

REFERENCE MANUAL



> Matrix 300™

DATALOGIC



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Matrix 300™ Reference Manual

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REFERENCES

CONVENTIONS

This manual uses the following conventions:

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

"Reader" refers to the Matrix 300™ reader.

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

REFERENCE DOCUMENTATION

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

SUPPORT THROUGH THE WEBSITE

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

- **Products - Industrial Automation - Identification**
Select your product from the links on the **Identification** page. The product page describes specific Info, Features, Applications, Models, Accessories, and Downloads including documentation, software drivers, and the VisiSet™ utility program, which allows device configuration using a PC through Serial and Ethernet interfaces.
- **Support & Services - Industrial Automation**
Several links from the **Industrial Automation** list take you to additional services such as: Service Program which contains Maintenance Agreements and Warranty Extensions; Repair Centers; On-Line RMA Return Material Authorizations; Technical Support through email or phone, Partner Program; Downloads for additional downloads.

PATENTS

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

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

Additional patents pending.

COMPLIANCE

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

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

EMC COMPLIANCE

In order to meet the EMC requirements:

- connect reader chassis to the plant earth ground by means of a flat copper braid shorter than 100 mm;
- connect pin "Earth" of the CBX connection box to a good Earth Ground;
- for direct connections, connect your cable shield to the locking ring nut of the connector

POWER SUPPLY

ATTENTION: READ THIS INFORMATION BEFORE INSTALLING THE PRODUCT

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

This product is intended to be connected to a UL Listed Computer (LPS or "Class 2") which supplies power directly to the reader, or a UL Listed Direct Plug-in Power Unit (rated 10 to 30 V, minimum 1 A) marked LPS or "Class 2", or Power over Ethernet source Device supplied by UL Listed Direct Plug-in Power Unit marked LPS or "Class 2".

CE COMPLIANCE

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

FCC COMPLIANCE

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

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

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

LASER SAFETY

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

Therefore the product is classified as a Class 2 laser product according to IEC 60825-1 regulations and as a Class II laser product according to CDRH regulations. Disconnect the power supply when opening the device during maintenance or installation to avoid exposure to hazardous laser light. The laser beam can be switched on or off through a software command.



LED SAFETY

LED emission according to EN 62471.

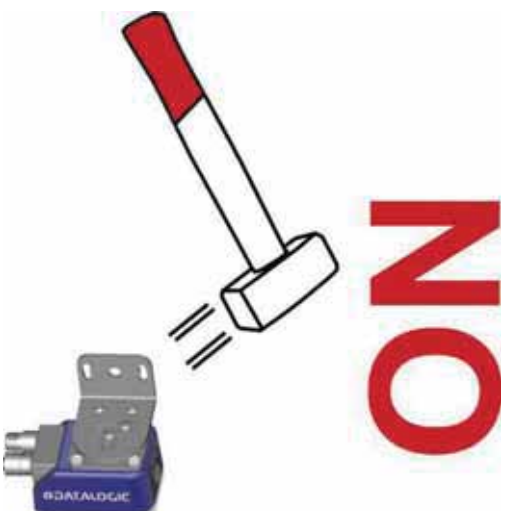
HANDLING

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

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



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



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

NO



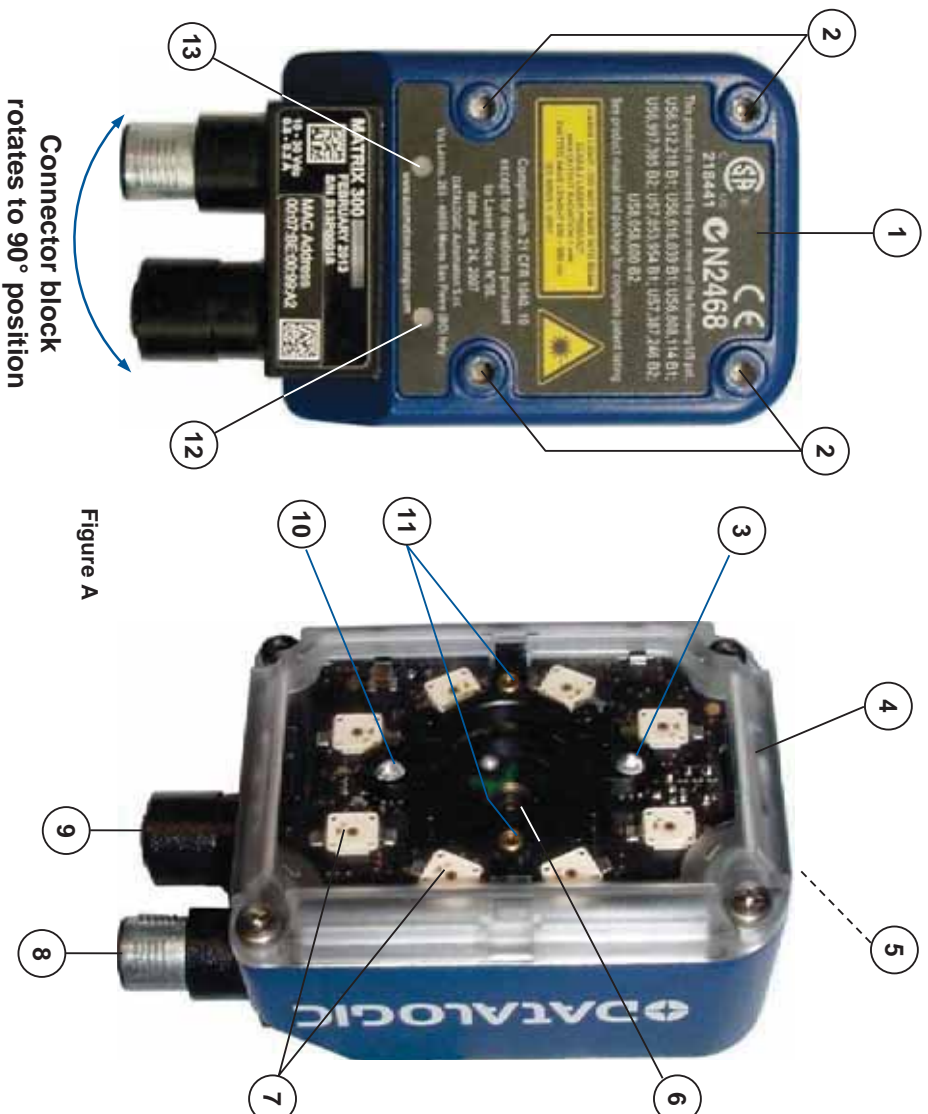
- do not spray paint near the reader which can cause reading window damage.

NO



GENERAL VIEW

Matrix 300™



Connector block rotates to 90° position

Figure A

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

1 RAPID CONFIGURATION

STEP 1 – CONNECT THE SYSTEM

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

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

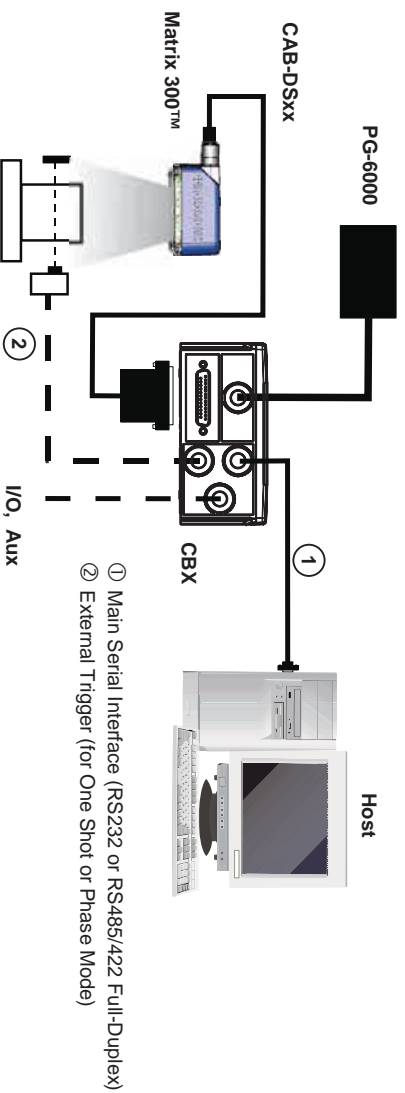


Figure 1 – Matrix 300™ in Stand Alone Layout

CBX100/CBX500 Pinout for Matrix 300™

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

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

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

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



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

STEP 2 – MOUNT AND POSITION THE READER

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



Figure 2 – Positioning with Mounting Bracket

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

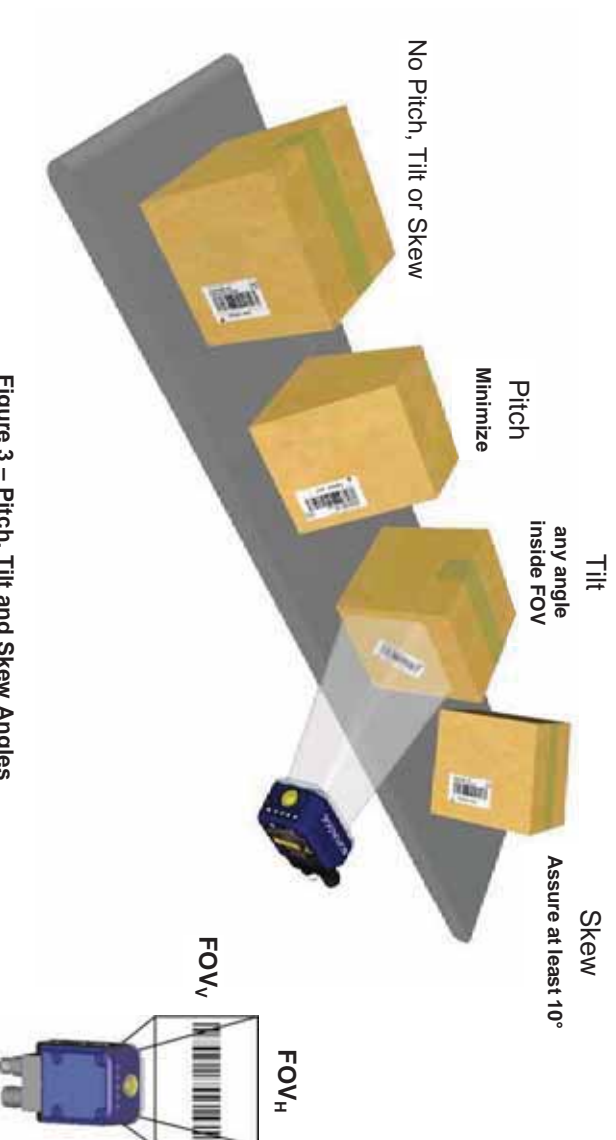


Figure 3 – Pitch, Tilt and Skew Angles

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



NOTE

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

STEP 3 – AIM AND AUTOFOCUS THE READER (Liquid Lens Models only)

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

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

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

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

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

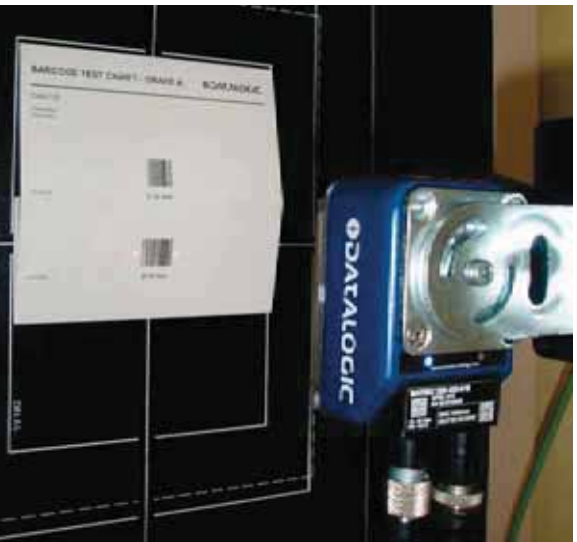


Figure 4 – X-PRESS™ Interface: Aim/Autofocus Function



NOTE

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

STEP 4 – X-PRESS™ CONFIGURATION

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

Aim

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

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.

Setup

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

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

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



Figure 5 – X-PRESS™ Interface: Aim Function



Figure 6 – X-PRESS™ Interface: Setup Function

Learn

6. Enter the Learn function by pressing and holding the X-PRESS™ push button until the Learn LED is on.
7. Release the button to enter the Learn function. The Learn LED will blink until the procedure is completed.
The Learn procedure ends when the Image Processing and Decoding parameters are successfully saved in the reader memory, the Green Spot is activated, the Learn LED will stop blinking and Matrix 300™ emits 3 high pitched beeps¹.
If the autolearning cannot be reached after a timeout of about 3 (three) minutes Matrix 300™ will exit without saving the parameters to memory, the Learn LED will stop blinking and in this case Matrix 300™ emits a long low pitched beep.



Figure 7 – X-PRESS™ Interface: Learn Function



NOTE

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



NOTE

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



NOTE

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

Reset Reader to Factory Default (Optional)

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

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

¹ The Learn procedure will not recognize Pharmacoce symbologies.

STEP 5 – INSTALLING VISISET™ CONFIGURATION PROGRAM

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

- Setup Wizard for rapid configuration and new users;
- Defined configuration directly stored in the reader;
- Communication protocol independent from the physical interface allowing the reader to be considered as a remote object to be configured and monitored.

To install VisiSet™, turn on the PC that will be used for the configuration, running Windows 98, 2000/NT, XP, Vista, 7 or 8; then insert the VisiSet™ Mini-DVD, wait for it to autorun and follow the installation procedure.

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

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



Figure 8 - VisiSet™ Opening Window

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

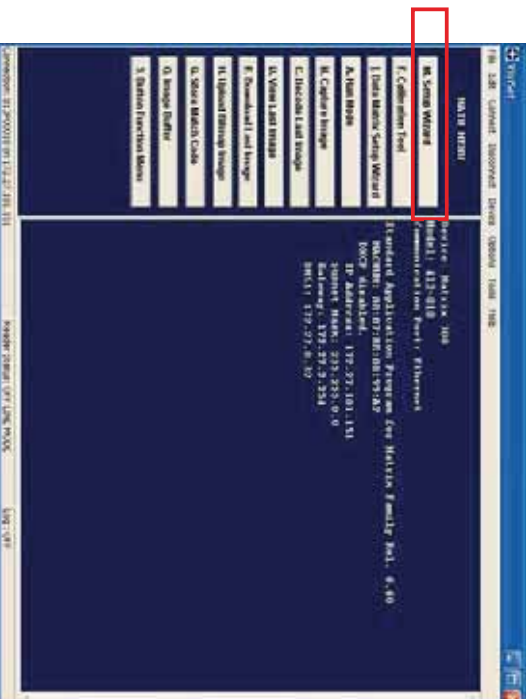
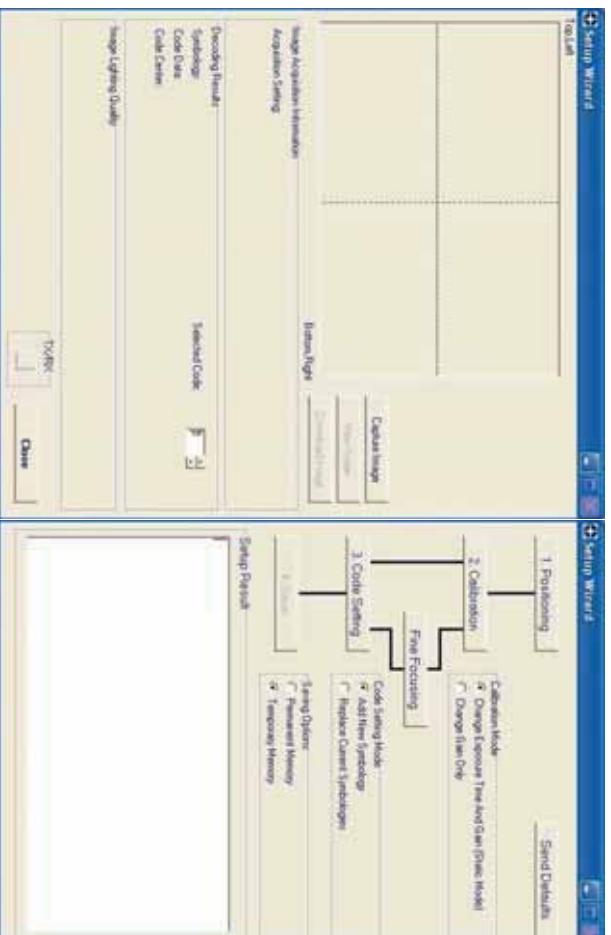


Figure 9 - VisiSet™ Main Window After Connection

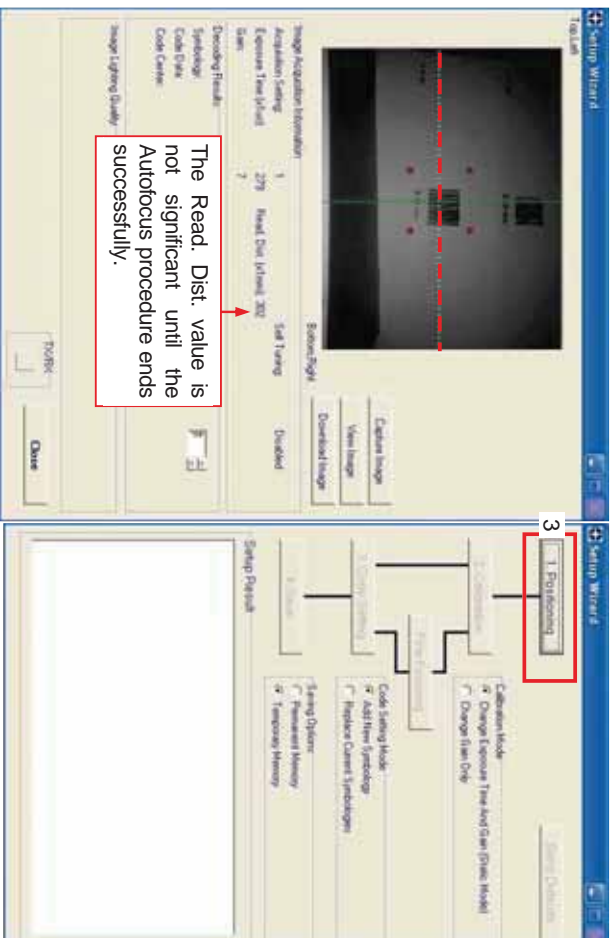
STEP 6 – CONFIGURATION USING SETUP WIZARD

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

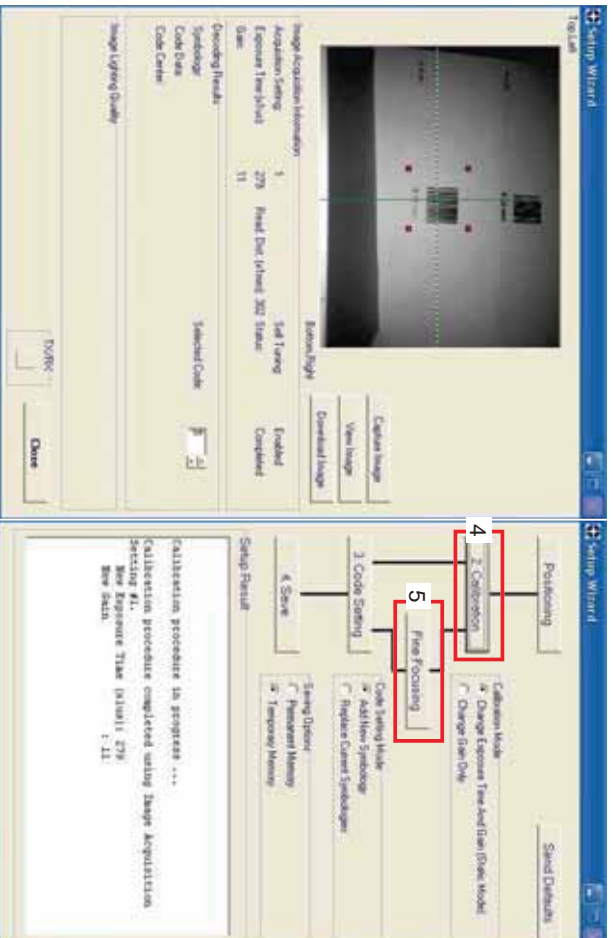
1. Select the Setup Wizard button from the Main menu.




2. Place the **Grade A Barcode Test Chart** in front of the reader at the correct reading distance for your application. See STEP 2 - Mount and Position the Reader and the Reading Diagrams in chapter 6 for reference.
 3. Press the "Positioning" button. The reader continuously acquires images and gives visual feedback in the view image window. The Setup Wizard now shows four delimiters (red points) in the acquired images which indicate the region in which the calibration algorithm is active. Choose one of the larger codes and move either the reader or code to center it. The code must be aligned across the X-axis reference line at the center of the FOV. See figure below.
- Press the Positioning button again to stop positioning.



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

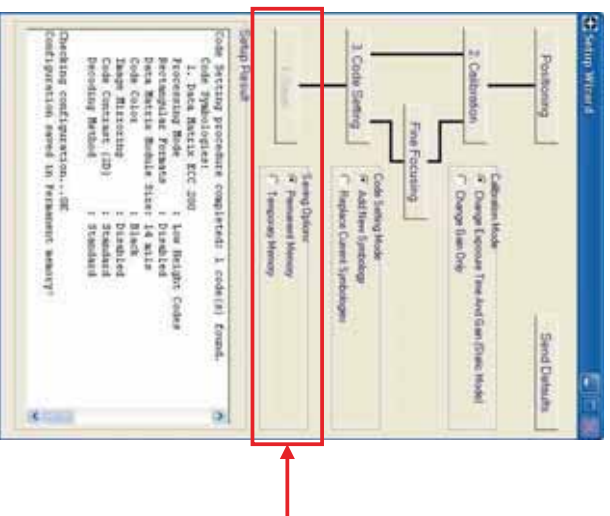


5. Press the "Fine Focusing" button to activate the Focus procedure.

 **CAUTION**

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

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



9. Close the Setup Wizard.

**NOTE**

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

STEP 7 – TEST MODE

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

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

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



Figure 10 – X-PRESS™ Interface: Test Function

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



NOTE

By default, the Test exits automatically after three minutes.

The Bar Graph has the following meaning:

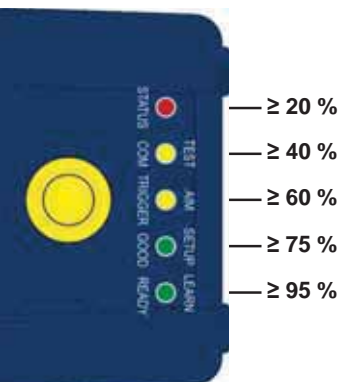


Figure 11 – Test Function Bar Graph

2 INTRODUCTION

2.1 PRODUCT DESCRIPTION

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

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

Matrix 300™ sets a new standard in 2D imager technology offering high performance with improved reading flexibility thanks to its intrinsic modularity.

Matrix 300™ features excellent reading and verifying performance thanks to 1.3 and 2.0 Mega pixel sensors and smart proprietary decoding libraries.

The modular combination of Mega pixels sensors, powerful lighting and adjustable C-Mount lenses provide high flexibility in covering application with various requirements.

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

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

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

- Automotive
 - DPM (Direct Part Marked) Reading and Verification
 - Tires Sorting
- Electronics
 - Large PCB Board Tracking
 - Electronics Product Tracking
- Distribution & Retail Industry
 - Presentation Scanner
 - Small Objects Tracking & Sorting
 - Warehouse applications
- Medical & Pharmaceutical
 - Medical Devices Traceability
 - Pharmaceutical and Medicine Manufacturing
 - Chemical & Biomedical Analysis
- Food & Beverage
 - Work in Progress Traceability
 - Code Quality Control

This technology intrinsically provides omni-directional reading.

Standard Application Program

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

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

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

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

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

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

Programmability

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

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

Excellent Performance

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

Ease of Setup

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

Ease of Use

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

Flexible Solution

- Modular design
- Adjustable Liquid lenses
- Complete set of Accessories like external lighting systems, light filters, mounting brackets, connection boxes, cables and photocells
- Ethernet Connectivity with TCP/IP socket for reader parameter configuration, data and image transfer, FTP client, etc.
- 3 serial communication interfaces (Main, Auxiliary, ID-NET™)
- General purpose I/Os

Versatility

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

Industrial Strength

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

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

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

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

2.2 INDICATORS AND KEYPAD BUTTON

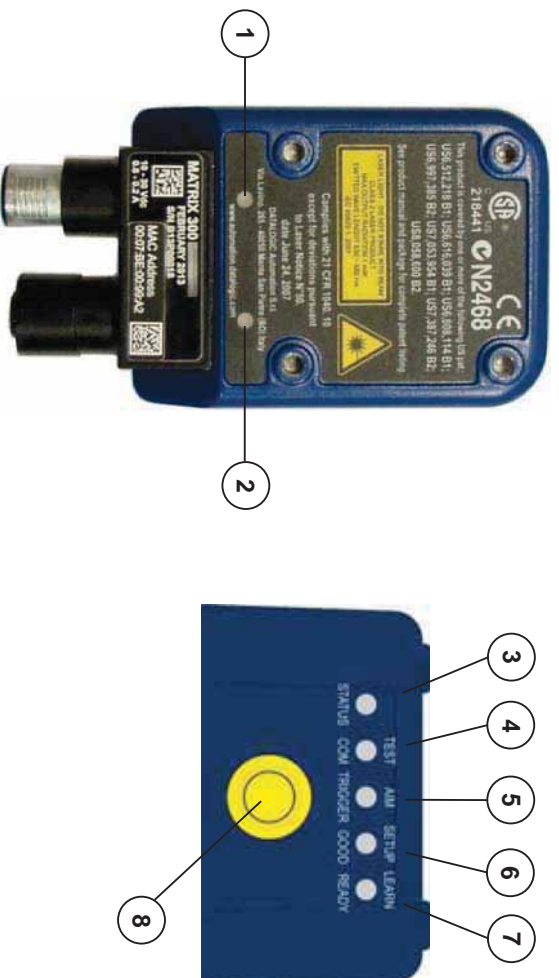


Figure 13 - Indicators

The following LED indicators are located on the reader:

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

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

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

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

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

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

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

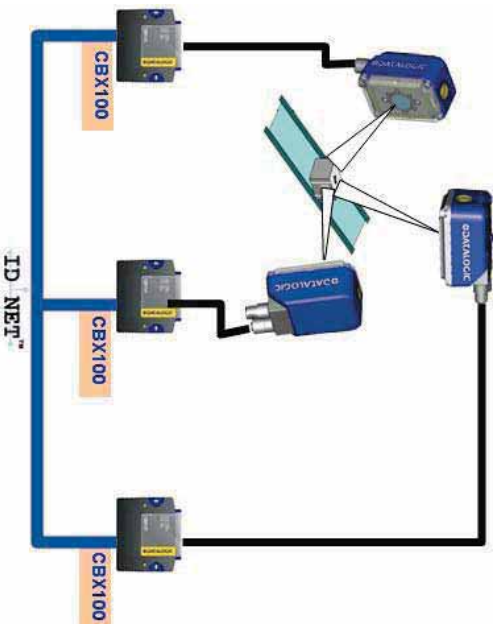
2.3 ID-NET™

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



The following network configurations are available:

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

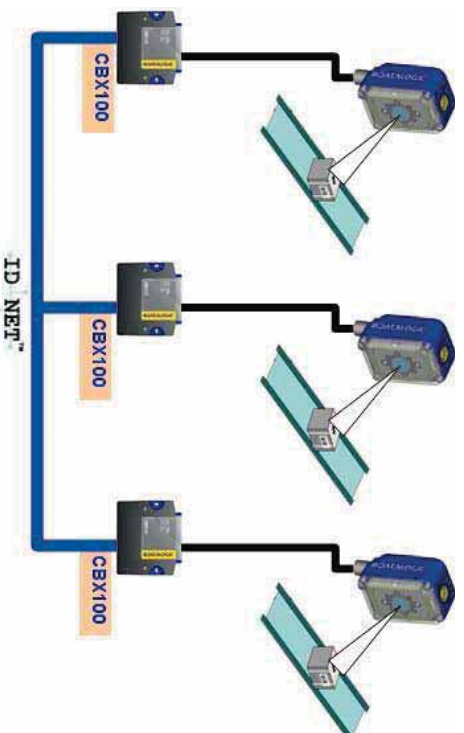


ID-NET™ interface allows local connection of multiple readers reading different sides of the same target. All readers share a single presence sensor and activate/deactivate simultaneously.

