APPLICATION NOTE

> MATRIX-120 AGV

DATALOGIC

Release history	
Description	**Release date**
First release	12/12/2018
Second release	19/12/2018
Third release	16/01/2019
Fourth release	31/01/2019

Contents

1 Models 3
2 Product Description 3
2.1 Indicators and Keypad Button 5
3 X-PRESS Human Machine Interface 5
4 General Specifications for AGV Applications 6
5 Ambient Conditions 6
6 Mechanical Dimensions 7
7 Working distance and moving direction 9
8 Interface 9
9 Electrical Specifications 10
9.1 Connector Pinout 10
9.2 On-Board Ethernet Connector (Matrix 120 311-215 model) 11
10 Data Matrix tags 12
11 Configuration 15
11.1 Step 1 – Connect the System 15
11.1.1 Ethernet Connections 15
11.1.2 USB Connections 16
11.1.3 Serial Connections 17
11.2 Step 2 – Mount and Position the Reader 18
11.3 Step 4 – Installing DL.CODE Configuration Program 19
11.4 Step 4A – Ethernet Device Discovery 20
11.5 Step 4B – USB Device Discovery 23
11.6 Step 5 – Device Configuration 25
11.6.1 Code Setup 25
11.6.2 Reading Phase 27
11.6.3 Data Formatting 29
11.7 Test 31
11.8 Backup and Restore Through DL.CODE 32
11.8.1 Backup 32
11.8.2 Restore 33
11.8.3 Replacement 34
11.9 Restore Defaults 34
11.9.1 Restore Default Startup Configuration 34
11.9.2 Restore Default Environment 35
11.9.3 Restore Factory Defaults 36

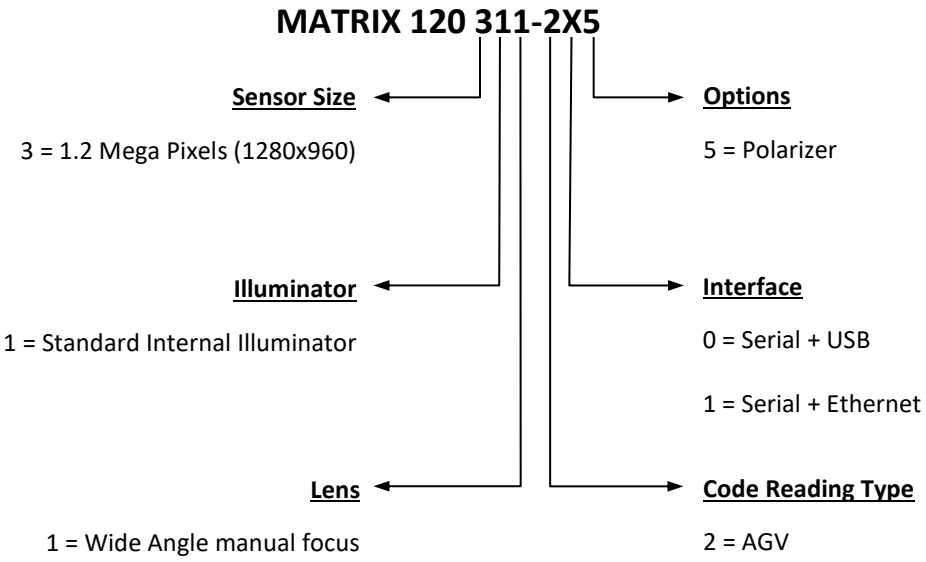
12 Calibration Procedure 37
12.1 Calibration setup 37
12.2 AGV Calibration on DL.CODE 37
13 Maintenance 39
13.1 Cleaning 39
14 Troubleshooting 39
14.1 General guidelines 39
14.2 Troubleshooting guide 39
15 Technical features 41
16 Accessories 42
17 Appendix 43

1 Models

This application note applies to the following models:

- Matrix 120 311-205 (part number 937800040)
- Matrix 120 311-215 (part number 937800041)

Their characteristics are described in the diagram below.



2 Product Description

The Matrix 120 AGV is a high-resolution positioning system to be used with Data Matrix codes. It can be used in all applications where Automated Guided Vehicles (AGV) need to be precisely placed at marked positions along a given lane. It detects Data Matrix tags to navigate within a grid. The device is located on an AGV and guides the vehicle within the grid, as shown in Fig. 1. For more details on Data Matrix tags, refer to par. 9.2.

Fig. 1 - AGV and Data Matrix tags

This device, just like every Matrix 120 reader, features the top industrial grade parts in its class (IP65 and 0-50 ºC / 32 – 122 ºF).

As part of the full Matrix series, the Matrix 120 AGV leads the market for customer ease of use because of DL.CODE™ configuration software, X-PRESS™ button and intuitive HMI.

The Matrix 120 AGV is the perfect solution when small dimension, simple integration and performance are the key drivers. This makes the Matrix 120 AGV the ideal product for all applications where AGVs are used to transport many different types of materials, e.g. pallets, rolls, racks, carts, and containers.

The Matrix 120 AGV comes in two different models (see par. 1) provided with a 1 m long cable and a M12 17-pole connector.

Fig. 2 - Matrix 120 311-215

Fig. 3 - Matrix 120 311-205

Highlights

- Ultra-compact dimensions for easy integration
- 1.2 MP models, wide angle optics, polarized filter
- Embedded Ethernet connectivity
- Top industrial grade: IP65; operating temperatures: 0-50 ºC / 32 – 122 ºF
- DL.CODE software configurator for outstanding ease of setup
- X-PRESS and intuitive HMI for top ease of use

2.1 Indicators and Keypad Button

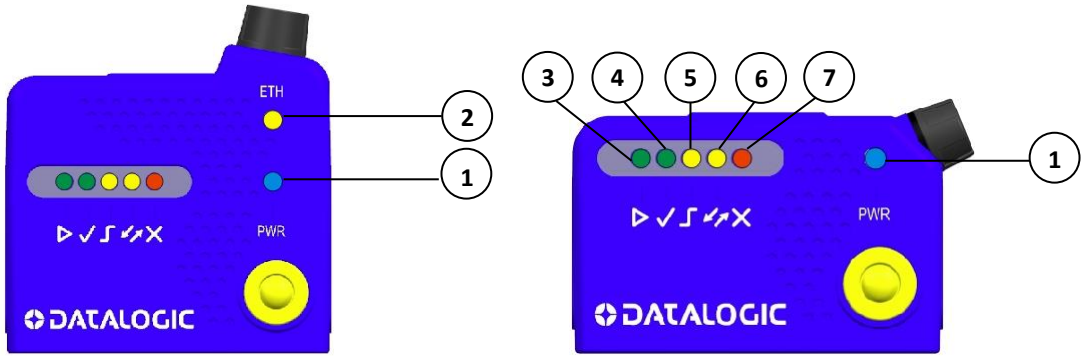


Fig. 4 - Indicators

The following LED indicators are located on the reader:

PWR	blue LED indicates that the reader is connected to the power supply (Fig. 4, 1)
NET	yellow LED indicates connection to the on-board Ethernet network (Fig. 4, 2)

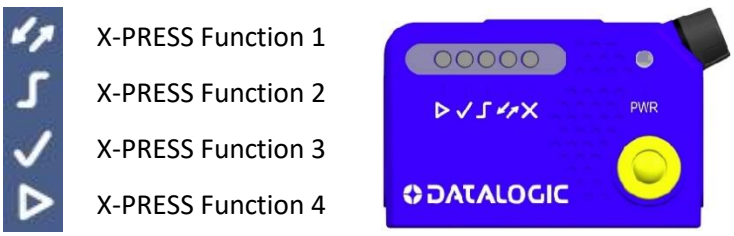
The colors and meaning of the five LEDs are illustrated in the following table:

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

3 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 can give immediate access to a set of functions (Backup, Restore, AGV Calibration, Backup Erase). To do this, the push button must first be assigned each function through the DL.CODE configuration program.



Quick access to these 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.

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

4 General Specifications for AGV Applications

Max. Speed	≤ 3 m/s
Reading Distance	85 mm ± 2mm
Reading Field (@85mm)	90 mm x 67 mm
Position Accuracy (X, Y)	± 0.1 mm*
Angle Accuracy	± 0.1 °degree*

**Typical Value at Nominal Reading Distance (85mm)*

5 Ambient Conditions

Operating Temperature	0°C to 50°C / 32 – 122 ºF
Degree of Protection	IP65

6 Mechanical Dimensions

The Matrix 120 AGV reader can be installed to operate in different positions. The four screw holes (M2.5 x 3.5) on the body of the reader are for mechanical fixture (see Fig. 5 and Fig. 6).
The diagrams below give the overall dimensions of the reader and may be used for its installation.
Refer to par. 11.2 for correct mounting and positioning.

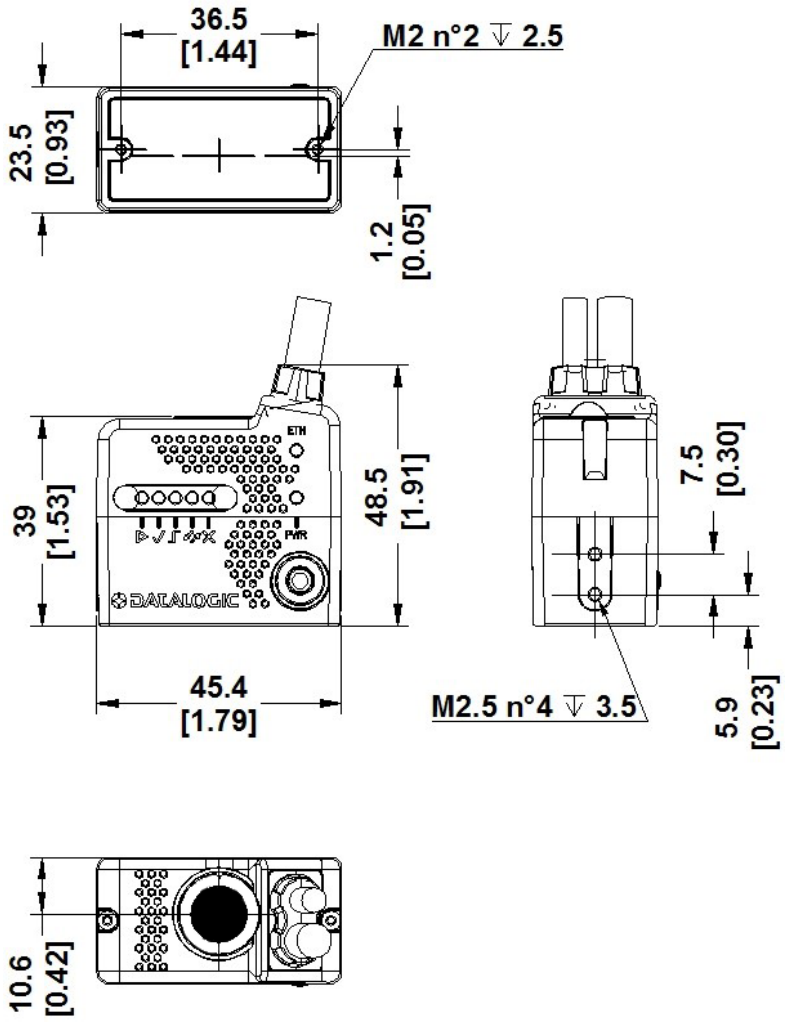


Fig. 5 - Matrix 120 311-215 mechanical dimensions

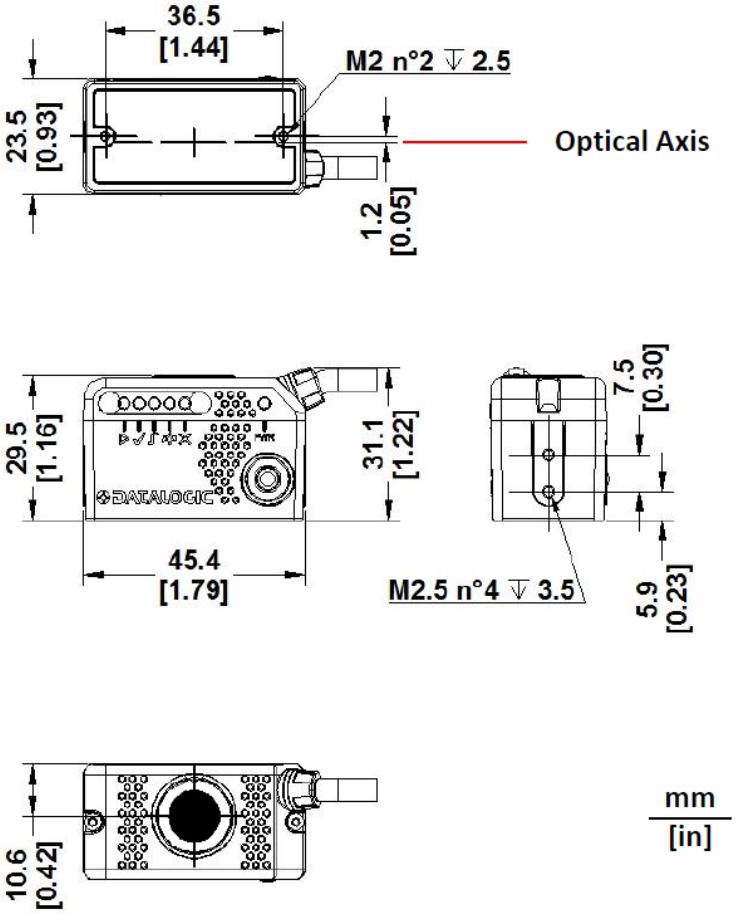


Fig. 6 - Matrix 120 311-205 mechanical dimensions

7 Working distance and moving direction

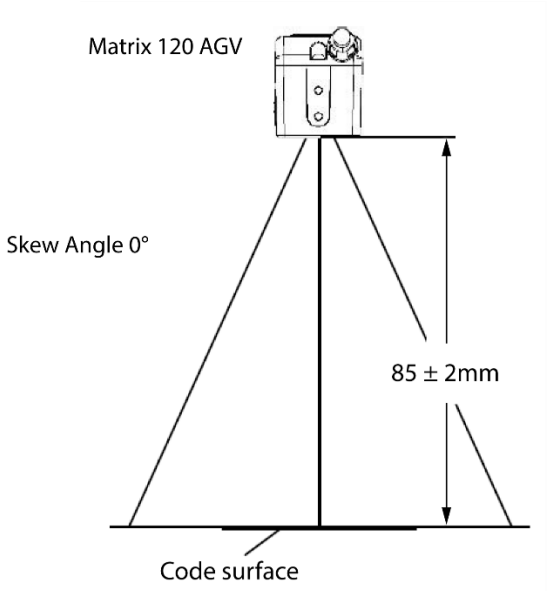


Fig. 7 - Working distance

The reading distance indicated in Fig. 7 applies to all Matrix 120 AGV models and must be observed to guarantee the best product performance.

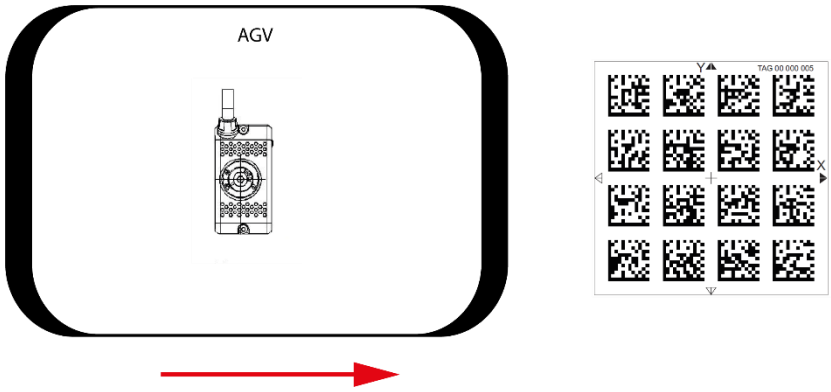


Fig. 8 - Moving direction

As shown in Fig. 8, the Matrix 120 AGV should be installed with the longer side of the camera module directed toward the Data Matrix tags to achieve greater code reading coverage.

