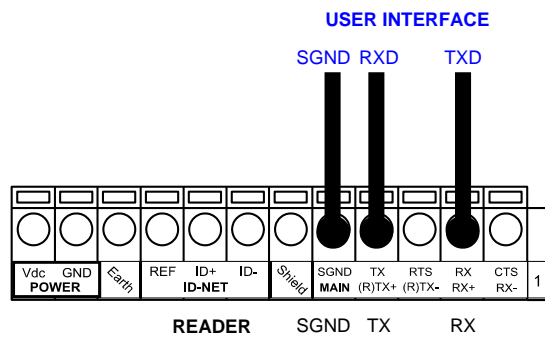


Figure 36 – RS232 Main Interface Connections

## 4.2.2 RS422 Full-Duplex Interface

The RS422 full-duplex (5 wires + shield) interface is used for non-pollled 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         |

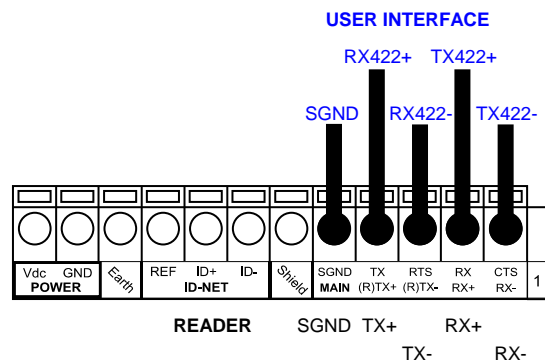


Figure 37 - RS422 Full-duplex Connections



**NOTE:** For applications that do not use RS422 transmission to the reader (terminal block RX+ and RX- signals), do not leave these lines floating but connect them to SGND as shown below.

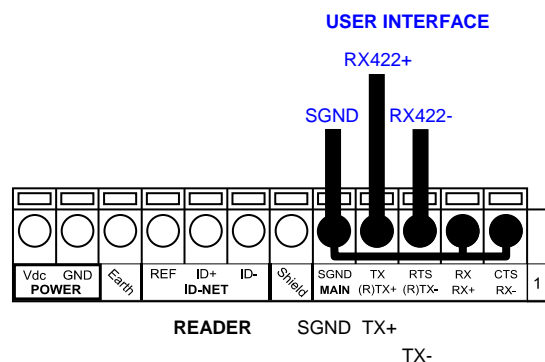


Figure 38 - RS422 Full-duplex Connections using Only TX Signals to Host

### 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 40, Figure 41 and Figure 42.

- 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 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.

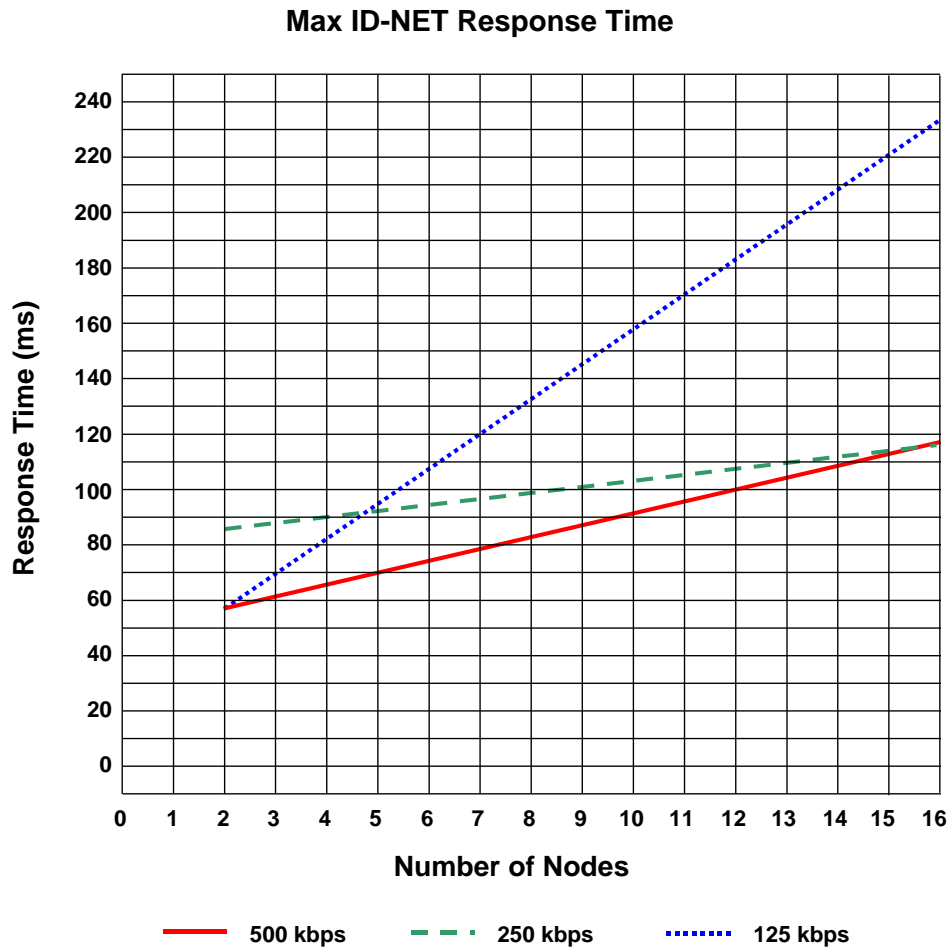


Figure 39 – ID-NET Response Time

#### 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.

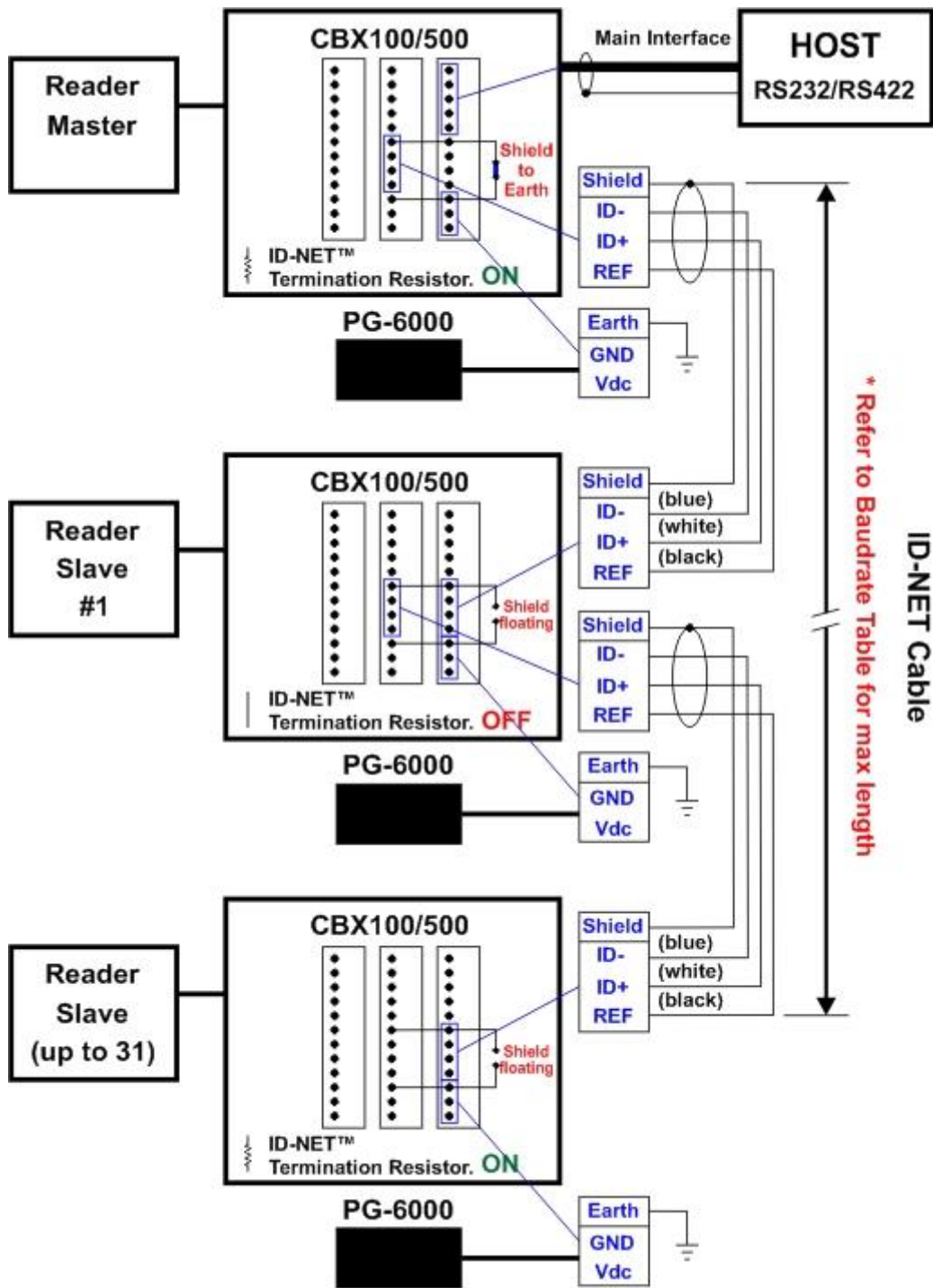


Figure 40 – ID-NET Network Connections with isolated power blocks

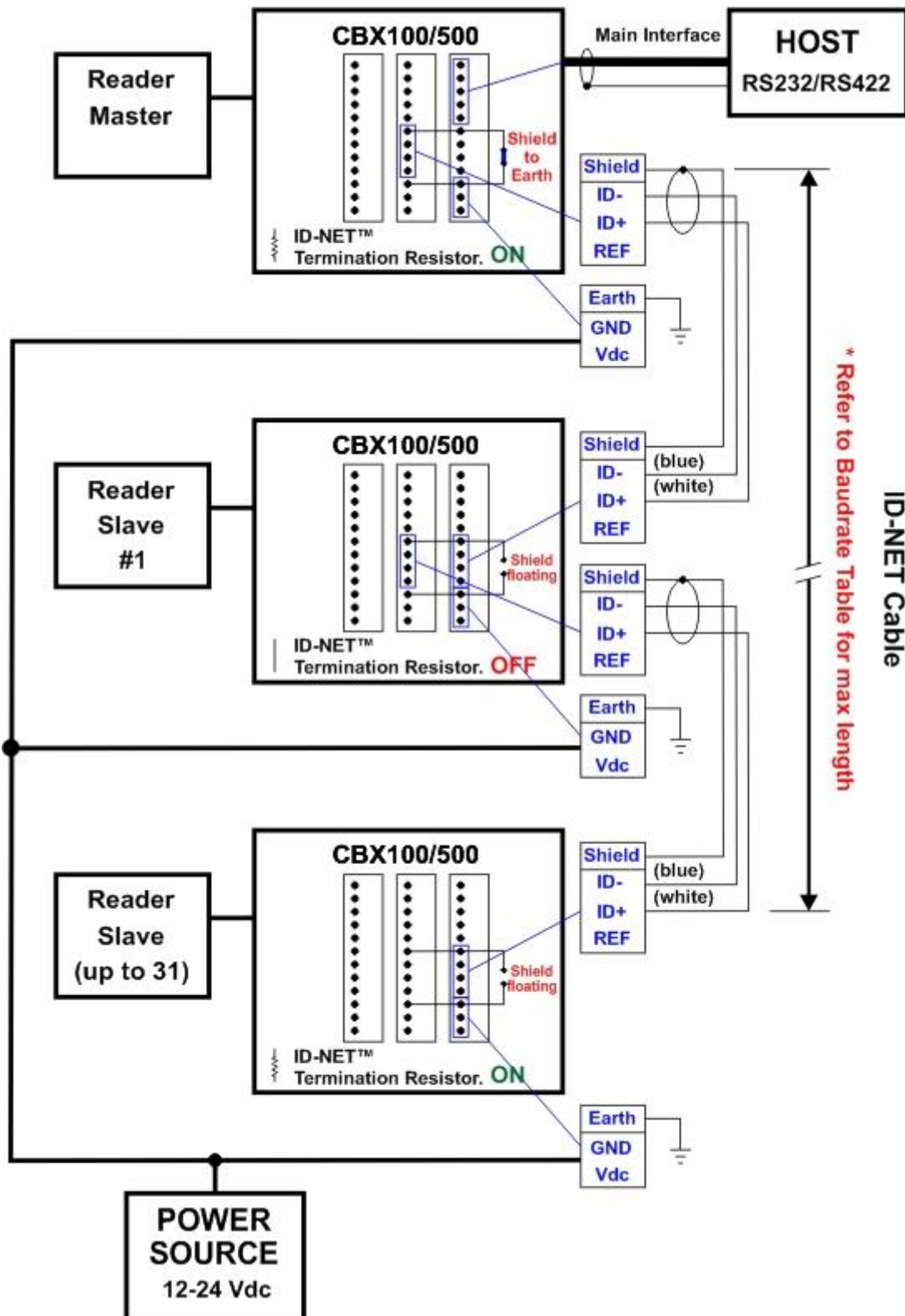


Figure 41 - ID-NET Network Connections with Common Power Branch Network



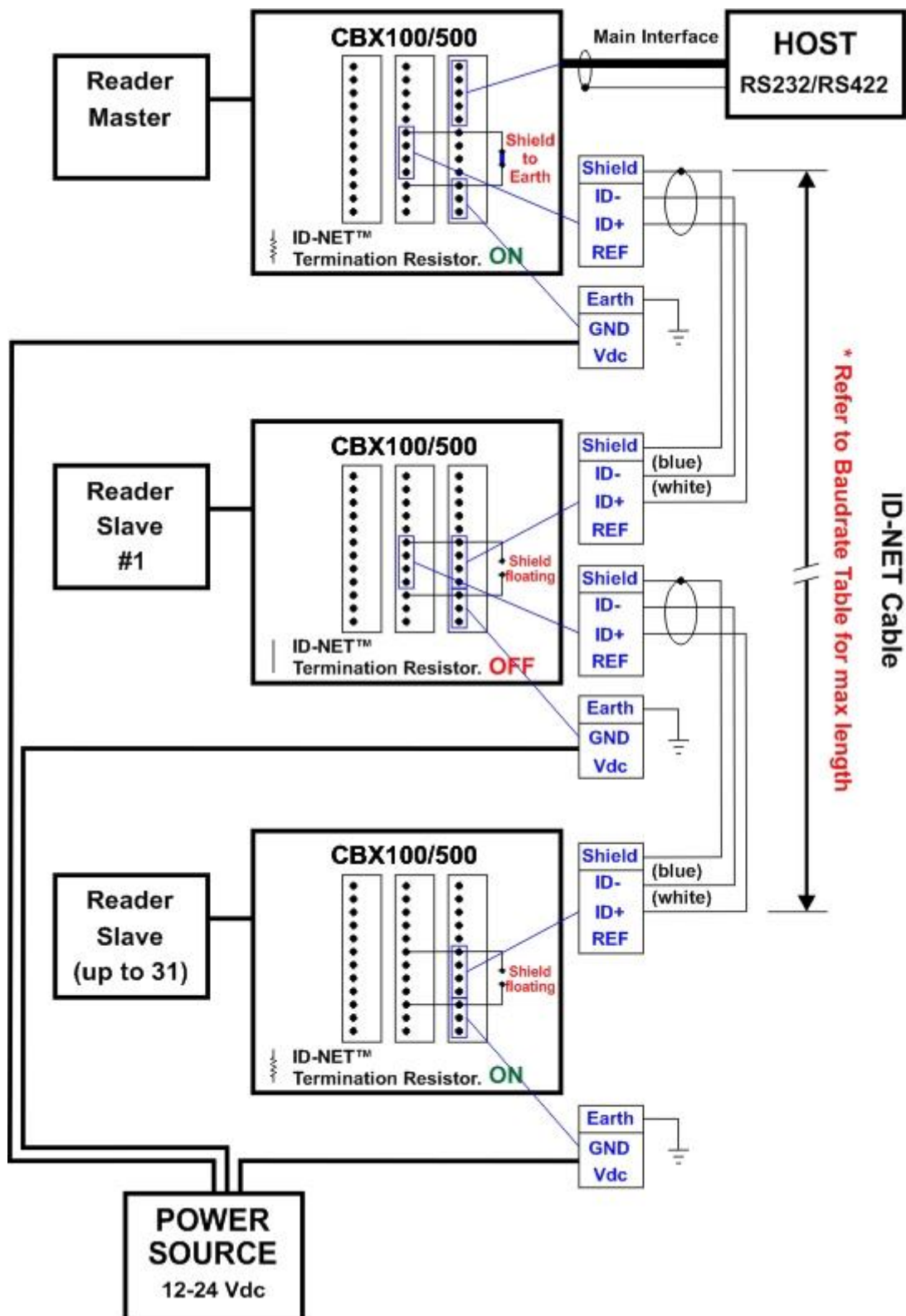


Figure 42 – ID-NET Network Connections with Common Power Star Network

### 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.

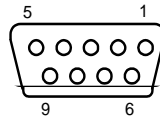


Figure 43 - 9-pin female connector

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     |

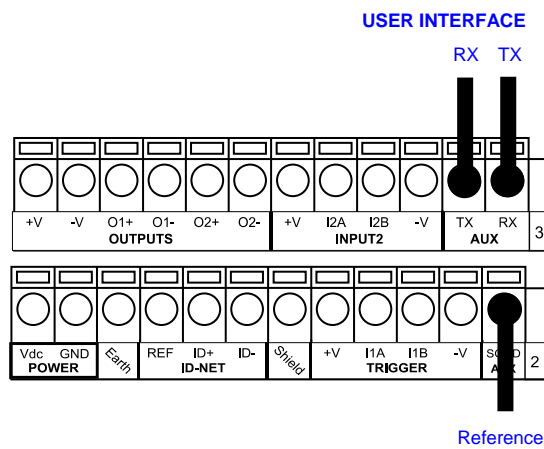


Figure 44 - RS232 Auxiliary Interface Connections



**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, by default, is implemented in software on both inputs. The value can be changed through the software parameter Debounce Filter. 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 13, 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.

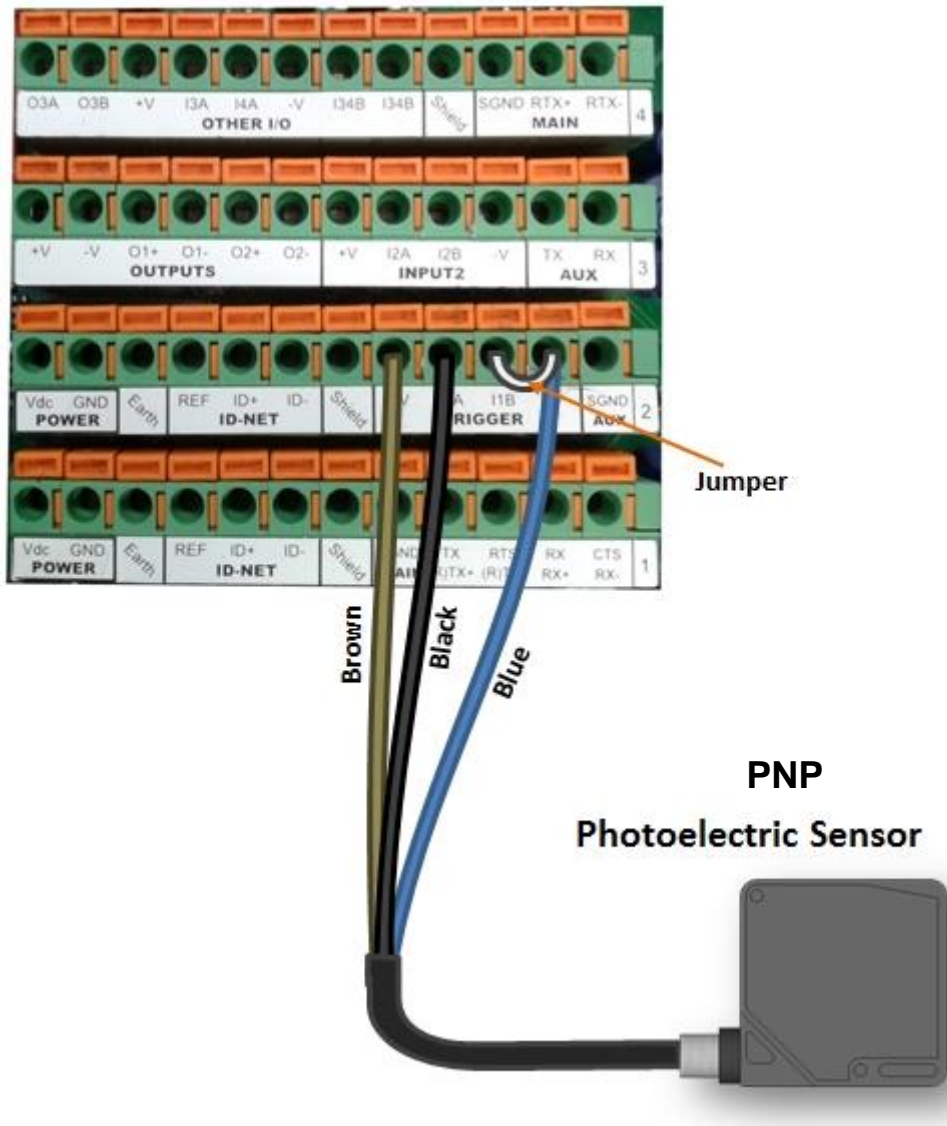


Figure 45 – PNP External Trigger Using Matrix 300N Power

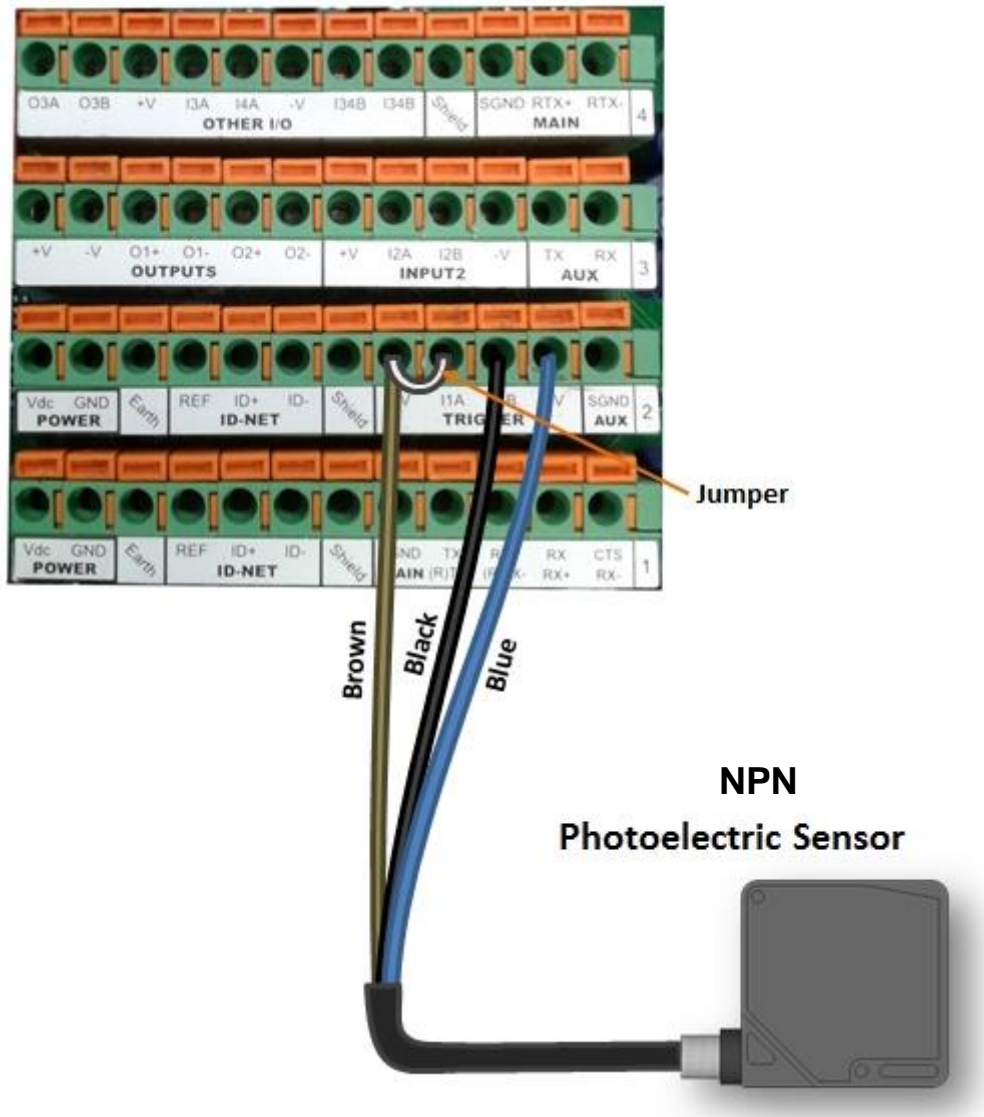


Figure 46 - NPN External Trigger Using Matrix 300N Power

EXTERNAL TRIGGER INPUT CONNECTIONS USING EXTERNAL POWER

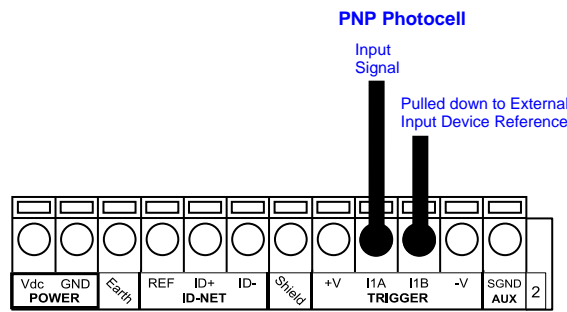


Figure 47 - PNP External Trigger Using External Power

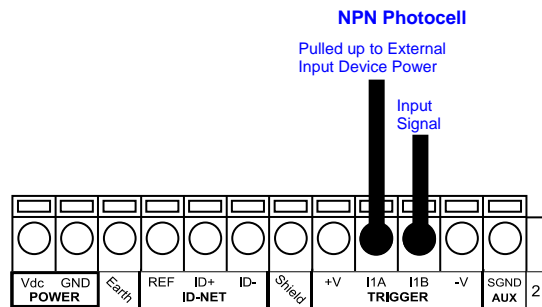


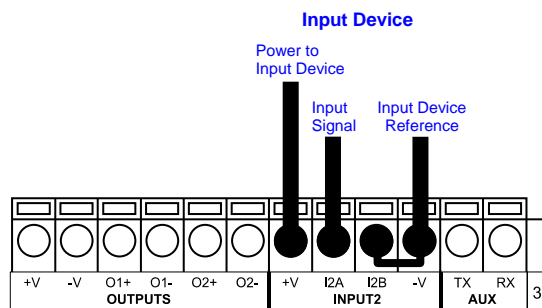
Figure 48 - NPN External Trigger Using External Power

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

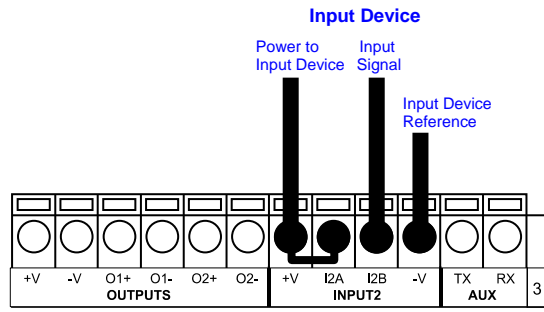
INPUT 2 CONNECTIONS USING MATRIX 300N POWER



**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.

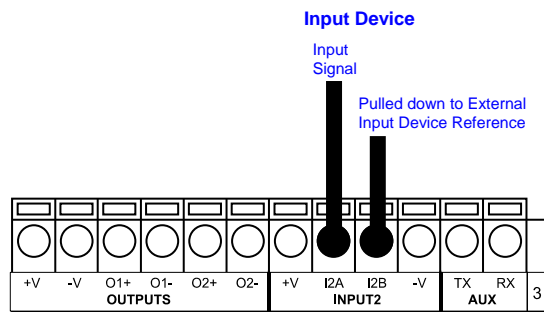


PNP Input 2 Using MATRIX 300N Power

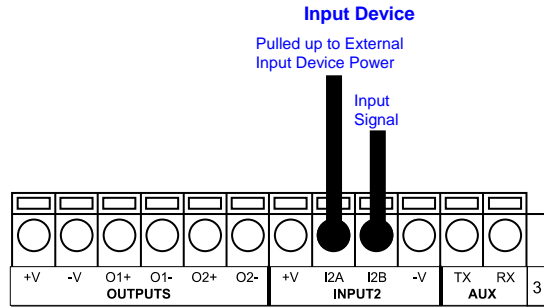


**NPN Input 2 Using MATRIX 300N Power**

**INPUT 2 CONNECTIONS USING EXTERNAL POWER**



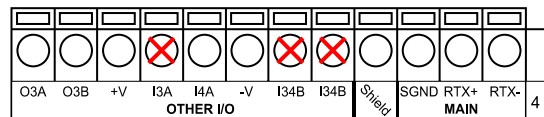
**Figure 49 - PNP Input 2 Using External Power**



**Figure 50 - NPN Input 2 Using External Power**

**INPUT 3 CONNECTIONS (CBX500 Only)**

**RESERVED**



**Figure 51 - 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                                     |
|------------------------------------------------------|----------------------------------------------|
| $V_{CE} = 30$ Vdc max.                               | Reverse-Polarity and Short-Circuit Protected |
| $I_{CE} = 40$ mA continuous max.; 130 mA pulsed max. | $V_{OUT}$ ( $I_{LOAD} = 0$ mA) max = 30 Vdc  |
| $V_{CE\ saturation} = 1$ Vdc max. @ 10 mA            | $V_{OUT}$ ( $I_{LOAD} = 100$ mA) max = 3 Vdc |
| $P_D = 90$ mW Max. @ 50 °C ambient temp.             | $I_{LOAD}$ max = 100 mA                      |

By default, Output 1 is associated with the No Read event, which activates when the code(s) signaled by the external trigger are not decoded, and Output 2 is associated with the Good 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.

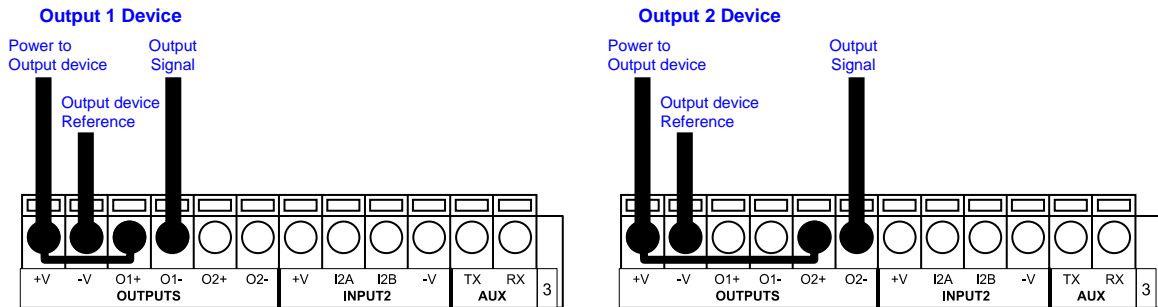


Figure 52 - PNP/Open Emitter Output Using MATRIX 300N Power

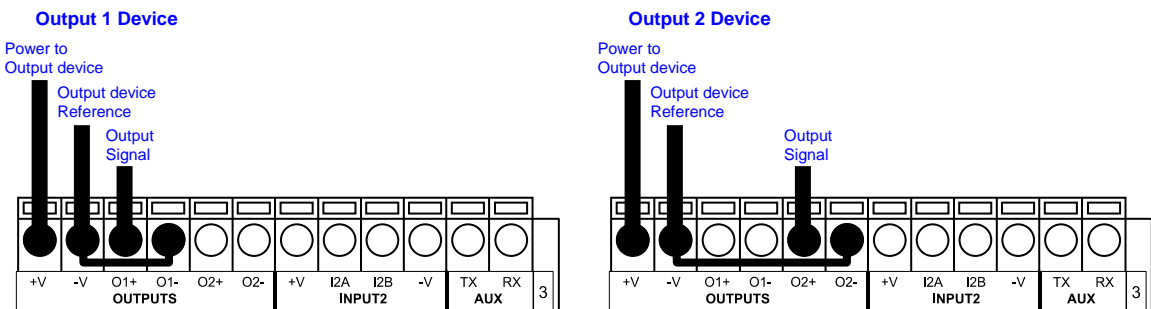


Figure 53 - NPN/Open Collector Output Using MATRIX 300N Power

**OUTPUT 1 AND 2 CONNECTIONS USING EXTERNAL POWER**

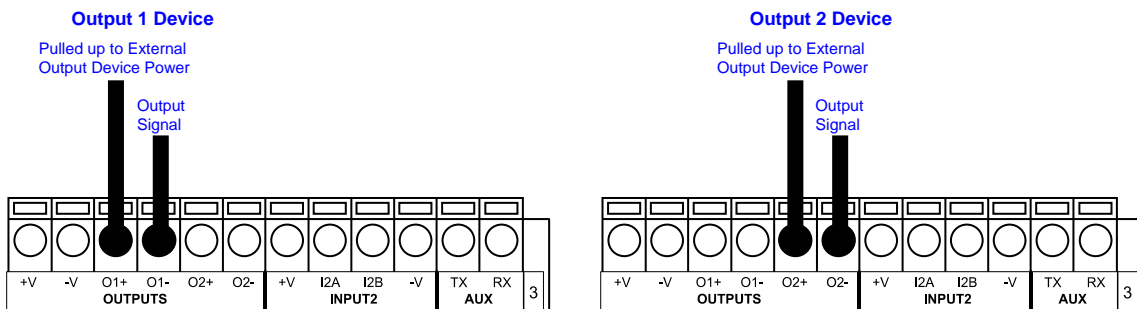


Figure 54 - PNP/Output Open Emitter Using External Power

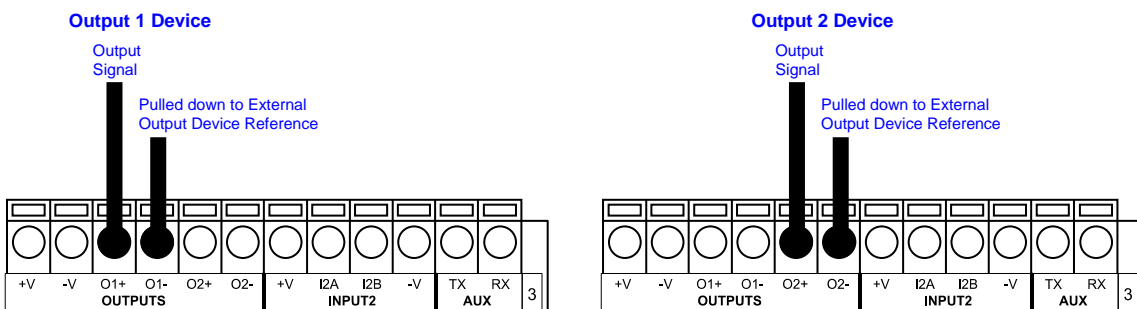


Figure 55 - NPN/Output Open Collector Using External Power

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)

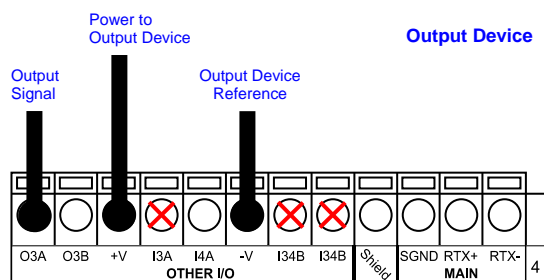


Figure 56 - Output 3 Using Matrix 300N Power

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

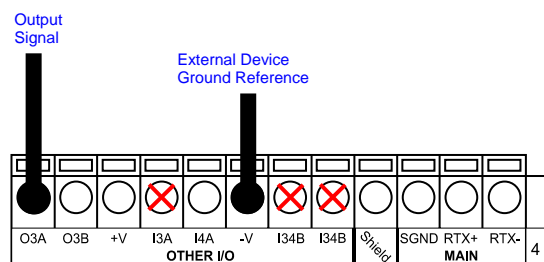


Figure 57 - Output 3 Using External Power



**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

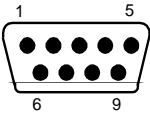
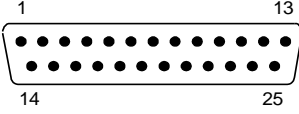
The following Fieldbus protocols are also available over the on-board Ethernet interface:

- 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.

### 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.



**NOTE:** DL.CODE now supports several different multi device configuration types using the PASS-THROUGH configuration. In particular this feature allows MULTIDATA ID-NET network configurations to be made. Master/Slave SYNCHRONIZED ID-NET network configurations are also configurable as before.



**NOTE:** The Master/Slave Role is only significant for the Internal ID-NET Network. If your layout doesn't use the ID-NET network then the device's Role is not significant and can be ignored.

### 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.

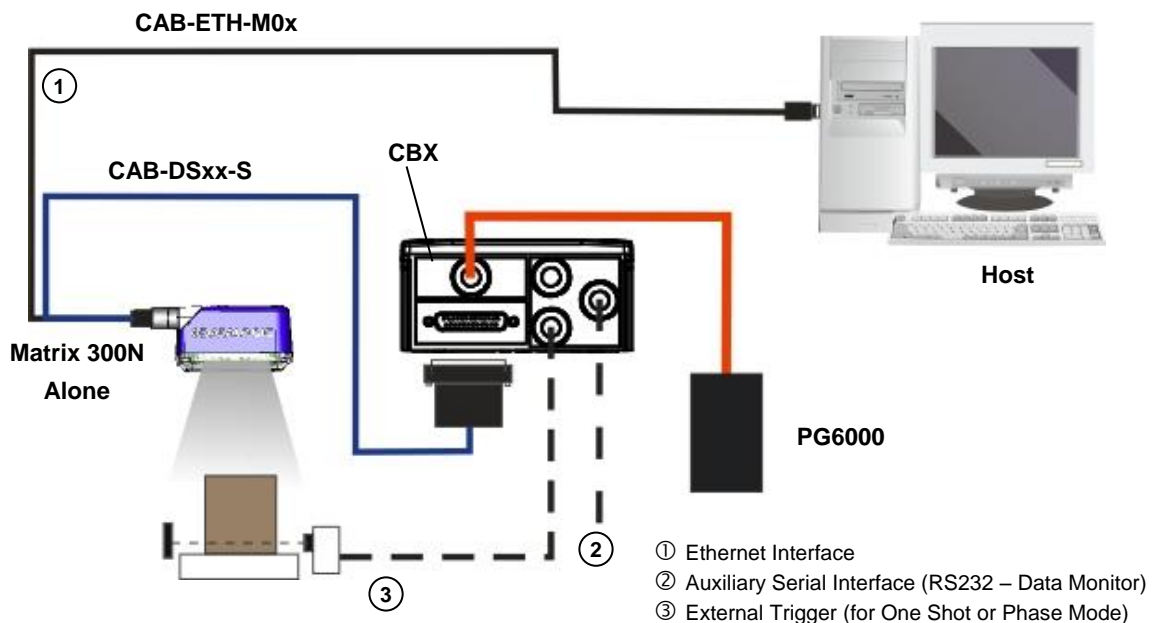


Figure 58 - Ethernet Point-to-Point Layout

All devices always support multiple output channels (i.e. for data monitoring).

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:

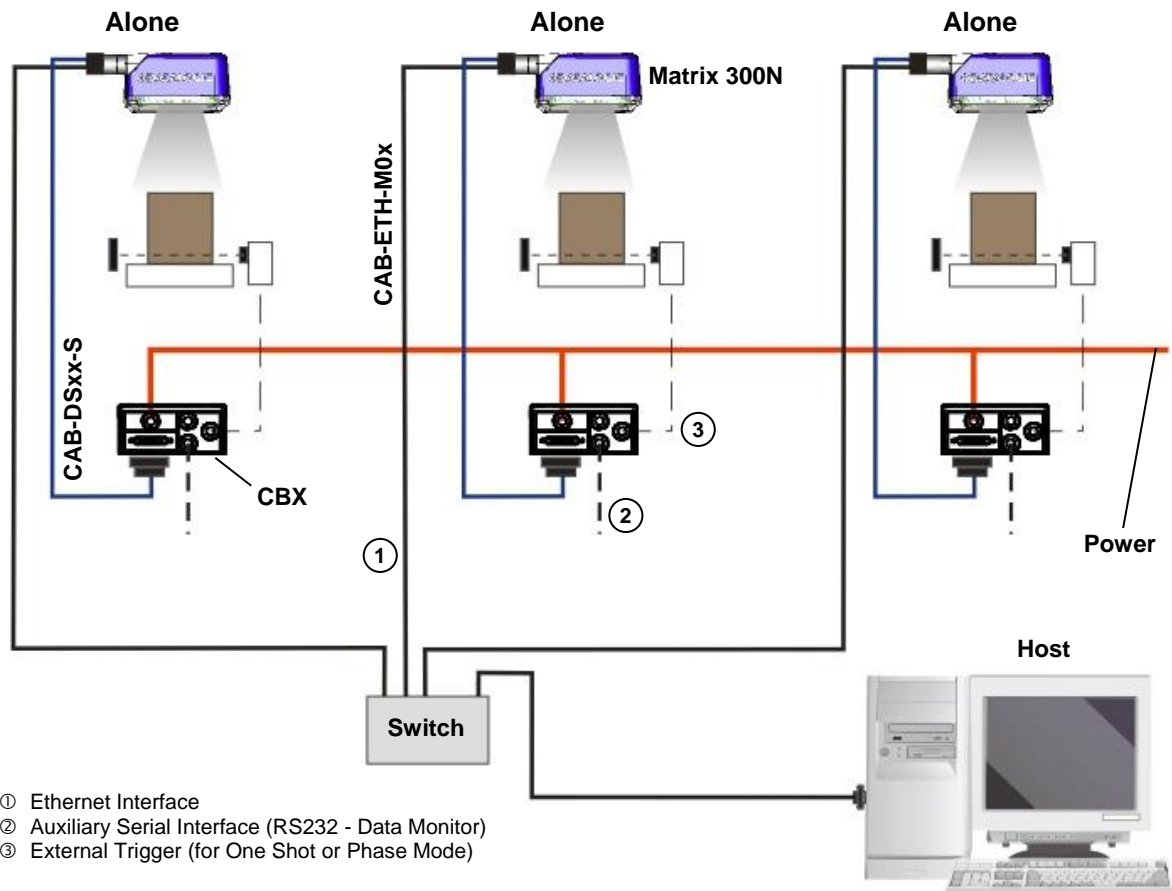


Figure 59 - Ethernet Network Layout

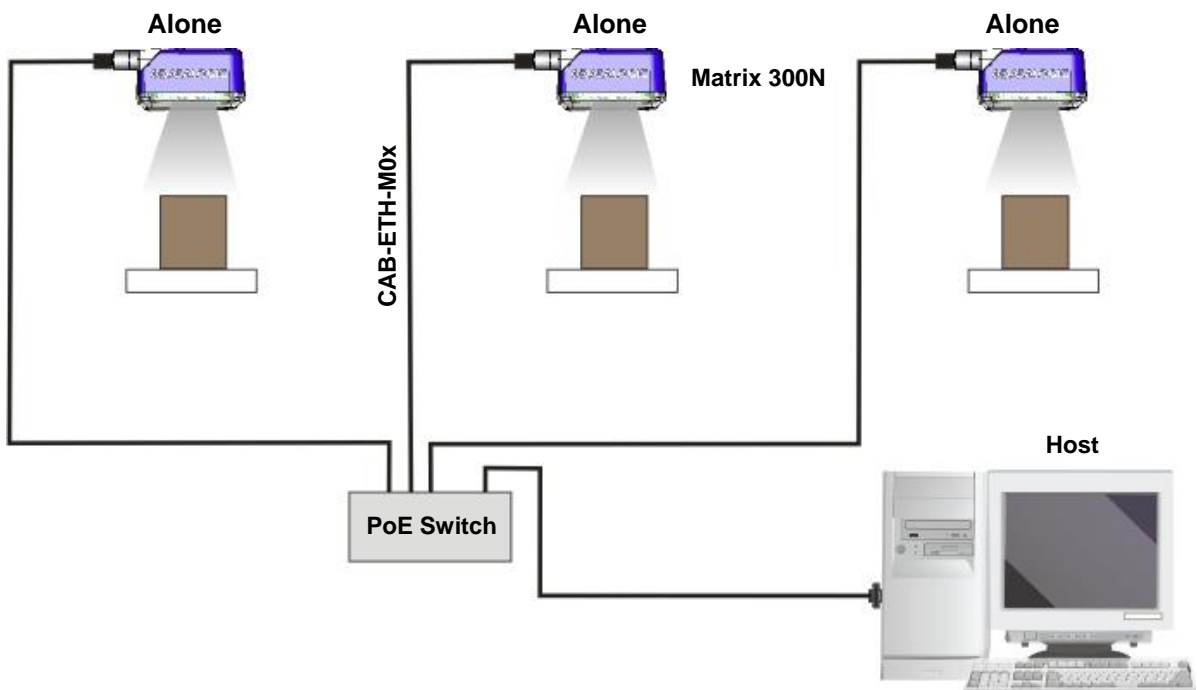


Figure 60 - POE Ethernet Network Layout

## 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.

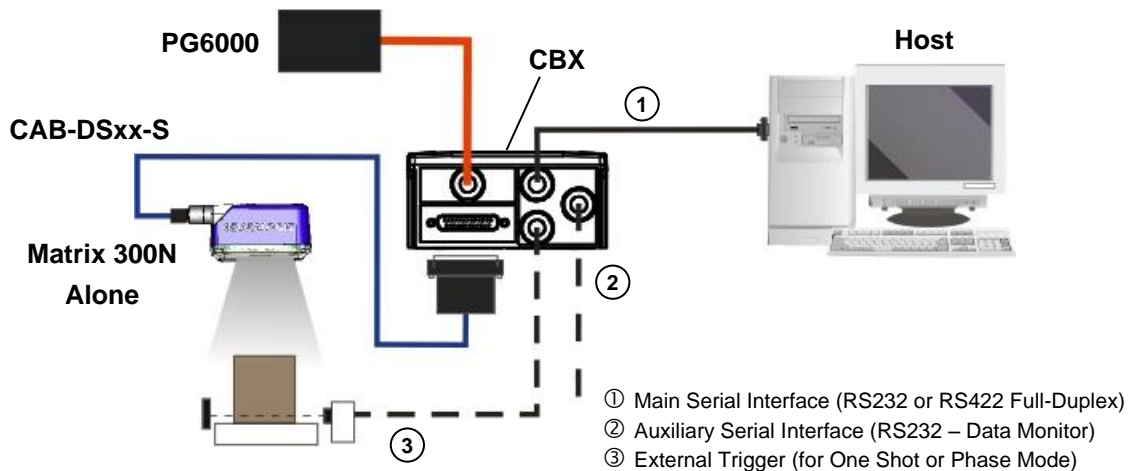


Figure 61 – Serial Interface Point-to-Point Layout

All devices always support multiple output channels (i.e. for data monitoring).