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

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

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



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

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

2.3.1 How To Setup/Configure the Reader Network

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

Mounting & Connection

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

Configuration of Slaves

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

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

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

Configuration of Master

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

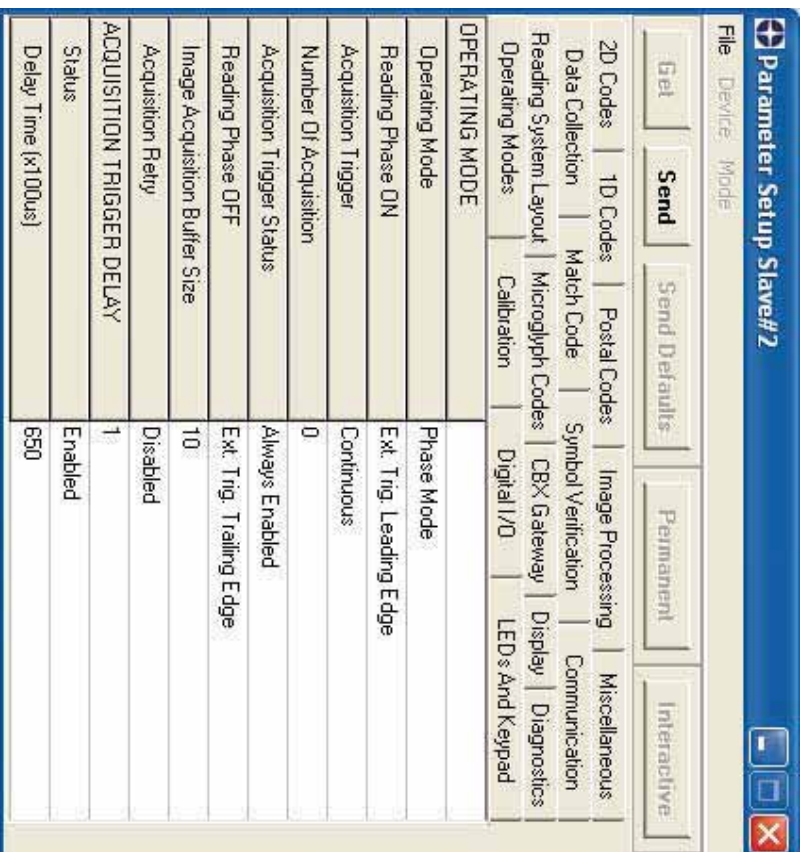
Slave Address	Requested Status	Current Status	Device Description	Serial Number	Parameter
1	Enabled	Present	Main 300	C10P01554	Get
2	Enabled	Present	Main 300	C10P01548	Get
3	Enabled	Present	Main 300	C10P01552	Get
4	Enabled	Present	Main 300	C10P01550	Get
5	Enabled	Present	Main 300	C10P01551	Get
6	Enabled	Present	Main 300	C10P01553	Get
7	Enabled	Present	Main 300	C10P01549	Get

The reader network is ready.

2.3.2 ID-NET™ Slave Management Through Master

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

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

**CAUTION**


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

2.4 EXTERNAL MEMORY BACKUP AND RESTORE THROUGH VISISET™

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

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

- CBX + BM1100 and/or BM2x0 (sw release 2.02.01 and later)
- QL500 (Ethernet TCP/IP) (sw release 2.02.01 and later)
- QLM-Series Gateways (reading device sw release 6.50 and later)

	<ul style="list-style-type: none"> • <i>Before executing a Backup on a BM1100 backup module make sure the Write Protection switch is set to Unlocked.</i> • <i>If BM1100 and BM2x0 are both installed B&R is automatically performed only on the BM1100 module.</i> • <i>BM2x0 can execute B&R only with Network up and running (network cable connected).</i> • <i>QL500 can backup up to 10 nodes (Master + 9 slaves).</i>
NOTE	

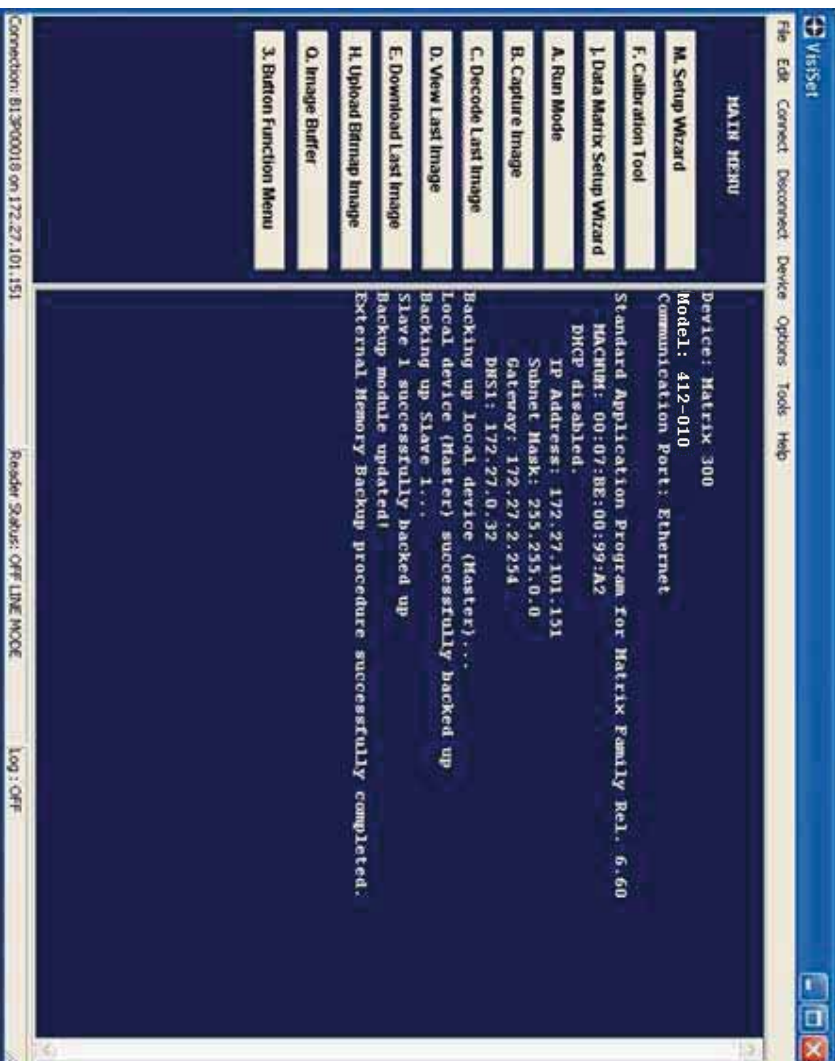
Backup

To perform a **Backup**:

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



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



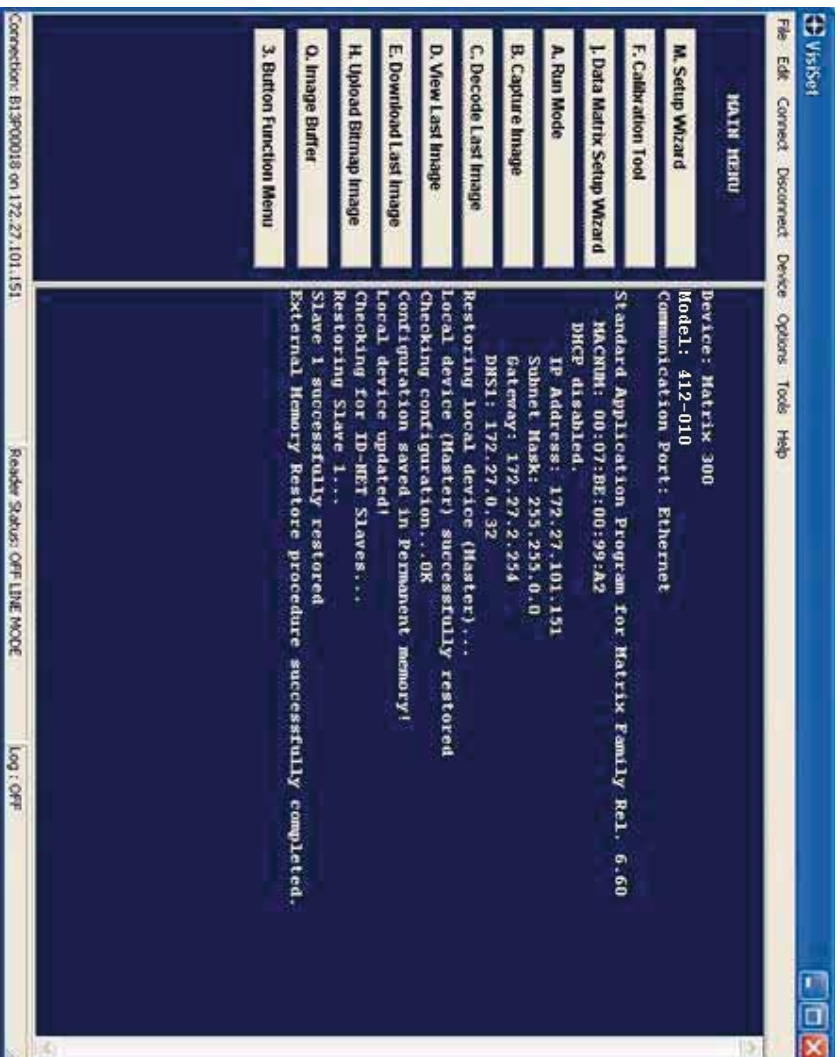
Restore

To perform a **Restore**:

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



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



Replacement

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

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

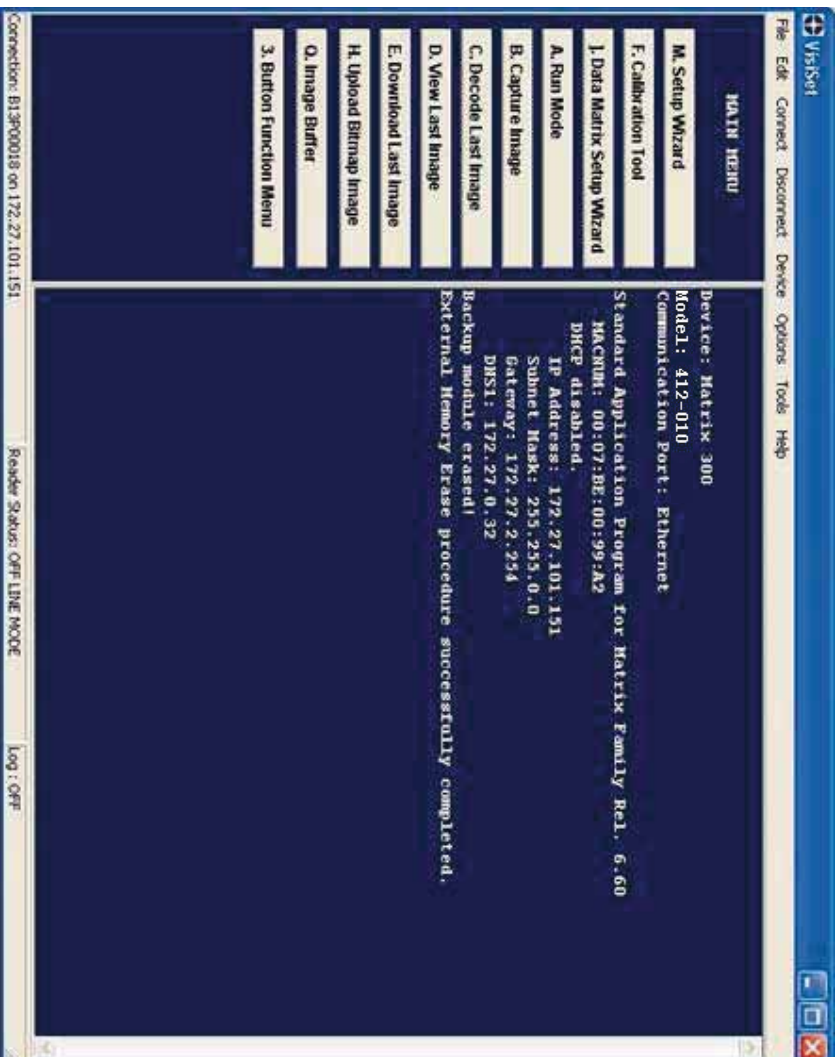
Erase

To Erase any previous Backup:

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



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

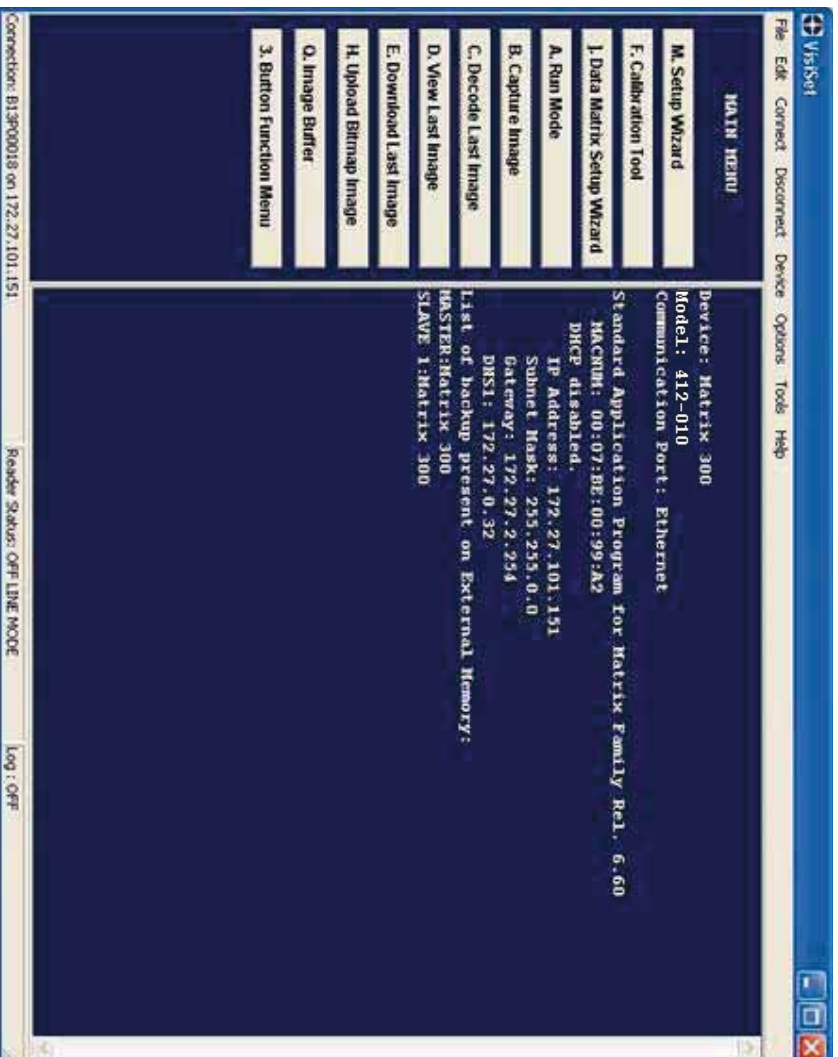


List

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

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

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



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

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

2.5 X-PRESS™ HUMAN MACHINE INTERFACE

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

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

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

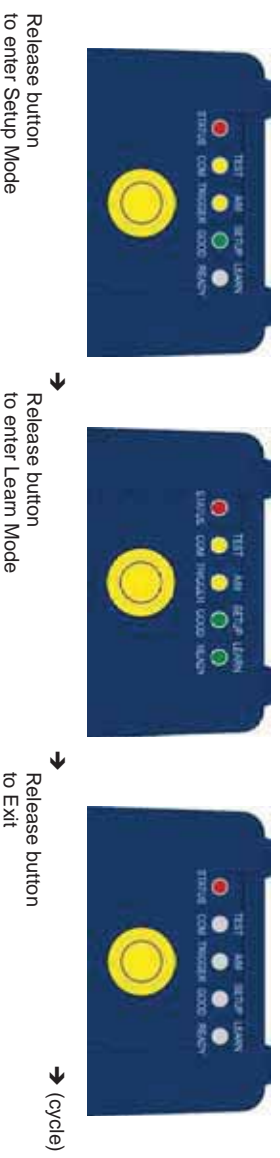
2.5.1 X-PRESS™ Functions

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

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



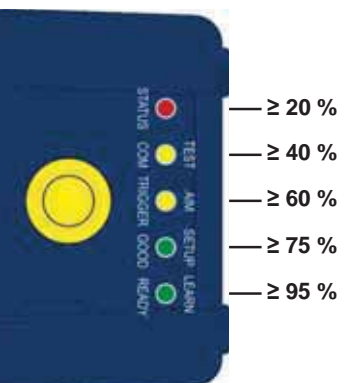
Once button is pressed, the cycle of LEDs activation is as follows:



Test Mode (Function 1)

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

The Bar Graph has the following meaning:



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



NOTE

By default, the Test exits automatically after three minutes.

Aim/Autofocus (Function 2)

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

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

Setup (Function 3)

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

The Setup LED will blink until the procedure is completed.

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

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

Learn (Function 4)

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

The Learn LED will blink until the procedure is completed.

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

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

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

2.5.2 Diagnostic Indication

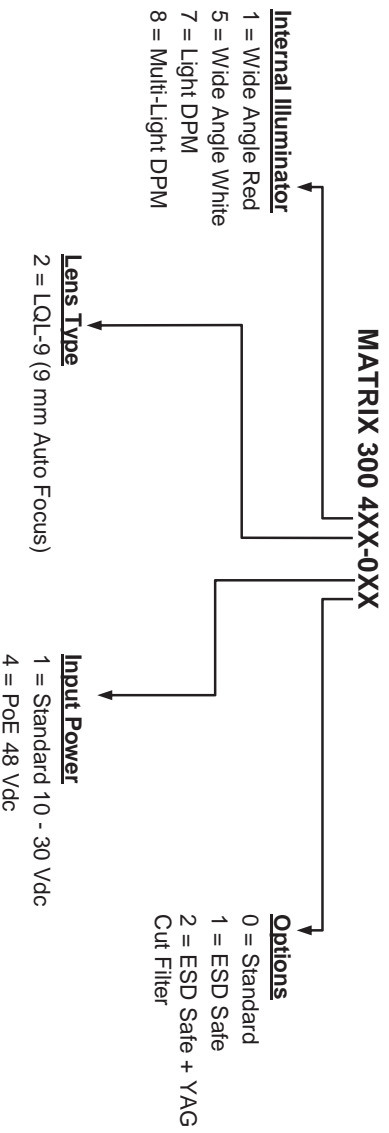
The "STATUS" and "READY" LEDs blink simultaneously while the "GOOD" LED is on to signal the presence of an error. Diagnostic message transmission on interfaces can be enabled to provide details about specific error conditions. See the Diagnostic Error Conditions chart in the Help On Line.



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

2.6 MODEL DESCRIPTION

The Matrix 300™ reader is available in different versions according to the following characteristics:



2.6.1 Lighting System Notes

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

Matrix 300 Models		Internal Illuminators	
Model	Lens Type	LEDs	Type
Matrix 300 412-0xx		8	Red Wide Angle
Matrix 300 452-0xx		8	White Wide Angle
Matrix 300 472-0xx	LQL-9MM Software Focus	50	Red Bright Field DPM (sw configurable chains)
Matrix 300 482-0xx		39	Red Bright/Blue Dark Field DPM (sw configurable chains)

2.7 ACCESSORIES

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

Accessory	Description	Order No.
Cables		
CAB-DS01-S	M12-IP67 Cable To CBX or QL (1M)	93A050058
CAB-DS03-S	M12-IP67 Cable To CBX or QL (3M)	93A050059
CAB-DS05-S	M12-IP67 Cable To CBX or QL (5M)	93A050060
CAB-ETH-M01	M12-IP67 Ethernet Cable (1M)	93A051346
CAB-ETH-M03	M12-IP67 Ethernet Cable (3M)	93A051347
CAB-ETH-M05	M12-IP67 Ethernet Cable (5M)	93A051348
CBL-1480-01	Thin M12/5P Male/Female (1M)	93A050049
CBL-1480-02	Thin M12/5P Male/Female (2M)	93A050050
CBL-1490	Term. Resist. Thin M12/5P/Male	93A050046
CBL-1496	Term. Resist. Thin M12/5P/Female	93A050047
Connectivity		
CBX100	Compact Connection Box	93A301067
CBX500	Modular Connection Box	93A301068
BM100	Backup Module for CBX100/500	93AC1808
BM150	Display Module for CBX500	93AC1809
Various Fieldbus and Non-Fieldbus Host Interface Modules and All-In-One Connection Box Kits are available		
BA100	DIN Rail Adapters	93ACC1821
BA200	Bosch Adapters	93ACC1822
Various M12 Panel Connectors for CBX Connection Boxes are available		
BA900	Two Cable Glands Panel	93ACC1847
QL100	Quick Link Slave ID-NET T-Connector	93ACC1860
QL150	Quick Link Slave ID-NET + Service T-Connector	93ACC1868
QL200	Quick Link Slave ID-NET + Power T-Connector	93ACC1861
QL300	Quick Link Master ID-NET - Serial Host Connector	93ACC1862
QL500	Quick Link Master ID-NET - Ethernet Host Connector (includes Ethernet/IP explicit messaging)	93ACC1864
QLM500	Quick Link Metal Master ID-NET - Ethernet/IP Gateway	93ACC0037
QLM600	Quick Link Metal Master ID-NET - Profibus Gateway	93ACC0033
QLM700	Quick Link Metal Master ID-NET - Profinet I/O Gateway	93ACC0038
Various M12 Service Cables and Field Mount Connectors are available for Quick Link Series Connectors		
Power Supplies		
PG6002	AC/DC Power Supply Unit (US)	93ACC1718
PG6001	AC/DC Power Supply Unit (UK)	93ACC1719
PG6000	AC/DC Power Supply Unit (EU)	93ACC1720
Sensors		
MEP-593	Photozell Kit PNP (PH-1)	93ACC1791
MEP-543	Photozell Kit-NPN	93ACC1728