8 Interface

Communication Interfaces	
Main - RS232 - RS422 full-duplex	 2400 to 115200 bit/s 2400 to 115200 bit/s
USB	USB 2.0 Hi-Speed
Ethernet (Built-in) supported application protocols	10/100 Mbit/s TCP/IP, EtherNet/IP, Modbus TCP

9 Electrical Specifications

Operating Voltage	5 to 30 Vdc
Power Consumption (typical)	1.8W

9.1 Connector Pinout

The Matrix 120 AGV 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:

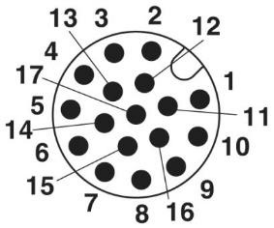


Fig. 9 - M12 17-pin Male COM, I/O and Power Connector

Power, COM and I/O Connector Pinout			
Pin	**Name**	**Function**	
1 2 Connector case	Vdc GND CHASSIS	Power supply input voltage + Power supply input voltage - Connector case provides electrical connection to the chassis and cable shield	
6 5 13 3	IN1 Reserved IN2 -	External Trigger (referenced to GND) Reserved - do not connect Input 2 (referenced to GND)	
9 8 16	O1 O2 -	Output 1 Output 2	(NPN or PNP short circuit protected and software programmable)
14 4	- -	Not used	
7 15	♦USB+ ♦USB-	USB data + (only for USB models) USB data - (only for USB models)	
Pin	**Name**	**RS232**	**RS422 Full-Duplex**
17 11 12 10	MAIN INTERFACE (SW SELECTABLE)	TX RX - -	TX+ ♦♦RX+ TX- ♦♦RX-

In order to meet EMC requirements:
Connect the reader chassis to the AGV case by means of the mounting bracket. Connect your cable shield to the locking ring nut of the connector.

- ♦ When using the USB interface without Datalogic accessory cables, EMC compliance requires the USB data and power signals originate from the same source (i.e. computer). Max USB cable length from M12 17-pin connector is 2 meters. **Incorrect disconnection can result in damage to the USB hub.**

♦♦ Do not leave floating

9.2 On-Board Ethernet Connector (Matrix 120 311-215 model)

A Standard M12 D-Coded female connector is provided for the on-board Ethernet connection of the Matrix 120 311-215 model. This interface is IEEE 802.3 10 BaseT and IEEE 802.3u 100 BaseTx compliant.

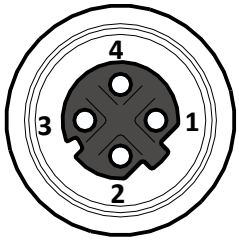


Fig. 10 - M12 D-Coded Female Ethernet Network Connector

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 (-)

10 Data Matrix tags

Data Matrix tags are numbered consecutively and contain position information within a grid formed by several tags. A cross in the center of the Data Matrix tag marks the zero point. The X and the Y axes are marked starting from the zero point. The black arrow indicates the positive axis and the white arrow indicates the negative axis (see Fig. 11 and Fig. 12).
Each Data Matrix tag measures 85mm x 85mm and is composed of 4 x 4 codes. Each code is identified with a 10-digit number and contains 12 x 12 modules (module resolution = 1.25mm).

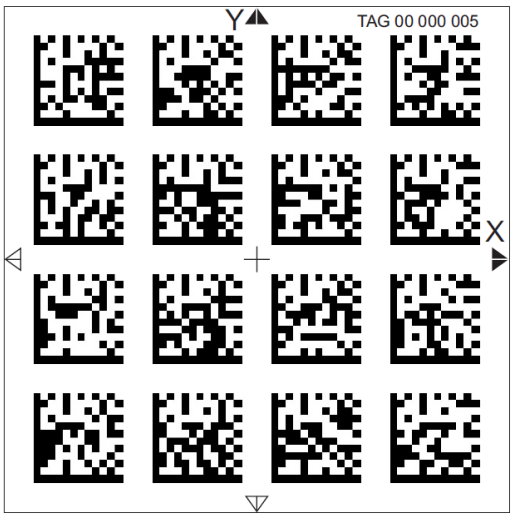


Fig. 11 - Data Matrix tag (1)

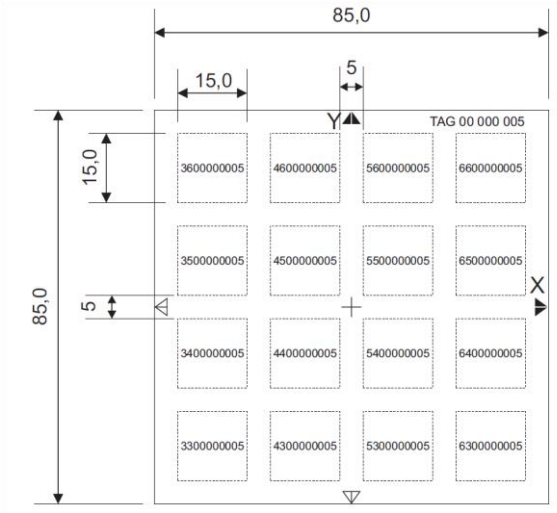


Fig. 12 - Data Matrix tag (2)

Each Data Matrix code inside the tag indicates its position relative to the center of the tag (first 2 digits) and the tag number, identified by a row (4 digits) and a column (4 digits) in relation to the whole plant.
For example, in code 3600000005:

- the first digit (3) refers to the X direction,
- the second digit (6) refers to the Y direction,
- the rest of the code (00000005) is the tag number (row = 0000; column = 0005).

To form a Data Matrix grid as shown in Fig. 13, Data Matrix tags should be positioned at a typical distance of 50cm – 1m from each other, depending on the AGV systems used in the plant, i.e. small sorting AGV systems (typical distance = 50-55cm) or warehousing & picking AGV systems (typical distance = up to 1m).

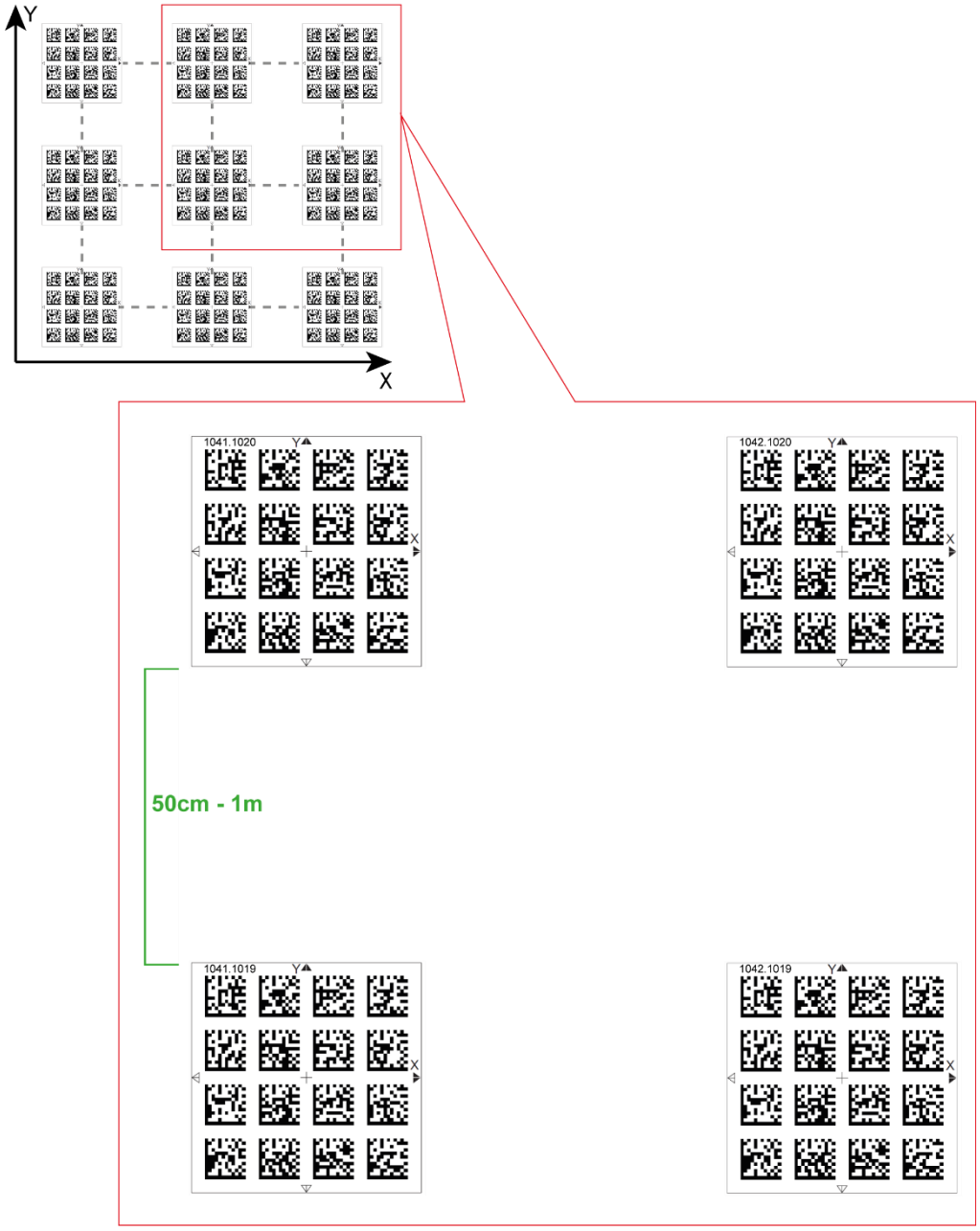


Fig. 13 - Data Matrix grid

Each tag inside the grid is identified by an 8-digit number, which refers to the row and column where the tag is located within the plant.
For example, in tag 1041.1020:

- 1041 refers to the row (X direction),
- 1020 refers to the column (Y direction).

When a tag image is captured, the reader first calculates its X, Y position and angle, and then communicates the X, Y and angle corrections to the AGV.

NOTE: Each time a tag is identified, the Matrix 120 AGV transmits the relative message to the client. Due to high data rate (max. 66 frames/s), it is recommended to use an efficient client system to manage all transmitted messages preventing any loss of data.

11 Configuration

11.1 Step 1 – Connect the System

The paragraphs in this step show a typical hardware setup depending on the Matrix 120 model and interface selection.

11.1.1 Ethernet Connections

To connect the system in an Ethernet point-to-point configuration, you need the hardware indicated in Fig. 14. In this layout the data is transmitted to the AGV from the Matrix 120 311-215 on-board Ethernet interface by using a **CAB-ETH-M0x** cable.

Matrix 120 311-215 power device connection takes place through the custom power cable.

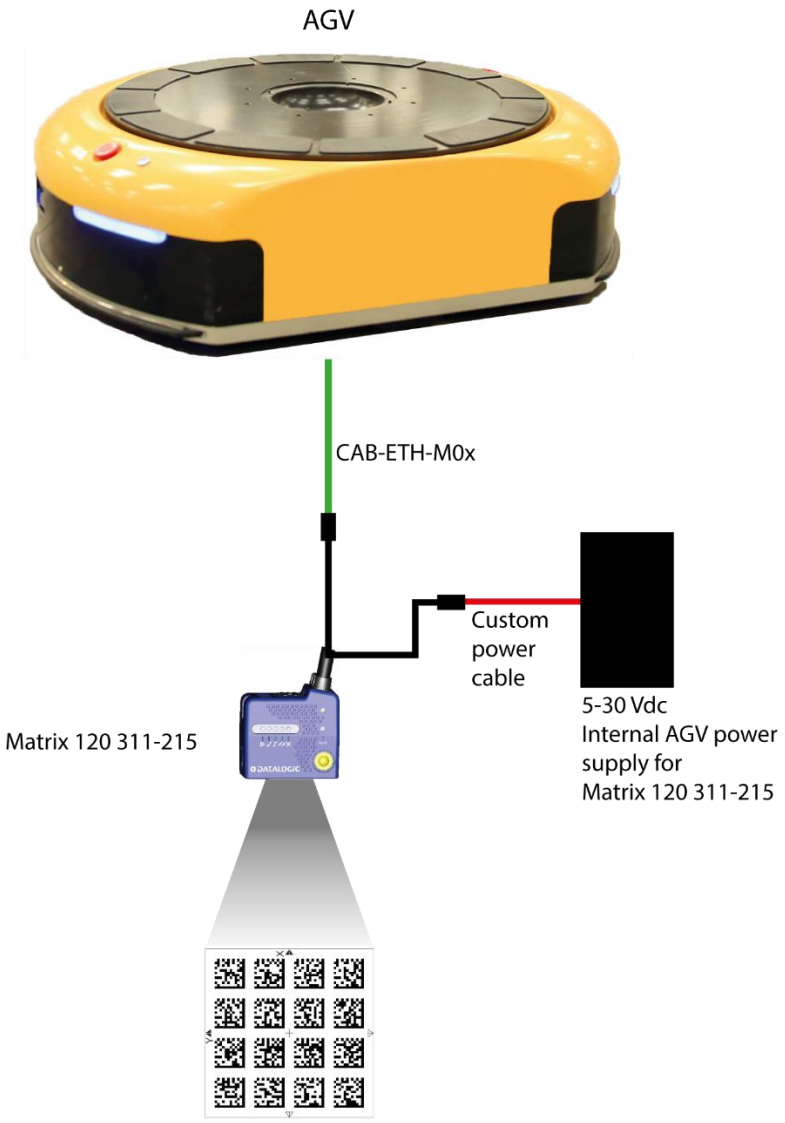


Fig. 14 - Ethernet Point-to-Point Layout

11.1.2 USB Connections

To connect the system in a USB point-to-point configuration, you need the hardware indicated in Fig. 15. In this layout the data is transmitted to the AGV from the Matrix 120 311-205 USB interface by using a **CAB-1021** accessory cable.