### 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.

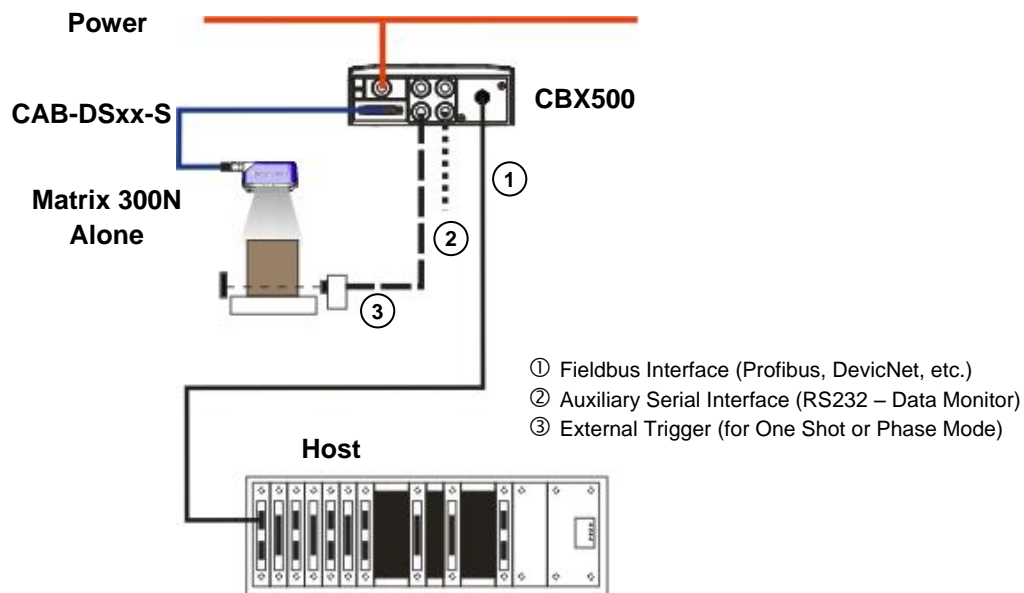


Figure 62 – Fieldbus Interface Point-to-Point Layout

All devices always support multiple output channels (i.e. for data monitoring).

## 5.4 PASS-THROUGH

The pass-through layout allows each device **working Alone**, to collect data from one or more pass-through input channels and send this data plus its own on one or more different output channels.

In this way independent devices can be connected together in combinations to create multi device networks. Many devices reading independently can send their messages through a common output channel which instead of being directed at a Host can be collected by another device on its pass-through input channel and sent to a Host on a different output channel.

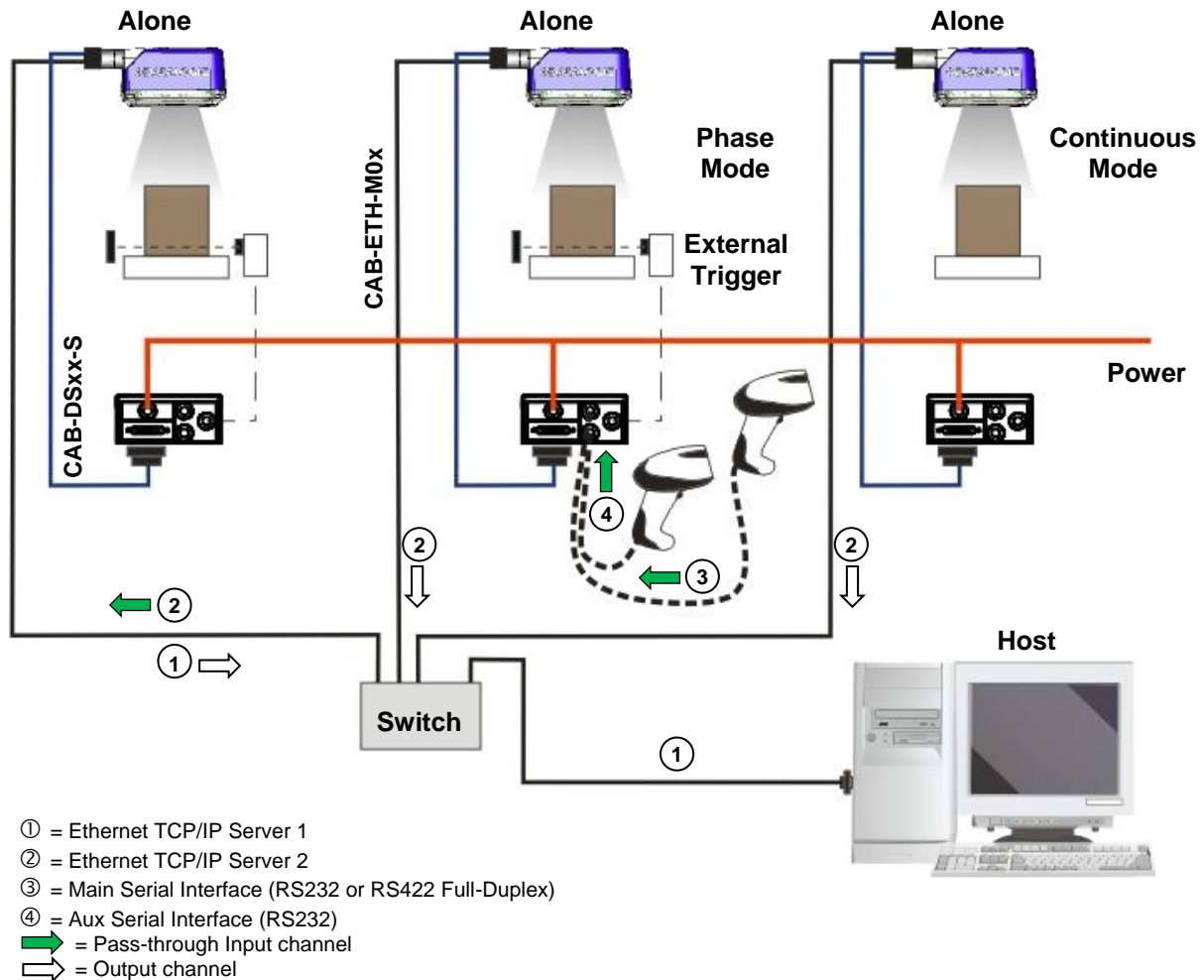


Figure 63 – Pass-through Layout

In a Pass-through layout each device supports multiple pass-through configurations to accept input from different devices on different channels (i.e. middle reader above). However, readers are not required to have a pass-through configuration if they don't need to receive data from an input channel (i.e. right reader above). The overall data collection device always has at least one pass-through configuration to collect the input data from the other devices and send it to the Host (i.e. left reader above).

All devices always support multiple output channels (i.e. for data monitoring).

In a Pass-through layout each device can have a different operating mode: Continuous, One Shot, Phase Mode, etc.



### 5.5 ID-NET MULTIDATA NETWORK (PASS-THROUGH)

A special case of the pass-through layout allows each Slave device **working Alone**, to collect data from one or more pass-through input channels and send this data plus its own on the ID-NET output channel to the Master.

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 collects the data from its pass-through ID-NET input channel and sends it to the Host on a different output channel.

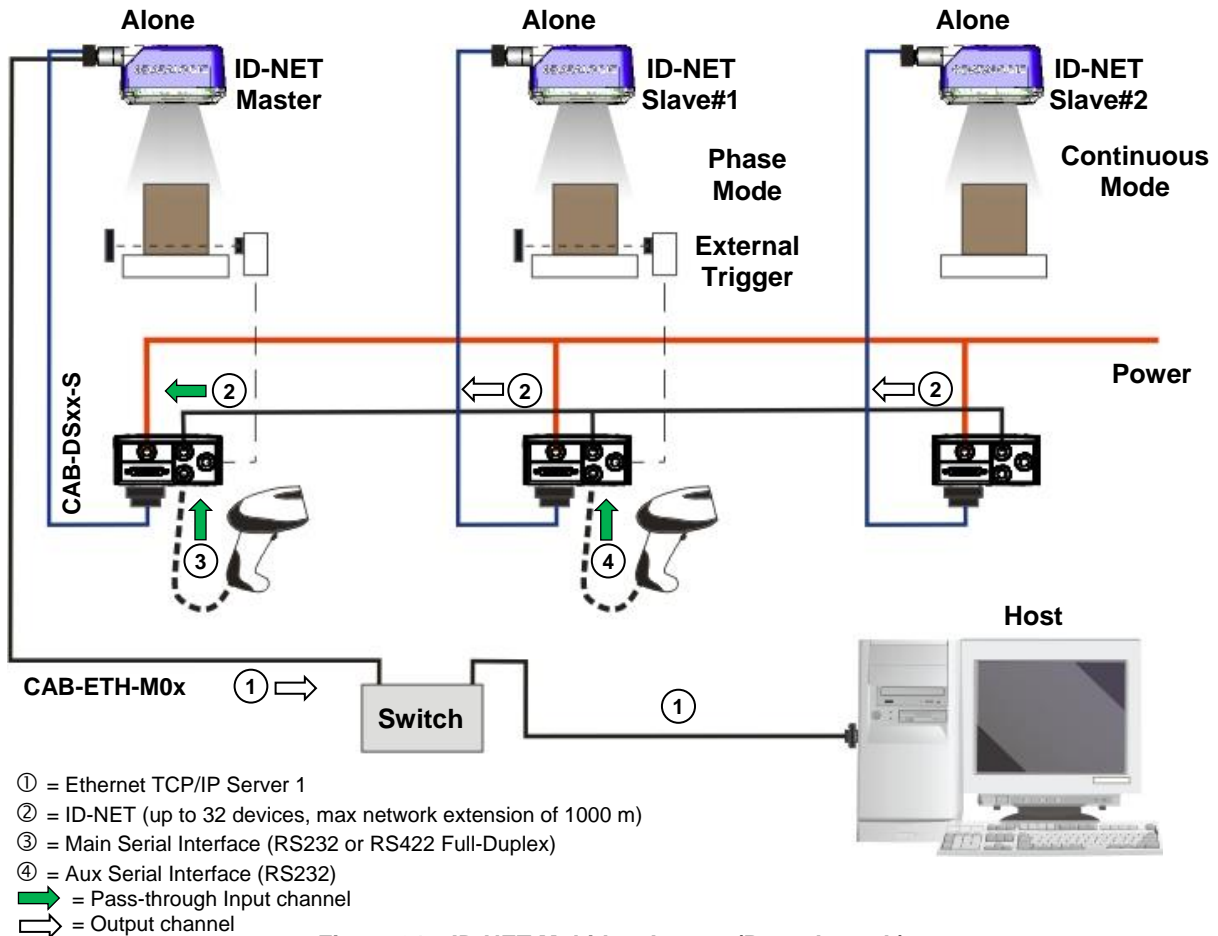


Figure 64 – ID-NET Multidata Layout (Pass-through)

In a Pass-through layout each device supports multiple pass-through configurations to accept input from different devices on different channels (i.e. Master reader above). However, ID-NET Slave readers are not required to have a pass-through configuration if they don't need to receive data from an input channel (i.e. right reader above). The ID-NET Master always has at least one pass-through configuration to collect the ID-NET Slaves data and send it to the Host.



**NOTE:** Slave devices cannot receive data from a pass-through ID-NET input channel and Master devices cannot send data on an ID-NET output channel.

All devices always support multiple output channels (i.e. for data monitoring).

In a Pass-through layout each device can have a different operating mode: Continuous, One Shot, Phase Mode, etc.

## 5.6 ID-NET SYNCHRONIZED NETWORK

When the device is **working Synchronized**, 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 one of its communication channels. In the following examples the RS232/RS422 main serial interface is used.

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.

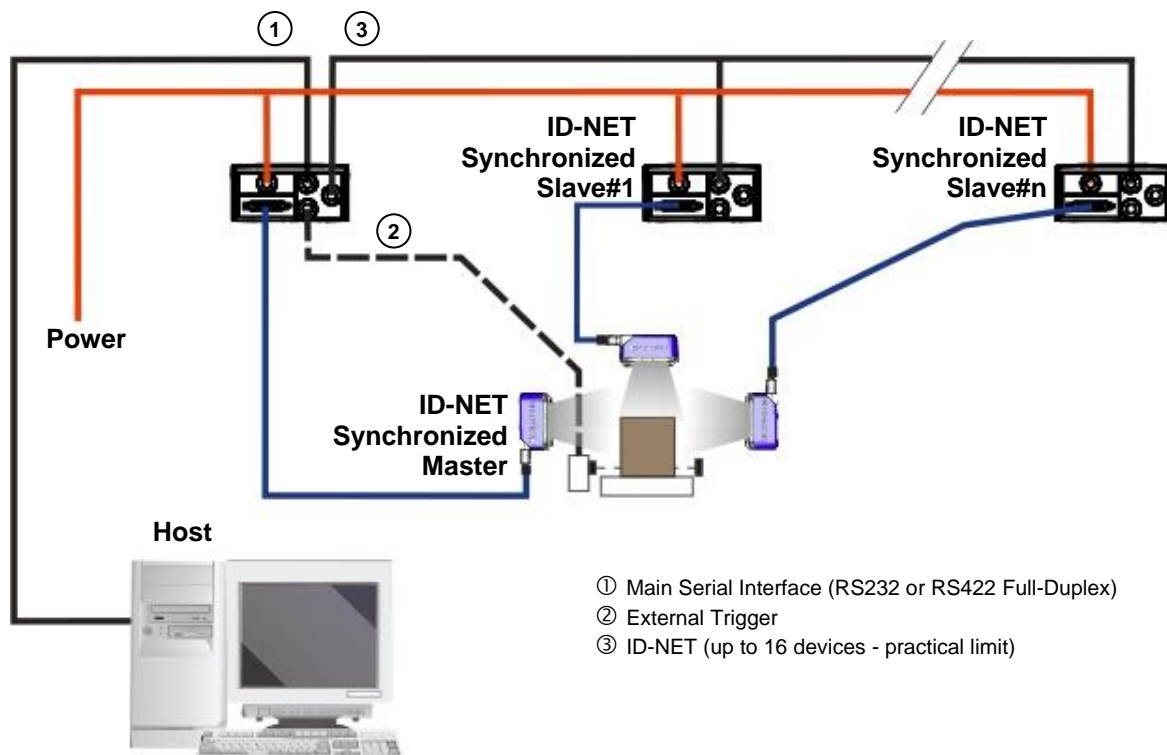
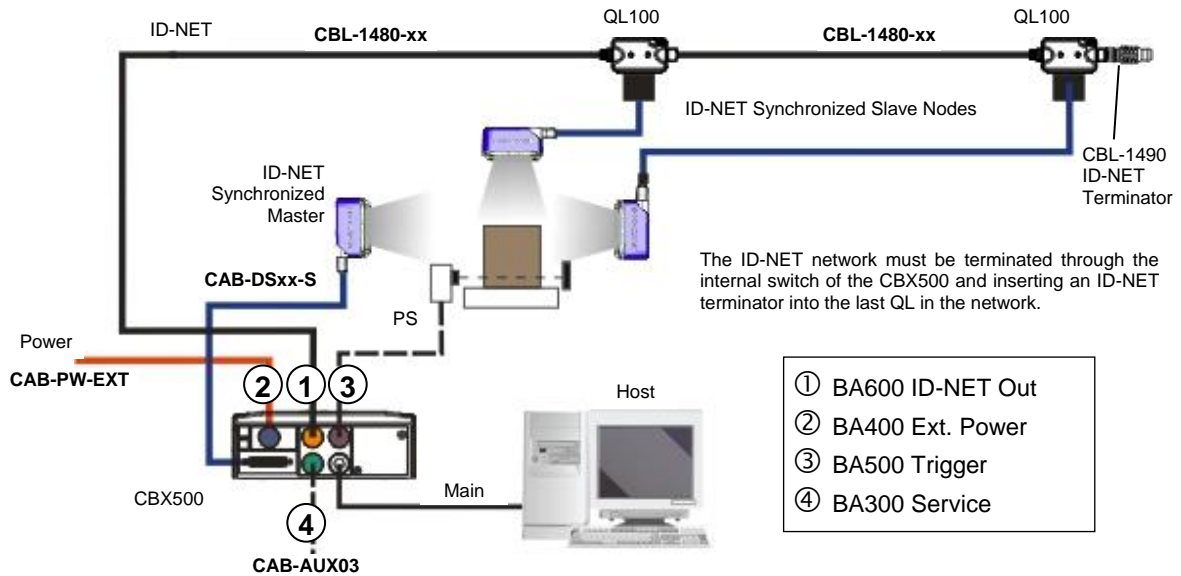


Figure 65 – ID-NET Synchronized Layout

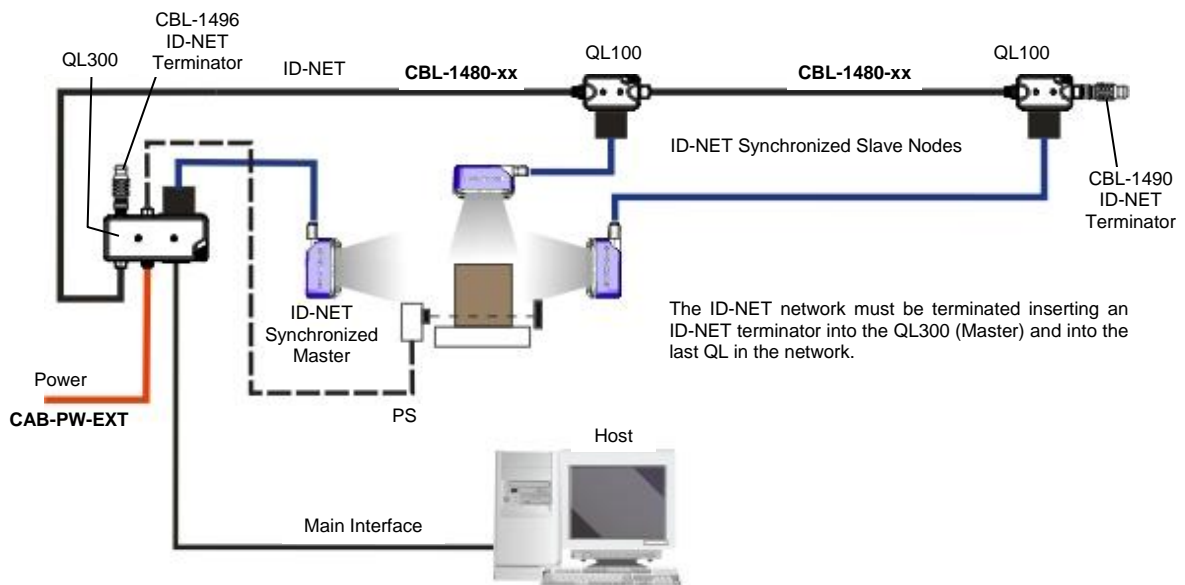
The Master reader can be connected to the CBX series connection box with the advantage of the Backup and Restore configuration function (CBX + BM100 module).

All devices always support multiple output channels (i.e. for data monitoring).



**Figure 66 - 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 67 - 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.

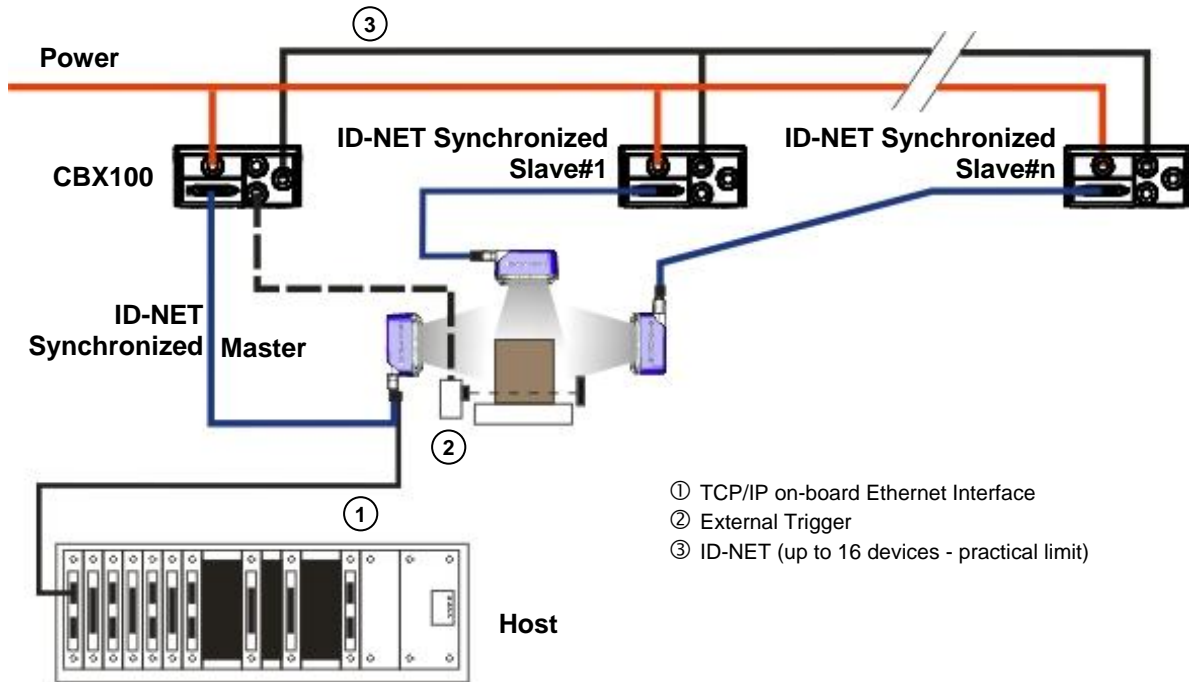


Figure 68 – ID-NET Synchronized Layout with Master on-board TCP/IP Ethernet Interface to Host

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.

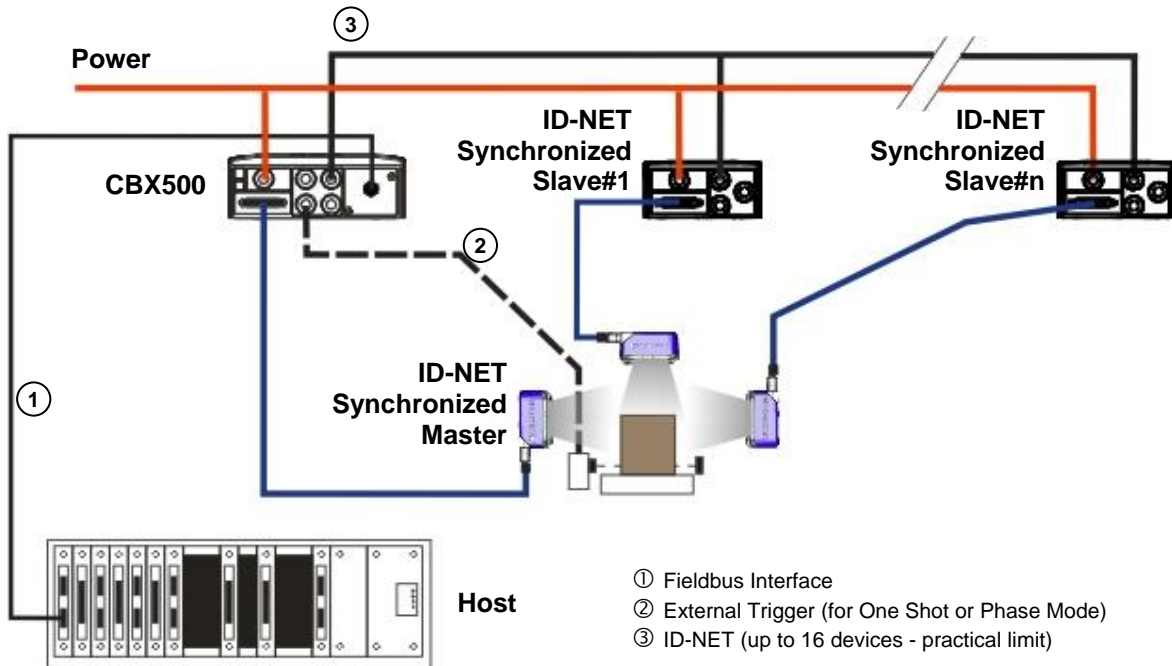


Figure 69 – ID-NET Synchronized Layout with Master CBX500 Fieldbus Interface to Host

## 6 READING FEATURES

### 6.1 FOV CALCULATION

Use the data in the following table to calculate the FOV for your application, referring to Figure 70 and the formula below.

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

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

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

where:

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

**α<sub>x</sub>** = 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

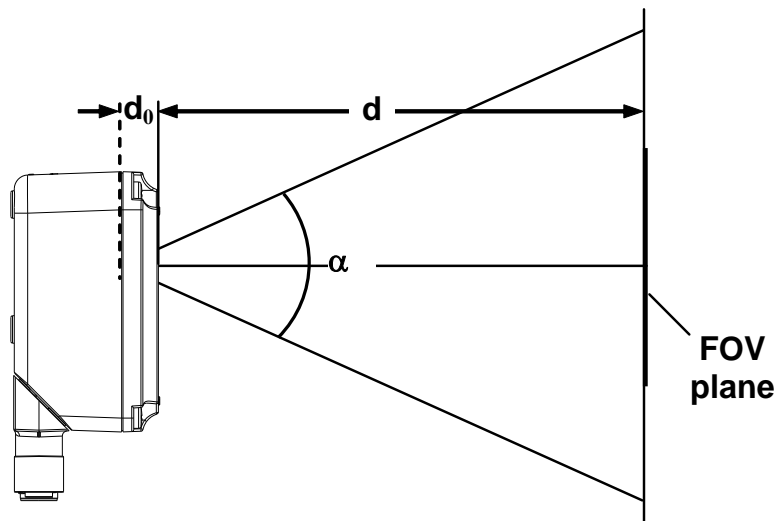


Figure 70 – Reading Distance References

**Example:**

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

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

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

## 6.2 GLOBAL FOV DIAGRAMS



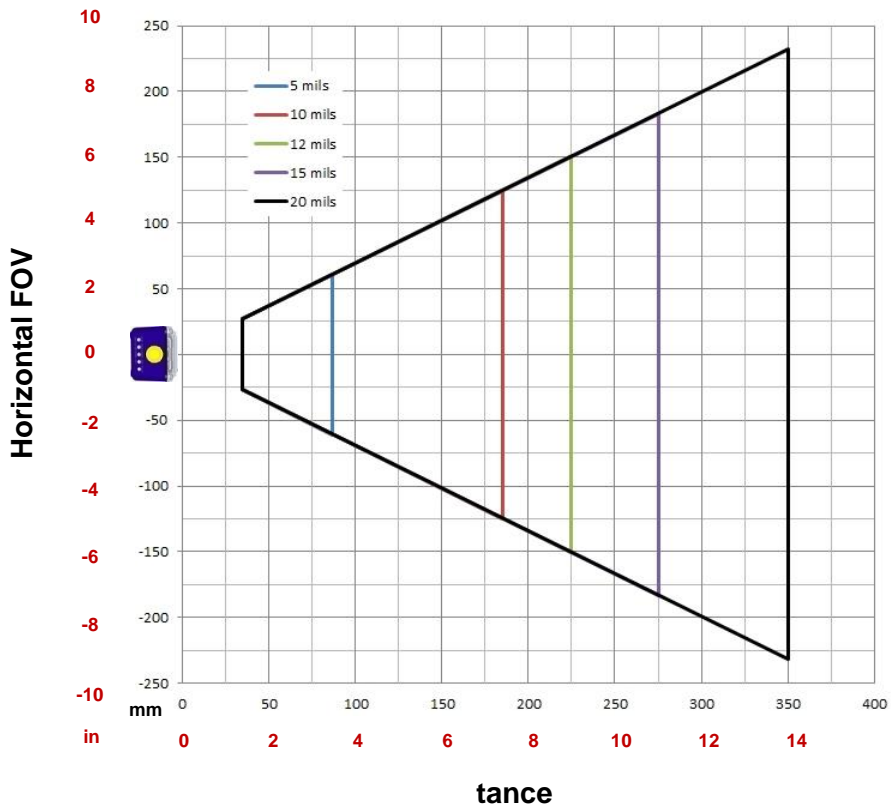
**NOTE:** The following diagrams are given for typical performance at 25°C using high quality grade A symbols according to ISO/IEC 15416 (1D code) and ISO/IEC 15415 (2D code) print quality test specifications. Testing should be performed with actual application codes in order to maximize the application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

The following diagrams show the **maximum obtainable** Field of View for 1D and 2D codes using Processing Mode = Advanced. **Depending on the code resolution, symbology, and number of characters in the code, the Reading Area can be different from the FOV.**

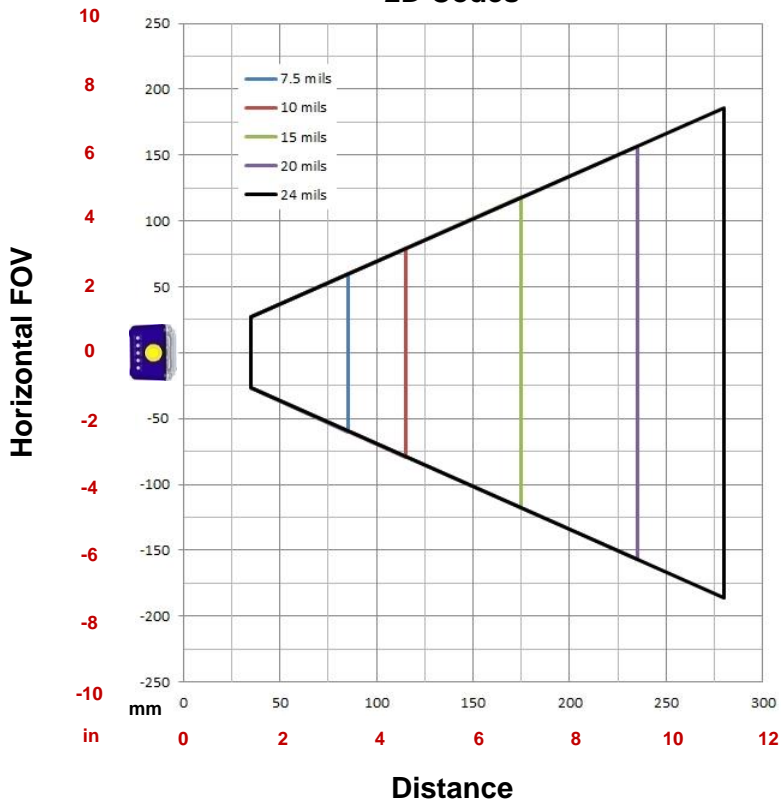
See the reference Reading Diagrams starting from par. 6.3.1 for specific reading area examples.

### 6.2.1 Manual Adjustable Focus Models 6 mm

1D Codes

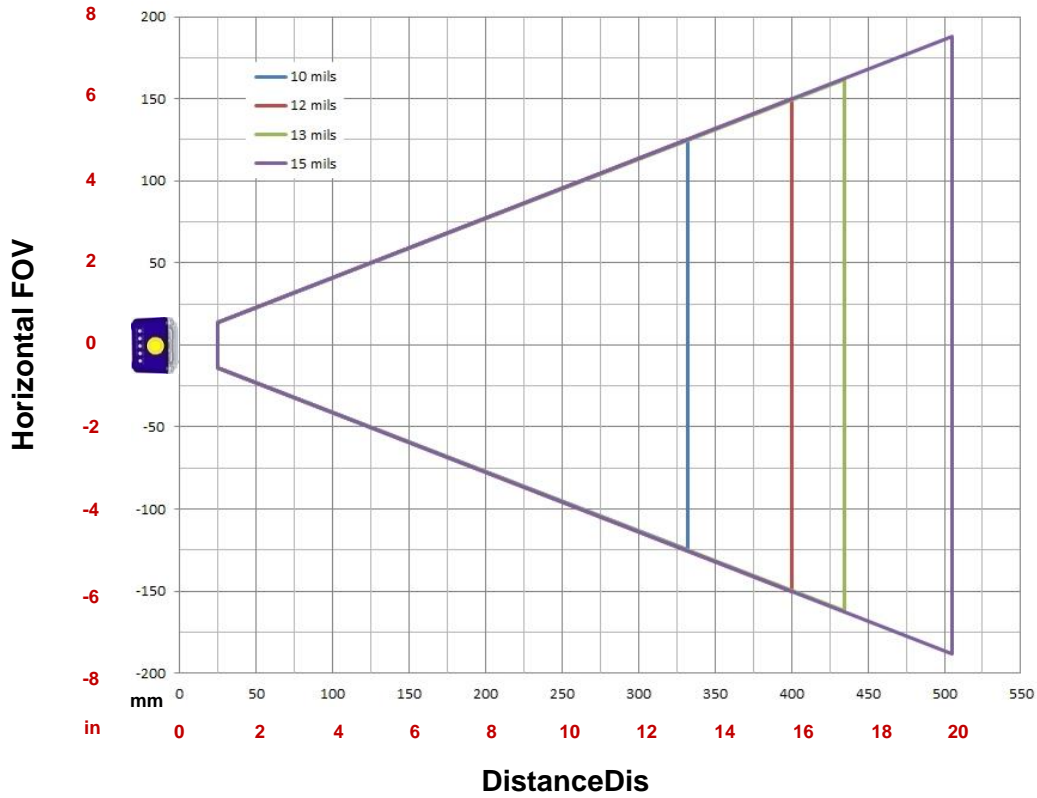


2D Codes

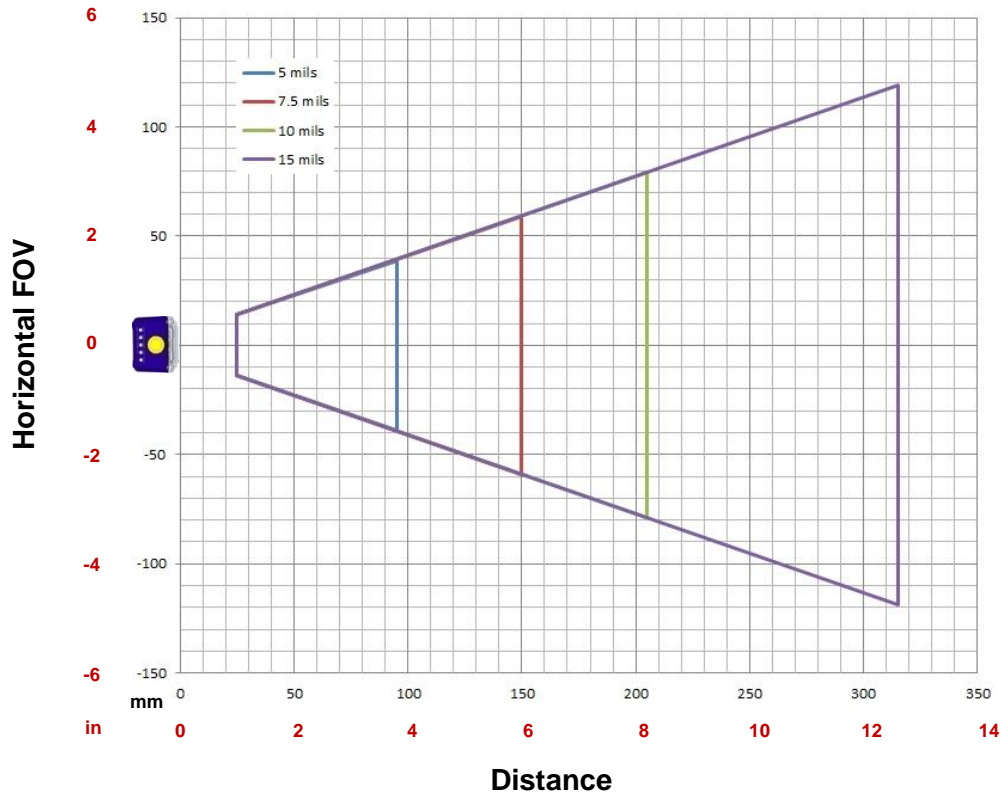


### 6.2.2 Software Adjustable Liquid Lens Models 9 mm

1D Codes



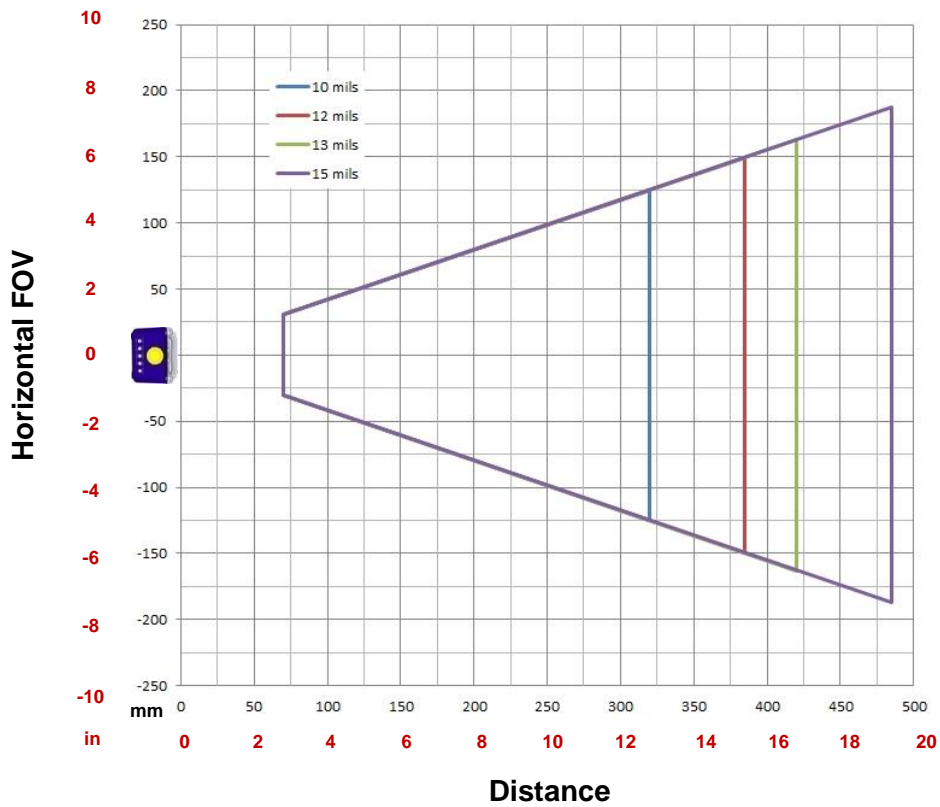
2D Codes



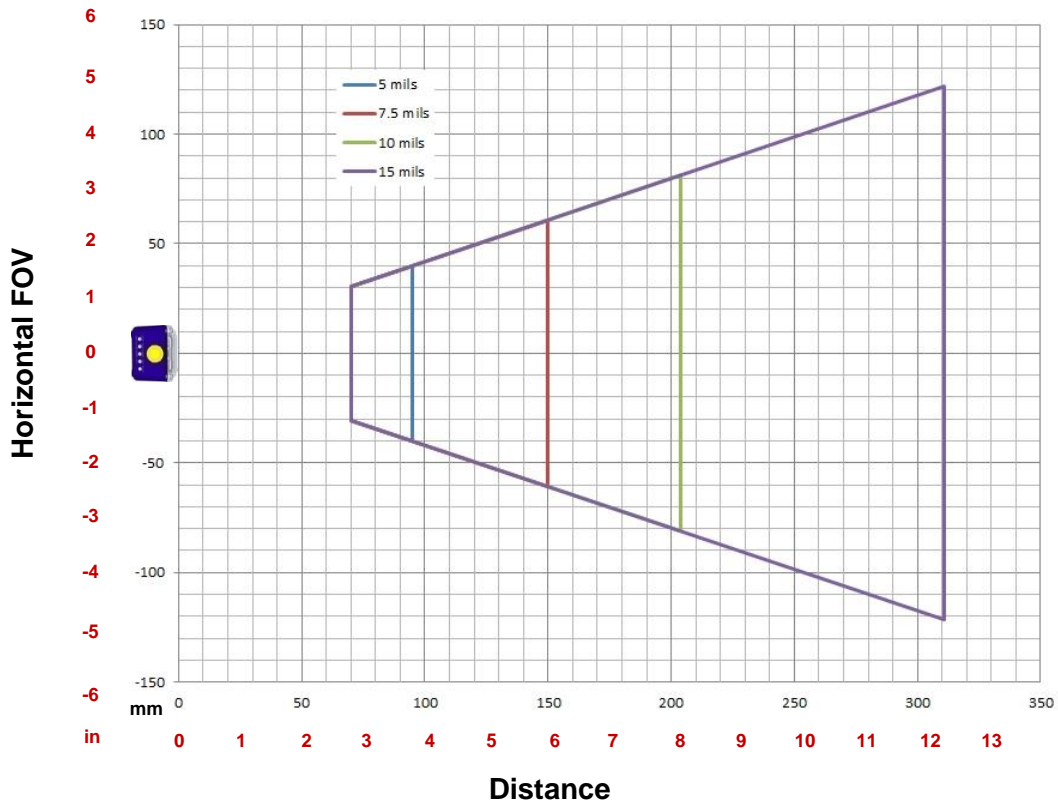


### 6.2.3 Manual Adjustable Focus Models 9 mm

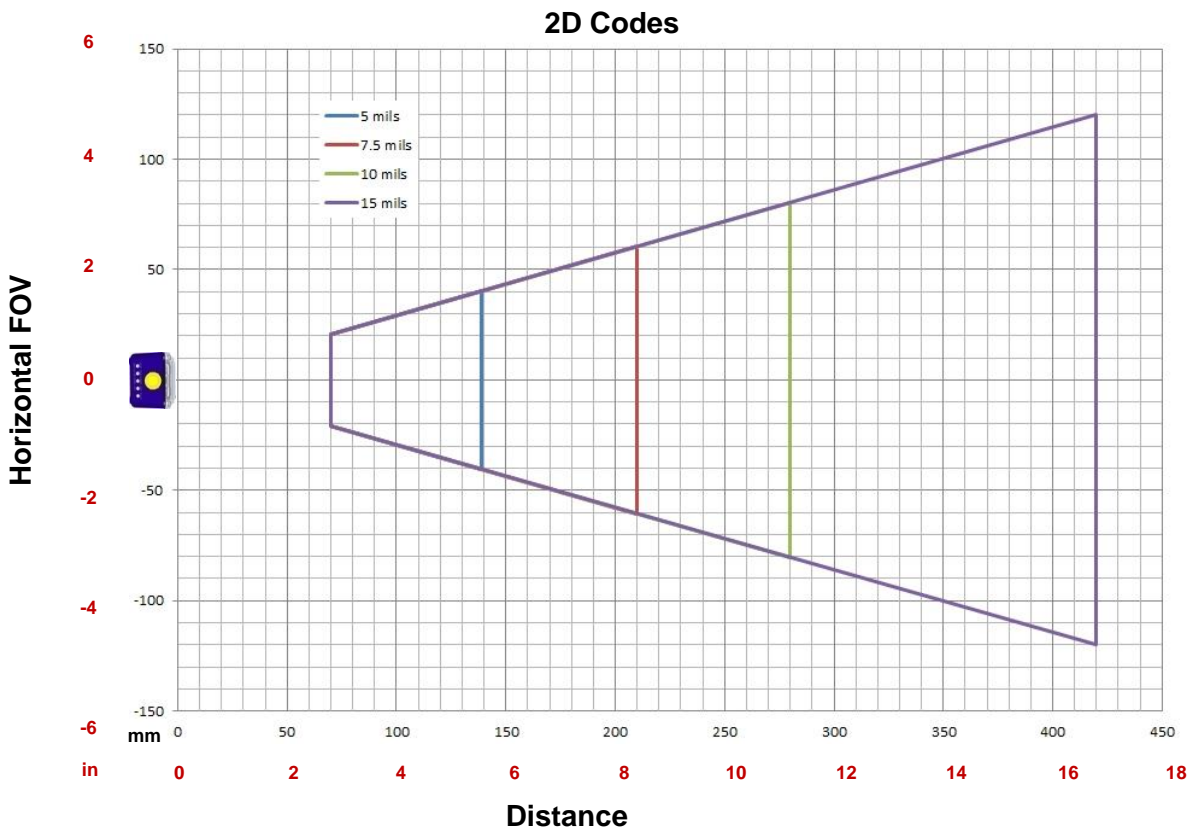
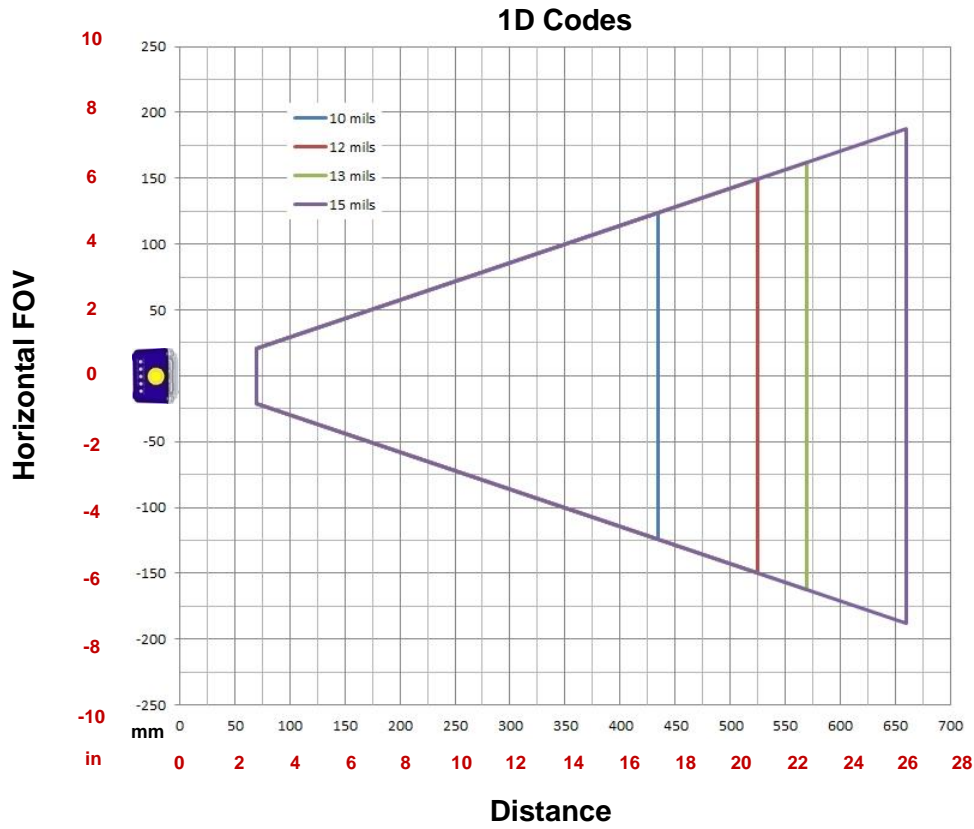
1D Codes