2.8 APPLICATION EXAMPLES

2.8.1 Document Handling

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



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

2.8.2 Deformed or Overprinted Code Reading

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



Figure 15 - Unidose Flow-Pack with PDF417 Code



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



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

2.8.3 Direct Part Marking

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



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



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



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

2.8.4 Ink-Jet Printing Technology



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

2.8.5 Laser Marking/Etching Technology



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



CAUTION

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

3 INSTALLATION

3.1 PACKAGE CONTENTS

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

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

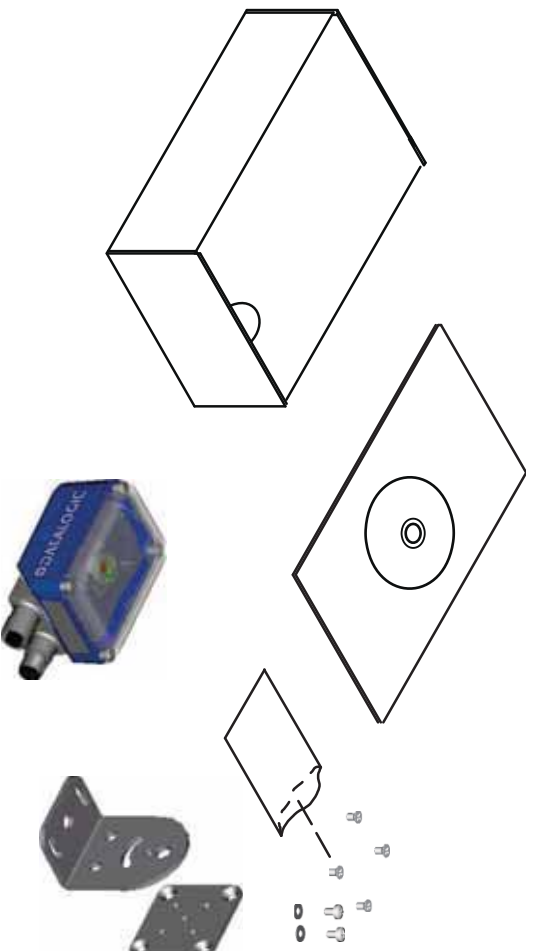


Figure 23 - Package Contents

3.2 MECHANICAL DIMENSIONS

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

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

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

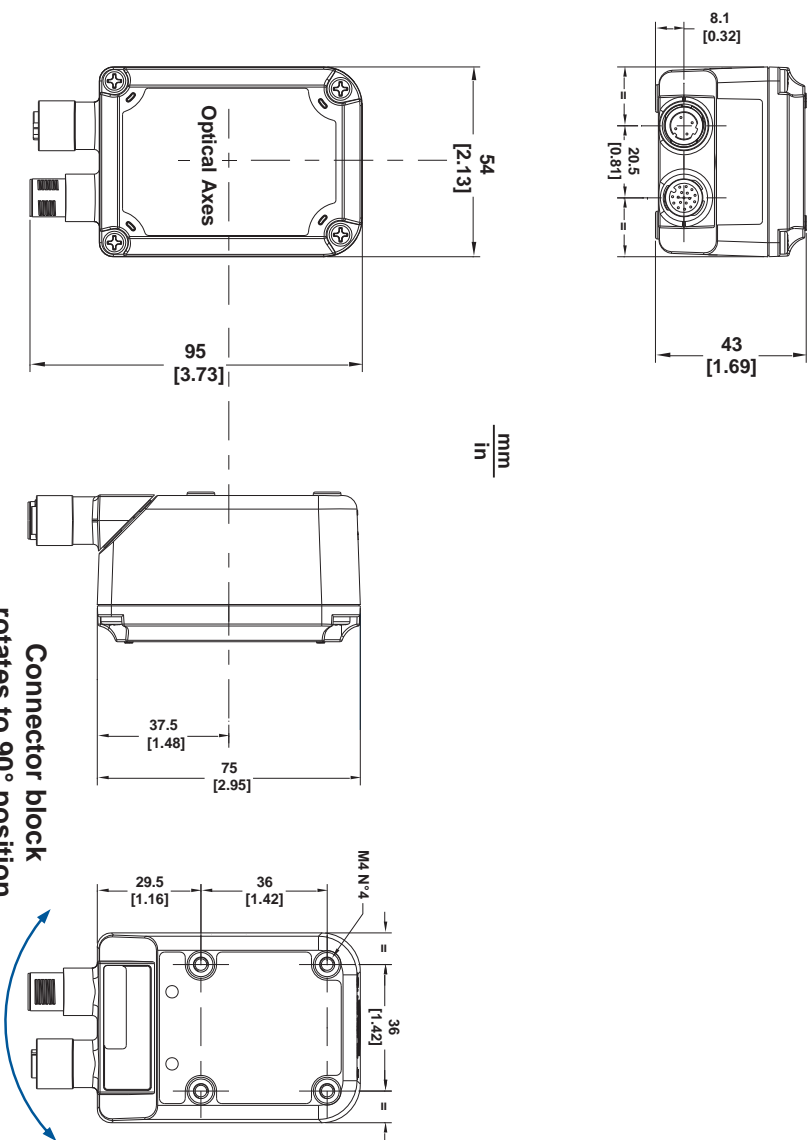


Figure 24 - Overall Dimensions with Connector at 0°

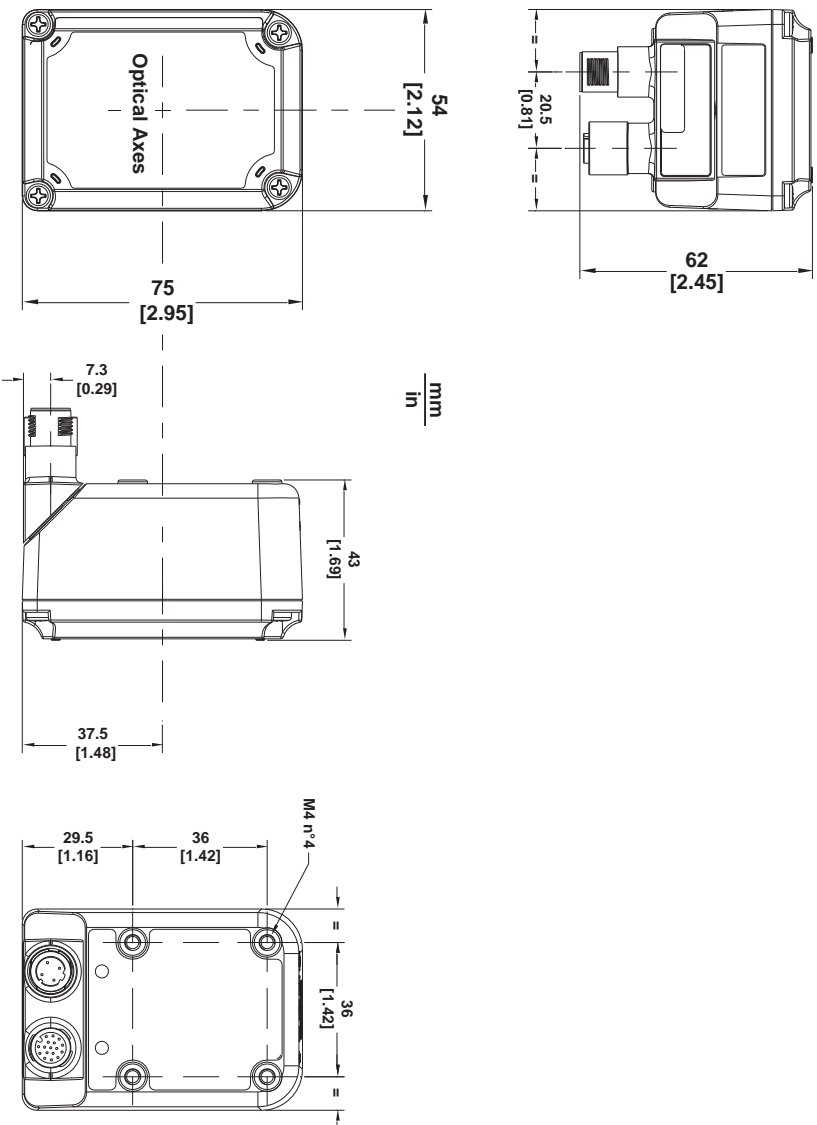


Figure 25 - Overall Dimensions with Connector at 90°

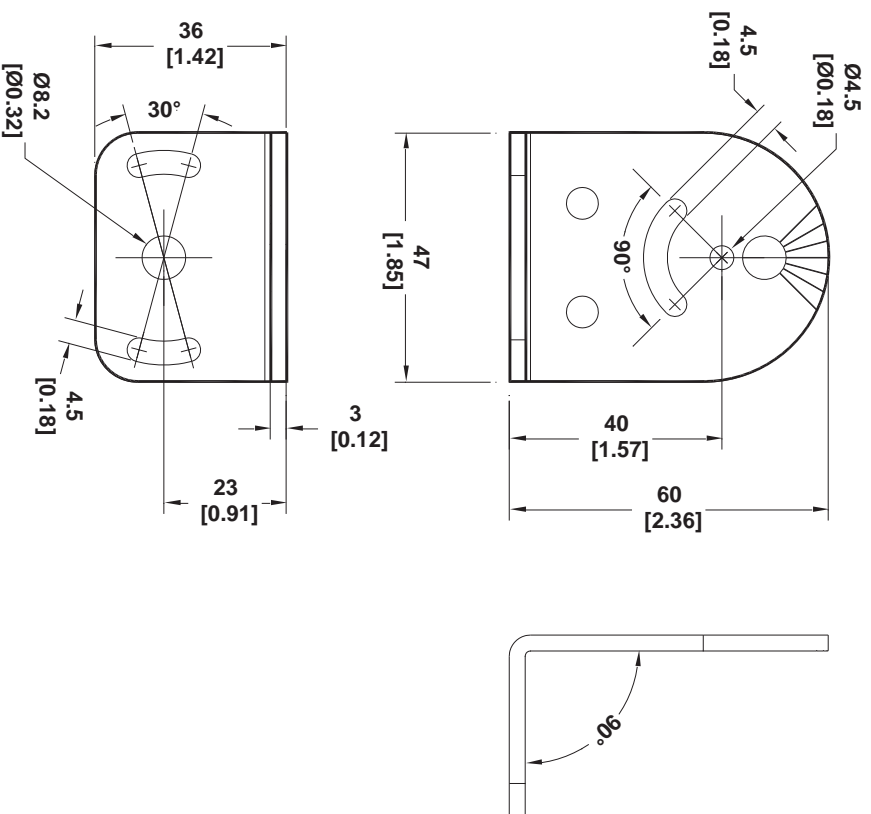
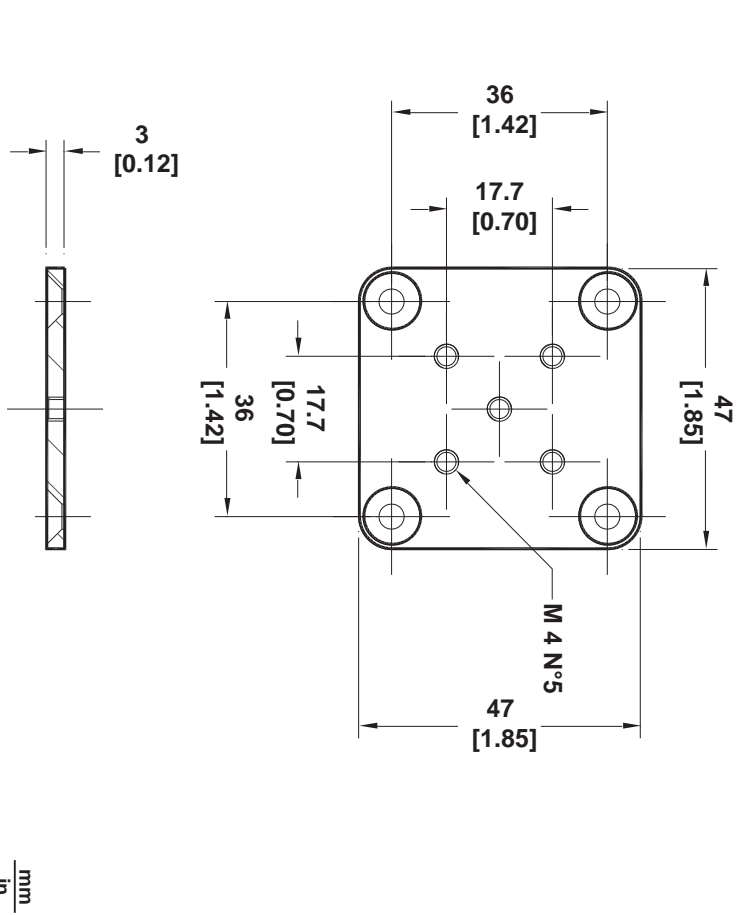


Figure 26 - Mounting Bracket Overall Dimensions

3.3 MOUNTING AND POSITIONING MATRIX 300™

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

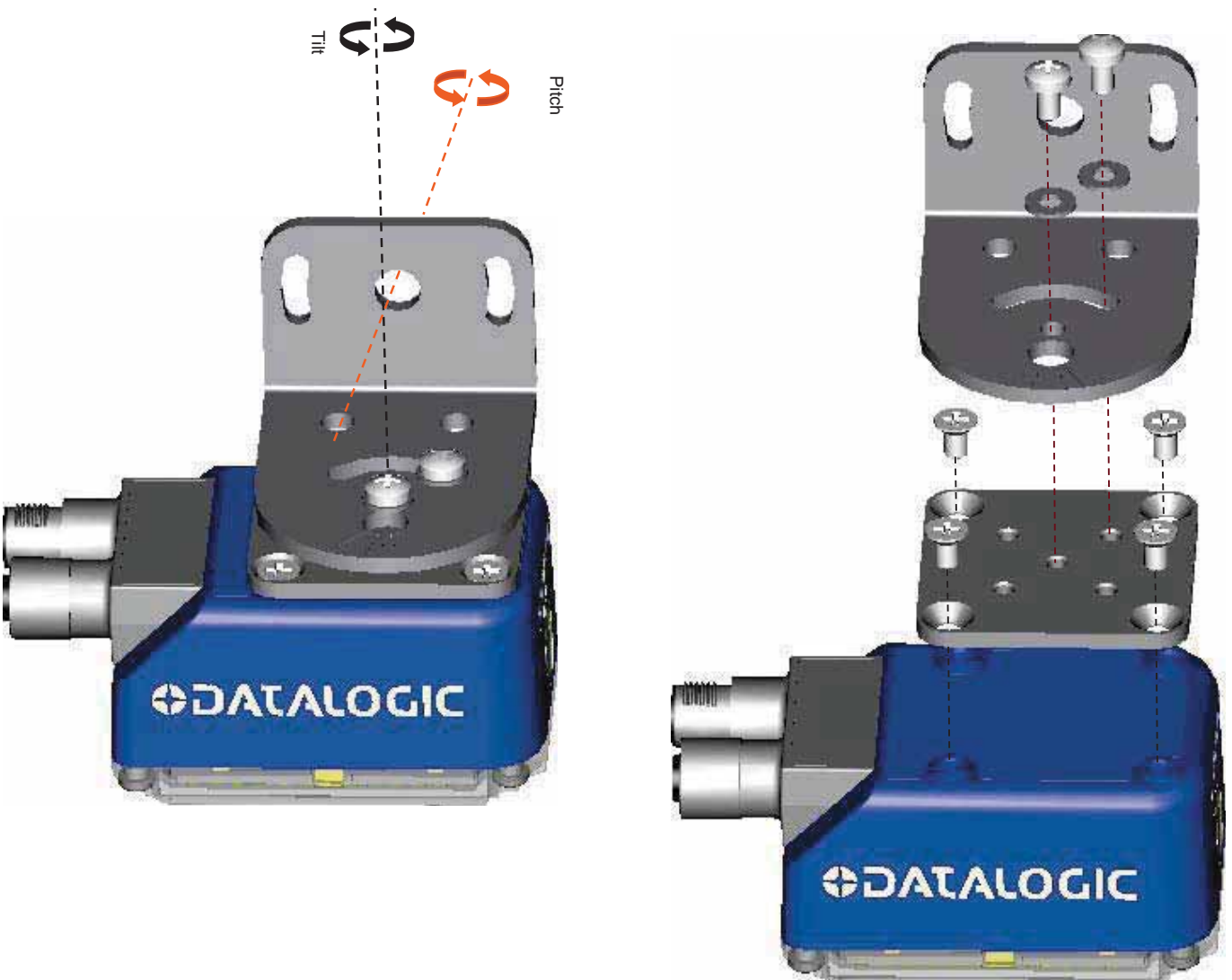


Figure 27 –Positioning with Mounting Bracket

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

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

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

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

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

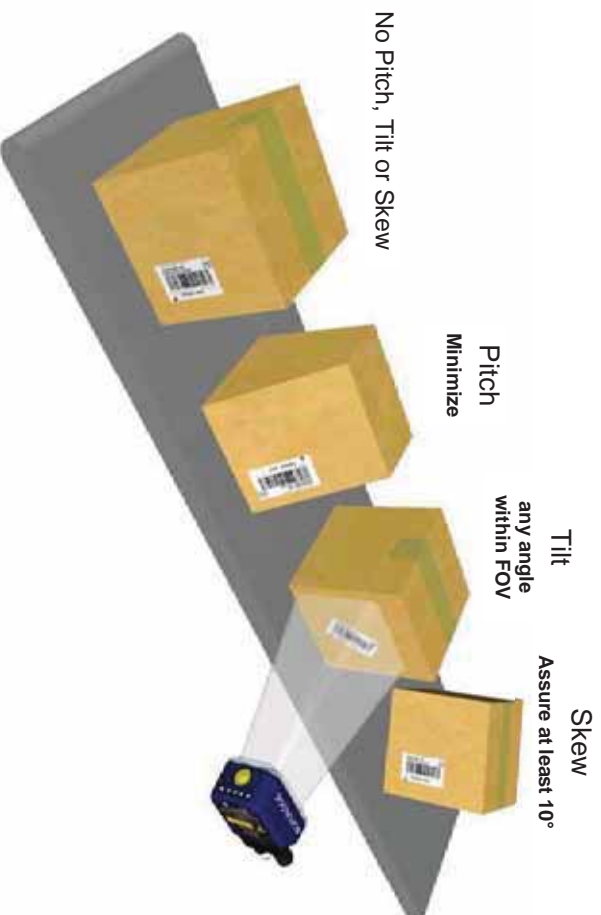


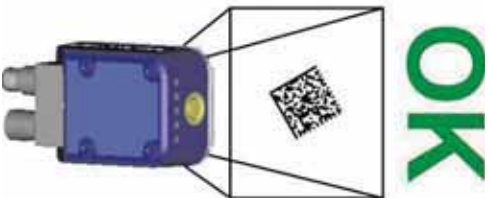
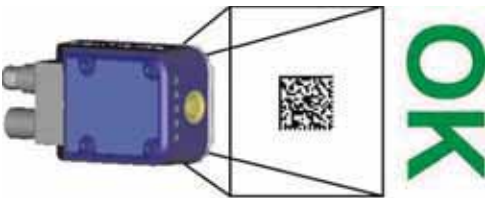
Figure 28 - Code Reading Orientation

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

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



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

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



NOTE

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

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

CBX100/500 Terminal Block Connectors	
Input Power	
Vdc	Power Supply Input Voltage +
GND	Power Supply Input Voltage -
Earth	Protection Earth Ground
Inputs	
+V	Power Source – External Trigger
11A	External Trigger A (polarity insensitive)
11B	External Trigger B (polarity insensitive)
-V	Power Reference – External Trigger
+V	Power Source – Inputs
12A	Input 2 A (polarity insensitive)
12B	Input 2 B (polarity insensitive)
-V	Power Reference – Inputs
Outputs	
+V	Power Source - Outputs
-V	Power Reference - Outputs
O1+	Output 1 + opto-isolated and polarity sensitive
O1-	Output 1 - opto-isolated and polarity sensitive
O2+	Output 2 + opto-isolated and polarity sensitive
O2-	Output 2 - opto-isolated and polarity sensitive
O3A	Output 3 non opto-isolated (only available on CBX500)
Auxiliary Interface	
TX	Auxiliary Interface TX
RX	Auxiliary Interface RX
SGND	Auxiliary Interface Reference
ID-NET™	
REF	Network Reference
ID+	ID-NET™ network +
ID-	ID-NET™ network -
Shield	Network Cable Shield
Main Interface	
RS232	
	TX
	RX
	RTS
	CTS
	SGND
RS485/422 Full-Duplex	
	TX+
	*RX+
	TX-
	*RX-
	SGND

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



NOTE

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

4.1 POWER SUPPLY

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

4.1.1 Standard Models

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

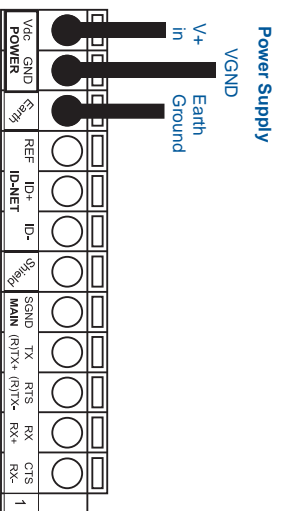


Figure 30 - Power Supply Connections

The power must be between 10 and 30 Vdc only.

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

4.1.2 Power over Ethernet (PoE) Models

Power over Ethernet models only support mode A Class 0 power levels and can be powered by any standard endspan PSE (i.e. PoE switch).

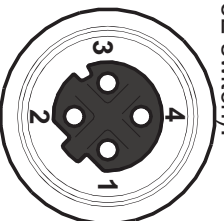


Figure 31 - M12 D-Coded Female Ethernet Network Connector

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**

These models can only supply power to the Digital Outputs directly. They cannot power any Input devices directly nor a CBX, nor any Input/Output devices through the CBX. If the CBX or any input devices are used for these models, they must be powered separately.

See par. 4.7 for further details.

4.2 MAIN SERIAL INTERFACE

**CAUTION**

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

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

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

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

4.2.2 RS485/422 Full-Duplex Interface

The RS485/422 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+	RS485/422 Transmit Data +
RX+	RS485/422 Receive Data +
TX-	RS485/422 Transmit Data -
RX-	RS485/422 Receive Data -
SGND	Signal Ground

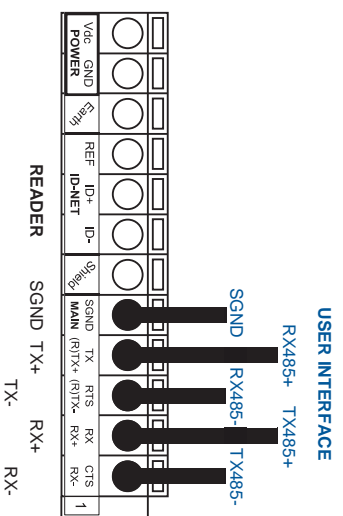



Figure 34 - RS485/422 Full-duplex Connections

 **NOTE**

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

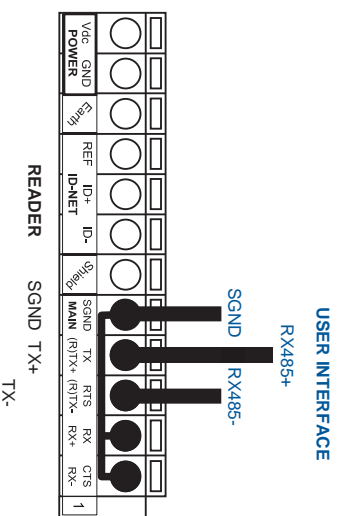


Figure 35 - RS485/422 Full-duplex Connections using Only TX Signals

4.3 ID-NET™ INTERFACE

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

4.3.1 ID-NET™ Cables

The following instructions are referred to Figure 37, Figure 38 and Figure 39.

- The general cable type specifications are: CAT5 twisted pair + additional CAT5 twisted pair, shielded cable AWG 24 (or AWG 22) stranded flexible.
We recommend using DeviceNet cables (drop or trunk type) to the following reference standards:
AN50325 – IEC 62026
UL STYLE 2502 80°C 30V
- Cable Shield **MUST** be connected to earth ground **ONLY** at the Master.
- NEVER** use ID-NET™ cable shield as common reference.
- The ID-NET™ max cable length depends on the baudrate used, (see the Baudrate Table below).
- For Common Power Connections use only 2 wires (ID+ and ID-).
 - DC Voltage Power cable (Vdc – GND) should be handled as a signal cable (i.e. do not put it together with AC cable):
 - Wire dimensioning must be checked in order to avoid voltage drops greater than 0.8 Volts.
 - Cable should lie down as near as possible to the ID-NET™ cable (avoiding wide loops between them).
- Reader's chassis may be connected to earth.
- Network inside the same building.

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

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



NOTE

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

4.3.2 ID-NET™ Response Time

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

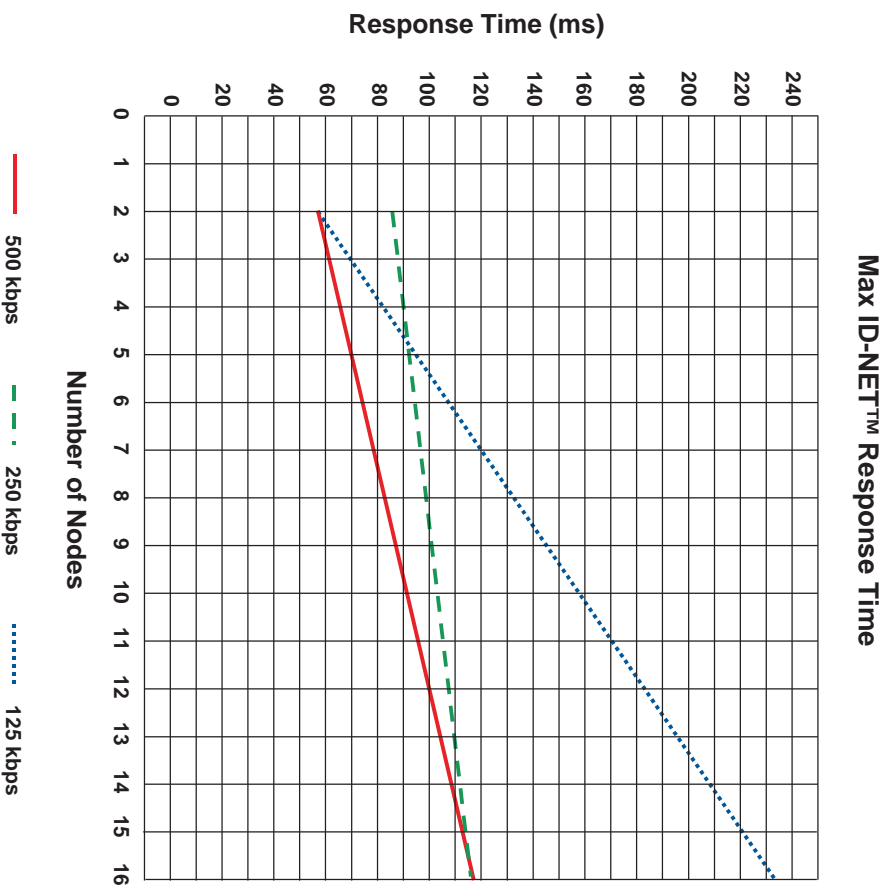


Figure 36 – ID-NET™ Response Time

CONDITIONS:

