DATALOGIC™

MATRIX 400™

Reference Manual

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Matrix 400™ Reference Manual

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CONTENTS

REFERENCES

CONVENTIONS

This manual uses the following conventions:

"User" refers to anyone using a Matrix 400™ reader.
"Reader" refers to the Matrix 400™ reader.
"You" refers to the System Administrator or Technical Support person using this manual to install, configure, operate, maintain or troubleshoot a Matrix 400™ 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 CD-ROM.

SERVICE AND SUPPORT

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

- **PRODUCTS**

  Search through the links to arrive at your product page which describes specific Info, Features, Applications, Models, Accessories, and Downloads including the VisiSet™ utility program, which allows device configuration using a PC. It provides RS232 and Ethernet interface configuration.

- **SERVICE**
  - **Overview -** Warranty Extensions and Maintenance Agreements
  - **Sales Network-** Listing of Subsidiaries, Repair Centers, Partners
  - **Helpdesk**
  - **Material Return Authorization**

PATENTS

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

U.S. patents: 6,512,218 B1; 6,616,039 B1; 6,808,114 B1; 6,997,385 B2; 7,102,116 B2; 7,282,688 B2

European patents: 999,514 B1; 1,014,292 B1; 1,128,315 B1.

Additional patents pending.

COMPLIANCE

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

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;
- for CBX connections, connect the pin "Earth" to a good Earth Ground
- for direct connections, connect the main interface cable shield to pin K of the 19-pin 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 which supplies power directly to the reader or a UL Listed Direct Plug-in Power Unit marked LPS or “Class 2”, rated 10 to 30 V, minimum 1 A.

LED CLASS

Class 1 LED Product to EN60825-1:2001

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.

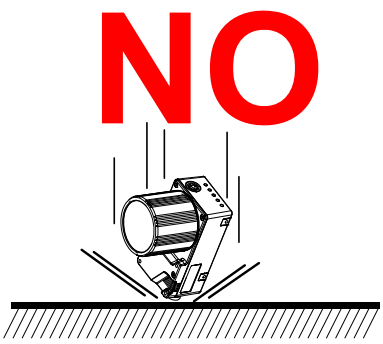
This device complies with PART 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference which may cause undesired operation.

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.

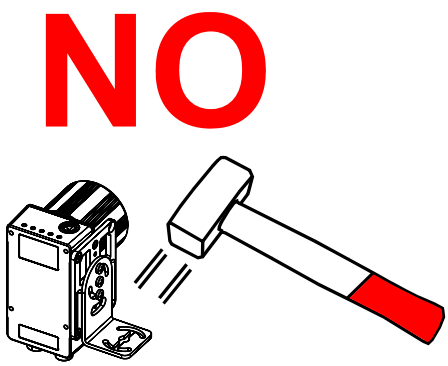
HANDLING

The Matrix 400™ is designed to be used in an industrial environment and is built to withstand vibration and shock when correctly installed, however it is also a precision product and therefore before and during installation it must be handled correctly to avoid damage.

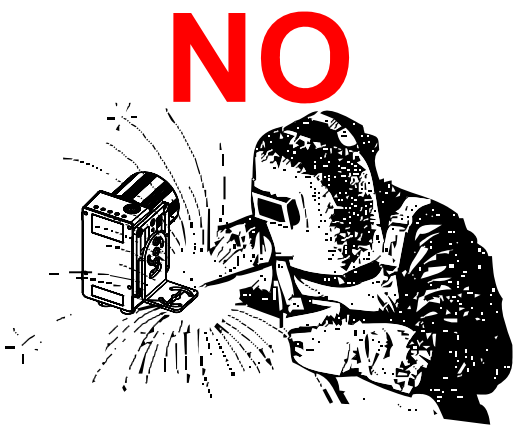
- avoid that the readers are dropped (exceeding shock limits).



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



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



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

GENERAL VIEW

Matrix 400™

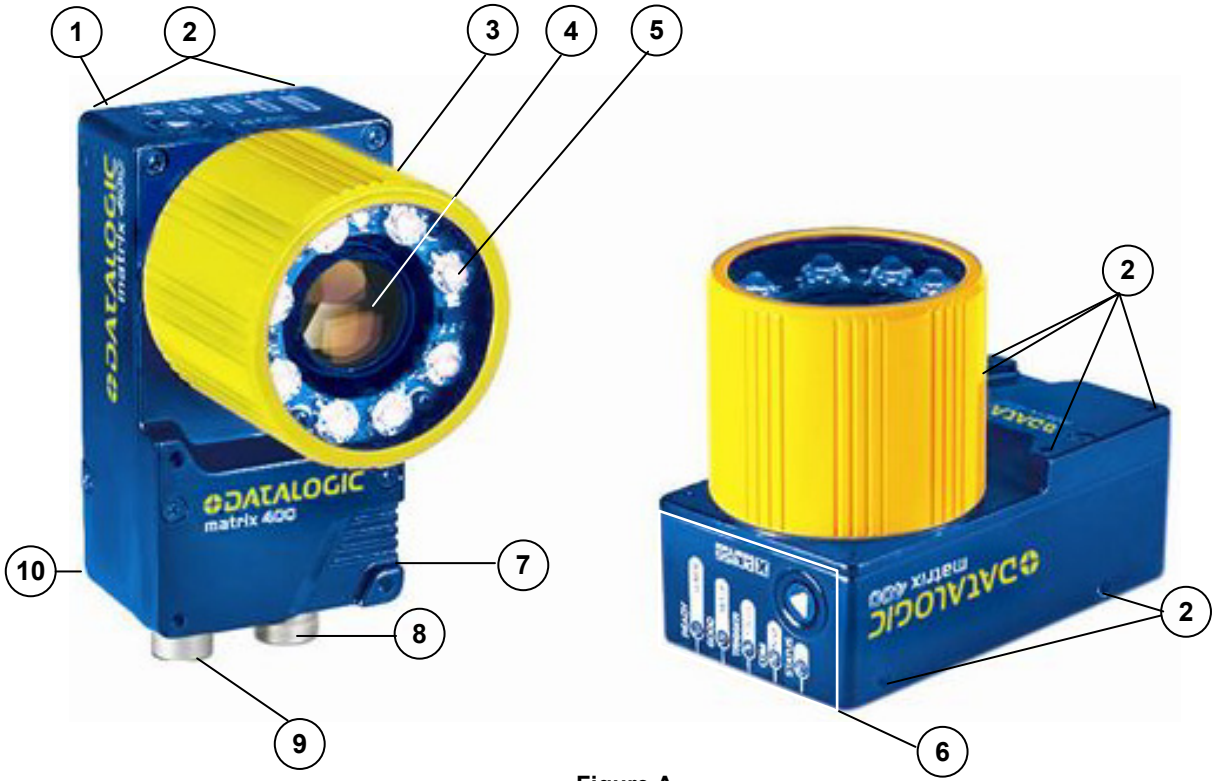


Figure A

1. Device Class Label
2. Mounting Holes (12)
3. Lens Cover
4. Lens (separate accessory)
5. Internal Illuminator (separate accessory)
6. HMI X-PRESS™ Interface
7. "POWER ON" LED
8. Power - Serial Interfaces - I/O Connector
9. Ethernet Connector (Ethernet Models Only)
10. Ethernet Connection LED (Ethernet Models Only)

1 RAPID CONFIGURATION

STEP 1 – ASSEMBLE THE READER

The first step to perform is to assemble the accessories that make up the Matrix 400™ reader. The lens and either an internal or an external illuminator must be used. This procedure shows an internal illuminator.

CAUTION

Matrix 400™ must be disconnected from the power supply during this procedure.

1. In a dust-free environment, remove the Matrix 400™ Lens Cover by unscrewing it.

CAUTION

Do not touch the sensor aperture, lens glass or lens cover glass. These areas must be kept clean. Avoid any abrasive substances that might damage these surfaces during cleaning.

2. Remove the sensor protection label by pulling it off of the base.
3. Mount the lens by screwing it tightly onto the base.

   If the Locking Knobs on the lens are obstructed because they are aligned behind an illuminator spacer base and illuminator spacer, insert the Lens Spacer between the Matrix 400™ body and the C-Mount lens so that the Locking Knobs will be unobstructed.

NOTE

It is strongly recommended to apply a lens locking sticker (provided with the lens), for applications where Matrix 400™ is subjected to vibration.

4. If using an internal illuminator:
   a. Mount the four internal illuminator spacers onto the illuminator spacer bases provided on the Matrix 400™ body.
   b. Align and mount the Illuminator tightly onto the spacers using the four screws and washers provided in the illuminator package. The spacers are positioned asymmetrically to avoid incorrect alignment.
5. To keep dust and dirt off of the lens during mounting, temporarily replace the lens cover.

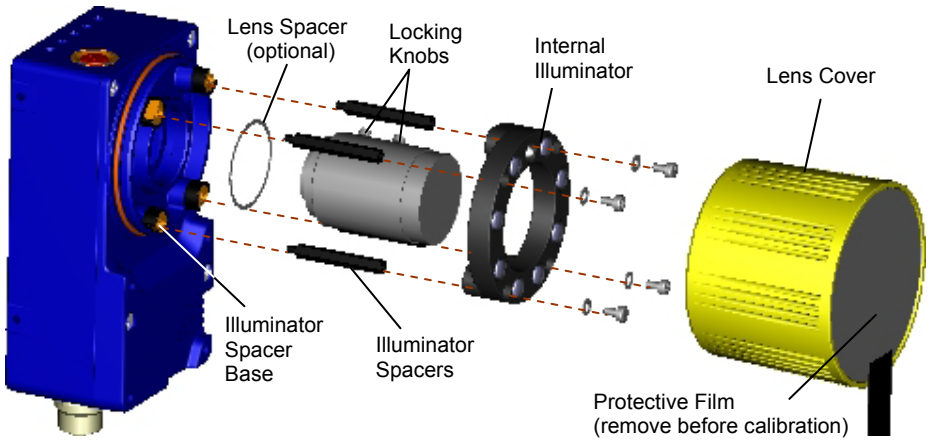


Figure 1 – Assembling Matrix 400™ Accessories

Required Accessories

The following table shows the correct lens/illuminator combinations to be used for Matrix 400™ imager assembly.

Lenses			Internal Illuminators		
93ACC1793	LNS-1006	6 mm C-Mount Lens (only for Matrix 400 600-0x0 models)	93A401020 93A401022	LT-002 LT-004	Red Wide Angle White Wide Angle
93ACC1794	LNS-1109	9 mm C-Mount Lens	93A401020 93A401022	LT-002 LT-004	Red Wide Angle White Wide Angle
93ACC1795	LNS-1112	12.5 mm C-Mount Lens	93A401020 93A401022	LT-002 LT-004	Red Wide Angle White Wide Angle
93ACC1796	LNS-1116	16 mm C-Mount Lens	93A401019 93A401021	LT-001 LT-003	Red Narrow Angle White Narrow Angle
93ACC1797	LNS-1125	25 mm C-Mount Lens	93A401019 93A401021	LT-001 LT-003	Red Narrow Angle White Narrow Angle
93ACC1798	LNS-1135	35 mm C-Mount Lens	93A401024	LT-006	Red Super Narrow Angle
93ACC1799	LNS-1150	50 mm C-Mount Lens	93A401024	LT-006	Red Super Narrow Angle

STEP 2 – CONNECT THE SYSTEM

To connect the system in a Stand Alone configuration, you need the hardware indicated in Figure 2. 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.

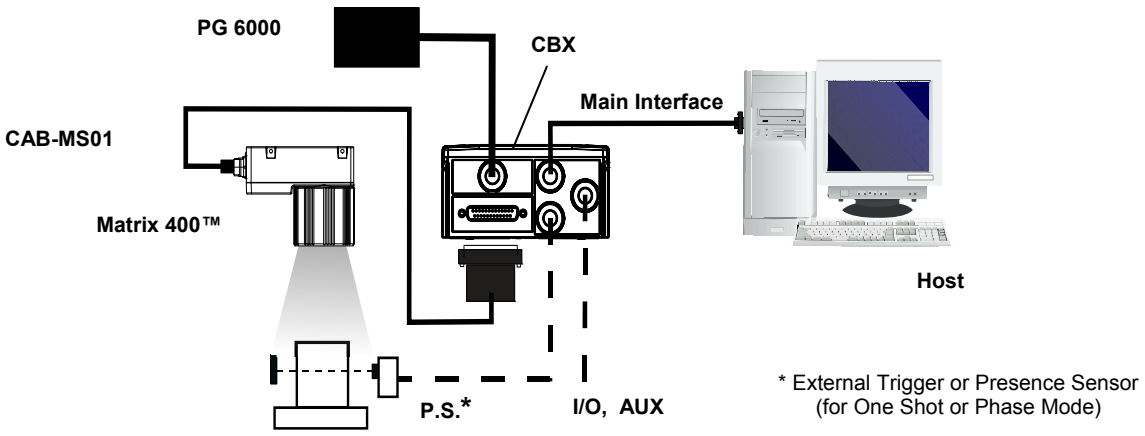


Figure 2 – Matrix 400™ in Stand Alone Layout

CBX100/CBX500 Pinout for Matrix 400™

The table below gives the pinout of the CBX100/CBX500 terminal block connectors. Use this pinout when the Matrix 400™ reader is connected by means of the CBX100/CBX500:

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

Main Interface			
	RS232	**RS485 Full-Duplex**	**RS485 Half-Duplex**
	TX	TX+	RTX+
	RTS	TX-	RTX-
	RX	*RX+	
	CTS	*RX-	
	SGND	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.

19-pin Connector Pinout for Matrix 400™

The table below gives the pinout of the 19-pin M16 male connector for connection to the power supply and input/output signals. Use this pinout when the Matrix 400™ reader is connected by means of the 19-pin connector:

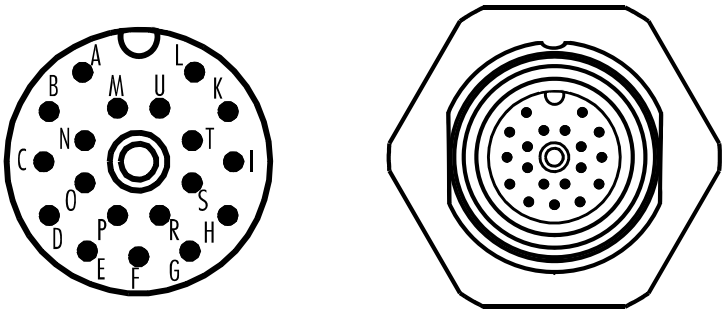


Figure 3 - 19-pin M16 Male Connector

19-pin M16 male connector pinout				
Pin	**Name**	**Function**		
A	Vdc	Power supply input voltage +		
L	GND	Power supply input voltage -		
K	CHASSIS	Cable shield internally connected by capacitor to the chassis		
B	I1A	External Trigger A (polarity insensitive)		
C	I1B	External Trigger B (polarity insensitive)		
D	I2A	Input 2 A (polarity insensitive)		
E	I2B	Input 2 B (polarity insensitive)		
H	O1+	Output 1 +		
F	O1-	Output 1 -		
G	O2+	Output 2 +		
I	O2-	Output 2 -		
S	RX	Auxiliary RS232 RX		
O	TX	Auxiliary RS232 TX		
R	ID+	ID-NET™ network +		
P	ID-	ID-NET™ network -		
Pin	**Name**	**RS232**	**RS485 Full-Duplex**	**RS485 Half-Duplex**
M	MAIN	TX	TX+	RTX+
U	INTERFACE	RX	*RX+	
N	(SW	RTS	TX-	RTX-
T	SELECTABLE)	CTS	*RX-	

***** Do not leave floating, see par. 5.4.2 for connection details.

STEP 3 – MOUNT AND POSITION THE READER

1. To mount the Matrix 400™, use the mounting brackets to obtain the most suitable position for the reader. Two of the most common mounting configurations are shown in the figures below. Other mounting solutions are provided in par. 3.3.

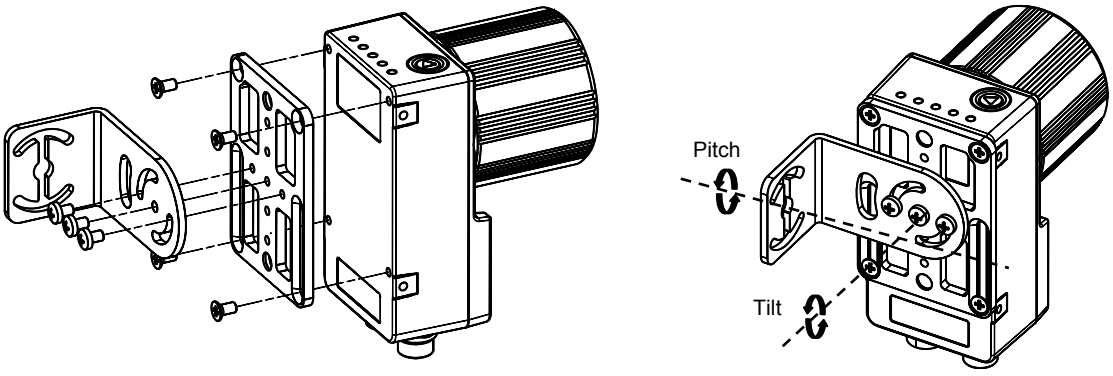


Figure 4 –Positioning with Mounting Bracket (Back)

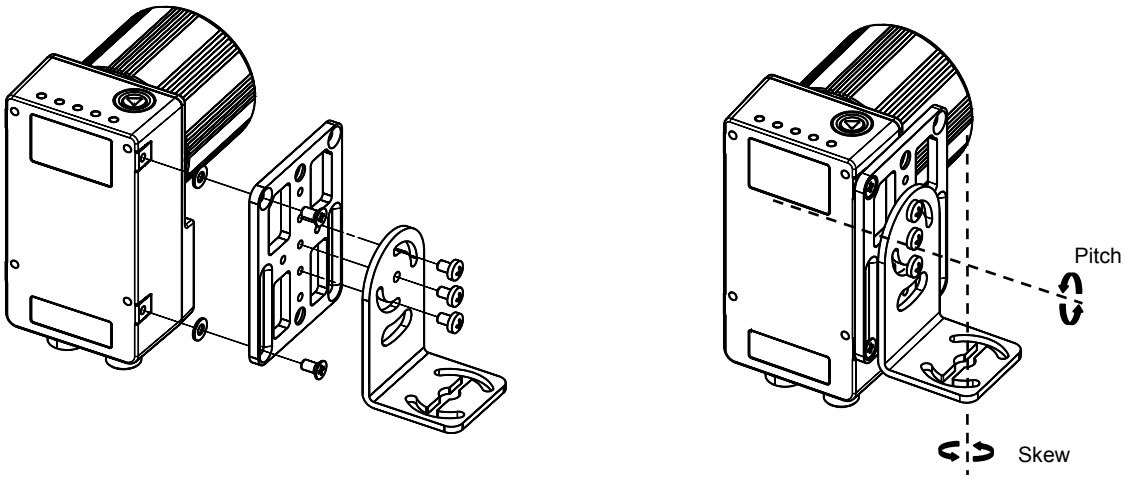


Figure 5 –Positioning with Mounting Bracket (Side)

2. When mounting the Matrix 400™ 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.

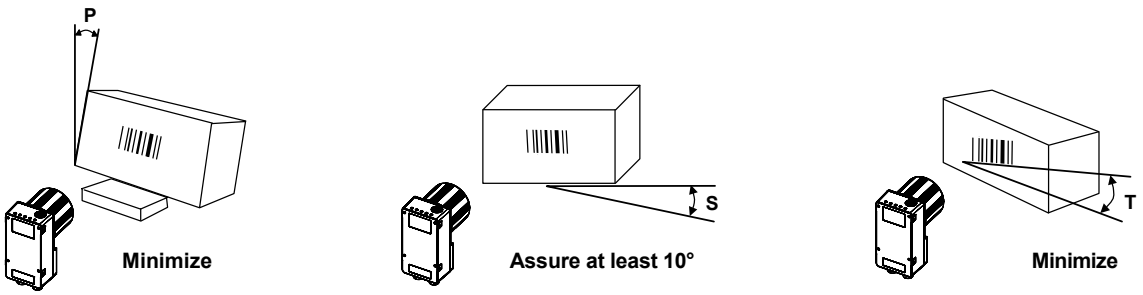


Figure 6 – Pitch, Skew and Tilt Angles

3. Refer to the Reading Features table in chp. 7 for **FOV calculation** and **minimum distance requirements** according to the base/lens combination used for your application.

NOTE *Rapid Configuration of the Matrix 400™ reader can be made **either** through the X-PRESS™ interface (steps 4-6) which requires no PC connection, **or** by using the VisiSet™ Setup Wizard (steps 7-8). Select the procedure according to your needs.*

STEP 4 – FOCUS THE READER

Matrix 400™ provides a built-in tool called Blue Diamonds™ to aid focusing the reader. The Blue Diamonds™ are accessed through the X-PRESS™ Interface.

1. Remove the lens cover in order to focus the reader.
2. Prepare the correct accessory lens for your application:
   a. Loosen the two Locking Knobs on the lens.
   b. Adjust the Focus ring to the "**Far position**" and the Diaphragm ring to the **"F4"**[1] number setting which is the preferred setting for installation.
3. Power the reader on. During the reader startup (reset or restart phase), all the LEDs blink for one second. On the connector side of the reader near the cable, the “POWER ON” LED (blue) indicates the reader is correctly powered.
4. Enter the Focus function by pressing and holding the X-PRESS™ push button until the Focus LED is on.
5. Release the button to enter the Focus function. The Blue Diamonds™ turn on.

The procedure is as follows:

a. Adjust the Focus ring towards the "Near position" until the Blue Diamonds™ are perfectly in focus, see Figure 8.

   At long focal distances a "skew" angle may cause a noticeable difference in focus between the two diamonds, in this case select the best possible focus (both diamonds slightly out of focus). Tighten the Focus Locking Knob.

b. Tighten the Diaphragm Locking Knob.

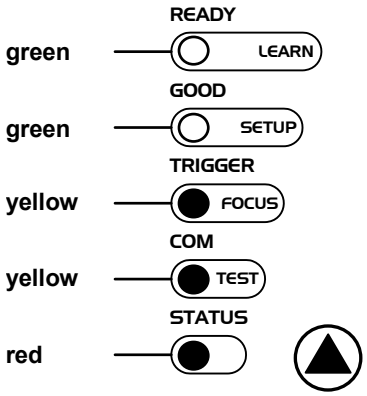


Figure 7 – X-PRESS™ Interface: Focus Function

NOTE *If necessary you can use the Fine Focusing Tool in the VisiSet™ Setup Wizard for fine focusing. See Step 8.*

[1] For far reading distances, the Diaphragm ring can be set to values between **F2** and **F4** to increase image lighting and Blue Diamond™ visibility.

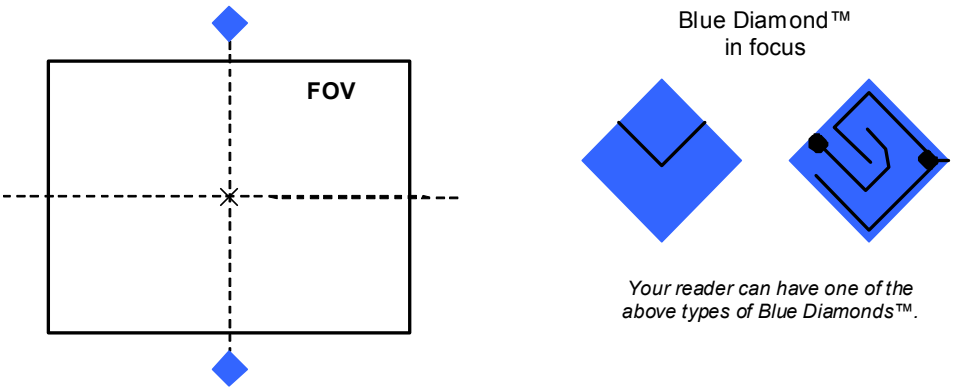


Figure 8 – Focus Function Using Blue Diamonds™

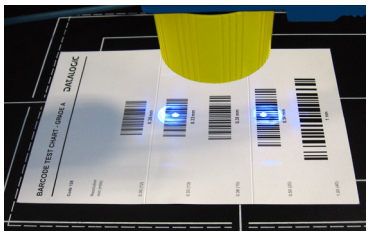
6. Exit the Focus function by pressing the X-PRESS™ push button once. The Blue Diamonds™ turn off.
7. Replace the lens cover, screwing it tightly to the base.

STEP 5 – CALIBRATE IMAGE DENSITY

In order to function correctly to the fullest extent of its capabilities, Matrix 400™ must acquire information regarding image density or PPI (pixels per inch). This calibration takes place through the X-PRESS™ Interface and the **Grade A Barcode Test Chart** included in the package. This procedure is necessary for the first time installation, if the lens type is changed or if the focal distance is changed.

Locate

1. Enter the Focus function by pressing and holding the X-PRESS™ push button until the Focus LED is on.
2. Release the button to enter the Focus function. The Blue Diamonds™ turn on.
3. From the **Grade A Barcode Test Chart**, select the longest code whose length fits between the two Blue Diamonds™. Rotate the code 90 degrees and position the code at the center of the FOV (equidistant from the Blue Diamonds™).



4. Exit the Focus function by pressing the X-PRESS™ push button once. The Blue Diamonds™ turn off.

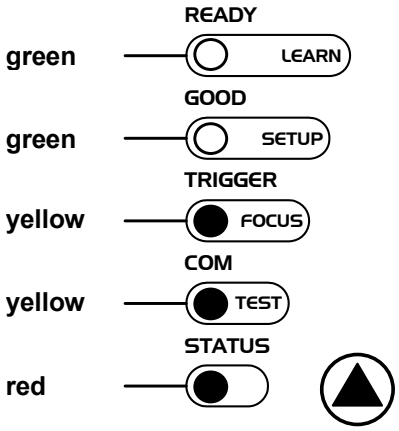


Figure 9 – X-PRESS™ Interface: Locate Function

Setup

5. Enter the Setup function by pressing and holding the X-PRESS™ push button until the Setup LED is on.
6. 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 remain on continuously and Matrix 400™ emits 3 high pitched beeps.