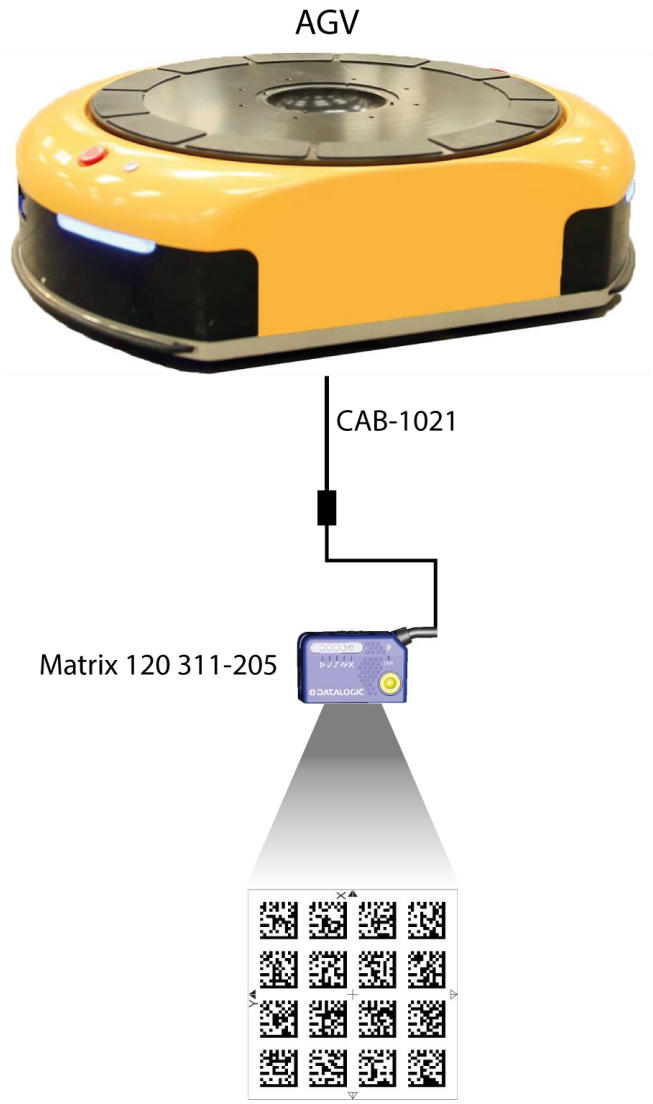


Fig. 15 - USB Point-to-Point Layout

11.1.3 Serial Connections

To connect the system in a Serial point-to-point configuration, you need the hardware indicated in Fig. 16. In this layout the data is transmitted to the AGV from the Matrix reader main serial interface.

Matrix 120 311-205 power connection takes place through the **RS232** or **RS422** accessory cable.

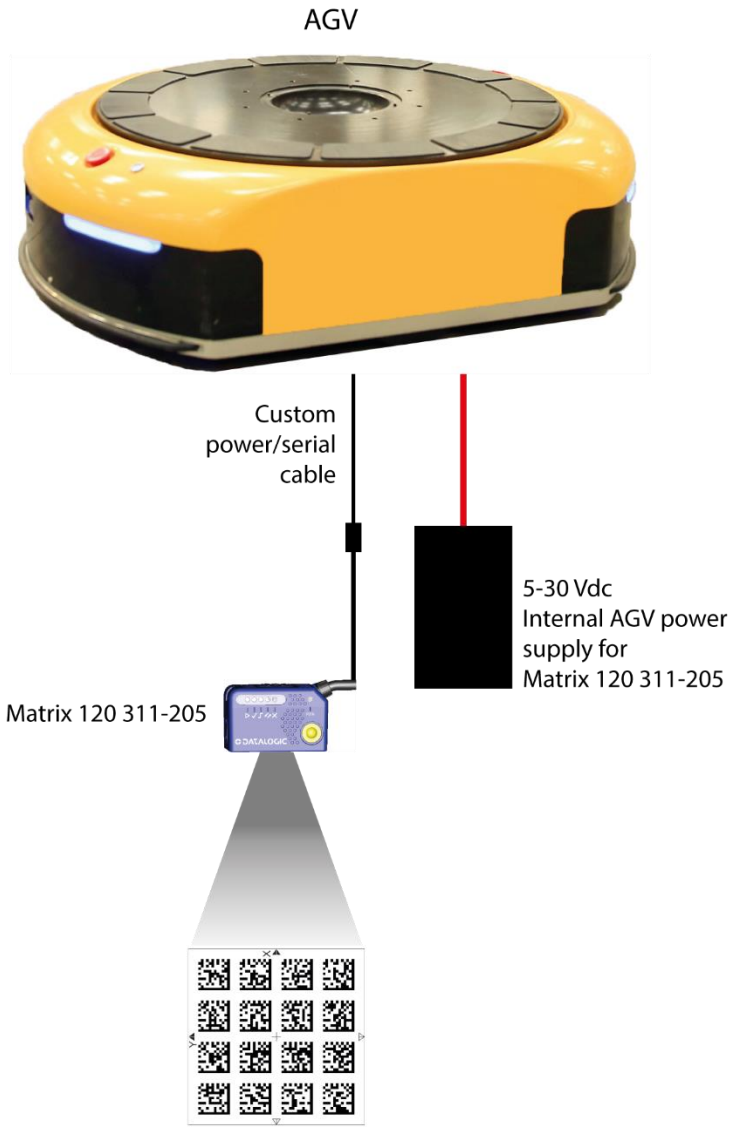


Fig. 16 - Serial Point-to-Point Layout

NOTE: For device configuration through DL.CODE, it is recommended to use either the Ethernet or USB interface (depending on your model). For Ethernet connections see par. 11.1.1, for USB connections see par. 11.1.2.

11.2 Step 2 – Mount and Position the Reader

To mount the Matrix 120 AGV, use a custom mounting bracket to obtain the most suitable position for the reader. The device is provided with two mounting holes on the left and two more on the right, as shown in Fig. 17.

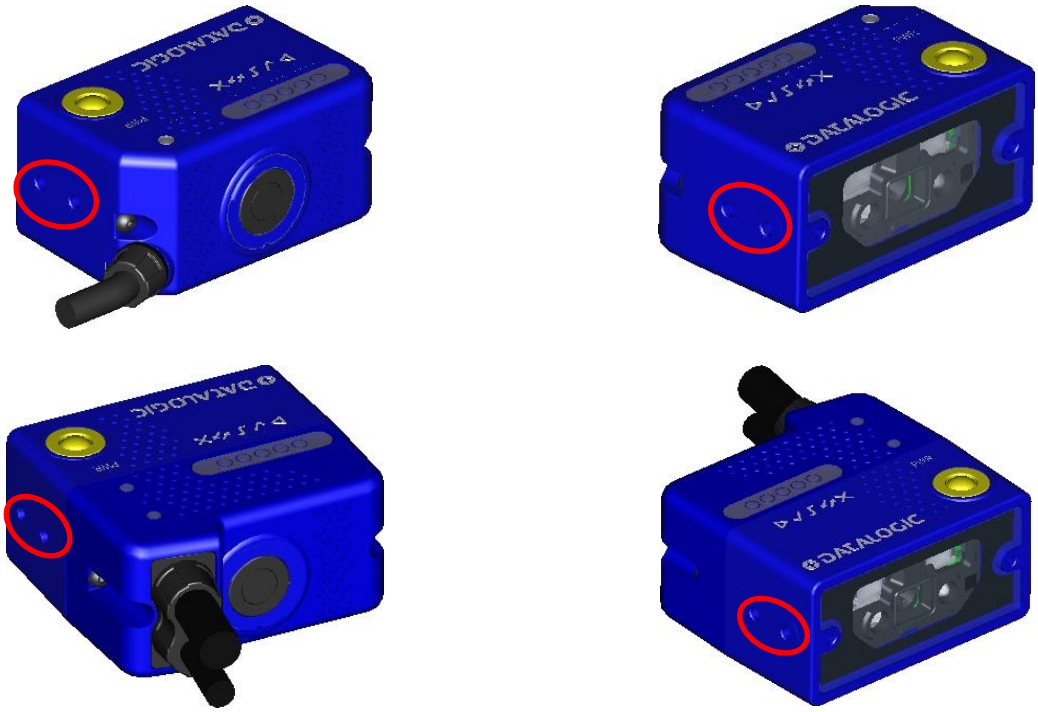


Fig. 17 – Holes for Mounting Bracket

NOTE: Refer to Fig. 7 and Fig. 8 to determine the distance your reader should be positioned at.

11.3 Step 4 – 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 Driver Installation

To install DL.CODE:

1. On the PC that will be used for configuration (running Windows 7, 8.1, 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 configure Serial + USB model devices, check the appropriate Matrix USB Driver and/or RS232 Serial Port Driver installation boxes in the Welcome window of the DL.CODE Installer. In this case it is recommended to reboot the PC after DL.CODE installation.

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.

The Matrix 120 AGV can be connected to the DL.CODE configuration environment through one of the following interfaces:

Interface	Instructions
Ethernet Configuration	STEP 4A (par. 11.4)
USB Configuration	STEP 4B (par. 11.5)

11.4 Step 4A – Ethernet Device Discovery

The following configuration procedure assumes that a laptop computer running DL.CODE is connected to a factory default reader through the Ethernet port. See par. 11.1.1.

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.

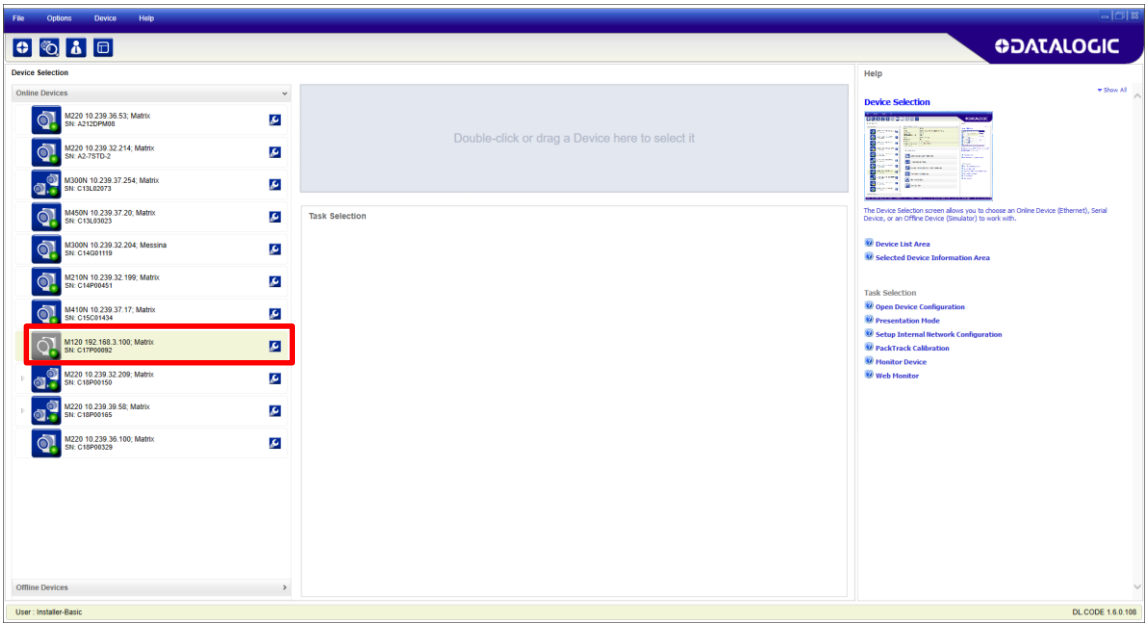


Fig. 18 - Device Discovery

The discovery feature will also show devices not belonging to the LAN and display them in gray.

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). To do this, follow this procedure:

1. 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.
2. Change the Ethernet Settings (IP Address, Subnet Mask, Gateway Address etc.) according to the network requirements.

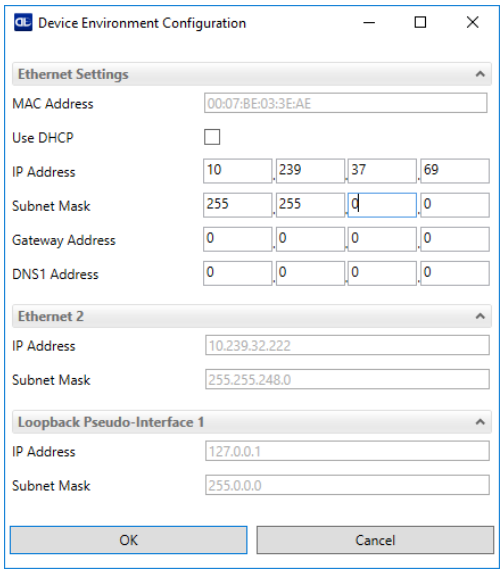


Fig. 19 - Device Environment Configuration Window (1)

3. Click OK; the device will now restart and apply the changes.

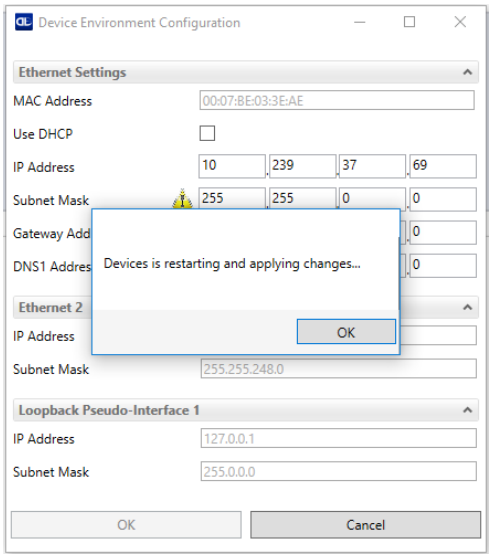


Fig. 20 - Device Environment Configuration Window (2)