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

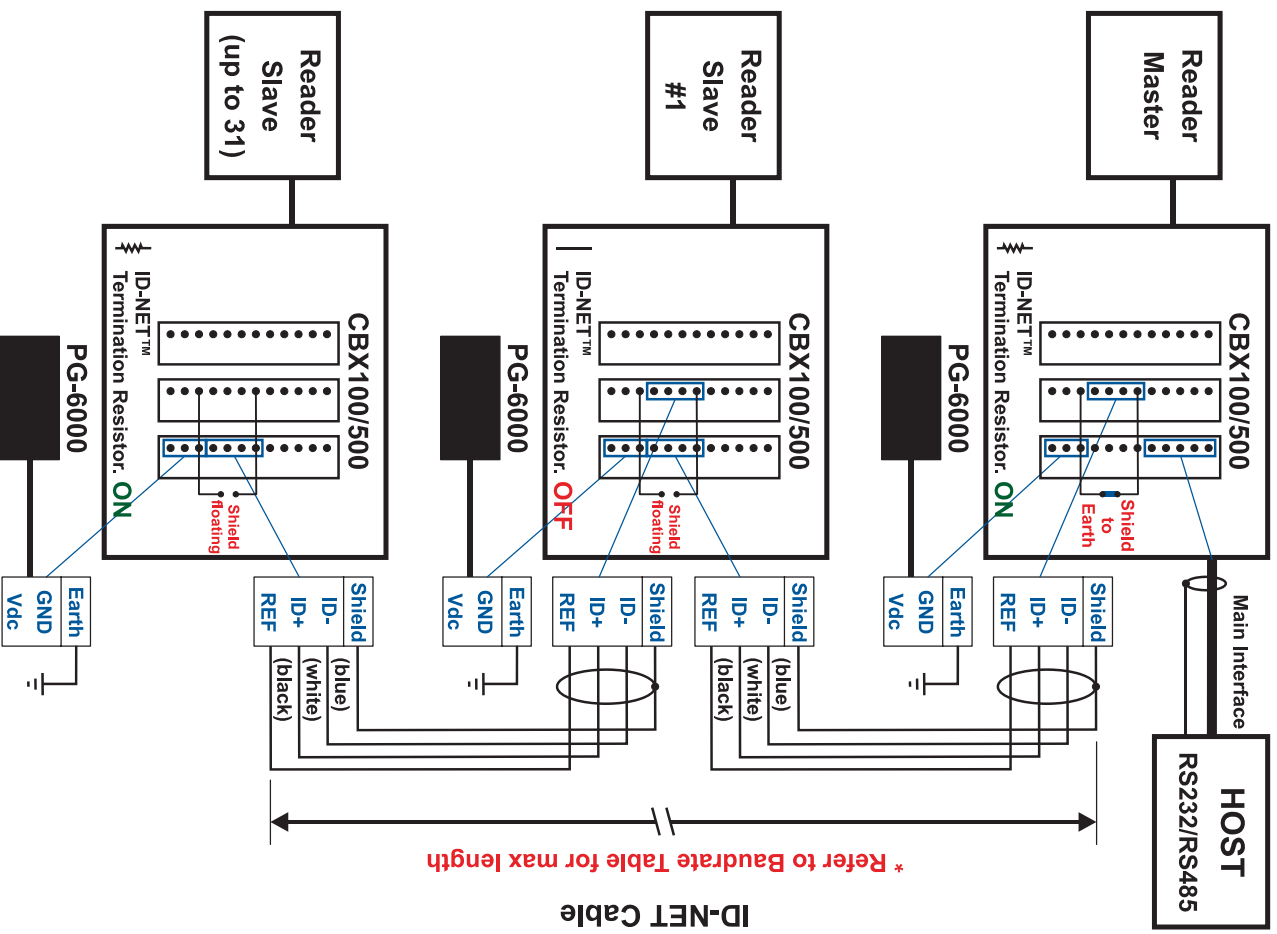


Figure 37 – ID-NET™ Network Connections with isolated power blocks

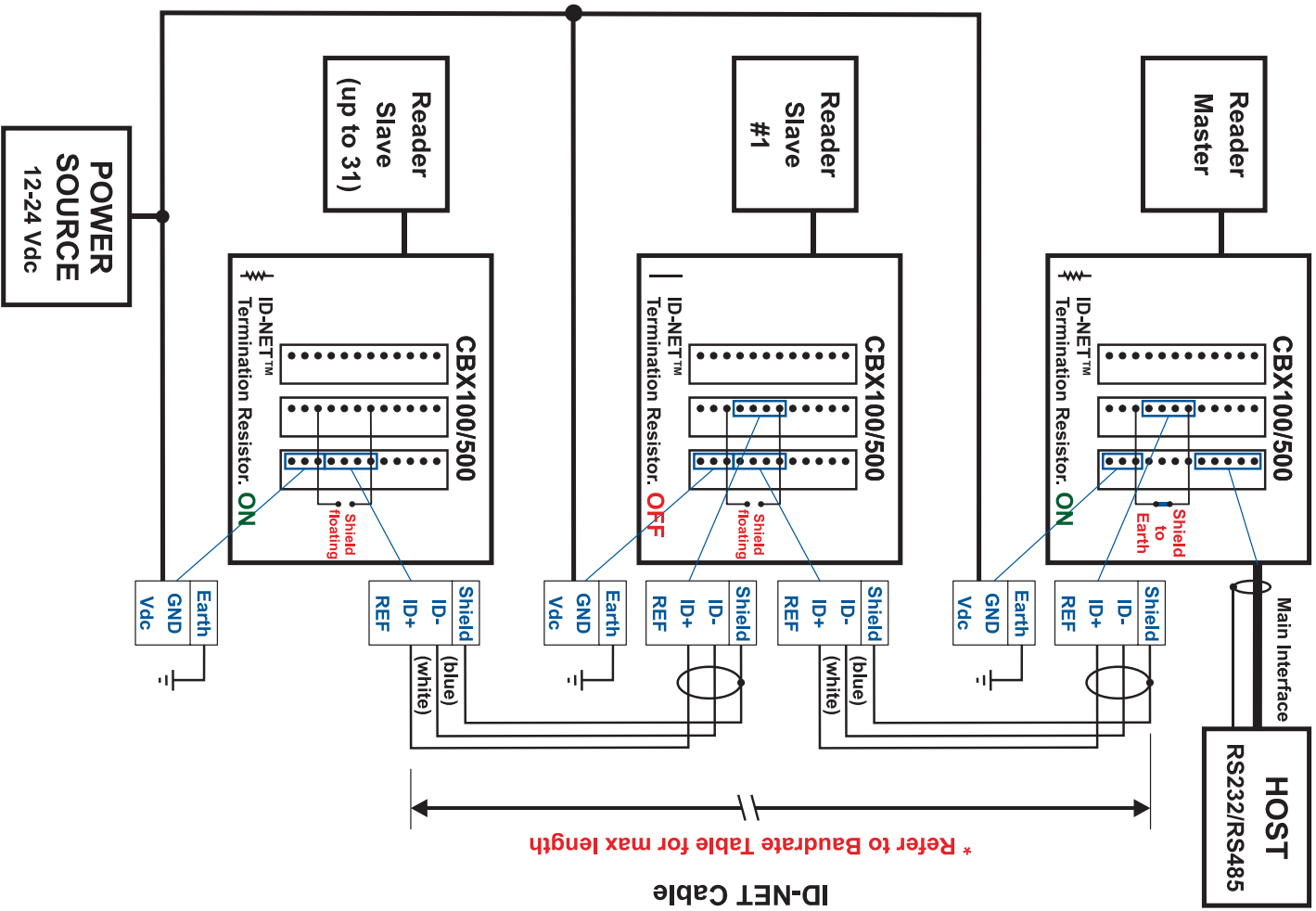


Figure 38 - ID-NET™ Network Connections with Common Power Branch Network

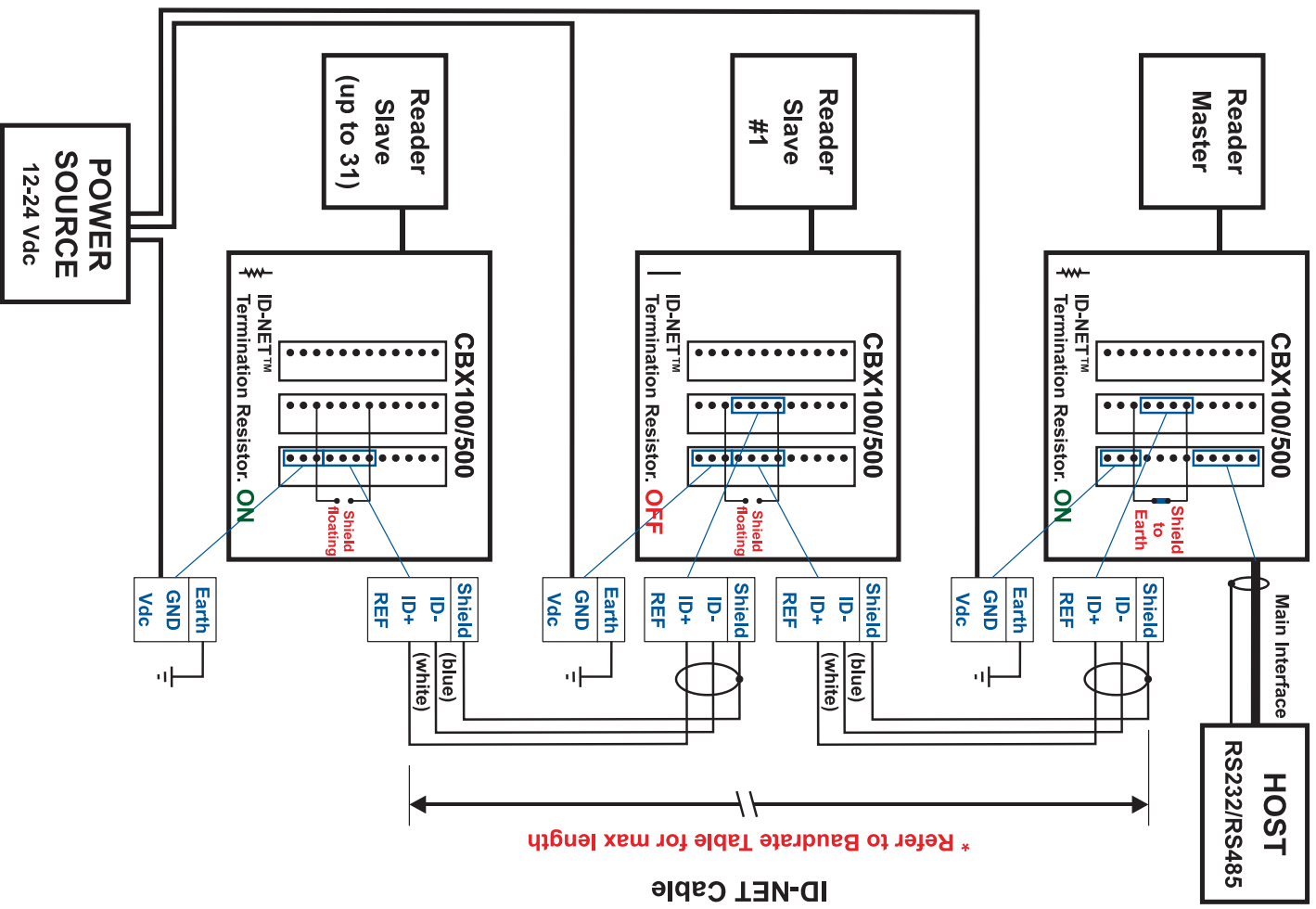


Figure 39 – ID-NET™ Network Connections with Common Power Star Network

4.3.3 ID-NET™ Network Termination

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

4.4 AUXILIARY RS232 INTERFACE

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

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

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

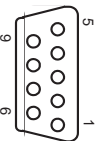


Figure 40 - 9-pin female connector

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

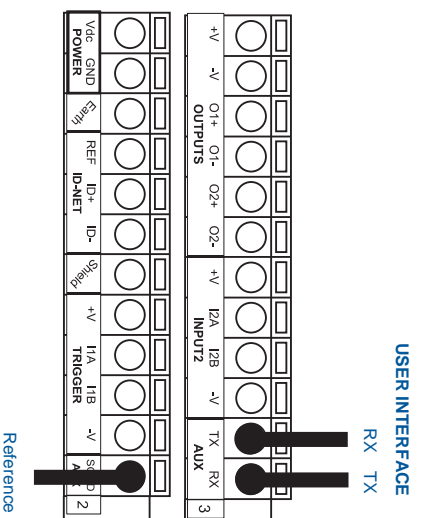


Figure 41 - RS232 Auxiliary Interface Connections



NOTE

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

4.5 INPUTS

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

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

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

The main functions of the general purpose Input 2 are:

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

The electrical features of both inputs are:

$V_{AB} = 30$ Vdc max.

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

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

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

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



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

NOTE

The connections are indicated in the following diagrams:

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

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

EXTERNAL TRIGGER INPUT CONNECTIONS USING MATRIX 300™ POWER

**CAUTION**

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

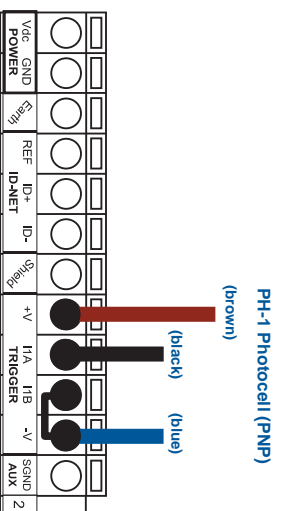


Figure 42 – PH-1 External Trigger Using Matrix 300™ Power

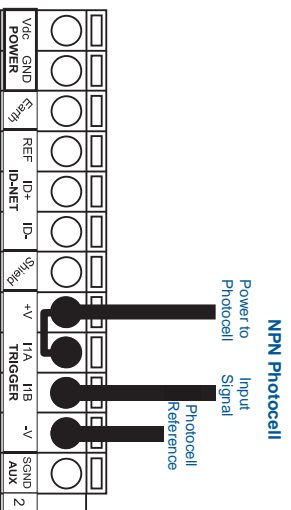


Figure 43 - NPN External Trigger Using Matrix 300™ Power

EXTERNAL TRIGGER INPUT CONNECTIONS USING EXTERNAL POWER

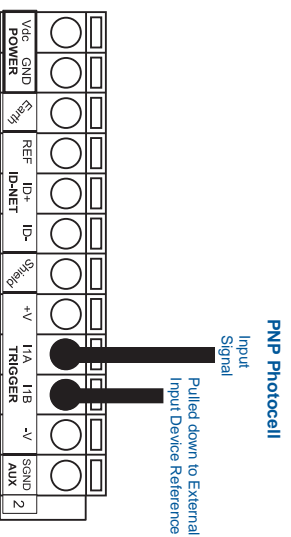


Figure 44 - PNP External Trigger Using External Power

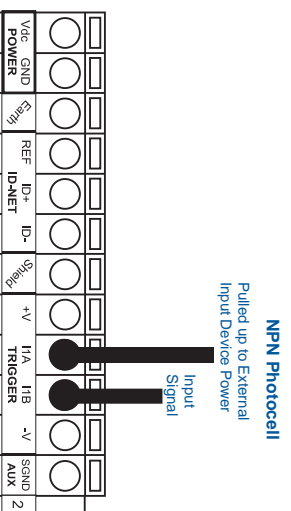


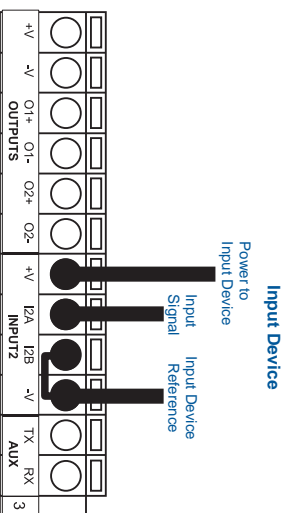
Figure 45 - NPN External Trigger Using External Power

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

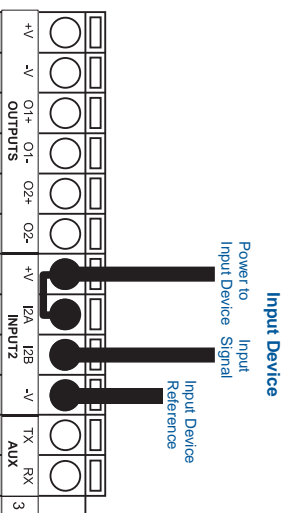
INPUT 2 CONNECTIONS USING MATRIX 300™ POWER



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



PNP Input 2 Using MATRIX 300™ Power



NPN Input 2 Using MATRIX 300™ Power

INPUT 2 CONNECTIONS USING EXTERNAL POWER

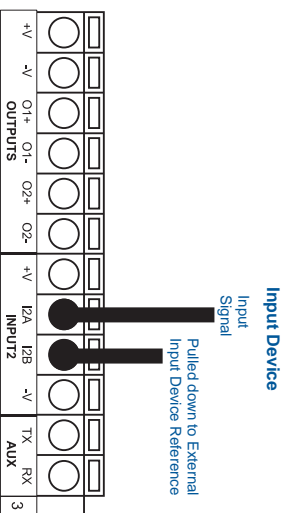


Figure 46 - PNP Input 2 Using External Power

Input Device
 Pulled up to External
 Input Device Power

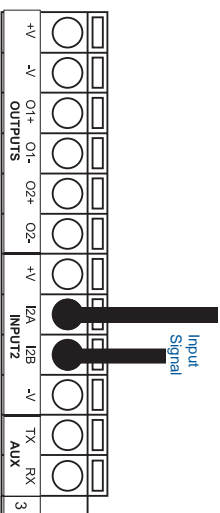


Figure 47 - NPN Input 2 Using External Power

INPUT 3 CONNECTIONS (CBX500 Only)

RESERVED

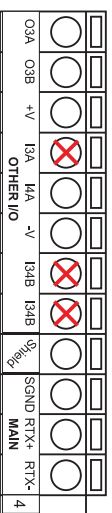


Figure 48 - Input 3 Using External Power



CAUTION

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

4.6 OUTPUTS



CAUTION

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

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

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

The electrical features of the outputs are the following:

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

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

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

OUTPUT 1 AND 2 CONNECTIONS USING MATRIX 300™ POWER



CAUTION

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

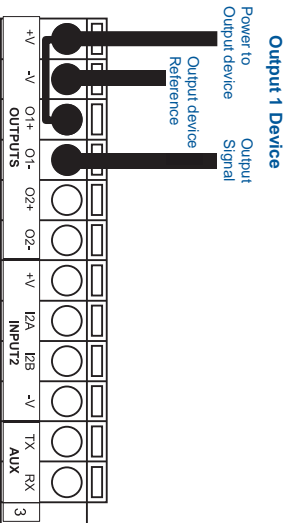


Figure 49 - PNP/Open Emitter Output Using MATRIX 300™ Power

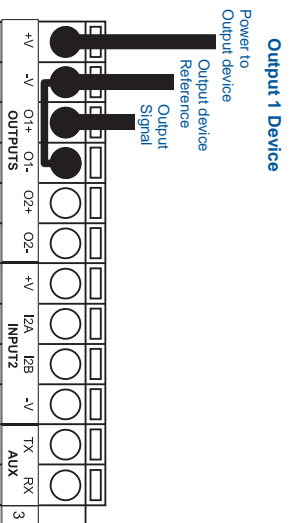


Figure 50 - NPN/Open Collector Output Using MATRIX 300™ Power

OUTPUT 1 AND 2 CONNECTIONS USING EXTERNAL POWER

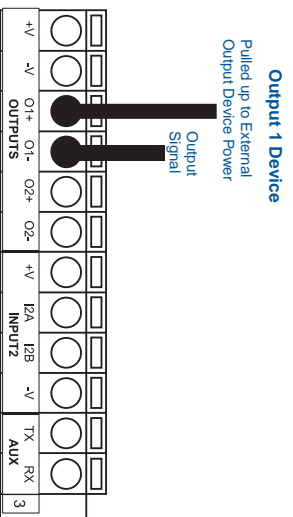


Figure 51 - PNP/Output Open Emitter Using External Power

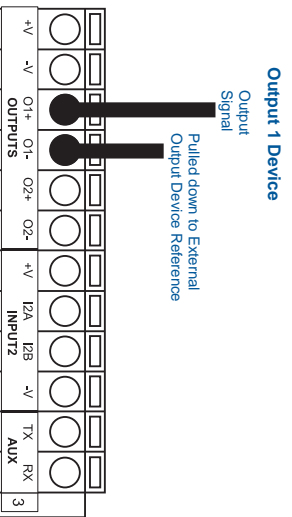


Figure 52 - NPN/Output Open Collector Using External Power

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

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

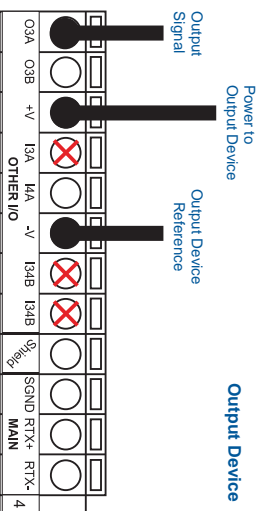


Figure 53 - Output 3 Using Matrix 300™ Power

OUTPUT 3 CONNECTIONS USING EXTERNAL POWER (CBX500 Only)

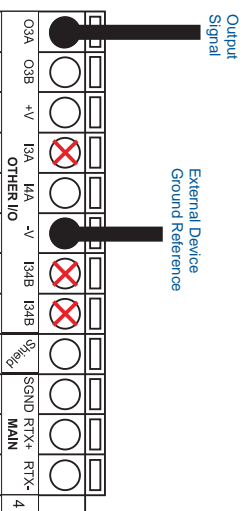


Figure 54 - Output 3 Using External Power



CAUTION

Do not connect to 13A or 134B signals, they are reserved.

4.7 ON-BOARD ETHERNET INTERFACE

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

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

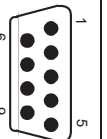
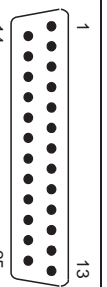
On the Matrix 300™ Ethernet interface the following communication channels are available:

- Data Socket
- Image Socket
- WebSentinel Socket
- Image FTP Client
- HTTP Server
- Ethernet IP
- Modbus TCP

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

4.8 USER INTERFACE - SERIAL HOST

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

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

5 TYPICAL LAYOUTS

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

5.1 POINT-TO-POINT

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

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

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

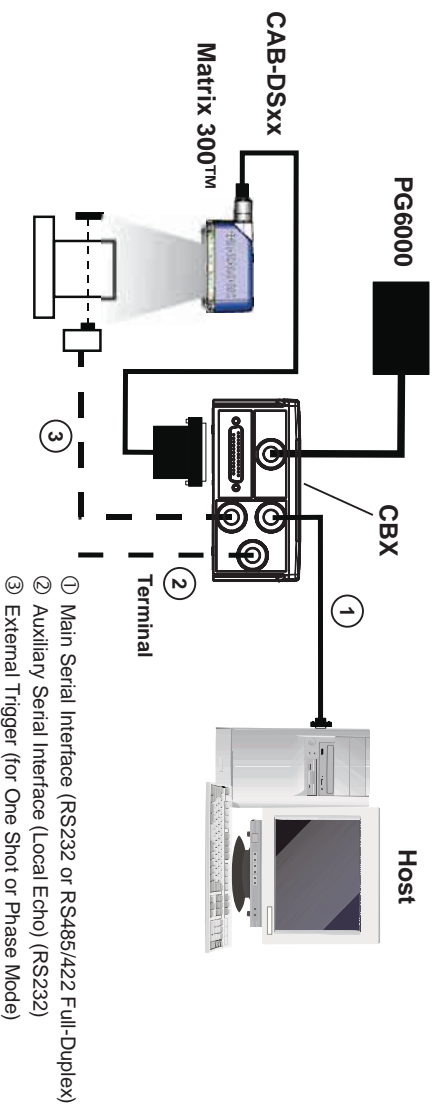


Figure 55 – Serial Interface Point-to-Point Layout

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

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

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

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

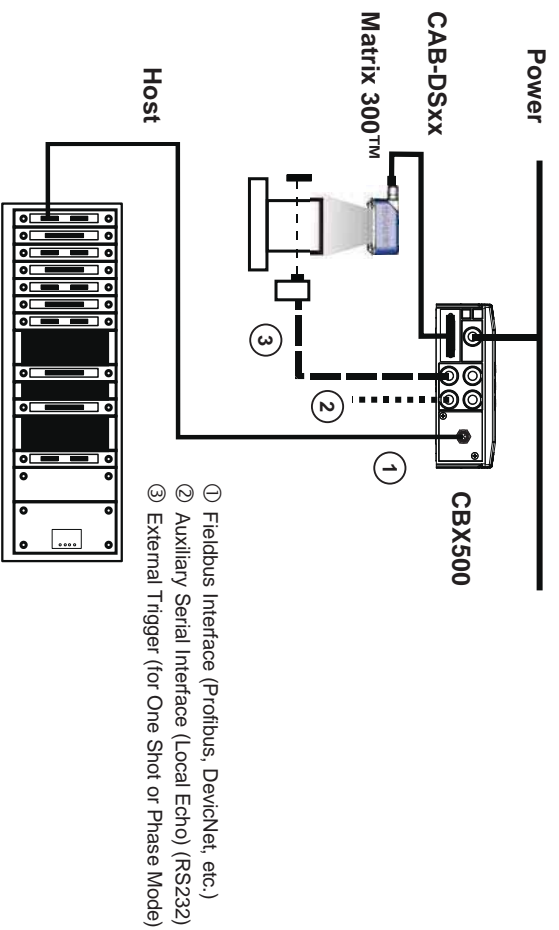


Figure 57 – Fieldbus Interface Point-to-Point Layout

5.2 ID-NET™ SYNCHRONIZED NETWORK

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

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

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

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

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

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

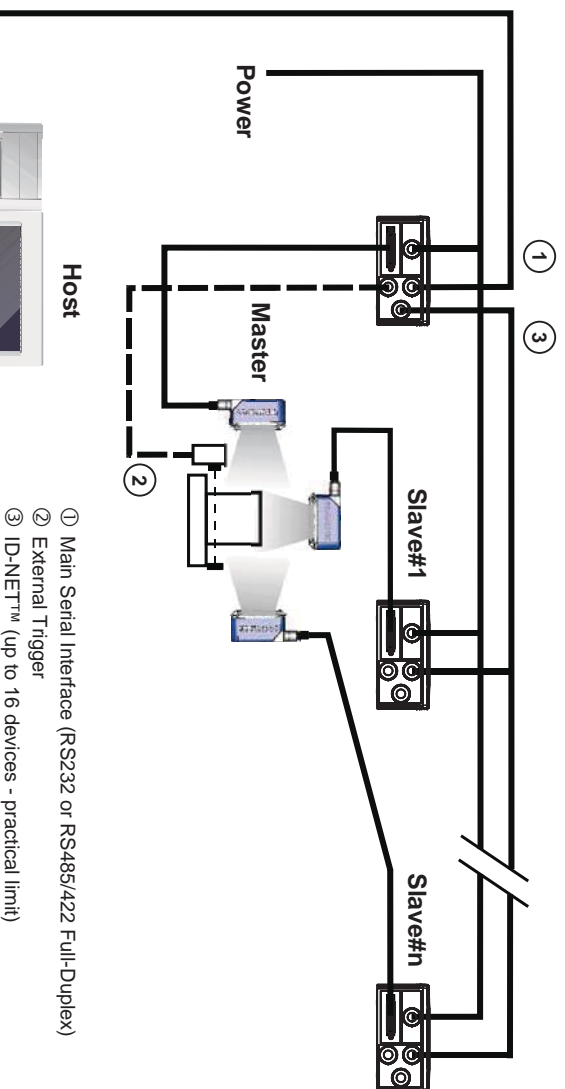


Figure 58 – ID-NET™ M/S Synchronized Layout

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

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

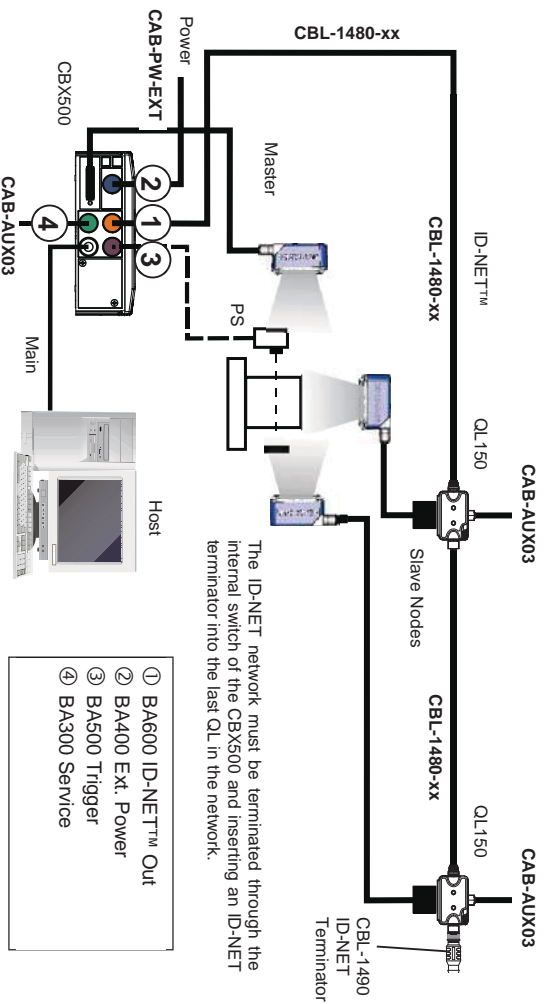


Figure 59 - ID-NET™ Synchronized Layout
Matrix 300™ Master with CBX500 + Matrix 300™ Slaves with QL150

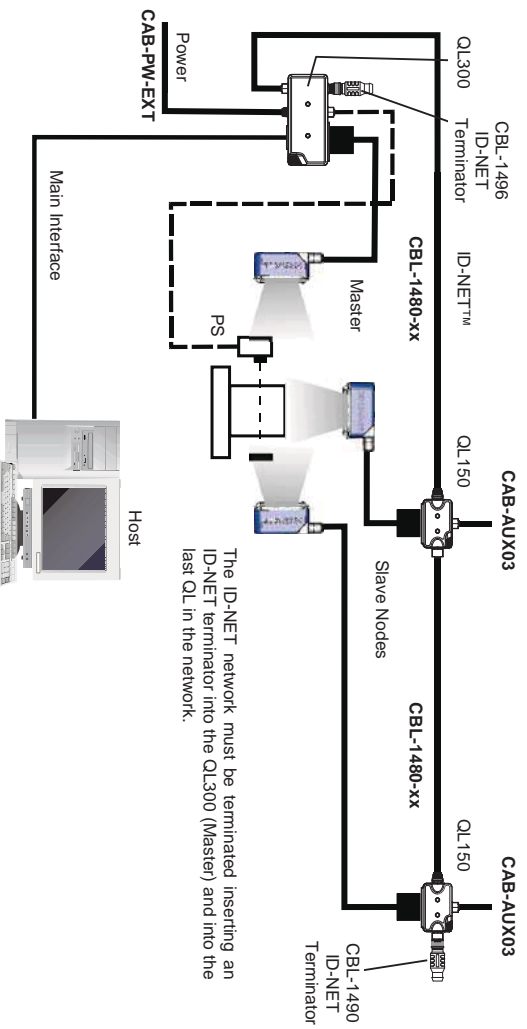


Figure 60 - ID-NET™ Synchronized Layout
Matrix 300™ Master with QL300 + Matrix 300™ Slaves with QL150

The same configuration can be made to a Host using a TCP/IP Ethernet interface. In this case the Master is connected to a CBX500 with BM200/210 Host Interface Module installed. The TCP/IP Ethernet, auxiliary, and ID-NET™ interfaces are connected as shown in the figure below.

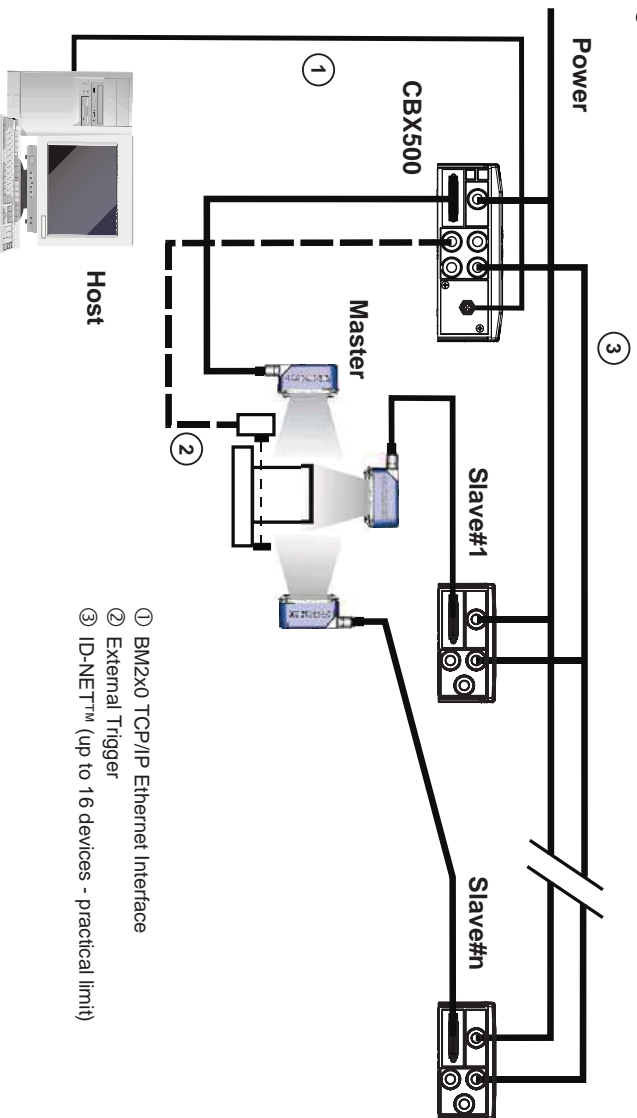
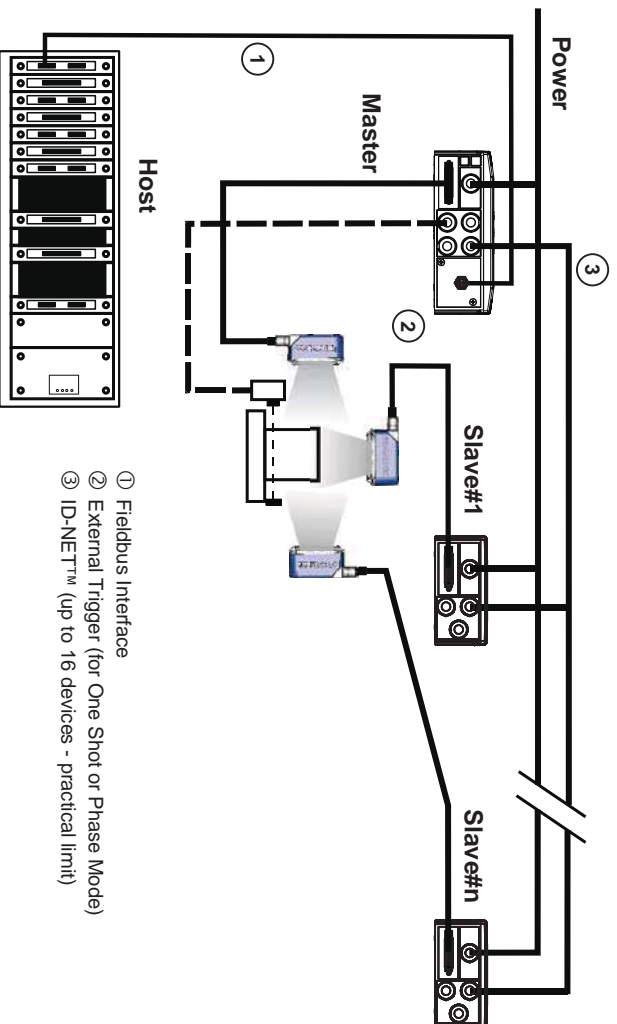