   If the calibration cannot be reached after a timeout of about 5 (five) seconds Matrix 400™ will exit without saving the parameters to memory, the Setup LED will not remain on continuously but it will just stop blinking. In this case Matrix 400™ emits a long low pitched beep.
7. Exit the Setup function by pressing the X-PRESS™ push button once.

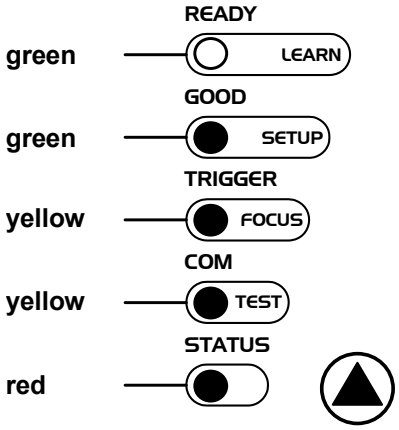


Figure 10 – X-PRESS™ Interface: Setup Function

Learn

8. Enter the Learn function by pressing and holding the X-PRESS™ push button until the Learn LED is on.
9. 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 Density value is successfully saved in the reader memory, the Learn LED will remain on continuously, the Green Spot is activated and Matrix 400™ emits 3 high pitched beeps.

   If the calibration cannot be reached after a timeout of about 3 (three) minutes Matrix 400™ will exit without saving the parameters to memory, the Learn LED will not remain on continuously but it will just stop blinking. In this case Matrix 400™ emits a long low pitched beep.
10. Exit the Learn function by pressing the X-PRESS™ push button once.

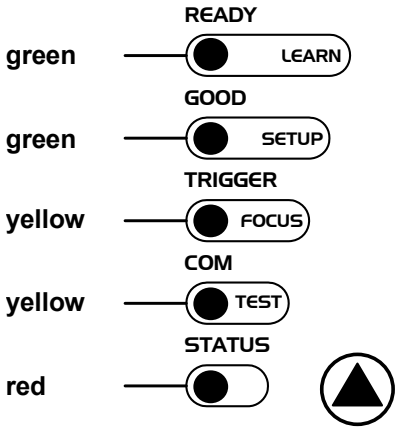


Figure 11 – X-PRESS™ Interface: Learn Function

STEP 6 – X-PRESS™ CONFIGURATION

Once Matrix 400™ has calibrated image density, you can 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.

Locate

1. Enter the Focus function by pressing and holding the X-PRESS™ push button until the Focus LED is on.
2. Release the button to enter the Focus function. The Blue Diamonds™ turn on.
3. **Select a code from your application**. Position the code at the center of the FOV (equidistant from the Blue Diamonds™).
4. Exit the Focus function by pressing the X-PRESS™ push button once. The Blue Diamonds™ turn off.

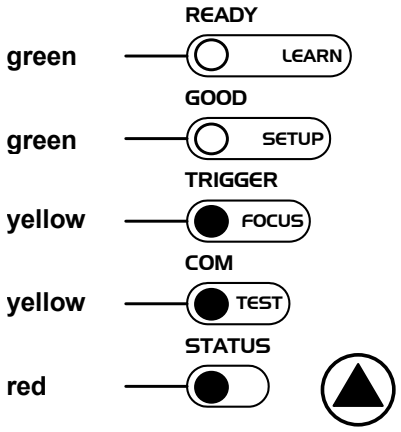


Figure 12 – X-PRESS™ Interface: Locate Function

Setup

5. Enter the Setup function by pressing and holding the X-PRESS™ push button until the Setup LED is on.
6. 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 remain on continuously and Matrix 400™ emits 3 high pitched beeps.

   If the calibration cannot be reached after a timeout of about 5 (five) seconds Matrix 400™ will exit without saving the parameters to memory, the Setup LED will not remain on continuously but it will just stop blinking. In this case Matrix 400™ emits a long low pitched beep.
7. Exit the Setup function by pressing the X-PRESS™ push button once.

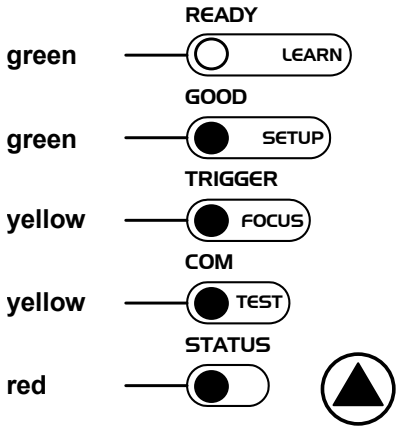


Figure 13 – X-PRESS™ Interface: Setup Function

Learn

8. Enter the Learn function by pressing and holding the X-PRESS™ push button until the Learn LED is on.
9. 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 Learn LED will remain on continuously, the Green Spot is activated and Matrix 400™ emits 3 high pitched beeps[2].

   If the autolearning cannot be reached after a timeout of about 3 (three) minutes Matrix 400™ will exit without saving the parameters to memory, the Learn LED will not remain on continuously but it will just stop blinking. In this case Matrix 400™ emits a long low pitched beep.
10. Exit the Learn function by pressing the X-PRESS™ push button once.

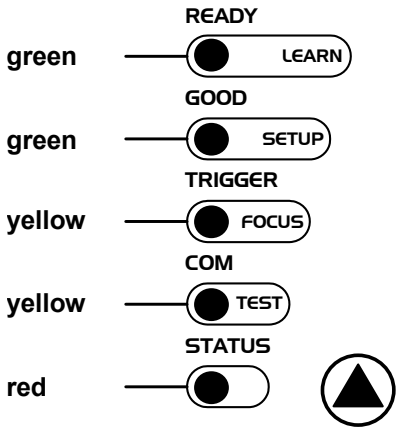


Figure 14 – X-PRESS™ Interface: Learn Function

NOTE

If you have used this procedure to configure Matrix 400™ go to step 9.

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.

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

STEP 7 – 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 to consider the reader 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 or Vista, then insert the VisiSet™ CD-ROM, wait for the CD to autorun and follow the installation procedure.

This configuration procedure assumes a laptop computer, running VisiSet™, is connected to the reader's auxiliary port.

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

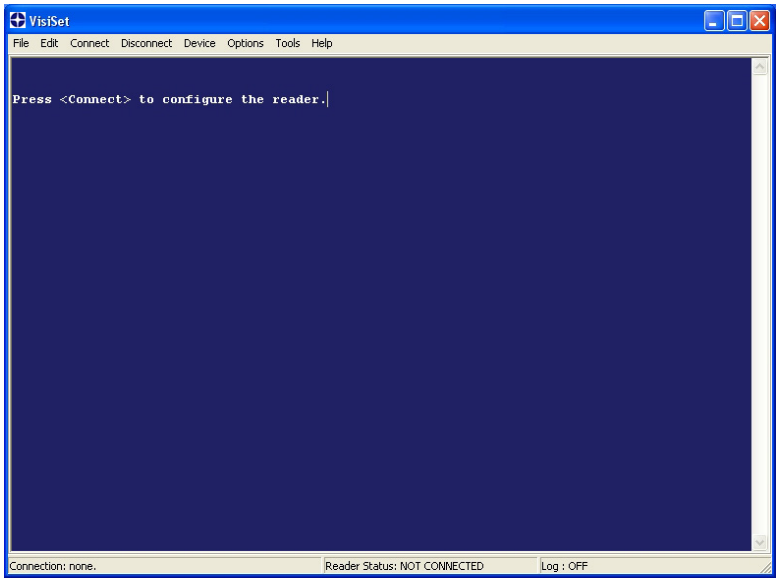


Figure 15 - VisiSet™ Opening Window

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

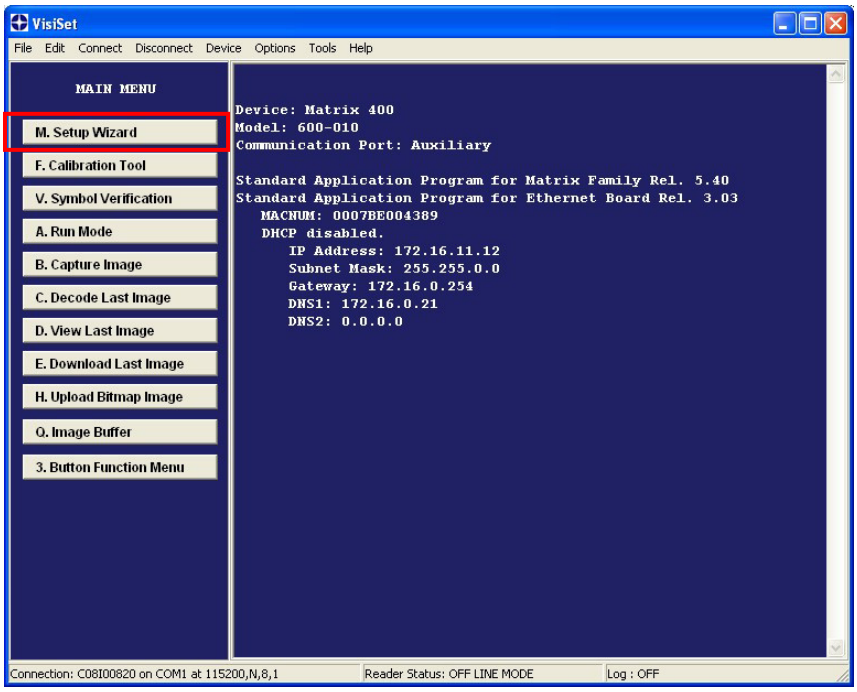
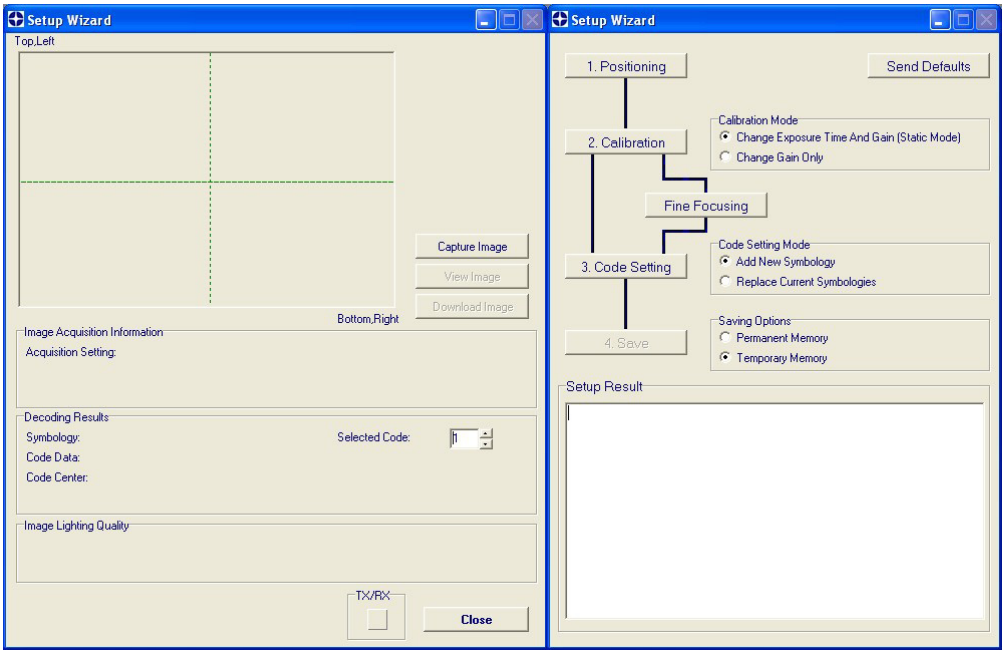


Figure 16 - VisiSet™ Main Window After Connection

STEP 8 – 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.



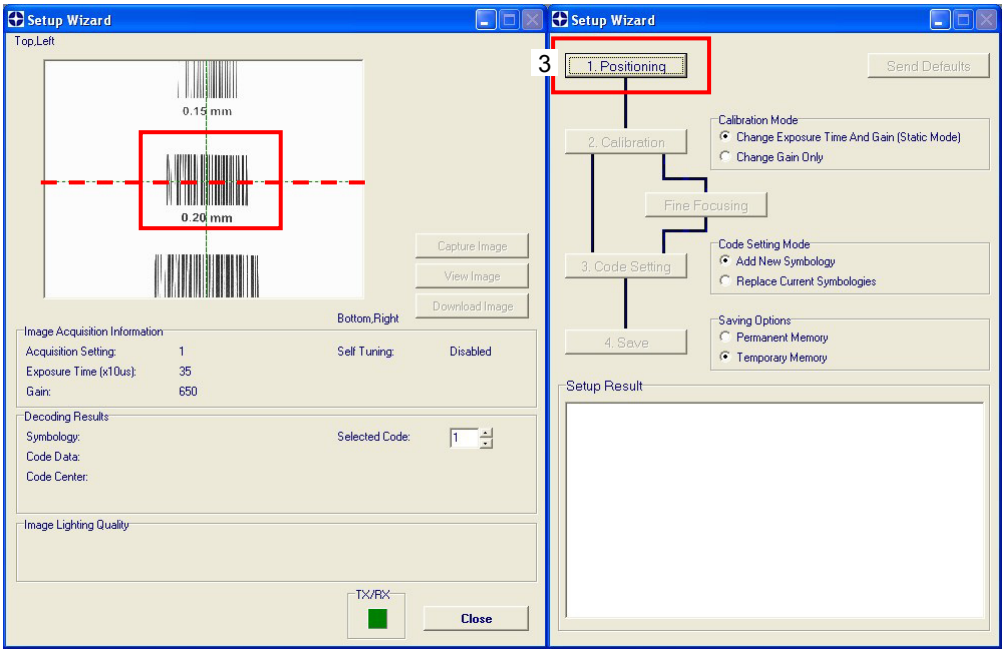
2. Remove the lens cover in order to focus the reader and loosen the two Locking Knobs on the lens.

   Adjust the Focus ring to the "**Far position**" and the Diaphragm ring to the "**F4**"[3] number setting which is the preferred setting for installation.

   Place the **Grade A Barcode Test Chart** in front of the reader at the correct reading distance (see step 3 and the Optical Accessory Selection table in the par. 7.1).

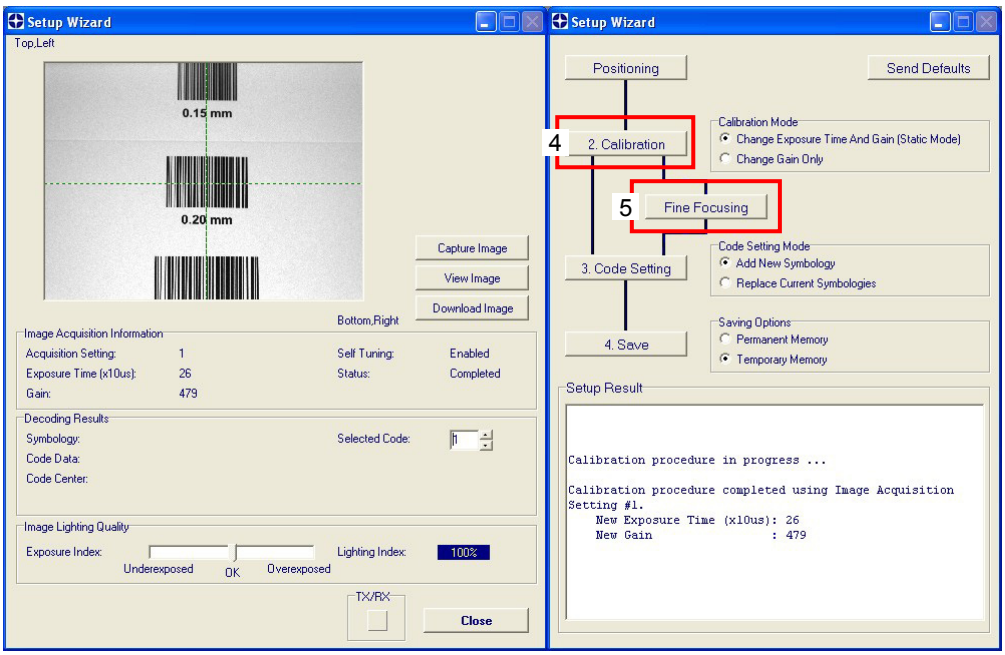
3. Press the "Positioning" button. The reader continuously acquires images and gives visual feedback in the view image window. Select the largest code from the chart that completely fits into the view image window. Move the reader (or code) to center it. The code must be aligned across the X-axis reference line at the center of the FOV. See figure below.

   Press the Positioning button again to stop positioning.

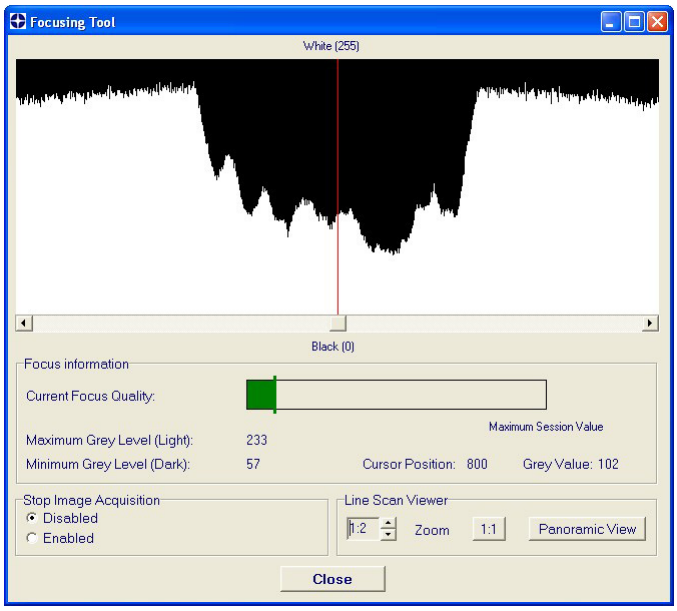


[3] For far reading distances, the Diaphragm ring can be set to values between **F2** and **F4** to increase image lighting.

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. If the code symbology is enabled by default, the code will also be decoded.

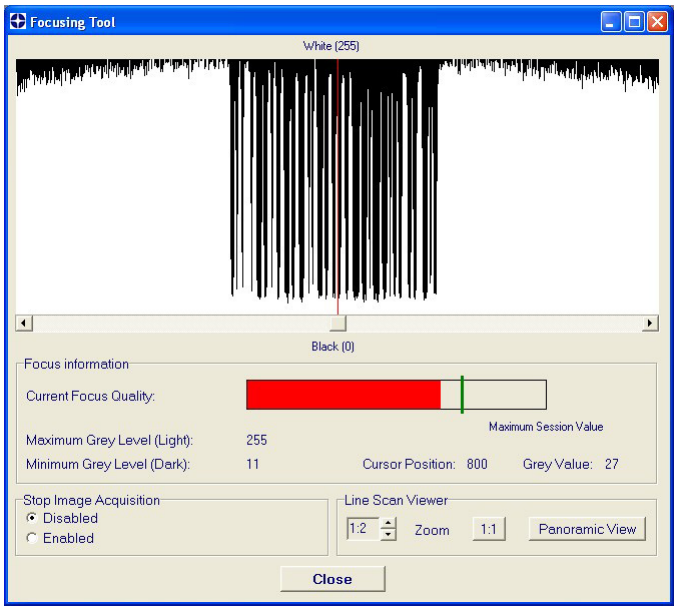


5. Press the "Fine Focusing" button to activate the Fine Focusing Tool.
The reader continuously acquires images and gives visual feedback on the focusing quality in the Focusing Tool window.

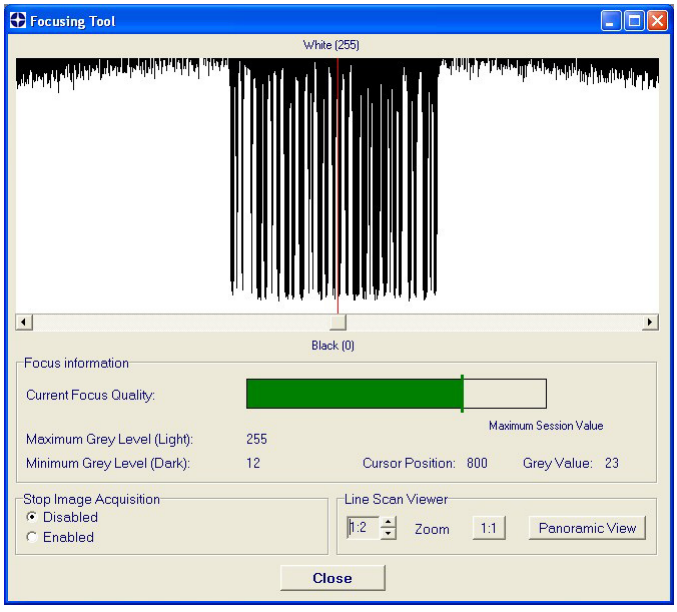


Rotate the Focusing ring on the lens. The Current Focus Quality Bar (green) together with the vertical optimal focus line (green) **increase together** until the optimal focus is reached; the vertical optimal focus line stops.

Continue rotating the Focusing ring on the lens a little farther; **the Current Focus Quality Bar decreases** (red) see below.



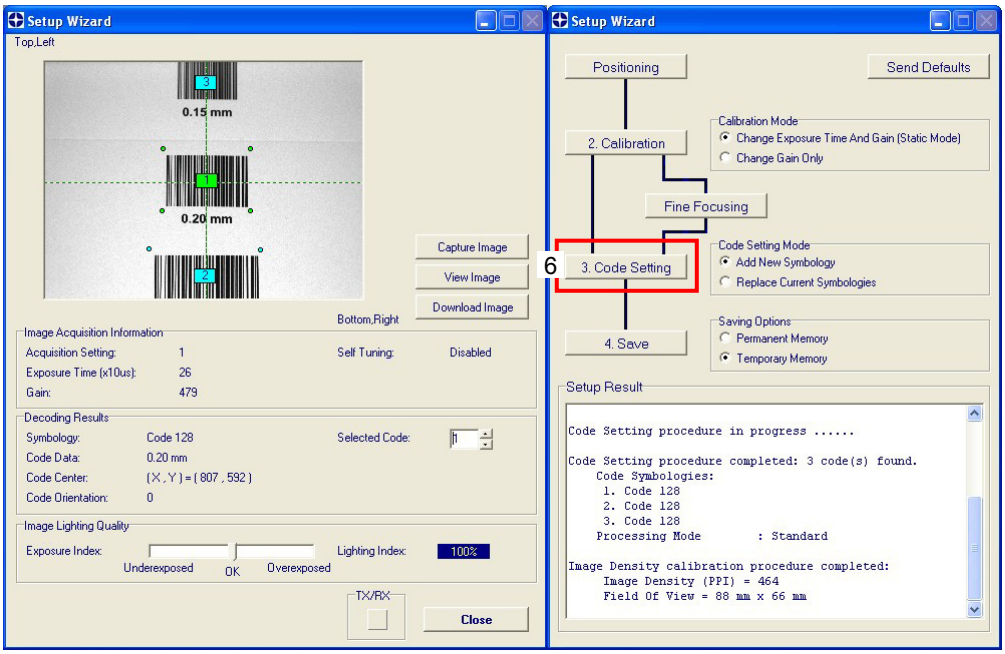
Rotate the Focusing ring in the opposite direction. The Current Focus Quality Bar (green) increases towards the vertical optimal focus line (green) until the optimal focus is reached; **the Current Focus Quality Bar touches the vertical optimal focus line** (indicating the best focus).



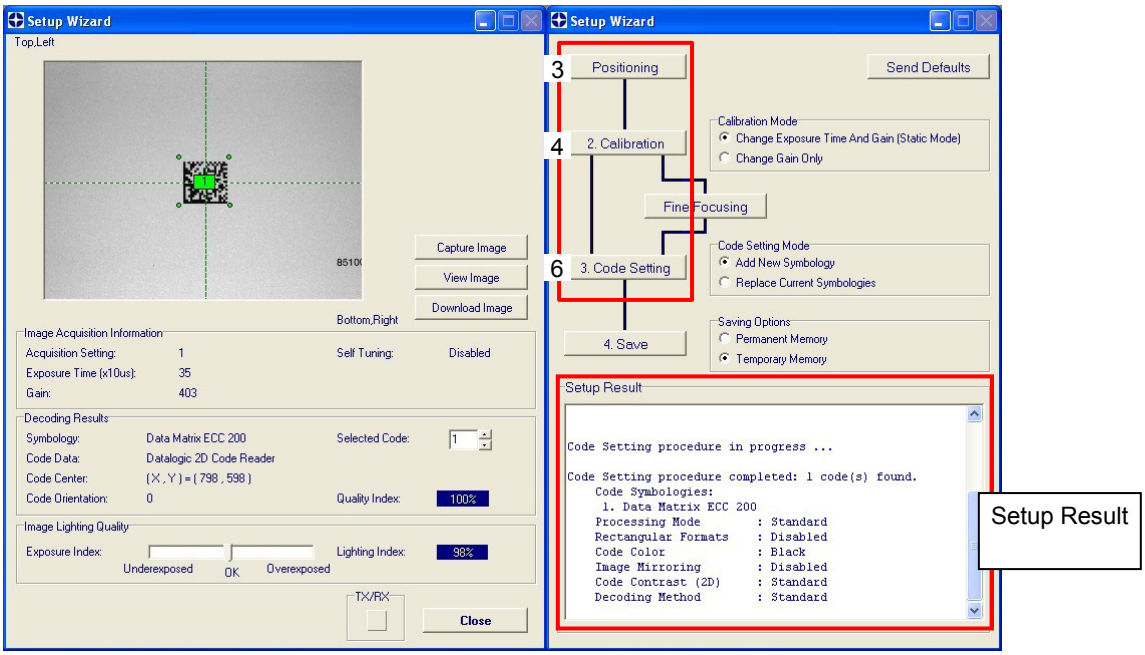
Tighten the Locking Knobs on the lens and press the "Close" button to return to the Setup Wizard.