2D Codes

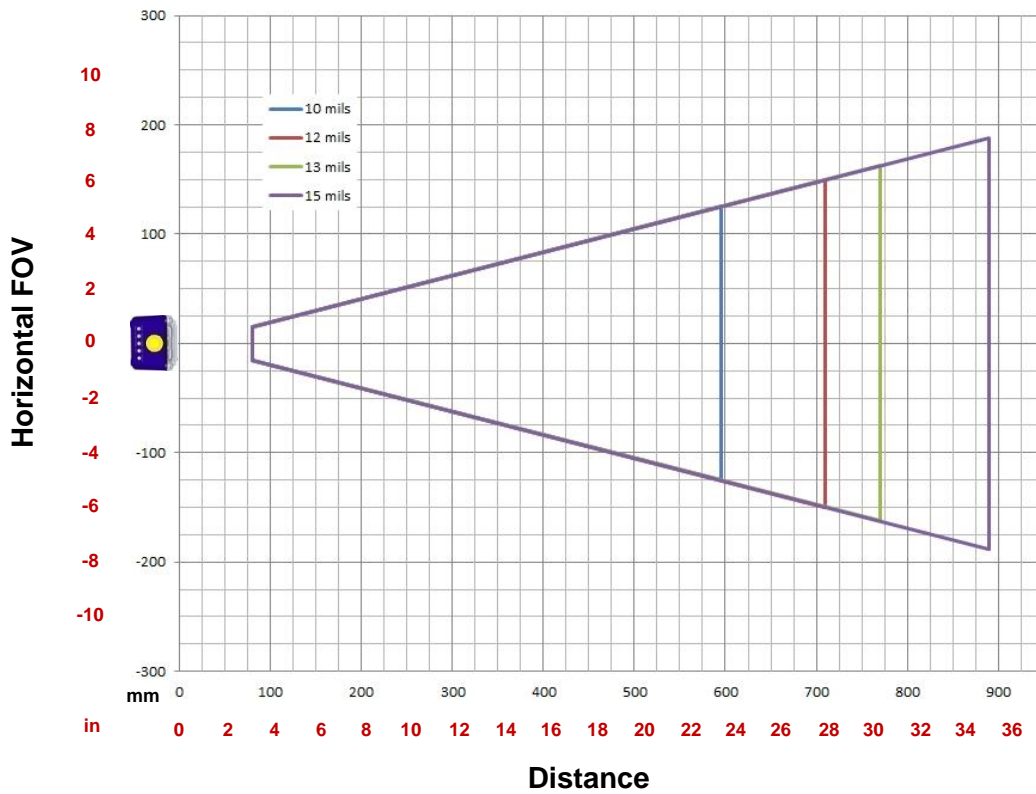


### 6.2.4 Manual Adjustable Focus Models 12 mm

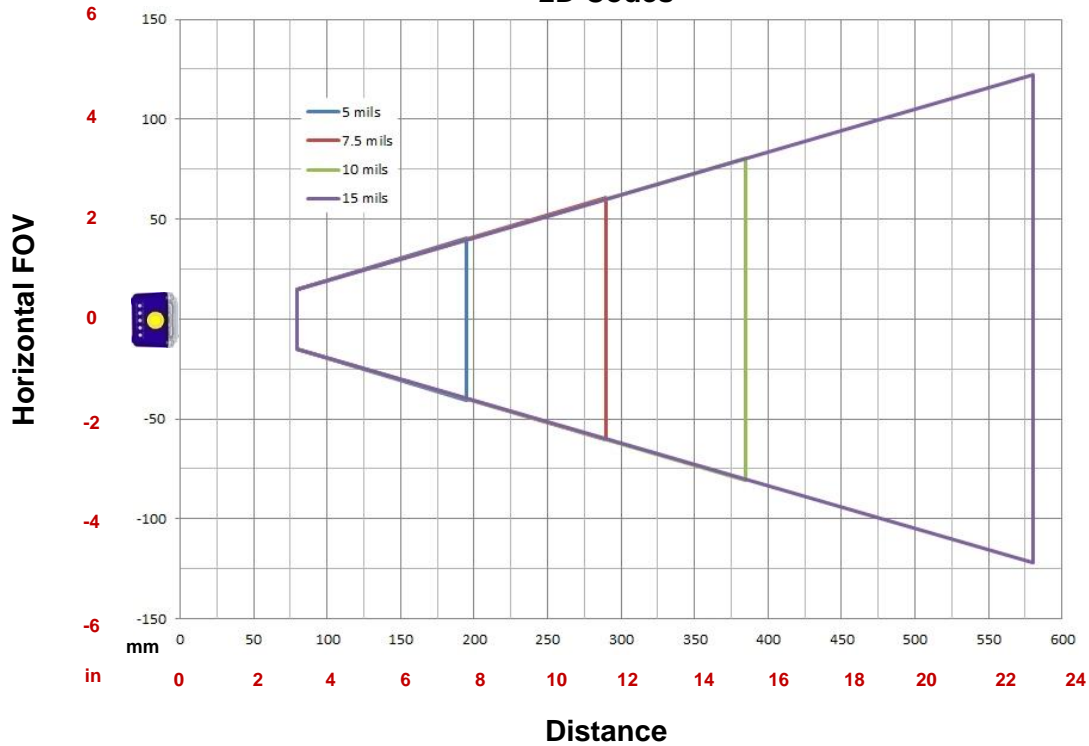


### 6.2.5 Manual Adjustable Focus Models 16 mm

1D Codes



2D Codes



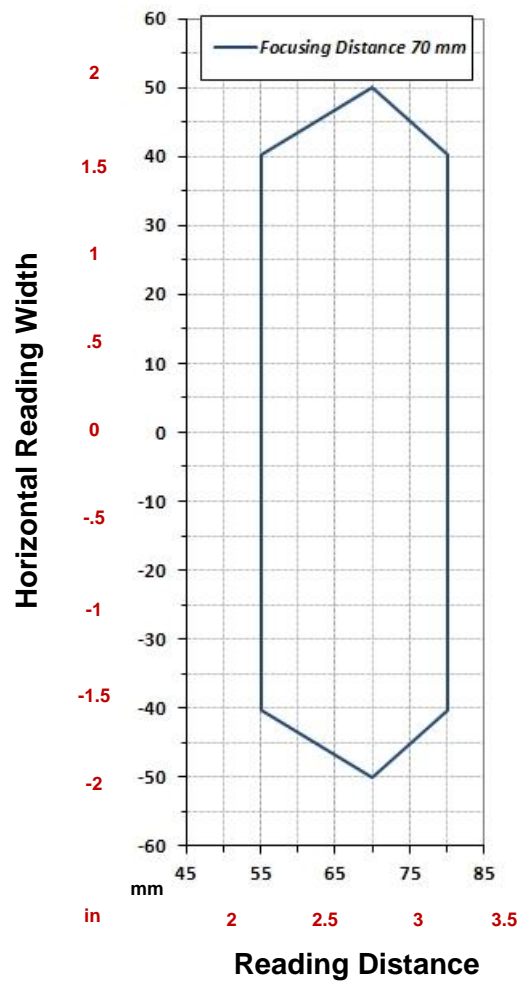
### 6.3 READING DIAGRAMS

- 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 “WIDE RED” illuminator is about equal to twice that of the “WIDE WHITE” 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 300N 4x1 (6 mm models) 1D Codes

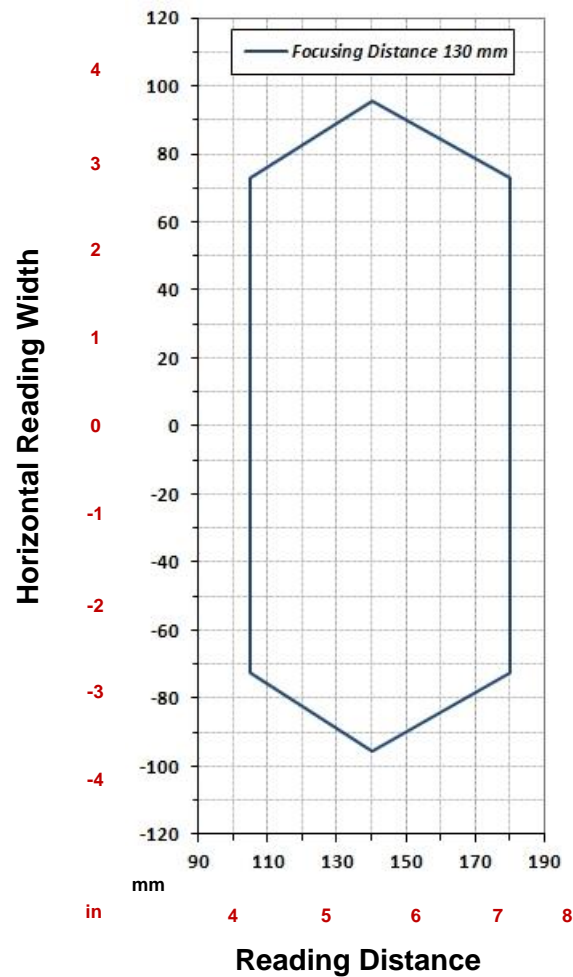
Matrix 300N 4x1 (6 mm lens)

Code 128 0.12 mm (5 mils)



**CONDITIONS:**

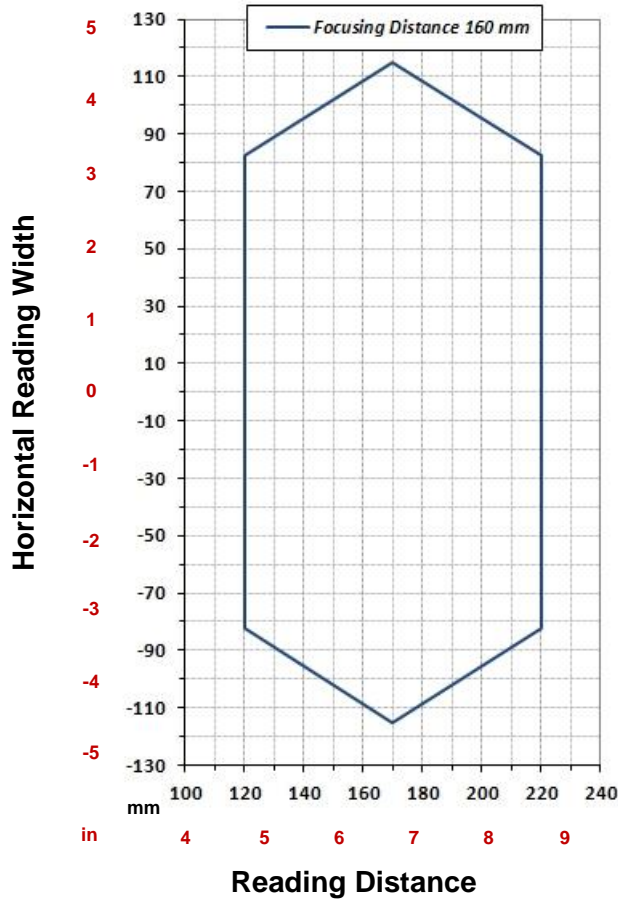
| <b>Hardware Settings</b>   |                         |
|----------------------------|-------------------------|
| Code Symbology             | Code 128                |
| Code Resolution            | 0.12 mm (5 mils)        |
| Tilt Angle                 | 0°                      |
| Skew Angle   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

**Matrix 300N 4x1 (6 mm lens)****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> |                         |
| Internal Lighting          | Very High Power Strobed |
| <b>411-xxx Wide Red</b>    |                         |
| Exposure Time (μs)         | 80                      |
| Gain                       | 20                      |

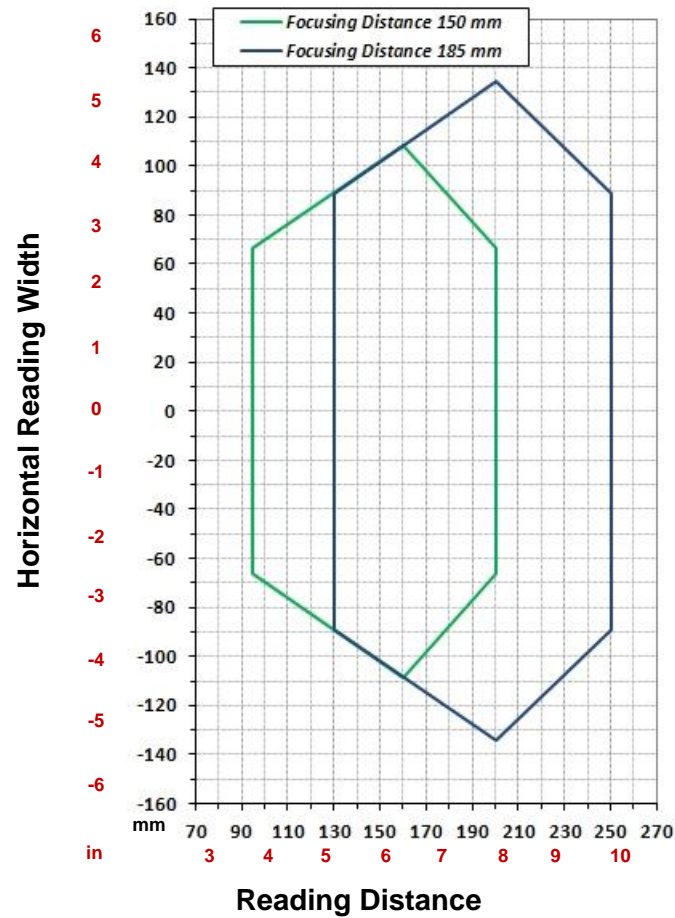
**Matrix 300N 4x1 (6 mm lens)**

**Code 128 0.30 mm (12 mils)**



**CONDITIONS:**

| <b>Hardware Settings</b>   |                         |
|----------------------------|-------------------------|
| Code Symbology             | Code 128                |
| Code Resolution            | 0.30 mm (12 mils)       |
| Tilt Angle                 | 0°                      |
| Skew Angle                 | 15°                     |
| Focusing Distance (mm)     | 160                     |
| <b>Software Parameters</b> |                         |
| Internal Lighting          | Very High Power Strobed |
| <b>411-xxx Wide Red</b>    |                         |
| Exposure Time (µs)         | 100                     |
| Gain                       | 20                      |

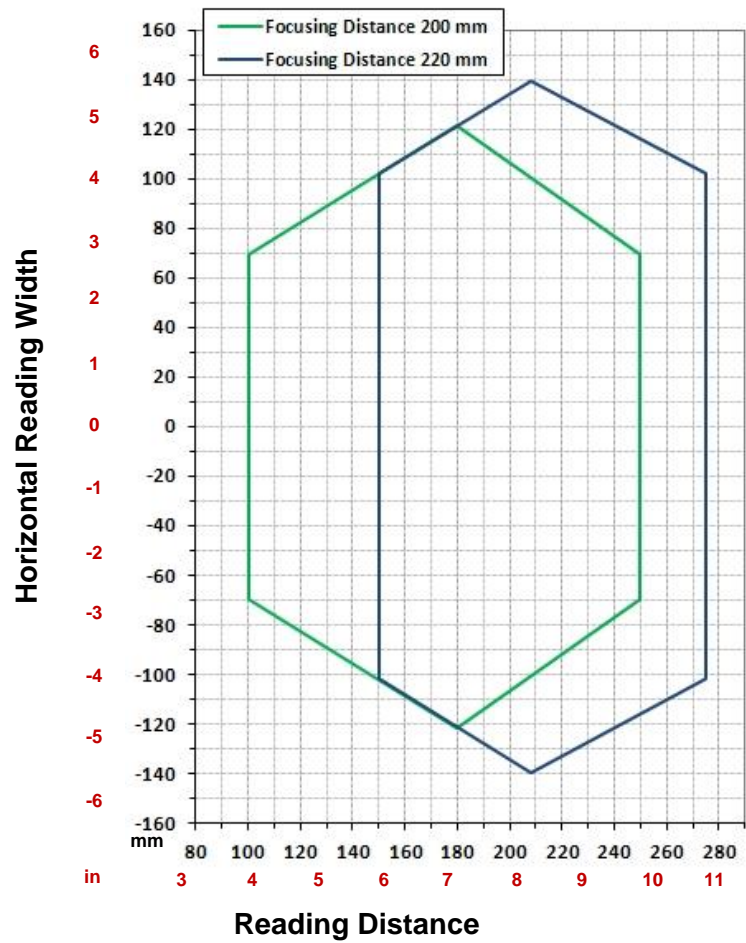
**Matrix 300N 4x1 (6 mm lens)****Code 128 0.33 mm (13 mils)****CONDITIONS:**

| <b>Hardware Settings</b>   |                         |     |
|----------------------------|-------------------------|-----|
| Code Symbology             | Code 128                |     |
| Code Resolution            | 0.33 mm (13 mils)       |     |
| Tilt Angle                 | 0°                      |     |
| Skew Angle                 | 15°                     |     |
| Focusing Distance (mm)     | 150                     | 185 |
| <b>Software Parameters</b> |                         |     |
| Internal Lighting          | Very High Power Strobed |     |
| <b>411-xxx Wide Red</b>    |                         |     |
| Exposure Time (μs)         | 150                     | 175 |
| Gain                       | 13                      | 20  |



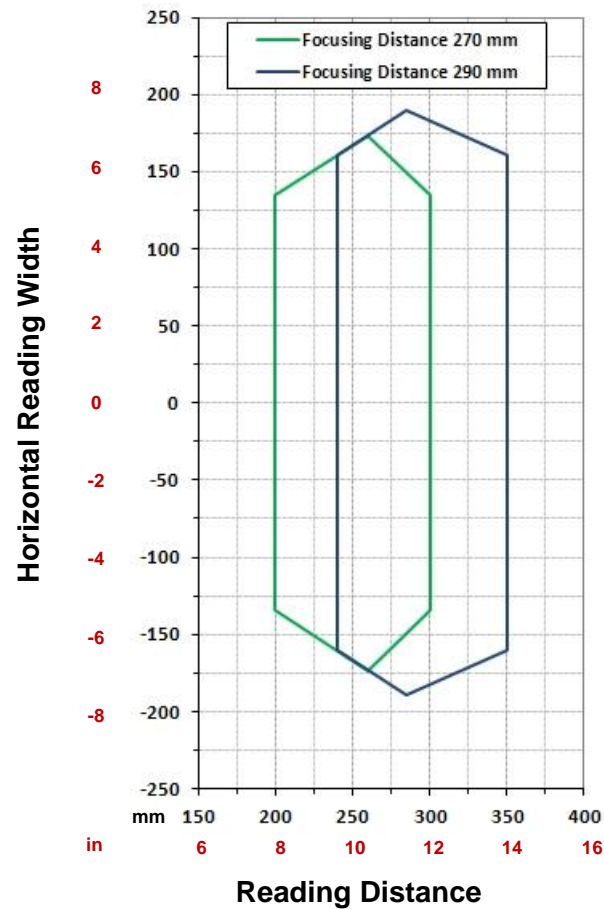
**Matrix 300N 4x1 (6 mm lens)**

**Code 128 0.38 mm (15 mils)**



**CONDITIONS:**

| <b>Hardware Settings</b>   |                         |     |
|----------------------------|-------------------------|-----|
| Code Symbology             | Code 128                |     |
| Code Resolution            | 0.38 mm (15 mils)       |     |
| Tilt Angle                 | 0°                      |     |
| Skew Angle                 | 15°                     |     |
| Focusing Distance (mm)     | 200                     | 220 |
| <b>Software Parameters</b> |                         |     |
| Internal Lighting          | Very High Power Strobed |     |
| <b>411-xxx Wide Red</b>    |                         |     |
| Exposure Time (µs)         | 250                     | 250 |
| Gain                       | 6                       | 15  |

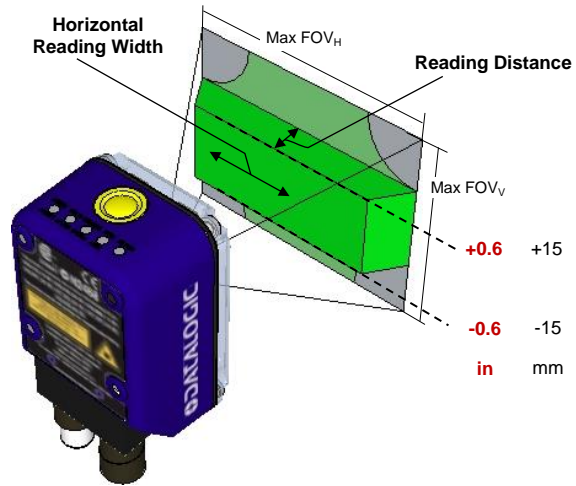
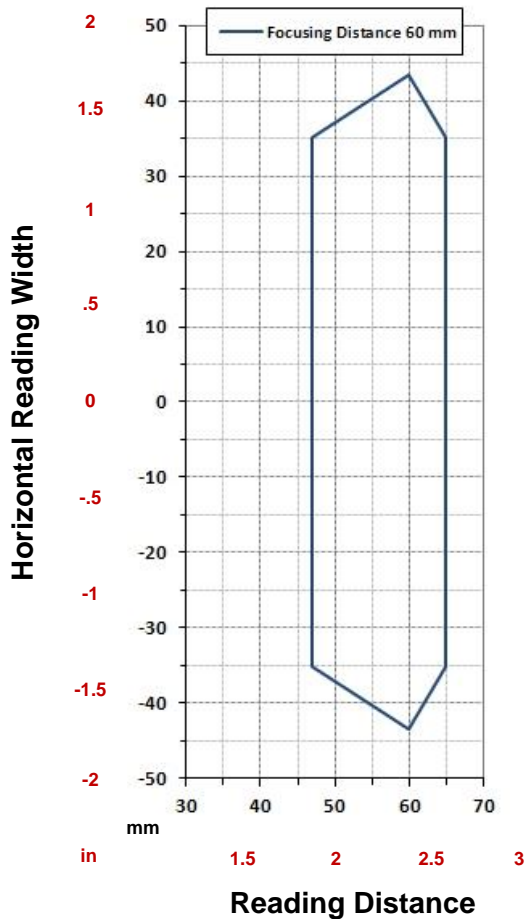
**Matrix 300N 4x1 (6 mm lens)****Code 128 0.50 mm (20 mils)****CONDITIONS:**

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

### 6.3.2 Matrix 300N 4x1 (6 mm models) 2D Codes

#### Matrix 300N 4x1 (6 mm lens)

#### 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. 7.2.6.

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

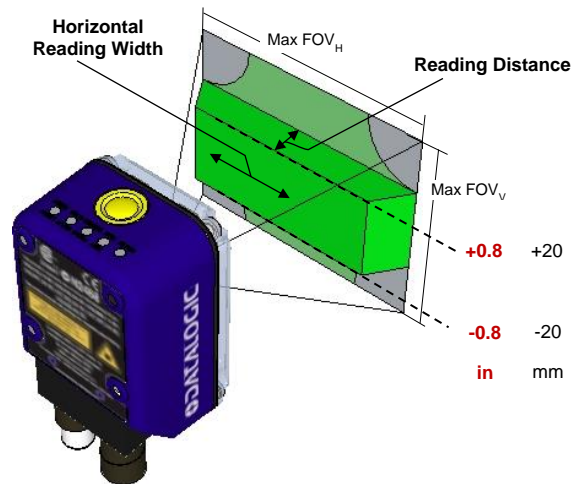
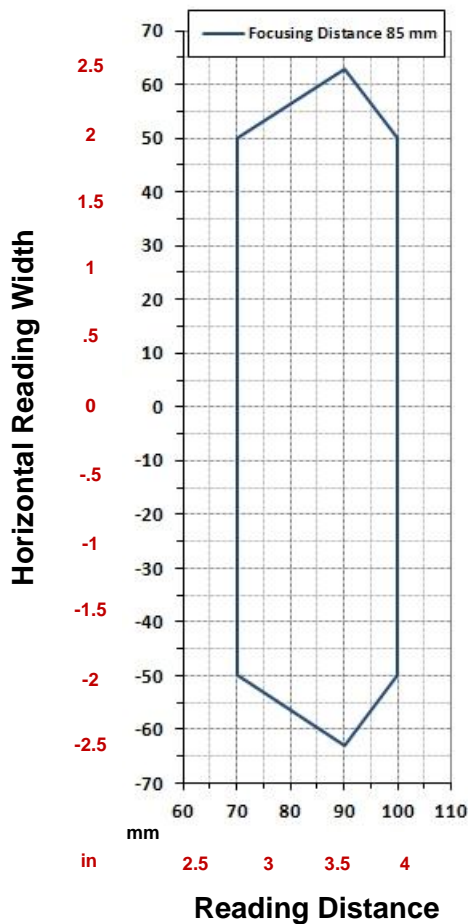
1. Drag top of box to set **x,y coordinates  $\cong 0,236$**
2. Drag bottom of box to set **vertical window dimensions  $\cong 550$  pixels**

**CONDITIONS:**

| <b>Hardware Settings</b>   |                         |
|----------------------------|-------------------------|
| Code Symbology             | Data Matrix ECC 200     |
| Code Resolution            | 0.19 mm (7.5 mils)      |
| Tilt Angle                 | 45°                     |
| Skew Angle                 | 0°                      |
| Focusing Distance (mm)     | 60                      |
| <b>Software Parameters</b> |                         |
| Internal Lighting          | Very High Power Strobed |
| <b>481-xxx MLT-DPM</b>     |                         |
| LED Group                  | Peripheral              |
| Exposure Time ( $\mu$ s)   | 380                     |
| Gain                       | 23                      |

## Matrix 300N 4x1 (6 mm lens)

## 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. 7.2.6.

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

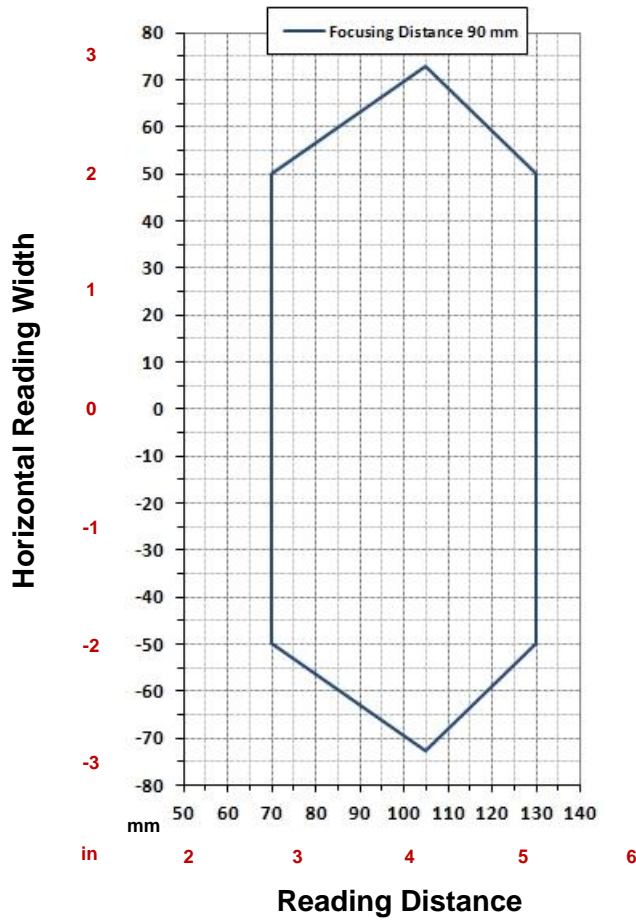
1. Drag top of box to set **x,y coordinates**  $\cong 0,255$
2. Drag bottom of box to set **vertical window dimensions**  $\cong 512 \text{ pixels}$

## 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             |                         |
| Internal Lighting               | Very High Power Strobed |
| <b>411-xxx Wide Red</b>         |                         |
| Exposure Time ( $\mu\text{s}$ ) | 170                     |
| Gain                            | 4                       |
| <b>481-xxx MLT-DPM</b>          |                         |
| Exposure Time ( $\mu\text{s}$ ) | 170                     |
| Gain                            | 6                       |

**Matrix 300N 4x1 (6 mm lens)**

**Data Matrix 0.38 mm (15 mils)**



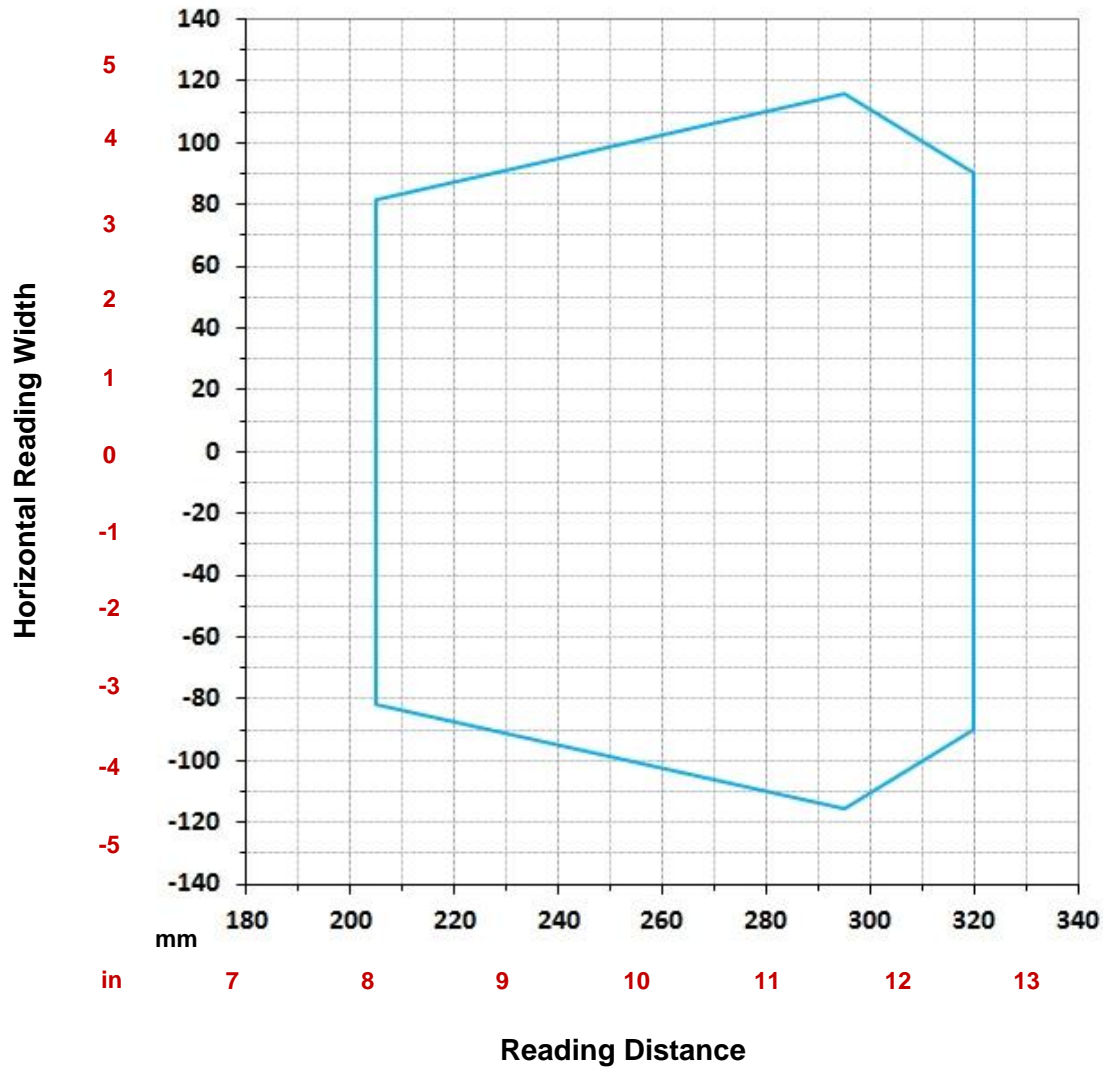
**CONDITIONS:**

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

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

Matrix 300N 4x3 (9 mm lens)

Code 128 0.25 mm (10 mils)

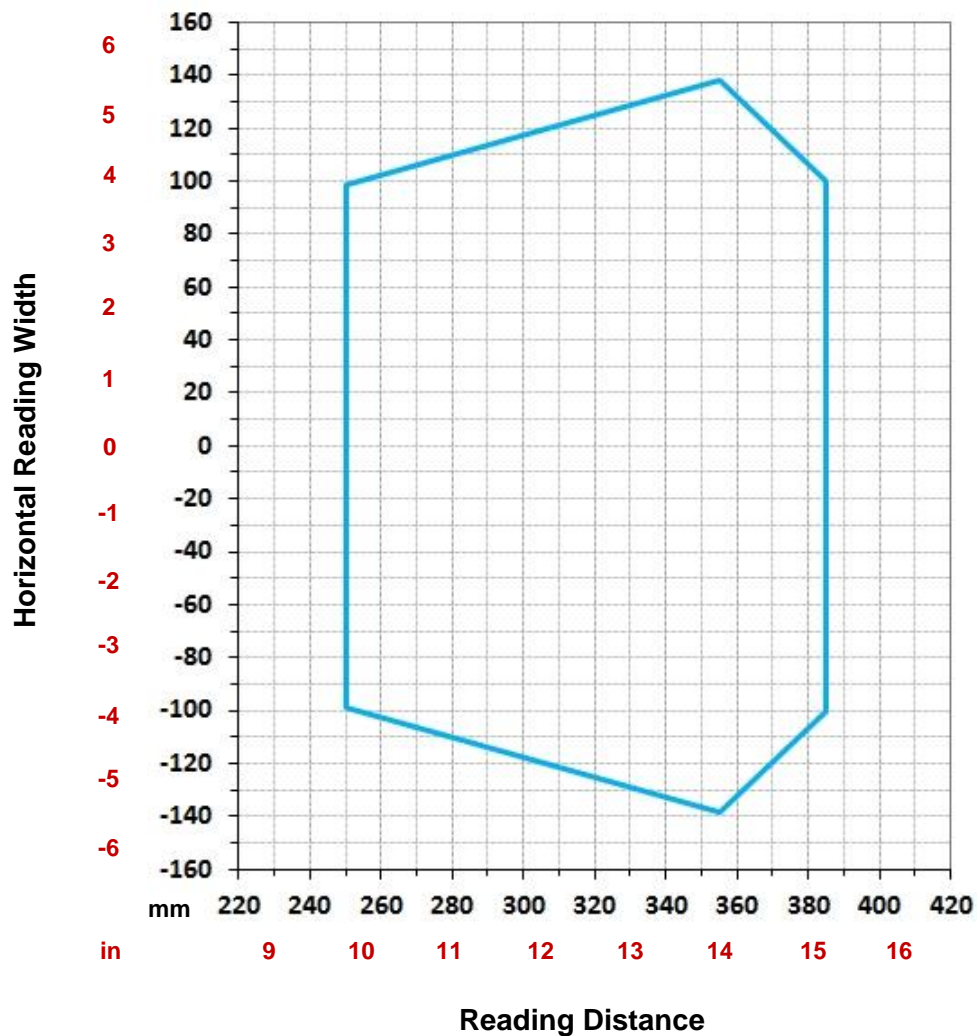


#### CONDITIONS:

| Hardware Settings         |                         |
|---------------------------|-------------------------|
| Code Symbology            | Code 128                |
| Code Resolution           | 0.25 mm (10 mils)       |
| Tilt Angle                | 45°                     |
| Skew Angle                | 15°                     |
| Focusing Distance (mm)    | 280                     |
| Software Parameters       |                         |
| Internal Lighting         | Very High Power Strobed |
| <b>423-xxx Medium Red</b> |                         |
| Exposure Time (μs)        | 166                     |
| Gain                      | 11                      |

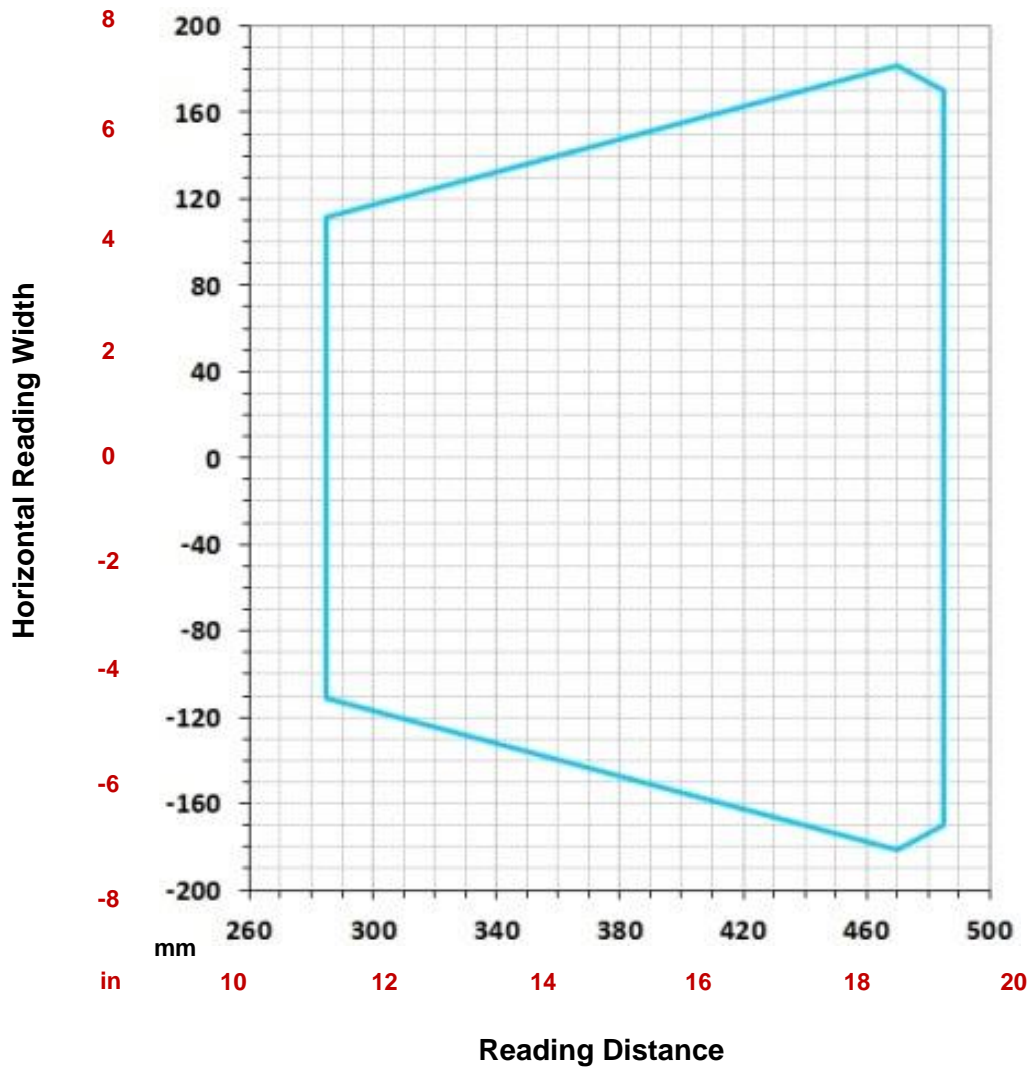
**Matrix 300N 4x3 (9 mm lens)**

**Code 128 0.30 mm (12 mils)**



**CONDITIONS:**

| <b>Hardware Settings</b>   |                         |
|----------------------------|-------------------------|
| Code Symbology             | Code 128                |
| Code Resolution            | 0.30 mm (12 mils)       |
| Tilt Angle                 | 45°                     |
| Skew Angle                 | 15°                     |
| Focusing Distance (mm)     | 310                     |
| <b>Software Parameters</b> |                         |
| Internal Lighting          | Very High Power Strobed |
| <b>423-xxx Medium Red</b>  |                         |
| Exposure Time (µs)         | 200                     |
| Gain                       | 14                      |

**Matrix 300N 4x3 (9 mm lens)****Code 128 0.38 mm (15 mils)****CONDITIONS:**

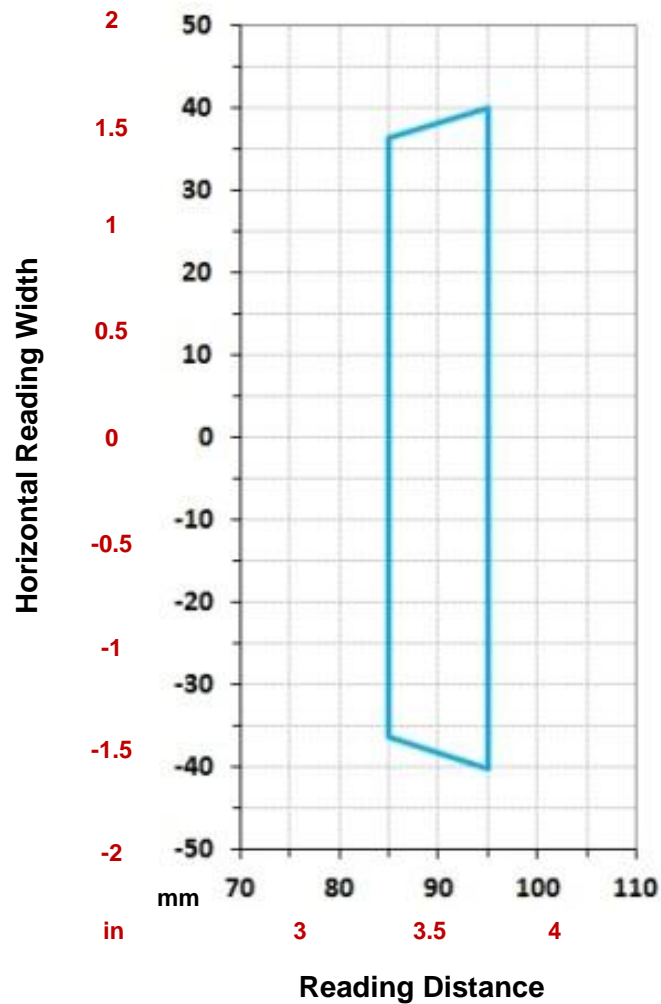
| <b>Hardware Settings</b>   |                         |
|----------------------------|-------------------------|
| Code Symbology             | Code 128                |
| Code Resolution            | 0.38 mm (15 mils)       |
| Tilt Angle                 | 45°                     |
| Skew Angle   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