Figure 61 – ID-NET™ M/S Synchronized Layout with BM200/210 TCP/IP Ethernet Interface to Host

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

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



- ① Fieldbus Interface
- ② External Trigger (for One Shot or Phase Mode)
- ③ ID-NET™ (up to 16 devices - practical limit)

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

5.3 ID-NET™ MULTIDATA NETWORK

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

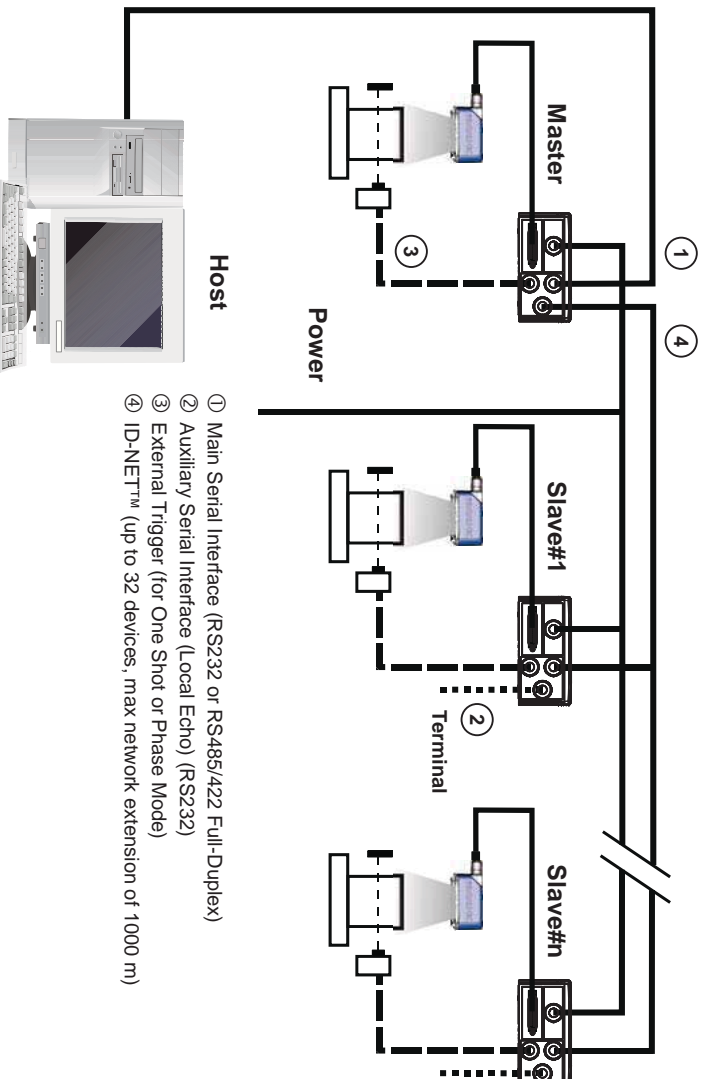


Figure 63 – ID-NET™ M/S Multidata



NOTE

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

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

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

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

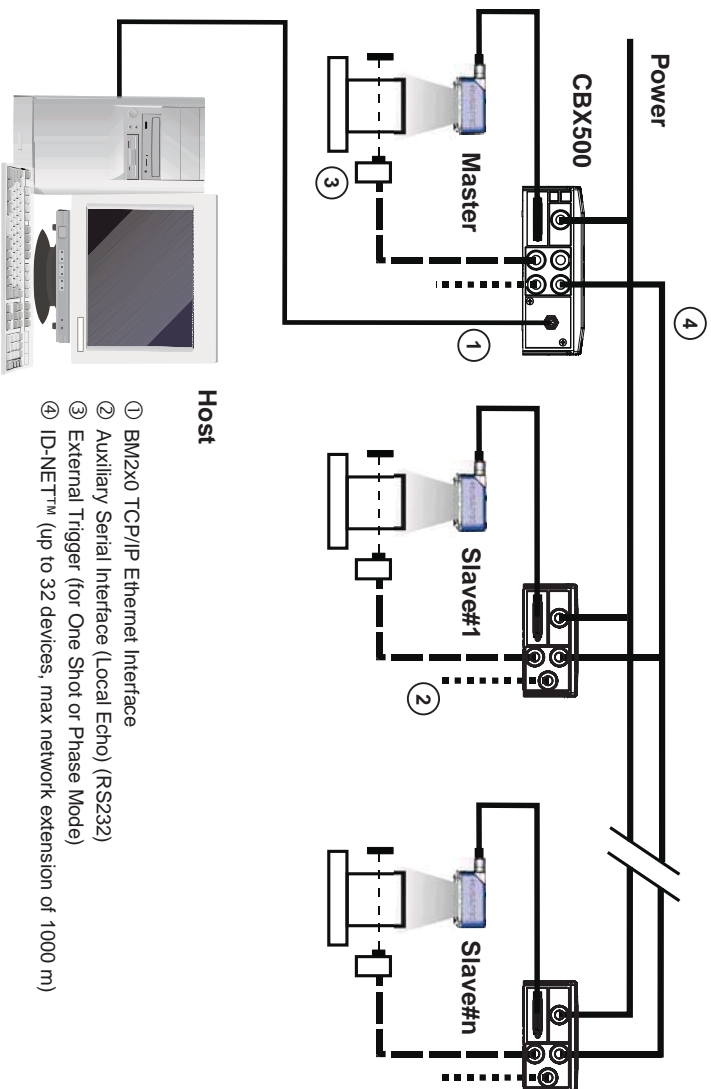


Figure 64 – ID-NET™ M/S Multidata Layout with BM200/210 TCP/IP Ethernet Interface to Host



NOTE

*The auxiliary serial interface of the slave readers can be used in Local Echo communication mode to control any single reader (visualize collected data) or to configure it using the VisiSet™ utility.
The ID-NET™ termination resistor switches must be set to ON only in the first and last CBX connection box.*

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

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

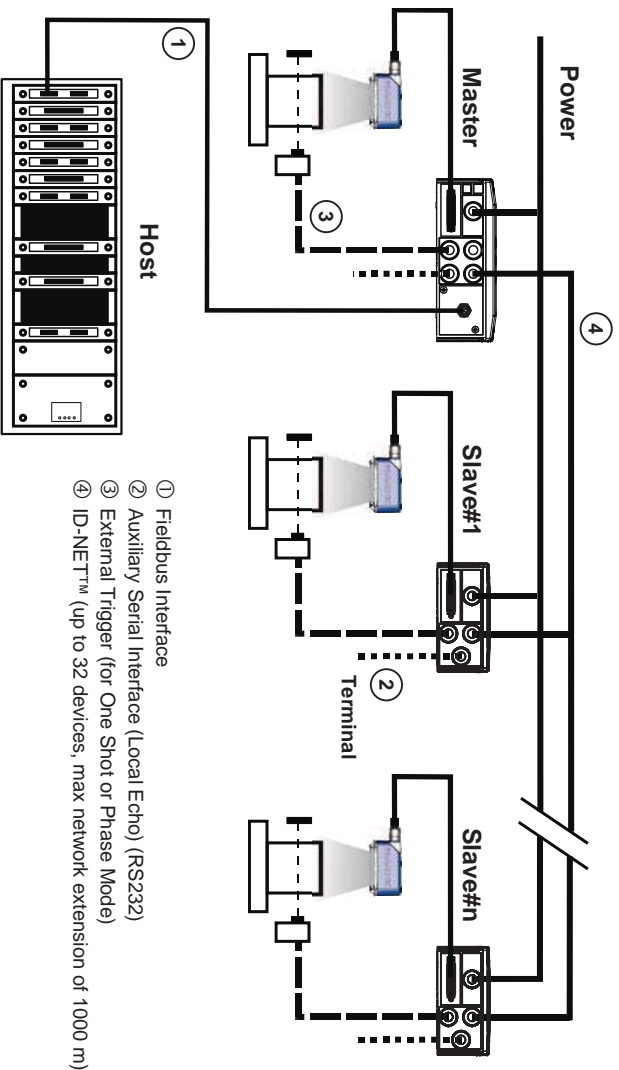


Figure 65 – ID-NET™ Fieldbus M/S Multidata

- ① Fieldbus Interface
- ② Auxiliary Serial Interface (Local Echo) (RS232)
- ③ External Trigger (for One Shot or Phase Mode)
- ④ ID-NET™ (up to 32 devices, max network extension of 1000 m)

5.4 PASS-THROUGH

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

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

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

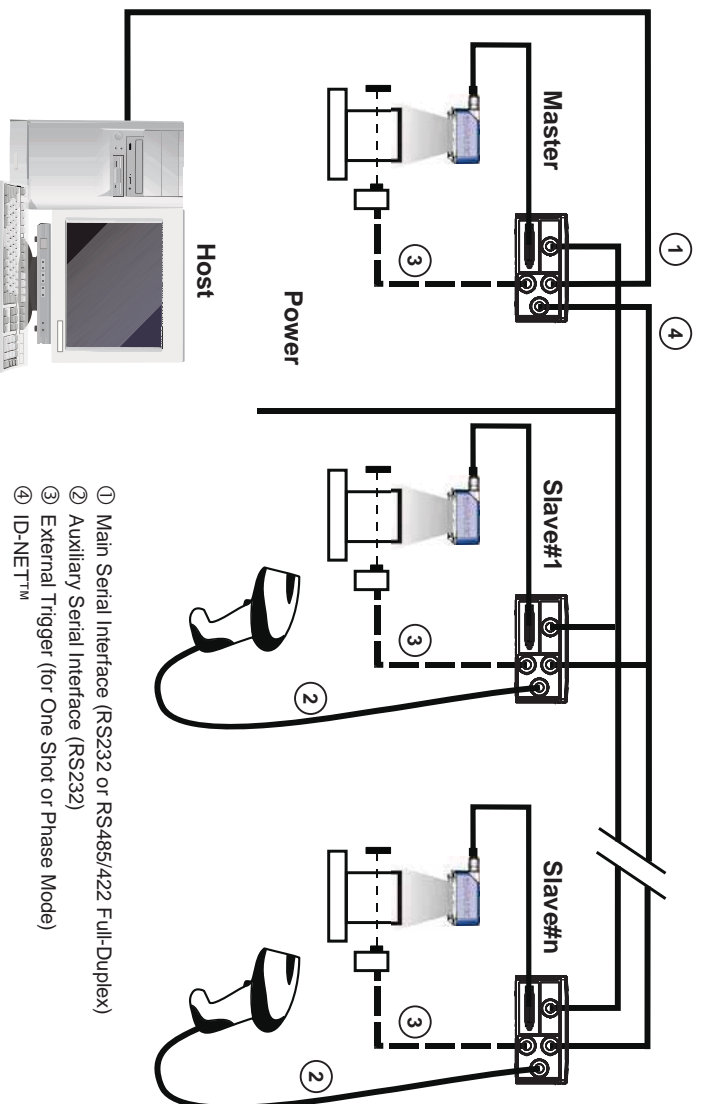


Figure 66 – Pass-Through On ID-NET™ Layout

- ① Main Serial Interface (RS232 or RS485/422 Full-Duplex)
- ② Auxiliary Serial Interface (RS232)
- ③ External Trigger (for One Shot or Phase Mode)
- ④ ID-NET™



NOTE

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

5.5 ETHERNET CONNECTION

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

In a Point-to-Point layout the reader is connected to a local host by using a **CAB-ETH-M0X** cable. There is no need to use a crossover adapter since Matrix 300™ incorporates an autocross function.

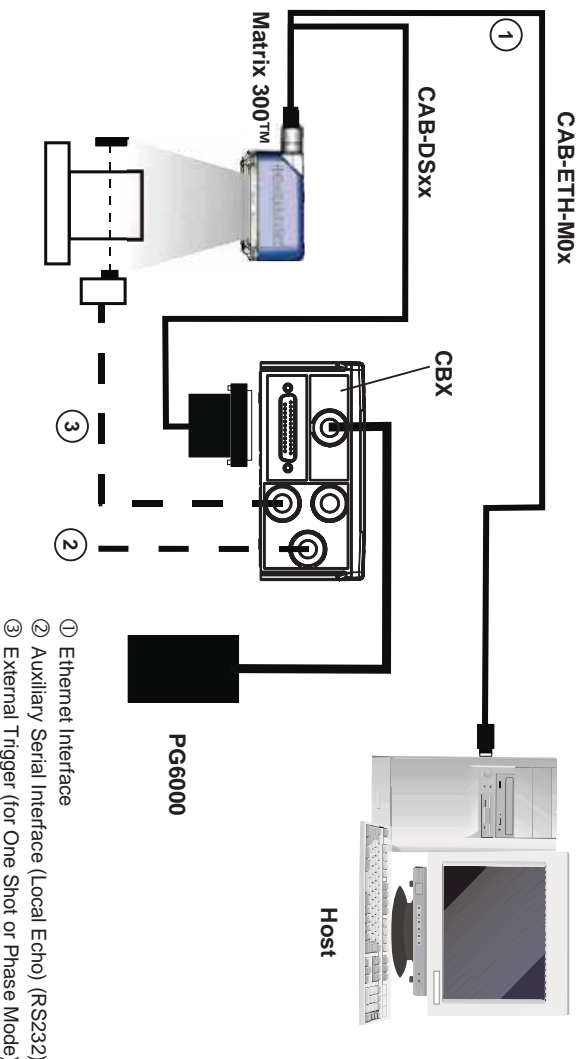


Figure 67 - Ethernet Point-to-Point Layout

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

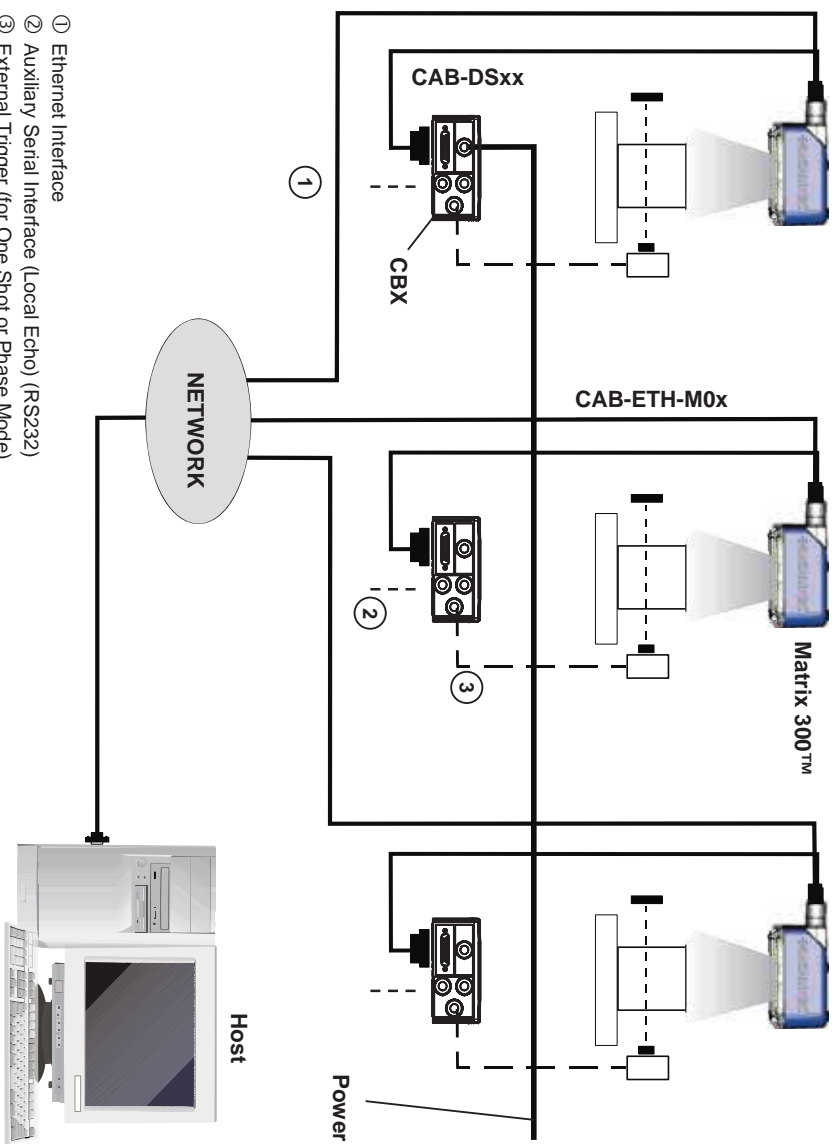


Figure 68 - Ethernet Network Layout

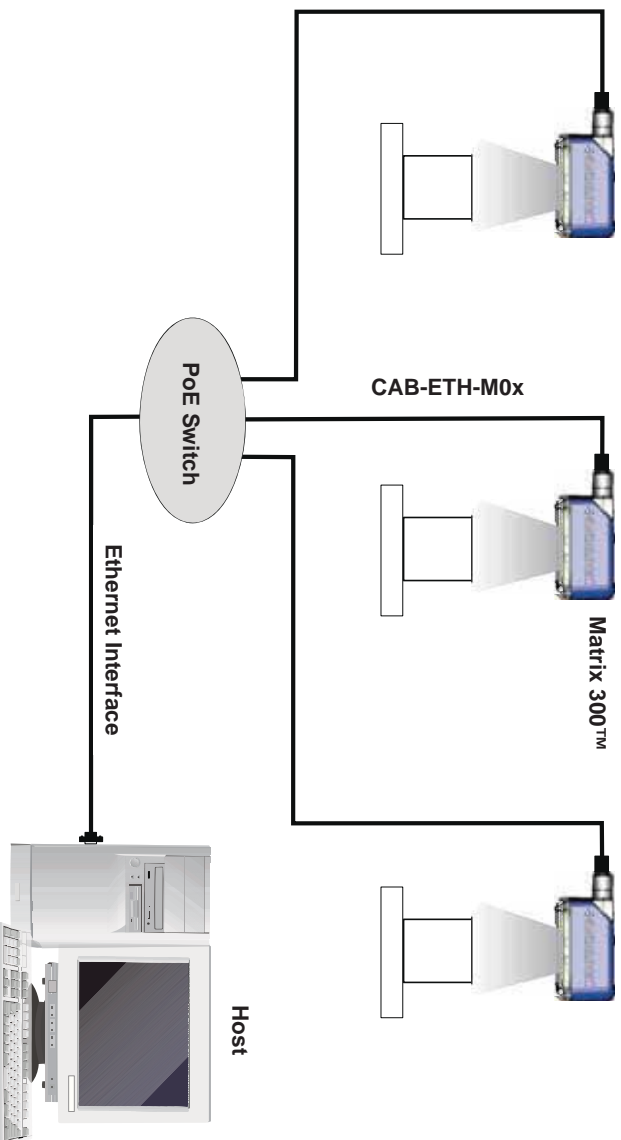


Figure 69 - POE Ethernet Network Layout

6 READING FEATURES

6.1 FOV CALCULATION

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

Model	Lens	d ₀	Viewing Angle Horizontal	Viewing Angle Vertical	Viewing Angle Diagonal	Min Reading Distance mm
Matrix 300 4x2-0xx	LNS-1109 9 mm	14 mm	39.8°	32.3°	49.7°	22

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

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

where:

FOV_x = horizontal, vertical or diagonal FOV

α_x = horizontal, vertical or diagonal viewing angles.

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

d₀ = reading distance offset (from center of lens to window surface)

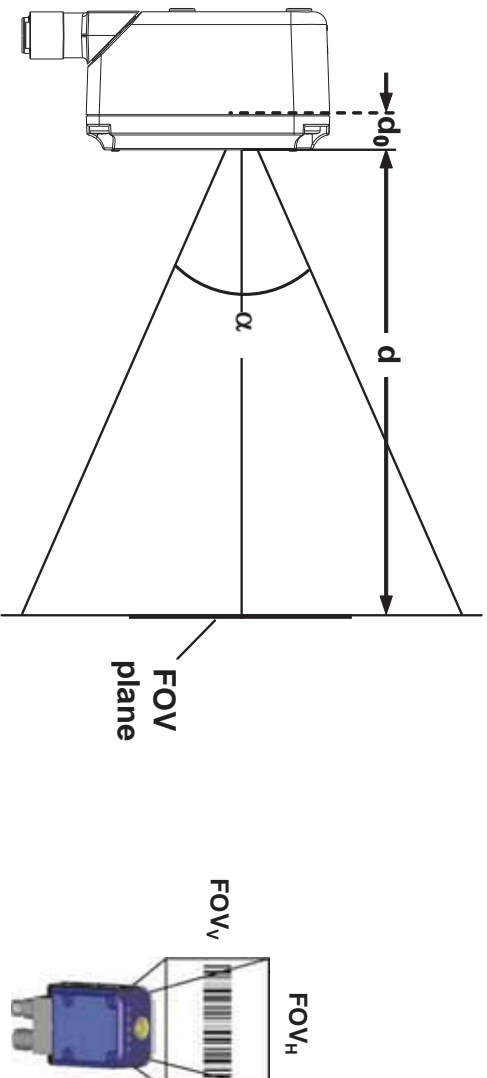


Figure 70 – Reading Distance References

Example:

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

$$FOV_H = 2 [(200 \text{ mm} + 14 \text{ mm}) \tan (39.8^\circ/2)] \cong 78 \text{ mm}$$

$$FOV_V = 2 [(200 \text{ mm} + 14 \text{ mm}) \tan (32.3^\circ/2)] \cong 62 \text{ mm}$$



NOTE

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

6.2 READING DIAGRAMS

- The following reading diagrams are to be considered as references and are given for typical performance at 25°C using high quality grade A symbols: Code 128 (1D code) and Data Matrix ECC 200 (2D code) from the Test Charts provided with the reader.
- Testing should be performed with the actual Matrix 300™ using application codes in order to evaluate whether maximizing application performance requires adjustments to the HW/SW configuration with respect to the Reference Conditions given under each diagram.
- The ratio of the Vertical FOV width with respect to the Horizontal FOV width in the diagrams is about equal to 0.8; specifically $1024/1280$. (i.e. $FOV_V \cong FOV_H \times 0.8$).
- 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. 6.3.
- Common software parameter settings for 1D Codes are: Processing Mode=Advanced Code Setting; Self Tuning=Disabled. For 2D Codes: Processing Mode=Standard; Self Tuning=Enabled; Self Tuning Mode=Processing Modes Only.
- When defining a HW/SW configuration for the Matrix 300™ for conditions different from those of the reference diagrams, it is suggested to keep in mind the following rules:
 - ◆ Changes in *Exposure Time* act directly proportional to the luminosity of the image and inversely proportional to the maximum code reading movement speed. Consequently, reducing the *Exposure Time* by half, reduces the luminosity of the image by half but doubles the theoretical code reading movement speed.
 - ◆ Changes in *Gain* act directly proportional to the luminosity of the image. Increasing the *Gain* value however, can reduce the quality of the acquired image.
 - ◆ At the center of the field of view, the lighting power of the “RED WIDE” illuminator is about equal to twice that of the “WHITE WIDE” illuminator, 1.5 times that of the “MLT-DPM” illuminator, and 2.9 times that of the “LT-DPM” illuminator.
 - ◆ For the two DPM illuminators, the overall lighting power being considered is from the four Central LED chains.

6.2.1 Pre-Configured .INI Files

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

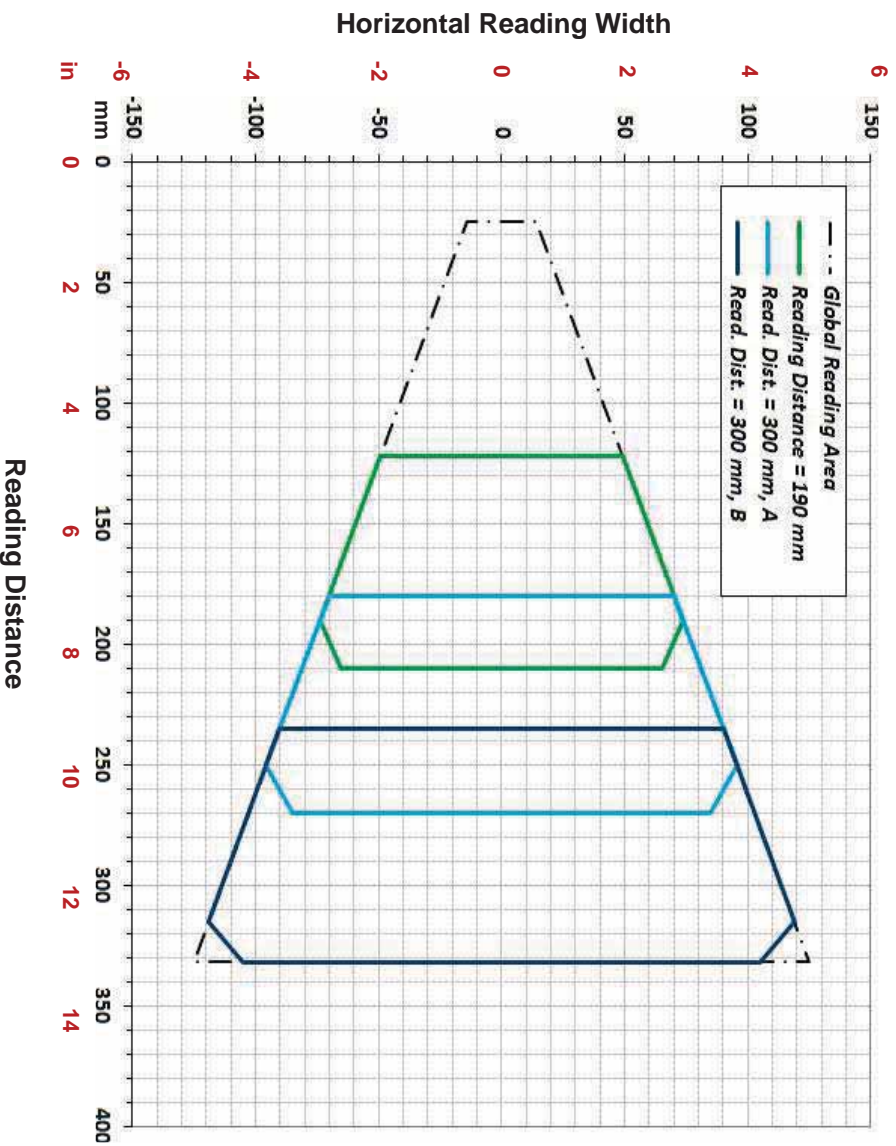
These .ini files are provided with and can be loaded from the VisiSet™ installation directory as in the following example:

C:\Program Files\DataLogic\VisiSet2Std_660\Reading Diagram Configuration Files\412-xxx RED Wide

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

6.2.2 1D (Linear) Codes

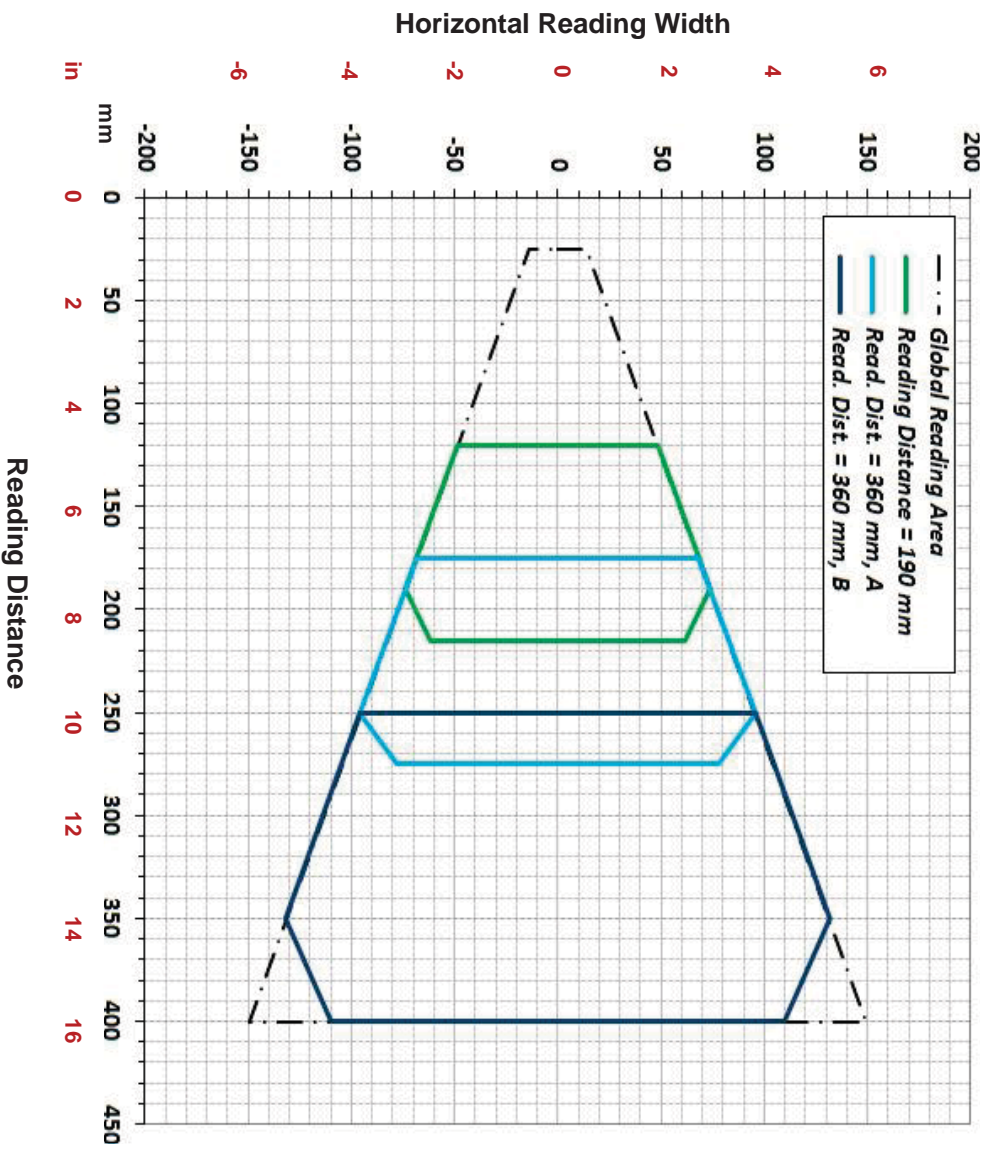
Code 128 0.25 mm (10 mils)