4. After restarting, 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.

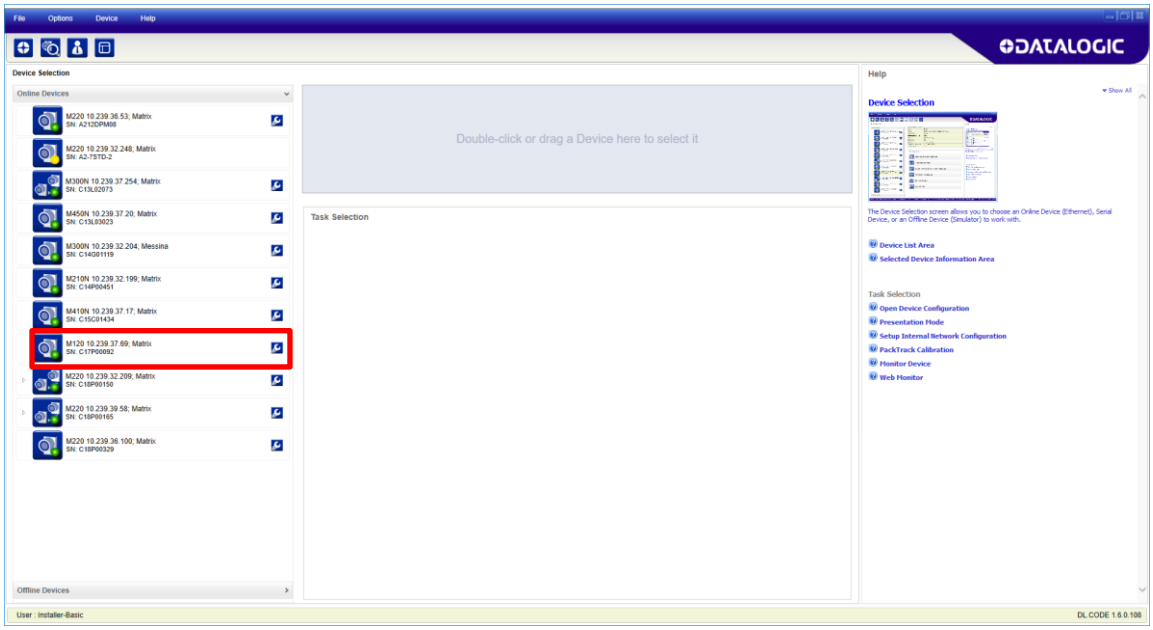


Fig. 21 - Device Discovery

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

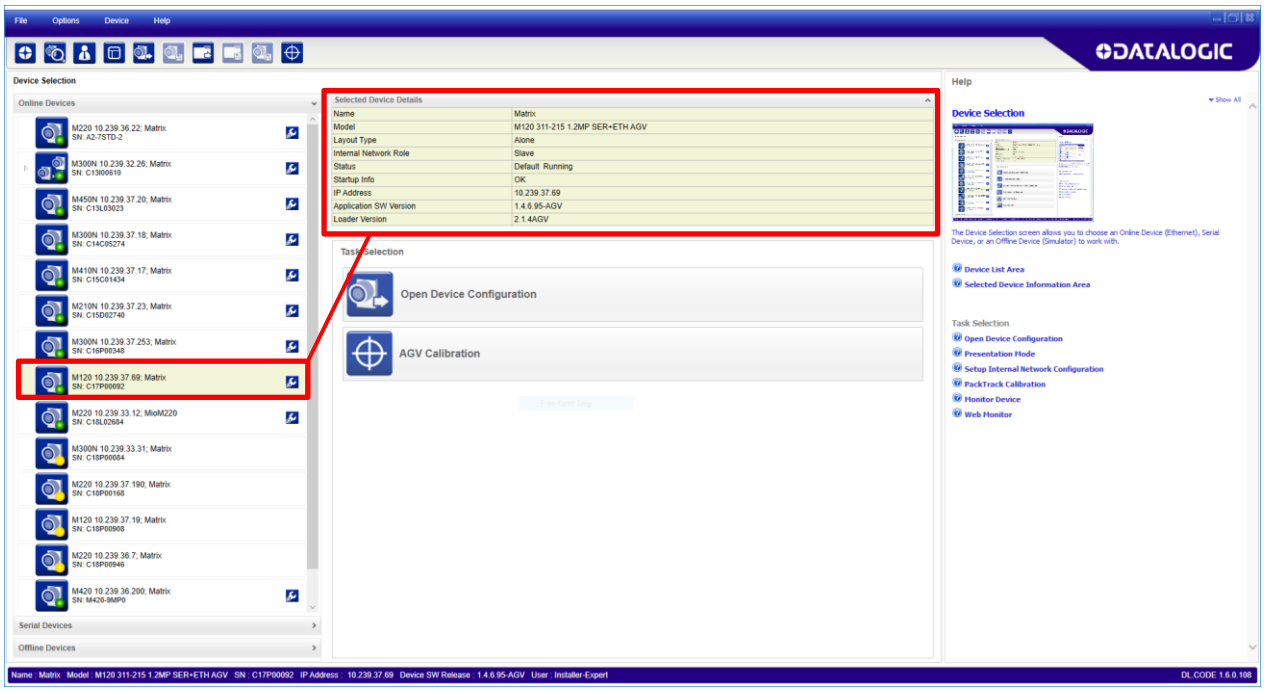


Fig. 22 - DL.CODE Opening Window

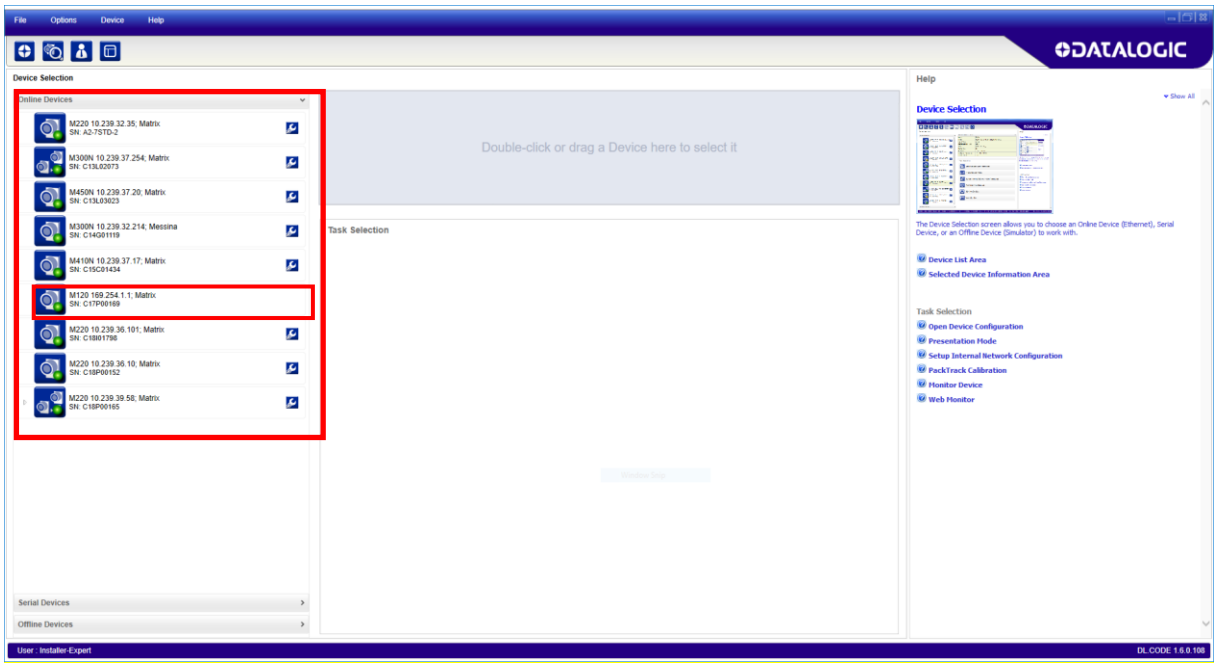
NOTE: After device discovery, configure your device through DL.CODE as described in par. 11.6.

11.5 Step 4B – USB Device Discovery

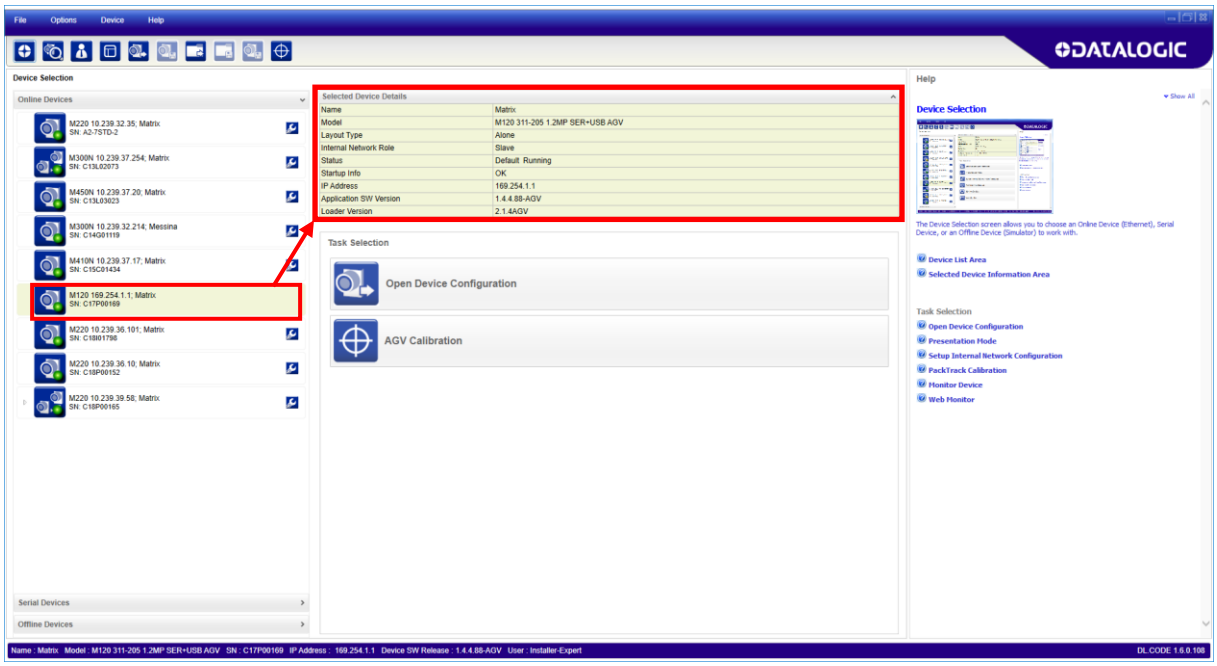
The following configuration procedure assumes that a PC running DL.CODE is connected to a Matrix 120 311-205 factory default reader through the USB port (CAB-1021). See par. 11.1.2.

1. After the reader is connected to the USB port and boots up successfully, from DL.CODE, click the Getting Started button to discover it. The unit will be shown in the network Online Devices list.

2. Find your device in the list by matching its serial number (SN). The USB driver creates a virtual Ethernet connection with an IP address that cannot be modified. It is easy to identify the unit in the list because it is the one without a wrench icon (used for modifying the IP parameters).



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



NOTE: After device discovery, configure your device through DL.CODE as described in par. 11.6.

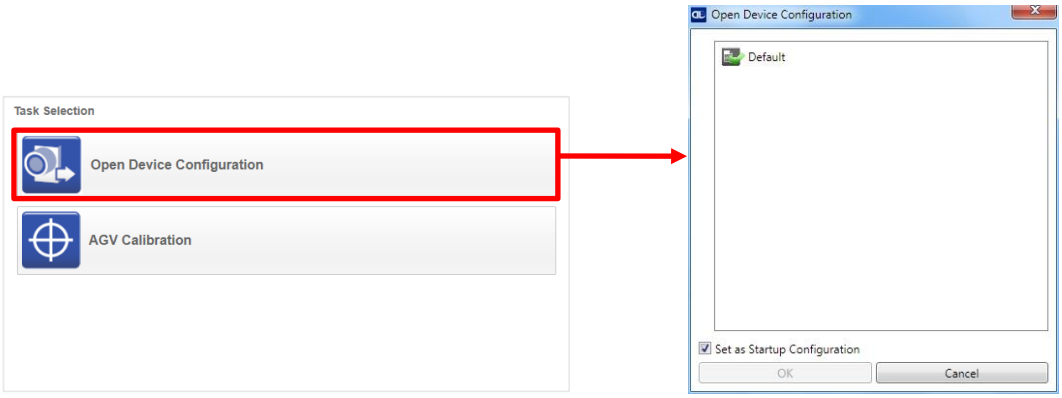
11.6 Step 5 – Device Configuration

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

11.6.1 Code Setup

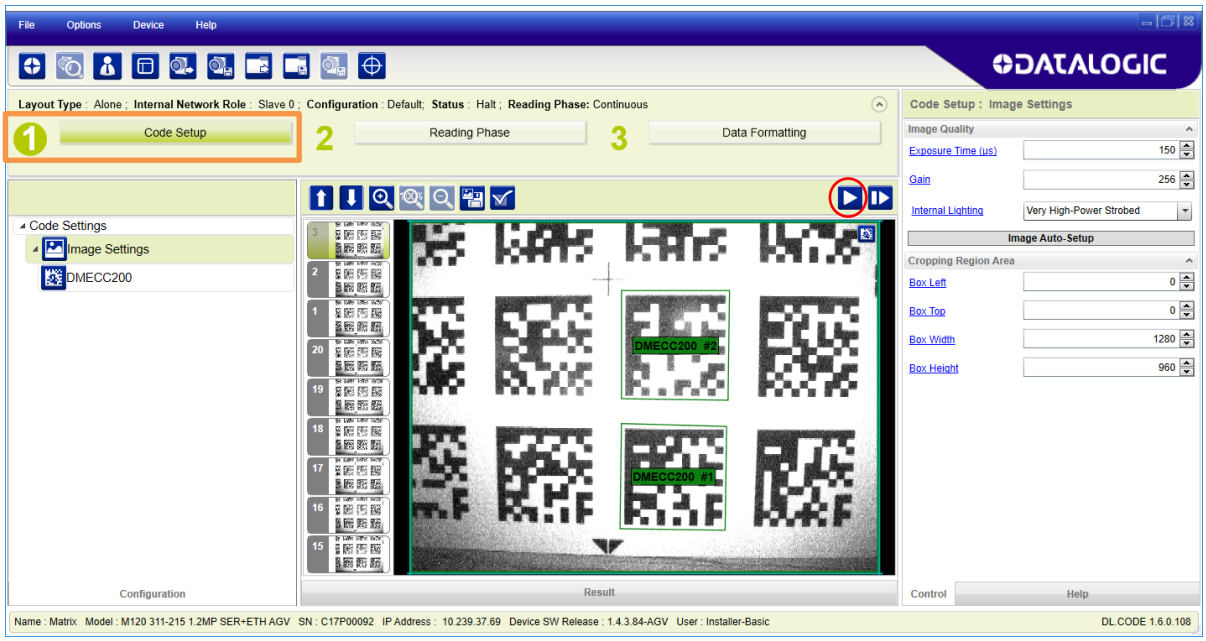
1. From the Task Area select Open Device Configuration.

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 a Data Matrix code in front of the reader at the correct application reading distance (refer to Fig. 7 and Fig. 8).

4. Once positioned, stop image acquisition by clicking on the Pause button .



NOTE: If the image display area is too dark to see the images being captured, you can edit the Gain and Exposure Time values on the right side to increase visibility. Changes of Gain and Exposure Time should be defined by the type of material of the Data Matrix tag (reflective or not)

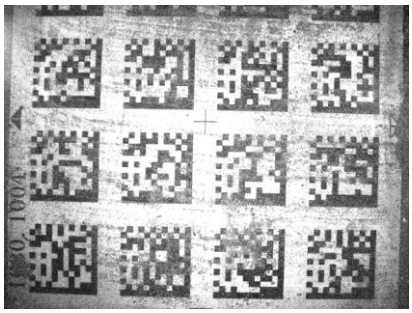
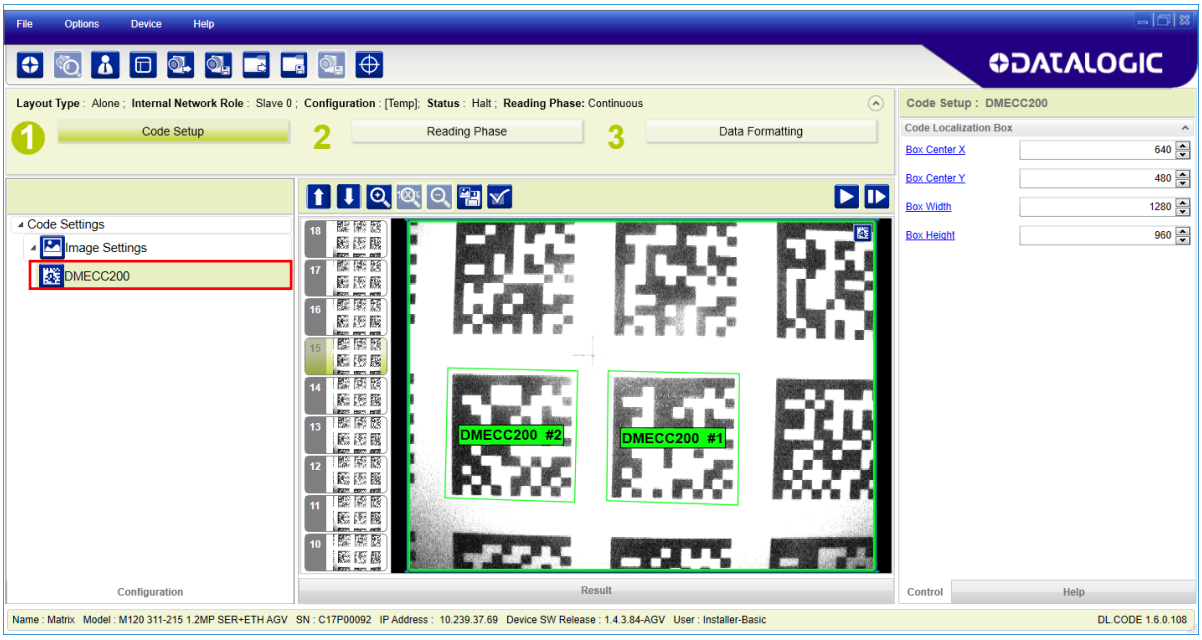


Fig. 23 - Dirty Data Matrix tag

If dirty Data Matrix tags are present in the plant, Datalogic suggests over-exposing the image (max. white level higher than 256 gray levels) to guarantee the best image contrast (over-exposed images can be managed by the Matrix 120 AGV reader thanks to its polarized filter).