6. Select a Code Setting Mode choice and press the "Code Setting" button.
   Using the **Grade A Barcode Test Chart**, this step performs image density calibration in order for Matrix 400™ to function correctly and to the fullest extent of its capabilities.

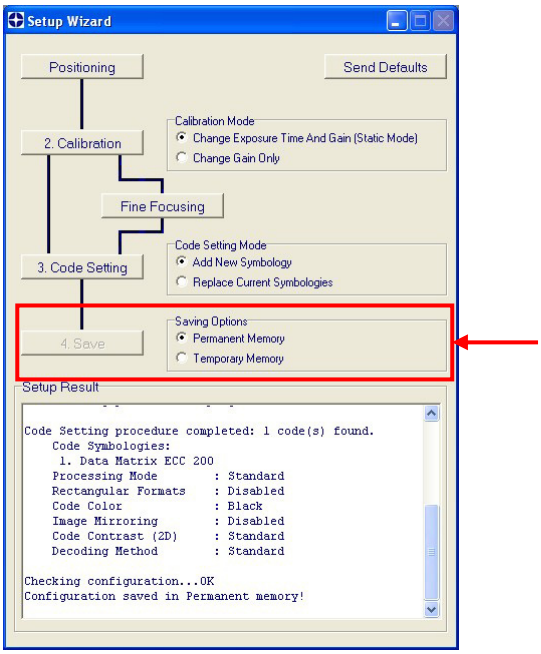
   The Setup Result section of the Setup Wizard window shows the code type results and the image density calibration settings.



7. Place the **application specific code** in front of the reader at the same reading distance and repeat steps 3, 4, and 6.



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 9 – 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.

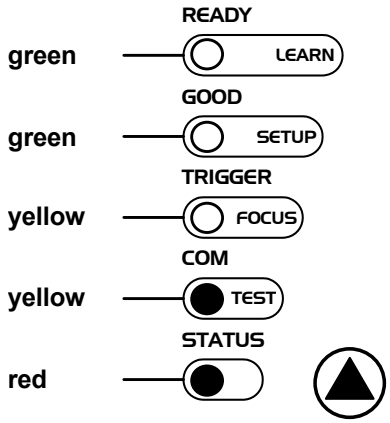


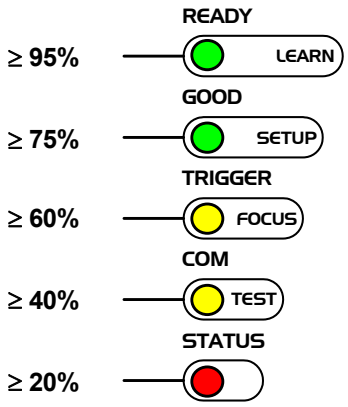
Figure 17 – X-PRESS™ Interface: Test Function

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:



ADVANCED READER CONFIGURATION

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

Advanced Configuration Using VisiSet™

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

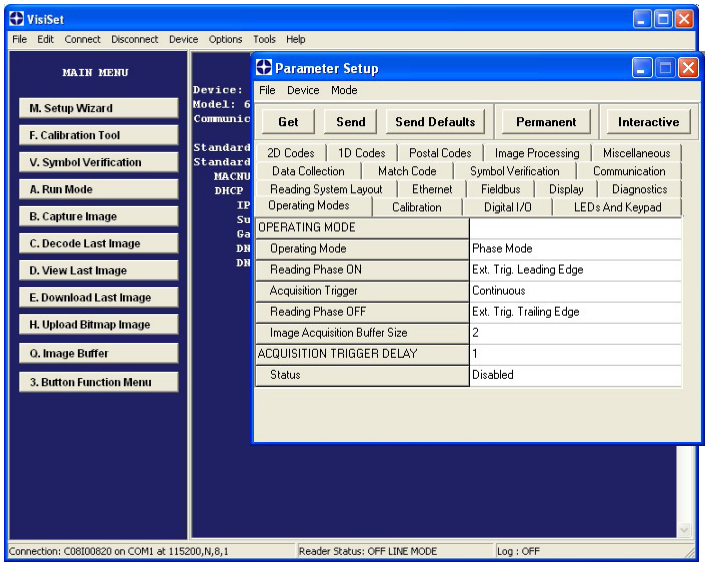


Figure 18 - VisiSet™ Parameter Setup Window

Host Mode Programming

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

Alternative Layouts

If you need to install an Ethernet network, ID-NET™ network, Fieldbus network, Pass-Through network, Multiplexer network or an RS232 Master/Slave refer to the Matrix 400™ Reference Manual.

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

Code Quality Verification

Matrix 400™ can be used as a Code Quality Verifier according to the ISO/IEC 15415, ISO/IEC 15416, AS9132, and AIM DPM Standards. For more details see the Matrix 400™ Code Quality Verifier Solution manual on the CD-ROM.

2 INTRODUCTION

2.1 PRODUCT DESCRIPTION

Matrix 400™ 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 400™ uses imaging technology and provides complete reading system functions by integrating image capturing, decoding and communicating in a single compact and versatile product.

Matrix 400™ sets a new standard in 2D imager technology offering high performance with improved reading flexibility thanks to its intrinsic modularity.

Matrix 400™ 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 Blue Diamonds™ aiming and focusing system 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 400™ the ideal product for industrial applications.

Matrix 400™ 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 400™. 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 CD-ROM 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™.

Symbol Verification can be performed through VisiSet™ when the reader has been installed and setup as a Verifier station. For details see the Matrix Code Quality Verifier Solution manual.

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) & 2.0 MPixels (UXGA) models
- Adjustable focus through C-Mount 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 27 frames/sec for SXGA models and 15 frame/sec for UXGA models
- 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
- Blue Diamonds™ aiming and focusing system
- 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 C-Mount 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, HTTP server, FTP and mail client, etc.
- 3 serial communication interfaces (Main, Auxiliary, ID-NET™)
- General purpose optocoupled I/Os

Versatility

- Excellent reading performance on Direct Part Marked (DPM) symbols
- Code Quality Verification 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 full 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, C-Mount lens and protective cover, the mechanical dimensions are 123 x 60.5 x 87 mm and it weighs about 482 g.

Electrical connection of Power, Host interfaces and I/O signals is provided through an M16 (IP67) 19-pin connector (Figure A, 9). A standard M12 D-Coded (IP67) Ethernet connector is present on Matrix 400 XXX-X1X models (Figure A, 10).

2.2 INDICATORS AND KEYPAD BUTTON

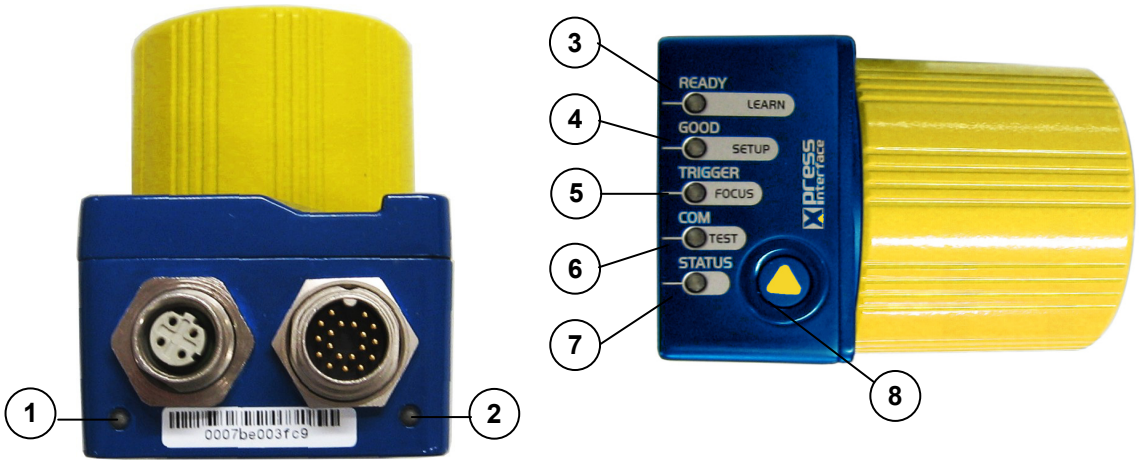


Figure 19 - Indicators

The following LED indicators are located on the reader:

NET	yellow LED indicates connection to the on-board Ethernet network (for Ethernet models) (Figure 19, 1)
PWR	blue LED indicates that the reader is connected to the power supply (Figure 19, 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 19, 3)
GOOD	green LED confirms successful reading (Figure 19, 4)
TRIGGER	yellow LED indicates the status of the reading phase (Figure 19, 5)
COM	yellow LED indicates active communication on the main serial port * (Figure 19, 6)
STATUS	red LED indicates a NO READ result (Figure 19, 7)

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

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

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

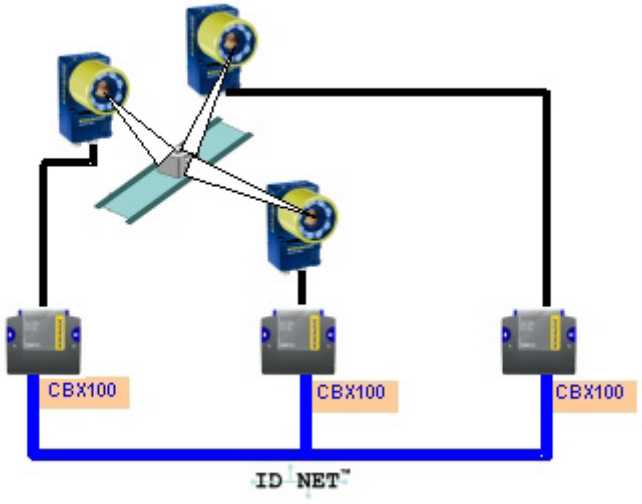
The keypad button (Figure 19, 8), is software programmable. By default it starts the X-PRESS™ interface for quick installation without using a PC (see chp. 1).

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

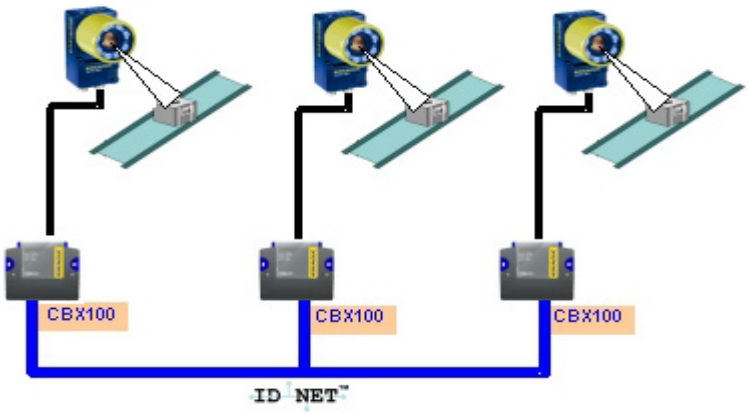


ID-NET™ interface allows local connection of multiple readers reading different sides of the same target. All readers share a single presence sensor and activate/deactivate simultaneously.

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 5.5).
3. Power up the entire system.

Configuration of Slaves

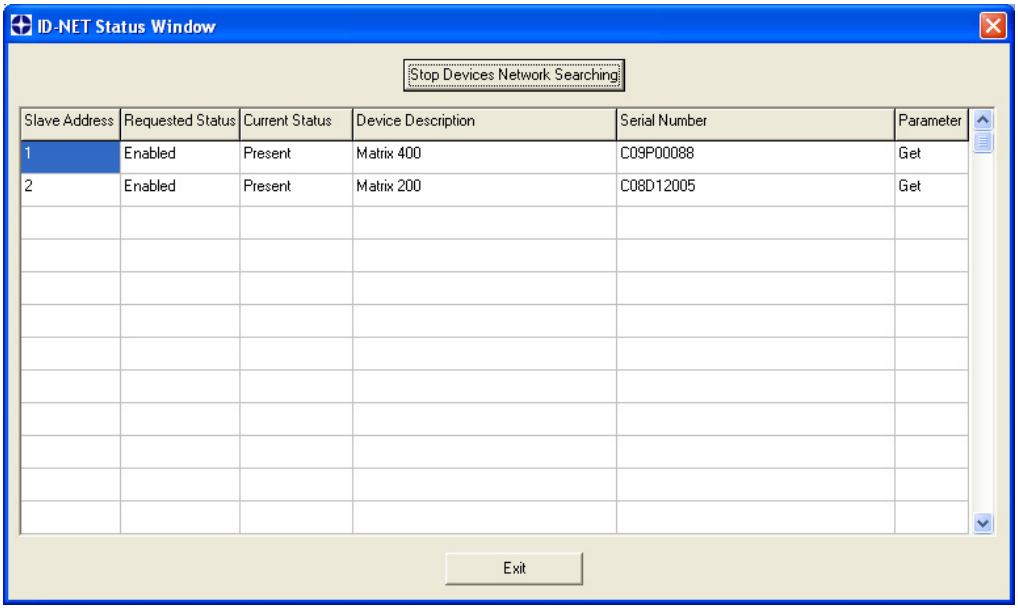
1. Connect a PC equipped with VisiSet™ to the Main, Auxiliary or Ethernet interface of the planned Slave reader.
2. Launch VisiSet™ and connect to the Slave reader.
3. From the VisiSet™ Device Menu select "Parameter Setup".
4. Set the Role of the Slave reader (Synchronized or Multidata) from the Reading 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. If using the CBX connection box equipped with a BM100 Backup module, perform Device Backup at the Slave.

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. If using the CBX connection box equipped with a BM100 Backup module, perform Device Backup at the Master.
9. From the VisiSet™ Device Menu select "ID-NET™ Status Window" and click on the "Look For Devices On Network" button to check the status of the expected Slave devices within the ID-NET™ network.

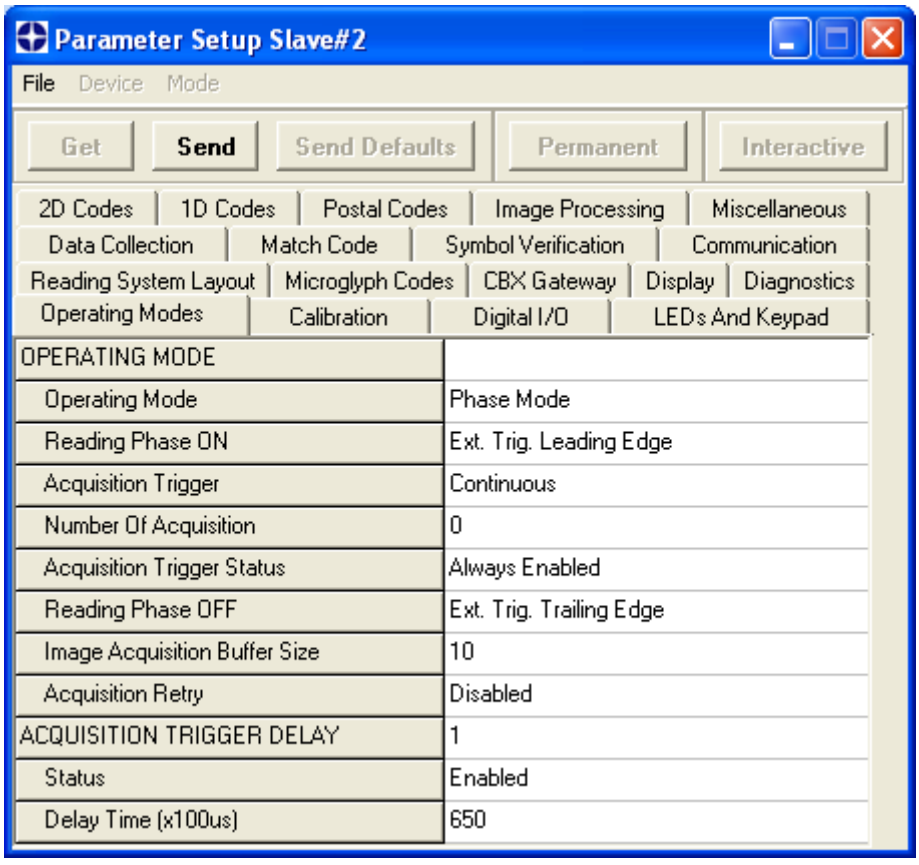


The reader network is ready.

2.3.2 ID-NET™ Slave Management Through Master

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

1. Connect a PC equipped with VisiSet™ to the Main, or Auxiliary interface of the Master reader.
2. Launch VisiSet™ and connect to the Master reader.
3. From the VisiSet™ Device Menu select "ID-NET™ Status Window" and click on the "Look For Devices On Network" button to check the status of the expected Slave devices within the ID-NET™ network.
4. Double click on the Get function of the specific slave in the Parameter column of 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 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.
- Focus/Locate to turn on the Blue Diamonds™ to aid focusing and positioning.
- Test with bar graph visualization to check static reading performance

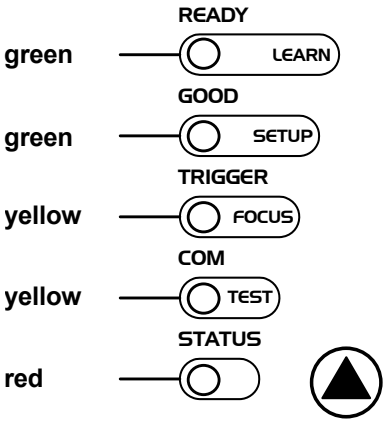
2.4.1 X-PRESS™ Functions

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

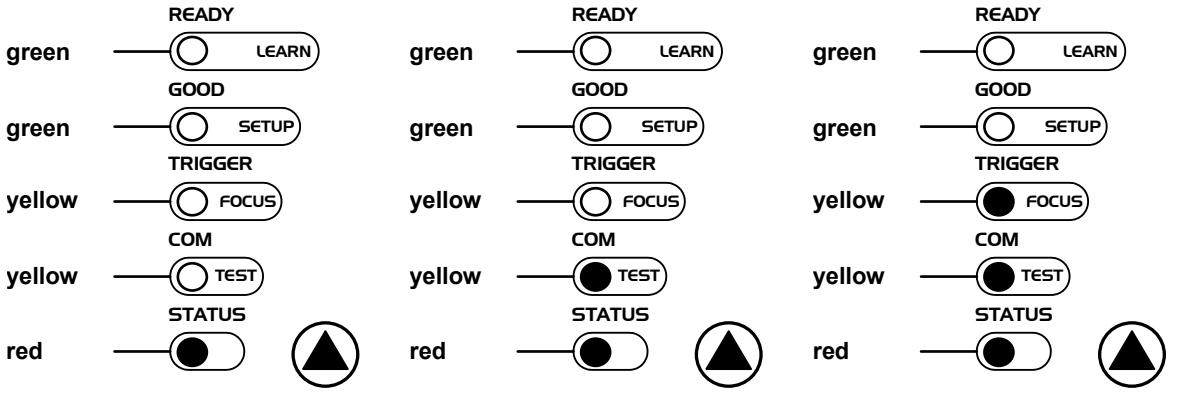
1 – **Press** the button (the Status LED will give a visual feedback).

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

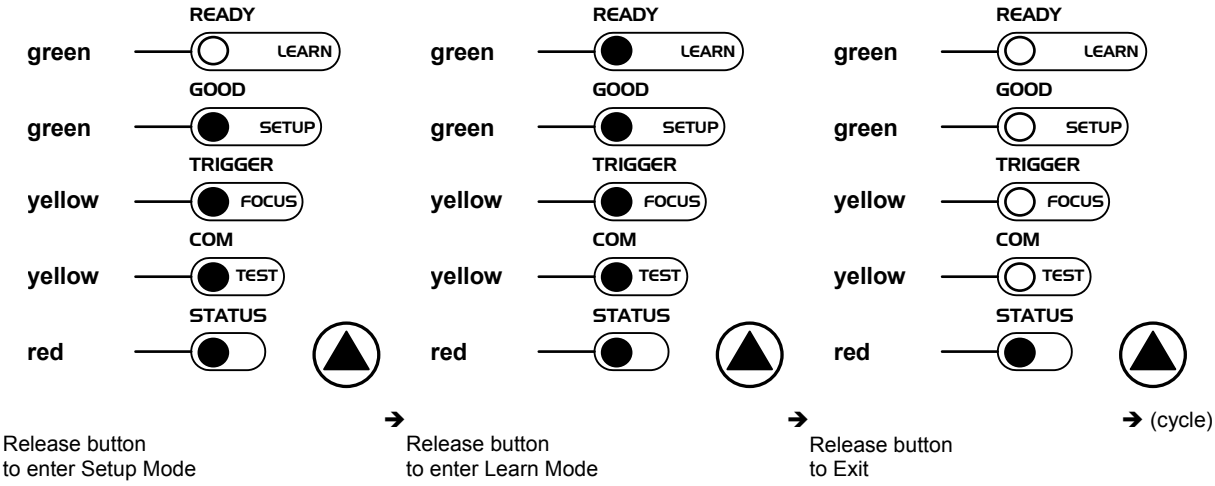
3 – **Release** the button to enter the specific function.



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



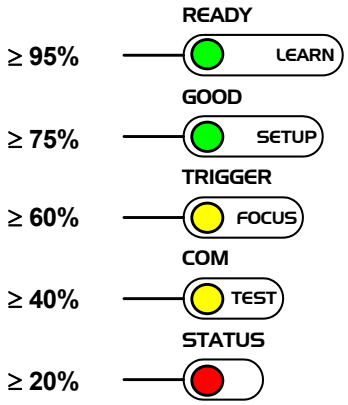
Release button to Exit → Release button to enter Test Mode → Release button to enter Focus/Locate Mode →



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.

Focus/Locate (Function 2)

This function causes the Blue Diamonds™ to turn on. The Blue Diamonds™ can be used to focus the lens at the desired reading distance and since they are centered on the FOV they can also be used to position the imager on the code. The Focus LED blinks to indicate this state.

To exit the Focus/Locate Mode, press the X-PRESS™ push button once. The Blue Diamonds™ 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 remain on continuously and Matrix 400™ emits 3 high pitched beeps.

If the calibration cannot be reached after a timeout of about 5 (five) seconds Matrix 400™ will exit without saving the parameters to memory, the Setup LED will not remain on continuously but it will just stop blinking. In this case Matrix 400™ 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.

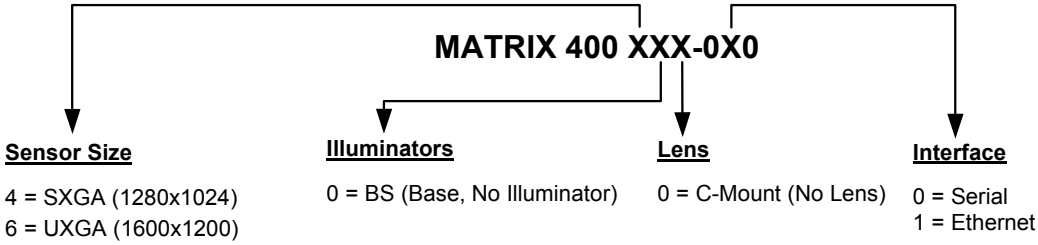
The Learn LED will blink until the procedure is completed.

The Learn procedure ends when the Image Processing and Decoding parameters are successfully saved in the reader memory, the Learn LED will remain on continuously and Matrix 400™ emits 3 high pitched beeps.

If the calibration cannot be reached after a timeout of about 3 (three) minutes, Matrix 400™ will exit without saving the parameters to memory, the Learn LED will not remain on continuously but it will just stop blinking. In this case Matrix 400™ emits a long low pitched beep.

2.5 MODEL DESCRIPTION

The Matrix 400™ reader is available in different versions according to the following characteristics:



2.6 ACCESSORIES

The following accessories can be used with the Matrix 400™ reader.

Accessory	Description	Order No.
Lenses		
LNS-1006	6 mm C-Mount Lens	93ACC1793
LNS-1109	9 mm C-Mount Lens	93ACC1794
LNS-1112	12.5 mm C-Mount Lens	93ACC1795
LNS-1116	16 mm C-Mount Lens	93ACC1796
LNS-1125	25 mm C-Mount Lens	93ACC1797
LNS-1135	35 mm C-Mount Lens	93ACC1798
LNS-1150	50 mm C-Mount Lens	93ACC1799
Internal Illuminators		
LT-001	Internal Illuminator Red Narrow Angle	93A401019
LT-002	Internal Illuminator Red Wide Angle	93A401020
LT-003	Internal Illuminator White Narrow Angle	93A401021
LT-004	Internal Illuminator White Wide Angle	93A401022
LT-006	Internal Illuminator Red Super Narrow Angle	93A401024
External Illuminators		
LT-100	Cone Lighting System	93A401003
LT-200	Spot Lighting System	93A401004
LT-210	Mini-Spot Lighting System	93A401012
LT-300	Ring Lighting System	93A401008
LT-314	45° Dark Field Ring Lighting System	93A401013
LT-316	60° Dark Field Ring Lighting System	93A401014
LT-410	Coaxial Lighting System	93A401015
LT-510	Mini-Dome Lighting System	93A401016
LT-511	Dome Lighting System	93A401017
LT-630	Four Bar Lighting System	93A401018
Filters		
FLT-111	IR Cut Filter (d 27 mm)	93ACC1800
FLT-112	IR Cut Filter (d 25.5 mm)	93ACC1801
FLT-121	Linear Polarizer (d 27 mm)	93ACC1802
FLT-122	Linear Polarizer (d 25.5 mm)	93ACC1803
Cables		
CAB-MS01	M16-IP67 Cable To CBX or QL (1M)	93A051358
CAB-MS03	M16-IP67 Cable To CBX or QL (3M)	93A051359
CAB-MS05	M16-IP67 Cable To CBX or QL (5M)	93A051360
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
Connection Boxes		
CBX100	Compact Connection Box	93A301067
CBX500	Modular Connection Box	93A301068
BM100	Backup Module for CBX100/500	93ACC1808
BM150	Display Module for CBX500	93ACC1809
BM200/BM210	Ethernet TCP/IP Module STD/IP65 for CBX500	93ACC1851, 93ACC1852
BM300/BM310	Profibus Module STD/IP65 for CBX500	93ACC1810, 93ACC1811
BM400	DeviceNet Module IP65 for CBX500	93ACC1814
BM500/BM510/BM520	Ethernet/IP Module STD/IP65/IP54 for CBX500	93ACC1812, 93ACC1813, 93ACC1840
BM600	CAN Open Module for CBX500	93ACC1815
BM700	Profinet IO Module for CBX500	93ACC1816
BM1100	CC-Link Module for CBX500	93ACC1845
BM1200/BM1210	Modbus TCP Module STD/IP65 for CBX500	93ACC1848, 93ACC1849
BA100	DIN Rail Adapters	93ACC1821
BA200	Bosch Adapters	93ACC1822
QL150	Quick Link Slave ID-NET + Service T-Connector	93ACC1868
QL300	Quick Link Master ID-NET - Serial Host Connector	93ACC1862
QL500	Quick Link Master ID-NET - Ethernet Host Connector	93ACC1864
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
LTC-630	Four Bar Lighting System Controller	93ACC1790

Sensors		
MEP-593	Photocell Kit PNP (PH-1)	93ACC1791
MEP-543	Photocell Kit-NPN	93ACC1728
Brackets		
USX-60	Adjustable Bracket	93ACC1729
BK-4410	Coaxial LT Bracket Matrix 400	93ACC1804
BK-4990	Generic LT Bracket Matrix 400	93ACC1805
ISO/IEC Calibration Chart	Calibration Chart for Code Verifier Solution	93ACC1841
ESD Safe Lens Cover	ESD Safe Lens Cover for Matrix 400	93ACC1858

The following table shows the correct lens/illuminator combinations to be used for Matrix 400™ imager assembly.