CONDITIONS:

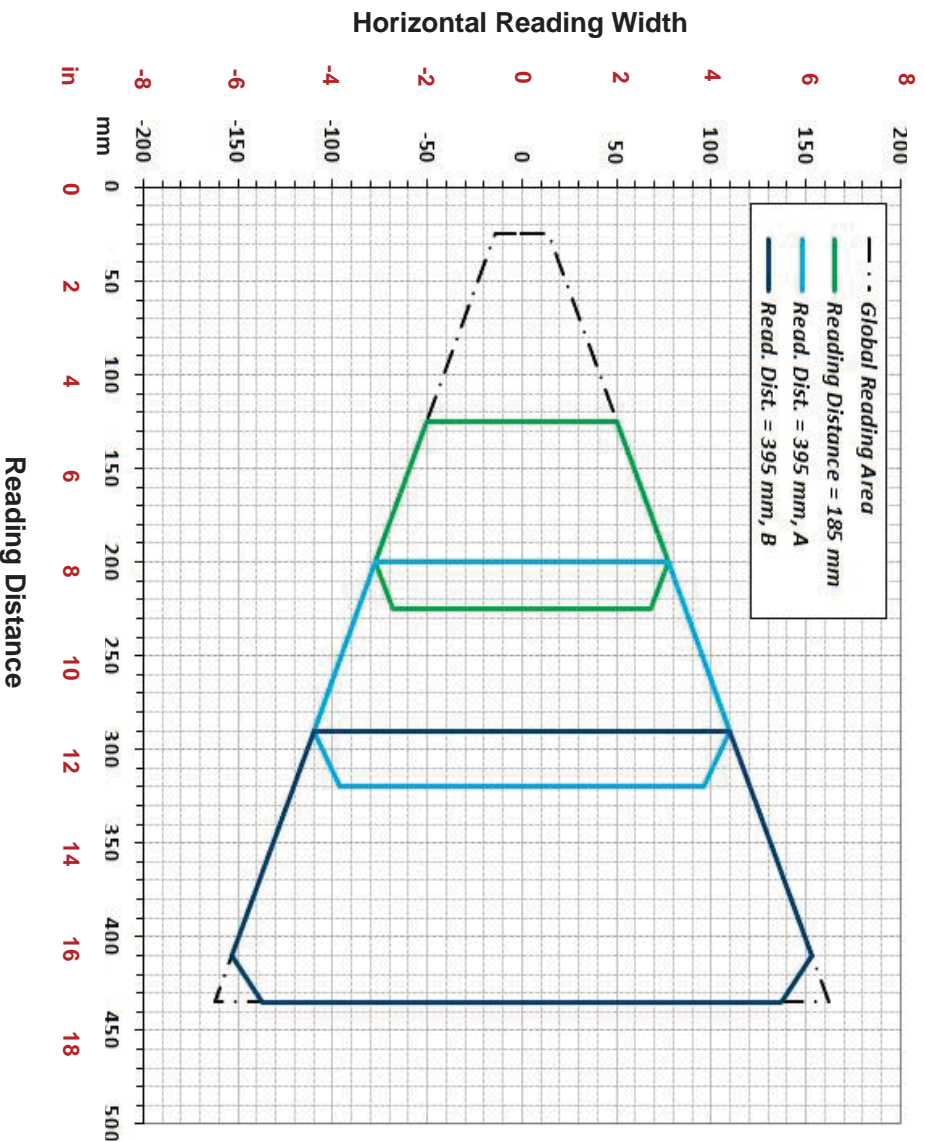
Hardware Settings	
Code Symbology	Code 128
Code Resolution	0.25 mm (10 mils)
Tilt Angle	45°
Skew Angle	15°
Software Parameters	
Reading Distance (mm)	190
412-xxx RED Wide	300
Exposure Time (µs)	A 130 B 230
Gain	25
Illuminator Lighting Mode	Very High Power Strobed

Code 128 0.30 mm (12 mils)

**CONDITIONS:**

Hardware Settings	
Code Symbology	Code 128
Code Resolution	0.30 mm (12 mils)
Tilt Angle	45°
Skew Angle	15°
Software Parameters	
Reading Distance (mm)	190
412-xxx RED Wide	
Exposure Time (µs)	150
Gain	20
ILLUMINATOR LIGHTING MODE	Very High Power Strobed

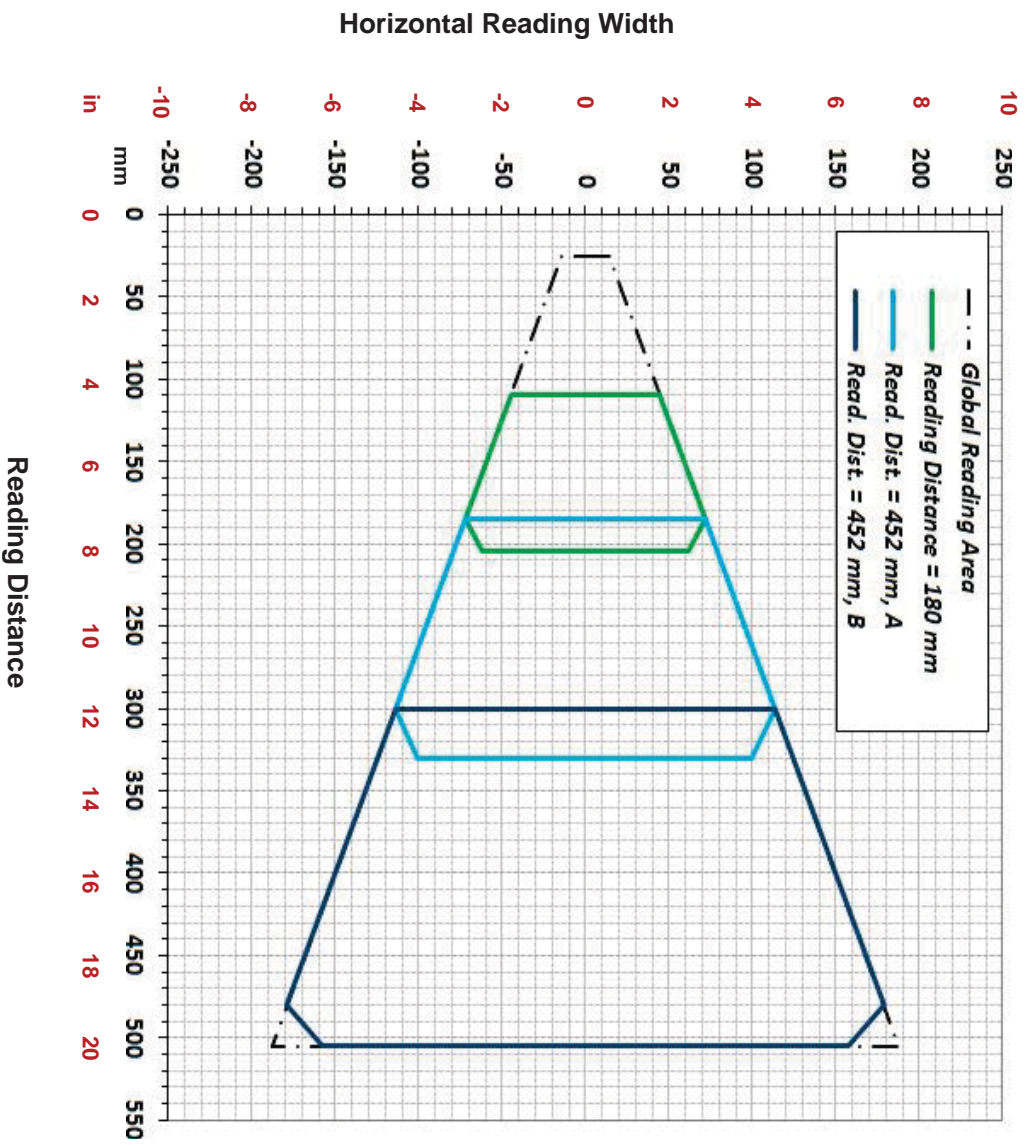
Code 128 0.33 mm (13 mils)



CONDITIONS:

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

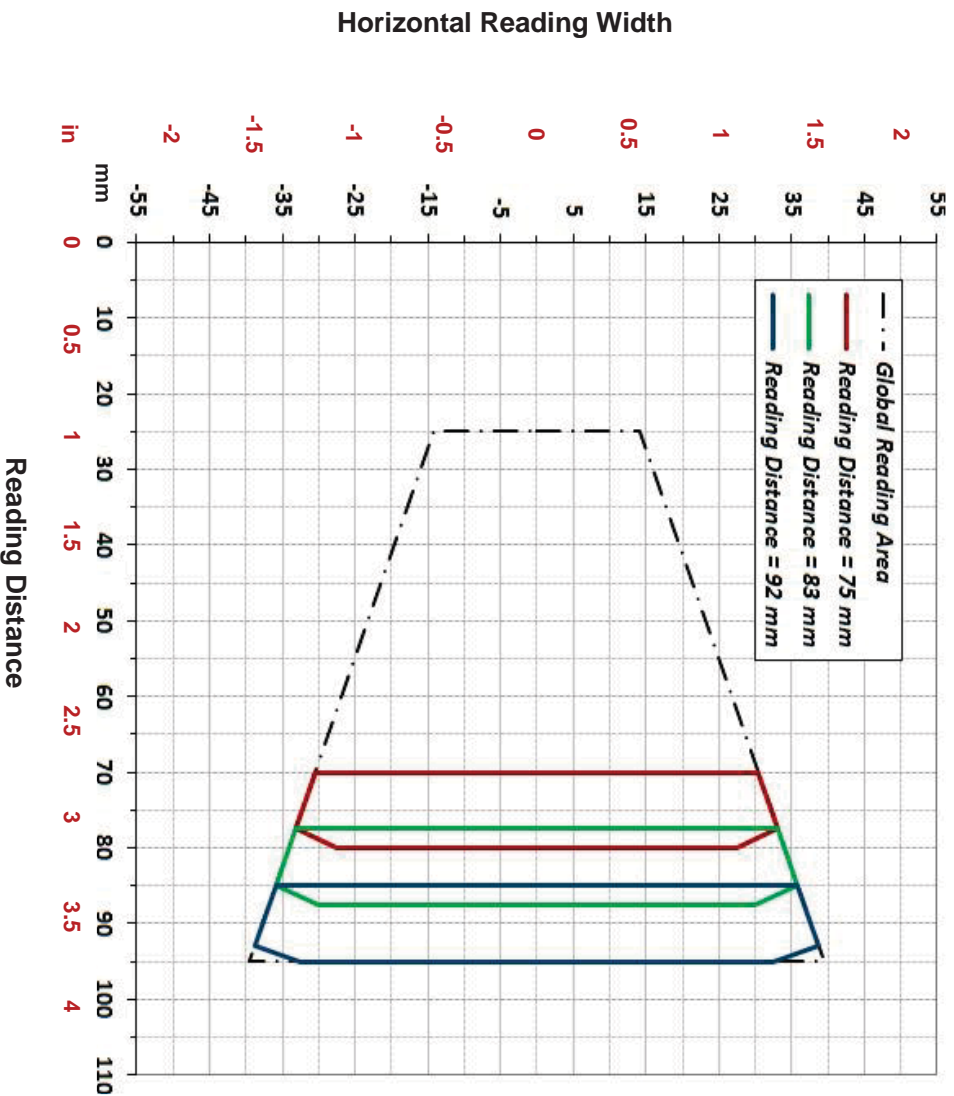
Code 128 0.38 mm (15 mils)

**CONDITIONS:**

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

6.2.3 2D (Bi-dimensional) Codes

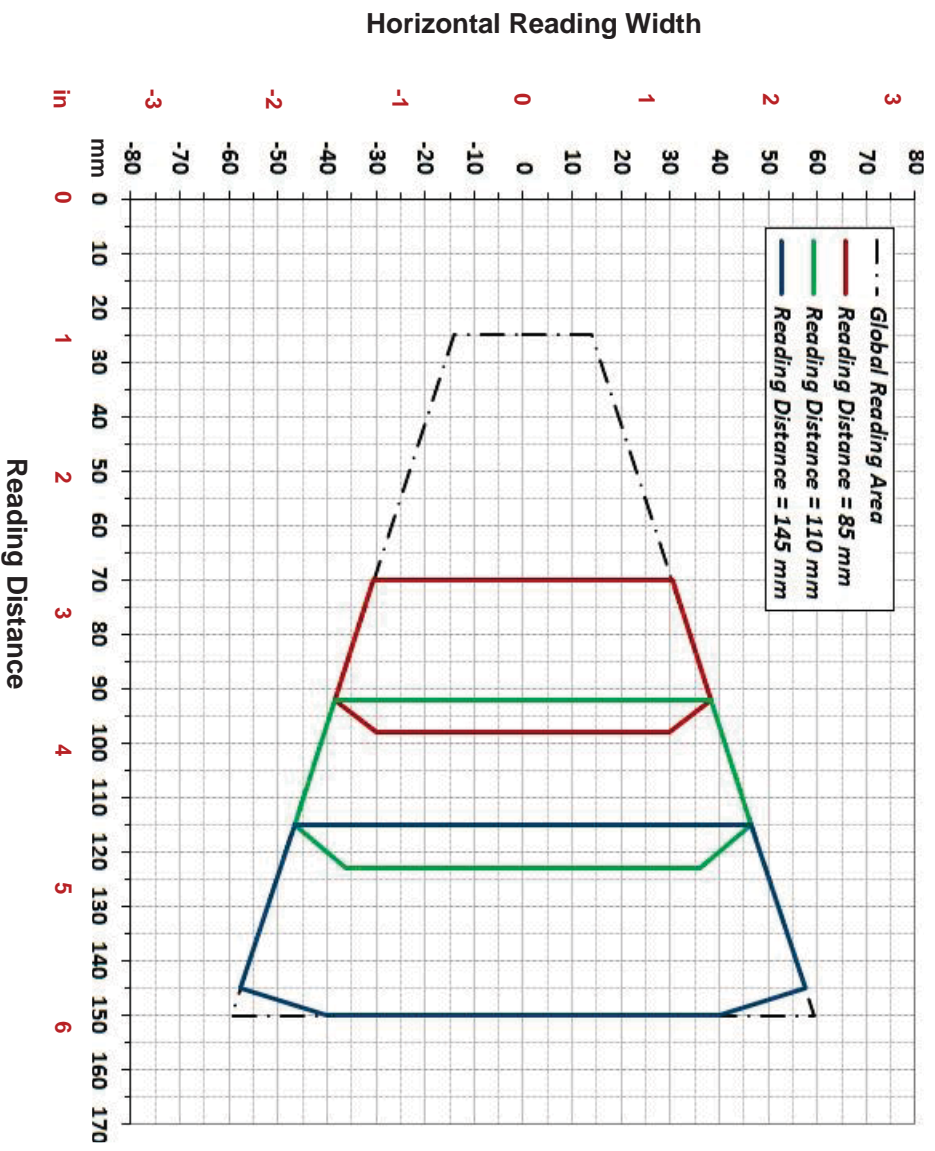
Data Matrix 0.13 mm (5 mils)



CONDITIONS:

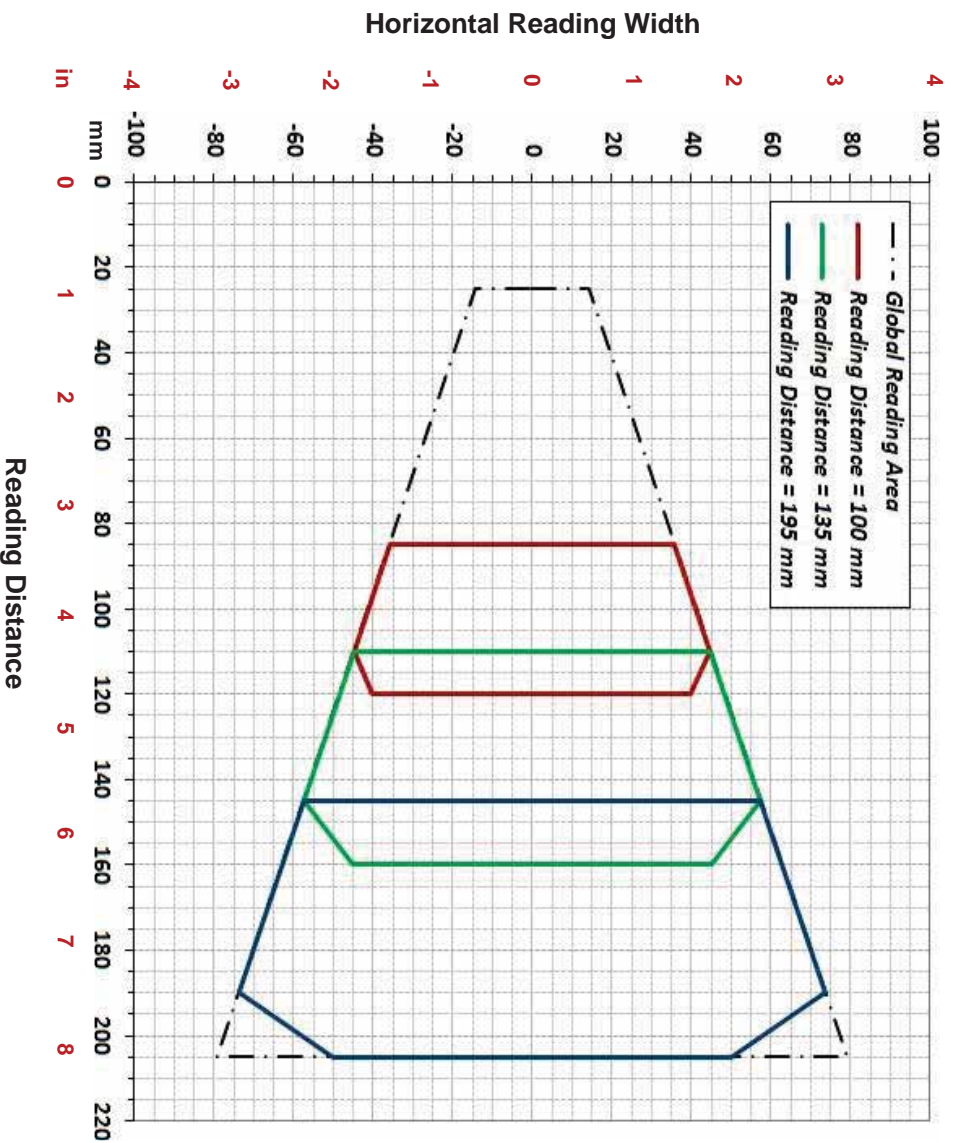
Hardware Settings			Data Matrix ECC 200
Code Symbology			0.13 mm (5 mils)
Code Resolution			45°
Tilt Angle			20°
Skew Angle			
Software Parameters			
Reading Distance (mm)	75	83	92
412-xxx RED Wide			
Exposure Time (µs)	60	80	100
Gain	15	12	10
Very High Power Strobed			
472-xxx LT-DPM			
Exposure Time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

Data Matrix 0.19 mm (7.5 mils)

**CONDITIONS:**

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

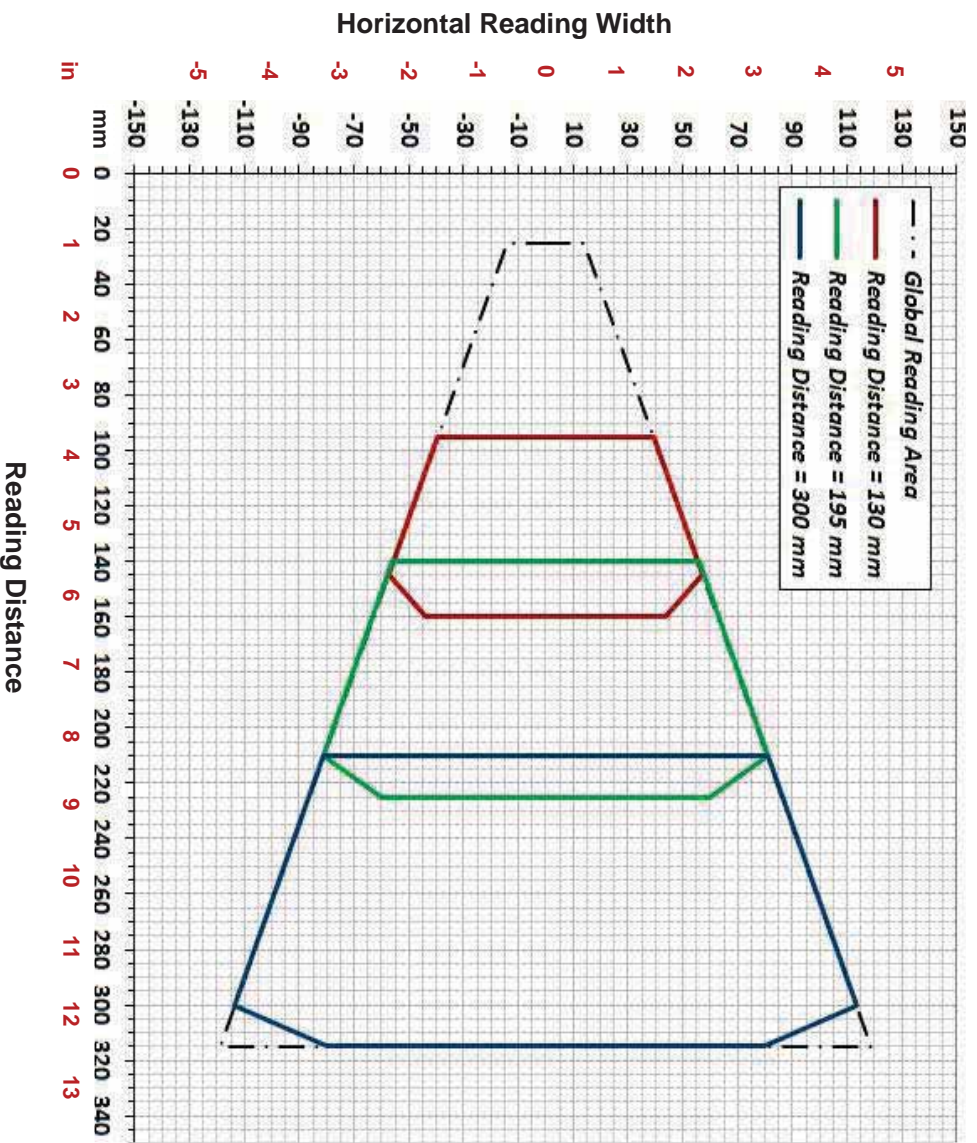
Data Matrix 0.25 mm (10 mils)



CONDITIONS:

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

Data Matrix 0.38 mm (15 mils)

**CONDITIONS:**

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

6.3 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_{exp}**: Exposure Time (s)
- **LS**: Line Speed (mm/s)

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

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

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

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

Example:

A Matrix 300™ using:

Internal Lighting Mode = Very High Power Strobe

Exposure Time (x1 μs) = 100 (100 μs)

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

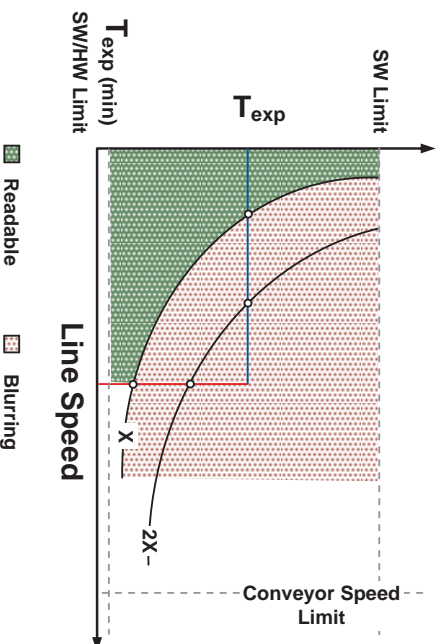
has a maximum line speed of:

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

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

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

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



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

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

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

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

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



NOTE

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

7 SOFTWARE CONFIGURATION

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

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

**NOTE**

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

7.1 VISISET™ SYSTEM REQUIREMENTS

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

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

7.2 INSTALLING VISISET™

To install VisiSet™, proceed as follows:

1. Turn on the Laptop or PC that will be used for configuration (connected to the Matrix 300™ communication ports).
2. After Windows finishes booting, insert the Mini-DVD provided.
3. Launch VisiSet™ installation by clicking [Install](#).
4. Follow the instructions in the installation procedure.

7.3 STARTUP

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

1. Power on the Matrix 300™ reader. Wait for the reader startup. The system bootstrap requires a few seconds to be completed. The reader automatically enters Run Mode.
2. Run the VisiSet™ program.
3. Press **Connect** on the VisiSet™ menu bar. The PC will automatically connect to the Matrix 300™ reader.

Upon connection, Matrix 300™ exits Run Mode and displays the Main Menu on VisiSet™ with all the commands necessary to monitor your reader's performance. You can select these commands using the mouse or by pressing the key corresponding to the letter shown on the button. See Figure 71.