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

Matrix 300N 4x3 (9 mm lens)

Data Matrix 0.13 mm (5 mils)



**CONDITIONS:**

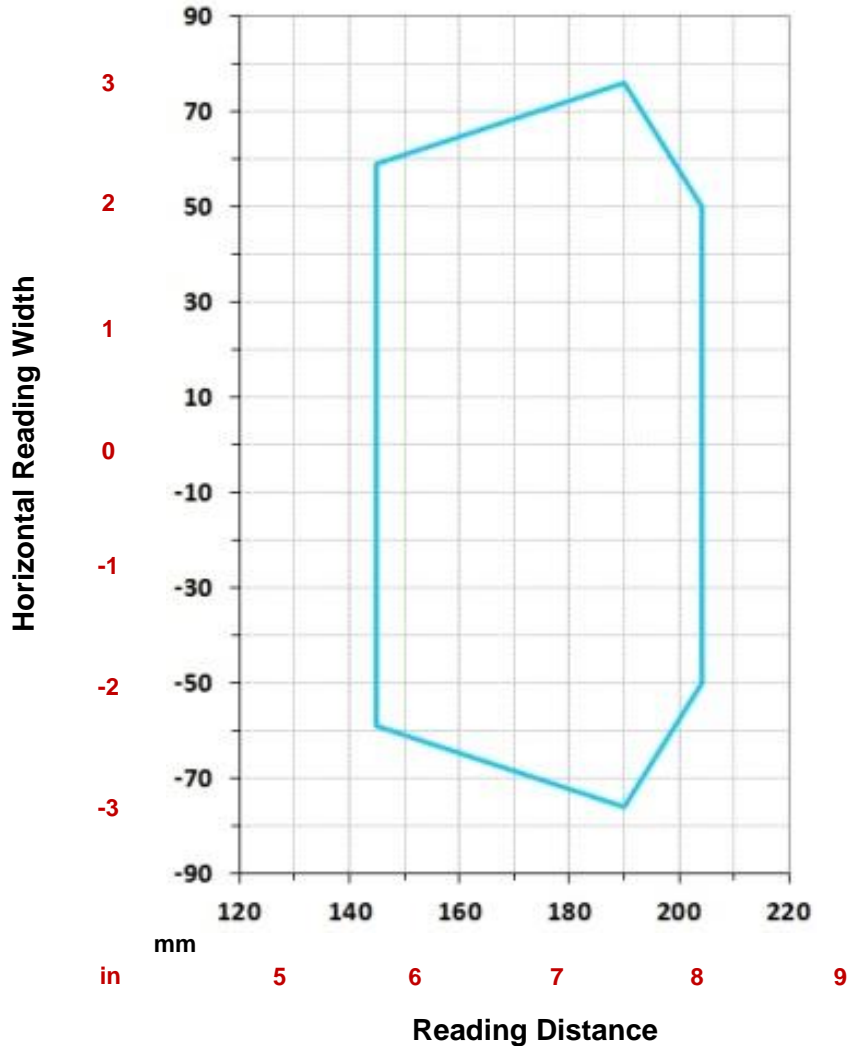
| <b>Hardware Settings</b>   |                         |
|----------------------------|-------------------------|
| Code Symbology             | Data Matrix ECC 200     |
| Code Resolution            | 0.13 mm (5 mils)        |
| Tilt Angle                 | 45°                     |
| Skew Angle                 | 15°                     |
| Focusing Distance (mm)     | 91                      |
| <b>Software Parameters</b> |                         |
| Internal Lighting          | Very High Power Strobed |
| <b>423-xxx Medium Red</b>  |                         |
| Exposure Time (µs)         | 50                      |
| Gain                       | 5                       |

**Matrix 300N 4x3 (9 mm lens)****Data Matrix 0.19 mm (7.5 mils)****CONDITIONS:**

| <b>Hardware Settings</b>   |                         |
|----------------------------|-------------------------|
| Code Symbology             | Data Matrix ECC 200     |
| Code Resolution            | 0.19 mm (7.5 mils)      |
| Tilt Angle                 | 45°                     |
| Skew Angle                 | 15°                     |
| Focusing Distance (mm)     | 135                     |
| <b>Software Parameters</b> |                         |
| Internal Lighting          | Very High Power Strobed |
| <b>423-xxx Medium Red</b>  |                         |
| Exposure Time (μs)         | 130                     |
| Gain                       | 5                       |

**Matrix 300N 4x3 (9 mm lens)**

**Data Matrix 0.25 mm (10 mils)**



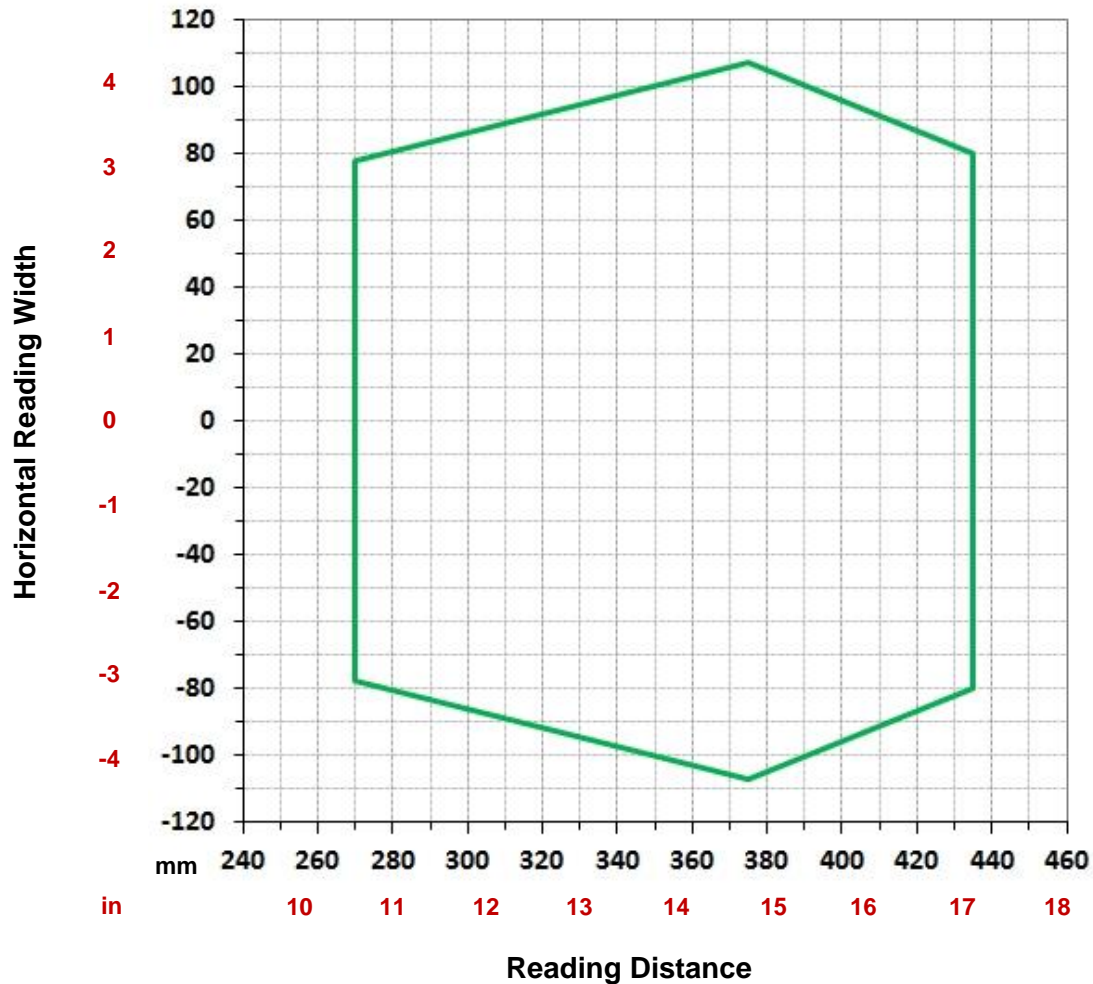
**CONDITIONS:**

| <b>Hardware Settings</b>   |                         |
|----------------------------|-------------------------|
| Code Symbology             | Data Matrix ECC 200     |
| Code Resolution            | 0.25 mm (10 mils)       |
| Tilt Angle                 | 45°                     |
| Skew Angle                 | 15°                     |
| Focusing Distance (mm)     | 180                     |
| <b>Software Parameters</b> |                         |
| Internal Lighting          | Very High Power Strobed |
| <b>423-xxx Medium Red</b>  |                         |
| Exposure Time (µs)         | 155                     |
| Gain                       | 8                       |
| <b>453-xxx Wide White</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 300N 4x4 (12 mm models) 1D Codes

#### Matrix 300N 4x4 (12 mm lens)

#### Code 128 0.25 mm (10 mils)

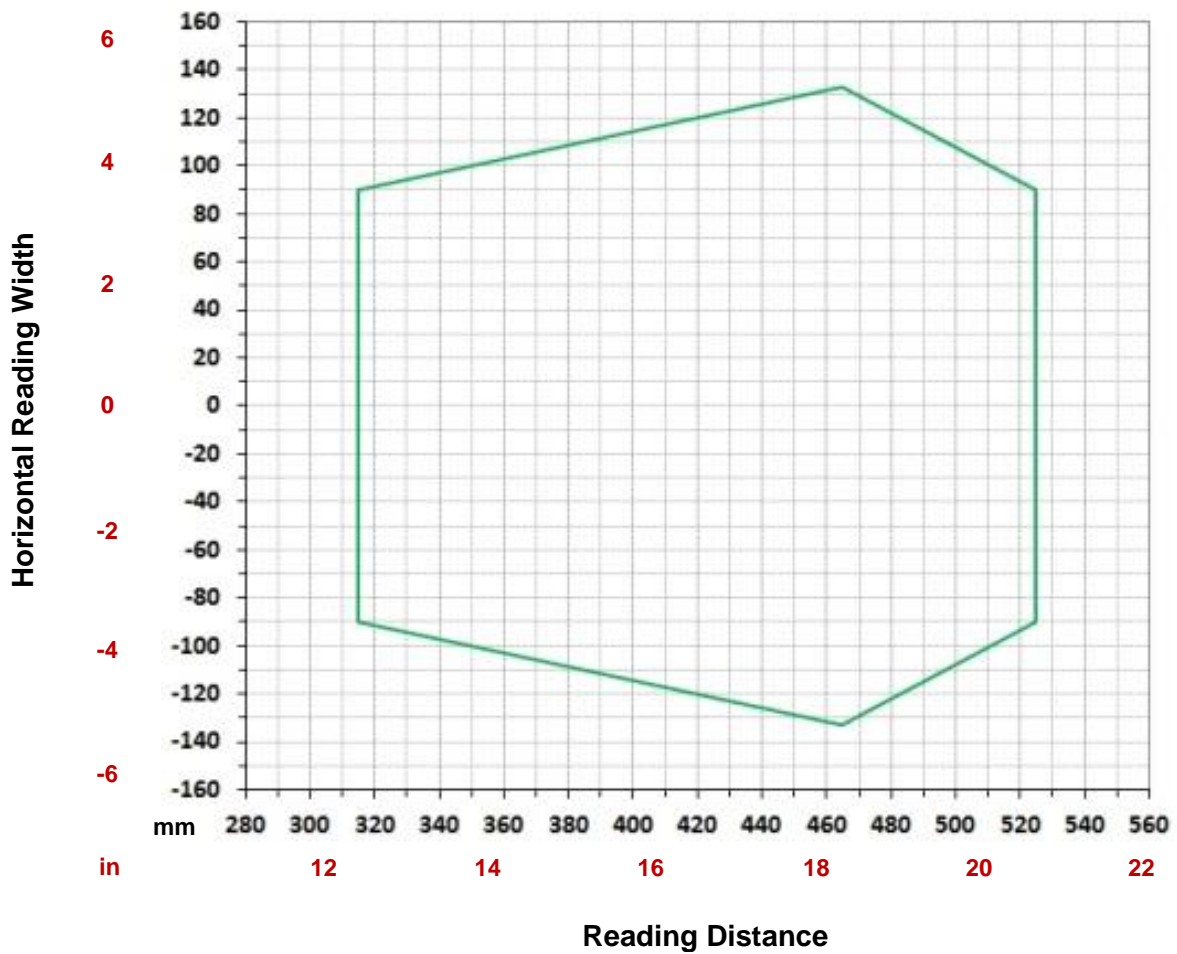


#### CONDITIONS:

| Hardware Settings         |                         |
|---------------------------|-------------------------|
| Code Symbology            | Code 128                |
| Code Resolution           | 0.25 mm (10 mils)       |
| Tilt Angle                | 45°                     |
| Skew Angle                | 15°                     |
| Focusing Distance (mm)    | 380                     |
| Software Parameters       |                         |
| Internal Lighting         | Very High Power Strobed |
| <b>434-xxx Narrow Red</b> |                         |
| Exposure Time (μs)        | 210                     |
| Gain                      | 10                      |

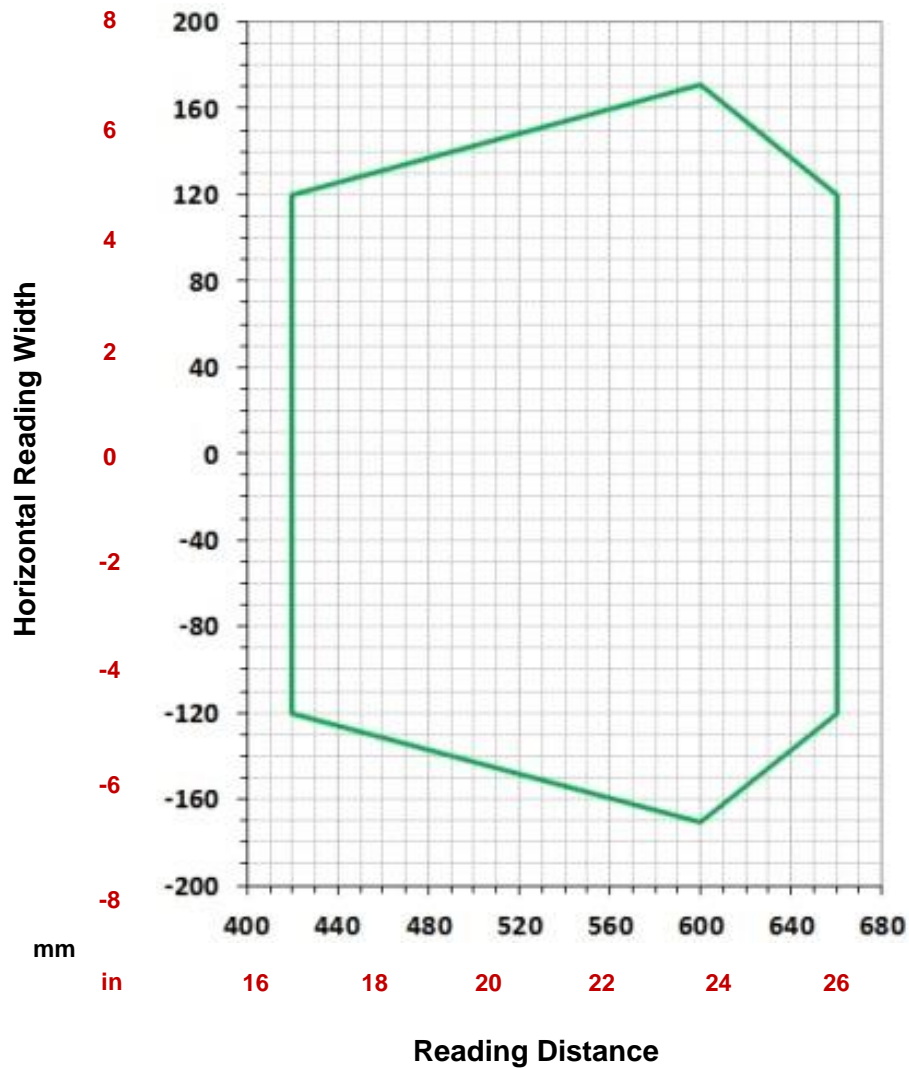
**Matrix 300N 4x4 (12 mm lens)**

**Code 128 0.30 mm (12 mils)**



**CONDITIONS:**

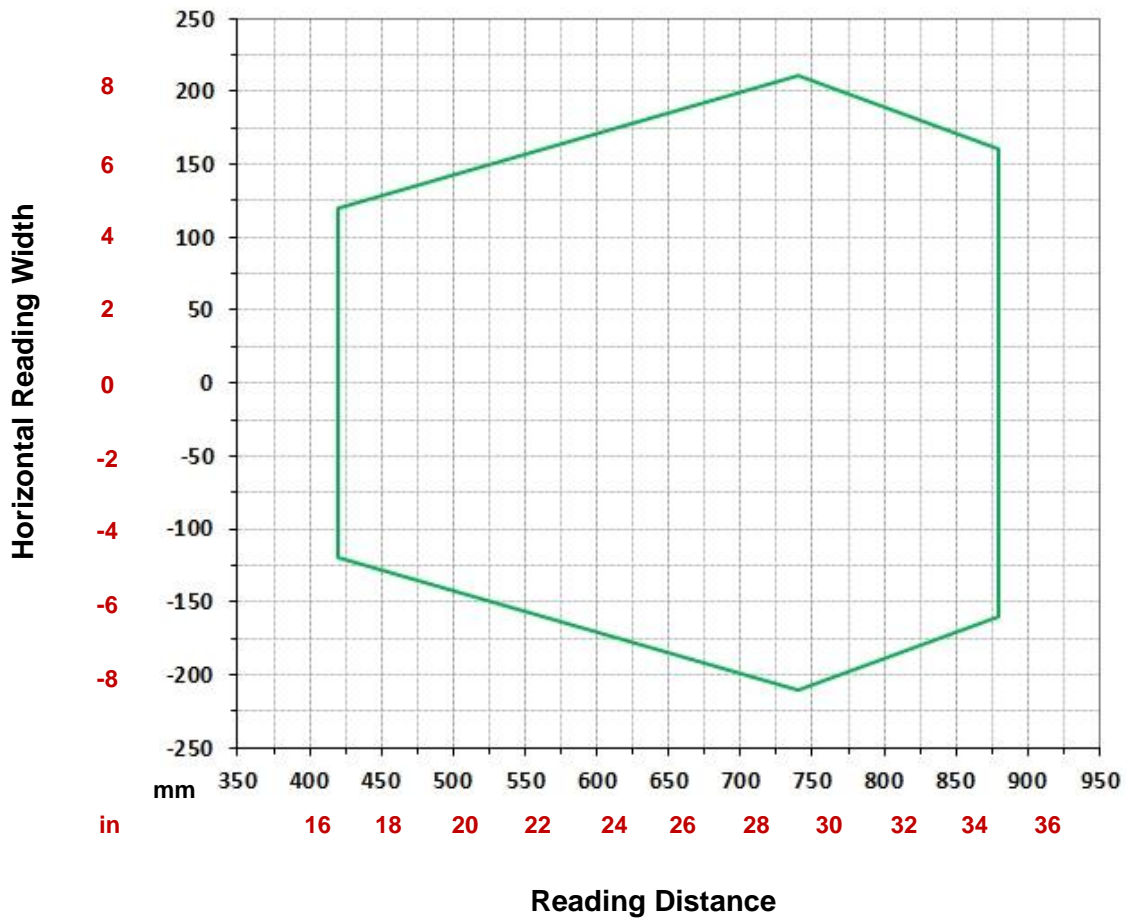
| <b>Hardware Settings</b>   |                         |
|----------------------------|-------------------------|
| Code Symbology             | Code 128                |
| Code Resolution            | 0.30 mm (12 mils)       |
| Tilt Angle                 | 45°                     |
| Skew Angle                 | 15°                     |
| Focusing Distance (mm)     | 415                     |
| <b>Software Parameters</b> |                         |
| Internal Lighting          | Very High Power Strobed |
| <b>434-xxx Narrow Red</b>  |                         |
| Exposure Time (µs)         | 250                     |
| Gain                       | 9                       |

**Matrix 300N 4x4 (12 mm lens)****Code 128 0.38 mm (15 mils)****CONDITIONS:**

| <b>Hardware Settings</b>   |                         |
|----------------------------|-------------------------|
| Code Symbology             | Code 128                |
| Code Resolution            | 0.38 mm (15 mils)       |
| Tilt Angle                 | 45°                     |
| Skew Angle                 | 15°                     |
| Focusing Distance (mm)     | 500                     |
| <b>Software Parameters</b> |                         |
| Internal Lighting          | Very High Power Strobed |
| <b>434-xxx Narrow Red</b>  |                         |
| Exposure Time (μs)         | 250                     |
| Gain                       | 12                      |

**Matrix 300N 4x4 (12 mm lens)**

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



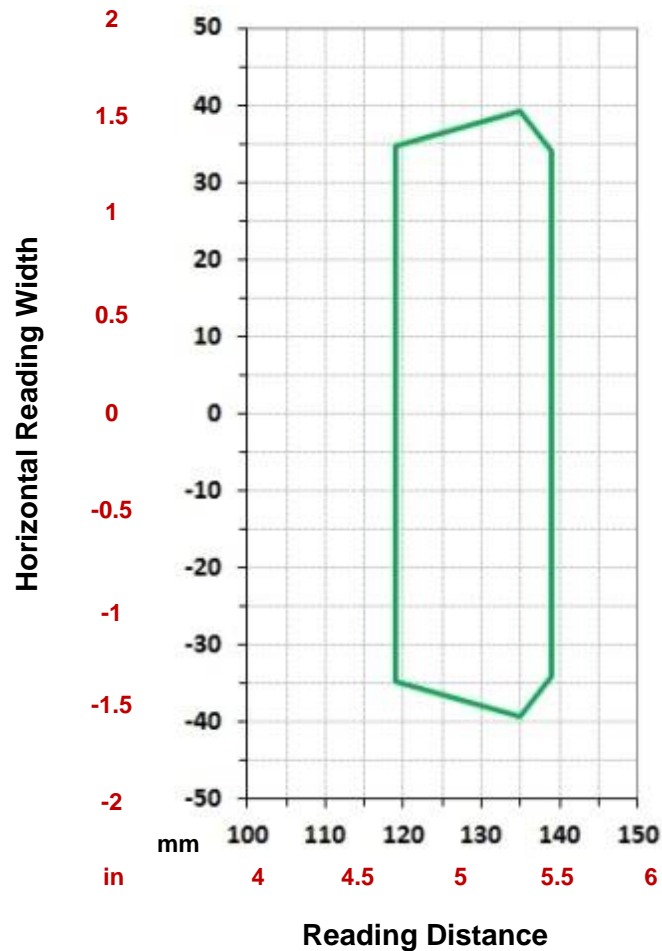
**CONDITIONS:**

| <b>Hardware Settings</b>   |                         |
|----------------------------|-------------------------|
| Code Symbology             | Code 128                |
| Code Resolution            | 0.50 mm (20 mils)       |
| Tilt Angle                 | 45°                     |
| Skew Angle                 | 15°                     |
| Focusing Distance (mm)     | 740                     |
| <b>Software Parameters</b> |                         |
| Internal Lighting          | Very High Power Strobed |
| <b>434-xxx Narrow Red</b>  |                         |
| Exposure Time (µs)         | 330                     |
| Gain                       | 17                      |

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

#### Matrix 300N 4x4 (12 mm lens)

#### Data Matrix 0.13 mm (5 mils)



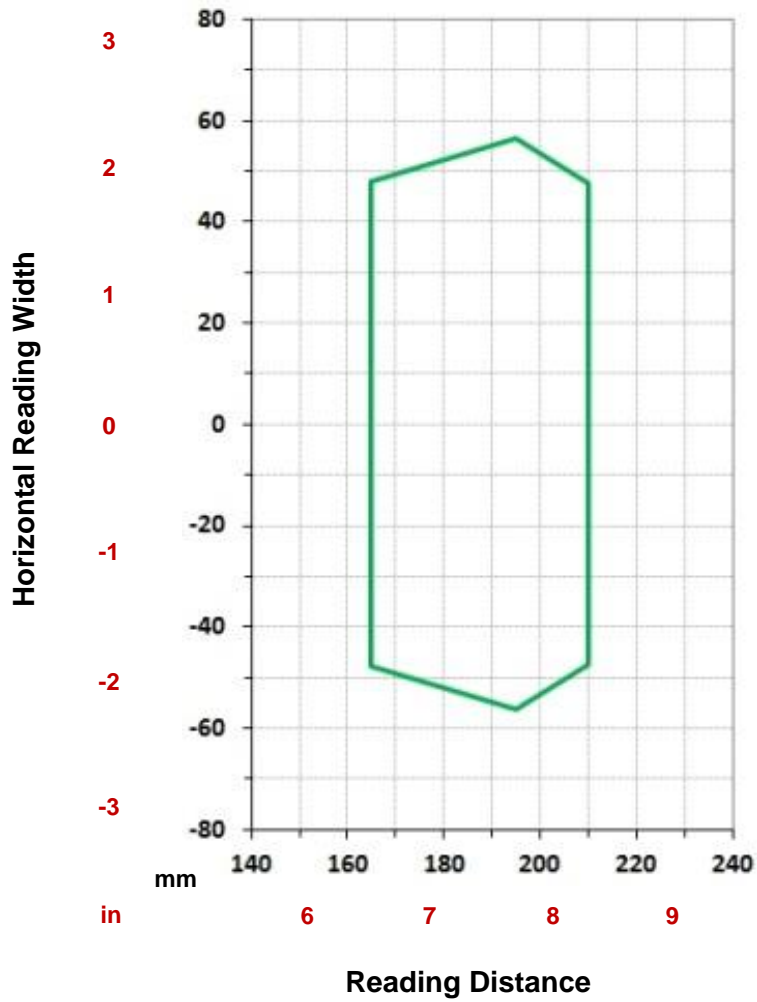
#### CONDITIONS:

| Hardware Settings         |                         |
|---------------------------|-------------------------|
| Code Symbology            | Data Matrix ECC 200     |
| Code Resolution           | 0.13 mm (5 mils)        |
| Tilt Angle                | 45°                     |
| Skew Angle                | 15°                     |
| Focusing Distance (mm)    | 133                     |
| Software Parameters       |                         |
| Internal Lighting         | Very High Power Strobed |
| <b>434-xxx Narrow Red</b> |                         |
| Exposure Time (µs)        | 45                      |
| Gain                      | 5                       |



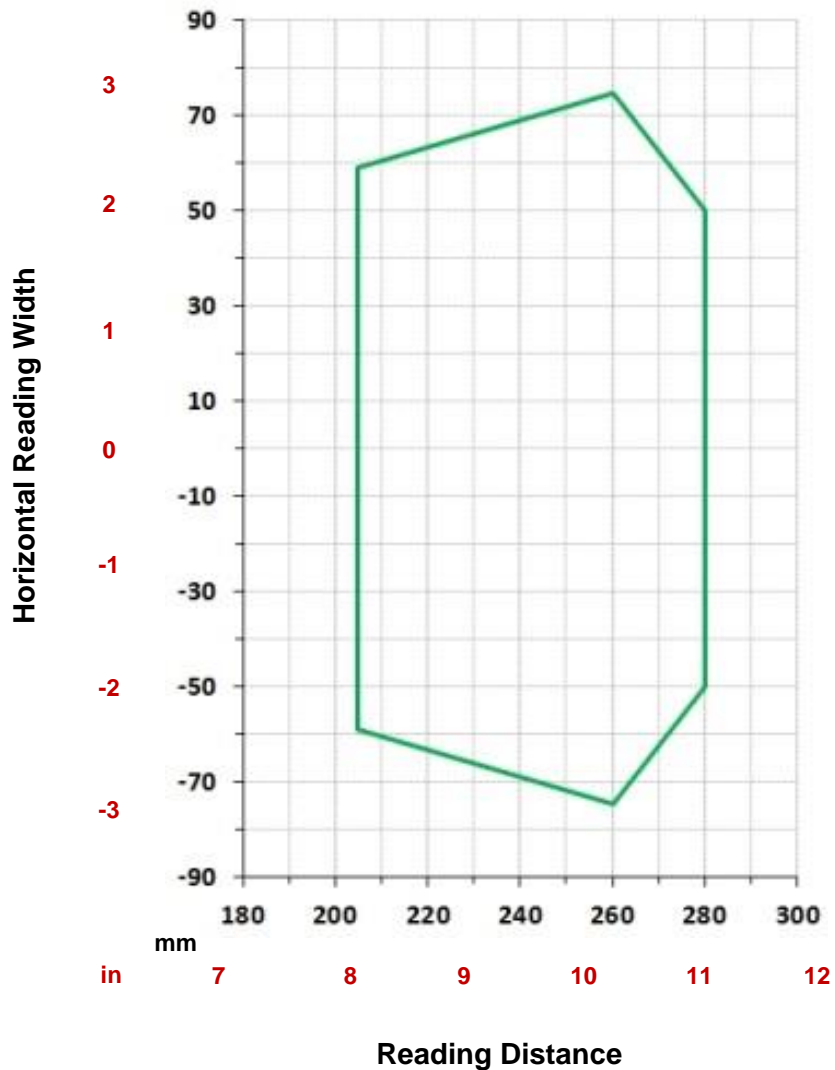
**Matrix 300N 4x4 (12 mm lens)**

**Data Matrix 0.19 mm (7.5 mils)**



**CONDITIONS:**

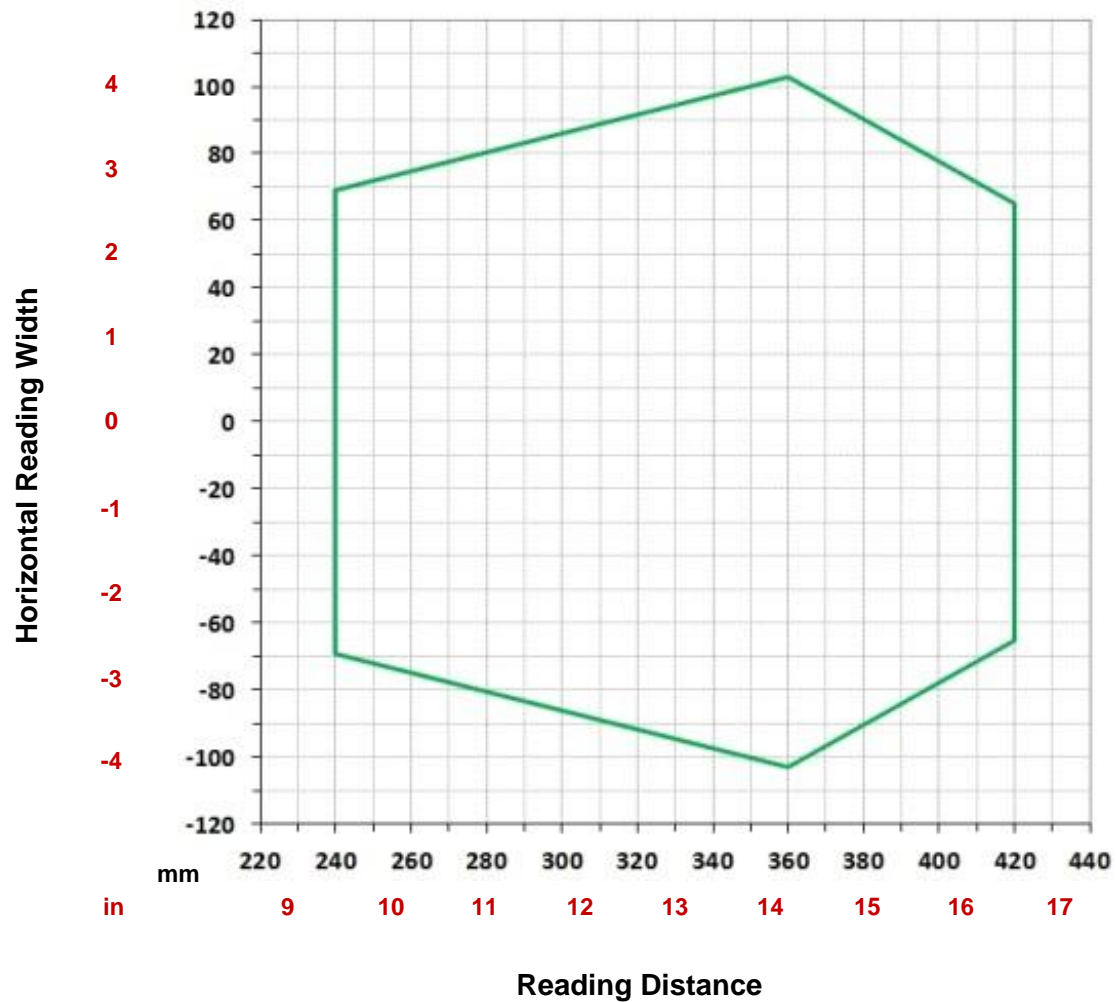
| <b>Hardware Settings</b>   |                         |
|----------------------------|-------------------------|
| Code Symbology             | Data Matrix ECC 200     |
| Code Resolution            | 0.19 mm (7.5 mils)      |
| Tilt Angle                 | 45°                     |
| Skew Angle                 | 15°                     |
| Focusing Distance (mm)     | 195                     |
| <b>Software Parameters</b> |                         |
| Internal Lighting          | Very High Power Strobed |
| <b>434-xxx Narrow Red</b>  |                         |
| Exposure Time (µs)         | 90                      |
| Gain                       | 5                       |

**Matrix 300N 4x4 (12 mm lens)****Data Matrix 0.25 mm (10 mils)****CONDITIONS:**

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

**Matrix 300N 4x4 (12 mm lens)**

**Data Matrix 0.38 mm (15 mils)**



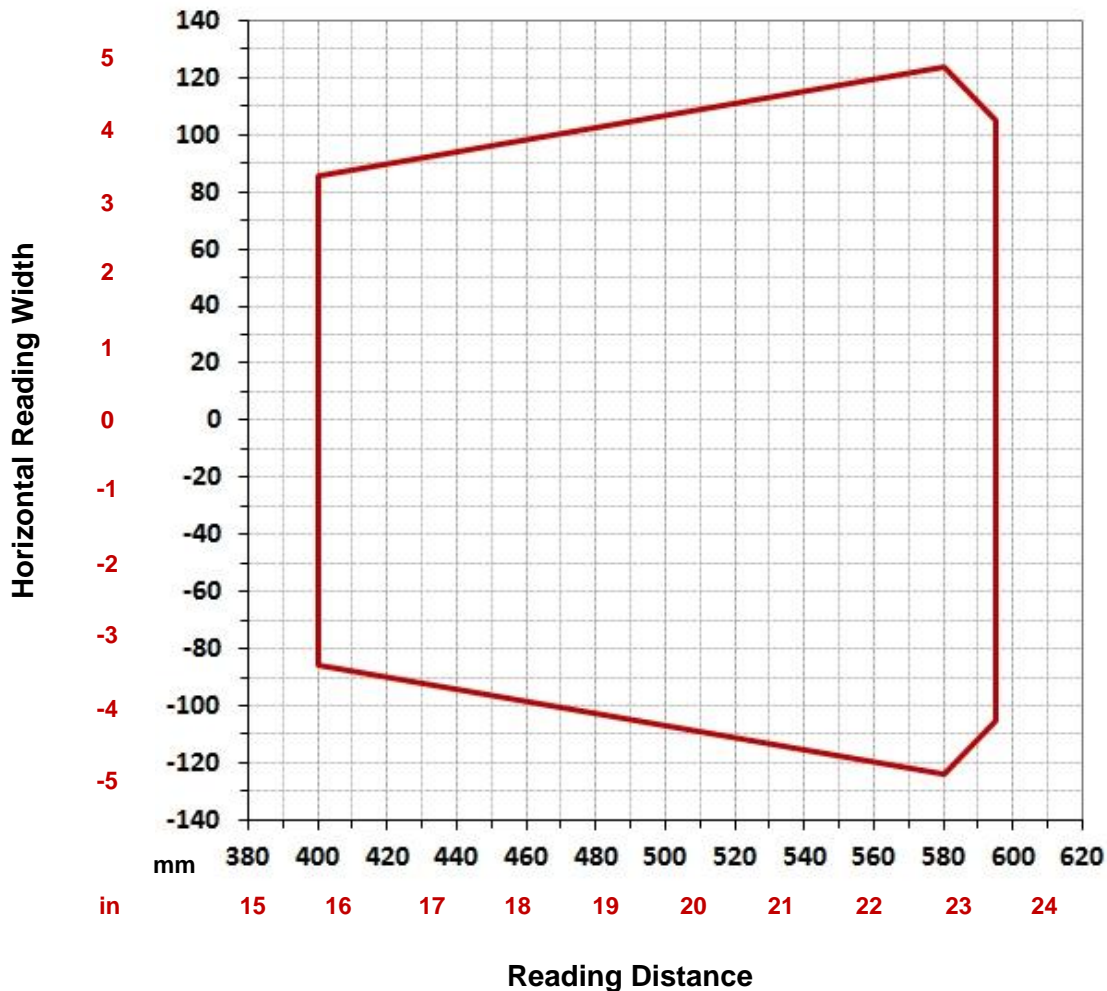
**CONDITIONS:**

| <b>Hardware Settings</b>   |                         |
|----------------------------|-------------------------|
| Code Symbology             | Data Matrix ECC 200     |
| Code Resolution            | 0.38 mm (15 mils)       |
| Tilt Angle                 | 45°                     |
| Skew Angle                 | 15°                     |
| Focusing Distance (mm)     | 355                     |
| <b>Software Parameters</b> |                         |
| Internal Lighting          | Very High Power Strobed |
| <b>434-xxx Narrow Red</b>  |                         |
| Exposure Time (µs)         | 250                     |
| Gain                       | 6                       |

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

#### Matrix 300N 4x5 (16 mm lens)

Code 128 0.25 mm (10 mils)

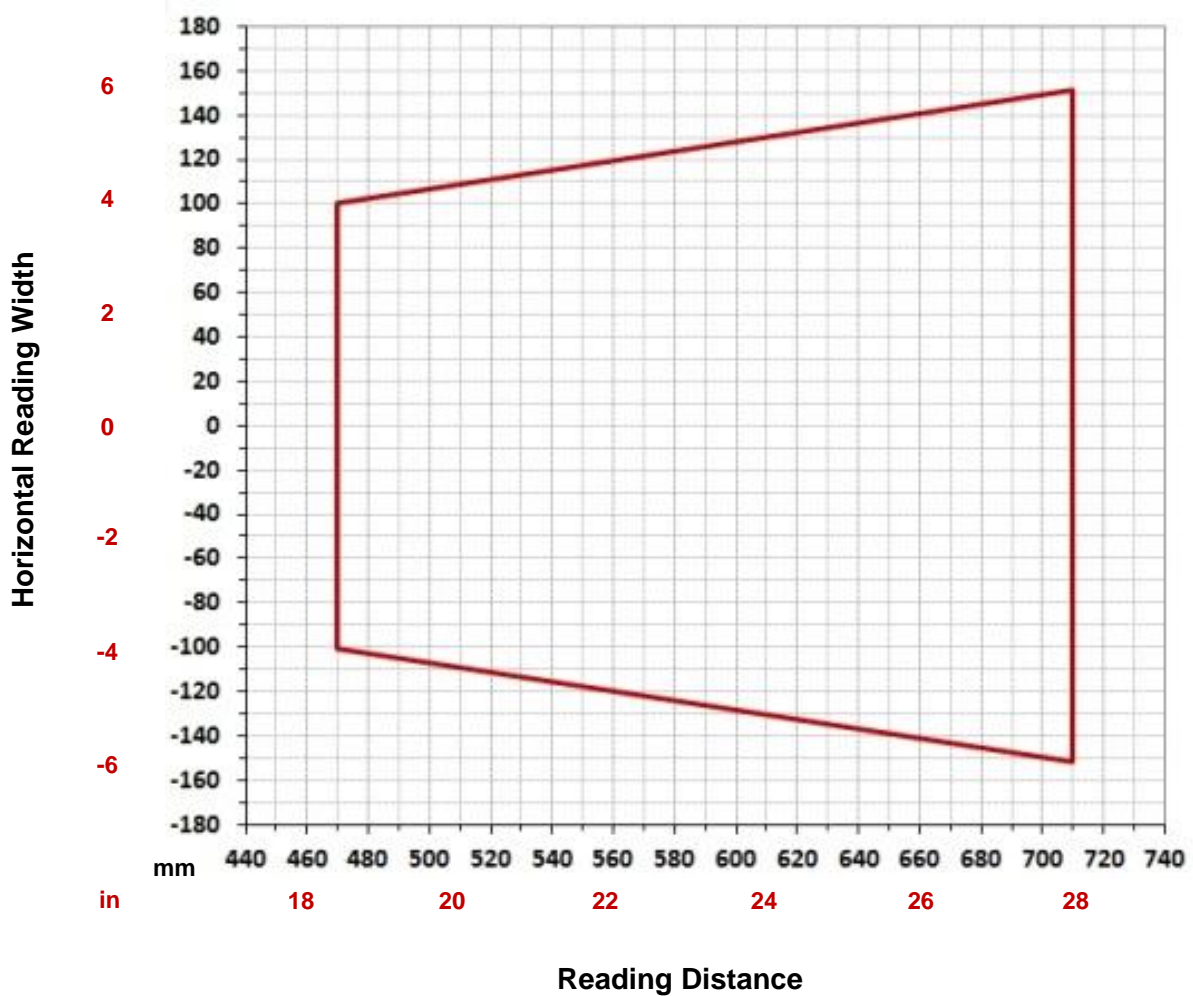


#### CONDITIONS:

| Hardware Settings         |                         |
|---------------------------|-------------------------|
| Code Symbology            | Code 128                |
| Code Resolution           | 0.25 mm (10 mils)       |
| Tilt Angle                | 45°                     |
| Skew Angle                | 15°                     |
| Focusing Distance (mm)    | 500                     |
| Software Parameters       |                         |
| Internal Lighting         | Very High Power Strobed |
| <b>435-xxx Narrow Red</b> |                         |
| Exposure Time (µs)        | 250                     |
| Gain                      | 16                      |