5. Click on the Data Matrix ECC 200 symbology under the Image Settings branch (enabled by default). It will be shown in the image display with its code symbology name and a small green box around it indicating it is decoded.

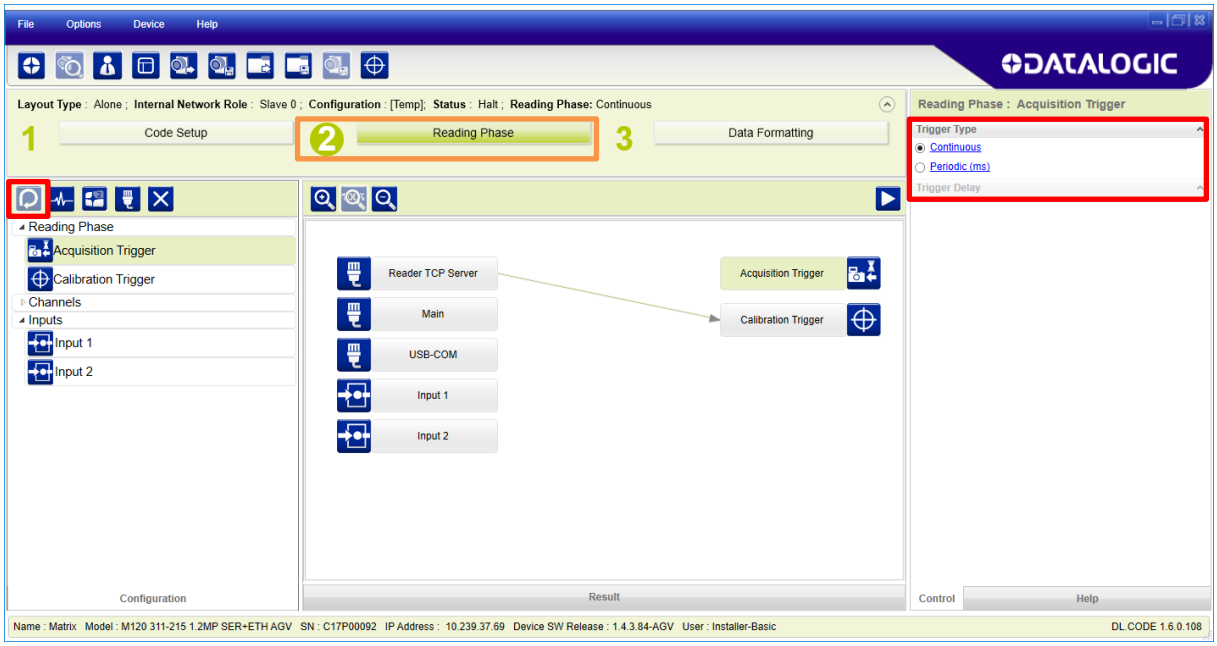


Your reader is now optimized for decoding. Continue with the Reading Phase configuration (refer to par. 11.6.2).

11.6.2 Reading Phase

1. Select your application specific Operating Mode from the icons over the Configuration Parameters tree area. If you select the **Continuous mode**, the following trigger types are available:

    - **Continuous** (suggested operating mode): allows acquiring images continuously with a rate up to the maximum allowable frame rate per second for the sensor depending on the decoding time and the Image Cropping settings.
    - **Periodic (ms)**: allows a continuous acquisition of images with a defined frequency. If a Delay on Internal Trigger is enabled, the acquisition process starts after the selected delay.



If you choose the **Phase Mode**, first select the source of the Phase On Trigger event. It is possible to select multiple events so that any one of them will start the reading phase.

- Communication Interfaces (Serial, TCP/IP User Sockets; Fieldbuses) require defining the string to use as the trigger event.
- Inputs (Input 1, Input 2; or any on-board Fieldbus Master Output Area bits 0-7) require defining the Leading or Trailing signal edge as the trigger event.

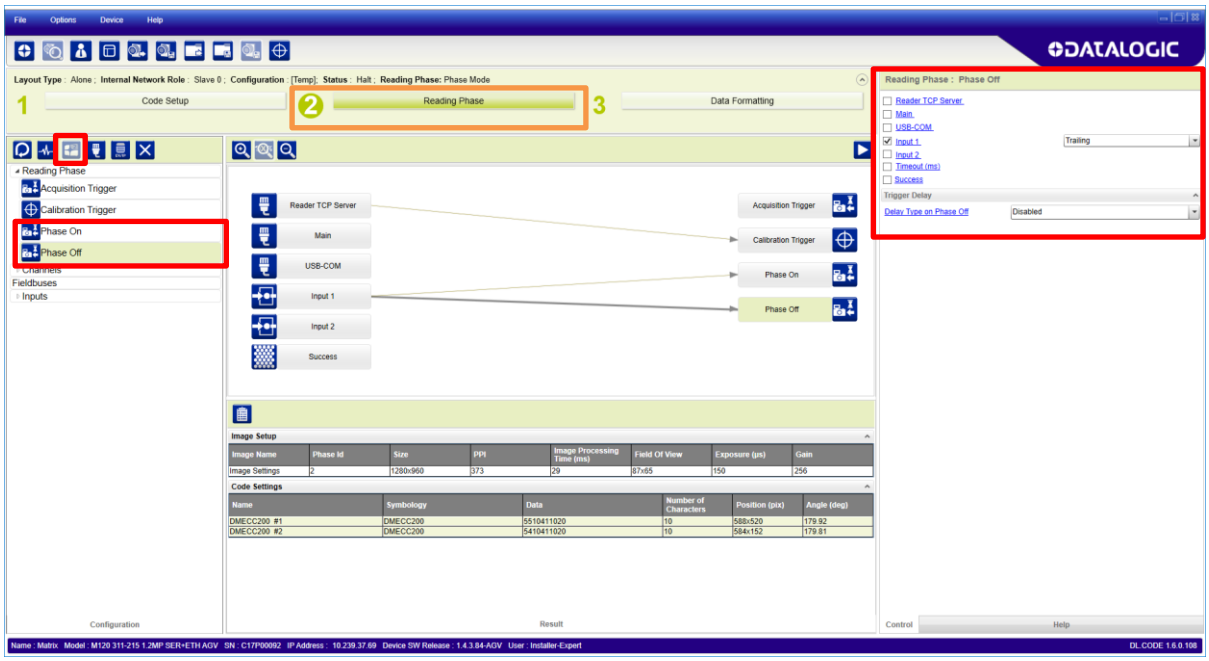
NOTE: Digital Inputs do not support more than one event per edge.

Then select the source of the Phase Off Trigger event. It is possible to select multiple events so that any one of them will end the reading phase.

- Communication Interfaces (Serial, TCP/IP User Sockets; Fieldbuses) require defining the string to use as the trigger event.
- Inputs (Input 1, Input 2; or any on-board Fieldbus Master Output Area bits 0-7) require defining the Leading or Trailing signal edge as the trigger event.

NOTE: Digital Inputs do not support more than one event per edge.

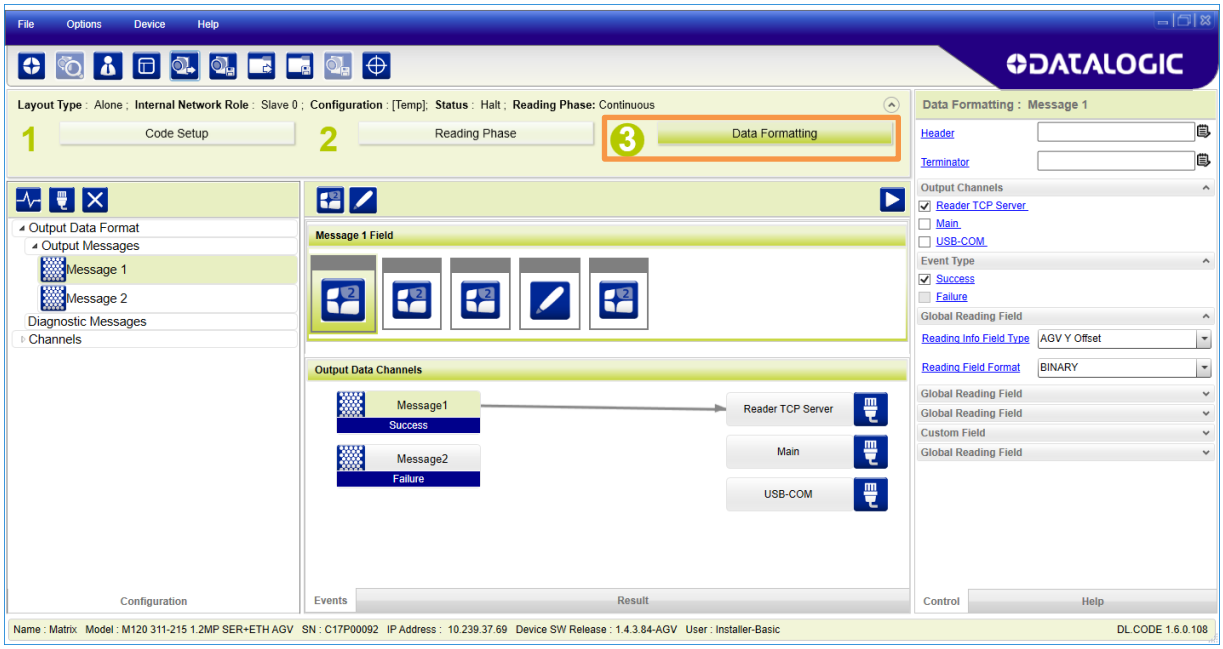
Timeout is the time starting from the Phase On event (plus any Phase Off Trigger Delay) to the Phase Off event. Values up to 1 minute can be set in millisecond increments.



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.

11.6.3 Data Formatting

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. You can also delete a field by selecting it and pressing the delete key.

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

NOTE: By default, the information acquired through successful reading is transmitted as a stream of bits. For the sake of clarity, you can switch from the binary to the ASCII format under “Reading Field Format” on the right side of the Data Formatting page (see figure above).

NOTE: By default, in case of reading failure (no read) no information is transmitted.

The output data format will send out the displacement between the tag center and the reader FOV center by means of the AGV Y Offset, the AGV Y Offset, the AGV Yaw Angle and the Tag number. See an example in the figure below.

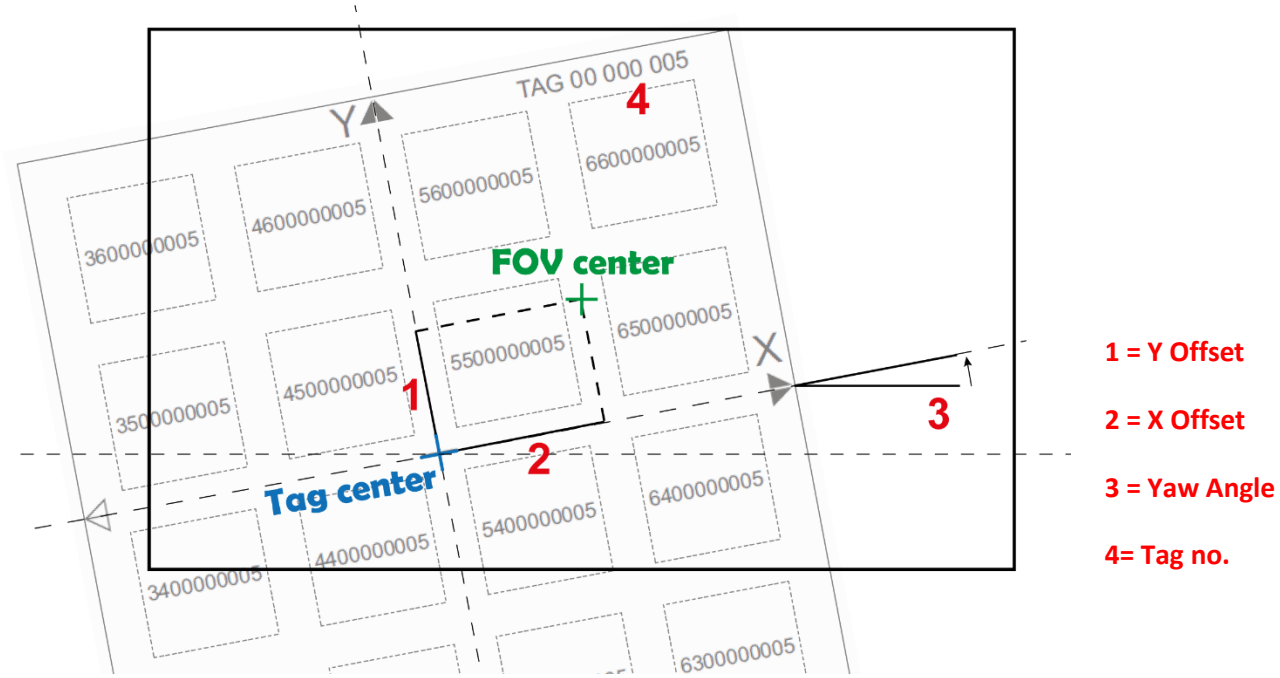
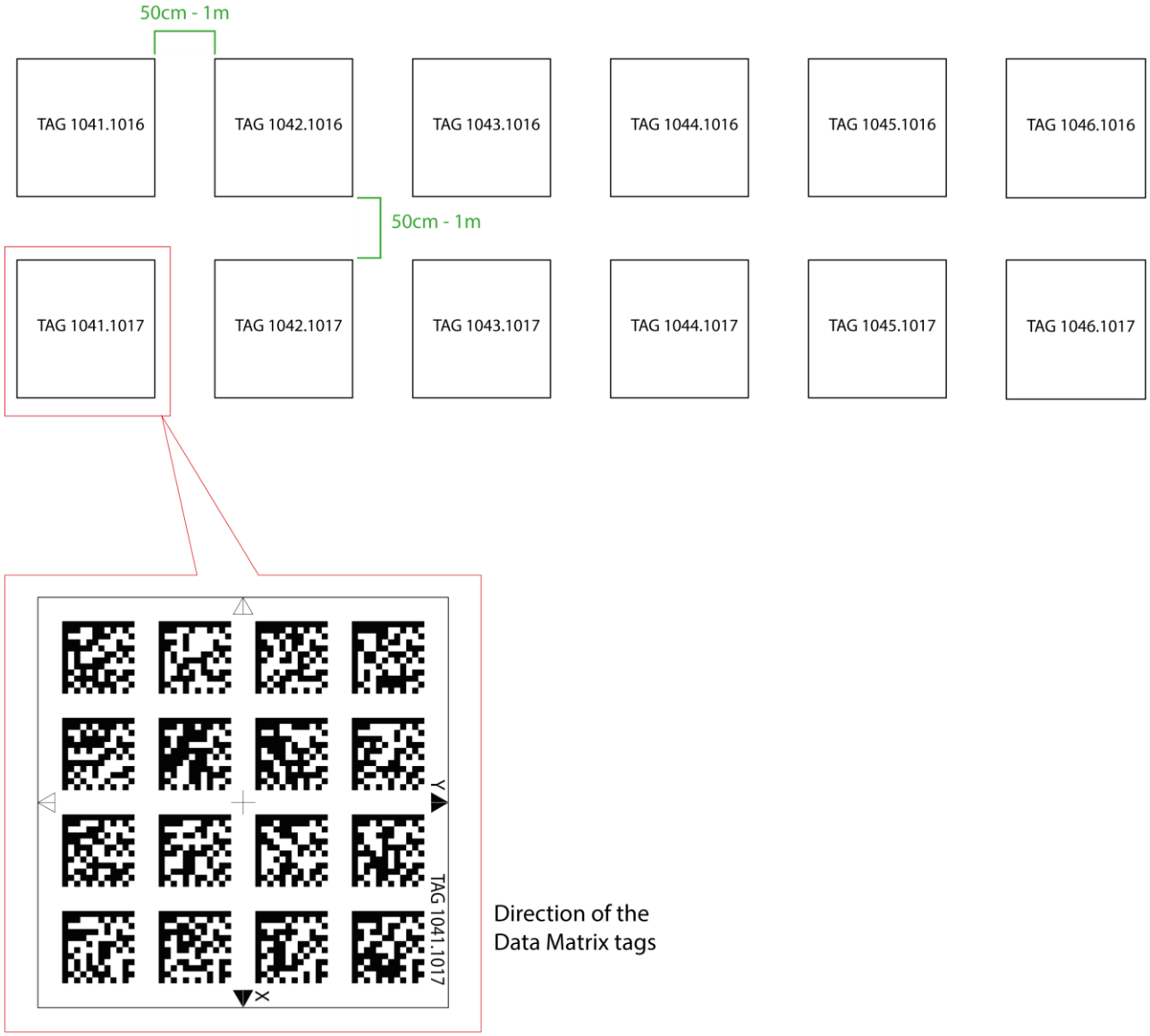


Fig. 24 – Displacement between tag center and FOV center

11.7 Test

To test your configuration, you can print the Data Matrix tags provided in the Appendix. These tags will form the following test grid, which is just part of a possible grid present in a plant.