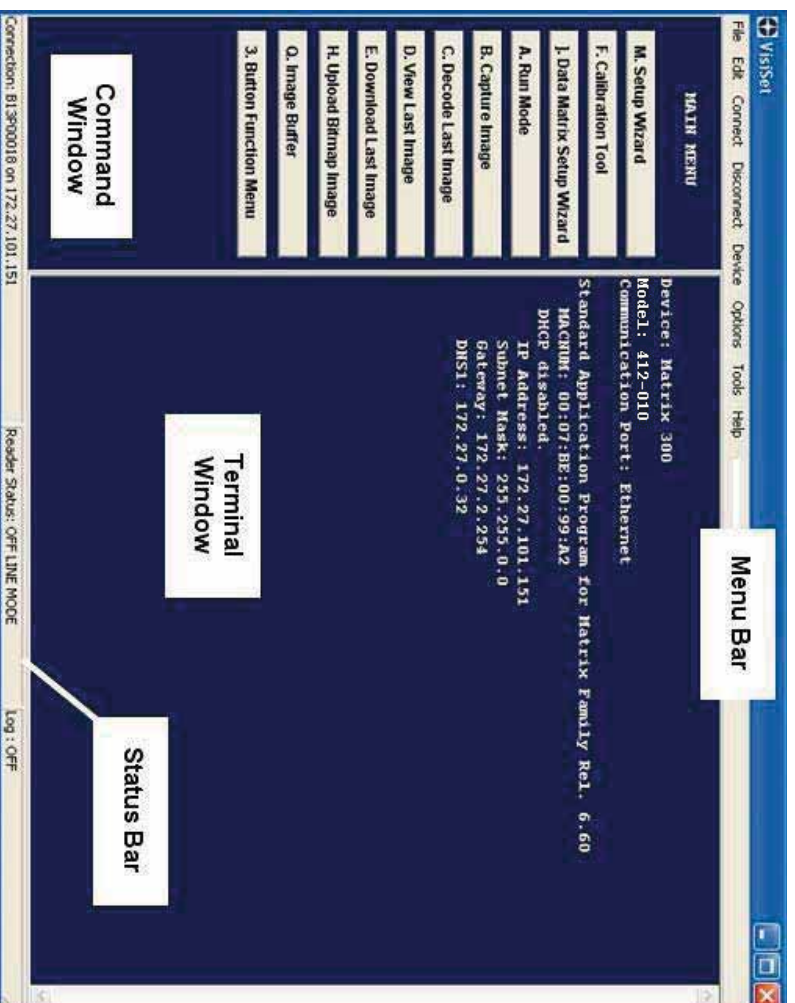


Figure 71 - Main Window

7.3.1 VisiSet™ Options

The **Options** item from the VisiSet™ menu (see Figure 71) presents a window allowing you to configure:

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

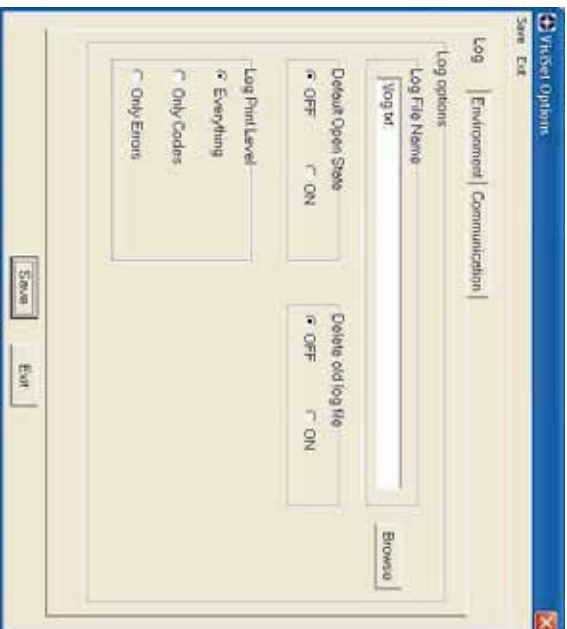


Figure 72 - Options - Log



Figure 73 - Options - Environment

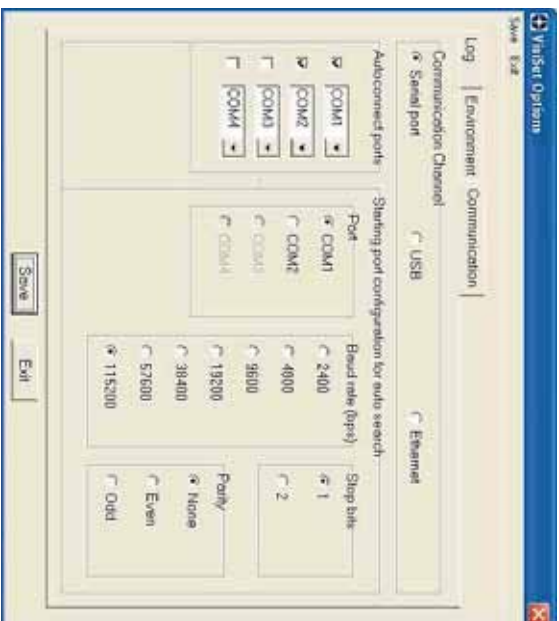


Figure 74 - Options – Communication: Serial Port

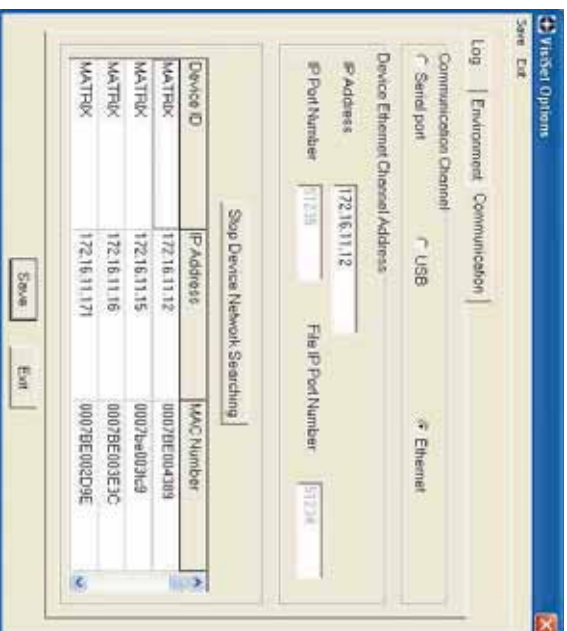


Figure 75 - Options – Communication: Ethernet

7.4 ETHERNET CONFIGURATION (STATIC IP ADDRESSING)

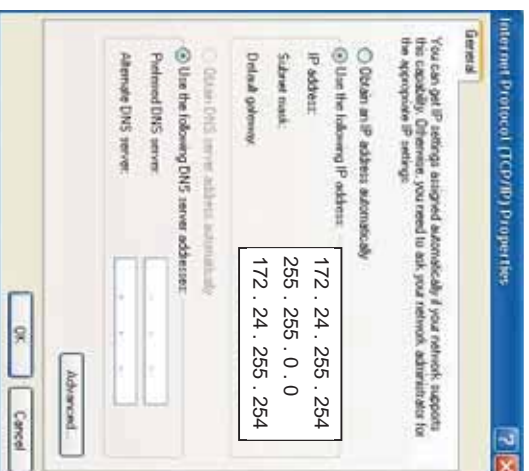
If you want to connect to VisiSet™ using Ethernet then follow the procedure below.

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

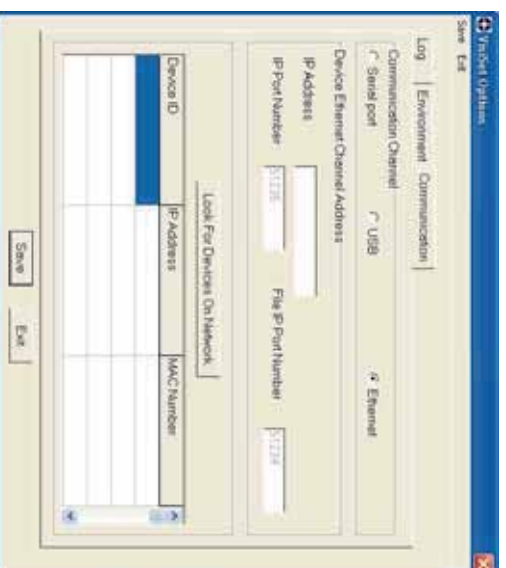
The Factory Default static IP address parameter settings for all Matrix Family readers are:

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

1. Before changing the Ethernet network settings on the PC running VisiSet™, close any open applications which use network resources (i.e. Outlook, or Web browser).
2. On the Configuration PC, from the Control Panel> Network Connections, right-click on the LAN connection icon and open the properties window.
3. Select the Internet Protocol (TCP/IP) item and open the properties window.
4. Set the IP Address fields as shown in the figure and click OK to save.
5. In VisiSet select the Ethernet Communication Channel in the Options> Communication window. Then press the **Look For Devices On Network** button. The Matrix reader will appear with its default IP Address in the list.



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



7.5 CONFIGURATION

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

1. Press the Calibration Tool button from the Main Menu. Matrix 300™ will download its permanent memory configuration parameters with the default values (if it is the first time) to VisiSet™. The Calibration Tool window will be displayed together with the Parameter Setup window working in Interactive Mode (see par. 7.5.1 and par. 7.5.3).
2. Edit the Matrix 300™ configuration parameters according to your application requirements.
3. Use the **Calibration Tool** to fine tune the reading performance. See par. 7.5.3.
4. Close the Calibration Tool window and disable the Interactive Mode by pressing the interactive button.
5. Save the new configuration to the reader permanent memory by pressing the Send button.
6. Close the Parameter Setup window and press **Disconnect** on the VisiSet™ menu bar (see Figure 71) or launch **Run Mode** from the VisiSet™ Main menu.

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

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

7.5.1 Edit Reader Parameters

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

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

You can **View the Selected Value** for each parameter.

You can **Restore the Default Value** of each parameter or of all the parameters of a group.

Get Properties gives information about the parameter in the form of a pop-up hint that describes the default value and the range/list of valid values.

The **Short Help** gives information about the parameter in the form of a pop-up hint.

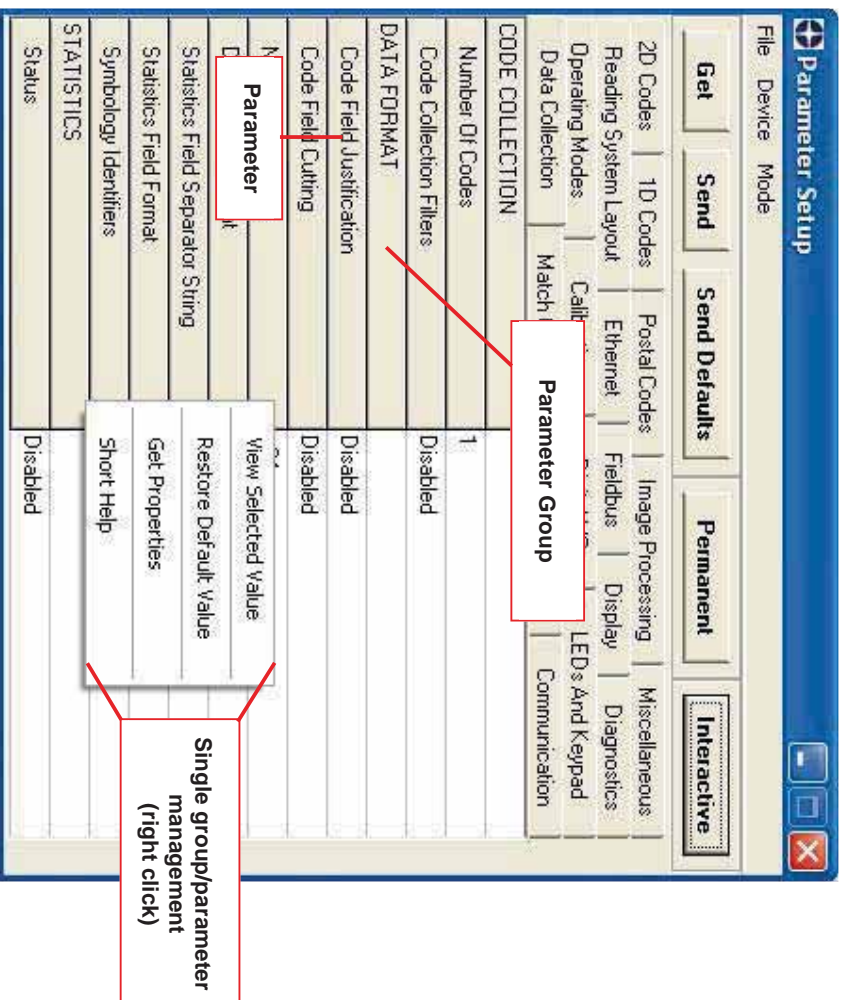


Figure 76 - Editing Parameters

Parameters to verify/modify:

<input type="checkbox"/> Operating Mode	Sets the parameters which customize the reader operating mode starting from three main modes: One Shot: acquires a single image based on the selected value for the Acquisition Trigger and Acquisition Trigger Delay. Continuous: continuously acquires images with a rate up to the maximum allowable frame rate per second for the given sensor depending on the decoding time and the Region of Interest settings. Phase Mode: acquires images during the reading phase depending on the selected value for the Acquisition Trigger and Acquisition Trigger Delay. The Reading Phase-ON and Reading Phase-OFF events mark respectively the beginning and end of the reading phase.
<input type="checkbox"/> Calibration	Calibrates the acquisition parameters to maximize the reading performance (see par. 7.5.3).
<input type="checkbox"/> Communication	Configures the parameters relative to each serial port regarding the transmission, message formatting and string receiving. Any change to the VisiSet™ communication port parameters (baud rate, data bits, etc.) is effective as soon as the reader is disconnected from VisiSet™.
<input type="checkbox"/> Reading System Layout	Allows configuring the device according to the desired layout: Standalone or ID-NET™
<input type="checkbox"/> WebSentinel	Enables the Ethernet WebSentinel Agent for communication with the Datalogic WebSentinel™ plant array monitor.
<input type="checkbox"/> Ethernet	Sets the parameters related to the on board Ethernet interface and to its communication channels.
<input type="checkbox"/> CBX Gateway	Sets the parameters related to the External Host Interface Module through the CBX500 and to its communication channels.
<input type="checkbox"/> Image Processing	Sets the image processing parameters shared by all available symbologies.
<input type="checkbox"/> 1D & 2D, Postal Codes	Sets the characteristics of the code symbologies to be read.
<input type="checkbox"/> Data Collection	Defines the code-collection parameters and the output message format.
<input type="checkbox"/> Digital I/O	Configures the reader input/output parameters.
<input type="checkbox"/> Match Code	Allows setting a user-defined code and relative parameters to which the read code will be compared (matched).
<input type="checkbox"/> Miscellaneous	Sets the reader name and the saved image format.
<input type="checkbox"/> Symbol Verification	Sets the parameters relative to the various specifications in the Standards which regulate code validation.
<input type="checkbox"/> LEDs And Keypad	Sets the X-PRESS™ LED and Keypad parameters related to their selected Functions: Beeper, Green Spot, Setup, Positioning, etc.
<input type="checkbox"/> Display	Sets the Display language and Layout of the BM150 Display when using the CBX500 connection box.
<input type="checkbox"/> Diagnostics	Enables various diagnostic messages, formatting and actions.

When all the configuration parameters are set correctly, save them to the Matrix 300™ reader by pressing the Send button. See Figure 76.

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

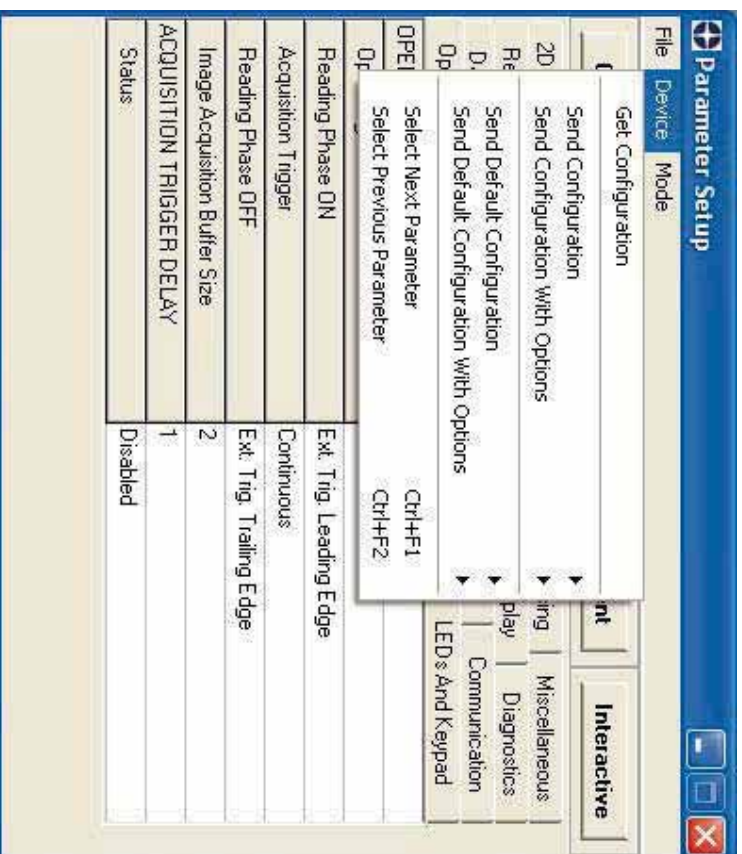
From the **File** menu, you can also **Save Configuration As Text File** for a human readable version.

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

7.5.2 Send Configuration Options

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

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



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

The following is a list of the Environmental Parameters:

READING SYSTEM LAYOUT

- Device Network Setting
- Number of Slaves

DEVICE NETWORK SETTINGS

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

EXPECTED SLAVE DEVICES

- Status
- Device Description
- Device Network Name

MAIN PORT

- Communication Protocol

ETHERNET SYSTEM (on board)

- Status
- DHCP Client
- IP Address
- Subnet Mask
- Gateway Address
- DNS1 Address

HOST INTERFACE

- Host Interface Type

CBX ETHERNET SYSTEM (CBX with Host Interface Modules)

- Status
- DHCP Client
- IP Address
- Subnet Mask
- Gateway Address

PROFIBUS

- Node Address

DEVICENET

- Node Address

ETHERNET-IP

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

PROFINET IO

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

CANOPEN

- Node Address

CC-LINK

- Node Address

MODBUS TCP

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

MISCELLANEOUS

- Reader Name
- User Name
- Line Name

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



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



7.5.3 Calibration

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

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

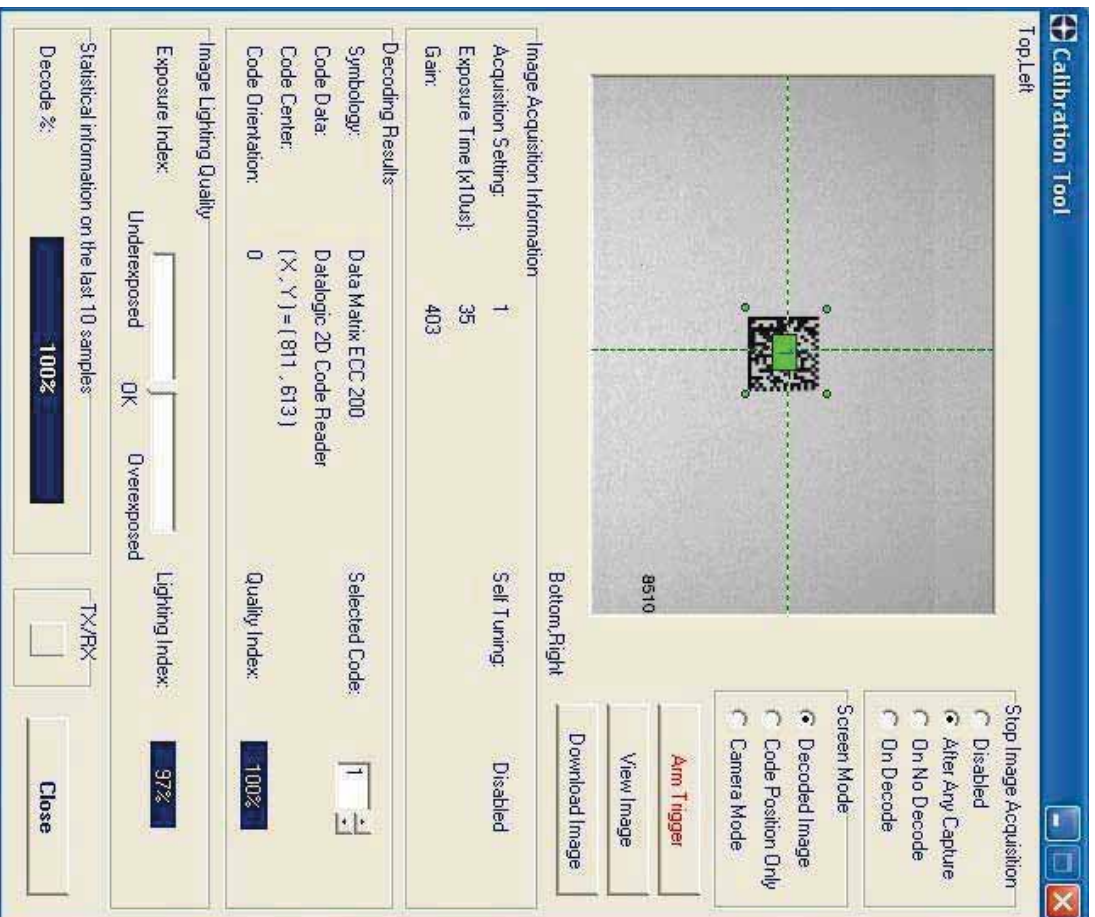


Figure 77 - Calibration OK

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

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

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

**NOTE**

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

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

Under-exposure:

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

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

**NOTE**

In general, a longer exposure time corresponds to a lighter image but is susceptible to blurring due to code movement. Exposure time is also limited by the Internal Lighting mode parameter. **Longer exposure times can be set if the power strobe level is lowered.**
High gain settings may produce a grainy image that may affect the decoding process.

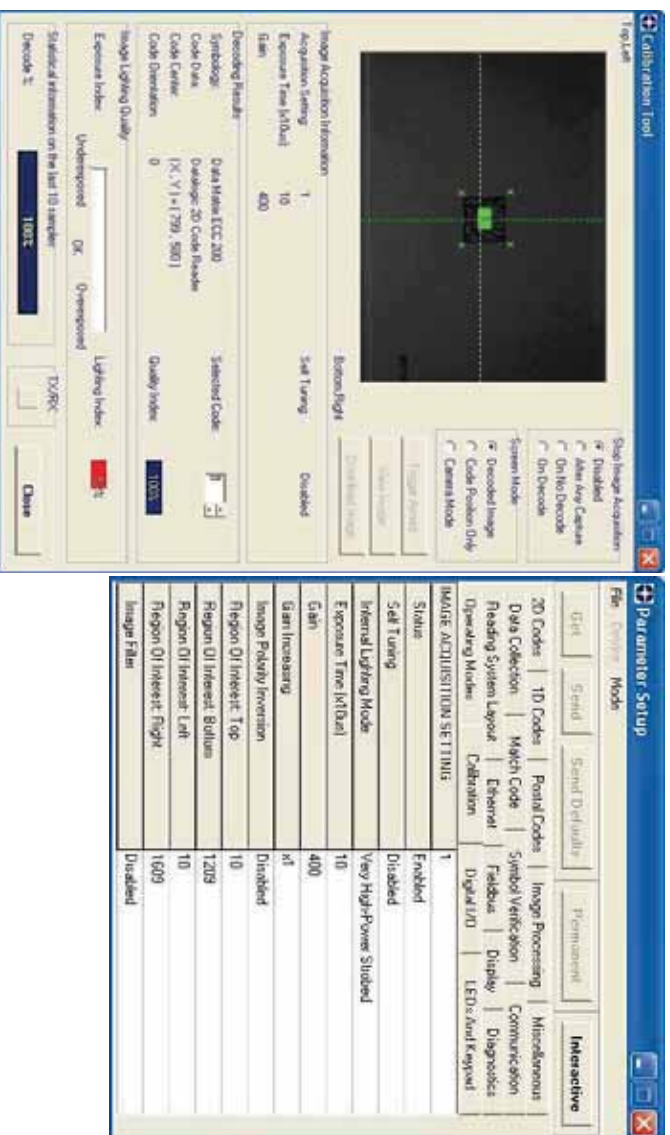


Figure 78 - Example Under Exposure: Too Dark

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**

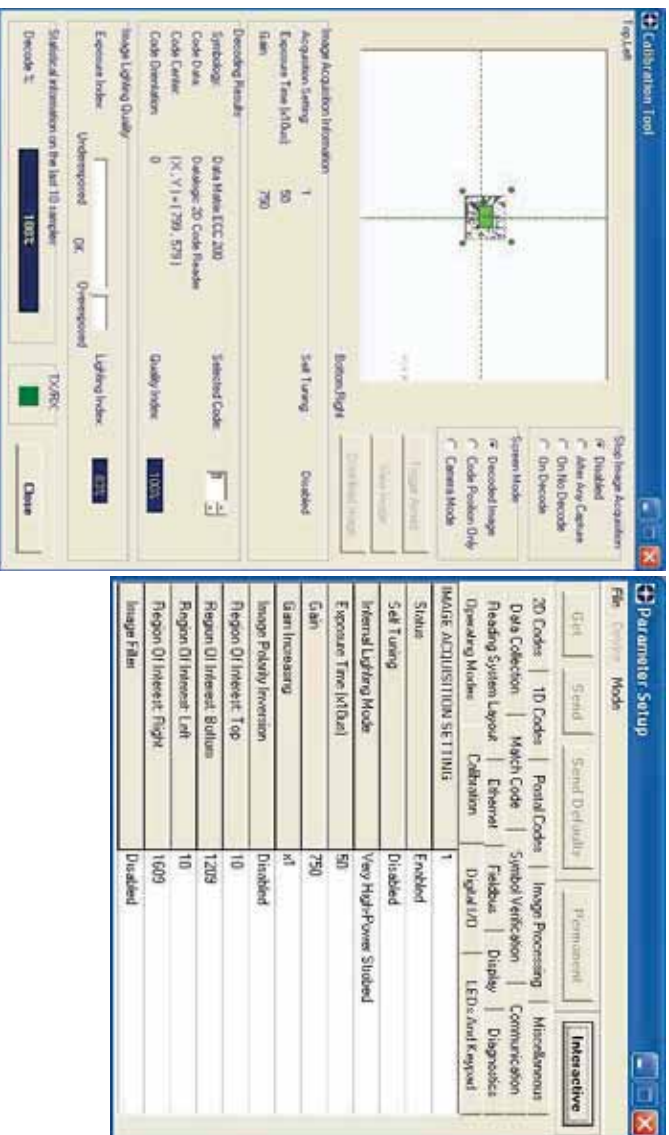


Figure 79 - Example Over Exposure: Too Light

Moving code out of the Field of View:

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

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

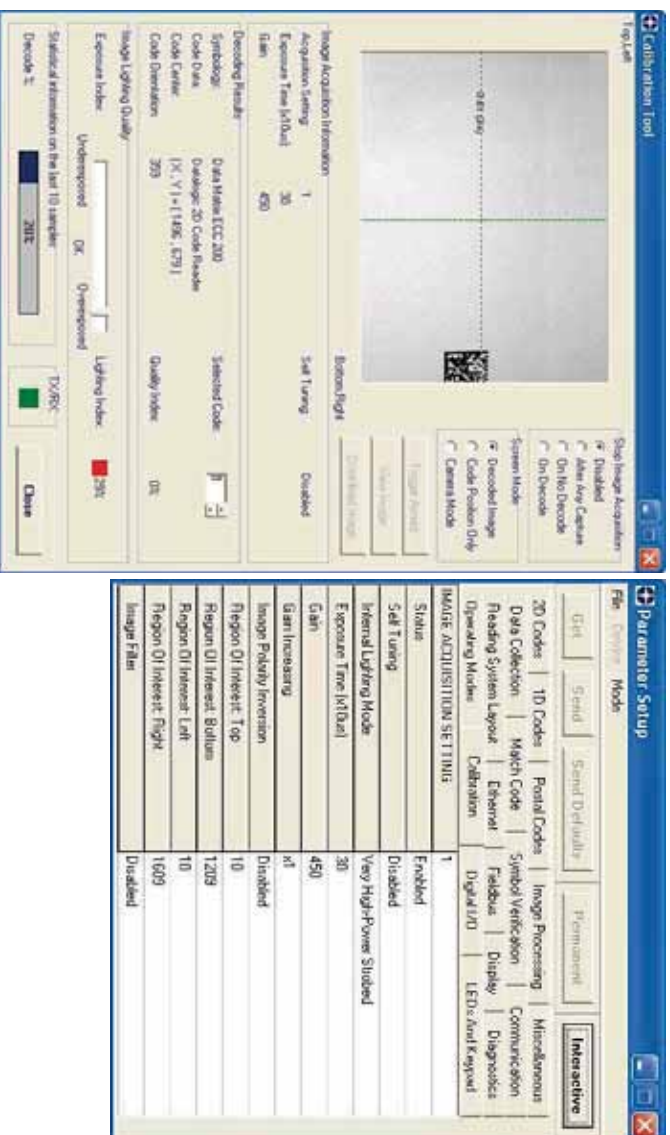


Figure 80 - Example out of FOV

7.5.4 Multi Image Acquisition Settings

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

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

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

7.5.5 Multi Image Acquisition Settings to Extend DOF

A useful case for Multiple Image Acquisition Settings is to extend the reader's depth of field (DOF). Some applications may require reading at more than one discrete reading distance or an extended range of reading distances.

Example:

Read a 15 mil Data Matrix ECC 200 code covering a range from 100 to 300 mm (see [15 mil Reading diagram](#)). The reading distance range is too long to be covered by a single acquisition setting, so two acquisition settings could be used in which the first has a reading distance of 100 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 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 multiple readers set to different reading distances.