Lenses			**Internal Illuminators**		
93ACC1793	LNS-1006	6 mm C-Mount Lens (only for Matrix 400 600-0x0 models)	93A401020 93A401022	LT-002 LT-004	Red Wide Angle White Wide Angle
93ACC1794	LNS-1109	9 mm C-Mount Lens	93A401020 93A401022	LT-002 LT-004	Red Wide Angle White Wide Angle
93ACC1795	LNS-1112	12.5 mm C-Mount Lens	93A401020 93A401022	LT-002 LT-004	Red Wide Angle White Wide Angle
93ACC1796	LNS-1116	16 mm C-Mount Lens	93A401019 93A401021	LT-001 LT-003	Red Narrow Angle White Narrow Angle
93ACC1797	LNS-1125	25 mm C-Mount Lens	93A401019 93A401021	LT-001 LT-003	Red Narrow Angle White Narrow Angle
93ACC1798	LNS-1135	35 mm C-Mount Lens	93A401024	LT-006	Red Super Narrow Angle
93ACC1799	LNS-1150	50 mm C-Mount Lens	93A401024	LT-006	Red Super Narrow Angle

2.7 APPLICATION EXAMPLES

Matrix 400™ 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 20).

Figure 20 - Address Coded in Data Matrix Symbology for Automated Mail Processing

The Matrix 400™ high resolution image sensors allow the reading of many small codes in a single image (see 96 vial application in Figure 21).

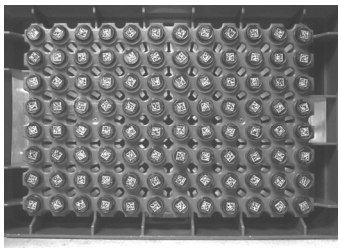


Figure 21 - 96-Vial Rack

Matrix 400™ assures the reading of deformed and / or overprinted codes, even though damaged or printed on high reflective surfaces (see Figures 22, 23, 24).

Figure 22 - Unidose Flow-Pack with PDF417 Code

Figure 23 - Overprinted Barcode Readable by Matrix 400™ also Through the Envelope Window Film

Figure 24 - Barcode Printed on Curved Surface Readable by Matrix 400™ in spite of Image Optical Distortion

Matrix 400™ is also very powerful in reading low-contrast direct part marked codes (see Figures 25, 26, 27, 28 and 29).

Figure 25 - Dot Matrix Code Directly Marked on Metal Surface by Using Dot Peening Technology

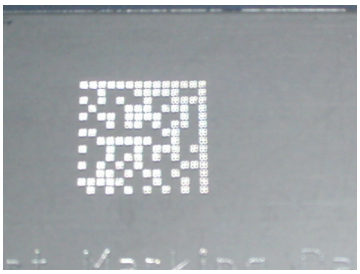


Figure 26 - Dot Peening Marking on Metal Surface with Multi-dot per Code Element

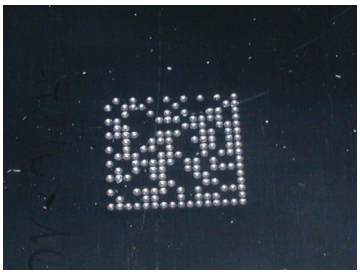


Figure 27 - Directly Marked Dot Matrix Code Characterized by Outstanding Separation Distance between Adjacent Code Elements

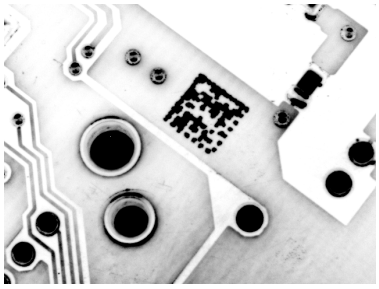


Figure 28 - DataMatrix Code Directly Marked on PCB Surface by Using Laser Etching Technology

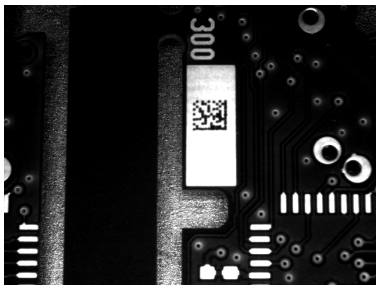


Figure 29 - Dot Matrix Code Directly Marked on PCB Copper Pad by Using Ink-Jet Technology

2.8 EXTERNAL LIGHTING SYSTEMS

In some direct part marking applications best reading results are obtained by using an external lighting system. A series of accessory illuminators are available which cover a variety of applications.

The LT-100 Cone Lighting System provides a circular symmetrical light source designed for the following applications:

- with uneven or noisy background surfaces
- where dot peening or laser etching codes are directly marked onto metal surfaces or PCBs and need to be highlighted
- in the presence of highly reflective surfaces (metal, glass, etc.) causing direct reflections

Figure 30 - LT-100 Cone Lighting System

The LT-200 Spot Lighting System provides a high intensity light source designed for the following applications:

- with uneven, noisy and scratched surfaces
- where dot peening or laser etching codes are directly marked onto metal surfaces or PCBs and need to be highlighted. Here the use of more than one Spot Light can remove any shadowing effect.
- in the presence of highly reflective surfaces (metal, glass, etc.) causing direct reflections. Low light path to surface angles strongly reduce direct reflections.

Figure 31 - LT-200 Spot Lighting System

The LT-210 Mini Spot Lighting System provides a high intensity light source designed for the following applications:

- with uneven, noisy and scratched surfaces
- where dot peening or laser etching codes are directly marked onto metal surfaces or PCBs and need to be highlighted. Here the use of more than one Spot Light can remove any shadowing effect.
- in the presence of highly reflective surfaces (metal, glass, etc.) causing direct reflections. Low light path to surface angles strongly reduce direct reflections.

Figure 32 - LT-210 Mini Spot Lighting System

The LT-300 Ring Lighting System is designed for reading codes produced by Dot Peening or Laser Etching on flat, reflective parts.

Figure 33 - LT-300 Ring Lighting System

The LT-314 45° Dark Field Ring Lighting System is designed for reading codes produced by Dot Peening or Laser Etching on flat, reflective parts.

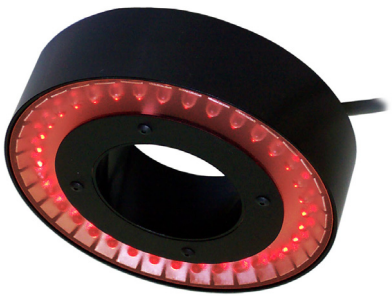


Figure 34 - LT-314 45° Dark Field Ring Lighting System

The LT-316 60° Dark Field Ring Lighting System is designed for reading codes produced by Dot Peening (especially by a 120° stylus) or Laser Etching on flat, reflective parts.

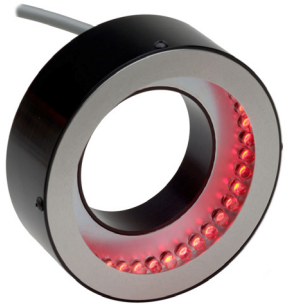


Figure 35 - LT-316 60° Dark Field Ring Lighting System

The LT-410 Coaxial Lighting System is an axial diffuse illuminator designed for reading codes produced by Dot Peening or Laser Etching on flat parts having a matte, specular or mixed surface reflectivity.

Figure 36 - LT-410 Coaxial Lighting System

The LT-510 Mini Dome Lighting System is a diffuse mini dome light designed for reading printed label or Direct Marking codes on small parts with a curved or specular surface.

Figure 37 - LT-510 Mini Dome Lighting System

The LT-511 Dome Lighting System is a diffuse dome light designed for reading printed label or Direct Marking codes on parts with a curved surface.

Figure 38 - LT-511 Dome Lighting System

The LT-630 Four Bar Lighting System is designed for Code verification applications according to ISO/IEC 15415 or ISO/IEC 15416 specifications.

Figure 39 - LT-630 Four Bar Lighting System

3 INSTALLATION

3.1 PACKAGE CONTENTS

Verify that the Matrix 400™ reader and all the parts supplied with the equipment are present and intact when opening the packaging; the list of parts includes:

- ❑ Matrix 400™ reader
- ❑ Quick Reference Guide
- ❑ Test Charts (2)
- ❑ Matrix family CD-ROM
- ❑ Mounting Kit
  - Mounting Screws (4 + 3)
  - Washers (2)
  - Mounting Brackets (2)

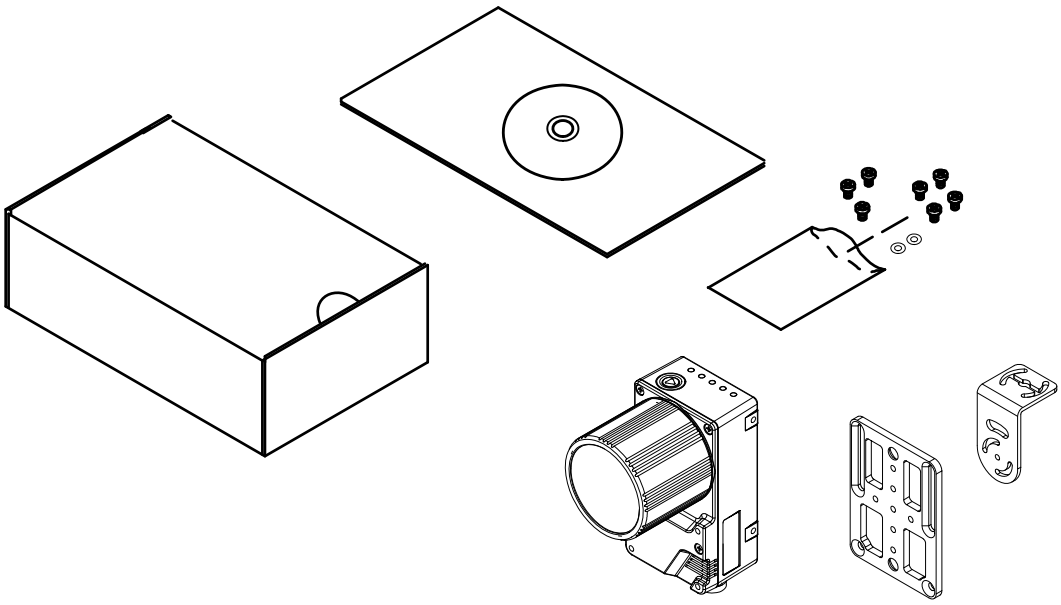


Figure 40 - Package Contents

3.2 MECHANICAL DIMENSIONS

Matrix 400™ 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 41).

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 par. 7.2 for FOV vs. Reading Distance considerations.

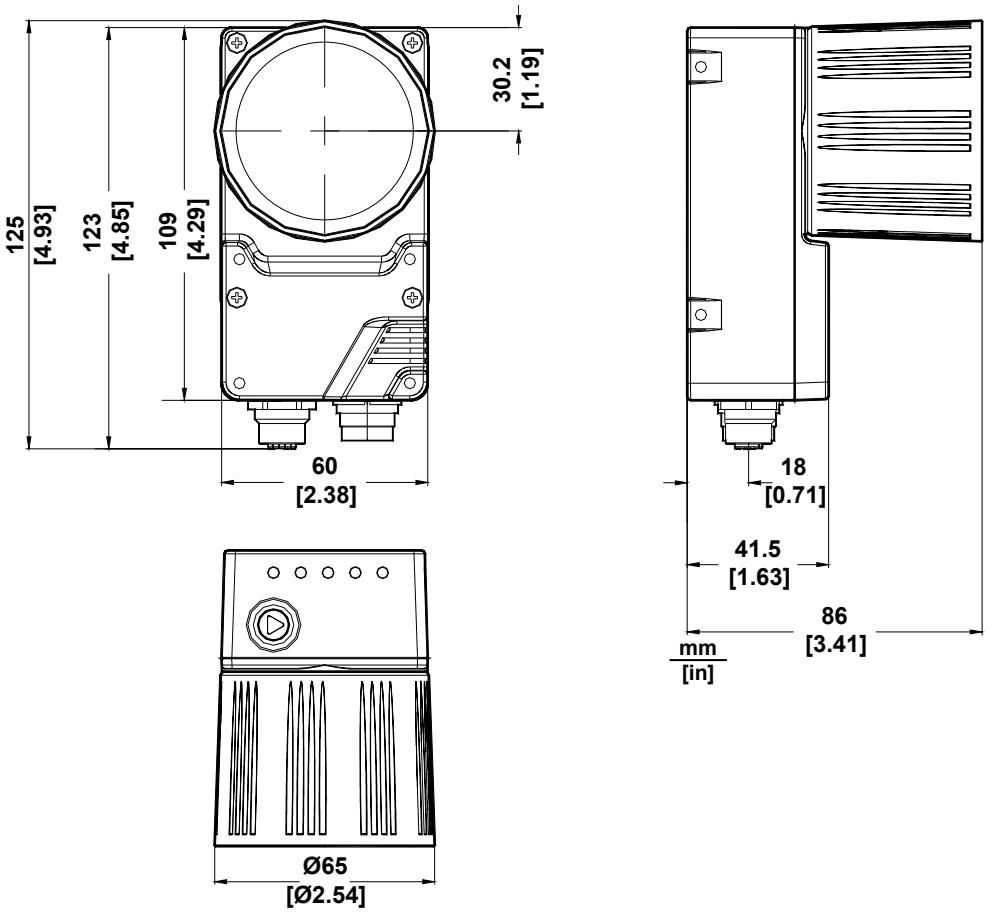


Figure 41 - Overall Dimensions

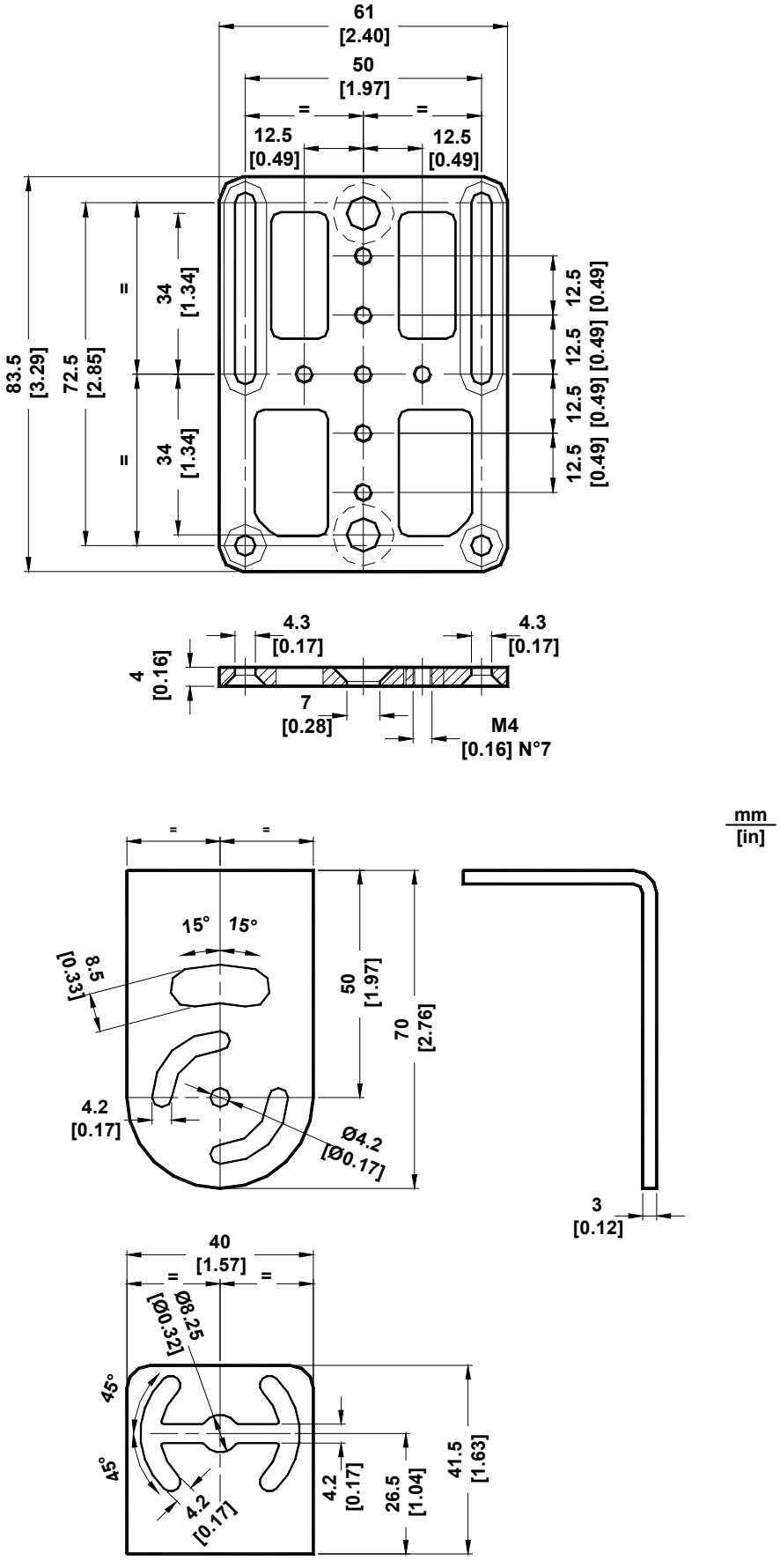


Figure 42 - Mounting Bracket Overall Dimensions

3.3 MOUNTING AND POSITIONING MATRIX 400™

Using the Matrix 400™ mounting brackets you can obtain rotation on the various axes of the reader as shown in the diagram below:

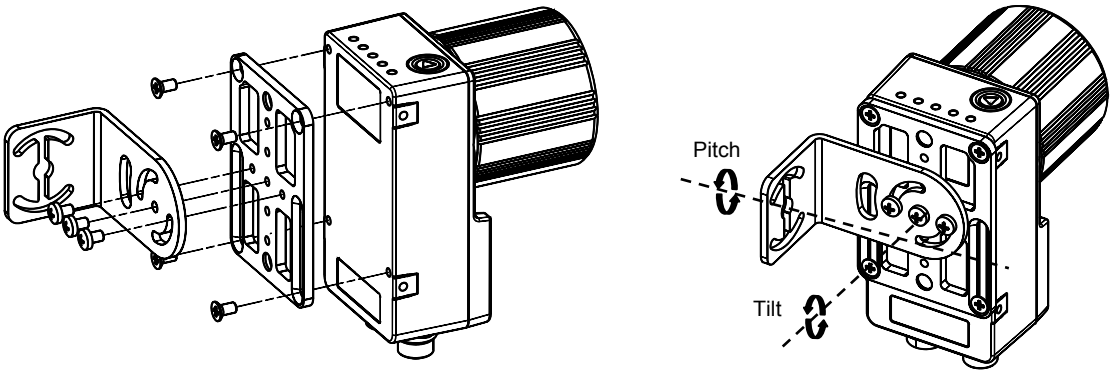


Figure 43 –Positioning with Mounting Bracket (Back)

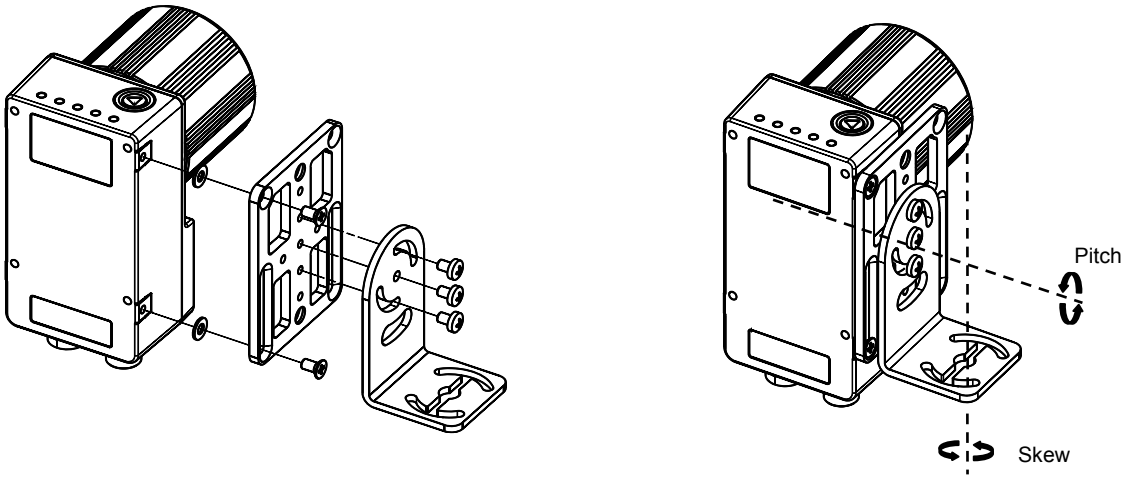


Figure 44 –Positioning with Mounting Bracket (Side)

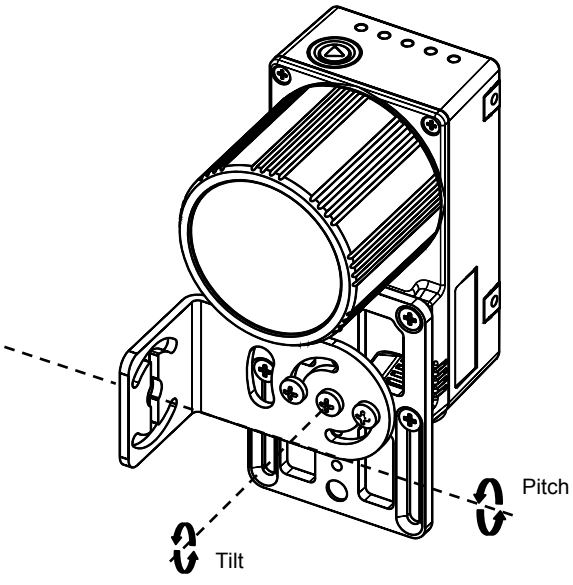


Figure 45 –Positioning with Mounting Bracket (Front)

Matrix 400™ is able to decode code labels at a variety of angles, however significant angular distortion may degrade reading performance.

When mounting Matrix 400™, take into consideration these **ideal** label position angles: **Pitch or Skew 10° to 20° and Tilt 0°**.

Note: Since Matrix 400™ 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.

Follow the suggestions below for the best orientation:

The **Pitch and Skew** angles are represented by the values **P** and **S** in Figure 46 and in Figure 47. Position the reader in order to avoid the direct reflection of the light emitted by the Matrix 400™ reader; it is advised to **assure at least 10°** for one of these angles. In some cases, such as low contrast or low illumination, it can be useful to use a **Pitch or Skew** angle = 0°.

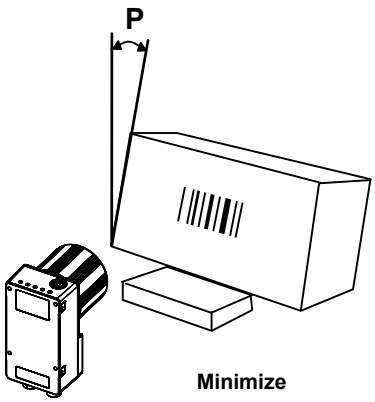


Figure 46 - Pitch angle

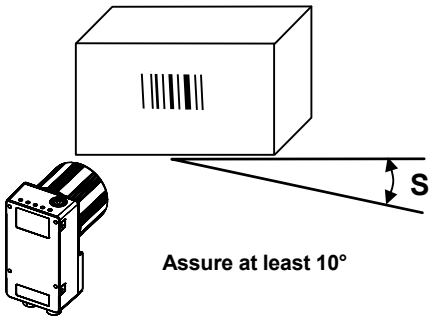


Figure 47 - Skew angle

The **Tilt** angle is represented by the value **T** in Figure 48. Matrix 400™ can read labels with any tilt angle.

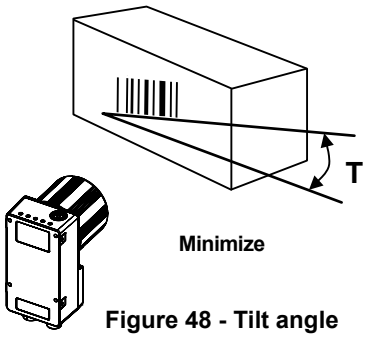


Figure 48 - Tilt angle

See par. 7.2 for FOV vs. Reading Distance considerations.

4 CBX ELECTRICAL CONNECTIONS

All Matrix 400™ models can be connected to a CBX connection box through one of the available **CAB-MSxx** accessory cables. These accessory cables terminate in a 19-pin connector on the Matrix 400™ 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 and filtered reference signals.