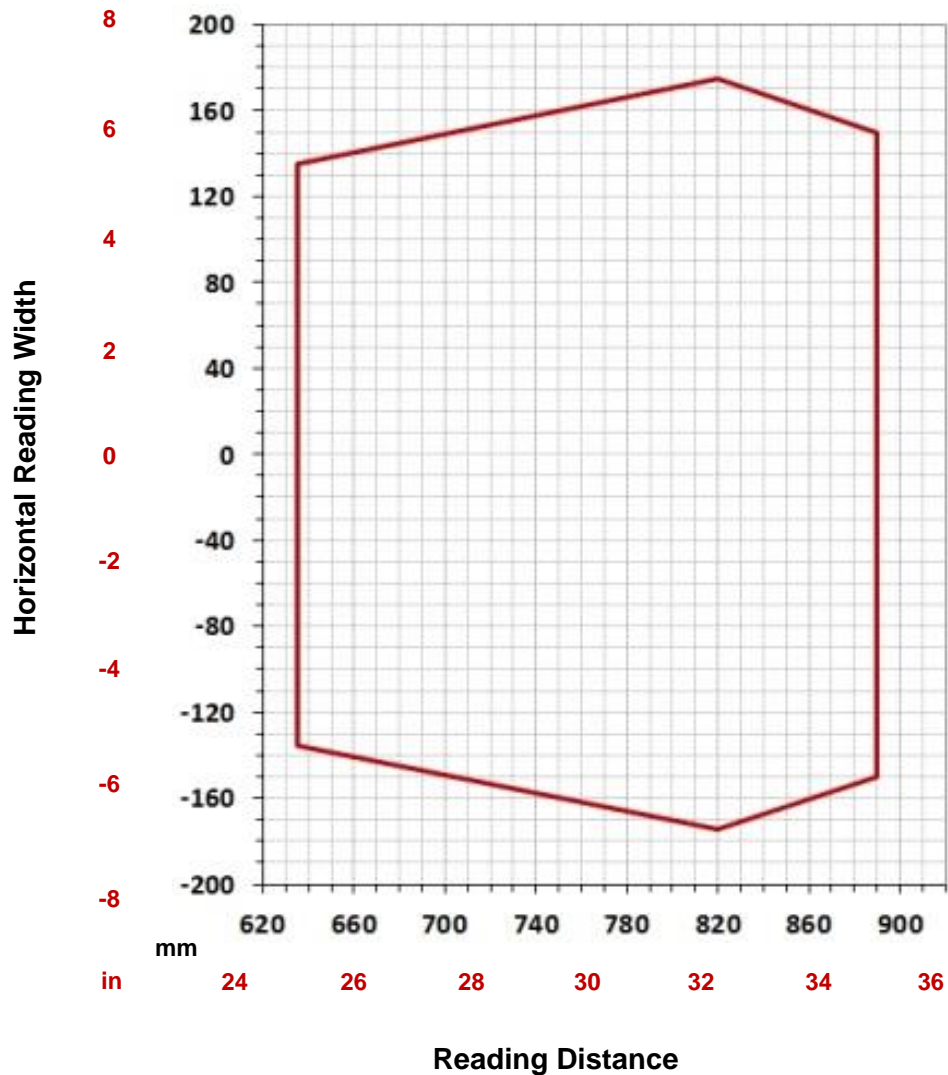
**Matrix 300N 4x5 (16 mm lens)**

**Code 128 0.30 mm (12 mils)**



**CONDITIONS:**

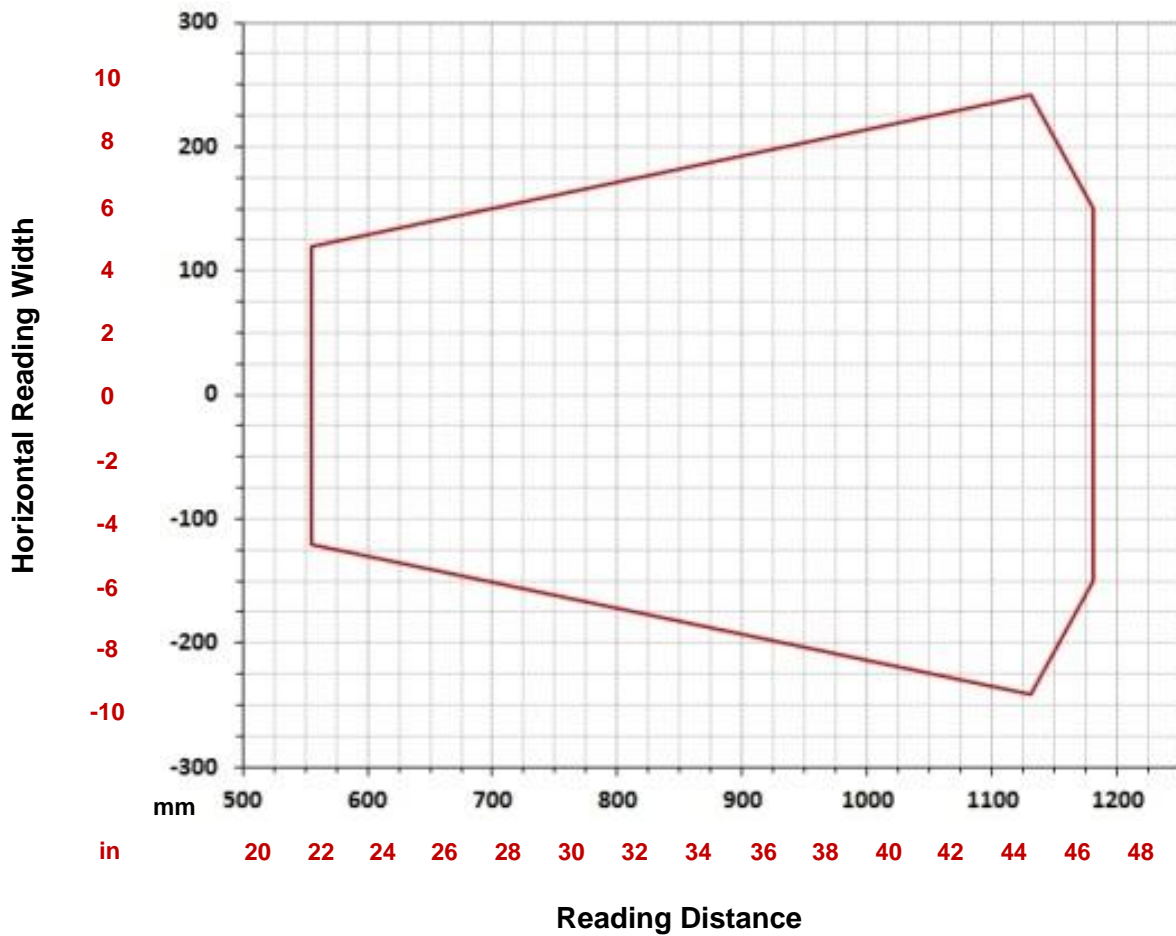
| <b>Hardware Settings</b>   |                          |
|----------------------------|--------------------------|
| Code Symbology             | Code 128                 |
| Code Resolution            | 0.30 mm (12 mils)        |
| Tilt Angle                 | 45°                      |
| Skew Angle                 | 15°                      |
| Focusing Distance (mm)     | 590                      |
| <b>Software Parameters</b> |                          |
| Internal Lighting          | Very High Power Strobbed |
| <b>435-xxx Narrow Red</b>  |                          |
| Exposure Time (µs)         | 300                      |
| Gain                       | 19                       |

**Matrix 300N 4x5 (16 mm lens)****Code 128 0.38 mm (15 mils)****CONDITIONS:**

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

**Matrix 300N 4x5 (16 mm lens)**

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



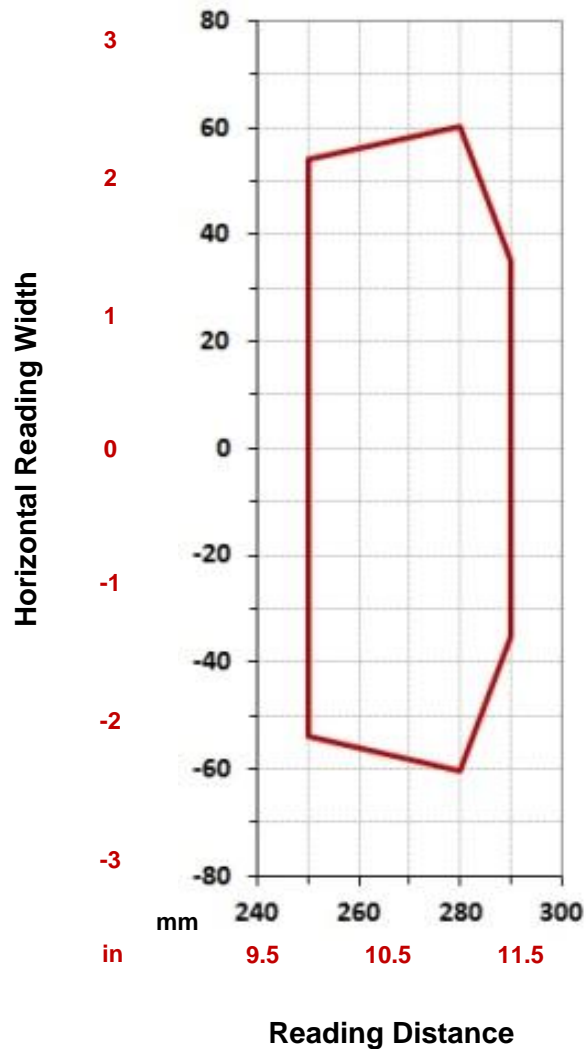
**CONDITIONS:**

| <b>Hardware Settings</b>   |                         |
|----------------------------|-------------------------|
| Code Symbology             | Code 128                |
| Code Resolution            | 0.50 mm (20 mils)       |
| Tilt Angle                 | 45°                     |
| Skew Angle                 | 15°                     |
| Focusing Distance (mm)     | 900                     |
| <b>Software Parameters</b> |                         |
| Internal Lighting          | Very High Power Strobed |
| <b>435-xxx Narrow Red</b>  |                         |
| Exposure Time (µs)         | 500                     |
| Gain                       | 19                      |

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

Matrix 300N 4x5 (16 mm lens)

Data Matrix 0.19 mm (7.5 mils)



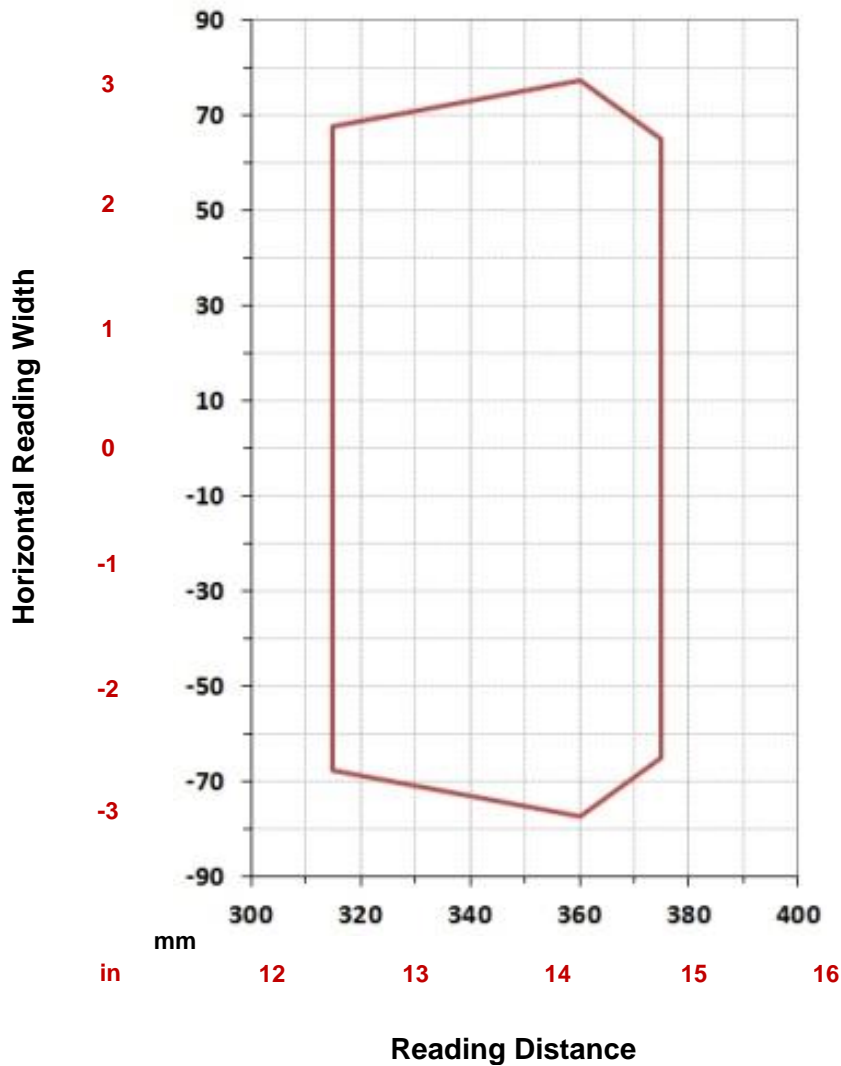
#### CONDITIONS:

| Hardware Settings         |                         |
|---------------------------|-------------------------|
| Code Symbology            | Data Matrix ECC 200     |
| Code Resolution           | 0.19 mm (7.5 mils)      |
| Tilt Angle                | 45°                     |
| Skew Angle                | 15°                     |
| Focusing Distance (mm)    | 275                     |
| Software Parameters       |                         |
| Internal Lighting         | Very High Power Strobed |
| <b>435-xxx Narrow Red</b> |                         |
| Exposure Time (µs)        | 190                     |
| Gain                      | 7                       |



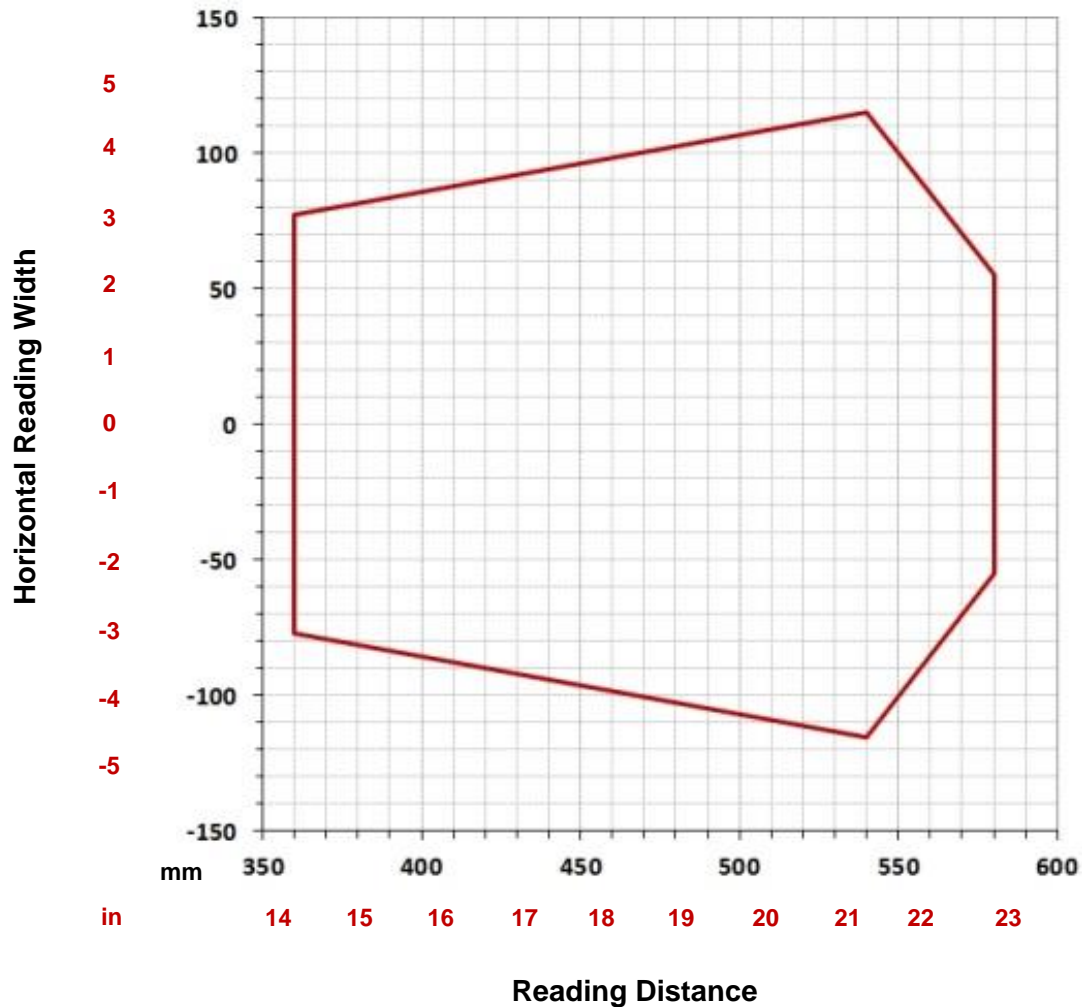
**Matrix 300N 4x5 (16 mm lens)**

**Data Matrix 0.25 mm (10 mils)**



**CONDITIONS:**

| <b>Hardware Settings</b>    |                         |
|-----------------------------|-------------------------|
| Code Symbology              | Data Matrix ECC 200     |
| Code Resolution             | 0.25 mm (10 mils)       |
| Tilt Angle                  | 45°                     |
| Skew Angle                  | 15°                     |
| Focusing Distance (mm)      | 340                     |
| <b>Software Parameters</b>  |                         |
| Internal Lighting           | Very High Power Strobed |
| <b>435-xxx Narrow Red</b>   |                         |
| Exposure Time (µs)          | 270                     |
| Gain                        | 8                       |
| <b>465-xxx Narrow White</b> |                         |
| Exposure Time (µs)          | 270                     |
| Gain                        | 8                       |

**Matrix 300N 4x5 (16 mm lens)****Data Matrix 0.38 mm (15 mils)****CONDITIONS:**

| <b>Hardware Settings</b>   |                         |
|----------------------------|-------------------------|
| Code Symbology             | Data Matrix ECC 200     |
| Code Resolution            | 0.38 mm (15 mils)       |
| Tilt Angle                 | 45°                     |
| Skew Angle                 | 15°                     |
| Focusing Distance (mm)     | 495                     |
| <b>Software Parameters</b> |                         |
| Internal Lighting          | Very High Power Strobed |
| <b>435-xxx Narrow Red</b>  |                         |
| Exposure Time (μs)         | 380                     |
| Gain                       | 12                      |

## 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:

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

**T<sub>exp (min)</sub>** 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.

### Example:

A Matrix 300N using:

*Internal Lighting Mode = Very High Power Strobe*

*Exposure Time ( $\mu$ s) = 100  $\mu$ s*

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

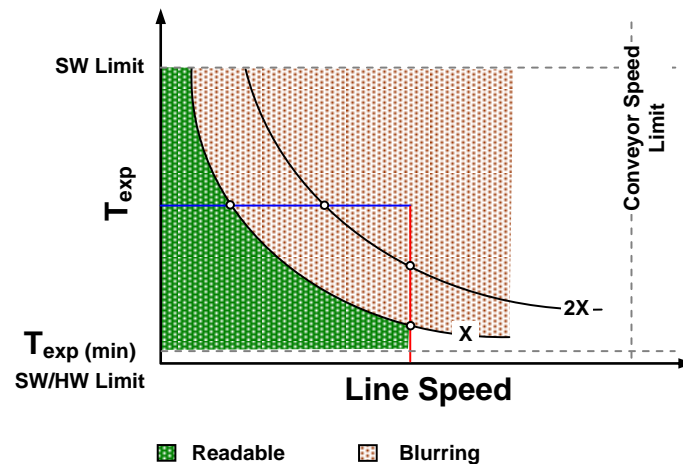
has a maximum line speed of:

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

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

$$X / LS = T_{\text{exp (max)}}$$

$T_{\text{exp (max)}}$  and  $LS_{\text{(max)}}$  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).

The **Internal Lighting** 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.
- **-Power Strobed:** the built-in LED array is on only during the image exposure time. Different Power Strobed 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**, recheck **Exposure Time**.

## 7 SOFTWARE CONFIGURATION

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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



**CAUTION:** DL.CODE does not currently support Windows Embedded (often used in industrial PCs and/or PLCs).

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, 7, 8, or 10
- 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. 7.5.



**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 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:

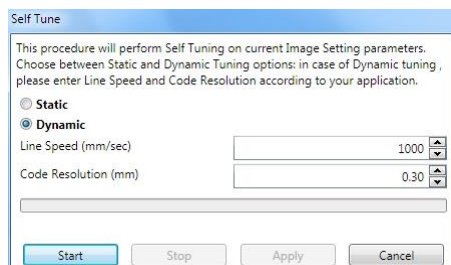


Figure 71 – Image Auto-Setup

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.

Device Model : M300N 435-010 LNS-16 RED NARR STD IP Address : 172.27.101.69 Configuration Schema Release : 9.6.7 User : Installer-Expert Packtrack Calibration : Not Calibrated 3.0.118 RC1

Figure 72 – Decoding Results OK

## 7.2.2 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.

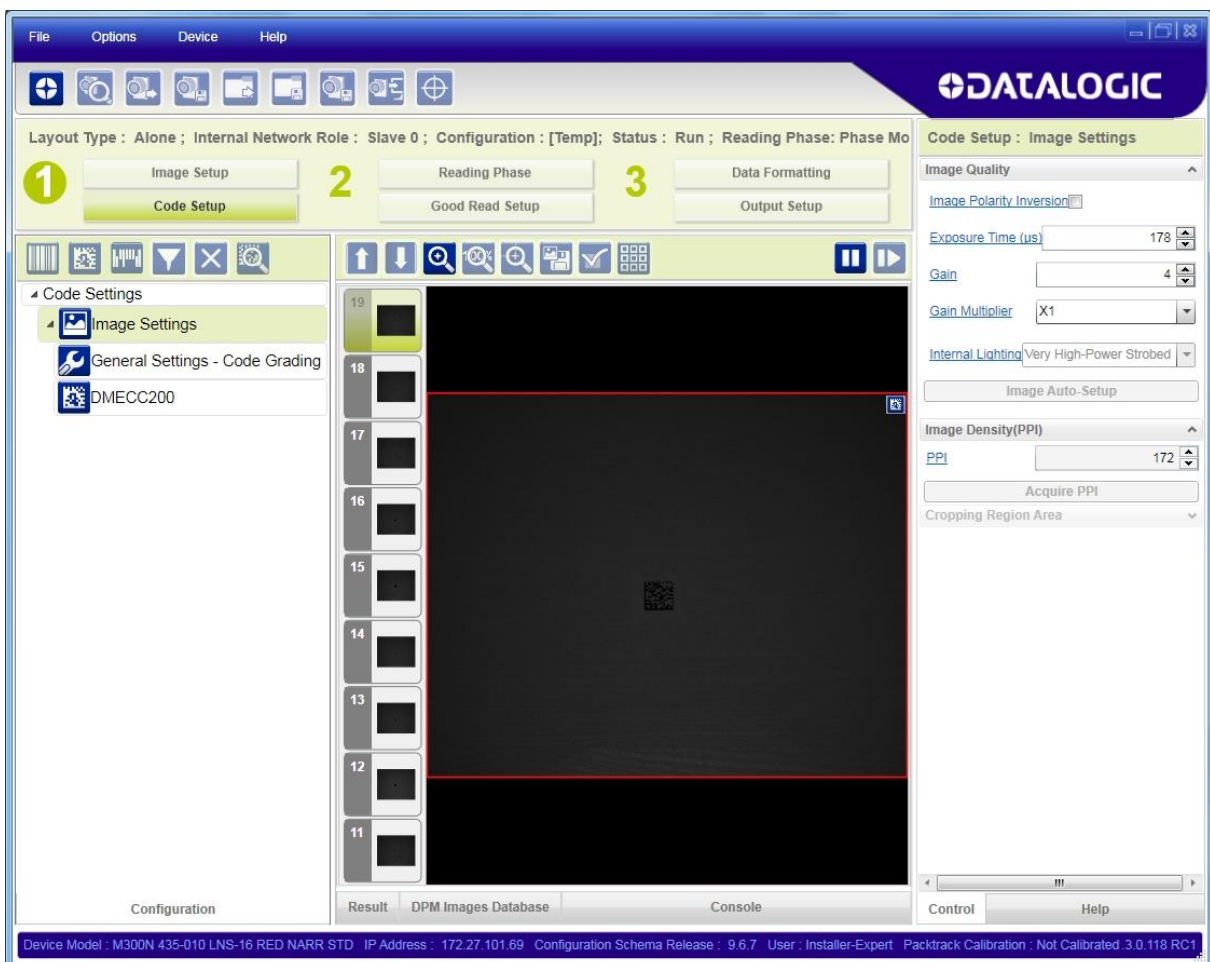


Figure 73 - Example Under Exposure: Too Dark

## 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**

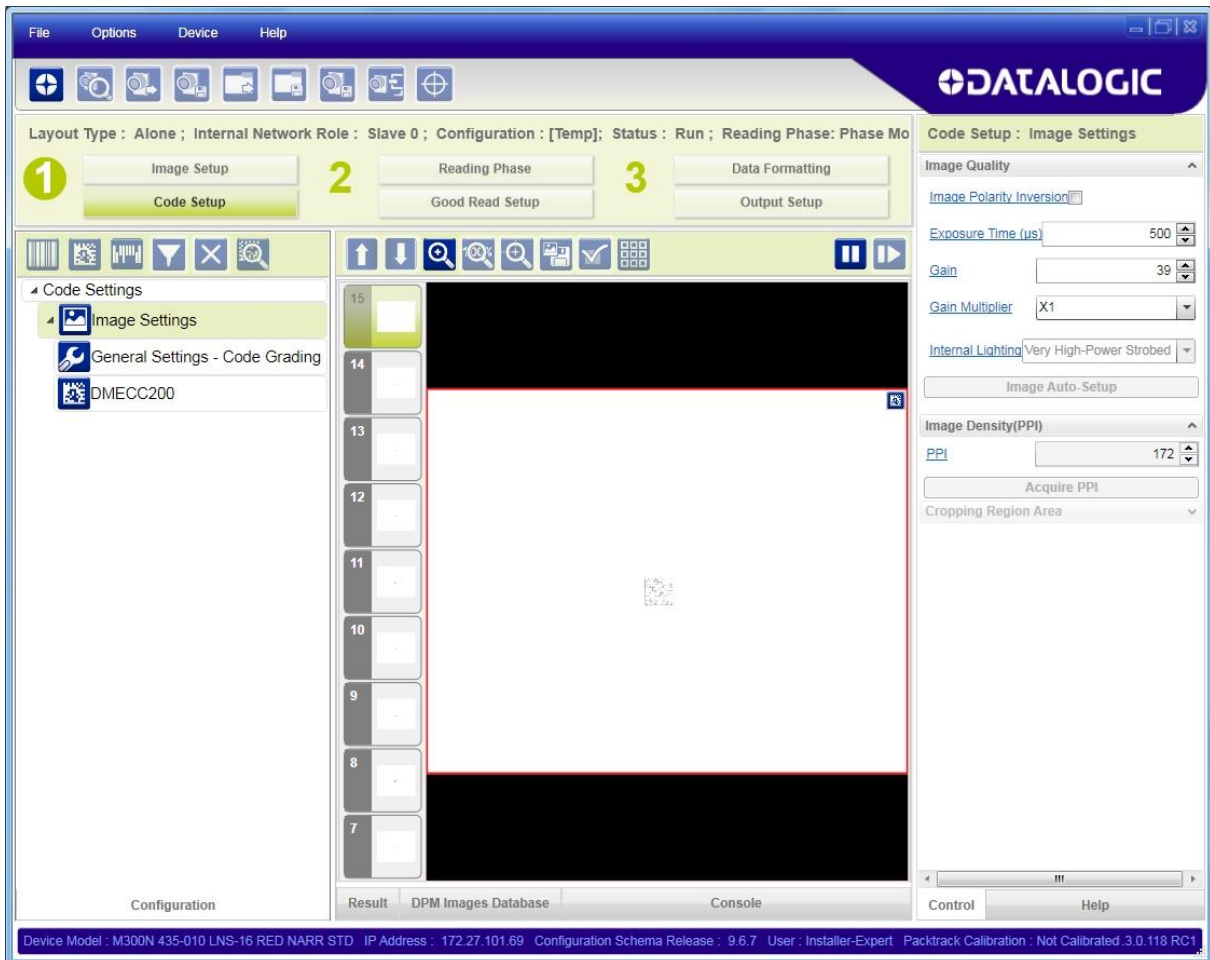


Figure 74 - Example Over Exposure: Too Light



## 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).

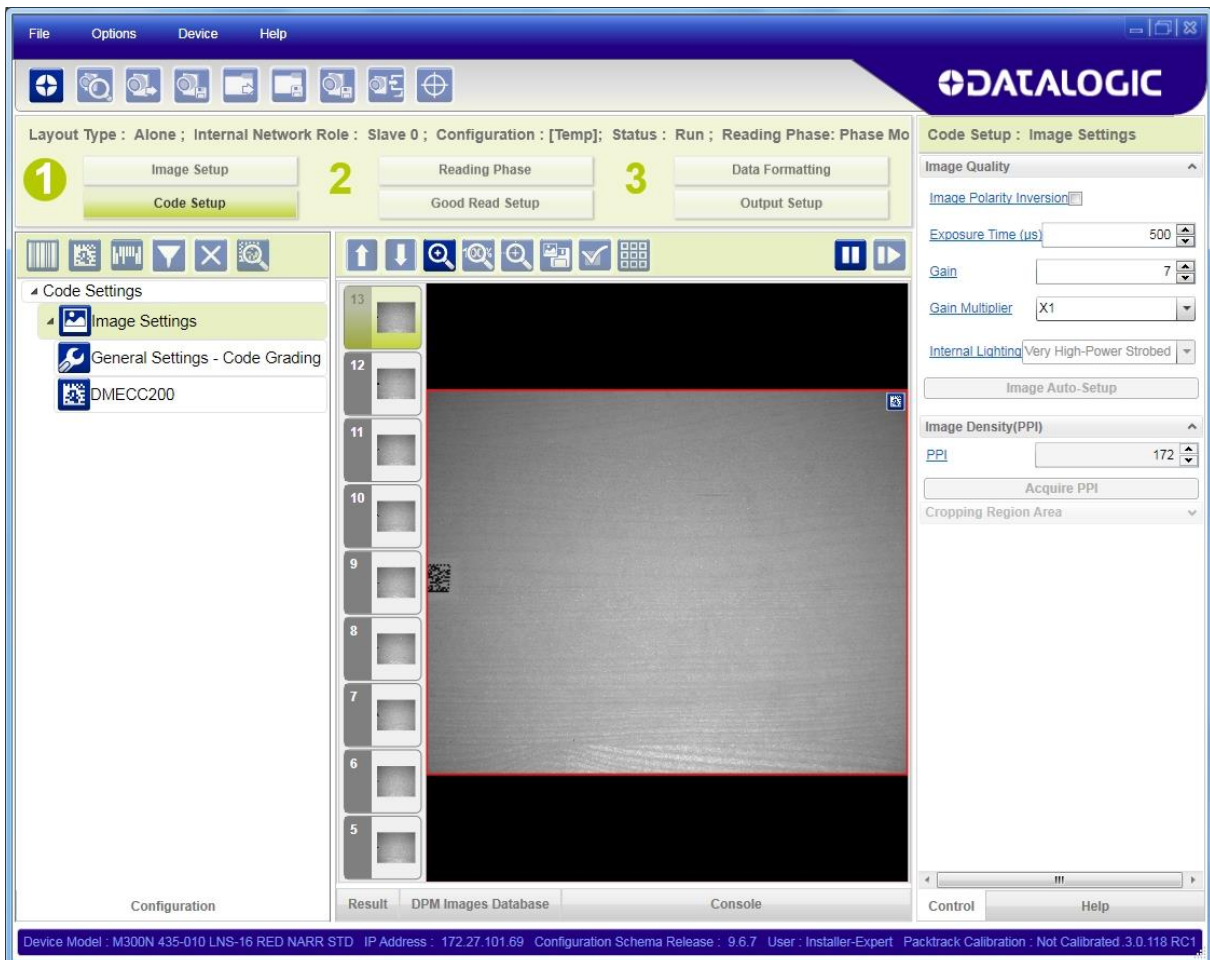



Figure 75 - Example out of FOV

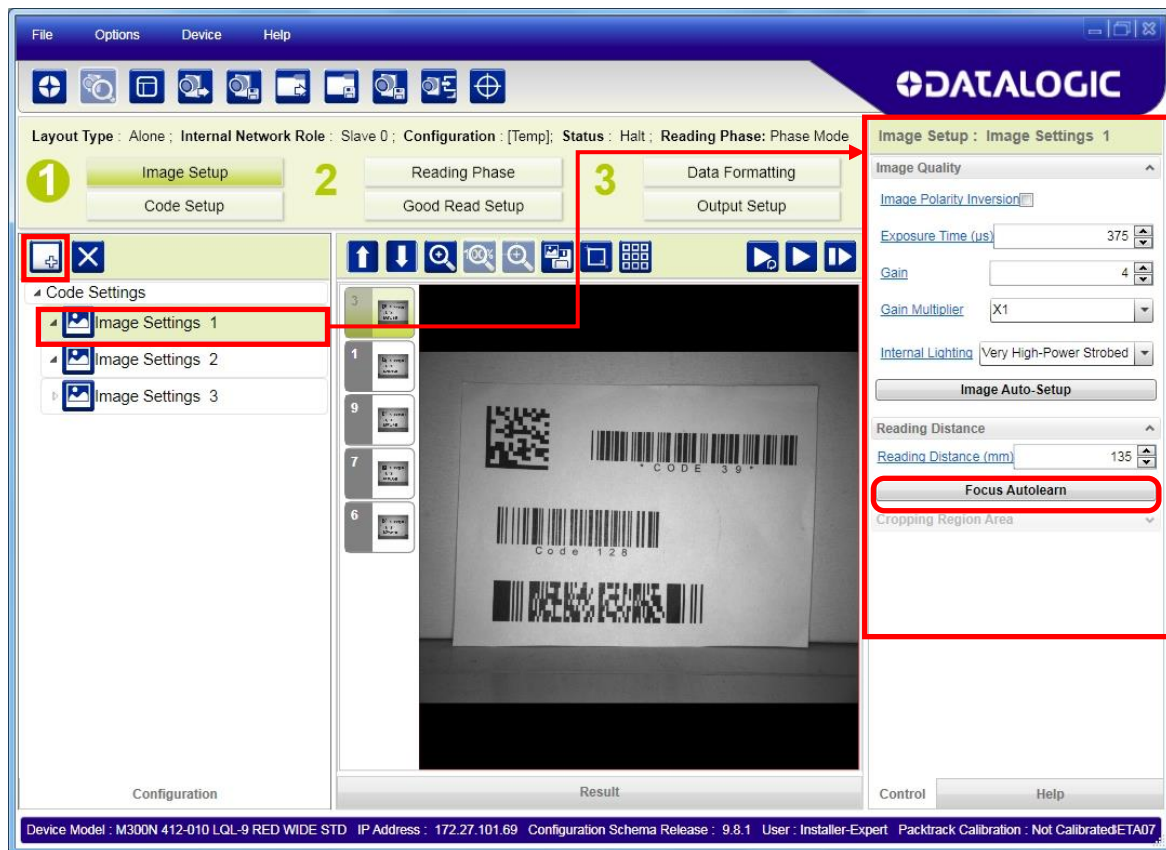
### 7.2.3 Multi Image Acquisition Settings

When controlled variable conditions occur in the application, Multiple **Image Acquisition Settings** can be defined to create a database of parameter groups that handle each specific application condition. This database of pre-defined settings improves system flexibility and readiness by being applied either automatically or selectively by an activation event.

For example, an application may have several stable but different lighting conditions which require different lighting options. One Image Acquisition Setting could enable and use an internal illuminator and another setting could enable and use an external lighting system.

This feature is available for all Operating Modes.

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

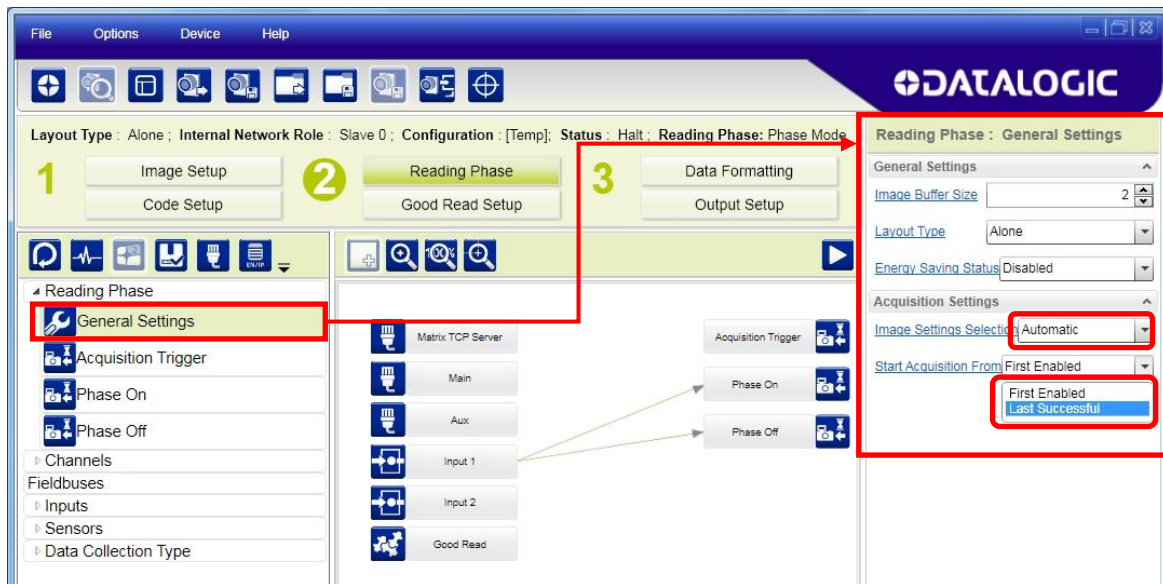


For each Image Setting condition start **Image Auto Setup**, select the Static or Dynamic Self-Tuning option; and Apply it.

## Automatic Image Settings Selection

If we don't know from one item to the next which reading condition will be presented, we will cycle through the pre-defined database of Image Settings (one per acquisition) in order to automatically capture the correctly lighted image over the course of several acquisitions. When the correct condition is matched, the result should be able to produce a Good Read.

When the **Image Settings Selection** is **Automatic** (default), then these Image Settings groups will be used cyclically.



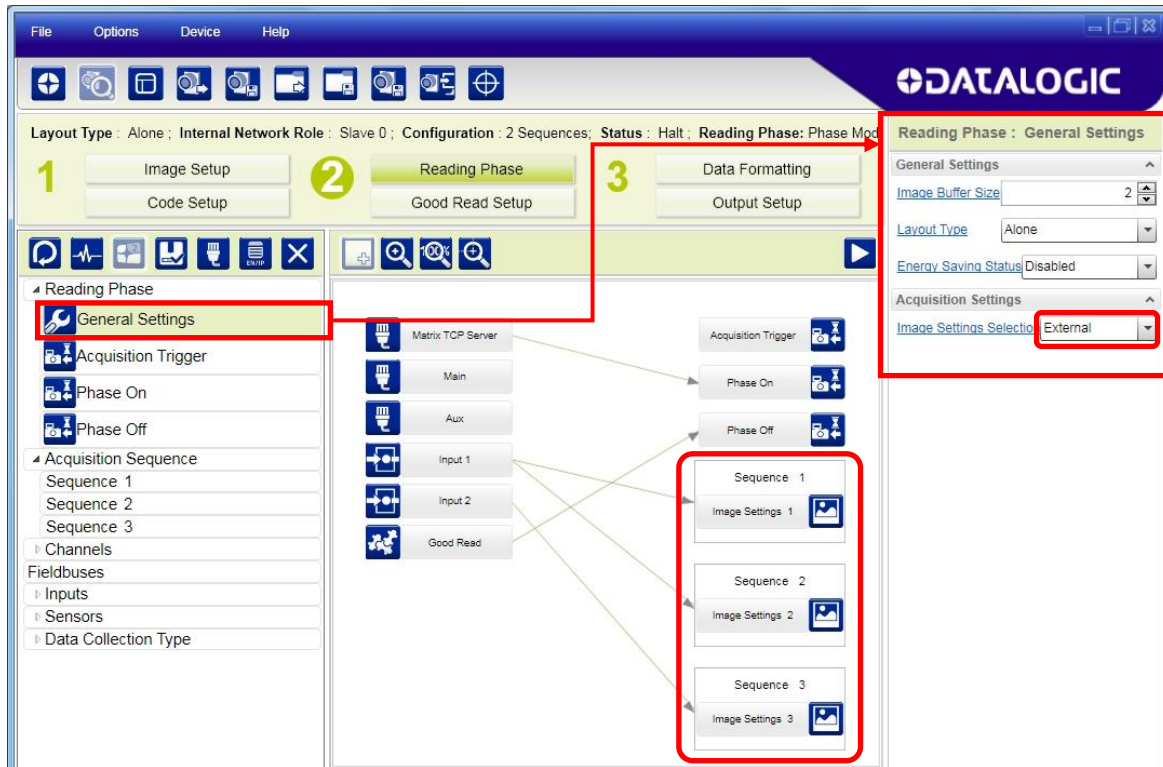
**NOTE:** Applications typically require more than one acquisition to obtain sufficient Good Read percentages. This means that for  $N$  acquisitions we will surely have captured the correct lighting condition but we will also have captured some acquisitions with the wrong lighting condition. A consequence then is that we cannot run these types of applications at the maximum speed because not all the acquisitions are useful to us. We must wait for a sufficient number of acquisitions that will guarantee a Good Read result.

If items to be read having the same lighting conditions are grouped together, then we can improve the read rate through the **Start Acquisition From** parameter. By choosing the **Last Successful** value, we will start with the Image Setting that last produced a Good Read. For this group of items the last Image Setting used will be correct for the next item and so we start each cycle with the acquisition that will potentially produce a Good Read.

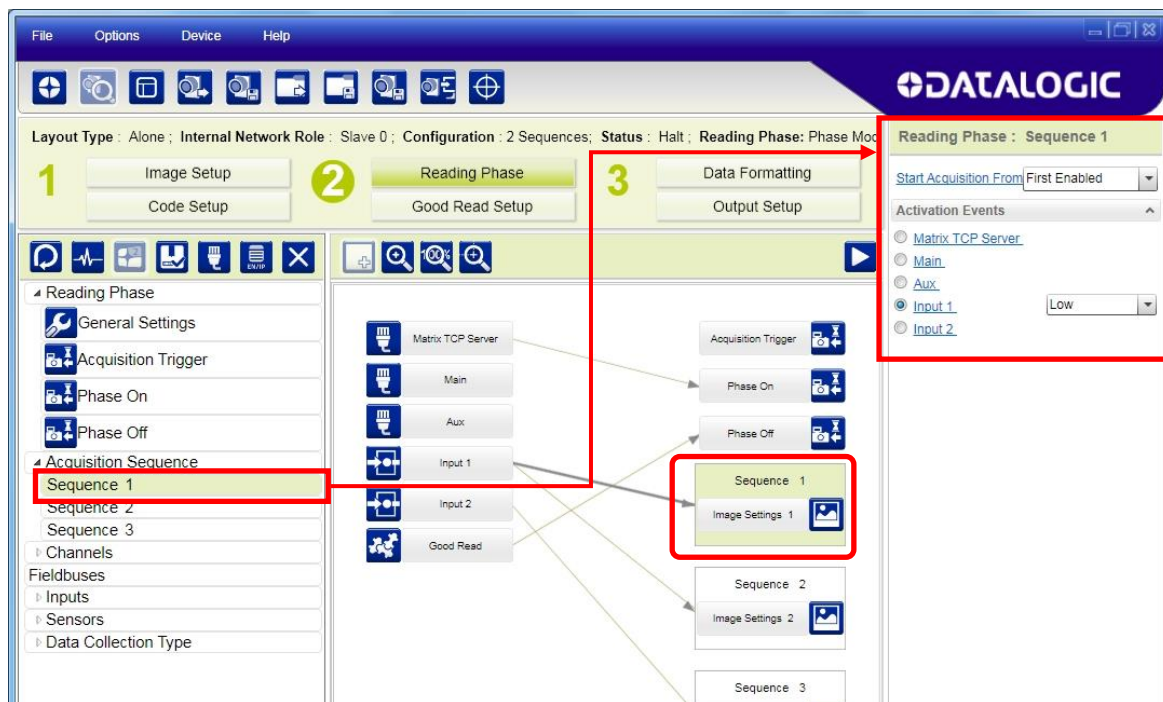
## External Image Settings Selection

There are some applications where the lighting conditions are known before each item is read and therefore we can pre-select the correct Image Setting from an external source.

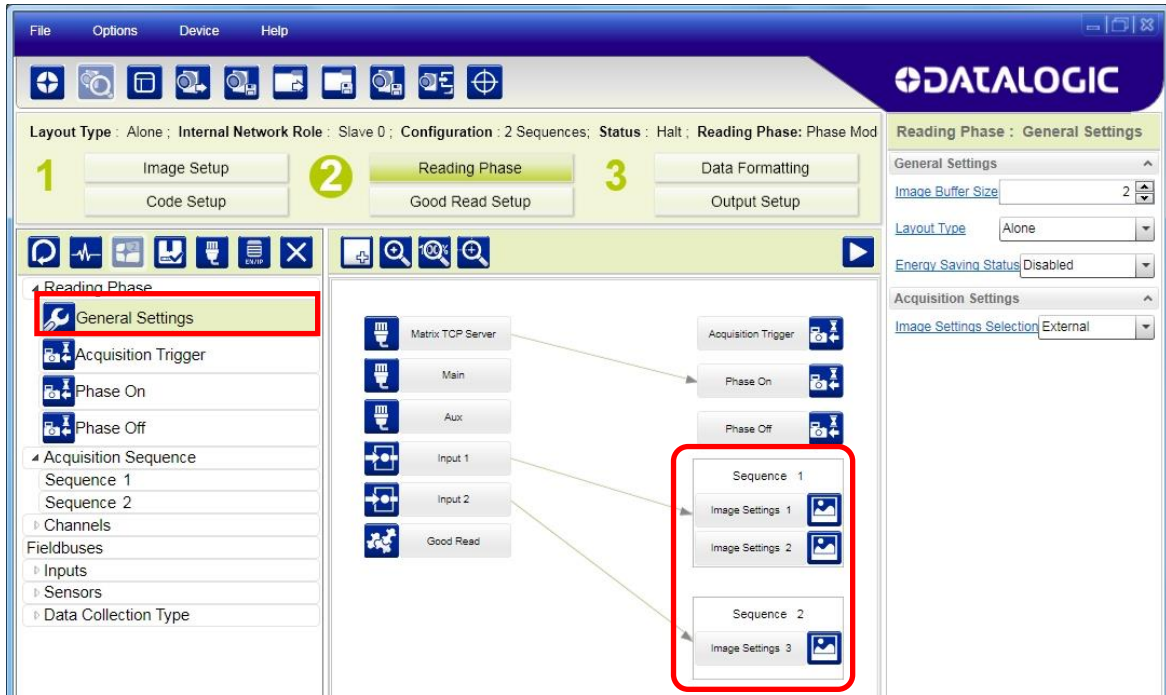
When the **Image Settings Selection** is **External**, Acquisition Sequences are created and by default each Image Setting has its own Acquisition Sequence.



Each **Acquisition Sequence** can be activated exclusively by a single event, either through a string from an available communication channel or by a digital input.