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

Multi Image Acquisition Settings Procedure using Standard Setup Wizard:

1. Using the Standard Setup Wizard set the first acquisition setting (default) for the 100 mm Reading Distance. Save the setting to **Permanent Memory**.
2. Through the Calibration Tool (Interactive Mode):
 - a. Set Calibration>Image Acquisition Setting 1 - Status to **Disable**
 - b. Set Calibration>Image Acquisition Setting 2 - Status to **Enable**
 - c. Set LEDs And Keypad>Autolearning Setup>Image Acquisition Setting to 2
 - d. Close the Calibration Tool

3. Using the Standard Setup Wizard set the second acquisition setting for the 300 mm Reading Distance. Save the setting to **Permanent Memory**.
4. Through the Calibration Tool (Interactive Mode):
 - a. Set Calibration>Image Acquisition Setting 1 and 2 - Status to Enable
 - b. Verify that the reader decodes at both distances then Close the Calibration Tool
 - c. **Send Configuration to Permanent Memory**

7.5.6 Run Time Self Tuning (RTST)

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

Self Tuning Calibration

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



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

Self Tuning Image Processing

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

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

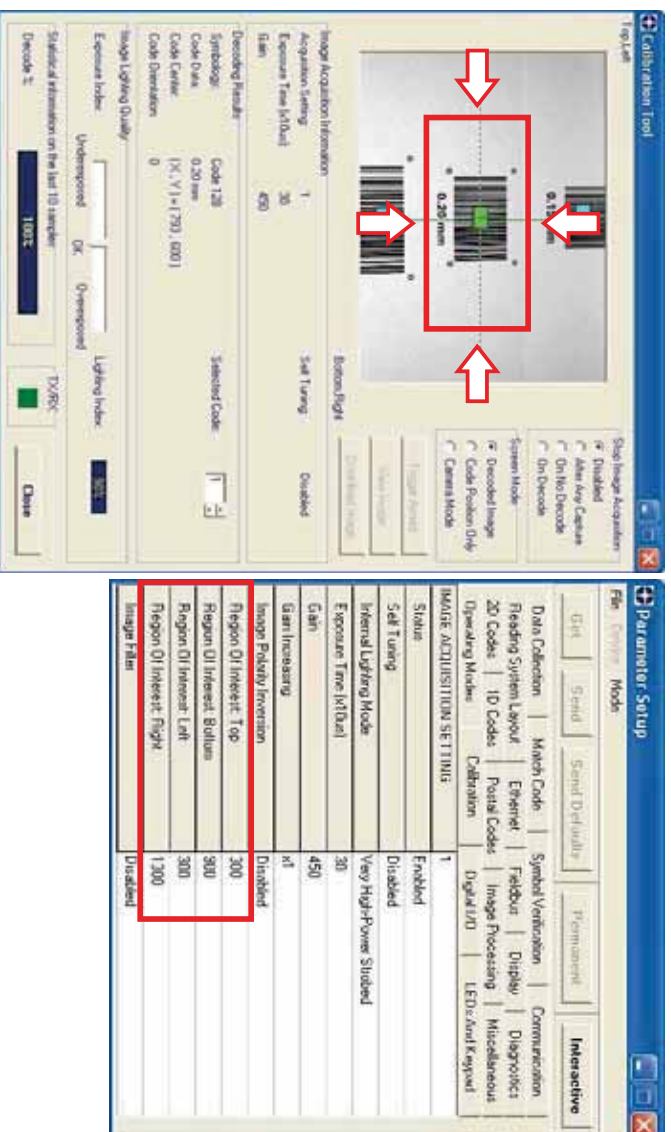
7.5.7 Region Of Interest Windowing

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

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

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

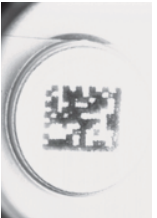
The smaller the window, the lower the frame period and consequently the higher the frame rate. In general the Image Processing time can be reduced by reducing the window dimensions.



7.5.8 Direct Part Marking Applications

Decoding Method: Direct Marking

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



Washed out and Axial
Distortion



Background
Problems



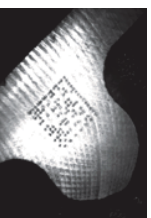
Half moon effects



Dot Peening On
Scratched Surface



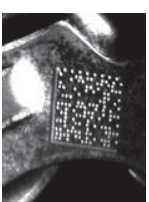
Marked On Curved
Shiny Surface



Shiny surface,
noisy background



Low Contrast
Problem



Axial
distortion



Low contrast,
noisy background

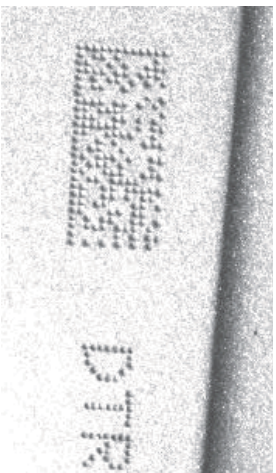
All the previous examples are successfully read selecting the **Direct Marking Decoding Method**.

Image Filter

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

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

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



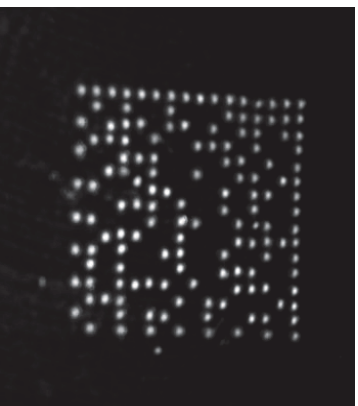
Before - No Read



After - Readable

Erode

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



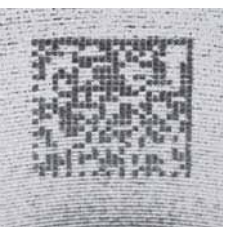
Before - No Read



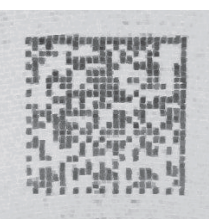
After - Readable

Dilate

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



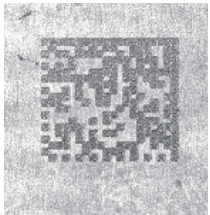
Before - No Read



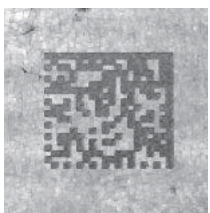
After - Readable

Close

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



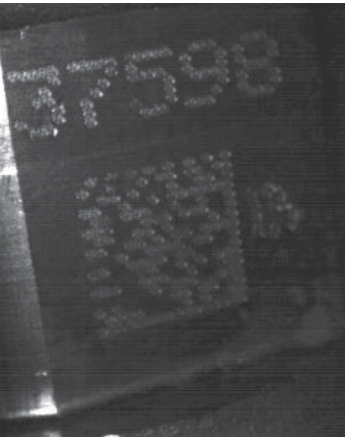
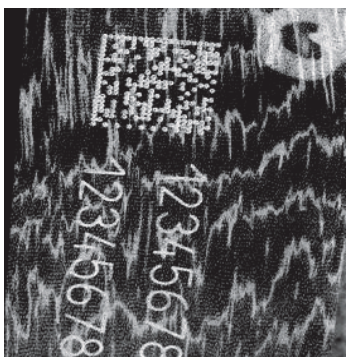
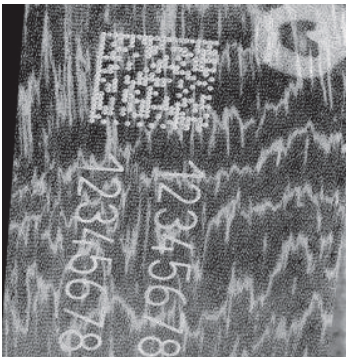
Before - No Read



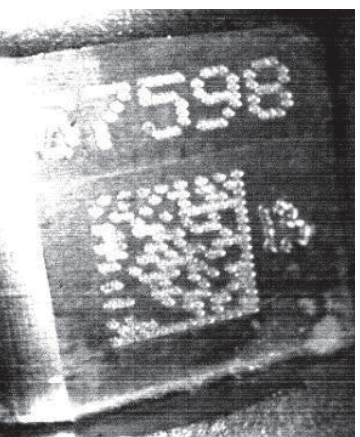
After - Readable

Open

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



Before - No Read



After - Readable

Contrast Stretching

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



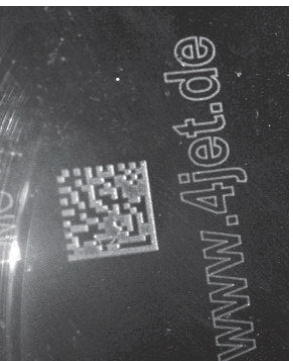
Before - No Read



After - Readable

Histogram Equalization

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



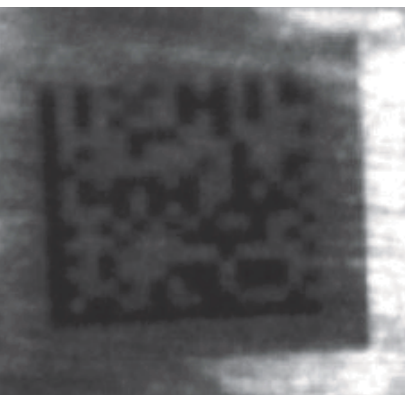
Before - No Read



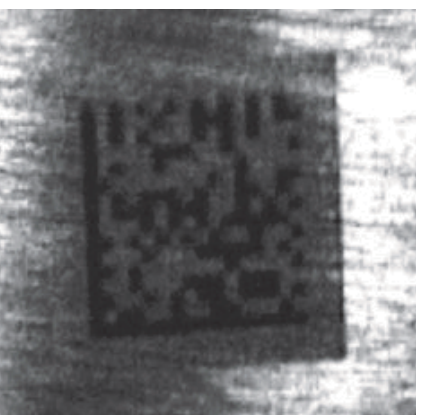
After - Readable

Smoothing

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



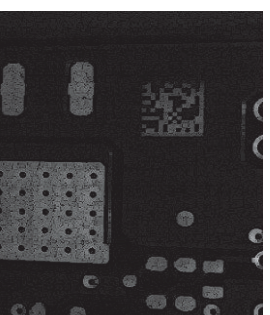
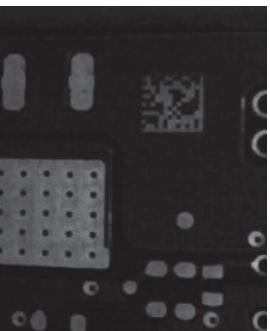
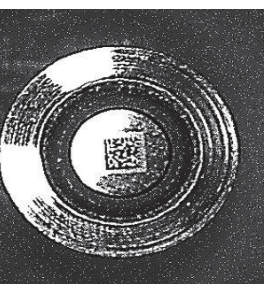
Before - No Read



After - Readable

Sharpening

The **Deblurring** filter improves blurred images.



Before - No Read

After - Readable

Deblurring

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

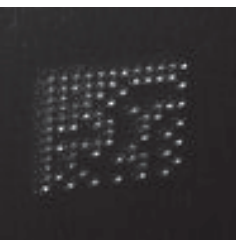


Before - No Read

After - Readable

Black Enhancement

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



Before - No Read

After - Readable

White Enhancement

7.6 IMAGE CAPTURE AND DECODING

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



Figure 81 - Capture and Decoding Functions

7.7 STATISTICS

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



Figure 82 - Code Statistics

8 MAINTENANCE

8.1 CLEANING

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

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

Repeat the operation frequently in particularly dirty environments.

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

9 TROUBLESHOOTING

9.1 GENERAL GUIDELINES

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

TROUBLESHOOTING GUIDE

Problem	Suggestion
<p>Power ON: the "POWER" LED is not lit.</p>	<ul style="list-style-type: none"> • Is power connected? • If using a power adapter (like PG6000), is it connected to wall outlet? • If using rail power, does rail have power? • If using CBX, does it have power (check switch and LED)? • Check if you are referring to the M16 19-pin connector or to the CBX spring clamp connectors. • Measure Voltage either at pin A and pin L (for 19-pin connector) or at spring clamp Vdc and GND (for CBX).
<p>One Shot or Phase Mode using the Input 1 (External Trigger) or Input 2: the "TRIGGER" LED is not blinking while the External Trigger is switching.</p>	<ul style="list-style-type: none"> • Check if you are referring to the 19-pin connector or to the CBX spring clamp connectors. • Is the sensor connected to the Input 1 or Input 2? • Is power supplied to the photo sensor? • For NPN configuration, is power supplied to one of the two I1 or I2 signals (A or B)? • For PNP configuration, is one of the two I1 or I2 signals grounded (A or B)? • Are the photo sensor LEDs (if any) working correctly? • Is the sensor/reflector system aligned (if present)? • In the Digital I/O folder check the EXTERNAL TRIGGER or INPUT 2\Debounce Filter parameter setting. • In the Operating Mode folder check the settings for Reading Phase-ON, Acquisition Trigger and Reading Phase-OFF parameters.

TROUBLESHOOTING GUIDE

Problem	Suggestion
<p>One Shot or Phase Mode using serial trigger source: the "TRIGGER" LED is not blinking.</p>	<ul style="list-style-type: none"> • In the Operating Mode folder check the settings for Reading Phase-ON, Acquisition Trigger and Reading Phase-OFF parameters. • Are the COM port parameters (Baud Rate, Parity, Data Bits, Stop Bits, Handshake) correctly assigned? • In the communication folder, check the settings of Reading Phase-ON String, Acquisition Trigger String and Reading Phase-OFF String parameters. • Is the serial trigger source correctly connected?
<p>Phase Mode: the "TRIGGER" LED is correctly blinking but no image is displayed in VisiSet™ Calibration Tool window.</p>	<ul style="list-style-type: none"> • Is the Phase frequency lower than the maximum frame rate?
<p>Continuous Mode: the "TRIGGER" LED is not blinking.</p>	<ul style="list-style-type: none"> • Verify the correct software configuration settings.
<p>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.</p>	<ul style="list-style-type: none"> • In the Data Collection folder check the settings for the CODE COLLECTION, DATA FORMAT and STATISTICS parameter groups.
<p>Image not clear:</p>	<ul style="list-style-type: none"> • verify the Focus procedure
<p>Image focused but not decoded:</p>	<ul style="list-style-type: none"> • verify the Calibrate Image Density procedure.
<p>Reading: the reader always transmits the No Read Message</p>	<ul style="list-style-type: none"> • Run the Rapid Configuration procedure in chapter 1. • Position the reader as described in par. 3.3 and through the VisiSet™ Calibration Tool: <ul style="list-style-type: none"> – Tune the ACQUISITION TRIGGER DELAY, if the moving code is out of the reader field of view; – Set the Continuous Operating Mode if no external trigger source is available; – Tune the IMAGE ACQUISITION SETTING to improve the code image quality; – Check the parameter setting in Decoding, 2D Codes, 1D Codes, and Postal Codes folders; – View the full resolution code image to check the printing or marking quality.
<p>Communication: reader is not transmitting anything to the host.</p>	<ul style="list-style-type: none"> • Is the serial cable wiring correct? • If using CBX, be sure the RS485/422 termination switch is OFF. • Are the host serial port settings the same as the reader serial port settings? • In VisiSet™ Digital I/O folder, "COM" LED can be configured to indicate MAIN COM port TX or MAIN COM port RX.

TROUBLESHOOTING GUIDE	
Problem	Suggestion
<p>Communication: data transferred to the host are incorrect, corrupted or incomplete.</p>	<ul style="list-style-type: none"> • Are the host serial port settings the same as the reader serial port settings? • In VisiSet™ Communication folder check the settings of Header and Terminator String parameters. • In VisiSet™ Data Collection folder, check the settings of DATA FORMAT parameter group.
<p>How do I obtain my reader Serial Number?</p>	<ul style="list-style-type: none"> • The reader Serial Number consists of 9 characters: one letter, 2 numbers, another letter followed by 5 numbers. • The reader Serial Number is printed on a label that is affixed on the bottom case near the reading window. • The Serial Number can also be obtained by selecting Tools/Get Reader Serial Number from the command menu in VisiSet™. A dedicated window will appear.
<p>How do I obtain my reader Order Number?</p>	<ul style="list-style-type: none"> • The reader Order Number consists of 9 numbers. • The reader Order Number can be obtained by selecting the Tools/Get Reader Order Number from the command menu in VisiSet™. A dedicated window will appear.

10 TECHNICAL FEATURES

ELECTRICAL FEATURES		
Power	4xx-01x models 10 to 30 Vdc 0.7 to 0.2 A	4xx-04x models PoE Device 48 Vdc 13 W max.
Supply Voltage		
Consumption		
Communication Interfaces		
Main	- RS232	2400 to 115200 bit/s
	- RS485/422 full-duplex	2400 to 115200 bit/s
Auxiliary - RS232		2400 to 115200 bit/s
ID-NET™		Up to 1Mbaud
Ethernet		10/100 Mbit/s
Inputs		
Input 1(External Trigger) and Input 2		Opto-coupled and polarity insensitive; see note for PoE models
Max. Voltage		30 Vdc
Max. Input Current		10 mA
Outputs *		
Output 1, 2 and 3		NPN or PNP short circuit protected; see note for PoE models
Vout (load = 0 mA) Max.		30 Vdc
Vout (load = 100 mA) Max.		3 Vdc
load Max		100 mA
OPTICAL FEATURES		
Image Sensor		CMOS sensor with Global Shutter
Image Format		SXGA (1280x1024) pixels
Frame Rate		60 frames/sec.
Pitch		± 35°
Tilt		0° - 360°
LED Safety		to EN 62471
Laser Safety (pointers)		IEC60825-1 2007
Lens		4x2-0xx models 9 mm via software
Focal Length		
Focus Control		Internal Illuminator
Lighting System		Laser Pointers
Aiming System		
ENVIRONMENTAL FEATURES		
Operating Temperature		0 to 50 °C (32 to 122 °F) **
Storage Temperature		-20 to 70 °C (-4 to 158 °F)
Max. Humidity		90% non condensing
Vibration Resistance		14 mm @ 2 to 10 Hz; 1.5 mm @ 13 to 55 Hz; 2 g @ 70 to 200 Hz; 2 hours on each axis
EN 60068-2-6		
Bump Resistance		30g; 6 ms; 5000 shocks on each axis
EN 60068-2-29		
Shock Resistance		30g; 11 ms; 3 shocks on each axis
EN 60068-2-27		
Protection Class		IP65/IP67 ***
EN 60529		
PHYSICAL FEATURES		
	Connector position 0°	Connector position 90°
Dimensions	95 x 54 x 43 mm (3.7 x 2.1 x 1.7 in.)	75 x 54 x 62 mm (3.0 x 2.1 x 2.4 in.)
Weight		about 238 g. (8.4 oz.)
Material		Aluminium

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

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

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

SOFTWARE FEATURES		
Readable Code Symbolologies		
1-D and stacked	2-D	POSTAL
<ul style="list-style-type: none"> • PDF417 Standard and Micro PDF417 • Code 128 (GS1-128) • Code 39 (Standard and Full ASCII) • Code 32 • MSI • Standard 2 of 5 • Matrix 2 of 5 • Interleaved 2 of 5 • Codabar • Code 93 • Pharmacode • EAN-8/13 - UPC-A/E (Including Addon 2 and Addon 5) • GS1 Databar Family • Composite Symbolologies 	<ul style="list-style-type: none"> • Data Matrix ECC 200 (Standard, GS1 and Direct Marking) • QR Code (Standard and Direct Marking) • Micro QR Code • MAXICODE • Aztec Code 	<ul style="list-style-type: none"> • Australia Post • Royal Mail 4 State Customer • Kix Code • Japan Post • PLANET • POSTNET • POSTNET (+BB) • Intelligent Mail • Swedish Post
Operating Mode	ONE SHOT, CONTINUOUS, PHASE MODE	
Configuration Methods	X-PRESS™ Human Machine Interface Windows-based SW (VisiSet™) via serial or Ethernet link Serial Host Mode Programming sequences	
Parameter Storage	Permanent memory (Flash)	
CODE QUALITY METRICS		
Standard	Supported Symbolologies	
ISO/IEC 16022	Data Matrix ECC 200	
ISO/IEC 18004	QR Code	
ISO/IEC 15415	Data Matrix ECC 200, QR Code	
ISO/IEC 15416	Code 128, Code 39, Interleaved 2 of 5, Codabar, Code 93, EAN-8/13, UPC-A/E	
AS9132A	Data Matrix ECC 200	
AIM DPM	Data Matrix ECC 200, QR Code	
USER INTERFACE		
LED Indicators	Power, Ready, Good; Trigger; Com, Status, (Ethernet Network); Good Read (Green Spot), No Read (Red Spot)	
Keypad Button	Configurable via VisiSet™	
Beeper	Configurable via VisiSet™	

A ALTERNATIVE CONNECTIONS

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

POWER, COM AND I/O CONNECTOR

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

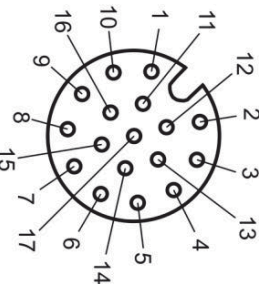


Figure 83 – M12 17-pin male COM, I/O and Power Connector

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
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
17	MAIN INTERFACE (SW SELECTABLE)	TX
11		RX
12		RTS
10		CTS
		RS485/422 Full-Duplex
		TX+
		*RX+
		TX-
		*RX-

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

In order to meet EMC requirements:

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

ON-BOARD ETHERNET CONNECTOR

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

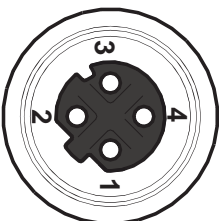


Figure 84 - M12 D-Coded Female Ethernet Network Connector

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

Power over Ethernet models only support mode A Class 0 power levels and can be powered by any standard endspan PSE (i.e. PoE switch).

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

These models can only supply power to the Digital Outputs directly. They cannot power any Input devices directly nor a CBX, nor any Input/Output devices through the CBX. If the CBX or any input devices are used for these models, they 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_N Max.
Open	0 V	2 V	0 mA
Closed	4.5 V	30 V	10 mA

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

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

OUTPUTS

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

The pinout is the following:

Pin	Name	Function
9	O1	Configurable digital output 1
8	O2	Configurable digital output 2
16	O3	Configurable digital output 3
2	GND	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. Refer to the Digital I/O folder in the VisiSet™ Help On Line for further details.

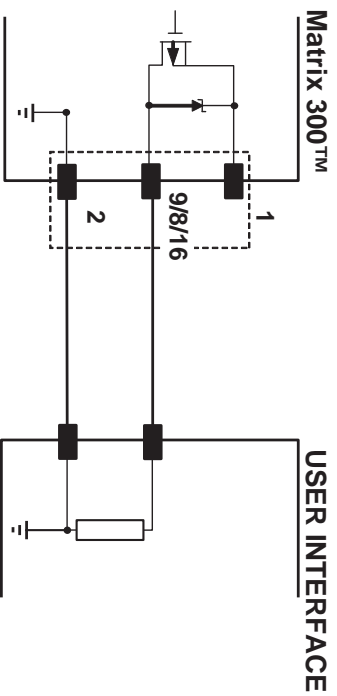


Figure 85 - PNP Output Connection

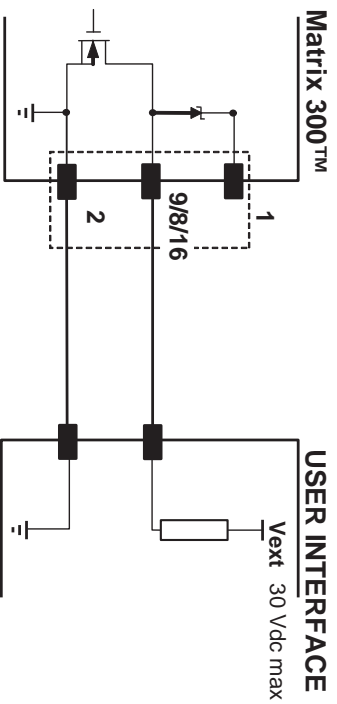


Figure 86 - NPN Output Connection

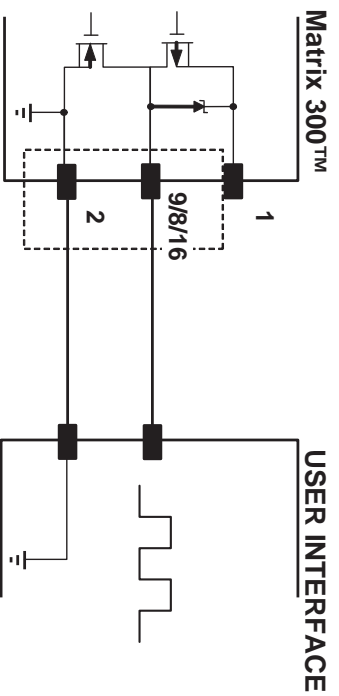
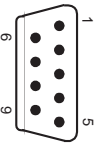
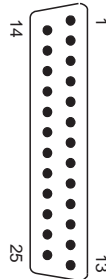


Figure 87 - Push-Pull Output Connection

USER INTERFACE - SERIAL HOST

RS232 PC-side connections	
	
Pin	Pin
2	3
3	2
5	7
7	4
8	5
Name	Name
RX	RX
TX	TX
GND	GND
RTS	RTS
CTS	CTS

How To Build A Simple Interface Test Cable:

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

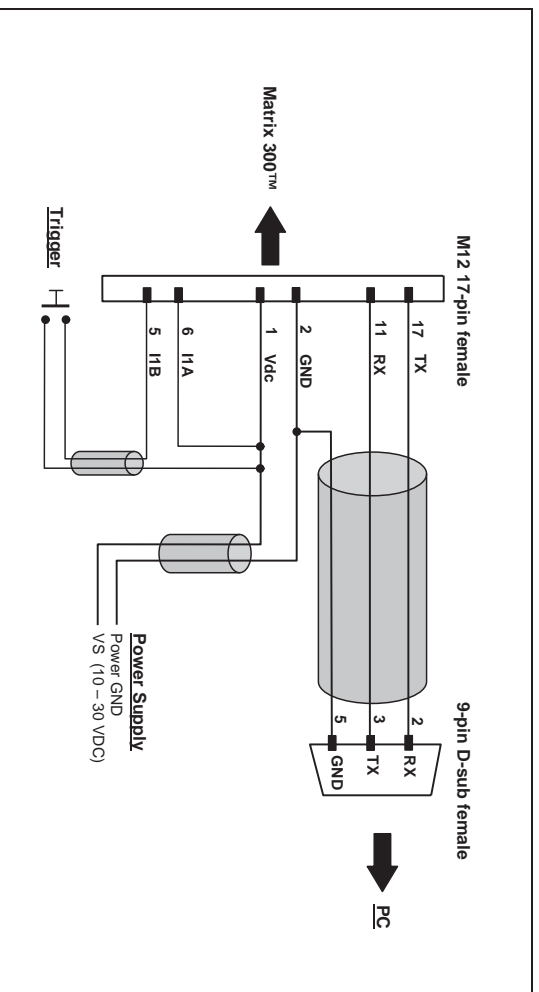


Figure 88- Test Cable for Matrix 300™

GLOSSARY

AIM

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

AIM DPM Quality Guideline

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

AS9132

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

Barcodes (1D Codes)

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

BIOS

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

Bit

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

Bits per Second (bps)

Number of bits transmitted or received per second.

Bright Field Illumination

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

Byte

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

Composite Symbologies

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

Dark Field Illumination

Lighting of surfaces at wide angles used to avoid direct reflection of the light into the reader's lens. Typically this type of lighting is used in DPM solutions to enhance reflectance of the uneven surface do to the symbol marking technique. Is 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 Symbolologies (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) Symbolologies

Symbolologies where a long symbol is broken into sections and stacked one upon another similar to sentences in a paragraph.

RAM

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

Symbol Verification

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

Transmission Control Protocol/Internet Protocol (TCP/IP)

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

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**Datalogic Automation S.r.l.**Via Lavino 265
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Bologna - Italy*declares that the***MATRIX 300 ; Compact 2D Imager***and all its models**are in conformity with the requirements of the European Council Directives listed below:***2004 / 108 / EC EMC Directive***This Declaration is based upon compliance of the products to the following standards:***EN 55022 (CLASS A ITE), DECEMBER 2010:**INFORMATION TECHNOLOGY EQUIPMENT
RADIO DISTURBANCE CHARACTERISTICS
LIMITS AND METHODS OF MEASUREMENTS**EN 61000-6-2, SEPTEMBER 2005:**ELECTROMAGNETIC COMPATIBILITY (EMC)
PART 6-2: GENERIC STANDARDS - IMMUNITY FOR INDUSTRIAL
ENVIRONMENTS

Monte San Pietro, April 3rd, 2013

Paolo Morselli
Quality Manager



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