NOTE

If you require direct wiring to the reader the details of the connector pins and relative connections are indicated in Chaper 5.

The table below gives the pinout of the CBX100/500 terminal block connectors. Use this pinout when the Matrix 400™ reader is connected by means of the CBX100/500:

CBX100/500 Terminal Block Connectors			
Input Power			
Vdc	Power Supply Input Voltage +		
GND	Power Supply Input Voltage -		
Earth	Protection Earth Ground		
Inputs			
+V	Power Source – External Trigger		
I1A	External Trigger A (polarity insensitive)		
I1B	External Trigger B (polarity insensitive)		
-V	Power Reference – External Trigger		
+V	Power Source – Inputs		
I2A	Input 2 A (polarity insensitive)		
I2B	Input 2 B (polarity insensitive)		
-V	Power Reference – Inputs		
Outputs			
+V	Power Source - Outputs		
-V	Power Reference - Outputs		
O1+	Output 1 +		
O1-	Output 1 -		
O2+	Output 2 +		
O2-	Output 2 -		
Auxiliary Interface			
TX	Auxiliary Interface TX		
RX	Auxiliary Interface RX		
SGND	Auxiliary Interface Reference		
ID-NET™			
REF	Network Reference		
ID+	ID-NET™ network +		
ID-	ID-NET™ network -		
Shield	Network Cable Shield		
Main Interface			
	RS232	**RS485 Full-Duplex**	**RS485 Half-Duplex**
	TX	TX+	RTX+
	RX	*RX+	
	RTS	TX-	RTX-
	CTS	*RX-	
	SGND	SGND	SGND

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

NOTE

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

4.1 POWER SUPPLY

Power can be supplied to the reader through the CBX100/500 spring clamp terminal pins as shown in Figure 49:

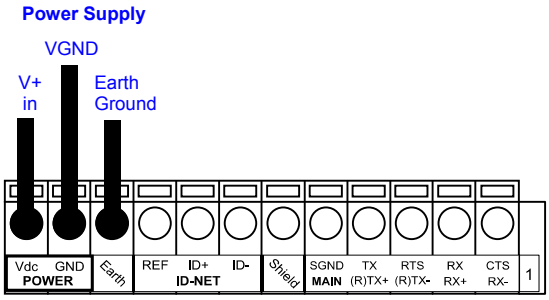


Figure 49 - Power Supply Connections

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.

4.2 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. The RS485 half duplex is automatically set whenever MUX32 communication protocol is enabled. For more details refer to the "Communication" folder in the VisiSet™ Help On Line.

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

4.2.1 RS232 Interface

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

The following pins are used for RS232 interface connection:

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

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

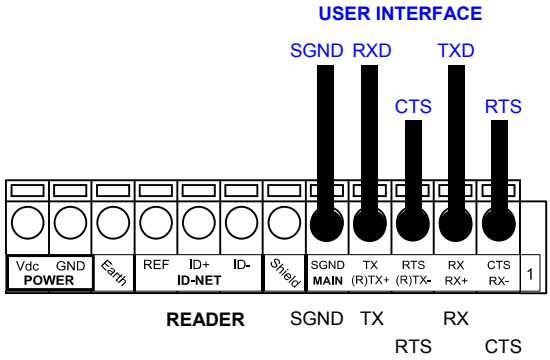


Figure 50 – RS232 Main Interface Connections Using Hardware Handshaking

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

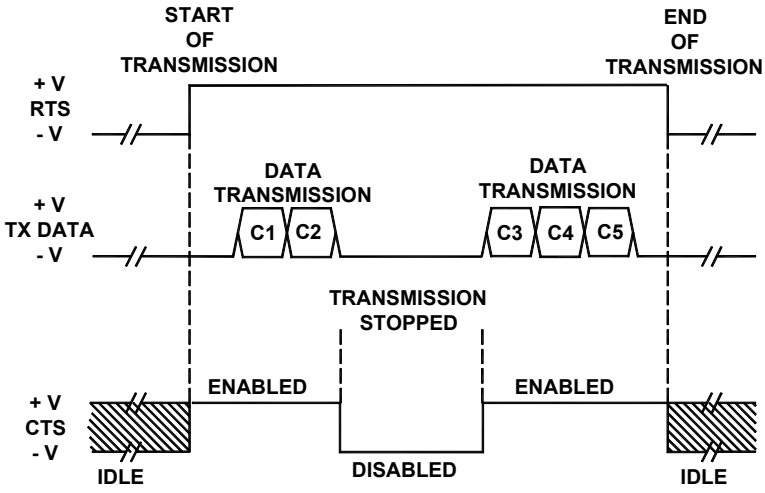


Figure 51 - RS232 Control Signals

If the RTS/CTS handshaking protocol is enabled, the Matrix 400™ activates the RTS output to indicate a message is to be transmitted. The receiving unit activates the CTS input to enable the transmission.

4.2.2 RS485 Full-Duplex Interface

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

The CBX pinout follows:

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

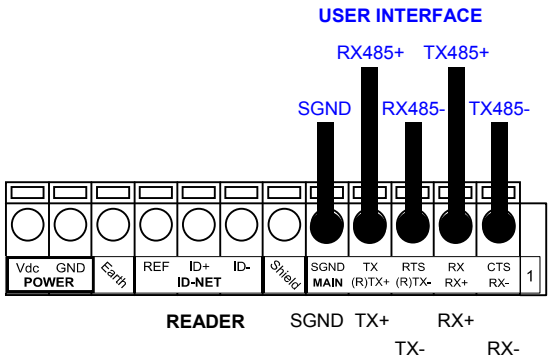


Figure 52 - RS485 Full-duplex Connections

NOTE

For applications that do not use RX485 signals, do not leave these lines floating but connect them to SGND as shown below.

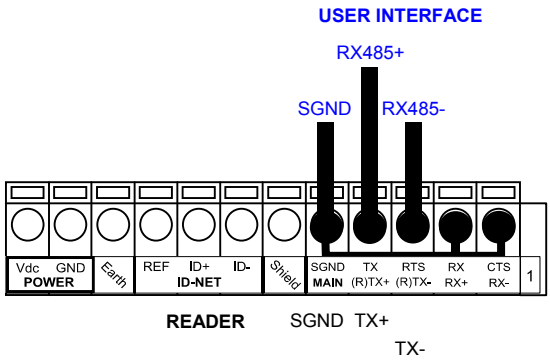


Figure 53 - RS485 Full-duplex Connections using Only TX Signals

4.2.3 RS485 Half-Duplex Interface

NOTE

This interface is provided for backward compatibility. We recommend using the more efficient ID-NET™ network for Master/Slave or Multiplexer layouts.

The RS485 half-duplex (3 wires + shield) interface is used for polled communication protocols.

It can be used for Multidrop connections with a Datalogic Multiplexer, (see par. 6.5) exploiting a proprietary protocol based on polled mode called MUX32 protocol, where a master device polls slave devices to collect data.

CBX100/500	Function
RTX+	RS485 Receive/Transmit Data +
RTX-	RS485 Receive/Transmit Data -
SGND	Signal Ground

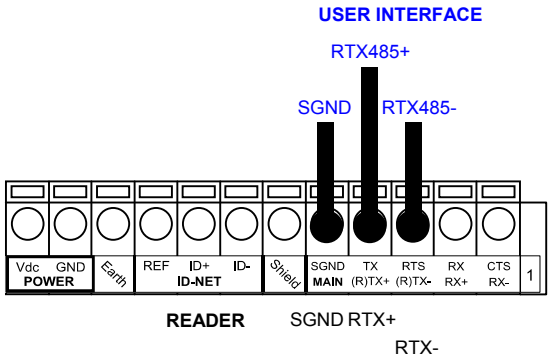


Figure 54 - RS485 Half-duplex Connections

This interface is forced by software when the protocol selected is MUX32 protocol.

In a Multiplexer layout, the Multidrop address must also be set via serial channel by the VisiSet™ utility or by the Host Programming Mode.

Figure 55 shows a multidrop configuration with Matrix 400™ readers connected to a Multiplexer.

CAUTION

This is an example of multidrop wiring. Consult the multiplexer manual for complete wiring instructions.

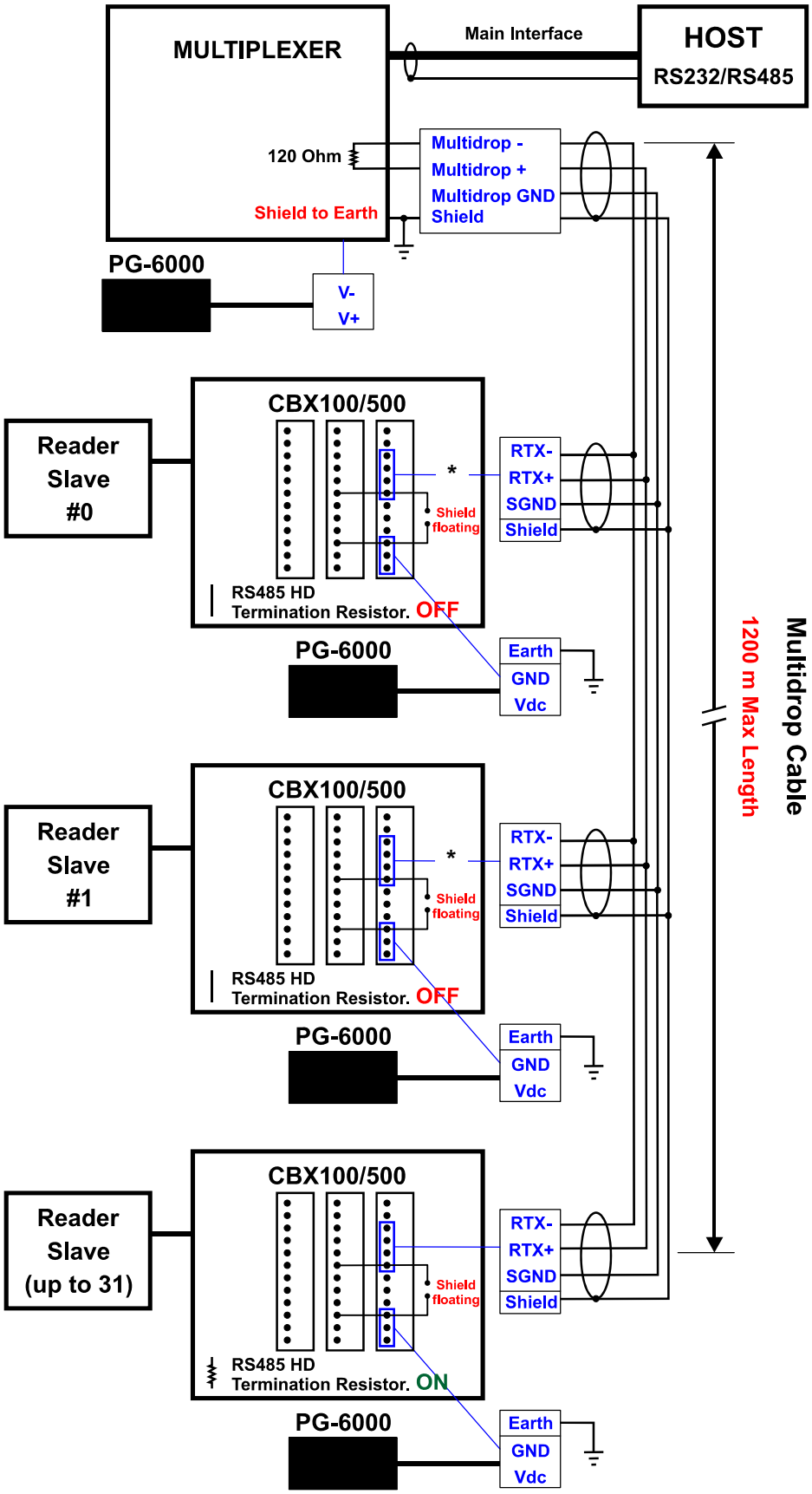


Figure 55 - Matrix 400™ Multidrop Connection to a Multiplexer

* When using CBX500, the **Main** interface multidrop network signals: **Shield**, **SGND**, **RTX+**and **RTX-** are repeated on terminal connector row 4 to facilitate system cabling.

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 57, Figure 58 and Figure 59.

- 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.

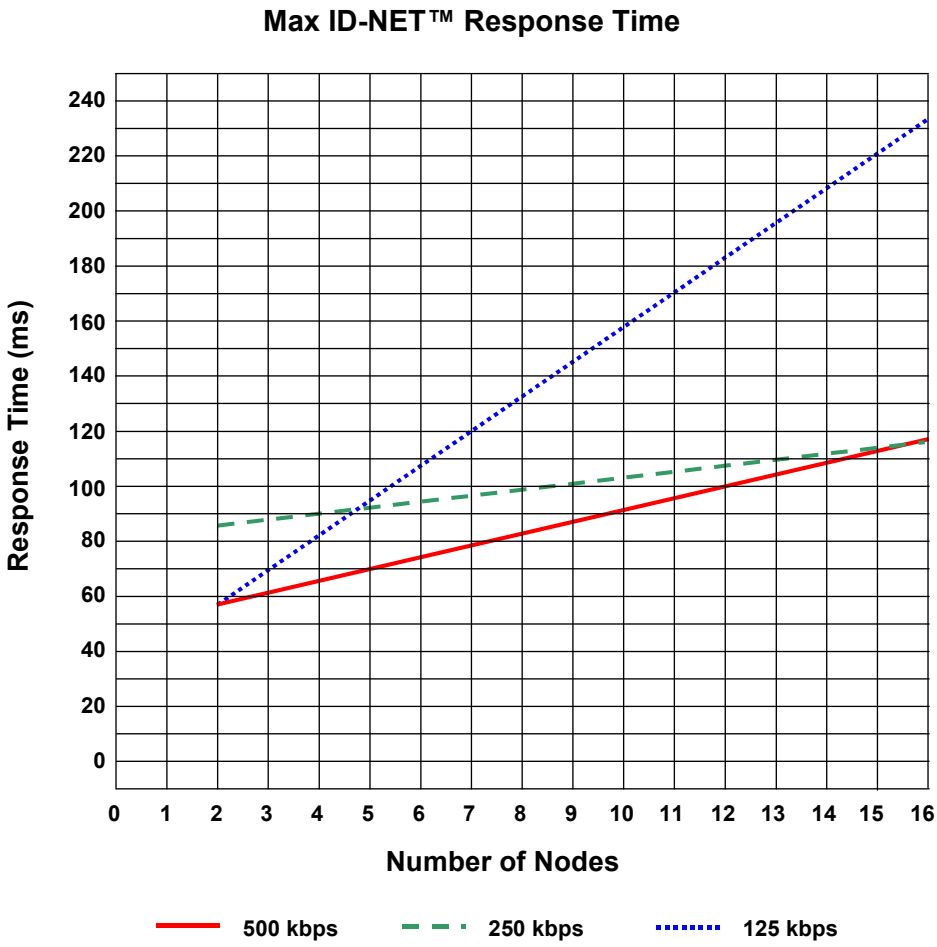


Figure 56 – ID-NET™ Response Time

CONDITIONS:

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

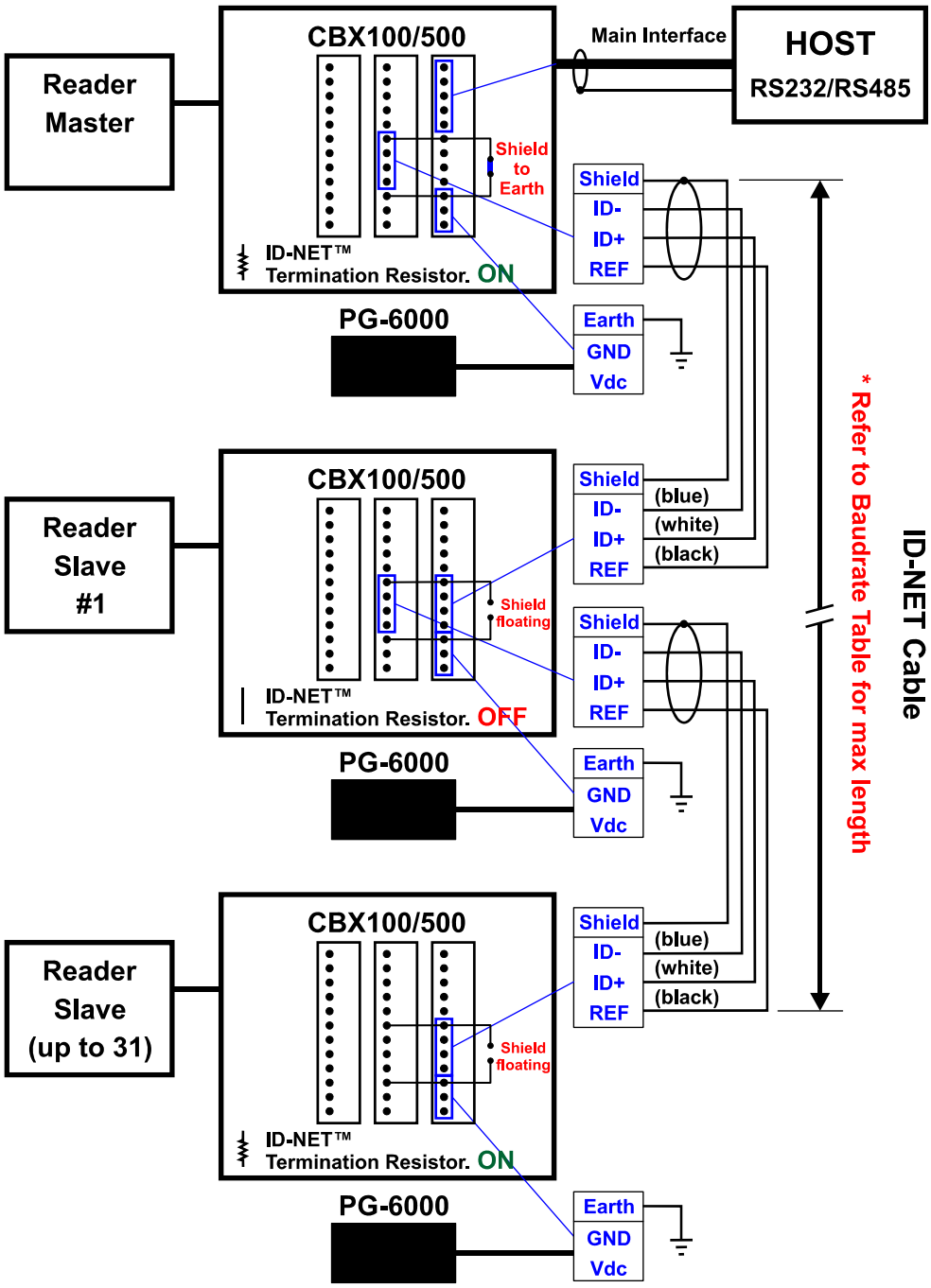


Figure 57 – ID-NET™ Network Connections with isolated power blocks

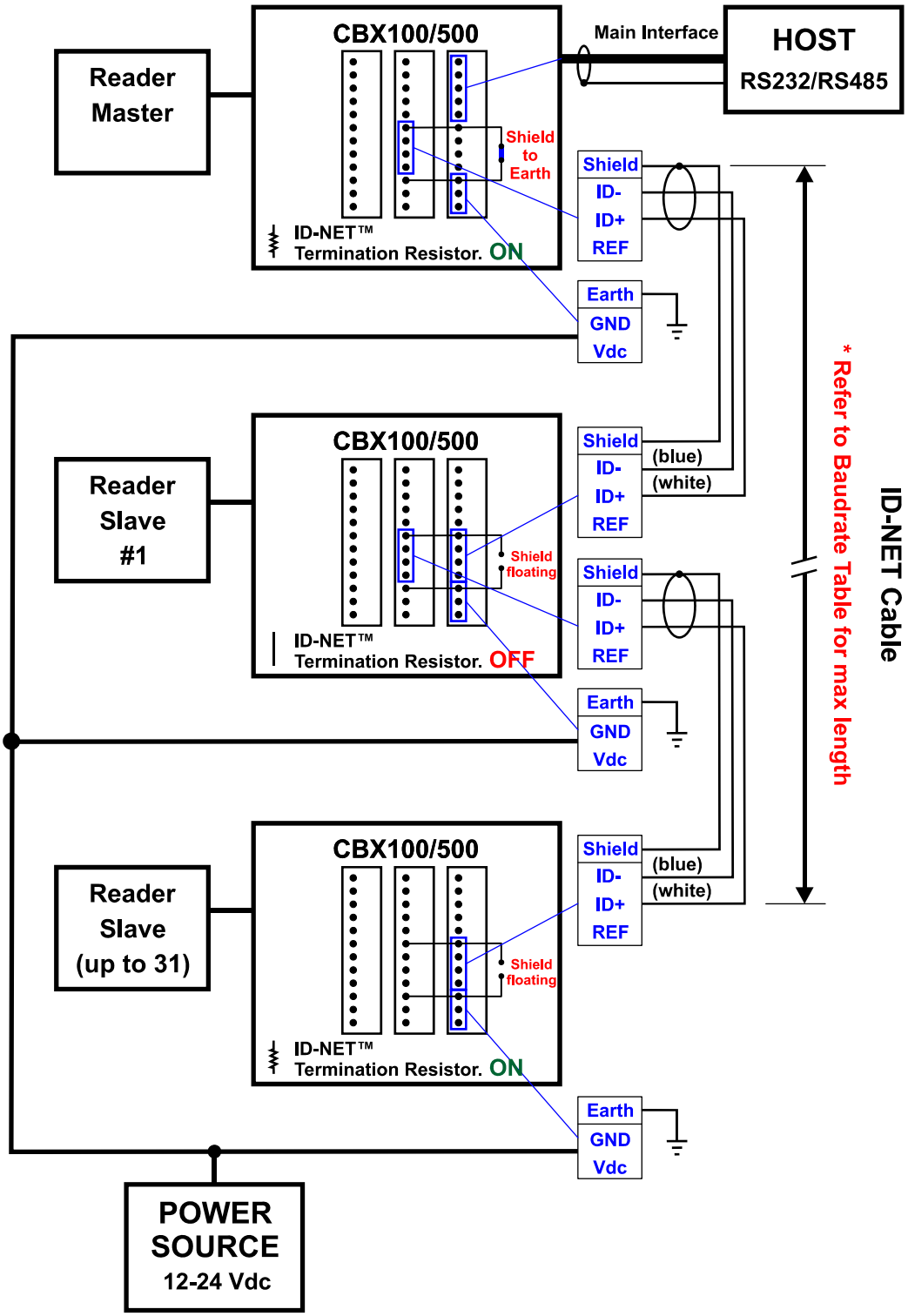


Figure 58 - ID-NET™ Network Connections with Common Power Branch Network

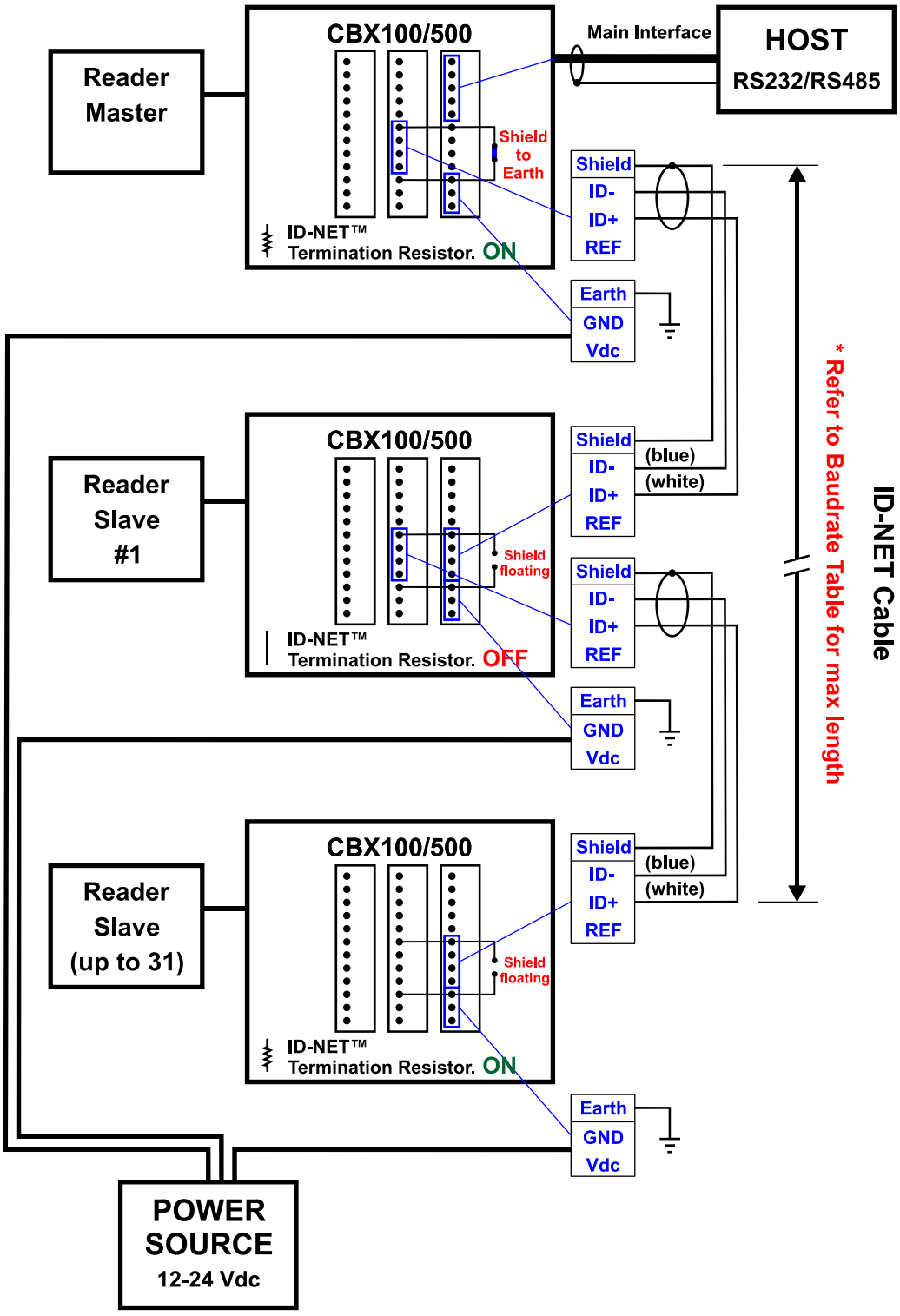


Figure 59 – ID-NET™ Network Connections with Common Power Star Network

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.