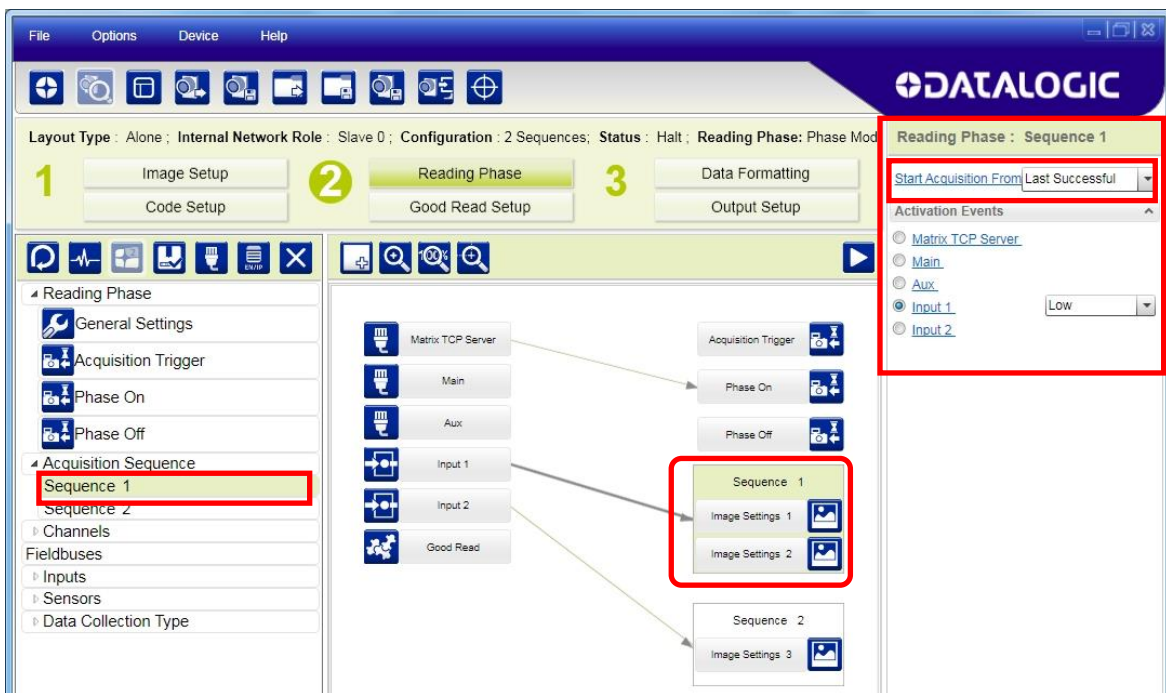


Alternatively a hybrid configuration can be made where more than one **Image Setting** can be grouped into an Acquisition Sequence by dragging it into the desired Sequence box. Select the empty Sequence box and delete it with the delete key.



Each **Acquisition Sequence** can be activated exclusively by a single event, either through a string from an available communication channel or by a digital input.

In this case the **Start Acquisition From** parameter can improve the read rate for that Sequence. It has no meaning for a Sequence containing only one Image Setting.



### 7.2.4 Extending DOF Using Automatic 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. 7.2.5. 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 Automatic.

#### Multi Image Acquisition Settings Procedure using Automatic 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 **Automatic** (default). Then **Save on Device**.
4. Verify that the reader decodes at both distances with the DL.CODE Monitor.

## 7.2.5 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 **Automatic**.

### 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.

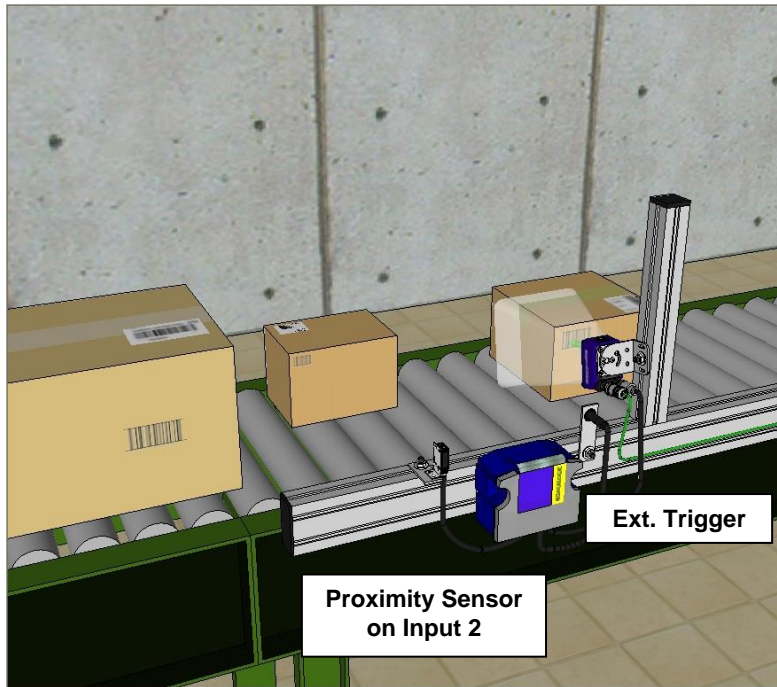


Figure 76 - Example Extending DOF Using External Image Settings Selection

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.



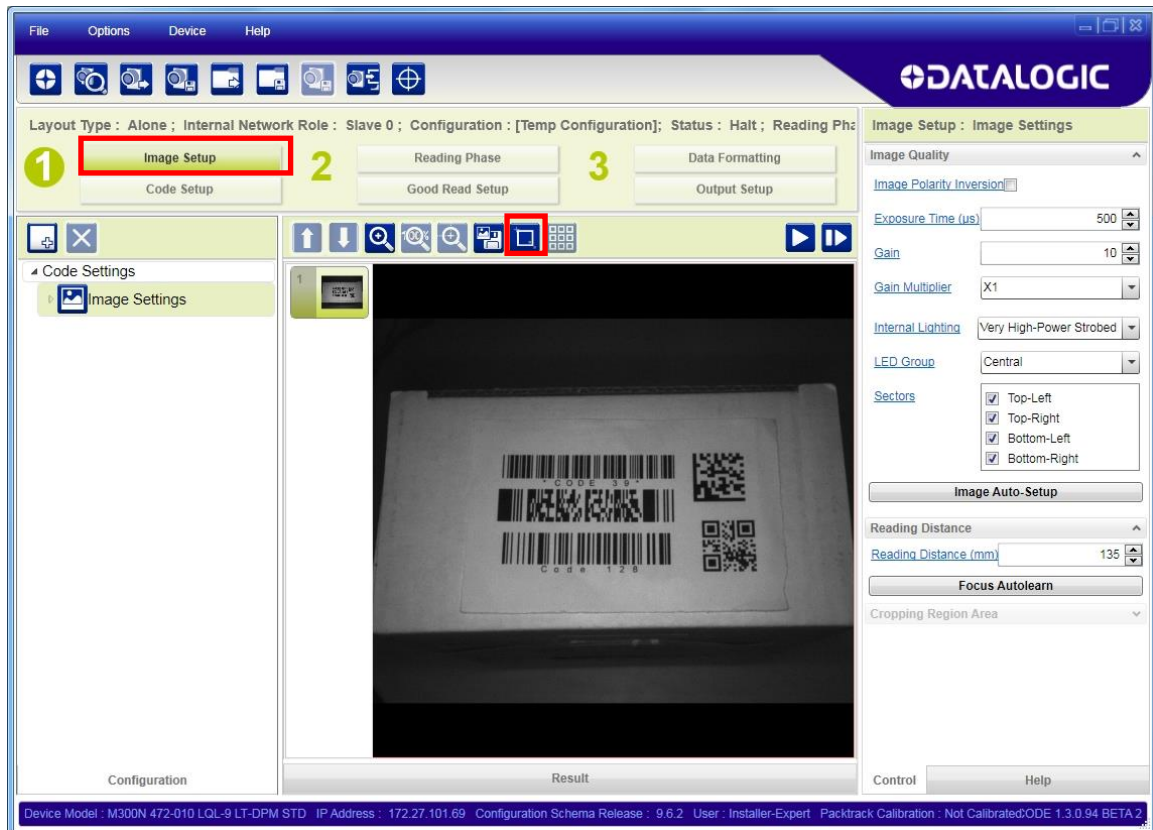
**NOTE:** The **Acquisition Sequences** (and therefore **Image Settings**) can alternatively be pre-selected by a string from an available communication channel instead of a digital input. In any case the activation event is exclusive (only one).



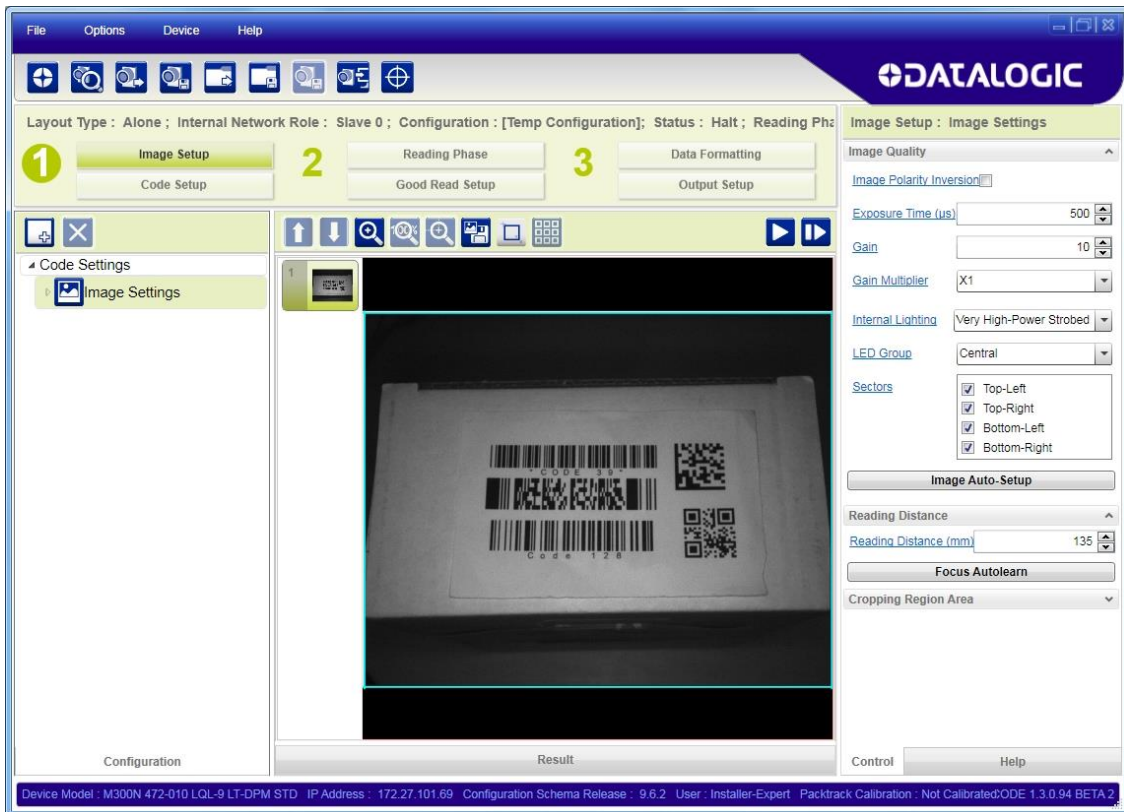
## 7.2.6 Image Cropping

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.

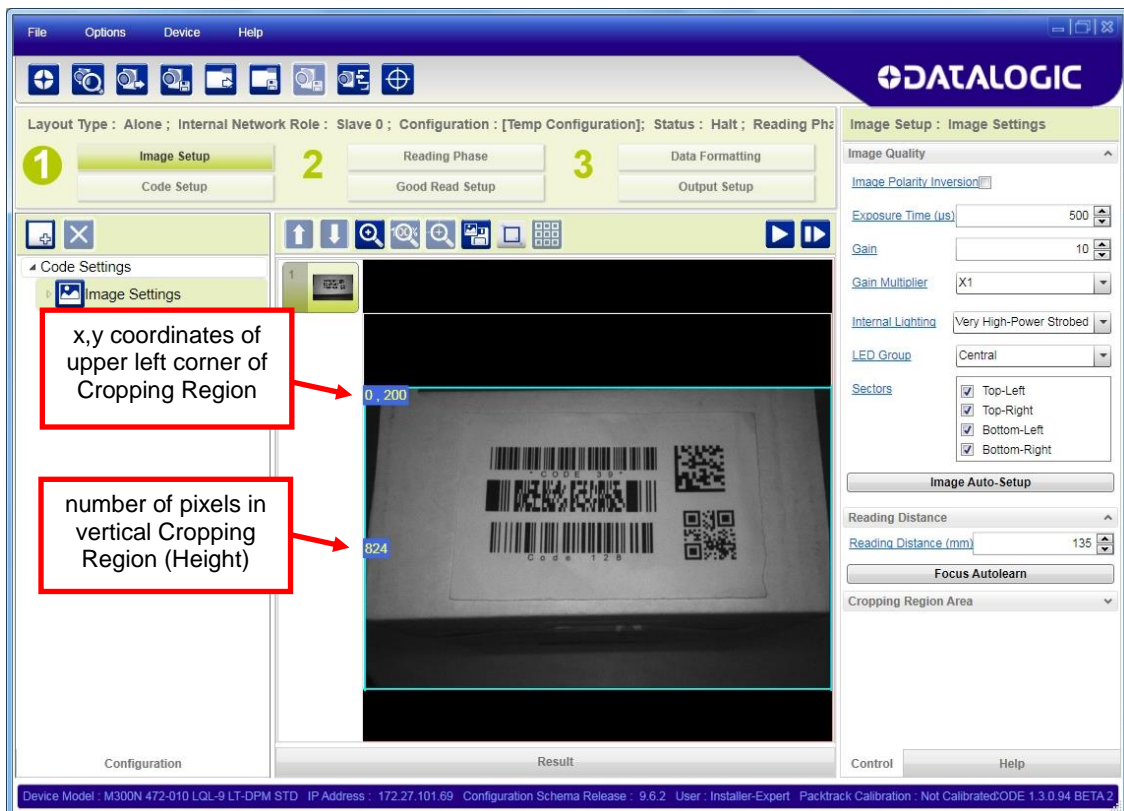
In Matrix 300N the frame rate is dependent on the number of rows and columns in the defined window. Image cropping allows reducing the Image processing area from the full FoV to a smaller area where codes are present. By excluding portions of the FoV, processing time is reduced.



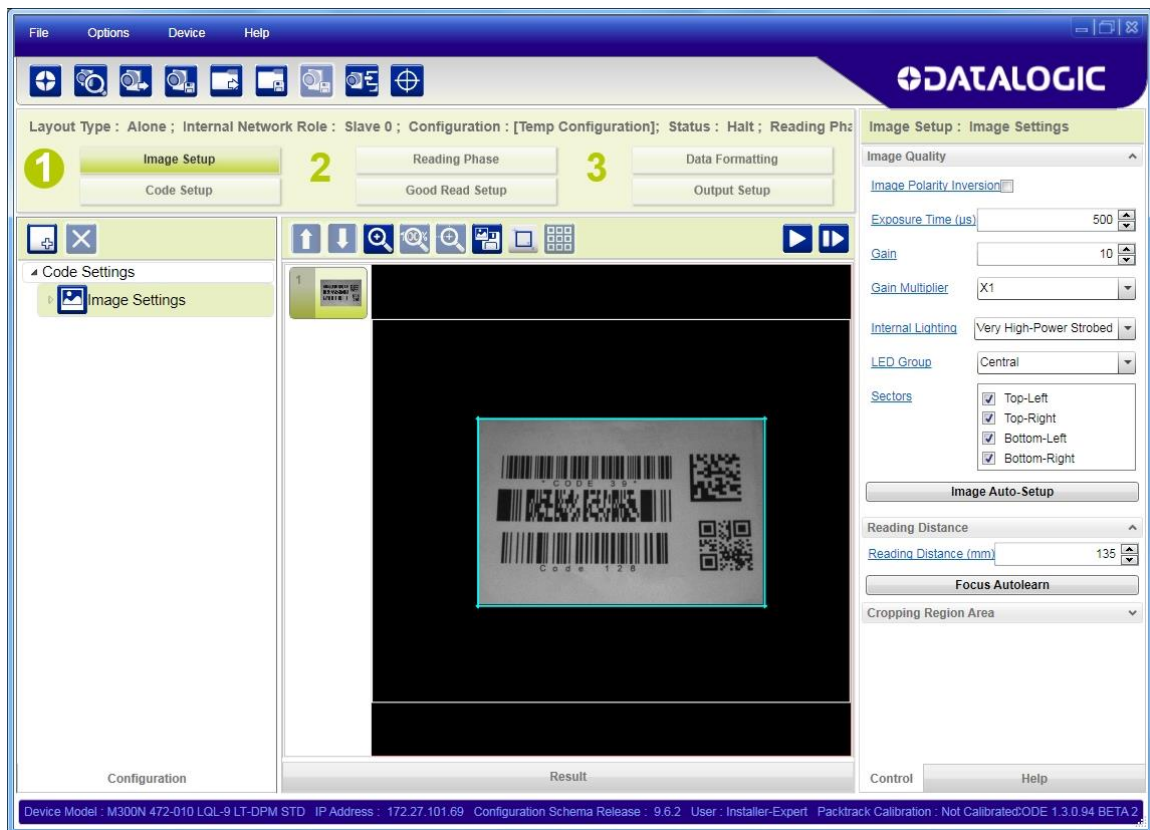
After clicking the Add Cropping Region icon, a blue border appears which by default is equal to the FoV.



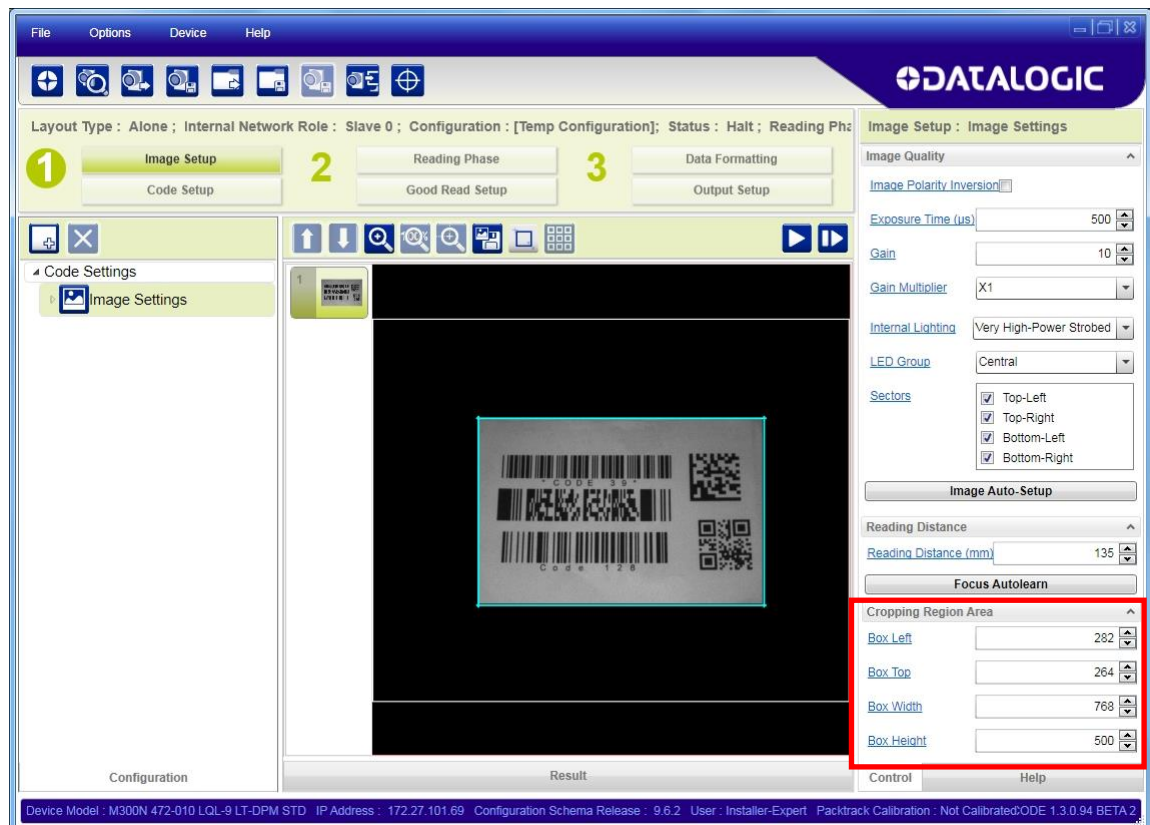
By dragging the edges with the mouse (resizing) you can crop the image to a specific location where codes are present. The numbers in the blue boxes refer to pixel references.



The cropped area can be moved by dragging the center.



You can also set the cropped image size and position through the Cropping Region Area group of parameters; size = **Width** and **Height**, position = **Left**, **Top** (x,y) coordinates.



## 7.2.7 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.**

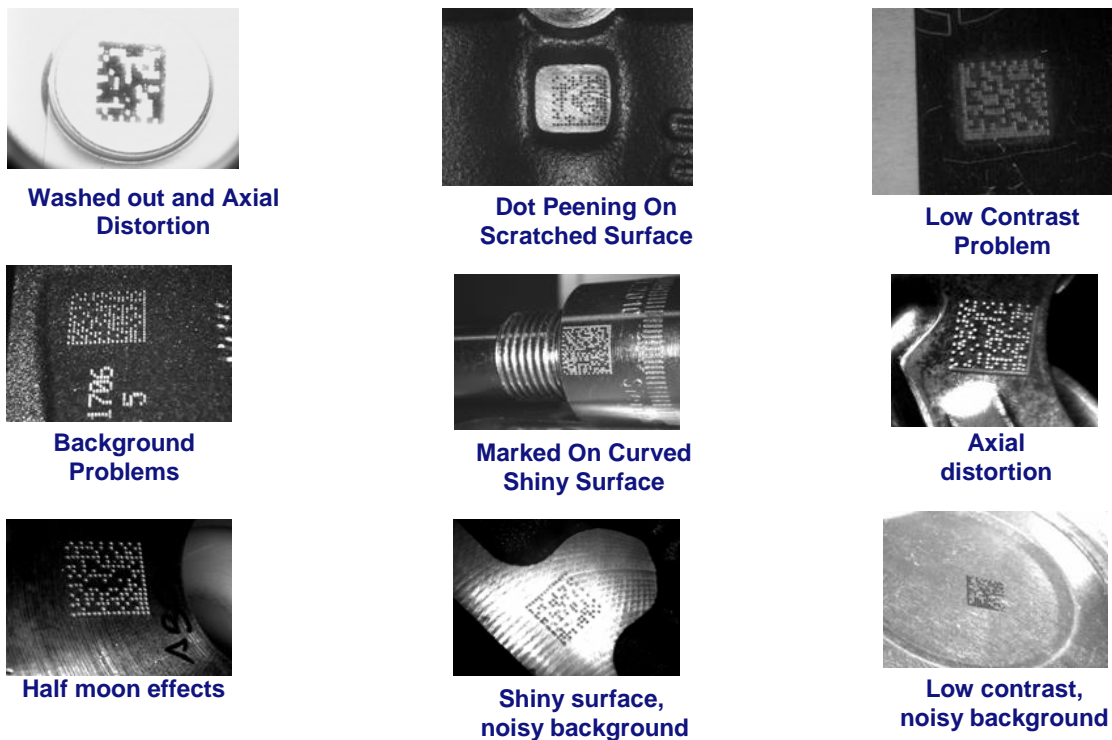


Figure 77 – Problematic Direct Part Marking Examples

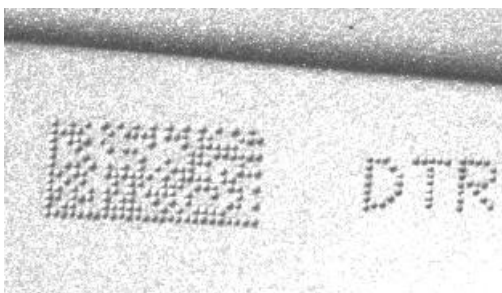
For **QR** code the **Decoding Method** parameter allows the Dot Peen Decoding algorithm to be selected which improves the decode rate for low quality Direct Part Mark codes and in general for Direct Part Mark codes with dot peening type module shapes.

## Image Filter

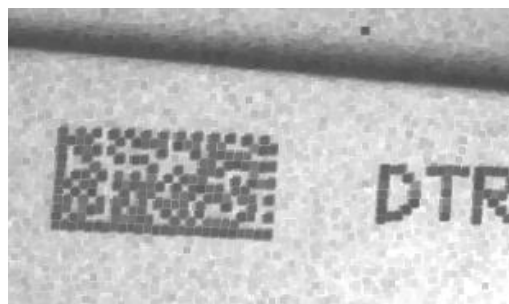
Sets the filter to be applied to the image before being processed. This parameter can be used to successfully decode particular ink-spread printed codes (ex. direct part mark codes).

Different filters can be applied to a single code or group of codes in one or more **Image Settings**. See the DL.CODE User's Manual for examples of Image Filter application.

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



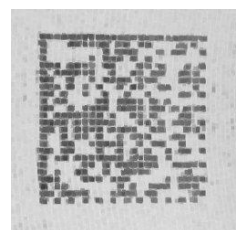
After - Readable

### Dilate

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



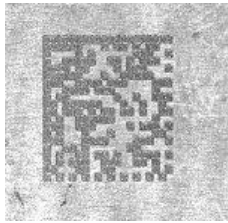
Before - No Read



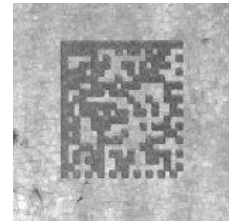
After - Readable

### Close

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



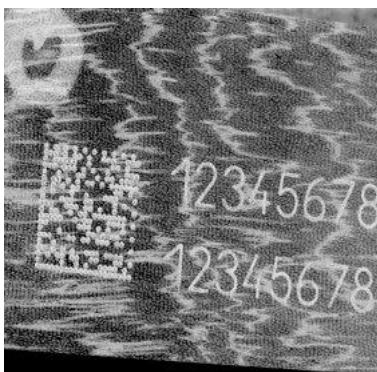
Before - No Read



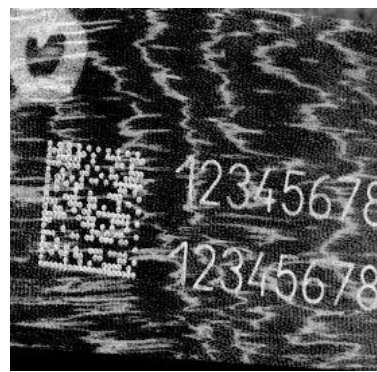
After - Readable

### 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.



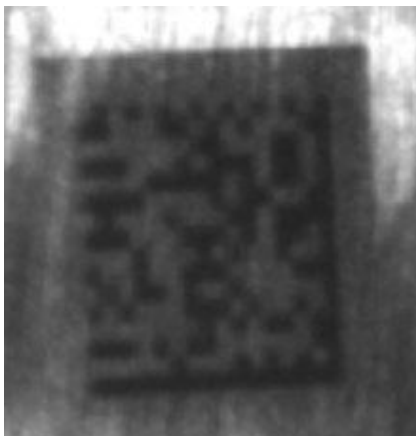
Before - No Read



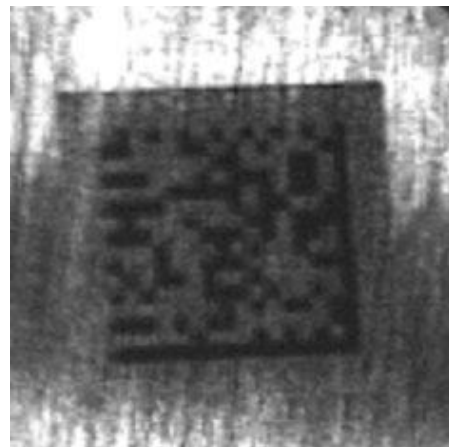
After - Readable

### Smoothing

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



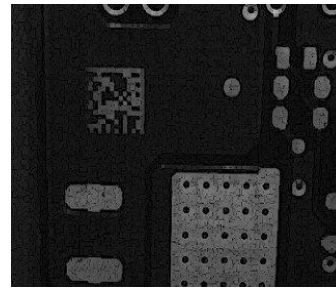
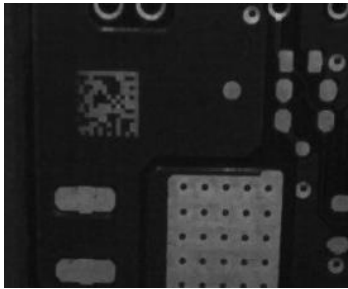
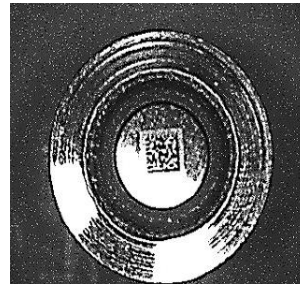
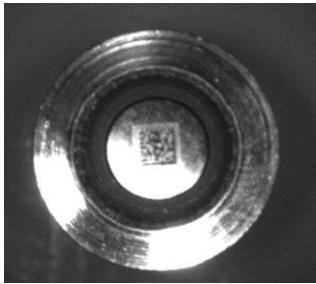
Before - No Read



After - Readable

### Sharpening

The **Deblurring** filter improves blurred images.

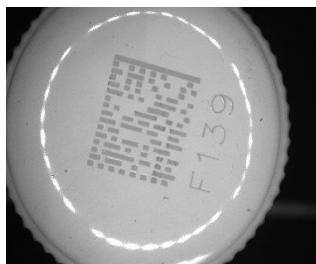


Before - No Read

After - Readable

### Deblurring

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

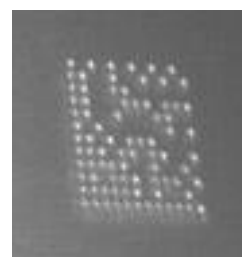


Before - No Read

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

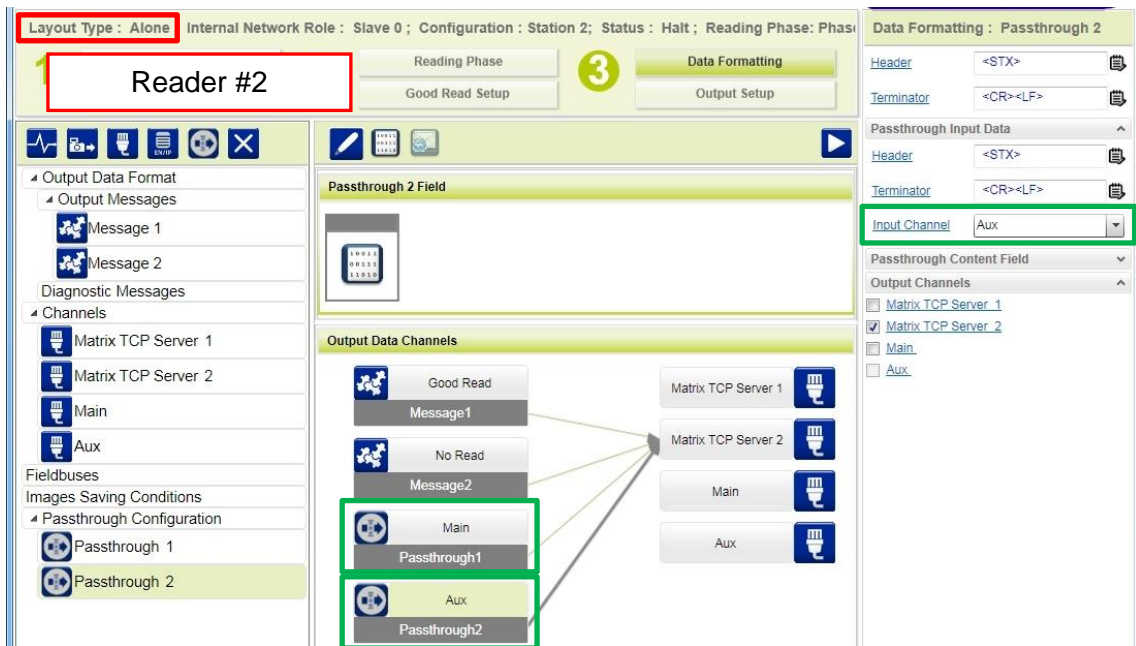
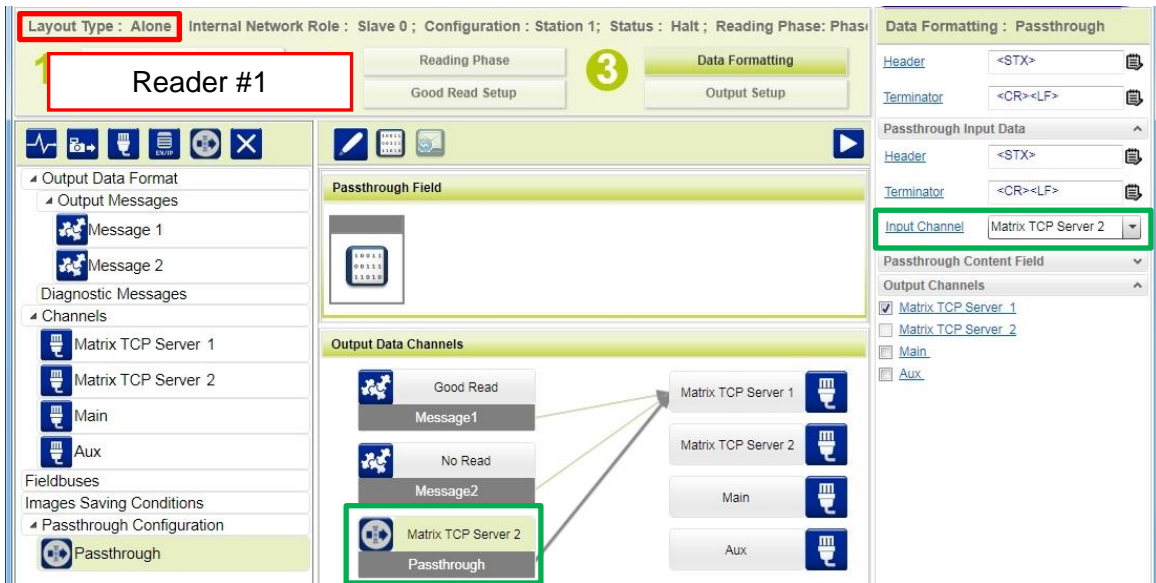


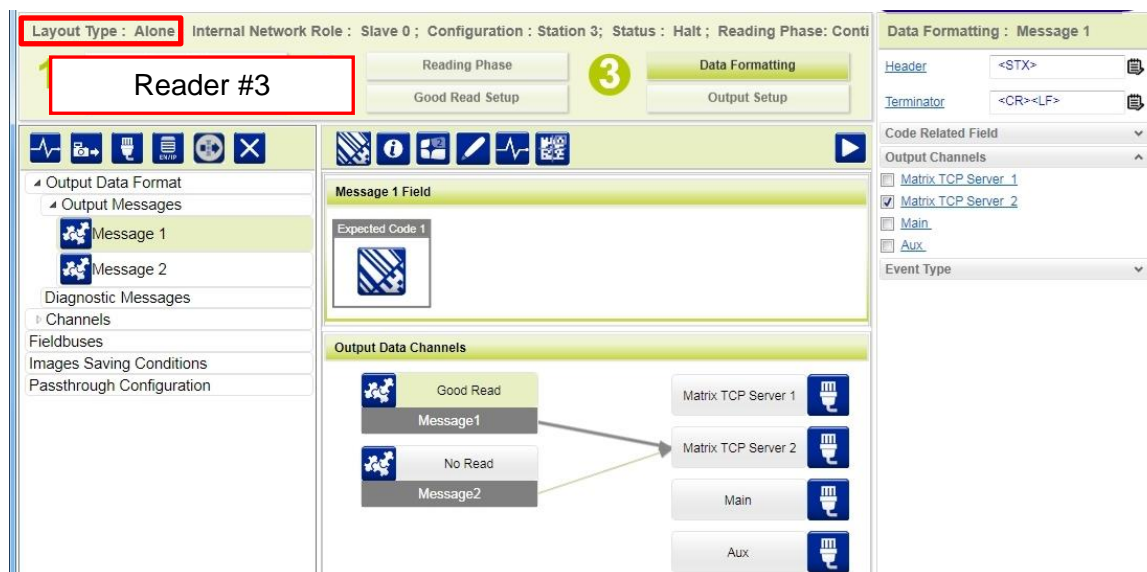
### 7.3 PASS-THROUGH CONFIGURATIONS

Starting from software version 1.3.0, DL.CODE and Matrix N family readers support pass-through multi device configurations.

The pass-through configuration allows individually working devices (Alone), to collect data from other devices (also working Alone), and pass this data to a third device through a different communication channel.

The following screenshots show the pass-through configuration settings for the three devices in the example in par. 5.4.





## 7.4 INTERNAL NETWORK CONFIGURATIONS

Internal Network 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.

DL.CODE has a Net Autoset feature for the Internal ID-NET Network which automatically recognizes and assigns addresses to all connected Slave readers.

In order to automatically recognize the ID-NET Slaves, all devices must be physically installed and electrically connected (including ID-NET network wiring).

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

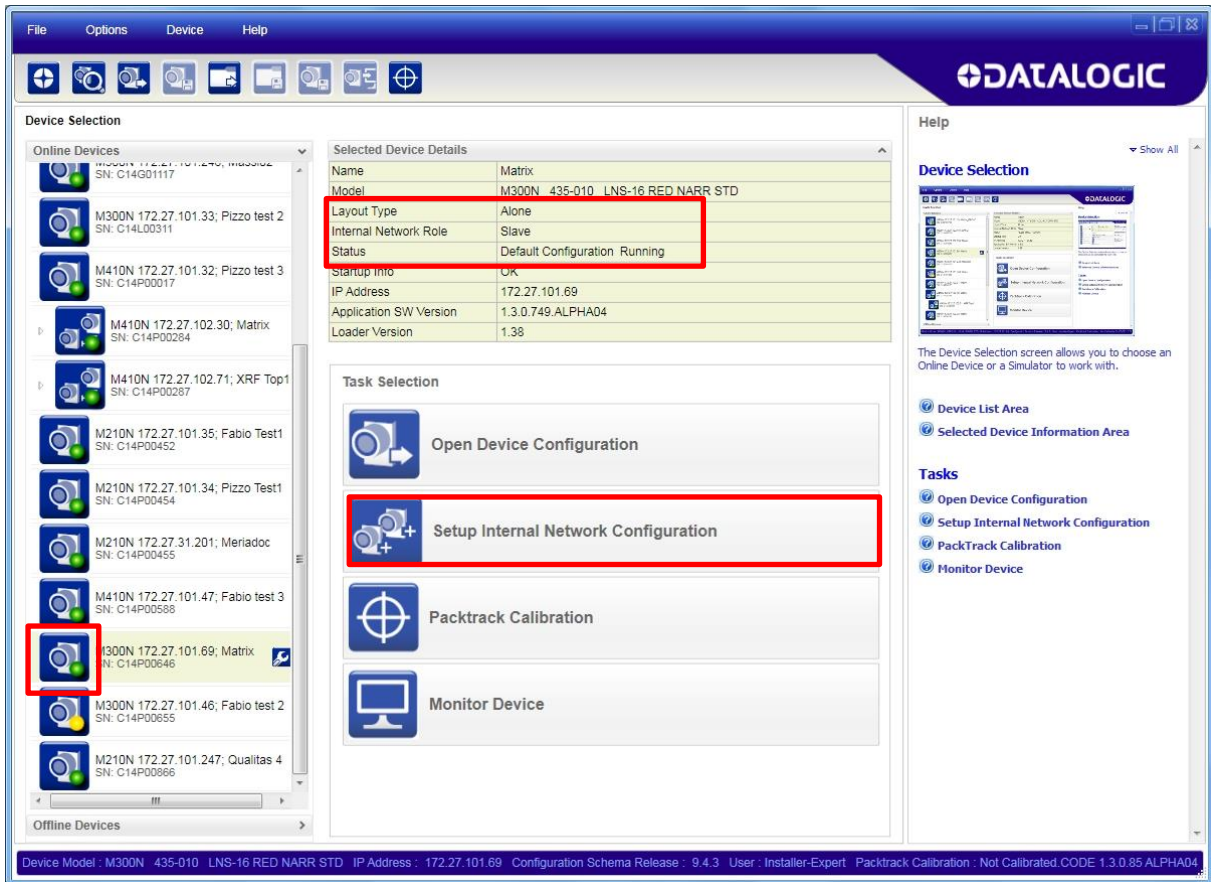
1. Mount all the readers mechanically (refer to par. 3.2 and 3.3) and electrically (refer to par. 4.3) with factory default settings (Layout Type = Alone, Internal Network Role = Slave).

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 the **Setup Internal Network Configuration**. You will be prompted to change the device to Master. Click OK. The Slave units will automatically be recognized. See par. 7.4.1.
3. Depending on the application, select Multidata, Synchronized Phase Mode or Synchronized PackTrack Configuration.
4. Connect to each Slave reader via Ethernet and set the Slave specific parameters depending on the application type. Save each Slave specific configuration. See par. 7.4.2 or 7.4.3.
5. For Synchronized networks Verify/Test network performance. See par. 7.4.4.
6. Perform the **Backup current Internal Network configurations** procedure. See par. 7.5.1.

## 7.4.1 Master Configuration

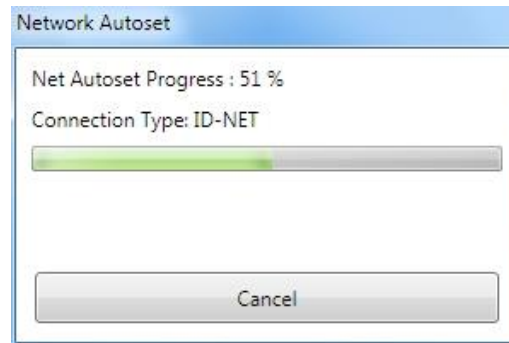
First start with the desired device to assign as ID-NET Master (current default setting is Slave). Click on Setup Internal Network Configuration from the Task area.



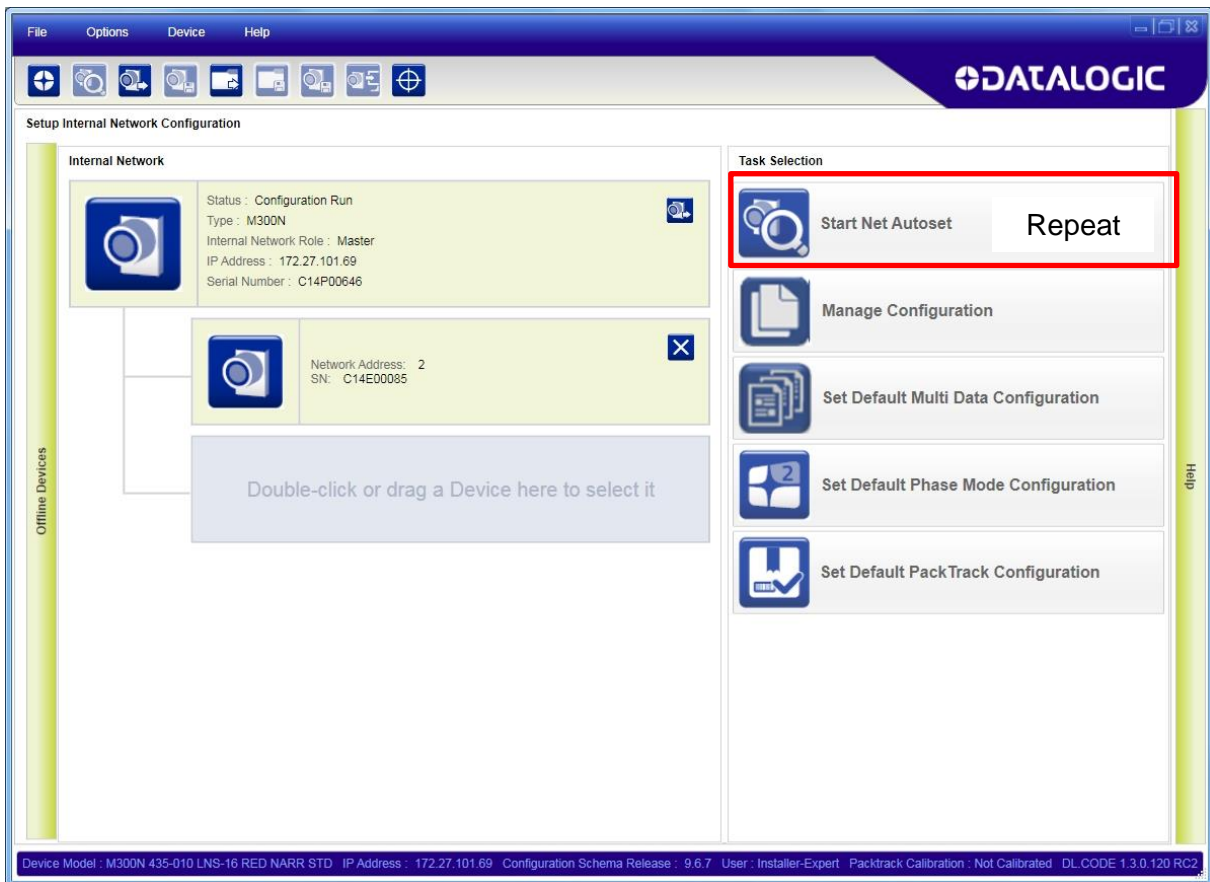
You will be advised that the device role will be changed to Master.