As described in par. 10, Data Matrix tags should be positioned at a typical distance of 50cm – 1m from each other, depending on the AGV systems used in the plant, i.e. small sorting AGV systems (typical distance = 50-55cm) or warehousing & picking AGV systems (typical distance = up to 1m).

Based on your configuration and the software installed on your device, the Matrix 120 AGV will read the tags (in this case, starting from tag 1041.1016). From DL.CODE you can check if the reading results are correct.

11.8 Backup and Restore Through DL.CODE

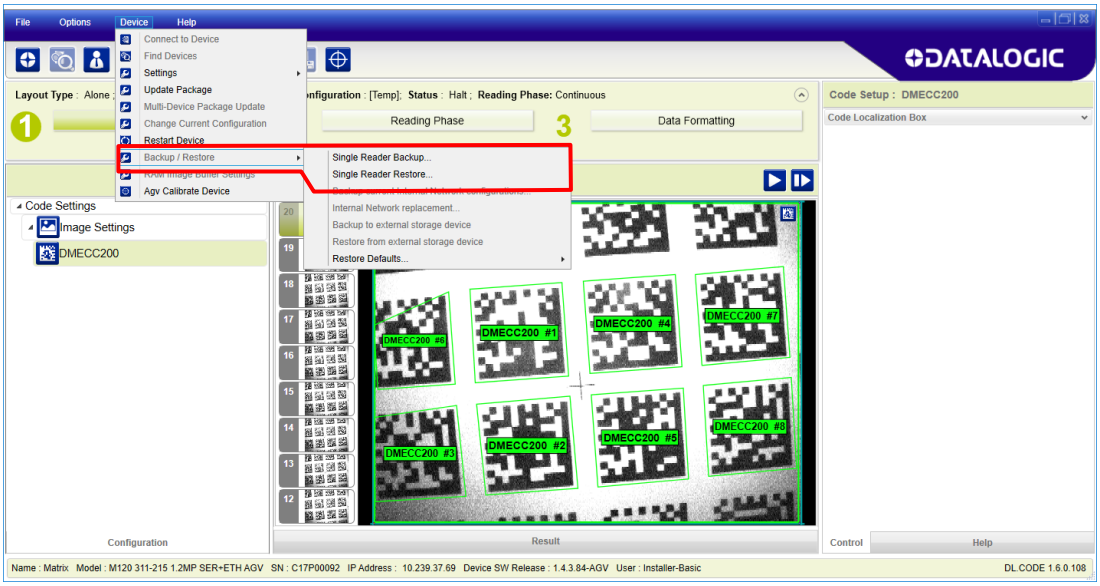
DL.CODE allows Backup and Restore to be performed to/from the configuration PC **only** via file.

DL.CODE provides complete backup and restore functions (Configuration and Environmental parameters) for Matrix 120 AGV readers.

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

CAUTION: It is strongly recommended to save all configurations to backup files.

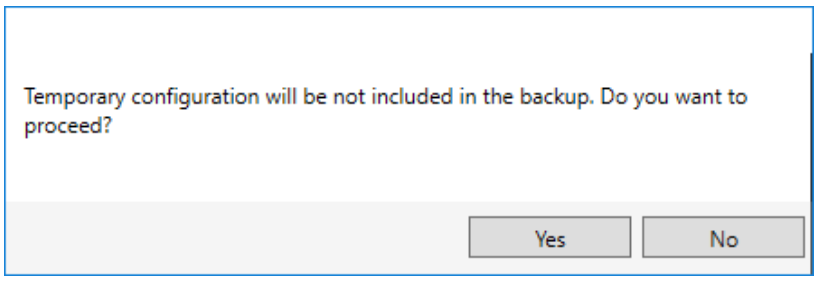
When performing Backup and Restore to/from file, device firmware can be included.



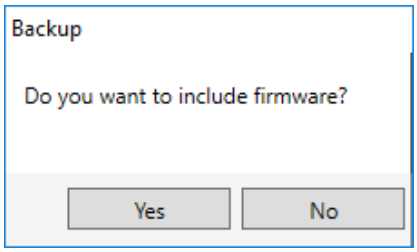
11.8.1 Backup

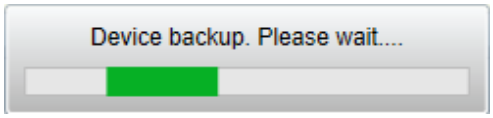
To perform a **Backup**:

1. From the DL.CODE Device menu, select **Backup/Restore > Single Reader Backup**…
2. 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.

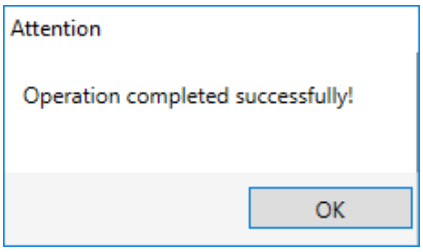


3. You will also be asked whether to include the firmware or not.





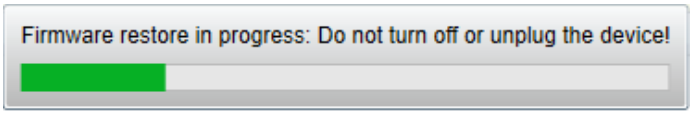
4. Choose the location where you want to save the backup .zip folder.
5. At the end of the backup, DL.CODE shows a message indicating successful completion.



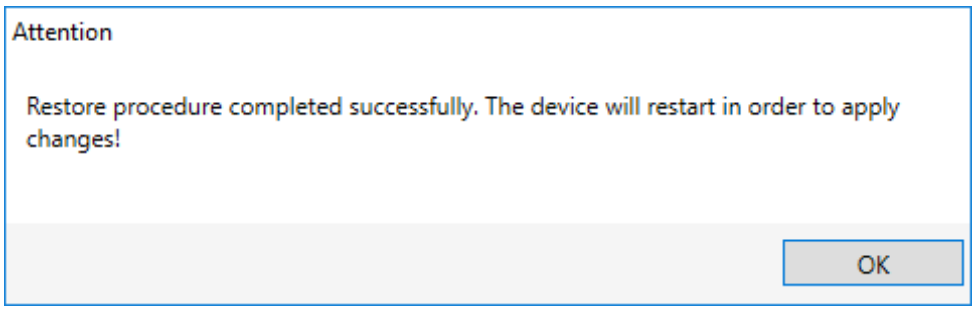
11.8.2 Restore

To perform a **Restore**:

1. From the DL.CODE Device menu, select **Backup/Restore > Single Reader Restore**…
2. Select the backup .zip folder you want to use for device restoring.



3. At the end of the procedure, DL.CODE shows a message indicating successful completion. The device will restart to apply changes.



11.8.3 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 **Single Reader Restore** (from file on PC) (see Restore procedure in par. 11.8.2).

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

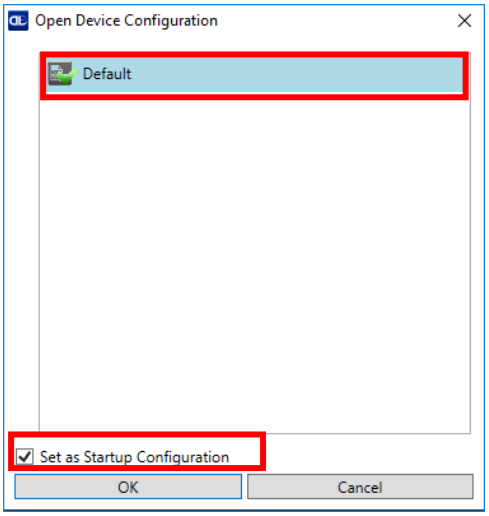
11.9 Restore Defaults

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

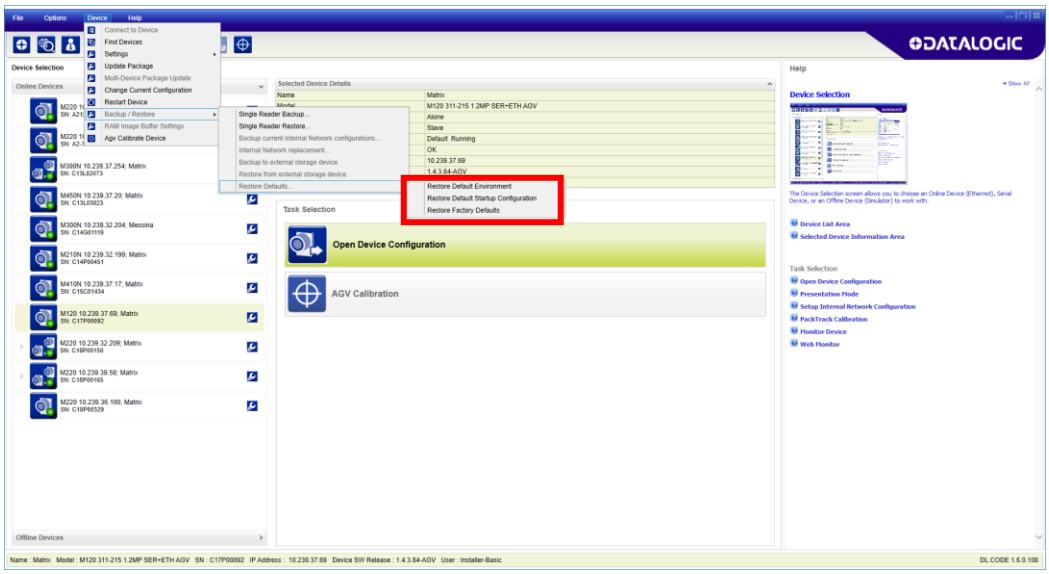
- The Configuration parameters are the ones set in the various steps of the configuration process and are specific to each application. When multiple configurations (jobs) are saved on a single device, these parameters can be different from one configuration to the next.
- Environment parameters regard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

11.9.1 Restore Default Startup Configuration

The Default configuration is always present on the reader, it cannot be edited or deleted. It can always be restored by simply selecting it from the Open 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.



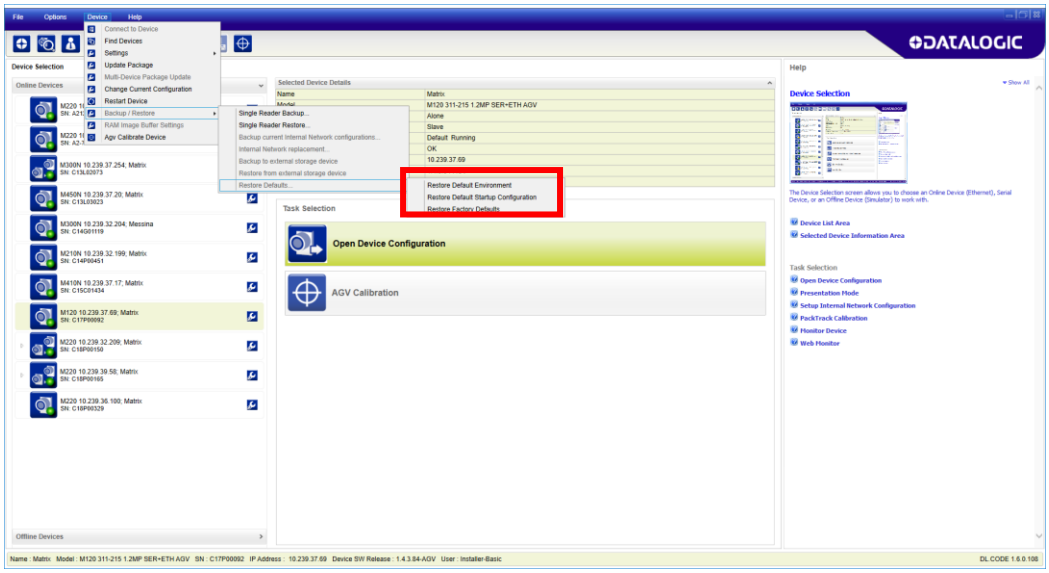
Any previously saved configurations on the device will remain in memory, but the Default configuration is set as the startup configuration.

11.9.2 Restore Default Environment

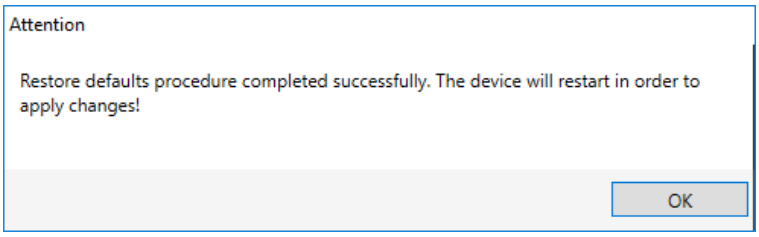
Restore Default Environment returns all Environment parameters to their factory default settings. For Ethernet models, the default IP address will be restored as well as all the parameters managed in the Device Environment Configuration window.

NOTE: The Factory Default static IP address for all Matrix 120 Ethernet model readers is: **IP Address = 192.168.3.100**

1. From the Device menu > Backup/Restore > Restore Defaults > Restore Default Environment.



2. At completion, the following message will be displayed, informing that the Matrix reader will restart to apply changes.



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

11.9.3 Restore Factory Defaults

In order to return a device to its absolute Factory default parameters (e.g. in case of 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 will start in run mode with the factory default configuration.

CAUTION: Do NOT upgrade the software package on the Matrix 120 AGV. The device may stop working correctly because of software compatibility issues.

12 Calibration Procedure

The calibration procedure is required to compensate the offset between the optical center of the reader and the effective center of the AGV due to mechanical tolerances.

12.1 Calibration setup

This procedure requires the reader to be already installed on the AGV. Special equipment, i.e. a template including a calibration tag at the center of the AGV is necessary to align the tag to the body of the AGV.