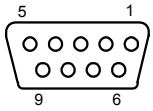


Figure 60 - 9-pin female connector

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

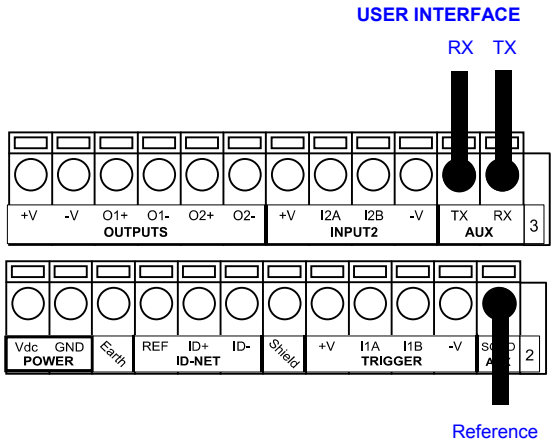


Figure 61 - RS232 Auxiliary Interface Connections

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 minimum pulse duration is ≅ 0.5 milliseconds. This value can be increased through the software parameter Debounce Filter, see the Digital I/O folder in the VisiSet™ Help On Line for further details.

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

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

The connections are indicated in the following diagrams:

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

The yellow Trigger LED (Figure 19, 5) is on when the active state of the External Trigger corresponds to ON.

EXTERNAL TRIGGER INPUT CONNECTIONS USING MATRIX 400™ POWER

CAUTION

Power is available directly to the Input Device, independently from the Power Supply Switch inside the CBX.

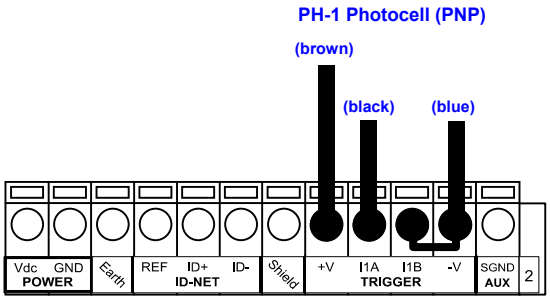


Figure 62 – PH-1 External Trigger Using MATRIX 400™ Power

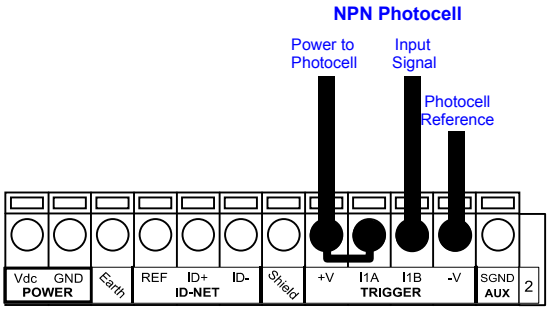


Figure 63 - NPN External Trigger Using MATRIX 400™ Power

EXTERNAL TRIGGER INPUT CONNECTIONS USING EXTERNAL POWER

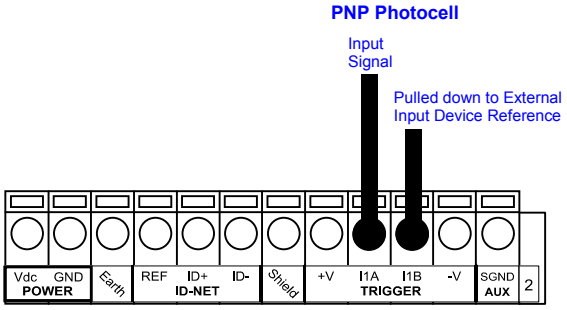


Figure 64 - PNP External Trigger Using External Power

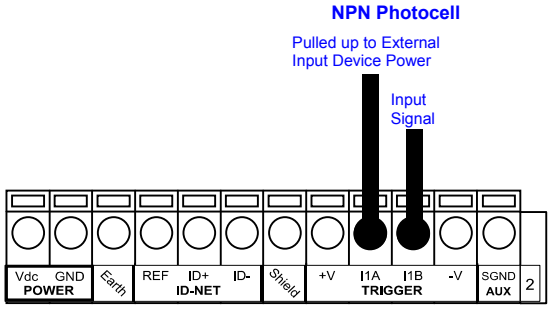


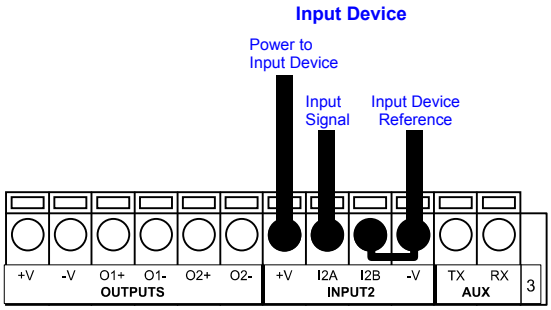
Figure 65 - NPN External Trigger Using External Power

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

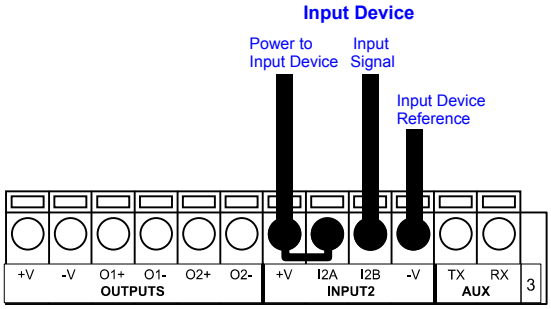
INPUT 2 CONNECTIONS USING MATRIX 400™ POWER

CAUTION

Power is available directly to the Input Device, independently from the Power Supply Switch inside the CBX.



PNP Input 2 Using MATRIX 400™ Power



NPN Input 2 Using MATRIX 400™ Power

INPUT 2 CONNECTIONS USING EXTERNAL POWER

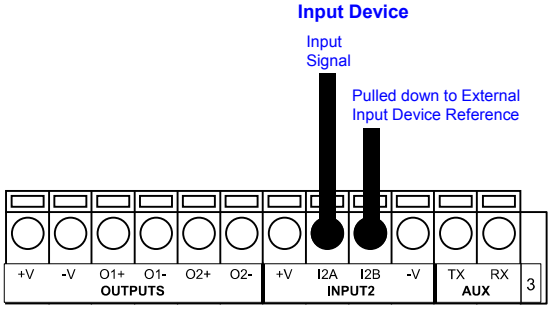


Figure 66 - PNP Input 2 Using External Power

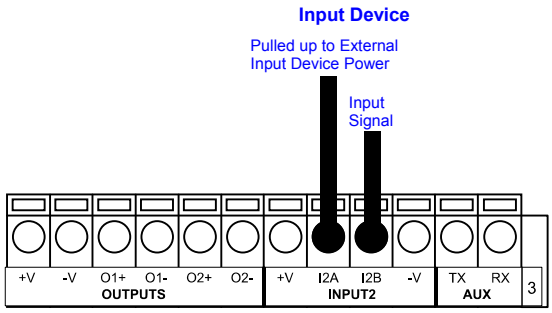


Figure 67 - NPN Input 2 Using External Power

4.6 OUTPUTS

Two optocoupled general purpose outputs are available. The meaning of the two outputs Output 1 and Output 2 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 +
O1-	Output 1 -
O2+	Output 2 +
O2-	Output 2 -
-V	Power Reference Outputs

The electrical features of the two outputs are the following:

V_{CE} = 30 Vdc max.

I_{CE} = 40 mA continuous max.; 130 mA pulsed max.

$V_{CE\ saturation}$ = 1 Vdc max. @ 10 mA

P_D = 80 mW Max. @ 45 °C ambient temp.

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 CONNECTIONS USING MATRIX 400™ POWER

CAUTION

Power is available directly to the Output Device, independently from the Power Supply Switch inside the CBX.

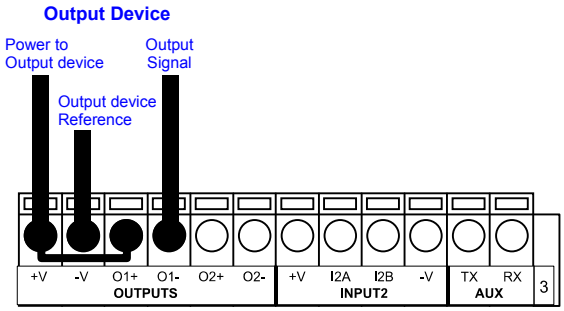


Figure 68 - Open Emitter Output Using MATRIX 400™ Power

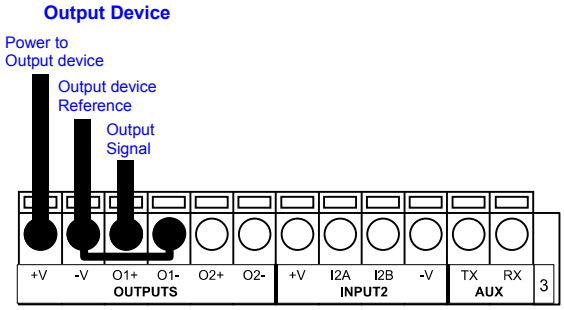


Figure 69 - Open Collector Output Using MATRIX 400™ Power

OUTPUT CONNECTIONS USING EXTERNAL POWER

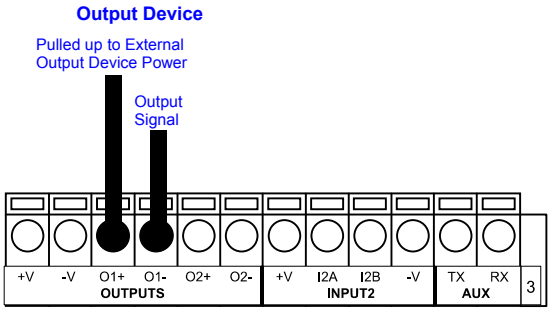


Figure 70 - Output Open Emitter Using External Power

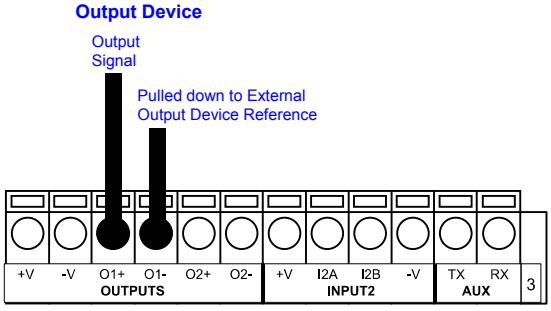


Figure 71 - Output Open Collector Using External Power

4.7 EXTERNAL LIGHTING SYSTEMS

If an External Illuminator is used, it can be powered from the CBX connection box. It must be connected to the **Vdc** and **GND** terminal clamps.

CAUTION

Power is available directly to the Illuminator, independently from the Power Supply Switch inside the CBX.

In the case of the LT-100, LT-200 or LT-300 illuminators, one of the available digital outputs must be connected as the control signal. In VisiSet™, configure the Output Line Function parameter to "External Lighting System" and the Matrix Output *x* External Lighting System Mode parameter to "Triggered".

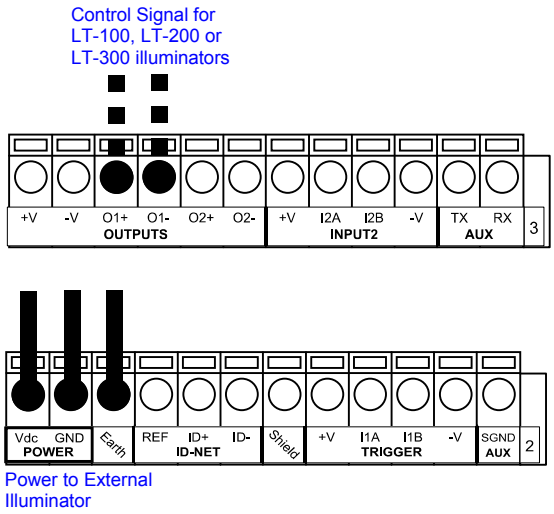


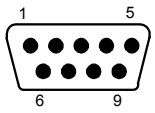
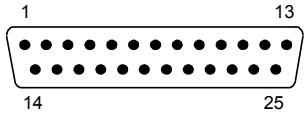
Figure 72 – External Lighting System Connections

Below is a table summarizing the various External Illuminator wiring and power requirements:

Illuminator	Wire Color	CBX/Matrix Signal	Meaning
LT-100 LT-200	Red	Vdc	10 to 30 Vdc
	Black	GND	Ground
	Blue	O1- or O2-	Control Signal -
	White	O1+ or O2+	Control Signal +
LT-300	Brown	Vdc	10 to 30 Vdc
	Black	GND	Ground
	Yellow/Green	Earth	Shield/Earth Ground
	Blue	O1- or O2-	Control Signal -
	White	O1+ or O2+	Control Signal +
LT-210, LT-314, LT-316, LT-410 LT-510, LT-511	White	Vdc	24 Vdc
	Black	GND	Ground
	Shield	Earth	Shield/Earth Ground

4.8 USER INTERFACE - 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 MATRIX 400™ CONNECTOR ELECTRICAL CONNECTIONS

5.1 M16 19-PIN CONNECTOR

The Matrix 400™ reader is equipped with an M16 19-pin male connector (Binder, 423 Series) for connection to the power supply, serial interfaces and input/output signals. The details of the connector pins are indicated in the following table:

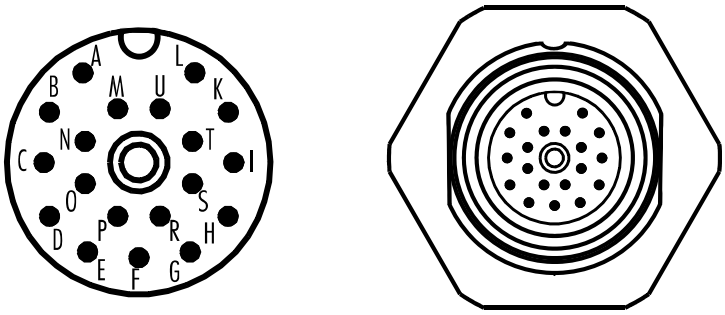


Figure 73 – M16 19-pin Male Connector

19-pin M16 male connector pinout				
Pin	**Name**	**Function**		
A L K	Vdc GND CHASSIS	Power supply input voltage + Power supply input voltage - Cable shield internally connected by capacitor to the chassis		
B C D E	I1A I1B I2A I2B	External Trigger A (polarity insensitive) External Trigger B (polarity insensitive) Input 2 A (polarity insensitive) Input 2 B (polarity insensitive)		
H F G I	O1+ O1- O2+ O2-	Output 1 + Output 1 - Output 2 + Output 2 -		
S O	RX TX	Auxiliary RS232 RX Auxiliary RS232 TX		
R P	ID+ ID-	ID-NET™ network + ID-NET™ network -		
Pin	**Name**	**RS232**	**RS485 Full-Duplex**	**RS485 Half-Duplex**
M U N T	MAIN INTERFACE (SW SELECTABLE)	TX RX RTS CTS	TX+ *RX+ TX- *RX-	RTX+ RTX-

* Do not leave floating, see par. 5.4.2 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 the main interface cable shield to pin K of the 19-pin connector;

5.2 M12-D 4-PIN CONNECTOR (ETHERNET)

In Matrix 400 xxx-x1x models, an M12 D-Coded connector is provided for the on-board Ethernet connection. This interface is IEEE 802.3 10 BaseT and IEEE 802.3u 100 BaseTx compliant. See par. 5.7 for connection details.

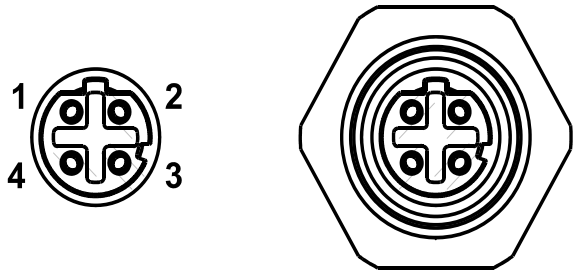


Figure 74 - M12 D-Coded Female Ethernet Network Connector

M12 D-Coded Ethernet Network Connector pinout		
Pin	**Name**	**Function**
1	TX +	Transmitted data (+)
2	RX +	Received data (+)
3	TX -	Transmitted data (-)
4	RX -	Received data (-)

5.3 POWER SUPPLY

Power is supplied to the reader through the pins provided on the M16 19-pin connector (see Figure 75):

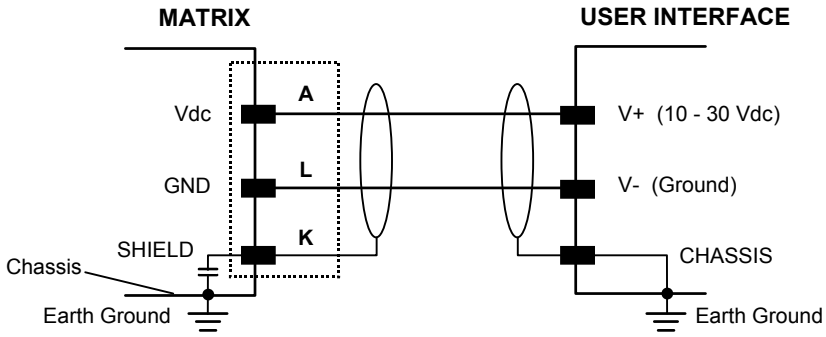


Figure 75 - Power Supply Connection

The allowed supply voltage range is 10 to 30 Vdc.

5.4 MAIN SERIAL INTERFACE

The signals relative to the following serial interface types are available on the M16 19-pin connector:

The main serial interface type and its parameters (baud rate, data bits, etc.) can be defined by the user via VisiSet™ software. The RS485 half duplex is automatically set whenever MUX32 communication protocol is enabled. 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.

5.4.1 RS232 Interface

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

The following pins of the M16 19-pin connector are used for RS232 interface connection:

Pin	Name	Function
M	TX	Transmit Data
U	RX	Receive Data
N	RTS	Request To Send
T	CTS	Clear To Send
L	GND	Ground

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

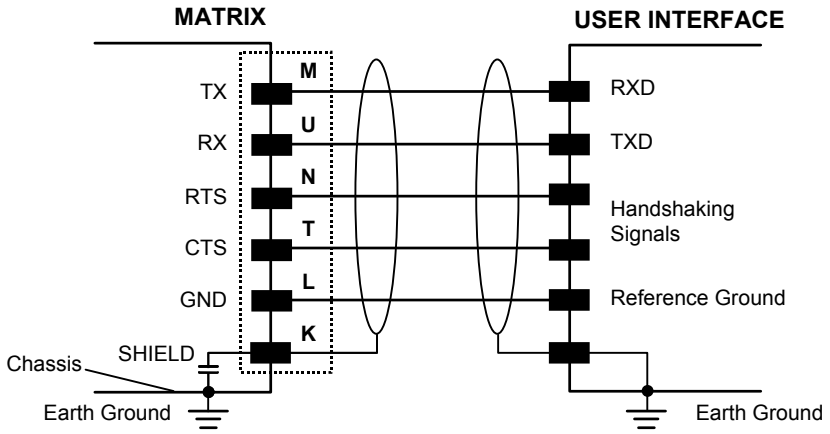


Figure 76 - RS232 Main Interface Connections

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

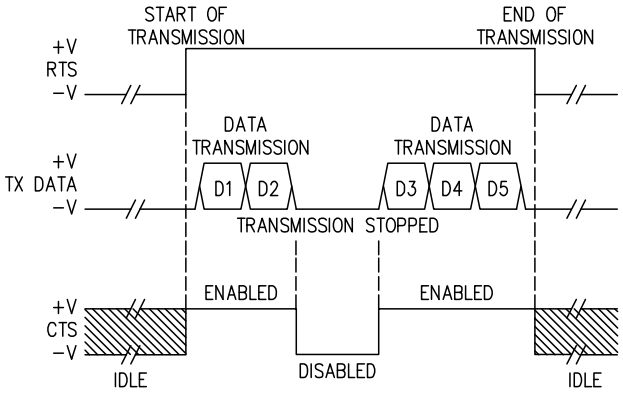


Figure 77 - RS232 Control Signals

If the RTS/CTS handshaking protocol is enabled, Matrix 400™ activates the RTS output to indicate a message is to be transmitted. The receiving unit activates the CTS input to enable the transmission.

5.4.2 RS485 Full-Duplex Interface

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

The following pins of the M16 19-pin connector are used for RS485 full-duplex communication:

Pin	Name	Function
M	TX+	RS485 Transmit Data (+)
N	TX-	RS485 Transmit Data (-)
U	RX+	RS485 Receive Data (+)
T	RX-	RS485 Receive Data (-)
L	GND	Ground

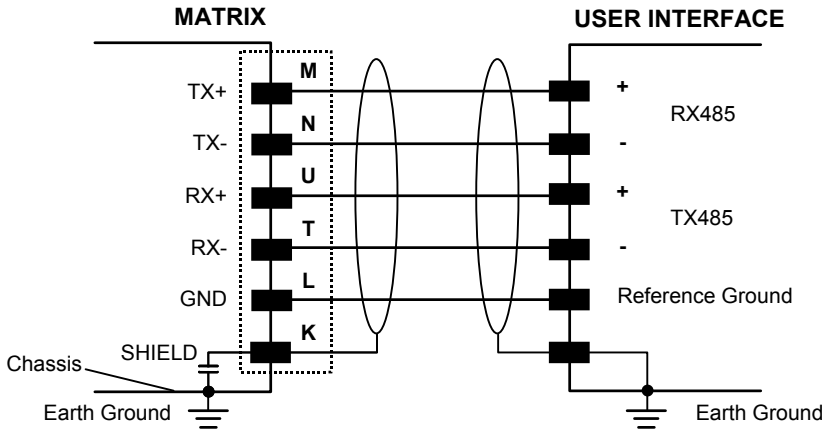


Figure 78 - RS485 Full-duplex Connections

NOTE

For applications that do not use RX485 signals, do not leave these lines floating but connect them to GND as shown below.

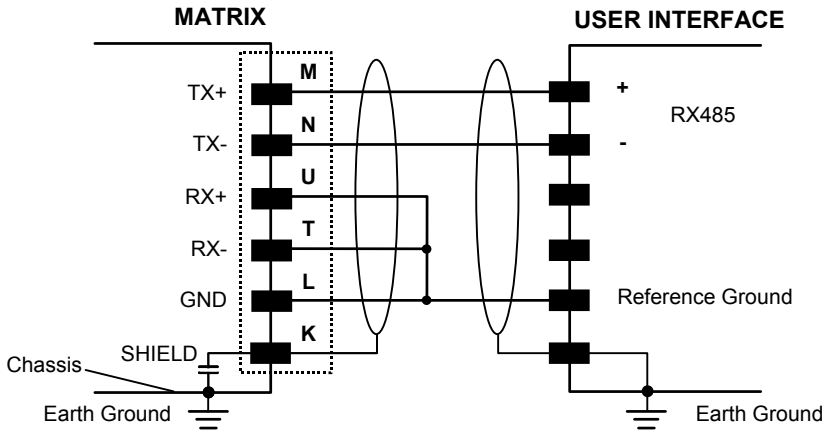


Figure 79 - RS485 Full-duplex Connections using Only TX Signals

5.4.3 RS485 Half-Duplex Interface

NOTE

This interface is provided for backward compatibility. We recommend using the more efficient ID-NET™ network for Master/Slave or Multiplexer layouts.

The RS485 half-duplex (3 wires + shield) interface is available for polled communication protocols.

It can be used for Multidrop connections with a Datalogic Multiplexer, (see par. 6.5) exploiting a proprietary protocol based on polled mode called MUX32 protocol, where a master device polls slave devices to collect data.

The following pins of the M16 19-pin connector are used for RS485 half-duplex communication:

Pin	Name	Function
M	RTX+	RS485 Receive/Transmit Data (+)
N	RTX-	RS485 Receive/Transmit Data (-)
L	GND	Ground

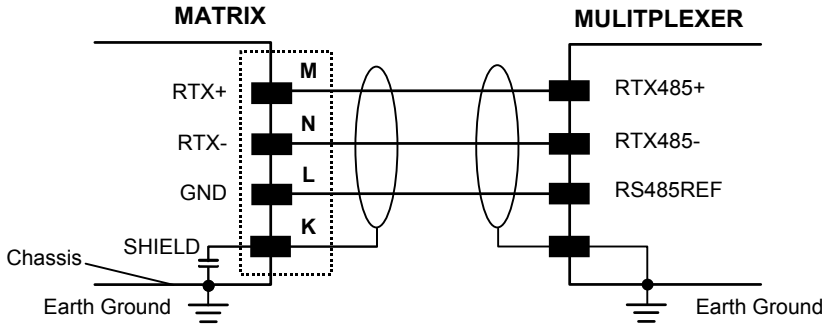


Figure 80 - RS485 Half-duplex Connections

This interface is forced by software when the protocol selected is MUX32 protocol.

In a Multiplexer layout, the Multidrop address must also be set via serial channel by the VisiSet™ utility or by the Host Programming Mode.

The figure below shows a multidrop configuration with Matrix 400™ readers connected to a Multiplexer.

CAUTION

This is an example of multidrop wiring. Consult the multiplexer manual for complete wiring instructions.