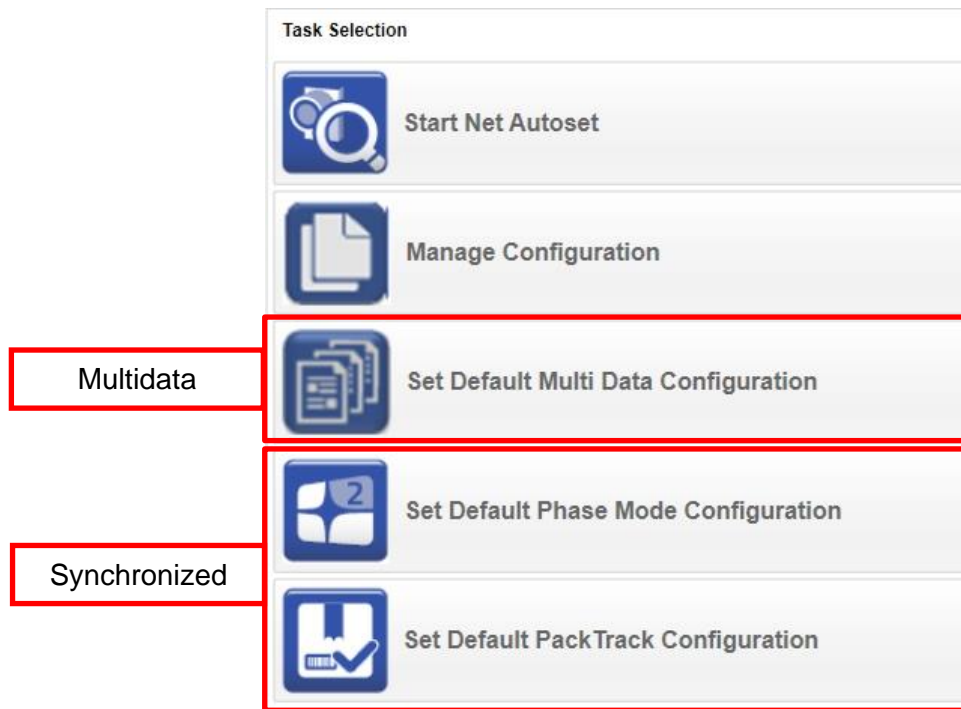
Click OK. The Net Autoset feature automatically starts to find Slave devices connected to the ID-NET network of the Master.



When finished, all the Slaves should have been correctly recognized. If not, verify all device connections and power and then repeat the operation by clicking on the Start Net Autoset button.



Depending on the application, select one of the Default Internal Network Configurations: **Multidata**, **Synchronized Phase Mode** or **Synchronized PackTrack**.



This selection will open a pre-configured job for the Master reader according to the selection. Follow the specific application instructions in the following paragraphs.

## 7.4.2 Multidata ID-NET Network Configurations

The Multidata ID-NET network communications between Master and Slave are managed by the application job (configuration) using the pass-through feature. A pre-configured job is loaded with the correct pass-through settings for both the Master and Slaves when the Default Multidata Configuration is selected from the Internal Network Setting feature.

1. Complete the configuration of all the application parameters (including Image Setup) and save them to the Master with an application specific name and **without** the option to **Clone Master configuration on Slaves**.

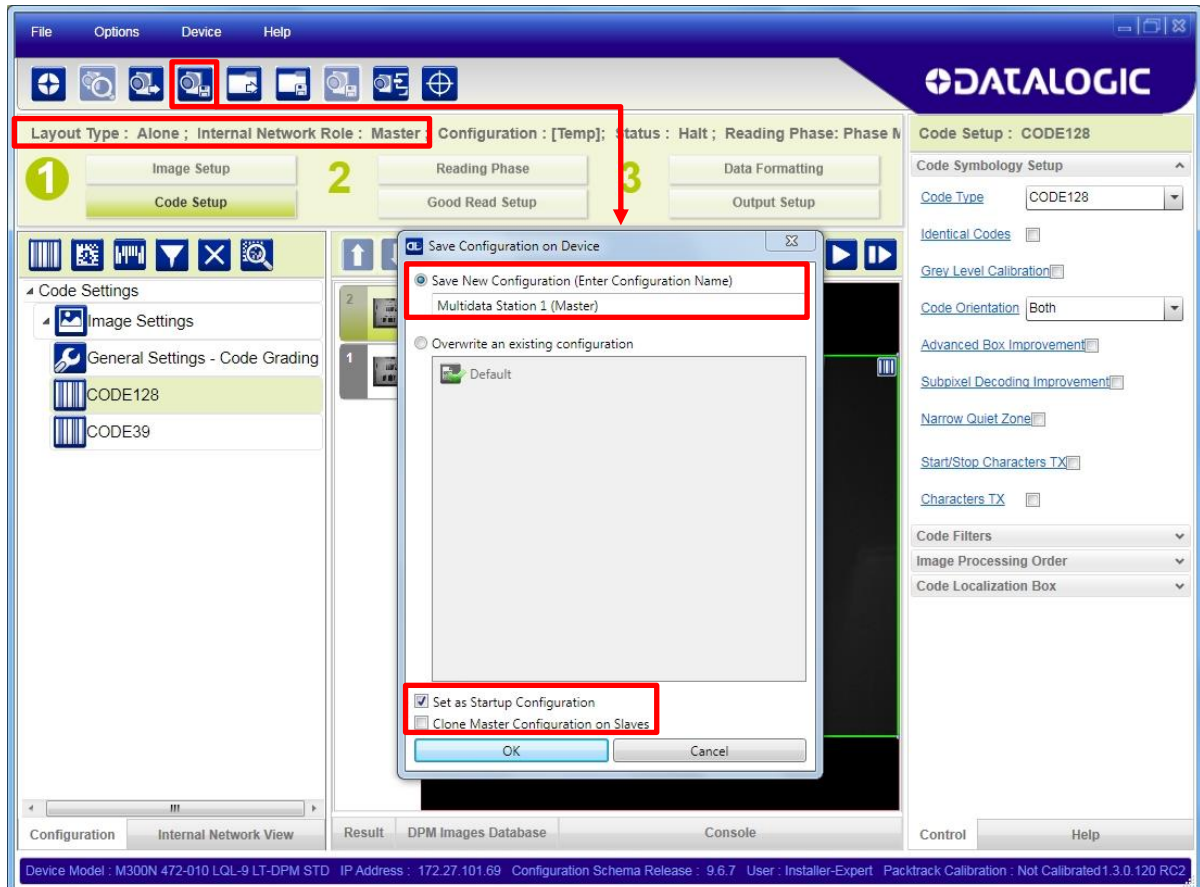


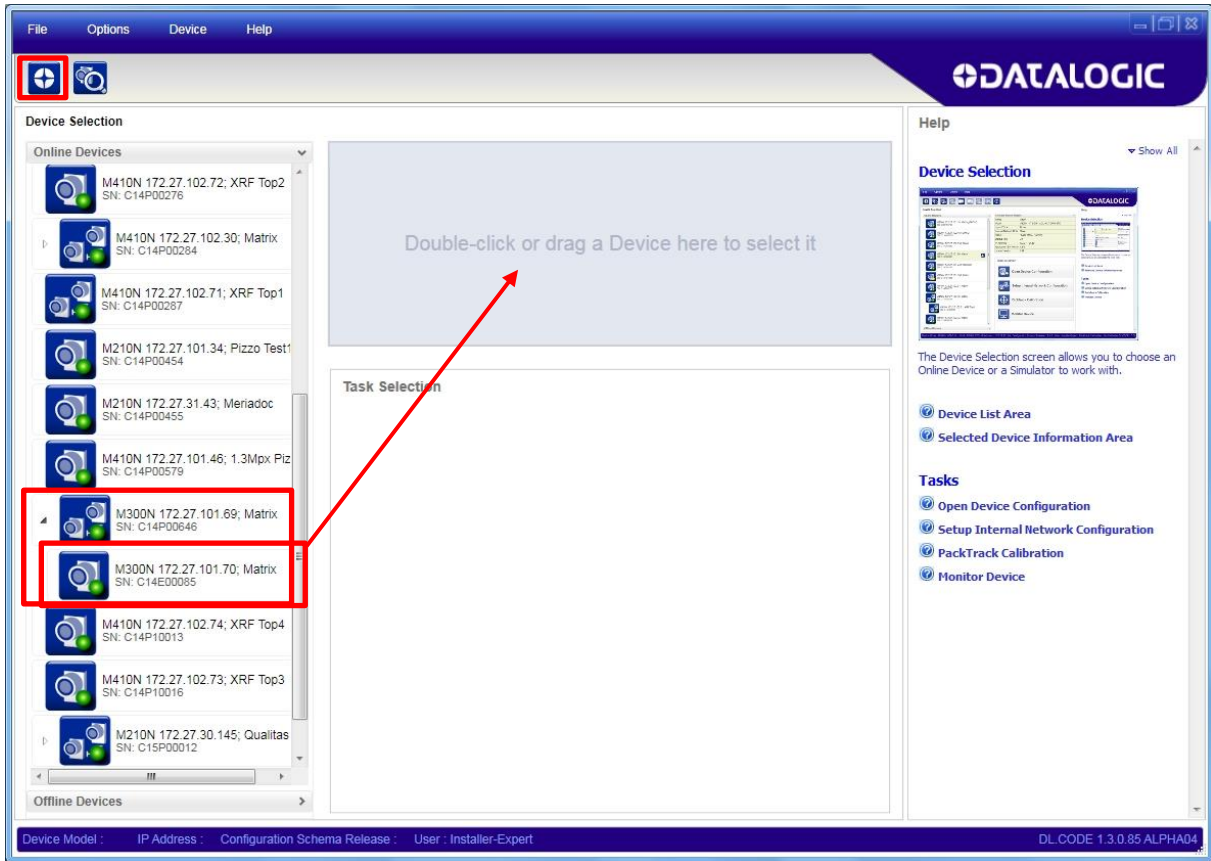
Figure 78 – Saving Multidata Configuration to Master

The jobs must not be cloned because the Master and Slaves have different input/output communication channels. The readers are also working independently from each other, often on separate stations with different code reading requirements, different operating modes, etc.

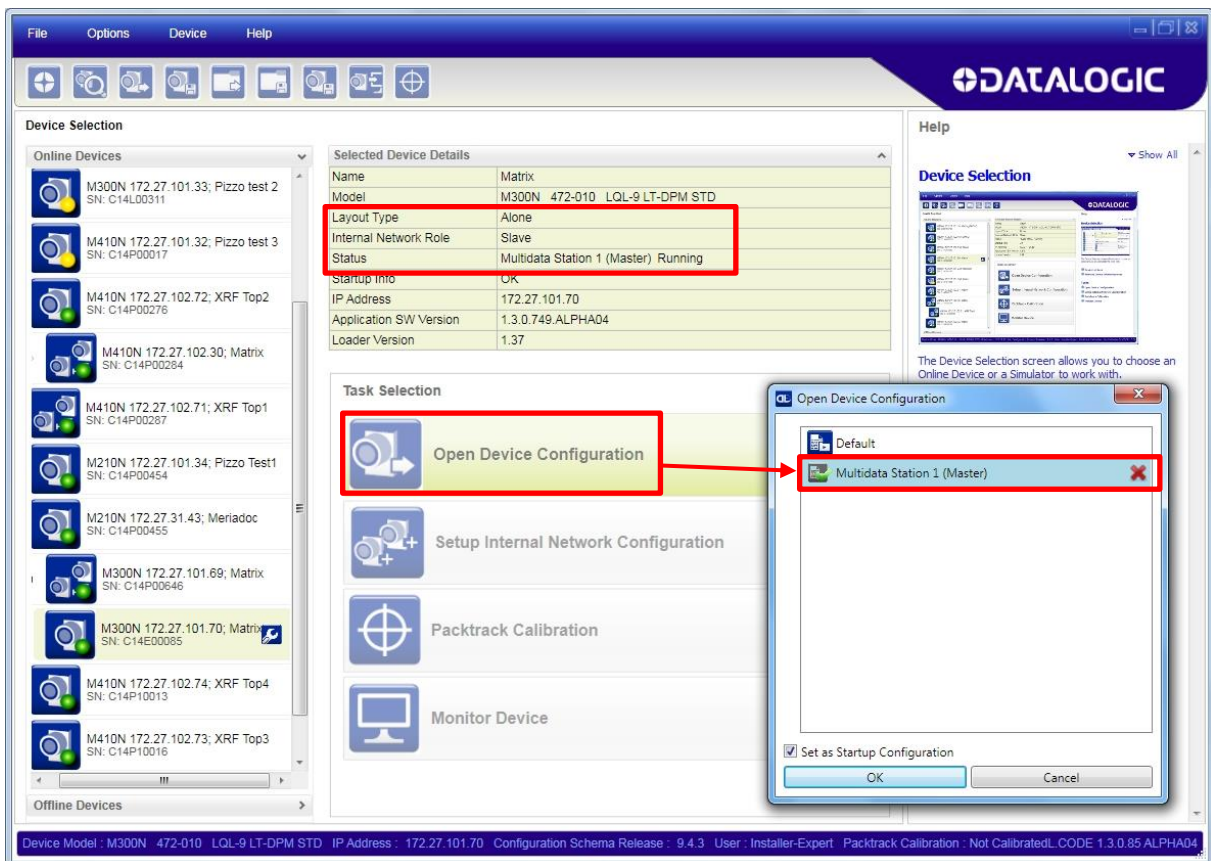
2. Connect to each Slave reader via Ethernet (see note below), and set all the configuration parameters of each Slave device.



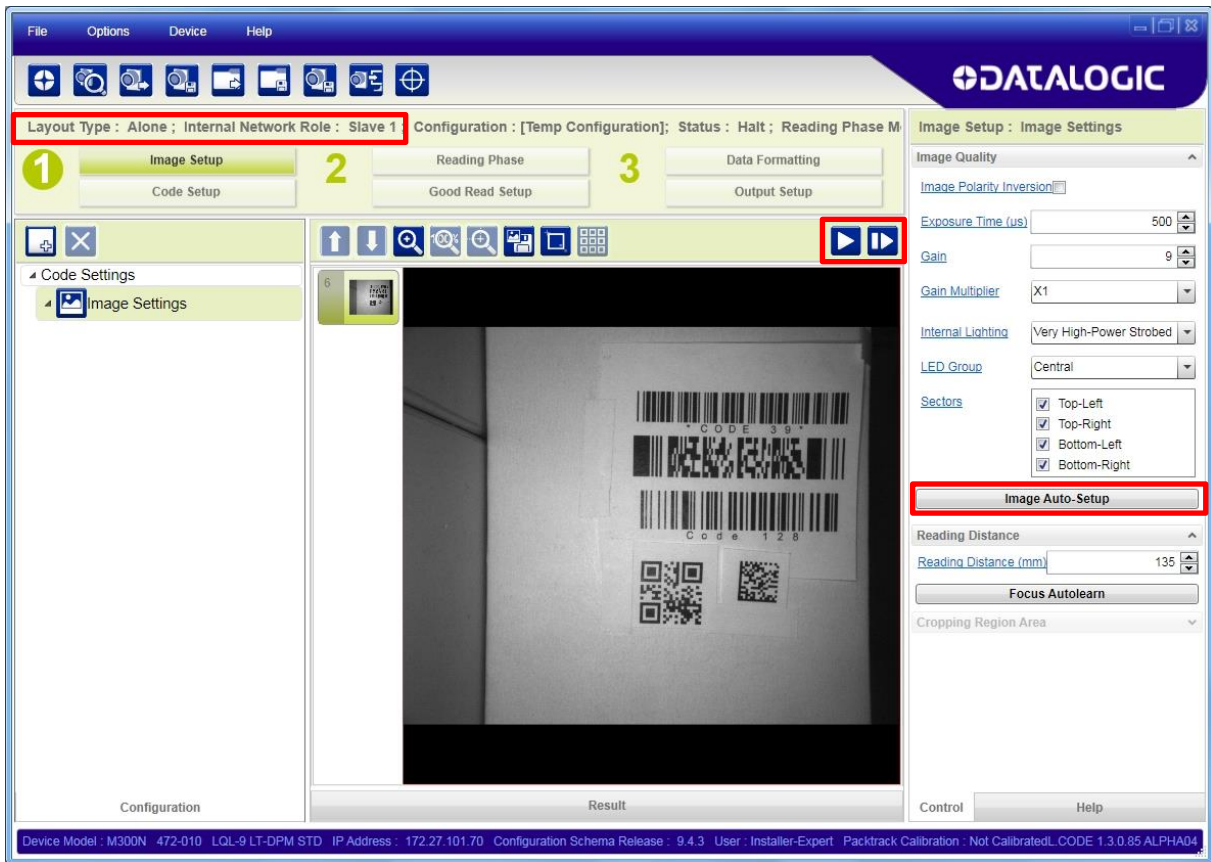
**NOTE:** If necessary, Slave device photometric (Image Setup) parameters must be configured separately through DL.CODE. This is preferably done through each device's Ethernet TCP/IP channel. If Slave devices are not connected to Ethernet you must temporarily (manually) connect them one by one to perform Image Setup.




Open the **Slave specific application** job, (the first time it has the Master Specific name).



When the configuration opens, pause run mode and set all the application specific configuration parameters (including Image Setup).



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



3. Now save them to a new Slave specific application job<sup>3</sup>.

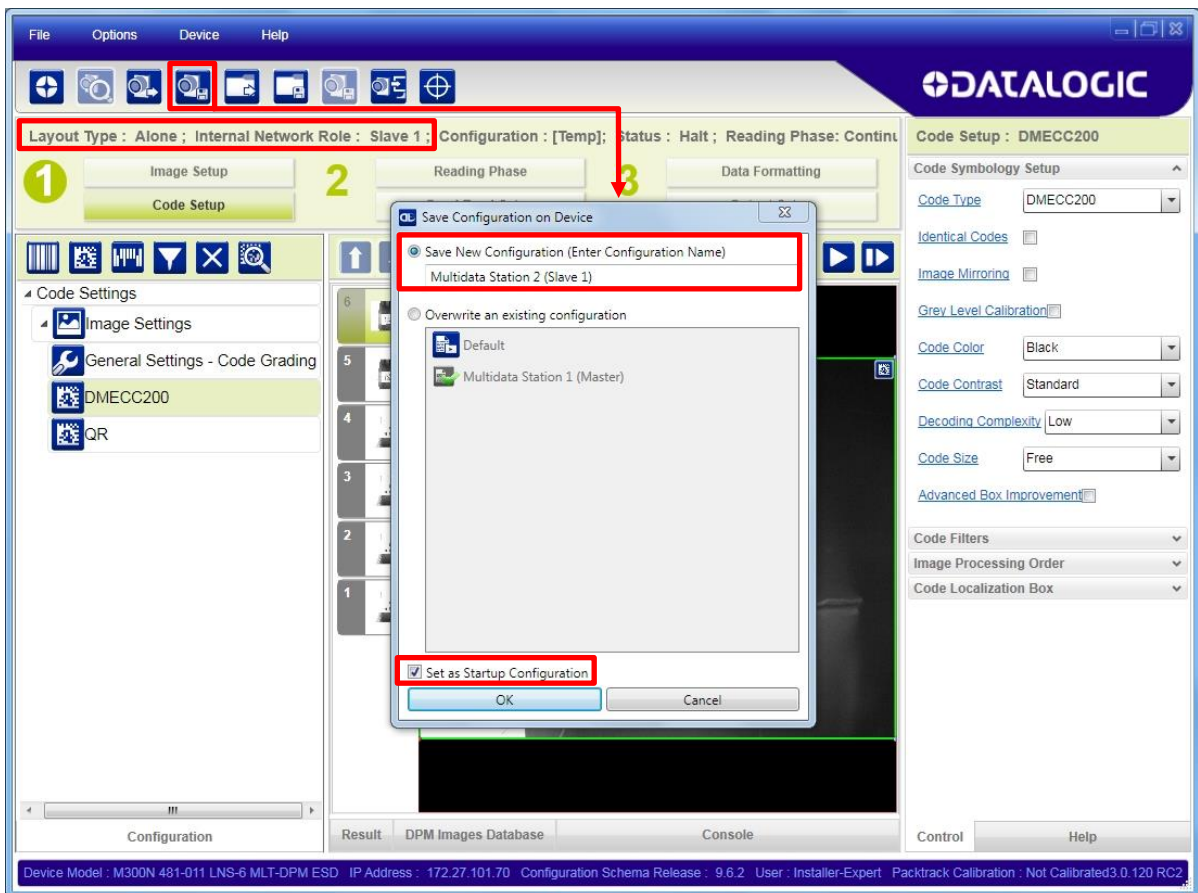


Figure 79 – Saving Multidata Configuration to Slave 1

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

The following screenshots show the pass-through configuration settings for the three devices in the example in par. 5.5.

<sup>3</sup> An application job with the same name as the Master's (but with Slave specific configuration parameters), has been saved to the Slaves. Each Slave has its own configuration parameters saved in its own copy of the application job. There are no common parameters managed by the Master for Multidata configurations.

Layout Type : Alone ; Internal Network Role : Master Configuration : [Temp]; Status : Halt ; Reading Phase: Phase I

### ID-NET Master

Reading Phase 3 Data Formatting

Good Read Setup Output Setup

Output Data Format

- Output Messages
  - Message 1
  - Message 2
- Diagnostic Messages
- Channels
  - Matrix TCP Server
  - Main
  - Aux
  - ID-Net
- Fieldbuses
- Images Saving Conditions
- Passthrough Configuration
  - Passthrough 1
  - Passthrough 2

Passthrough 2 Field

Output Data Channels

- Good Read Message1
- No Read Message2
- Main Passthrough1
- ID-Net Passthrough2

Matrix TCP Server

- Main
- Aux

Data Formatting : Passthrough 2

Header <STX>

Terminator <CR><LF>

Passthrough Input Data

Header <STX>

Terminator <CR><LF>

Input Channel ID-Net

Passthrough Content Field

Output Channels

- Matrix TCP Server
- Main
- Aux

Layout Type : Alone ; Internal Network Role : Slave 1 Configuration : [Temp]; Status : Halt ; Reading Phase: Phase I

### ID-NET Slave #1

Reading Phase 3 Data Formatting

Good Read Setup Output Setup

Output Data Format

- Output Messages
  - Message 1
  - Message 2
- Diagnostic Messages
- Channels
  - Matrix TCP Server
  - Main
  - Aux
  - ID-Net
- Fieldbuses
- Images Saving Conditions
- Passthrough Configuration
  - Passthrough

Passthrough Field

Output Data Channels

- Good Read Message1
- No Read Message2
- Aux Passthrough

Matrix TCP Server

- Main
- Aux
- ID-Net

Data Formatting : Passthrough

Header <STX>

Terminator <CR><LF>

Passthrough Input Data

Header <STX>

Terminator <CR><LF>

Input Channel Aux

Passthrough Content Field

Output Channels

- Matrix TCP Server
- Main
- Aux
- ID-Net

Layout Type : Alone ; Internal Network Role : Slave 2 Configuration : [Temp]; Status : Halt ; Reading Phase: Contin

### ID-NET Slave #2

Reading Phase 3 Data Formatting

Good Read Setup Output Setup

Output Data Format

- Output Messages
  - Message 1
  - Message 2
- Diagnostic Messages
- Channels
- Fieldbuses
- Images Saving Conditions
- Passthrough Configuration

Message 1 Field

Expected Code 1

Output Data Channels

- Good Read Message1
- No Read Message2

Matrix TCP Server

- Main
- Aux
- ID-Net

Data Formatting : Message 1

Header <STX>

Terminator <CR><LF>

Code Related Field

Output Channels

- Matrix TCP Server
- Main
- Aux
- ID-Net

Event Type

### 7.4.3 Synchronized ID-NET Network Configurations

The Synchronized ID-NET network communications between Master and Slave are internally managed by the application software. A pre-configured job is loaded with the Synchronized Layout Type and the correct Operating Mode for both the Master and Slaves when either the Phase Mode or PackTrack Configuration is selected from the Internal Network Setting feature.

1. Complete the configuration of all the application parameters (including Image Setup) and save them to the Master with an application relative name and **with the option to Clone Master configuration on Slaves**.

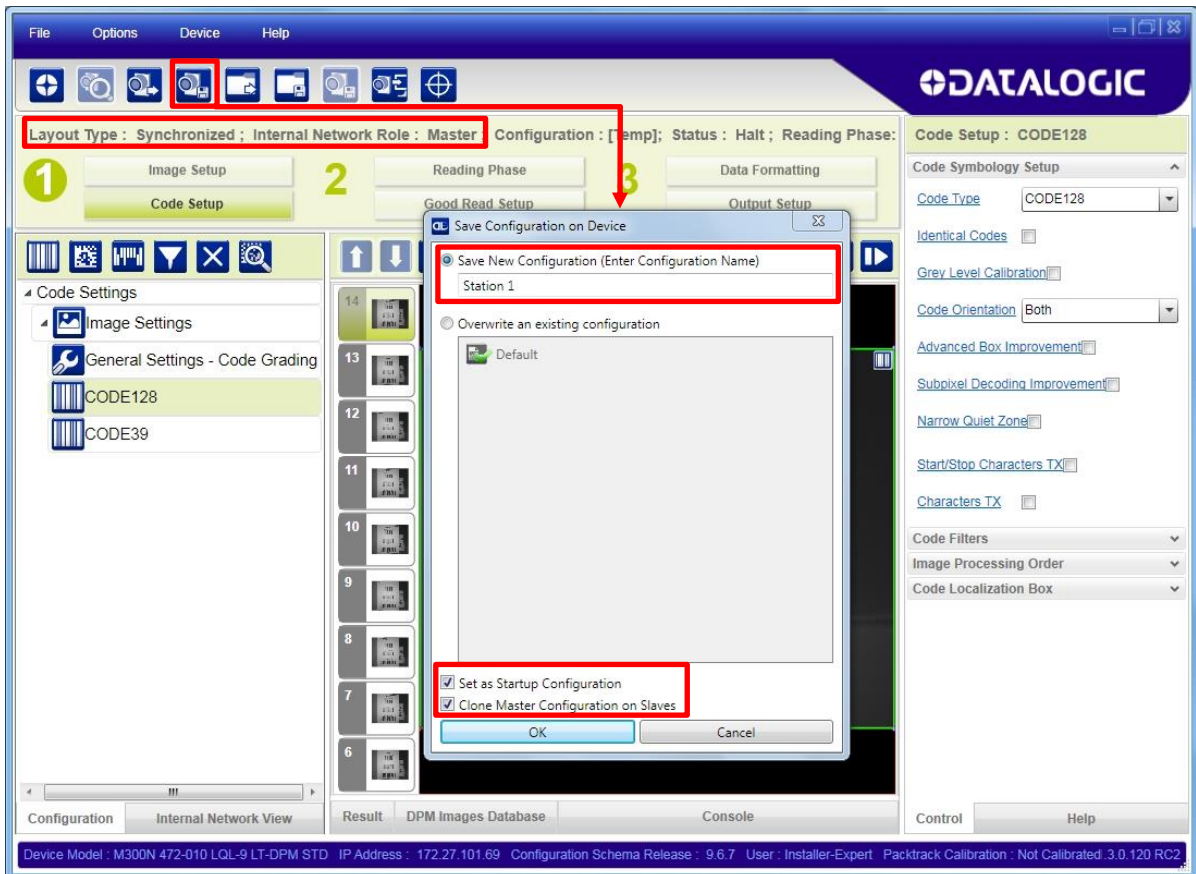
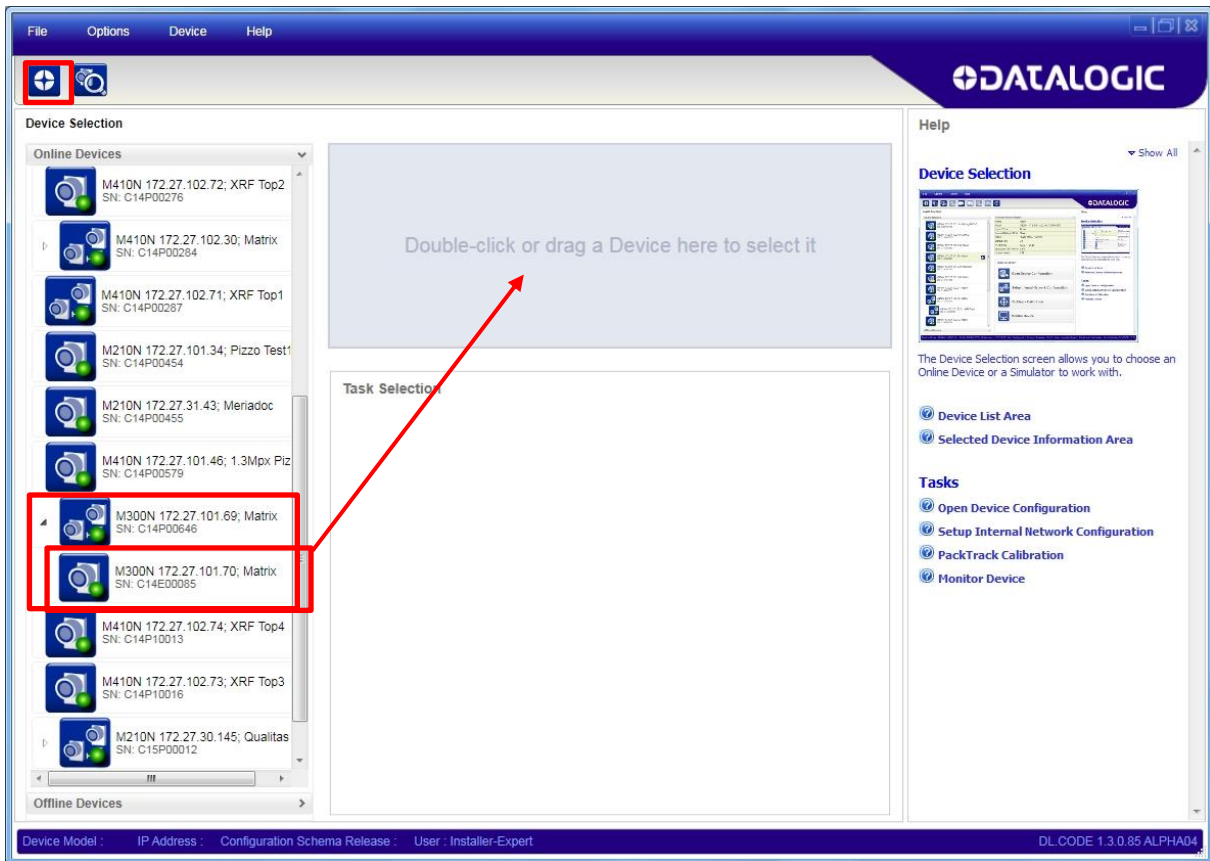


Figure 80 – Saving Synchronized Phase Mode Configuration to Master

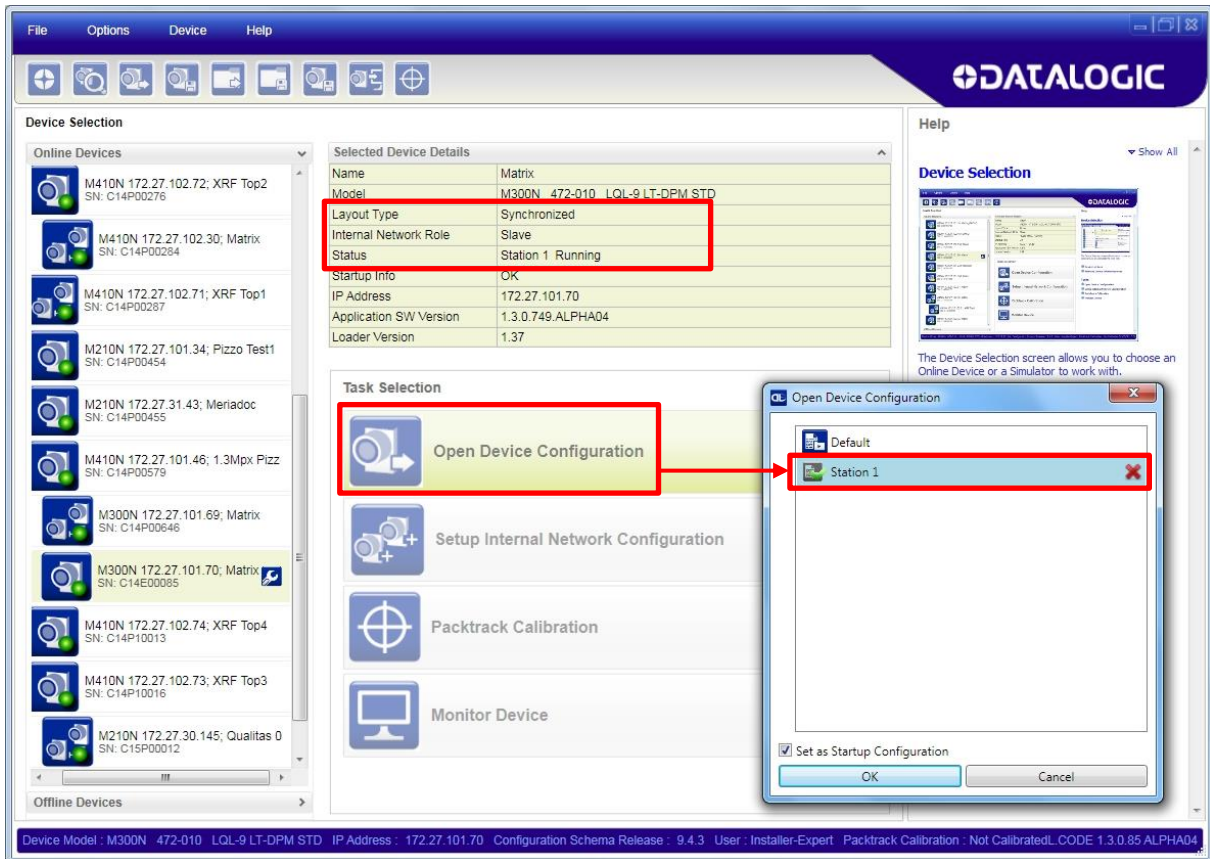
2. Connect to each Slave reader via Ethernet (see note below), and set the Slave specific parameters.



**NOTE:** If necessary, Slave device photometric (Image Setup) parameters must be configured separately through DL.CODE. This is preferably done through each device's Ethernet TCP/IP channel. If Slave devices are not connected to Ethernet you must temporarily (manually) connect them one by one to perform Image Setup.

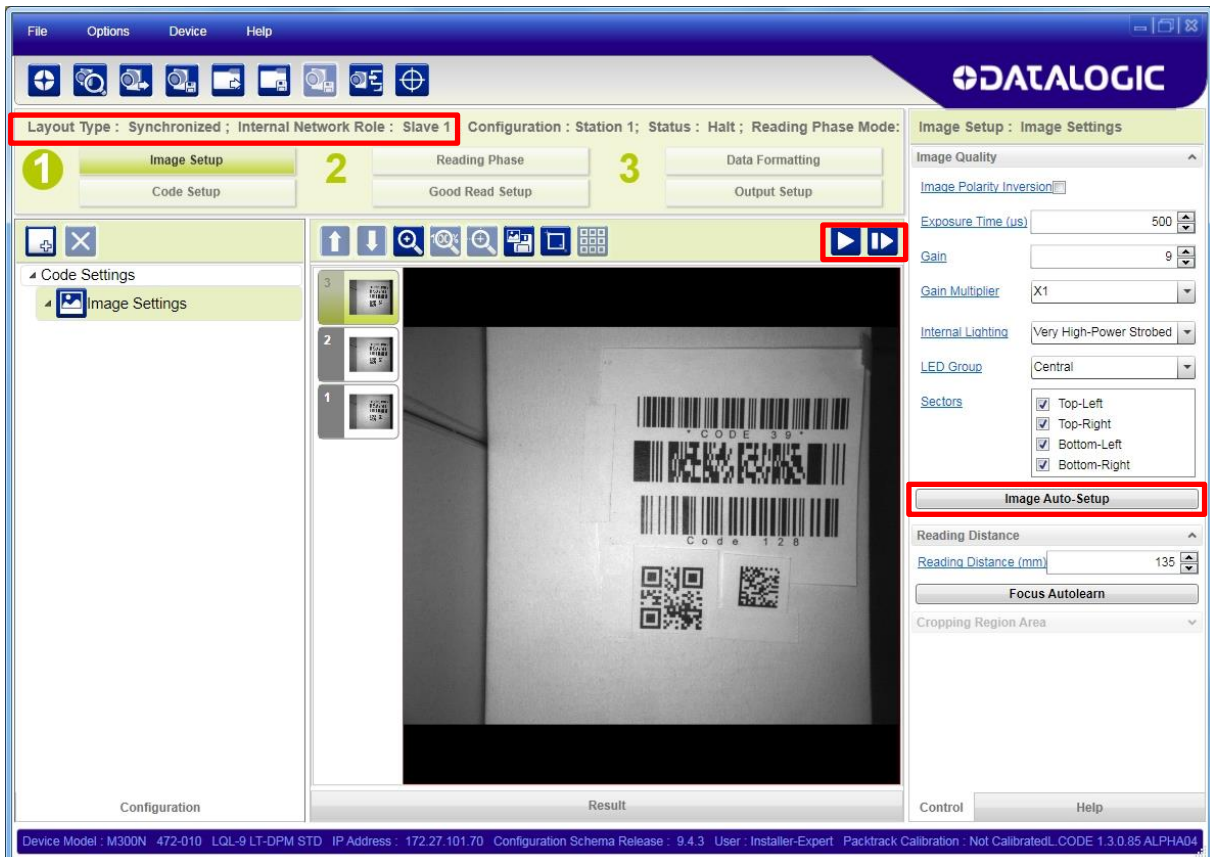



Open the cloned application job.



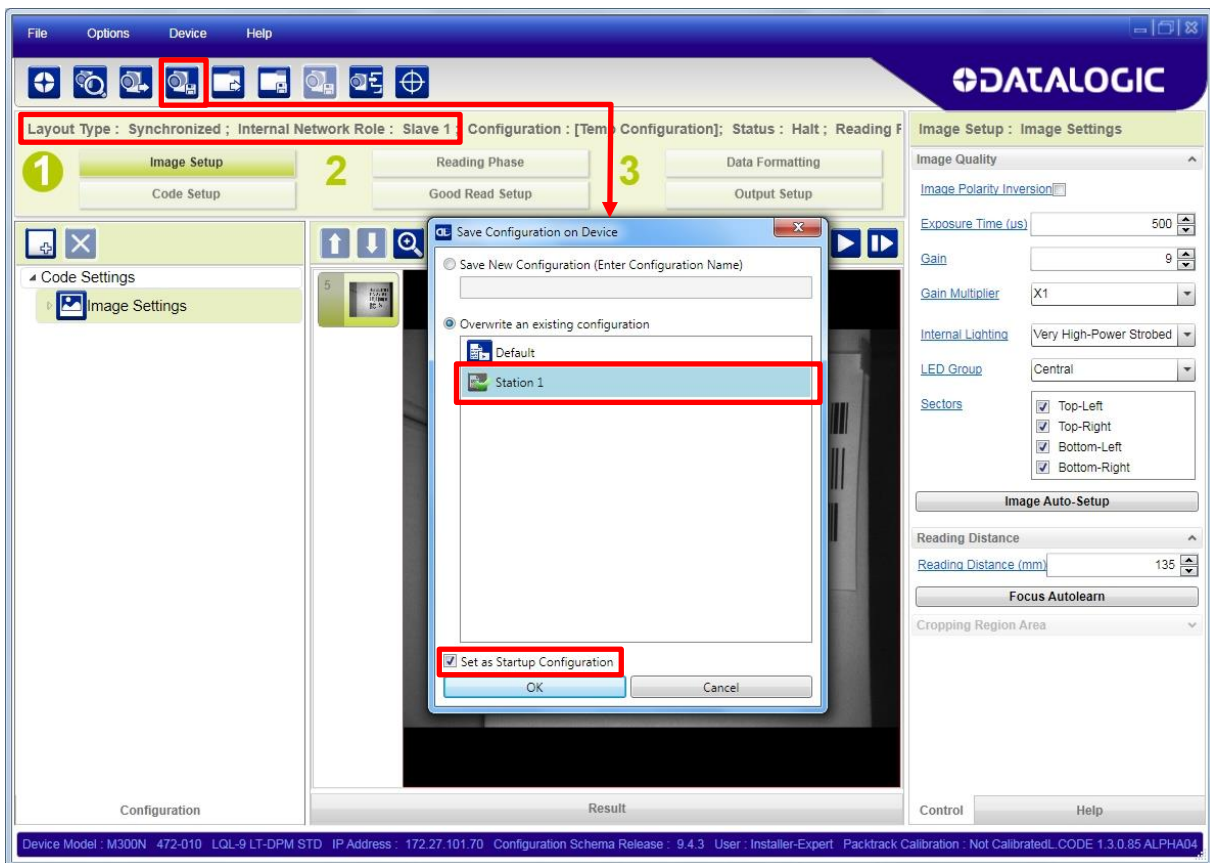
When the job opens, pause run mode and configure the Slave specific parameters. These depend on the application and include the following:

- photometric parameters (Image Auto-Setup feature in the 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**)



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

3. Now save them, overwriting the cloned application job<sup>4</sup>.



**Figure 81 – Saving Synchronized Phase Mode Configuration to Slave**

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

See par. 5.6 for an example Synchronized ID-NET configuration.

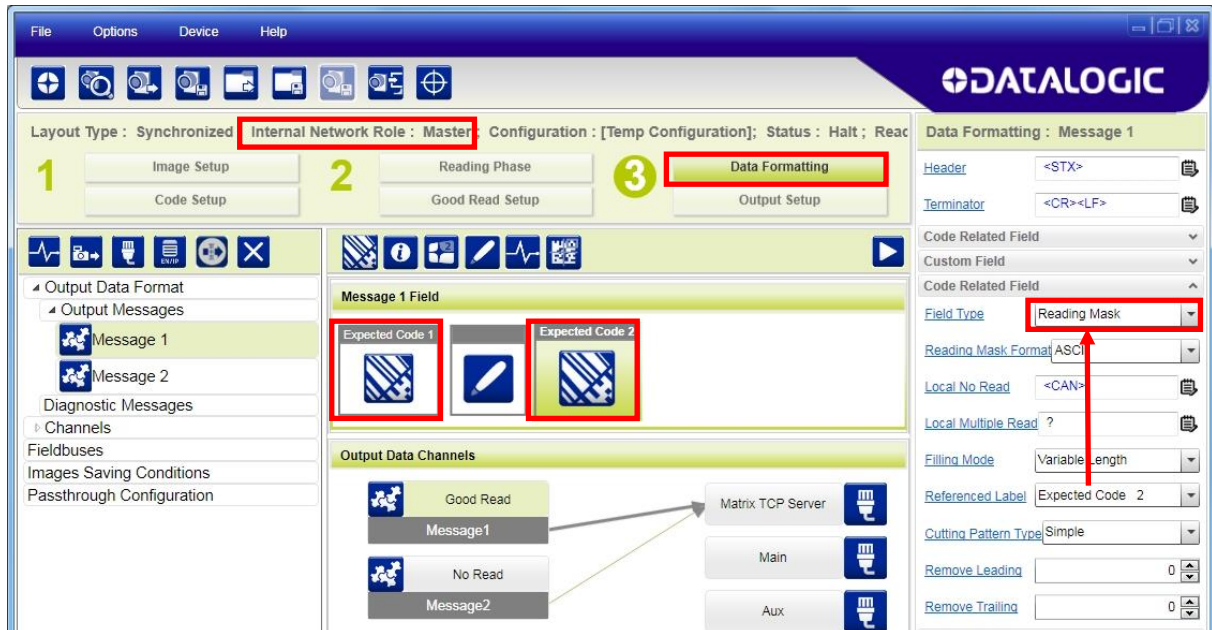
<sup>4</sup> An application job with the same name as the Master's has been cloned to the Slaves. Each Slave can have its own Image Setup parameters saved in its own copy of the application job. Common parameters managed by the Master such as Operating Mode cannot be modified in the Slave jobs and are shown in grey.

### 7.4.4 Verify Master/Slave Synchronized Configuration

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

If necessary, as a troubleshooting tip, you can temporarily apply the **Reading Mask** field in place of each Code Content field to verify if all devices are reading. To do this:

1. Connect to the Master device via Ethernet and from the Data Formatting step, change each Expected Code Field Type from Code Content to Reading Mask.