Achieving a correct calibration is essential. The calibration tag must be oriented towards the AGV as shown in Fig. 25:

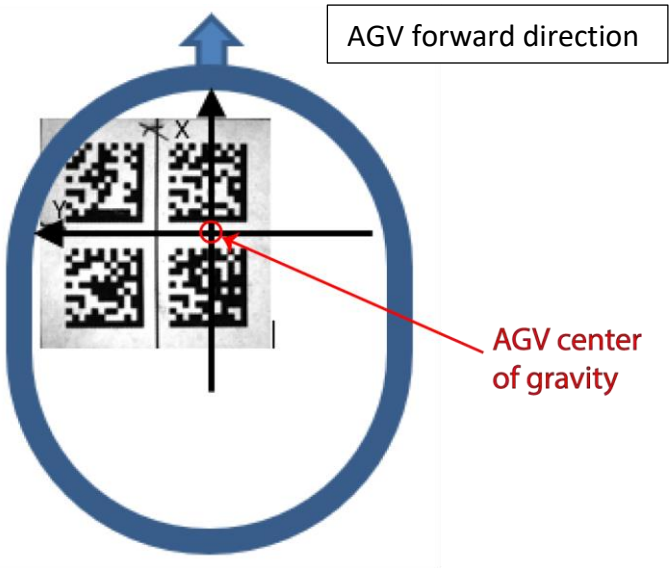
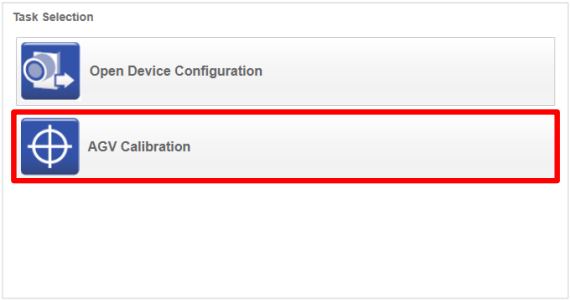


Fig. 25 - Calibration tag orientation

12.2 AGV Calibration on DL.CODE

1. From the Task Area select *AGV Calibration*.



2. The AGV Calibration page will be shown. Place a Data Matrix code in front of the reader at the correct application reading distance (refer to Fig. 7 and Fig. 8).
3. First pause reading, then click on the *Calibration* button at the bottom right corner and select *Calibrate*.

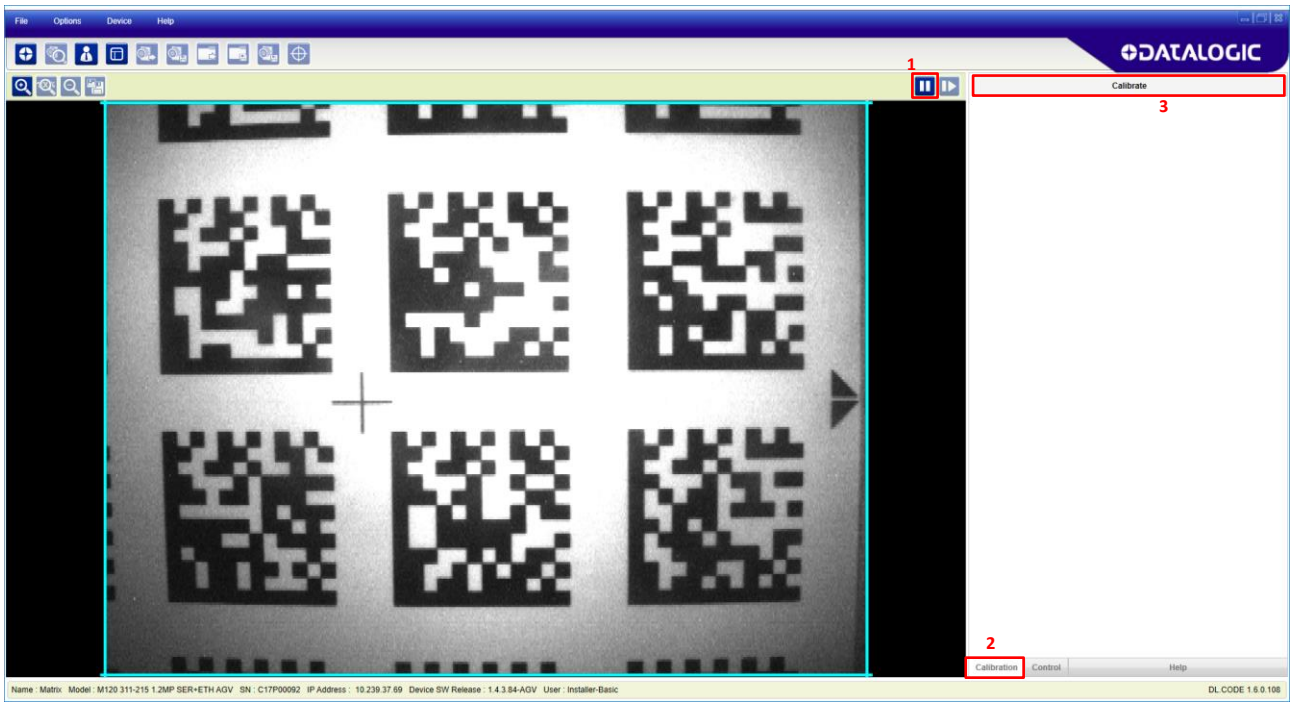
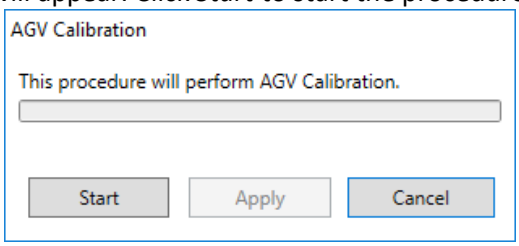
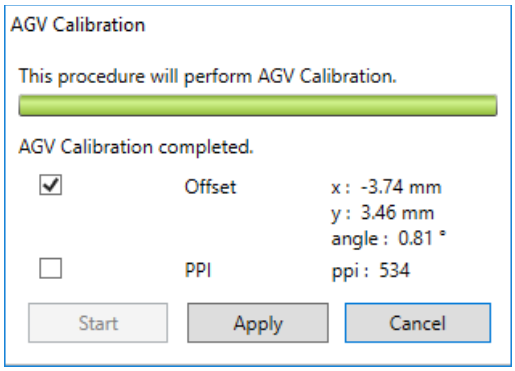


Fig. 26 - Calibration procedure

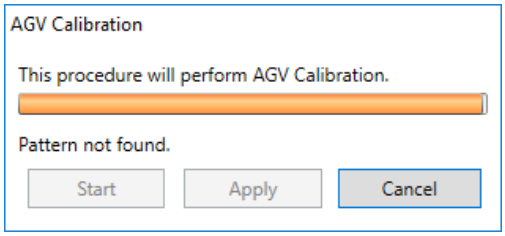
4. The AGV Calibration window will appear. Click *Start* to start the procedure.



5. At calibration completion, the following window will be displayed providing offset and PPI data. Click *Apply* to apply the calibration.



6. In case of calibration failure, the following window will appear. Reposition the Data Matrix code for correct reading and try again.



13 Maintenance

13.1 Cleaning

Clean the lens cover periodically for continued correct operation of the reader.

Dust, dirt, etc. on the lens cover may alter its 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.

14 Troubleshooting

14.1 General guidelines

- 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 are interested in.
- If you can't fix the problem and you are 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.

14.2 Troubleshooting guide

Problem	Suggestion
DL.CODE Installation: Autorun or Start.hta doesn't run	• Check Windows settings to see if Autorun is disabled. • Associate the file type .hta with the Microsoft HTML Application host **mshta.exe** in Windows\System32.
Driver Installation Error: The ECM driver fails to install correctly.	• Windows 7 requires that update KB3033929 be installed in order for the Matrix 120 ECM driver to work properly.
Power ON: the "POWER" LED is not lit.	• Is power connected? • If using a power adapter (like PG6000), is it connected to wall outlet? • If using rail power, does rail have power? • Measure Voltage either at pin **1** and pin **2**
Continuous Mode: the "TRIGGER" LED is not blinking.	• Verify the correct software configuration settings.
Any Operating Mode: the "TRIGGER" LED is correctly blinking but no result is transmitted by the reader at the end of the reading phase collection.	• Check the Code Collection parameters on the Reading Phase step and the Data Formatting parameters on the Data Formatting step.
Image not clear:	• Verify the reading distance.
Reading: the reader always transmits the ***No Read Message***	• Run the Configuration procedure in par. 11. • Position the reader as described in par. 7 and through DL.CODE: – Set the Continuous Operating Mode if no external trigger source is available; – Tune the Image Settings to improve the code image quality.
Serial Communication:	• Is the serial cable wiring correct?

Problem	Suggestion
reader is not transmitting anything to the host.	• Are the host serial port settings the same as the reader serial port settings?
Serial Communication: data transferred to the host are incorrect, corrupted or incomplete.	• Are the host serial port settings the same as the reader serial port settings? • In the DL.CODE Data Formatting step, check the settings of Header and Terminator String parameters. • In the DL.CODE Data Formatting step, check the various Message Field parameter settings.
Configuration: cannot access environment parameters in DL.CODE (Device>Settings>Settings menu item is grey)	• Are you using the Installer - Expert User level? If not, change it in the Options>Change User menu.
How do I obtain my reader Serial Number?	• The reader Serial Number consists of 9 characters: one letter, 2 numbers, another letter followed by 5 numbers. • The reader Serial Number is printed on the reader chassis. • The Serial Number is also visible from the DL.CODE Device List Area.
How do I obtain my reader Order Number?	• The reader Order Number consists of 9 numbers. • The reader Order Number can be obtained by comparing the Device Model (in DL.CODE Device Menu > Settings > Settings > About Device) with the product models page on the Datalogic website.

15 Technical features

ELECTRICAL FEATURES	
Power Supply Voltage Consumption	 5 to 30 Vdc 0.4 to 0.1 A
Communication Interfaces Main - RS232 - RS422 full-duplex	 2400 to 115200 bit/s 2400 to 115200 bit/s
USB	USB 2.0 Hi-Speed
Ethernet (Built-in) supported application protocols	10/100 Mbit/s TCP/IP, EtherNet/IP, Modbus TCP
Inputs Input 1(External Trigger) and Input 2 Max. Voltage Max. Input Current	short circuit protected 30 Vdc 3.5 mA
Outputs Output 1 and 2 $V_{OUT\ high}$ (I_{LOAD} = -100 mA) Max. $V_{OUT\ low}$ (I_{LOAD} = 100 mA) Max. I_{LOAD} Max.	NPN or PNP short circuit protected 28.3 Vdc (when using 30 Vdc power supply) 1.7 Vdc 145 mA
OPTICAL FEATURES	**MP**
Image Format	1280x960
Frame Rate	max. 66 frames/sec.
Image Sensor	CMOS sensor with Global Shutter
Pitch	± 35°
Tilt	0° - 360° (within vertical FOV)
LED Safety	to EN 62471
Lighting System	Internal Illuminator
ENVIRONMENTAL FEATURES	
Operating Temperature [1]	0 to 50 °C (32 to 122 °F)
Storage Temperature	-20 to 70 °C (-4 to 158 °F)
Max. Humidity	90% non condensing
Vibration Resistance EN 60068-2-6	14 mm @ 2 to 10 Hz; 1.5 mm @ 13 to 55 Hz; 2 g @ 70 to 500 Hz; 2 hours on each axis
Shock Resistance EN 60068-2-27	30g; 11 ms; 3 shocks on each axis
Bump Resistance EN 60068-2-29	30g; 6 ms; 5000 shocks on each axis
Protection Class EN 60529	IP65

[1] high ambient temperature applications should use metal mounting bracket for heat dissipation

PHYSICAL FEATURES		
	Serial + USB	**Serial + Ethernet**
Dimensions Standard Models	45.4 x 31.1 x 23.5 mm (1.8 x 1.2 x 1 in.)	45.4 x 48.5 x 23.5 mm (1.8 x 1.9 x 1 in.)
Weight (with cable)	117 g. (4.1 oz.)	200 g. (7.1 oz.)
Material	Aluminum	
SOFTWARE FEATURES		
Readable Code Symbologies	**2-D**	
	Data Matrix ECC 200	
Operating Mode	CONTINUOUS, PERIODIC, PHASE MODE	
Configuration Methods	• X-PRESS Human Machine Interface • Windows-based SW (DL.CODE) via Ethernet, USB or Serial Interface • Host Mode Programming sequences sent over Serial or Ethernet TCP interfaces	
Parameter Storage	Permanent memory (Flash)	
CODE QUALITY METRICS		
Standard	**Supported Symbologies**	
ISO/IEC 16022 AIM DPM	Data Matrix ECC 200 Data Matrix ECC 200	
USER INTERFACE		
LED Indicators	Power, Ready, Good; Trigger; Com, Status, (Ethernet Network); Good Read (Green Spot)	
Keypad Button	Configurable via DL.CODE	
Beeper	Configurable via DL.CODE	

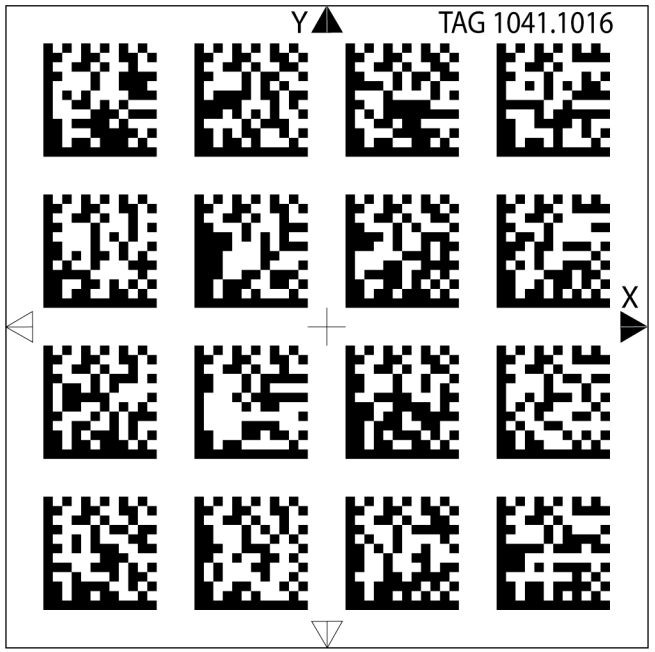
16 Accessories

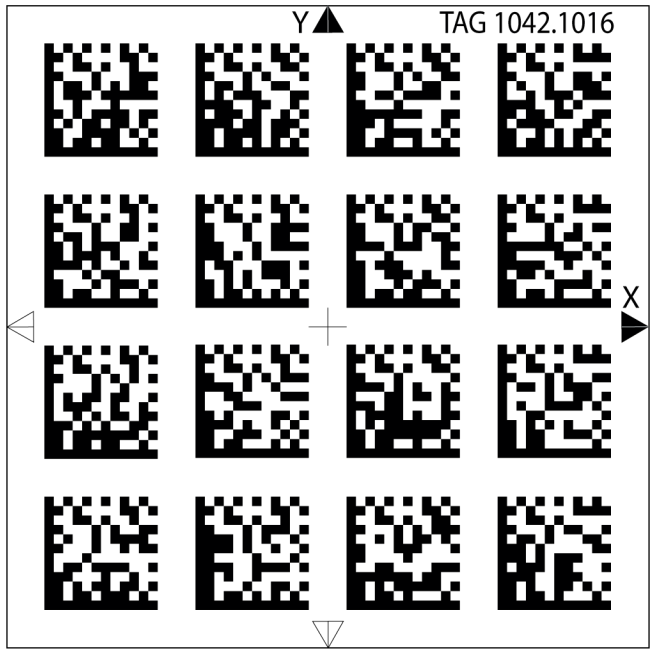
The following accessories can be used with the Matrix 120 AGV readers.