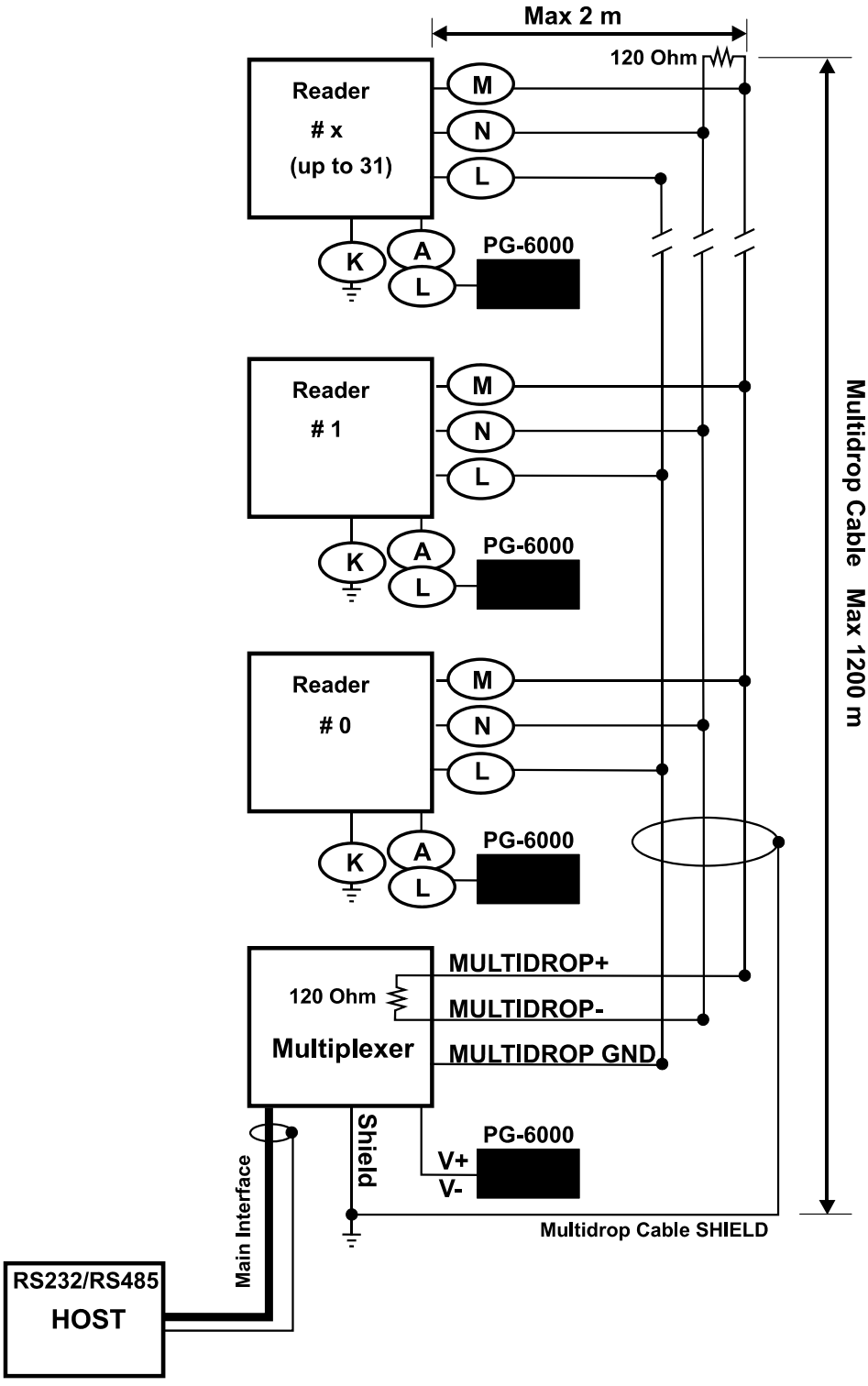


Figure 81 - Matrix 400™ Multidrop Connection to a Mutiplexer

5.5 ID-NET™ INTERFACE

Pin	Name	Function
R	ID+	ID-NET™ network +
P	ID-	ID-NET™ network -
L	GND	Ground

5.5.1 ID-NET™ Cables

The following instructions are referred to Figure 83, Figure 84 and Figure 85.

- 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 (R and P).
  - 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.

5.5.2 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.

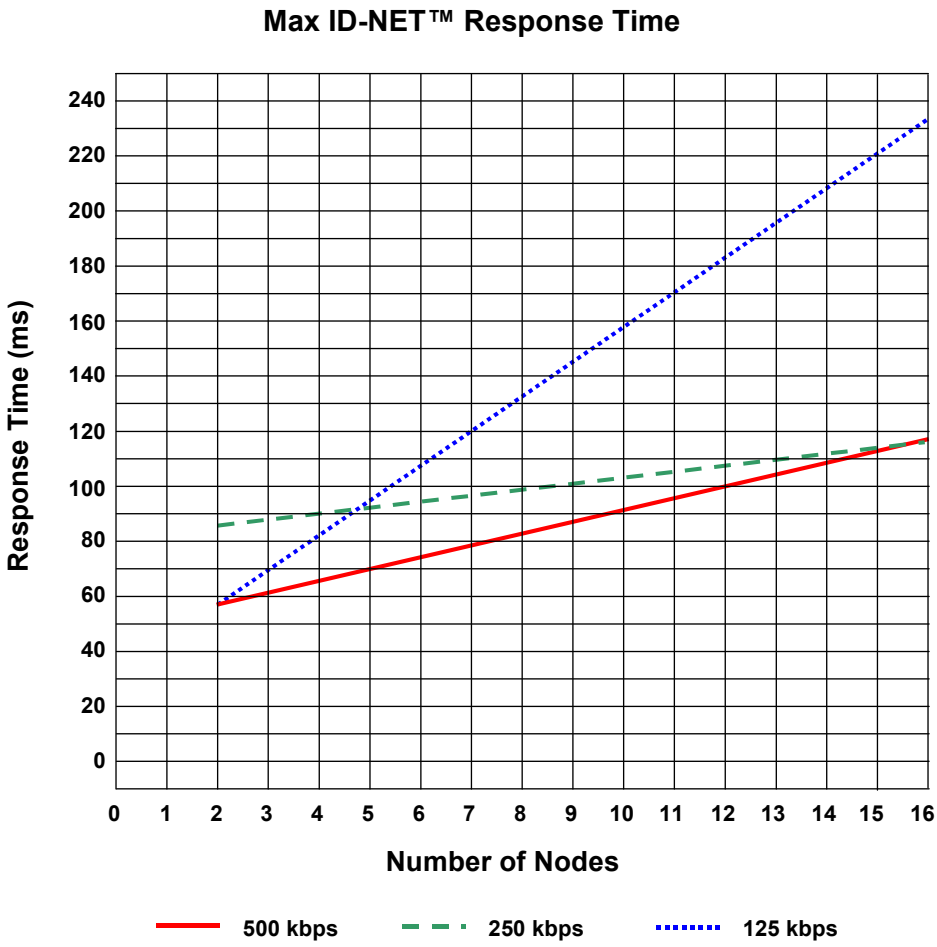


Figure 82 – ID-NET™ Response Time

CONDITIONS:

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

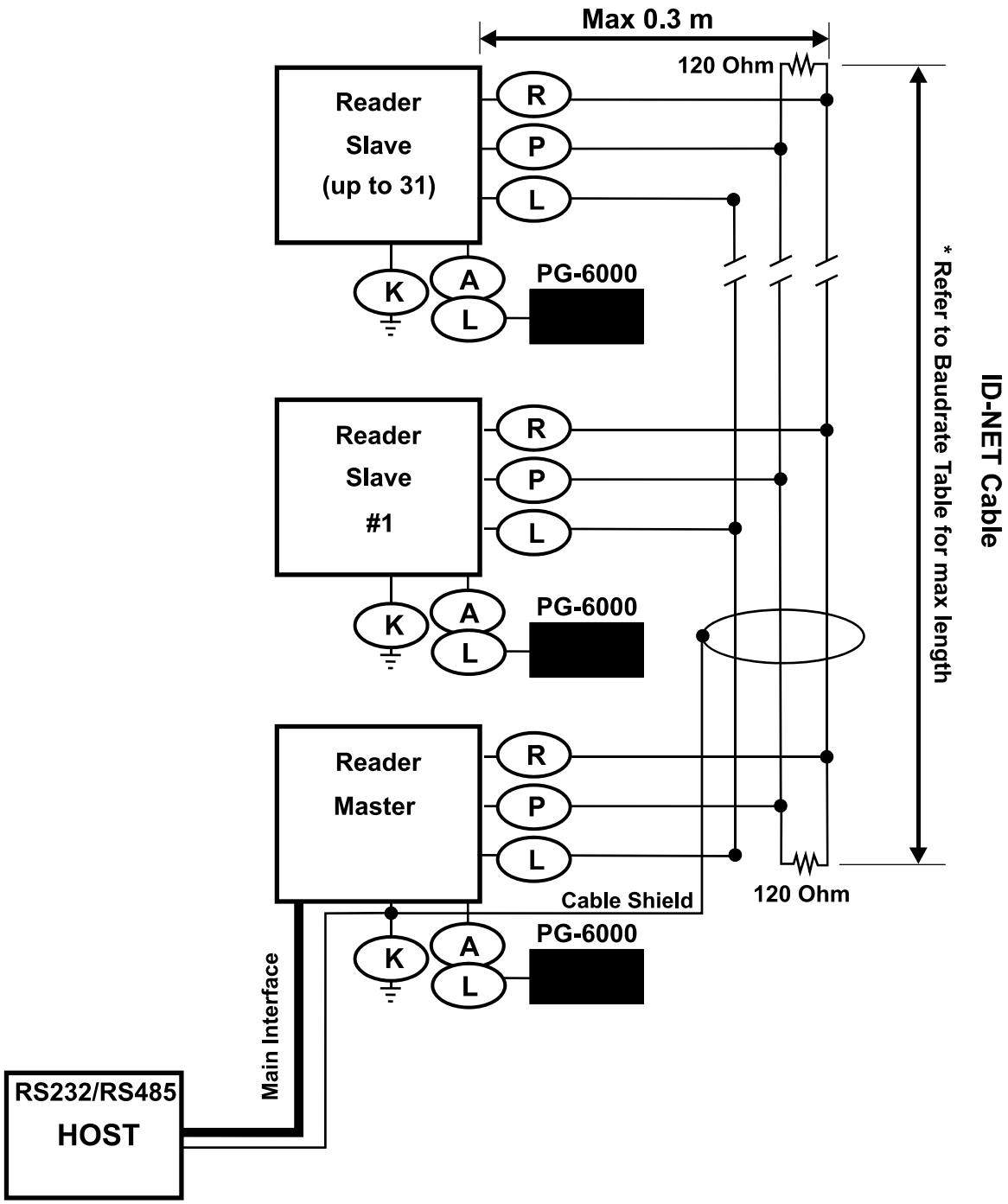


Figure 83 – ID-NET™ Network Connections with isolated power blocks

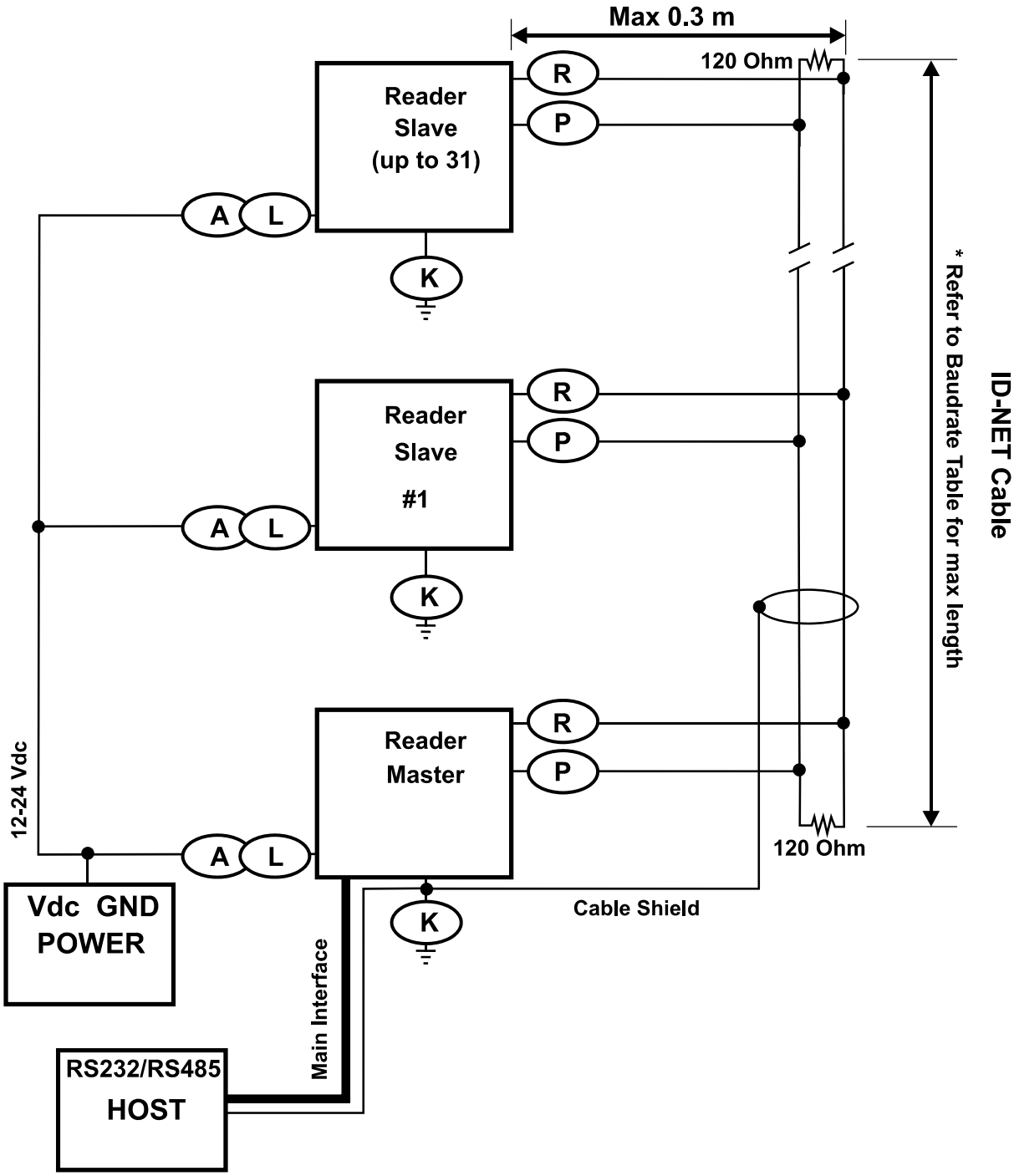


Figure 84 - ID-NET™ Network Connections with Common Power Branch Network

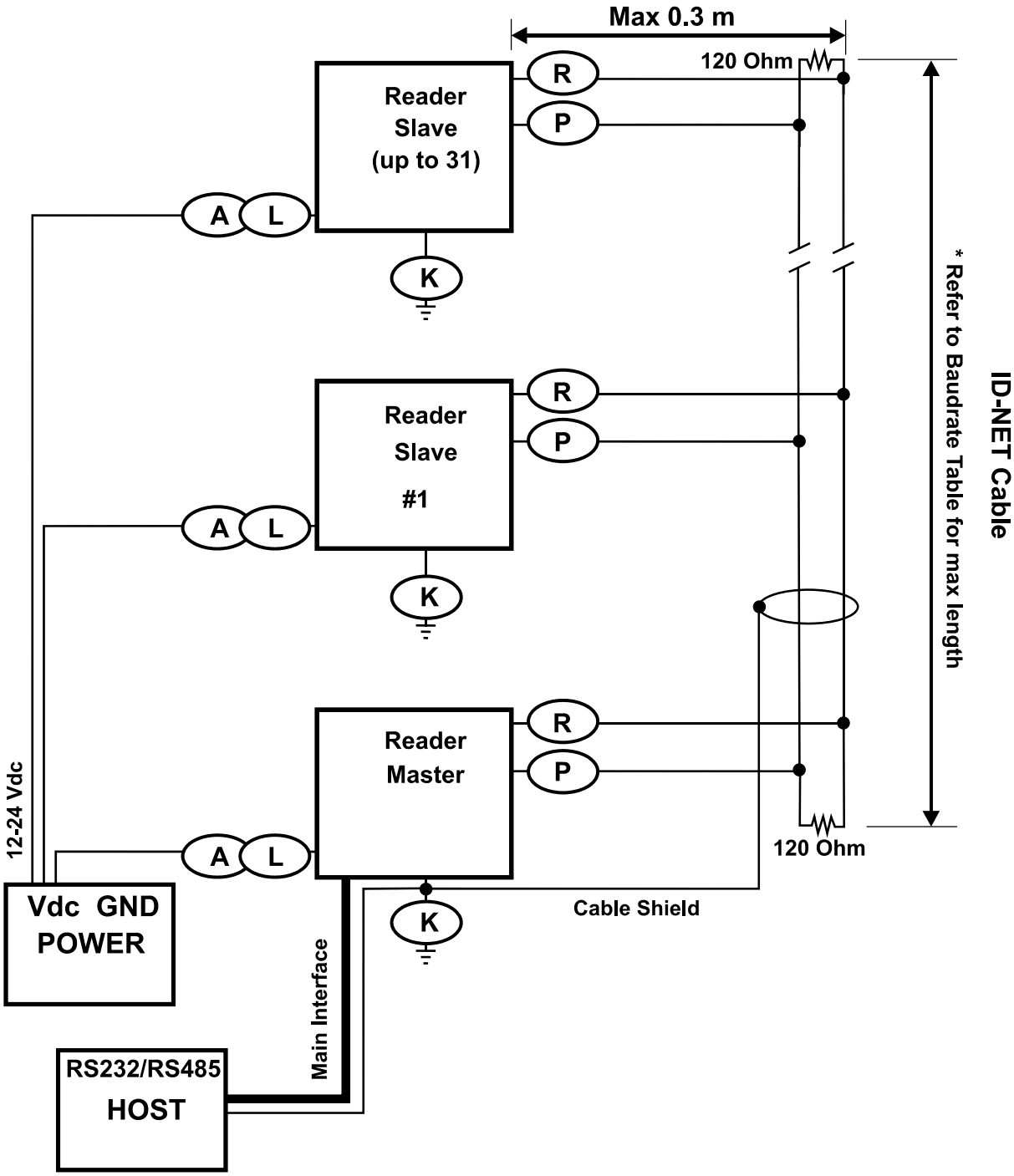


Figure 85 – ID-NET™ Network Connections with Common Power Star Network

5.5.3 ID-NET™ Network Termination

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

5.6 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 following pins of the M16 19-pin connector are used for auxiliary interface communication:

Pin	Name	Function
O	TX	Transmitted data
S	RX	Received data
L	GND	Ground

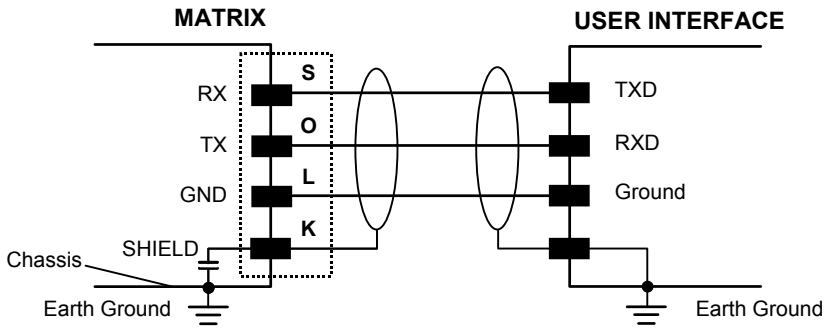


Figure 86 - RS232 Auxiliary Interface Connections Using 19-pin Connector

5.7 ETHERNET INTERFACE (MATRIX 400 XXX-010 MODELS ONLY)

The 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.

The following is an example of a connection to a LAN using a **CAB-ETH-M0x** straight through cable:

M12 D-Coded Connector Pinout		
Pin	**Name**	**Function**
1	TX+	Transmitted data (positive pin)
2	RX+	Received data (positive pin)
3	TX-	Transmitted data (negative pin)
4	RX-	Received data (negative pin)

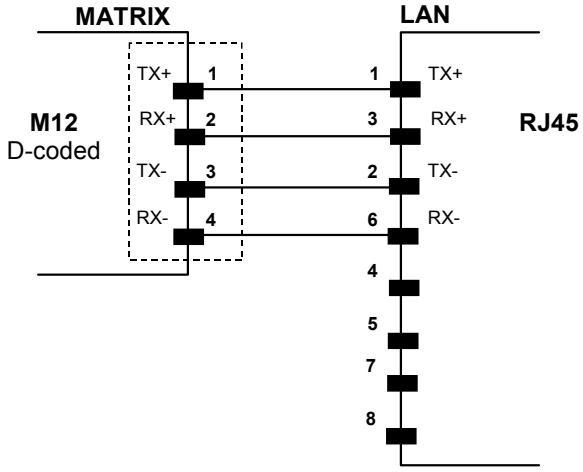


Figure 87 - Straight-Through Cable

For direct connection to a PC use the **CAB-ETH-M0x** cable with a crossover adapter.

On the Matrix 400™ Ethernet interface the following communication channels are available:

- Data Socket
- Image Socket
- WebSentinel Socket
- Image FTP Client
- HTTP Server
- Email Client
- Ethernet IP

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.

5.8 INPUTS

There are two optocoupled polarity insensitive inputs available on the M16 19-pin connector of 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:

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

The 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 minimum pulse duration is ≅ 0.5 milliseconds. This value can be increased through the software parameter Debounce Filter, see the Digital I/O folder in the VisiSet™ Help On Line for further details.

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

NOTE

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

The connections are indicated in the following diagrams:

Pin	Name	Function
A	Vdc	Power Supply input voltage +
B	I1A	External Trigger A (polarity insensitive)
C	I1B	External Trigger B (polarity insensitive)
L	GND	Power Supply input voltage -

The yellow Trigger LED (Figure 19, 5) is on when the active state of the External Trigger corresponds to ON.

EXTERNAL TRIGGER INPUT PNP PH-1

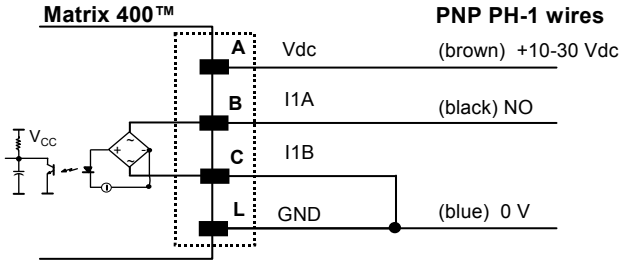


Figure 88 - External Trigger Using PNP PH-1 Photocell

EXTERNAL TRIGGER INPUT CONNECTIONS USING MATRIX 400™ POWER

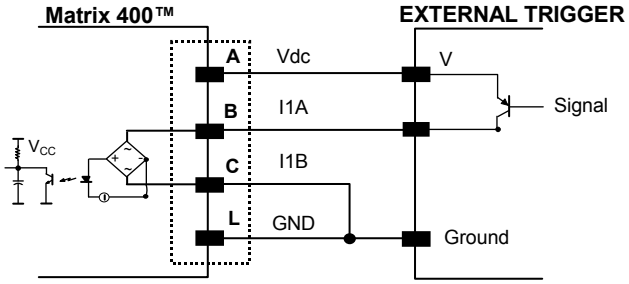


Figure 89 – External Trigger PNP Using Matrix 400™ Power

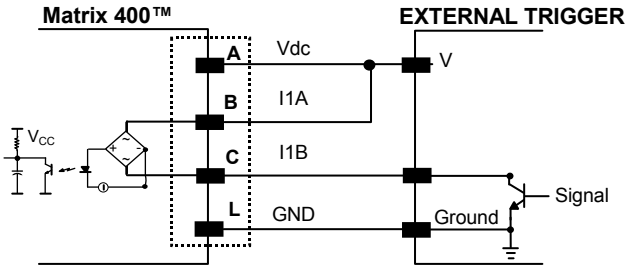


Figure 90 - External Trigger NPN Using Matrix 400™ Power

EXTERNAL TRIGGER INPUT CONNECTIONS USING EXTERNAL POWER

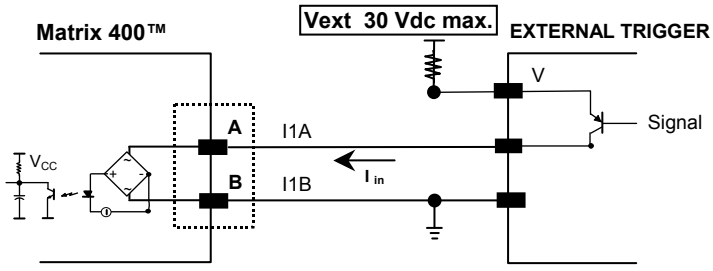


Figure 91 - External Trigger PNP Using External Power

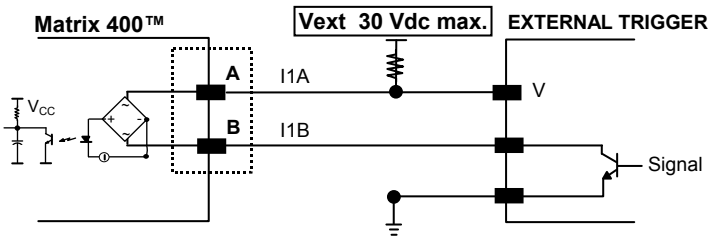


Figure 92 - External Trigger NPN Using External Power

Pin	Name	Function
A	Vdc	Power Supply input voltage +
D	I2A	Input 2 A (polarity insensitive)
E	I2B	Input 2 B (polarity insensitive)
L	GND	Power Supply input voltage -

INPUT 2 CONNECTIONS USING MATRIX 400™ POWER

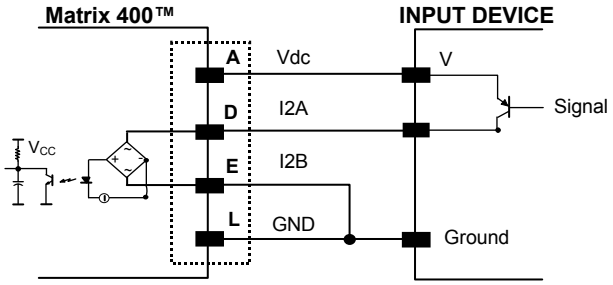


Figure 93 - Input PNP Using Matrix 400™ Power

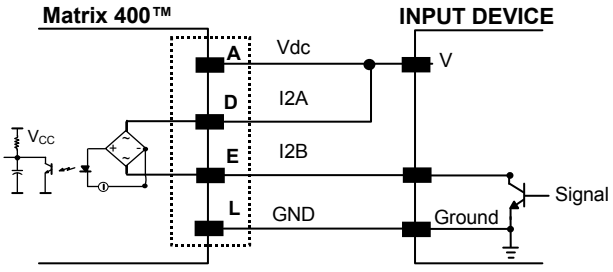


Figure 94 - Input NPN Using Matrix 400™ Power

INPUT 2 CONNECTIONS USING EXTERNAL POWER

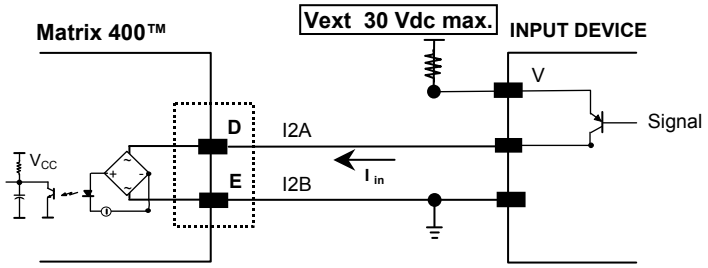


Figure 95 - Input PNP Using External Power

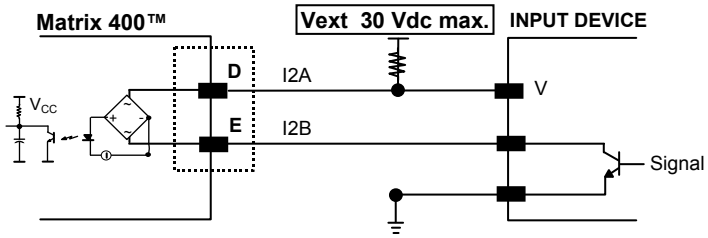


Figure 96 - Input NPN Using External Power

5.9 OUTPUTS

Two opto-coupled general purpose outputs are available on the M16 19-pin connector. The meaning of the two outputs Output 1 and Output 2 can be defined by the user. They are typically used either to signal the data collection result or to control an external lighting system.