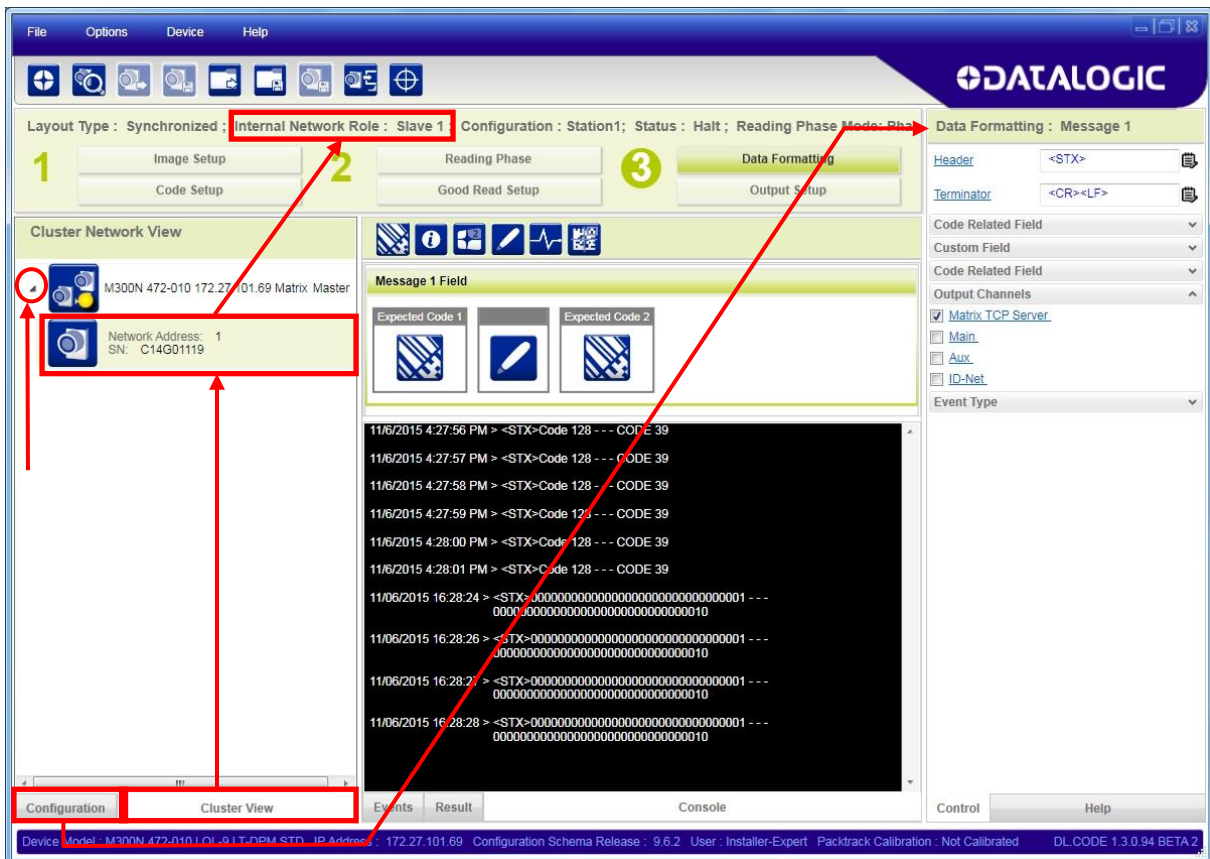




To view the connected Slave configurations:

1. Click on the Internal Network View tab at the bottom of the screen
2. Open the Master branch by clicking on the arrow to the left of the Master icon.
3. Select any slave.
4. Click The Configuration tab at the bottom of the screen.

By selecting the various configuration steps above you can visualize the slave configuration.



**NOTE:** You can modify some Slave Synchronized parameters from this view but you cannot save them here.

To save changed slave parameters here, you must click on the Master and Save the configuration overwriting it, making sure to save **without Clone Master Configuration on Slaves**, otherwise all the Slave configuration parameters will be overwritten.

## 7.5 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 Single Reader and Internal Network (Master/Slave) configurations.

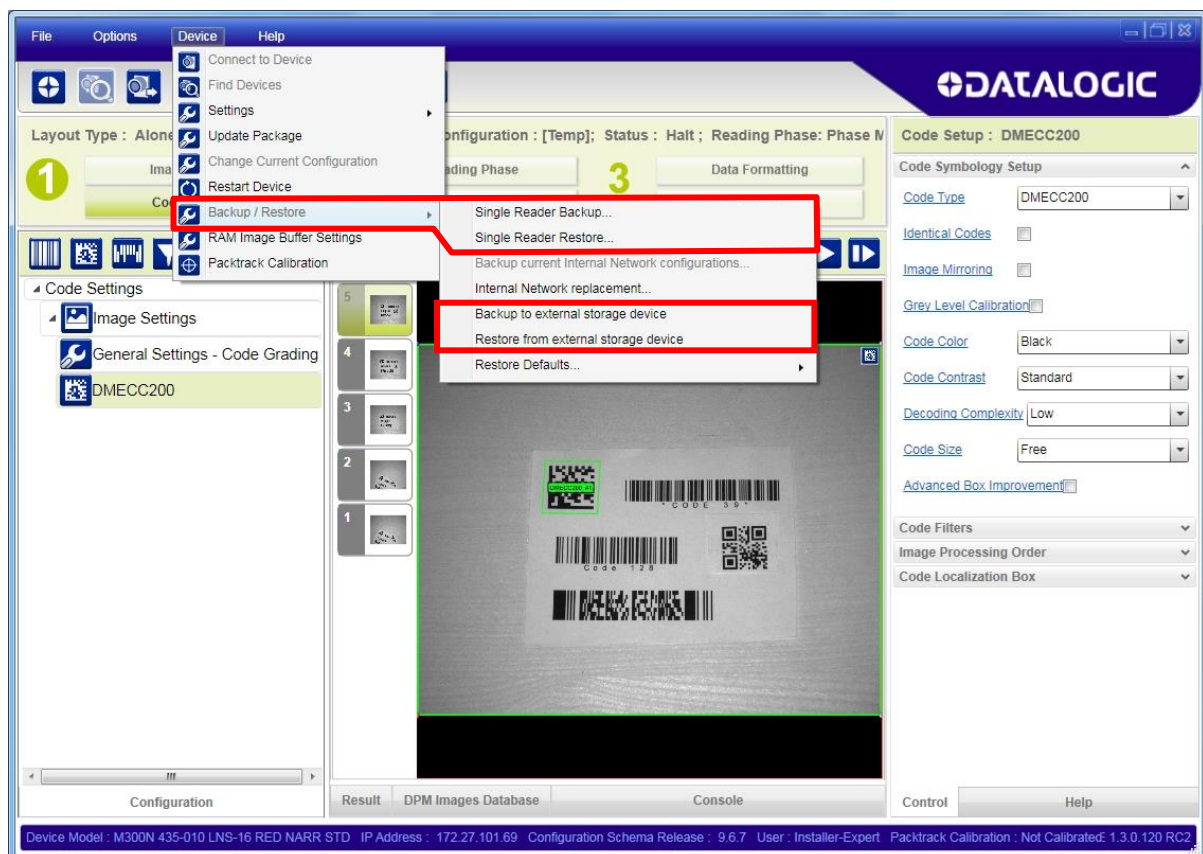
Backup and Restore functions allow performing Complete Configuration and Environment parameter storage for Single Reader and ID-NET (Master/Slave) network devices as well as device firmware. Backup and Restore can be applied to any reader connected through a device having external backup memory, regardless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

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

- CBX + BM100
- QLM-Series Gateways



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



## 7.5.1 Backup

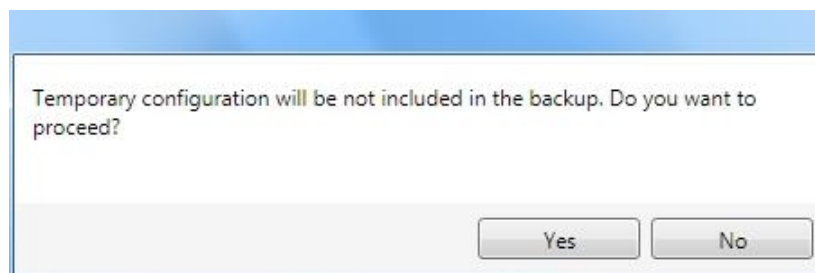
To perform a **Backup**:

1. From the DL.CODE Device menu, select either **Single Reader Backup** (to file on PC); or **Backup to external storage device**.

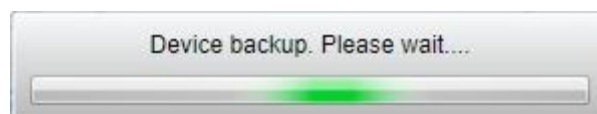
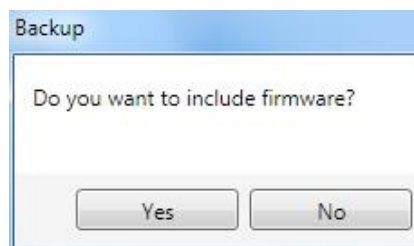


**NOTE:** For ID-NET network Backup, select the **Backup current Internal Network configurations** selection.

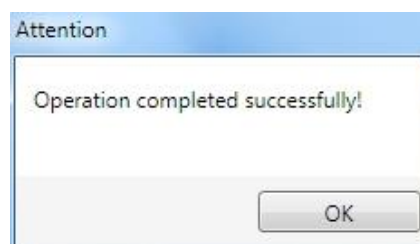
You will be reminded that configuration in temporary memory will not be saved so you should save the configuration to the reader before performing Backup.



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.




## 7.5.2 Restore

To perform a **Restore**:

1. From the DL.CODE Device menu, select either **Single Reader Restore** (from file on PC); or **Restore from external storage device**.



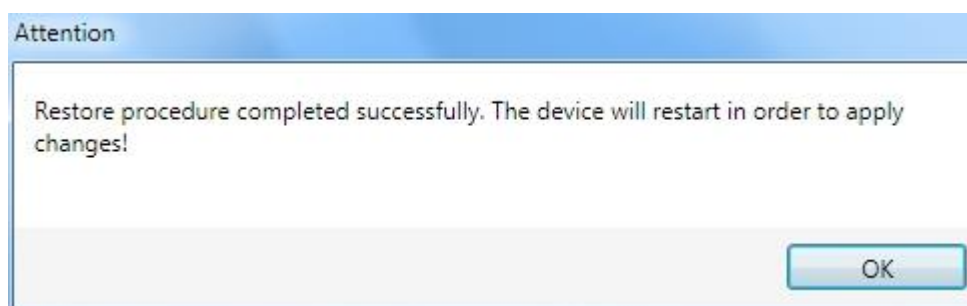
**NOTE:** For ID-NET network Restore, select the **Internal Network replacement** selection.



Restore from external storage device. Please wait....

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.



## 7.5.3 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 **Single Reader Restore** (from file on PC) or **Restore from external storage device** item (see: Restore procedure).



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

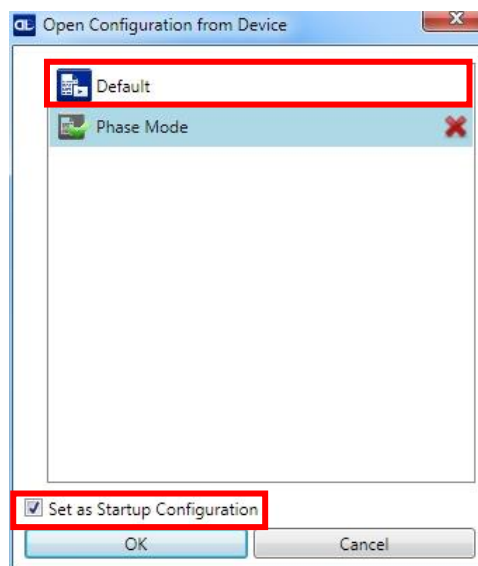
## 7.6 RESTORE DEFAULTS

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

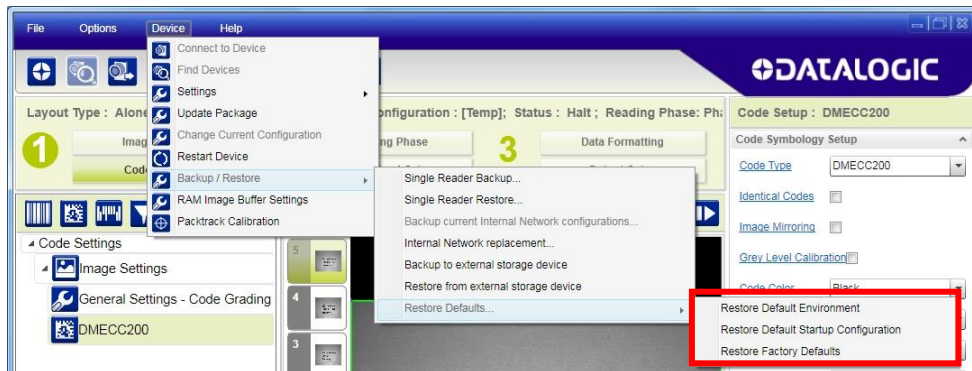
- The Configuration parameters are the ones set in the various steps of the configuration process and are specific to each application. When multiple configurations (jobs) are saved on a single device, these parameters can be different from one configuration to the next.
- Environment parameters regard 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.

### 7.6.1 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.



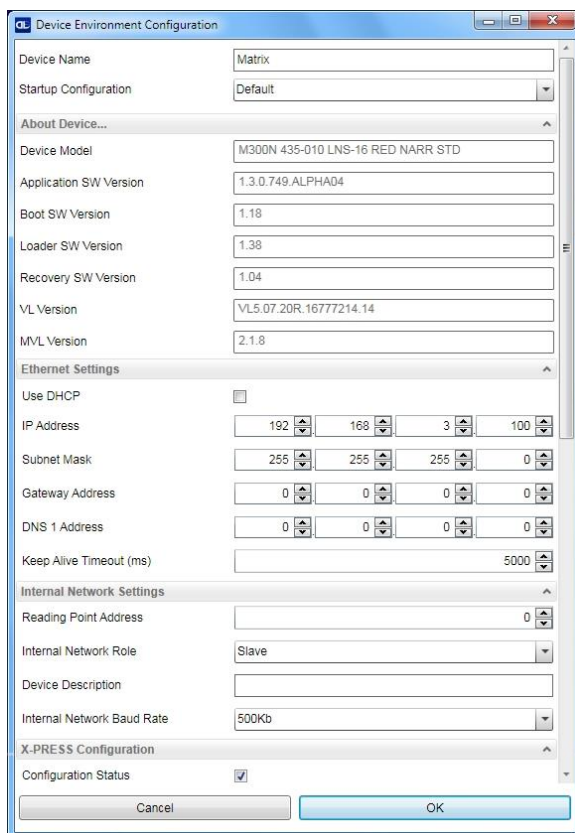
The same action can be performed from the Device menu >Backup/Restore > Restore Defaults > **Restore Default Startup Configuration**. The Default Configuration will be set to run at startup and the reader will be reset.



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

## 7.6.2 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.

### 7.6.3 Restore Factory Defaults

In order to return a device to its absolute Factory default parameters (for example device replacement) it is necessary to use the **Restore Factory Defaults** 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.

## 7.7 DIAGNOSTIC ALARMS

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.

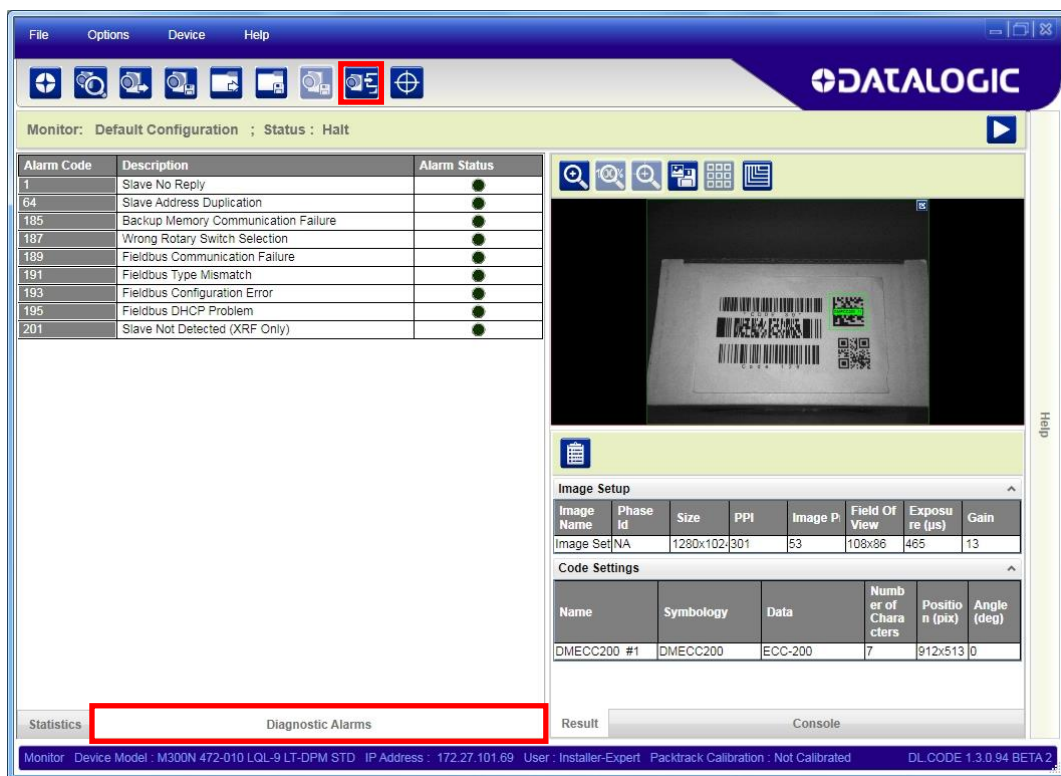


Figure 82 - Diagnostic Alarms

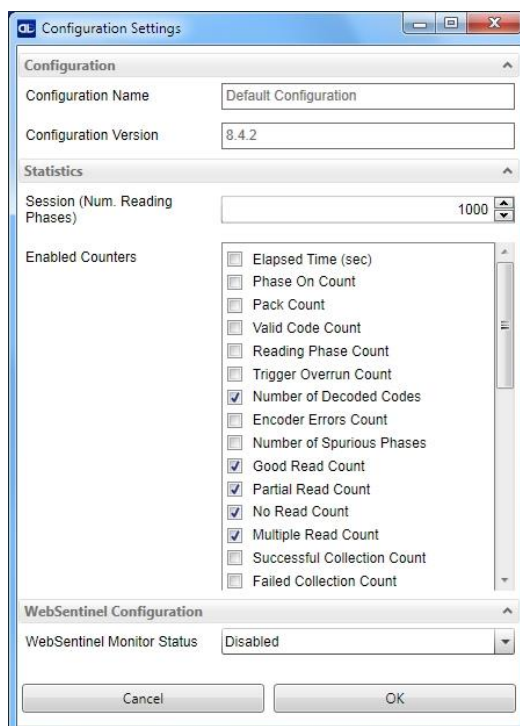
## 7.8 STATISTICS

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 83 - Reading Statistics

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





## 7.9 BM150 DISPLAY MODULE CONFIGURATION AND MESSAGES

The BM150 display module is an optional accessory for the CBX500 connection box. Although independent, it is an extension of the reader's HMI Interface, so through its keypad it provides execution of HMI features such as Test, Focus/Locate, Calibration and Code Setting. It also displays device status information, reading results, diagnostic and network messages. Since it connects through the BM100 backup memory module, it provides access to Backup and Restore features through its Extended menu.

### 7.9.1 Configuration Through DL.CODE

BM150 must be detected through the BM100 backup memory module at power-up/reset and this is done through a command setting in DL.CODE. By connecting the reader to DL.CODE the following parameters can be managed.

In the Device>Settings>Settings>Maintenance window:

- **Enable BM100 Detection**

Checked (Enabled): the BM100 backup memory module will be detected on power-up/reset; therefore the BM150 display module (if present), will also be enabled.

Unchecked (Disabled): the BM100 backup memory module will **not** be detected on power-up/reset; therefore the BM150 display module (if present), will also **not** be enabled.

- **BM150 Display Layout (Master Only)**

Reading Mask Only: the Reading Mask screen is sent to the BM150 display.

Reading Mask/Device State: the Reading Mask/Device State screen is sent to the BM150 display.

### 7.9.2 Accessing the HMI Interface Through Keypad and Display Menu

Through its keypad and display, the BM150 provides a remote extension of the reader's HMI Interface. The HMI default menu items can be accessed as well as the View menu for Master devices and the Extended menu for Backup and Restore functions.

To enter the Main Menu press the **Up** and **Down** buttons simultaneously.

The menu structure is shown below.



**Up   Enter   Down**

**Figure 84 – BM150 Keypad**

#### Main Menu:

1. **[Exit]** (exits HMI Interface menu)
2. **Test Mode** (performs Test mode)
3. **Focus/Locate** (performs Focus function: turns on Blue Diamonds and laser pointers)
4. **Calibration** (performs Setup function)
5. **Code Setting** (performs Learn function)
6. **Match Code Tra...**(Training: allows to read a code and store it as the Match code)

## 7. View Menu (Master Only):

1. **[Exit]** (returns to Main menu)
2. **Standard** (displays the Standard Reading Results screen during run mode)
3. **Reading Mask** (displays the Reading Mask or Reading Mask/Device State screen during run mode) depends on the selection in DL.CODE see par. 7.9.1.
4. **Network State** (displays the Network State screen during run mode)

## 8. Extended Menu:

1. **[Exit]** (returns to Main menu)
2. **Backup** (performs Backup - uninterruptible)
3. **Restore** (performs Restore - uninterruptible)
4. **Erase** (erases the backup configuration in external memory - uninterruptible)

To move through the list press and release the **Up** or **Down** key.

To select an item or enter a submenu, press and release the **Enter** key. After executing an HMI function the display shows a result message and then automatically exits from the menu structure.

To exit a menu manually, press and release the **Enter** key at the [Exit] item or press the **Up** and **Down** buttons simultaneously.

To exit from a running HMI function, press the **Up** and **Down** buttons simultaneously. These functions will also exit upon their configured timeout.



**NOTE:** When the HMI Interface is entered from either the Local Device (reader) or Remote Device (BM150), the key(s) on the other device are disabled.



**NOTE:** When the reader is connected to DL.CODE, access to the BM150 HMI Interface is disabled.



**NOTE:** The "Reset Reader to Factory Default Environment" function of the HMI Interface is only available on the local device (reader), and not on the BM150.

### 7.9.3 Display Messages

The following examples of Remote Display messages are given to help interpret the information reported. The content of these messages depends on the connected reader.

#### Welcome Message:

```
M M M M M M M M M M M M M
K K K V V V V V V V V V R R R N N N
S N D D D D D D D D D
E T H A A A . A A A . A A A . A A A
```

M = scanner model

K = software – STD=Standard, SS =Special

V = software version

R = Device Network Type – MUL=Multidata, SYN=Synchronized, ALN=Alone

N = Device Network Setting – M00=ID-NET Network Master, Sxx= ID-NET Network Slave address, Null string= Alone (no network)

D = device serial number

A = Ethernet IP Address

#### Test Mode Results:

```
A A A % Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z
Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z
Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z
```

A = reading percentage from 000 to 100%.

Z = code content.

#### Calibration (Setup) Results:

```
E x p = X X X X
G a i n = G G
C a l i b r a t i o n
O K ( p e r m a n e n t )
```

X = exposure value (in  $\mu$ s).

G = gain value

#### Code Setting (Learn) Results:

```
X X X X X X X X X
C o d e S e t t i n g
O K ( p e r m a n e n t )
```

X = recognized code symbology.

**Diagnostic Alarms:**

Diagnostic error messages are sent to the BM150 display as numeric Alarm Codes, (even if Failure Messages are selected for data transmission the numeric Alarm Code is sent to the display).

```
A l e r t      :
F a i l u r e      # X X X

R R R      N N N
```

X = numeric Alarm Code (see below for the list of Alarm Codes)  
 R = Device Network Type – MUL=Multidata, SYN=Synchronized, ALN=Alone  
 N = Device Network Setting – M00=ID-NET Network Master, Sxx= ID-NET Network Slave address, Null string= Alone (no network)

| Alarm Code | Description                         |
|------------|-------------------------------------|
| 1          | Slave No Reply                      |
| 64         | Slave Address Duplication           |
| 171        | Protocol Index Failure              |
| 185        | Backup Memory Communication Failure |
| 187        | Wrong Rotary Switch Selection       |
| 189        | Fieldbus Communication Failure      |
| 191        | Fieldbus Type Mismatch              |
| 193        | Fieldbus Configuration Error        |
| 195        | Fieldbus DHCP Problem               |
| 201        | No XRF Slave(s) Detected            |

**Slave Node Alarms (Master only):**

```
A l e r t      : I D - N E T
N o d e # X X      M i s s i n g

R R R      M 0 0
```

X = slave node number (1-31)  
 R = Device Network Type – MUL=Multidata, SYN=Synchronized

**Network State (Master only):**

```
0      N e t w o r k      1 5
M S S S S S S S S S S S S S S S
1 6      N e t w o r k      3 1
S S S S S S S S S S S S S S S S
```

M = Master diagnostic condition; S = Slave diagnostic condition:  
 \* = scanner OK  
 - =scanner not detected at startup  
 ? =scanner detected at startup but not responding to diagnostic polling  
 ! = scanner diagnostic error

**Standard Reading Results:**

```

A A A A A A A A A A A A A
X X X X X X X X X X X X X X X X X X X X
X X X X X X X X X X X X X X X X X X X X
Y Y C o d e s

```

A = reading result – Good Read, Partial Read, Multiple Read

X = code content

Y = number of codes read

**Reading Mask Only (Master Only):**

```

X X X X X X X X X X X X X X X X X . . .
G Y Y Y % N Y Y Y % M Y Y Y % P Y Y Y %
S S S S S S S S S S S S S S S S
T T T T T T T T T T T T T T T T

```

X = code content (or "No Read" or "Multiple Read")

Y = Good Read, No Read, Multiple Read and Partial Read counters on the last 100 codes read (%)

S = Reading Mask for Stand Alone or Master plus Slave readers 1 - 15

(0 = No Read, 1 = Good Read, M = Multiple Read)

T = Reading Mask for Slave readers 16 - 31

(0 = No Read, 1 = Good Read, M = Multiple Read)

**Reading Mask/Device State (Master Only):**

```

X X X X X X X X X X X X X X X X X . . .
P = Y Y Y Y Y Y Y Y G R = Z Z Z . Z Z %
S S S S S S S S S S S S S S S S
U U U U U U U U U U U U U U U U

```

X = Recognized code label data (or "No Read" or "Multiple Read")

Y = Phase Counter (range: 0000000 to 9999999)

Z = Good Read or Multiple Read counters (%)

S = Reading Mask for Stand Alone or Master plus Slave readers 1 - 15

(0 = No Read, 1 = Good Read, M = Multiple Read)

U = Diagnostic condition for Stand Alone or Master plus Slave readers 1 - 15:

\* = reader OK

- = reader not detected at startup

? = reader detected at startup but not responding to diagnostic polling

! = reader diagnostic error

## 7.9.4 BM150 Backup and Restore Procedure

The Backup and Restore functions are valid for any application layout type (point-to-point, network, etc.) using CBX500 connection boxes through the BM100 Backup module (required accessory for BM150 installation).

The Backup and Restore functions are managed through the BM150 display and keypad and therefore are disabled at the BM100 Backup/Restore button.

If it ever becomes necessary to replace the reading device it can be quickly configured through the restore procedure.

BM150 provides complete backup and restore functions (Configuration and Environmental parameters) with the following difference:

For Single Readers or individual ID-NET Slaves:

- Backup and Restore functions provide parameter storage including all configuration jobs present on the reader.

For Master Readers in ID-NET Master/Slave networks:

- Backup and Restore functions provide parameter storage of only the Startup Configuration for the Master and all Slaves present in the network.



**CAUTION:** For Master/Slave networks any other configurations (jobs) stored in the device memory will not be backed up. Therefore upon a restore, all jobs other than the startup configuration will be overwritten (erased). It is strongly recommended to save all configurations to backup files.

**The Slaves must always be configured with the same network baudrate as the Master for correct functioning including performing Backup and Restore procedures.**

Backup and Restore functions cannot be interrupted once started.

To perform **Backup**:

1. Make sure the Write Protection switch on the BM100 is unlocked.
2. Select the **Backup** item from the Extended menu and press the Enter key.
3. When the procedure is complete a message appears on the display showing the results (**Backup OK 1 File Saved** or an error message).
4. Set the Write Protection switch to locked.

To perform **Restore**:

1. Select the **Restore** item from the Extended menu and press the Enter key.
2. When the procedure is complete a message appears on the display showing the results (**Restore OK 1 File Restored** or an error message).

## **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>DL.CODE Installation:</b><br>Autorun or Start.hta doesn't run                                                                                             | <ul style="list-style-type: none"> <li>• Check Windows settings to see if Autorun is disabled.</li> <li>• Associate the file type .hta with the Microsoft HTML Application host <b>mshta.exe</b> in Windows\System32.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Power ON:</b><br>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><br>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><br>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><br>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><br>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><br>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><br>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><br>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>                                                                                                                                                                                                                                                 |

| <b>TROUBLESHOOTING GUIDE</b>                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Problem</b>                                                                                                                      | <b>Suggestion</b>                                                                                                                                                                                                                                                                                                                                                         |
| <p><b>Communication:</b><br/>data transferred to the host are incorrect, corrupted or incomplete.</p>                               | <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>                      |
| <p><b>Configuration:</b><br/>cannot access environment parameters in DL.CODE (Device&gt;Settings&gt;Settings menu item is grey)</p> | <ul style="list-style-type: none"> <li>• Are you using the Installer - Expert User level? If not change it in the Options&gt;Change User menu.</li> </ul>                                                                                                                                                                                                                 |
| <p><b>How do I obtain my reader Serial Number?</b></p>                                                                              | <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> |
| <p><b>How do I obtain my reader Order Number?</b></p>                                                                               | <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

| <b>ELECTRICAL FEATURES</b>                         |                                                                                       |                                  |
|----------------------------------------------------|---------------------------------------------------------------------------------------|----------------------------------|
| <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                                               | 2400 to 115200 bit/s                                                                  |                                  |
| - 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                                                                                |                                  |
| <b>OPTICAL FEATURES</b>                            |                                                                                       |                                  |
| 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>                                      |                                                                                       |                                  |
| Focal Length                                       | <b>Manual Adjustable Focus</b>                                                        | <b>Software Adjustable Focus</b> |
|                                                    | 4x1-0xx models = 6 mm                                                                 | 4x2-0xx models = 9 mm            |
|                                                    | 4x3-0xx models = 9 mm                                                                 |                                  |
|                                                    | 4x4-0xx models = 12 mm                                                                |                                  |
|                                                    | 4x5-0xx models = 16 mm                                                                |                                  |
| Lighting System                                    | Internal Illuminator                                                                  |                                  |
| Aiming System                                      | Laser Pointers                                                                        |                                  |
| <b>ENVIRONMENTAL FEATURES</b>                      |                                                                                       |                                  |
| Operating Temperature **                           | 0 to 50 °C (32 to 122 °F)<br>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<br>EN 60068-2-6               | 14 mm @ 2 to 10 Hz; 1.5 mm @ 13 to 55 Hz;<br>2 g @ 70 to 500 Hz; 2 hours on each axis |                                  |
| Bump Resistance<br>EN 60068-2-29                   | 30g; 6 ms;<br>5000 shocks on each axis                                                |                                  |
| Shock Resistance<br>EN 60068-2-27                  | 30g; 11 ms;<br>3 shocks on each axis                                                  |                                  |
| Protection Class ***<br>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 saturation</sub> = 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.

| <b>PHYSICAL FEATURES</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Connector position 0°</b>                                                                                                                                                                                                            | <b>Connector position 90°</b>                                                                                                                                                                                                                                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                       |
| <b>SOFTWARE FEATURES</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                       |
| <b>Readable Code Symbologies</b>                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                       |
| <b>1-D and stacked</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>2-D<sup>5</sup></b>                                                                                                                                                                                                                  | <b>POSTAL</b>                                                                                                                                                                                                                                                         |
| <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> |
| <b>Operating Mode</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                        | CONTINUOUS, ONE SHOT, PHASE MODE, PACKTRACK                                                                                                                                                                                             |                                                                                                                                                                                                                                                                       |
| <b>Configuration Methods</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <ul style="list-style-type: none"> <li>• X-PRESS Human Machine Interface</li> <li>• Windows-based SW (DL.CODE) via Ethernet Interface</li> <li>• Host Mode Programming sequences sent over Serial or Ethernet TCP interfaces</li> </ul> |                                                                                                                                                                                                                                                                       |
| <b>Parameter Storage</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Permanent memory (Flash)                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                       |
| <b>CODE QUALITY METRICS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                       |
| <b>Standard</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Supported Symbologies</b>                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                       |
| 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                                                                                                                                                              |                                                                                                                                                                                                                                                                       |
| <b>USER INTERFACE</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                       |
| 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                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                       |

<sup>5</sup> VeriCode® licensed models available.

## 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:

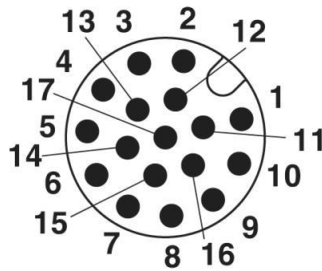


Figure 85 – M12 17-pin male COM, I/O and Power Connector

| Power, COM and I/O Connector Pinout |             |                                                                         |                   |
|-------------------------------------|-------------|-------------------------------------------------------------------------|-------------------|
| Pin                                 | Name        | Function                                                                |                   |
| 1                                   | Vdc         | Power supply input voltage +                                            |                   |
| 2                                   | GND         | Power supply input voltage -                                            |                   |
| Connector case                      | CHASSIS     | Connector case provides electrical connection to the chassis            |                   |
| 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)                                        |                   |
| 9                                   | O1          | Output 1                                                                |                   |
| 8                                   | O2          | Output 2 (NPN or PNP short circuit protected and software programmable) |                   |
| 16                                  | O3          | Output 3                                                                |                   |
| 14                                  | RX          | Auxiliary RS232 RX                                                      |                   |
| 4                                   | TX          | Auxiliary RS232 TX                                                      |                   |
| 7                                   | ID+         | ID-NET network +                                                        |                   |
| 15                                  | ID-         | 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.

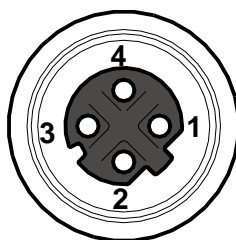


Figure 86 - M12 D-Coded Female Ethernet Network Connector

| 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

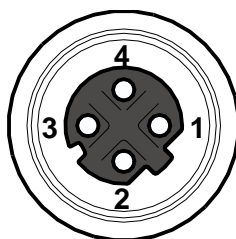


Figure 87 - M12 D-Coded Female Ethernet Network Connector

| 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.

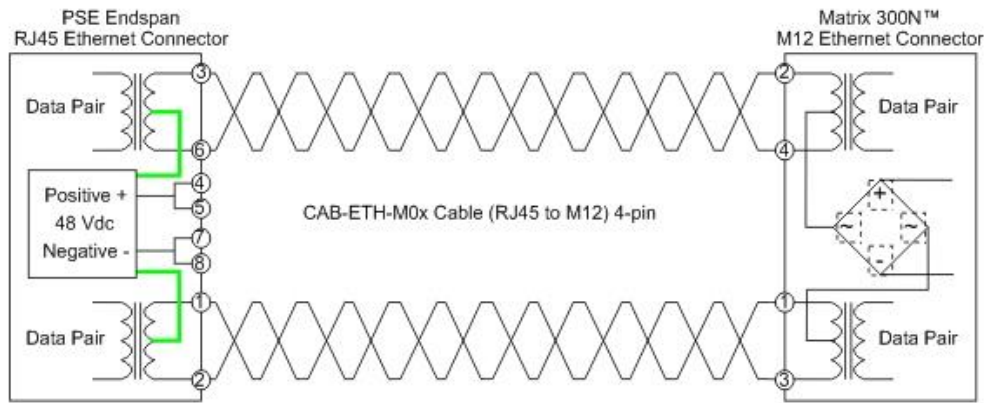


Figure 88 – Matrix 300N PoE PSE Endspan Alternative A Connections OK

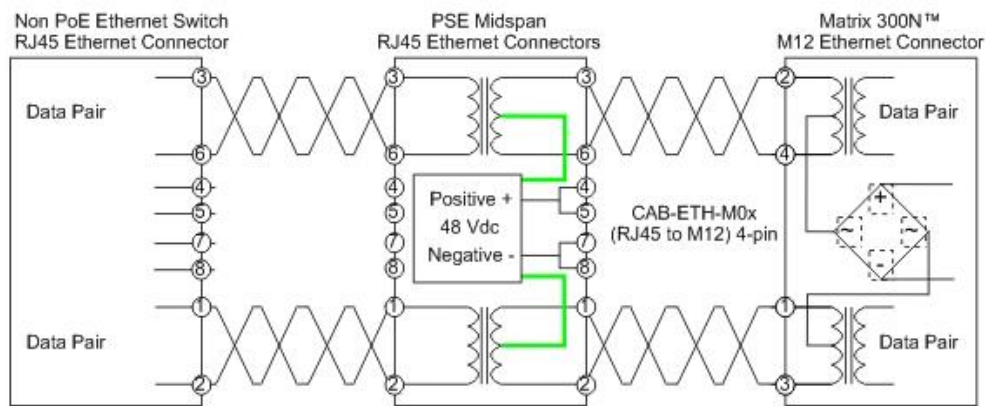


Figure 89 – Matrix 300N PoE PSE Midspan Alternative A Connections OK

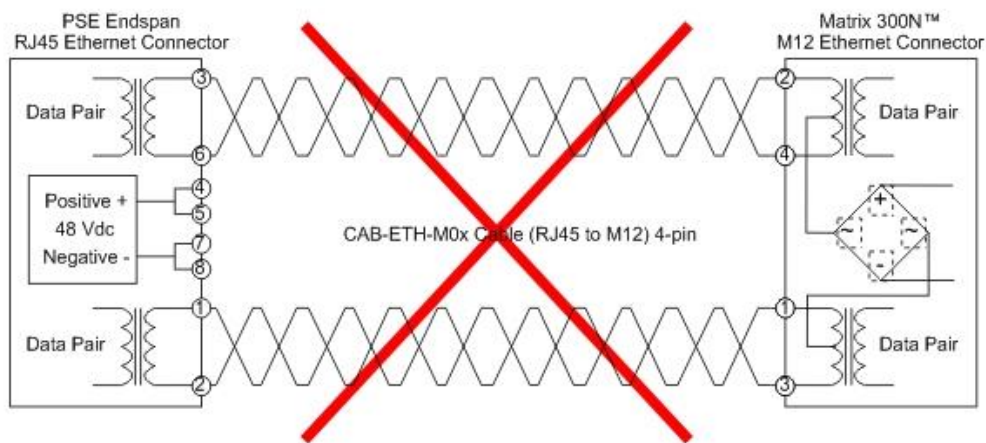


Figure 90 – Matrix 300N PoE PSE Endspan Alternative B Connections NOT SUPPORTED

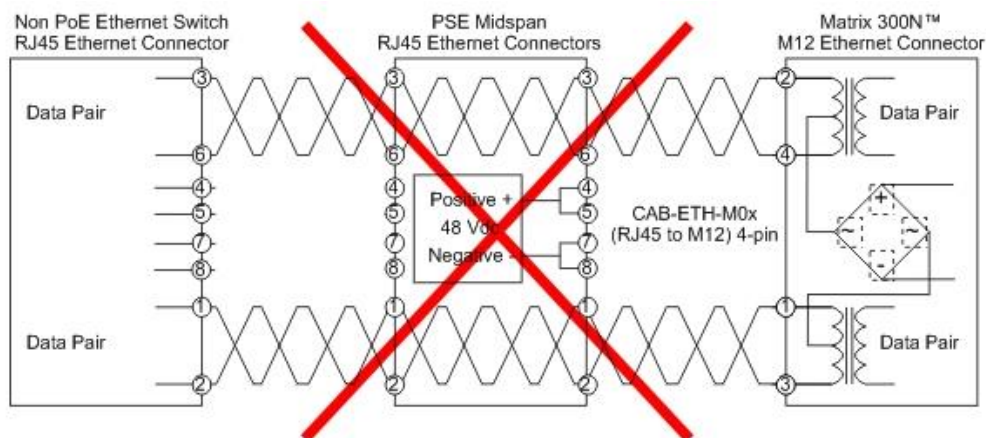


Figure 91 – Matrix 300N PoE PSE Midspan Alternative B Connections NOT SUPPORTED



**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. 4.5 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.

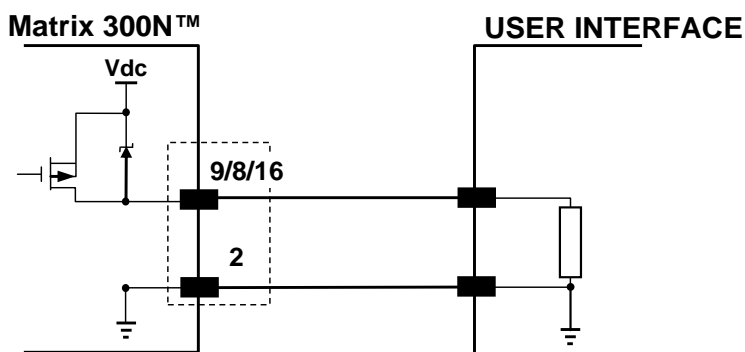


Figure 92 - PNP Output Connection

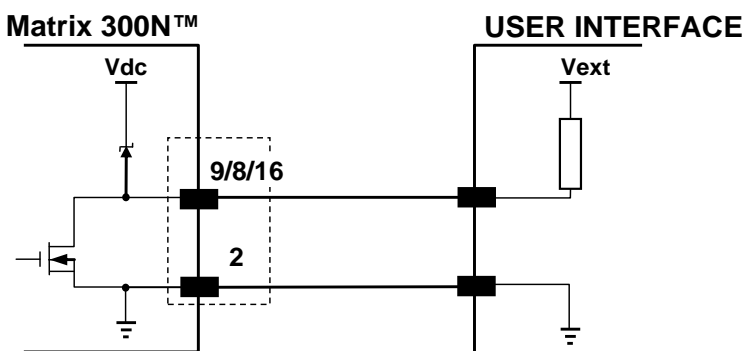


Figure 93 - NPN Output Connection



**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.

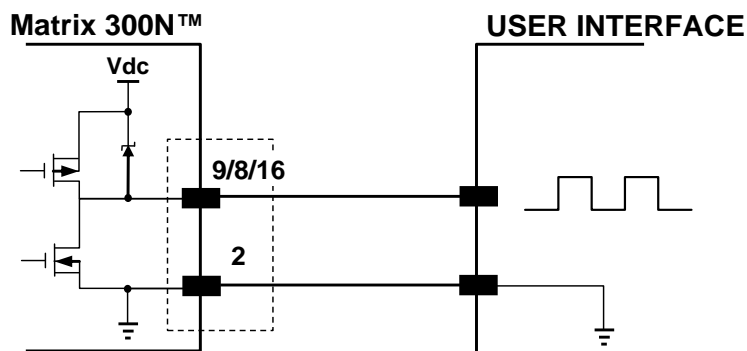


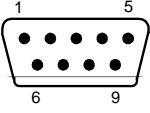
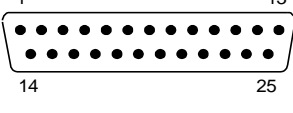
Figure 94 - Push-Pull Output Connection



**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                                                                                     |      |                                                                                                                 |      |
|---------------------------------------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------------------------|------|
|  <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  |

#### 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.

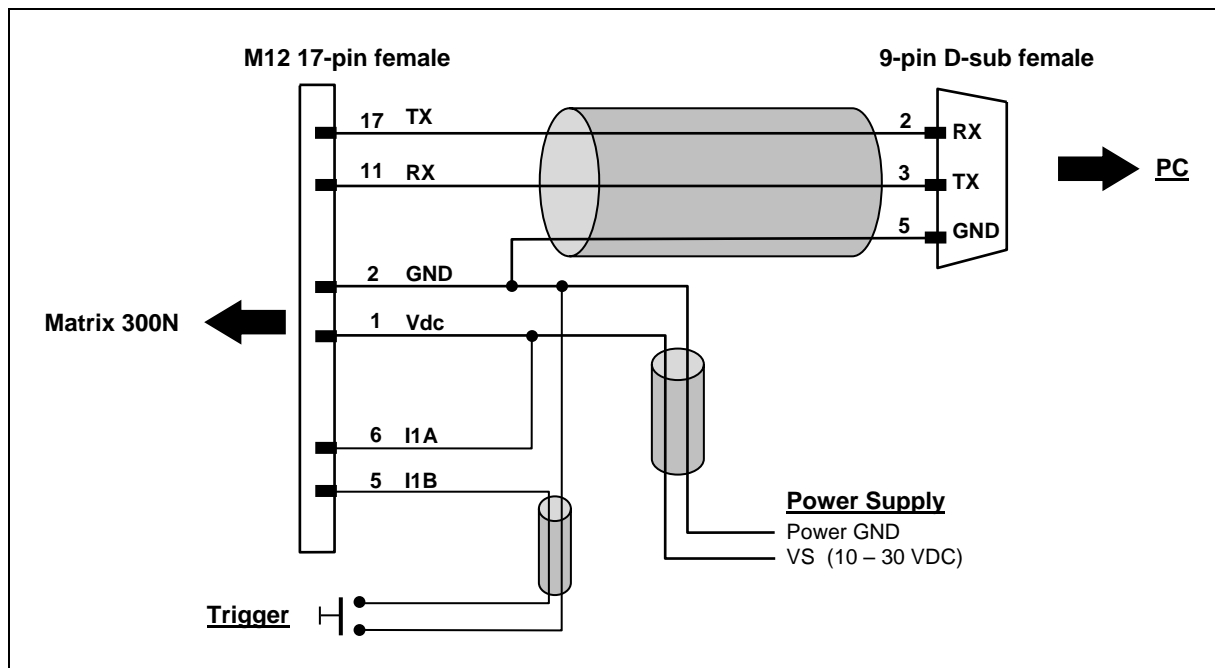


Figure 95- Test Cable for Matrix 300N

# GLOSSARY

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## **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.

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