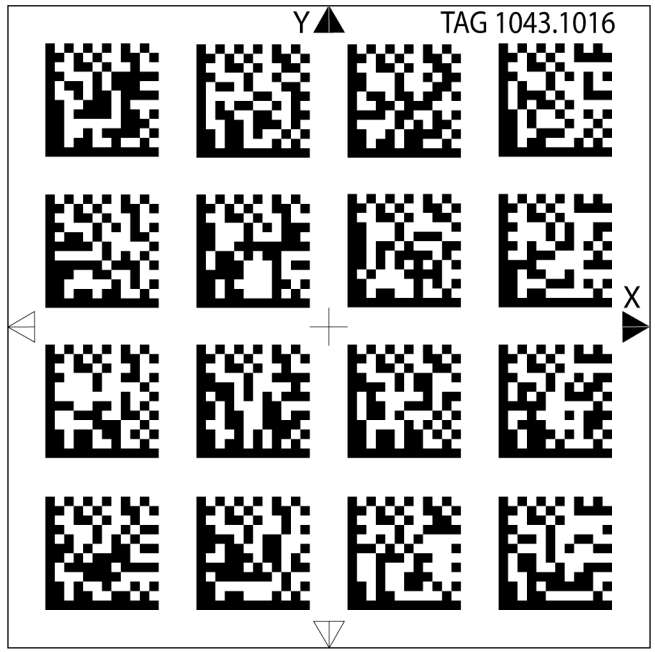
Accessory	Description	Order No.
Cables		
CAB-1021	M120 M12 Main To USB (1M)	93A050100
CAB-1001	M120 M12-M12 Main Extension (1M)	93A050103
CAB-1002	M120 M12-M12 Main Extension (2M)	93A050104
CAB-1005	M120 M12-M12 Main Extension (5M)	93A050105
CAB-ETH-M01	M12-IP67 Ethernet Cable (1M)	93A051346
CAB-ETH-M03	M12-IP67 Ethernet Cable (3M)	93A051347
CAB-ETH-M05	M12-IP67 Ethernet Cable (5M)	93A051348
CBL-1534.02	Adapter Cable Ethernet M12 to female RJ45	93A050057

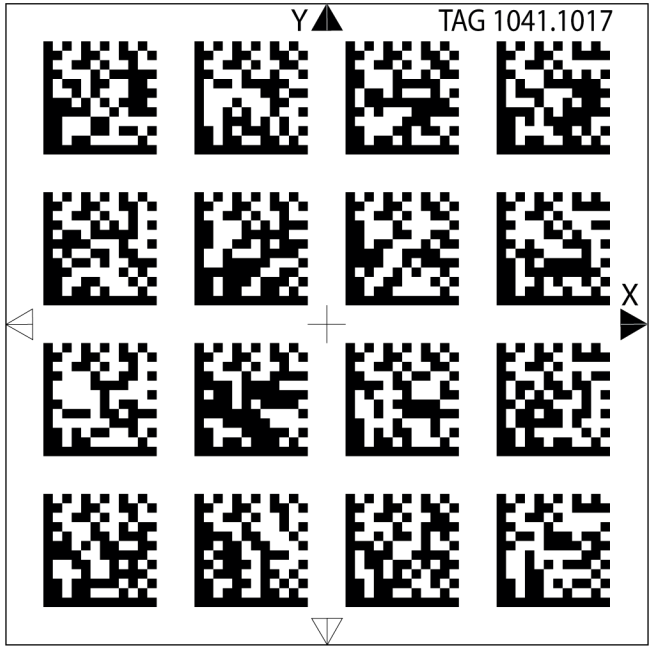
17 Appendix

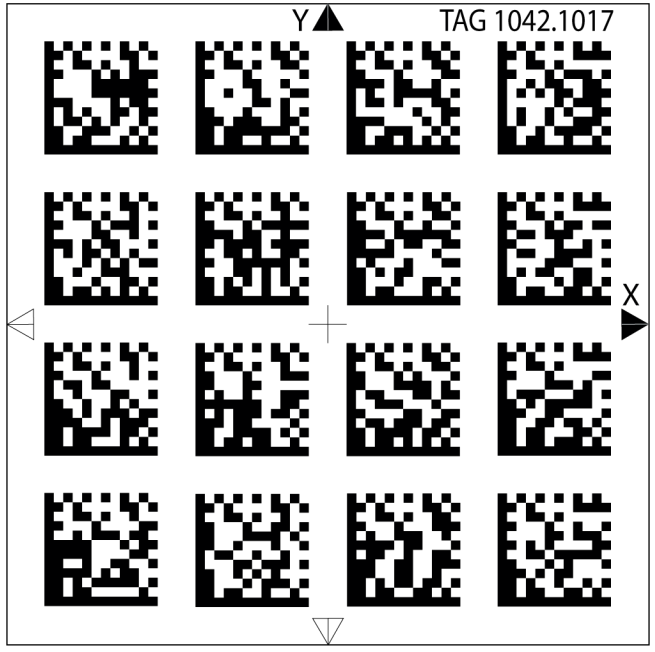
Print the Data Matrix tags provided in the following pages to perform the test described in par. 11.7.

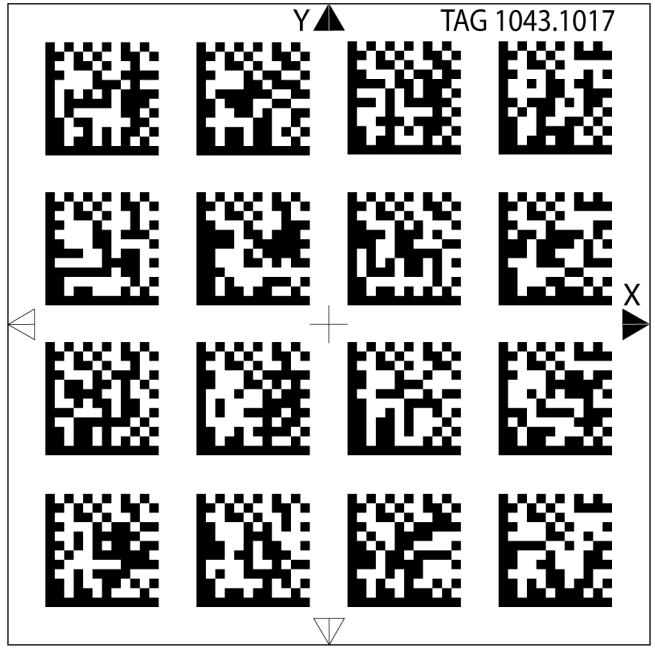

Y
TAG 1041.1016
X

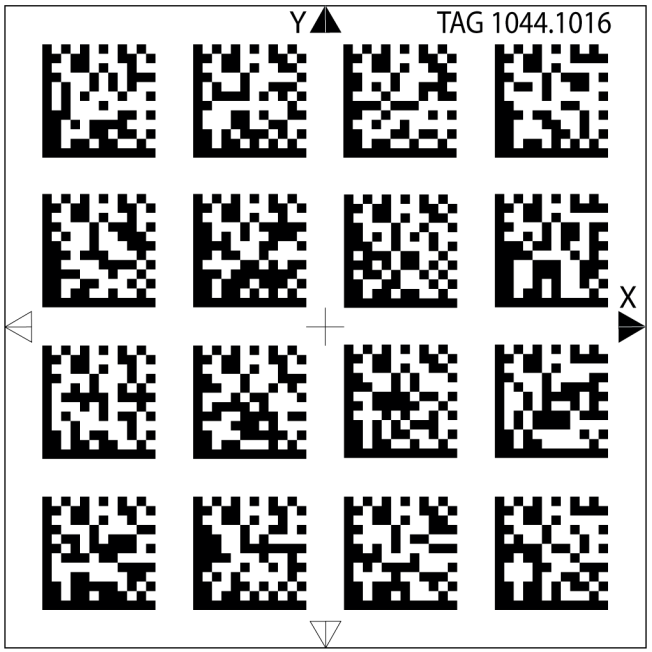

Y
TAG 1042.1016
X

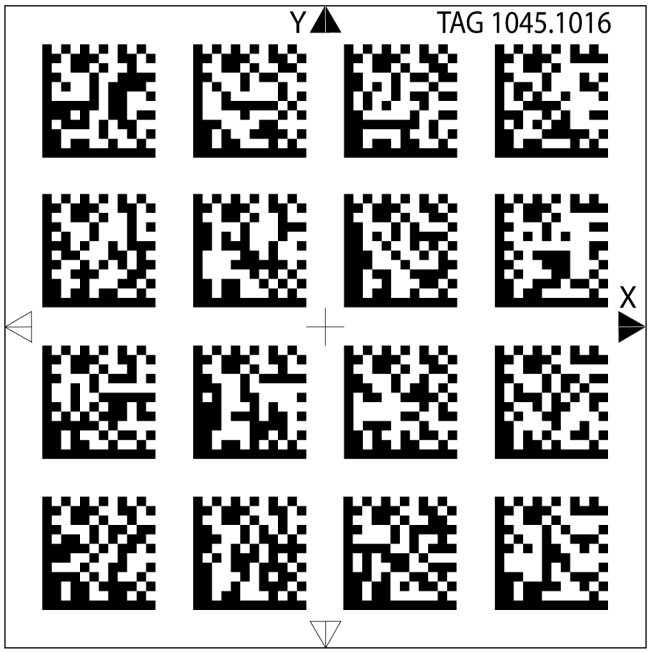

Y
TAG 1043.1016
X

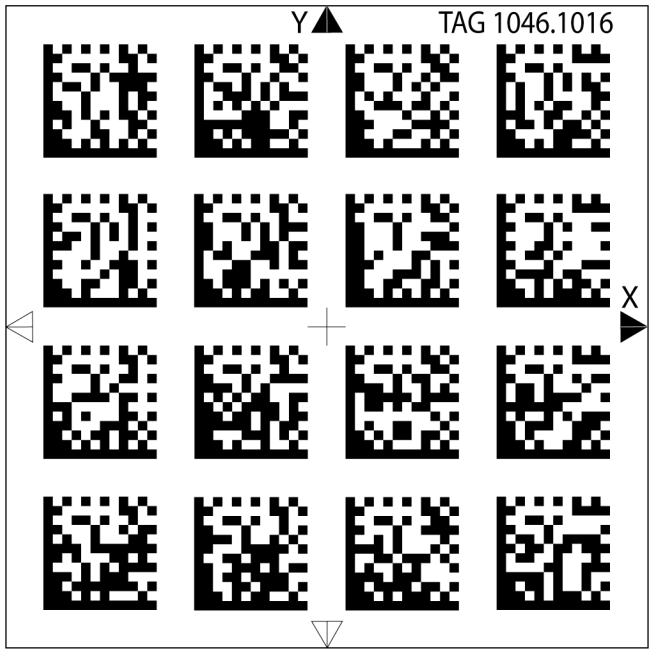

Y
TAG 1041.1017
X


Y
TAG 1042.1017
X


Y
TAG 1043.1017
X


Y
TAG 1044.1016
X


Y
TAG 1045.1016
X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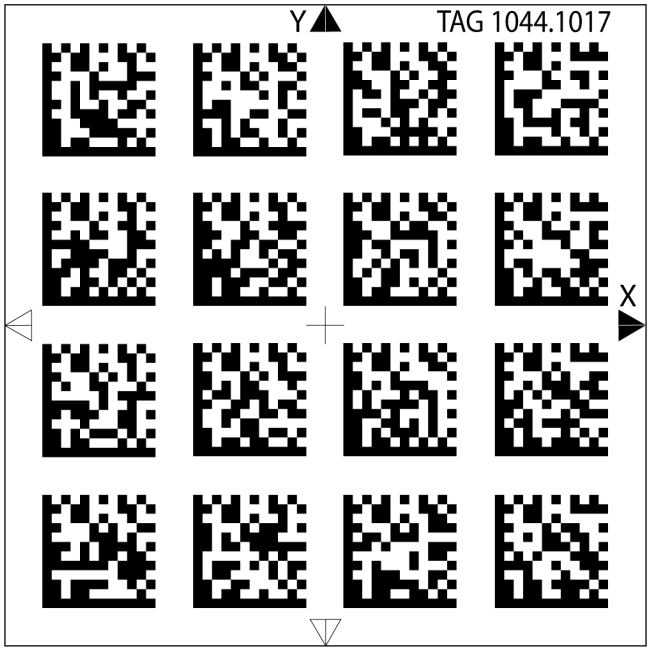
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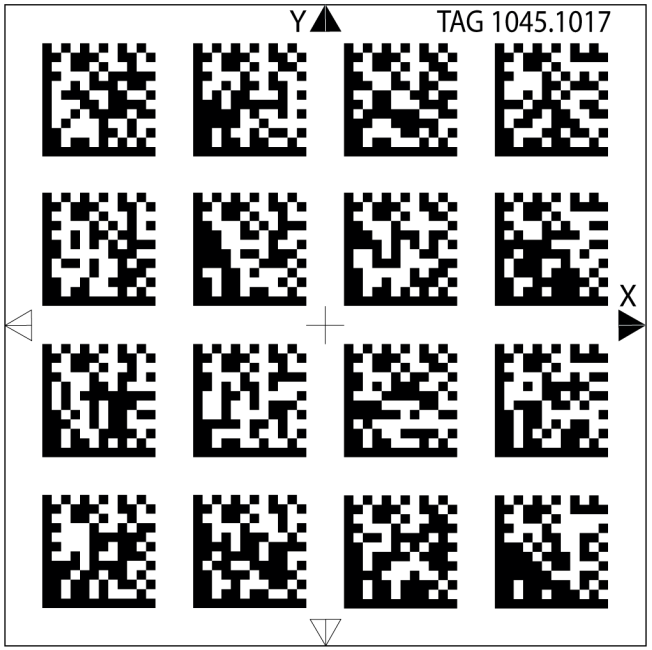
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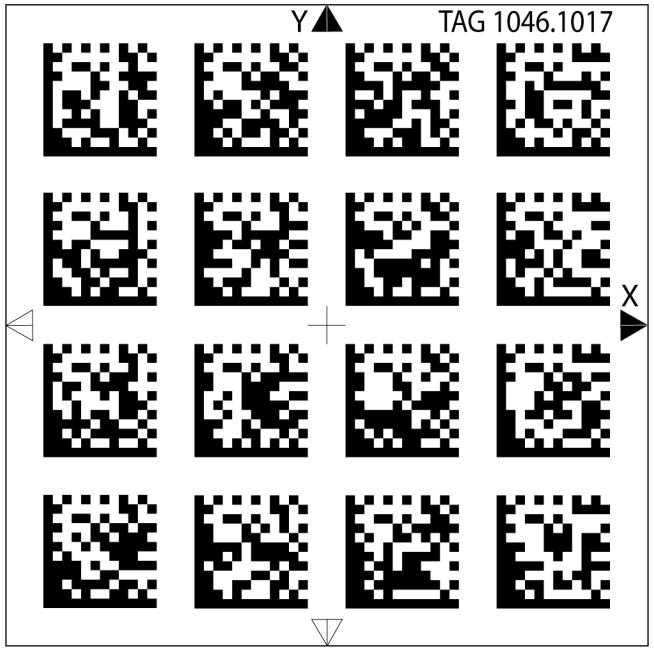
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