The pinout is the following:

Pin	Name	Function
H	O1+	Configurable digital output 1 - positive pin
F	O1-	Configurable digital output 1 - negative pin
G	O2+	Configurable digital output 2 - positive pin
I	O2-	Configurable digital output 2 - negative pin

The electrical features of the two outputs are the following:

OUTPUT	I_{Load}	V_{Out}
Open	0 mA	30 Vdc Max
Closed	10 mA	1.8 Vdc Max

$P_D = V_{Out} \times I_{oLoad}$ = 170 mW Max.

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.

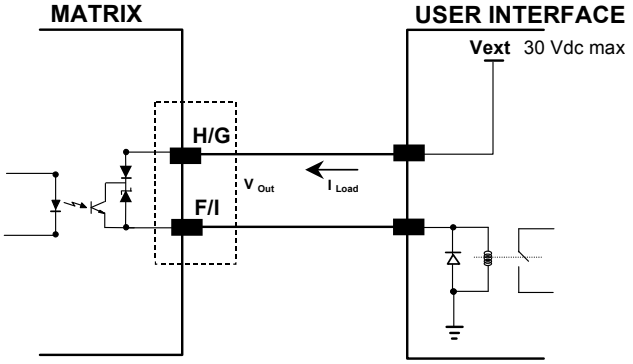


Figure 97 - Open Emitter Output Connection

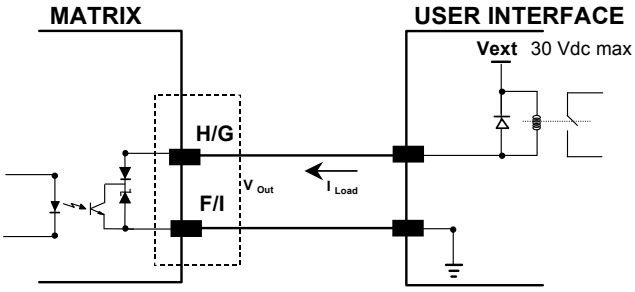
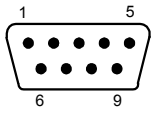
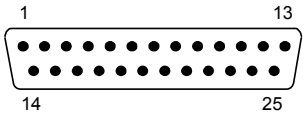


Figure 98 - Open Collector Output Connection

5.10 USER INTERFACE

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

How To Build A Simple Interface Test Cable:

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

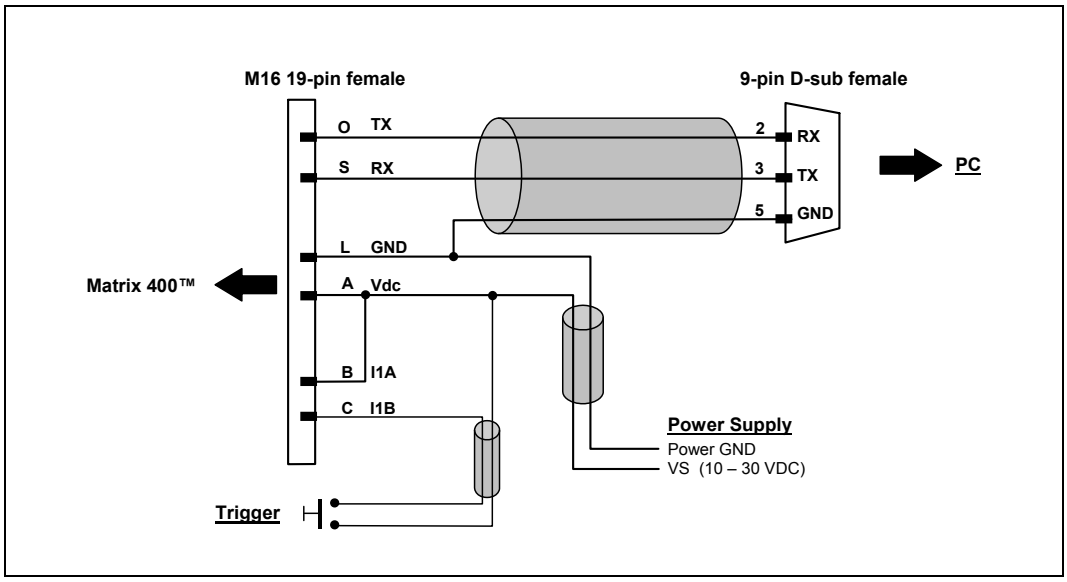


Figure 99- Test Cable for Matrix 400™

6 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.

6.1 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.

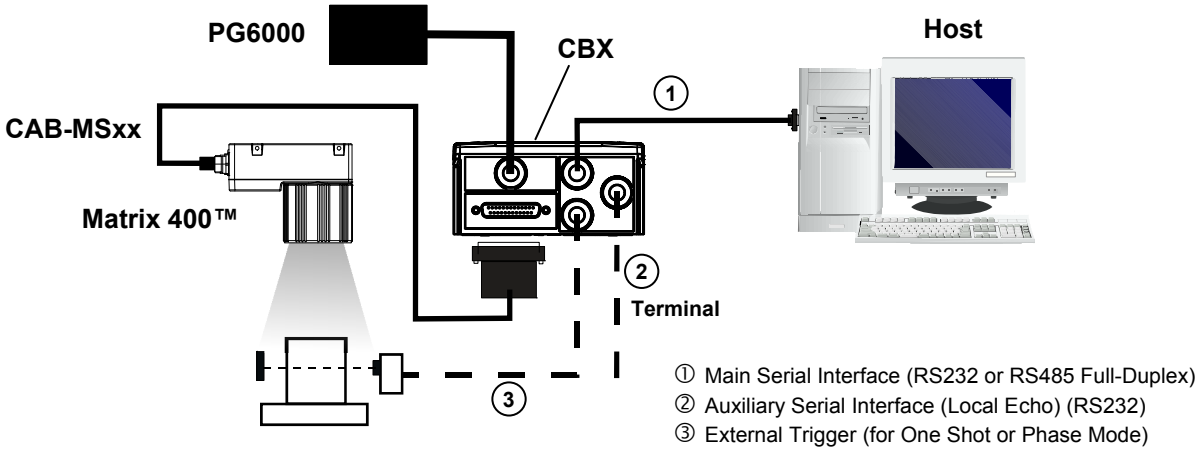


Figure 100 – Serial Interface Point-to-Point Layout

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

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

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

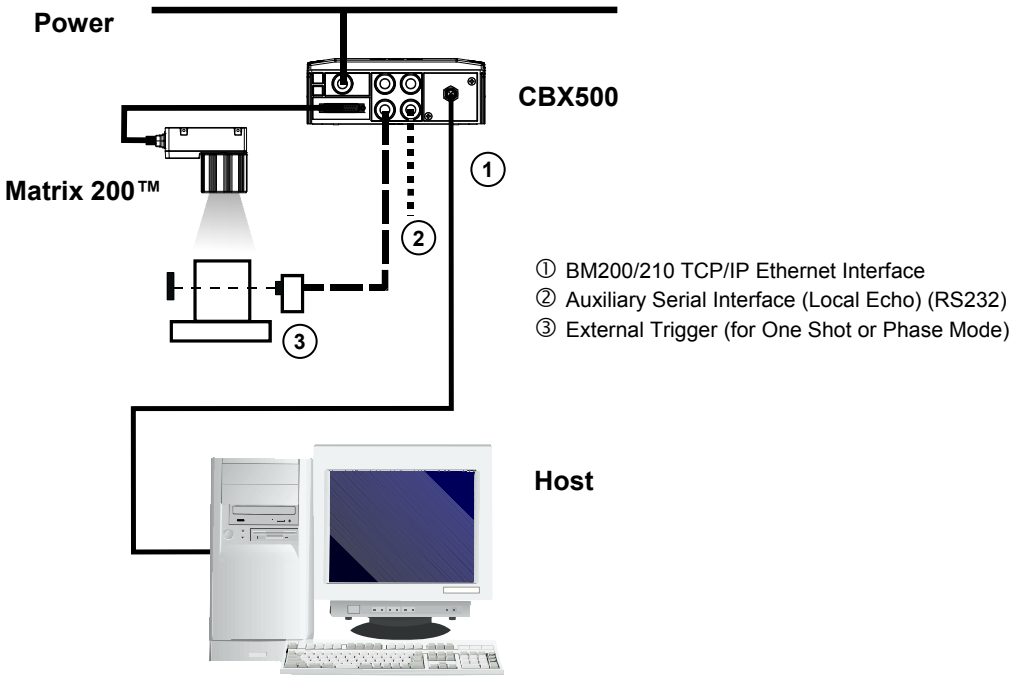


Figure 101 – BM200/210 TCP/IP Ethernet Interface Point-to-Point Layout

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

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

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

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

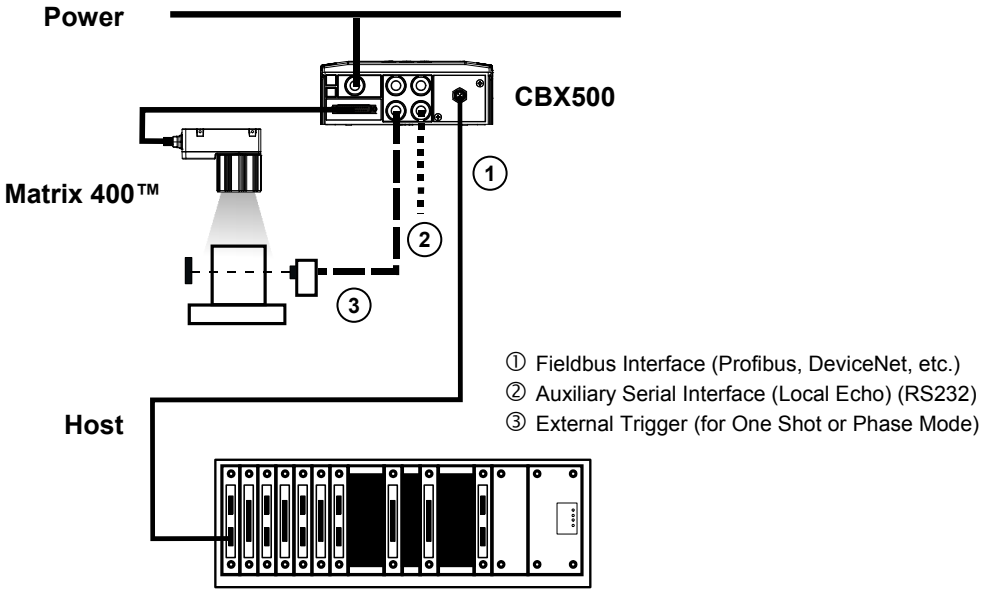


Figure 102 – Fieldbus Interface Point-to-Point Layout

6.2 PASS-THROUGH

6.2.1 Pass-Through on RS232

Pass-through mode allows two or more devices to be connected to a single external serial interface.

Each reader transmits the messages received by the Auxiliary interface onto the Main interface. All messages will be passed through this chain to the host.

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.

Applications can be implemented to connect a device such as a hand-held reader to the Auxiliary port of the last reader in the chain for manual code reading capability.

The Main and Auxiliary ports are connected as shown in the figure below:

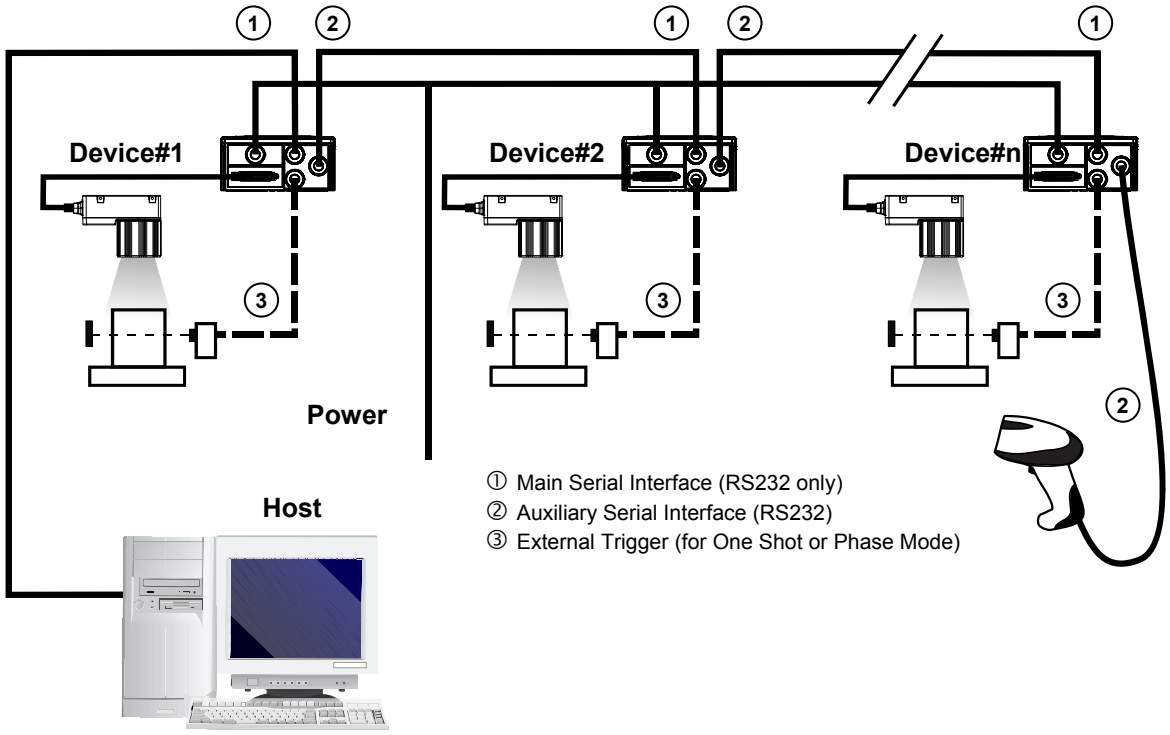


Figure 103 – Pass-Through Layout

NOTE

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

6.2.2 Pass-Through on ID-NET™

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 400™ 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.

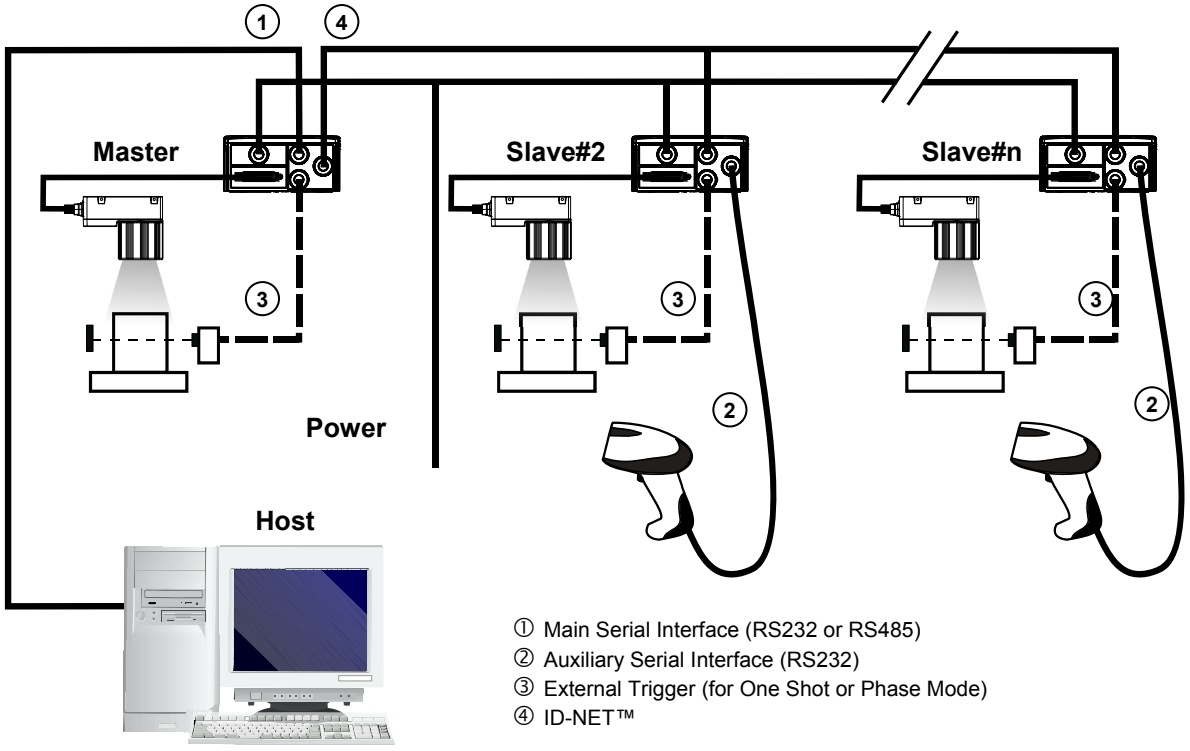


Figure 104 – Pass-Through On ID-NET™ Layout

NOTE

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

6.3 ID-NET™

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 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.

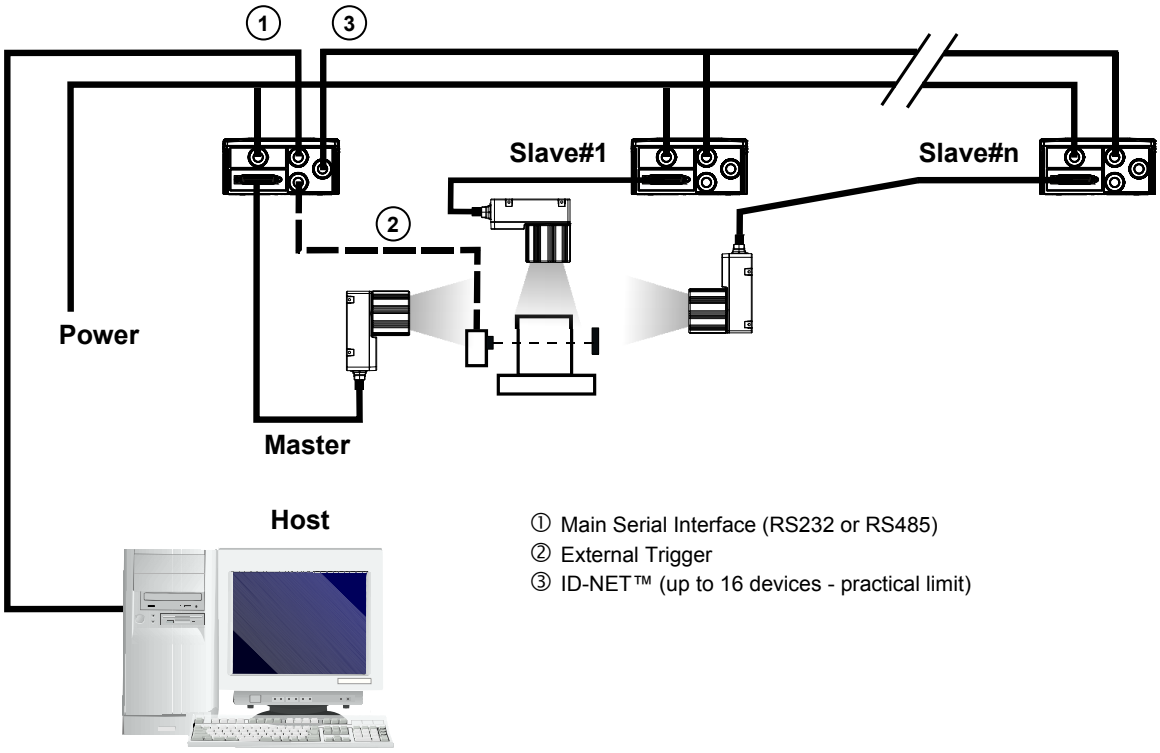


Figure 105 – ID-NET™ M/S Synchronized Layout

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.

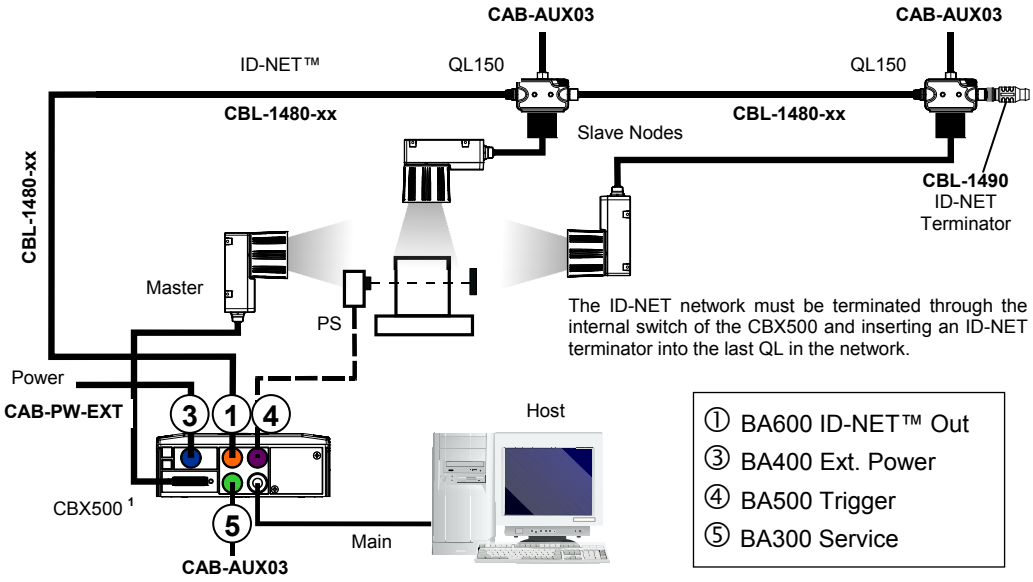


Figure 106 - ID-NET™ Synchronized Layout
Matrix 400™ Master with CBX500 + Matrix 400™ Slaves with QL150

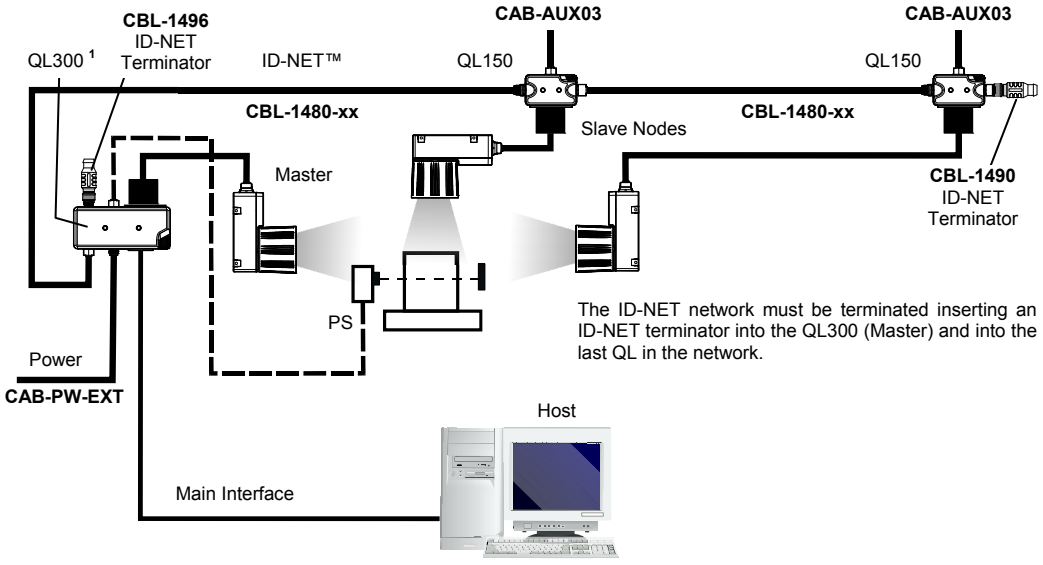


Figure 107 - ID-NET™ Synchronized Layout
Matrix 400™ Master with QL300 + Matrix 400™ Slaves with QL150

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.

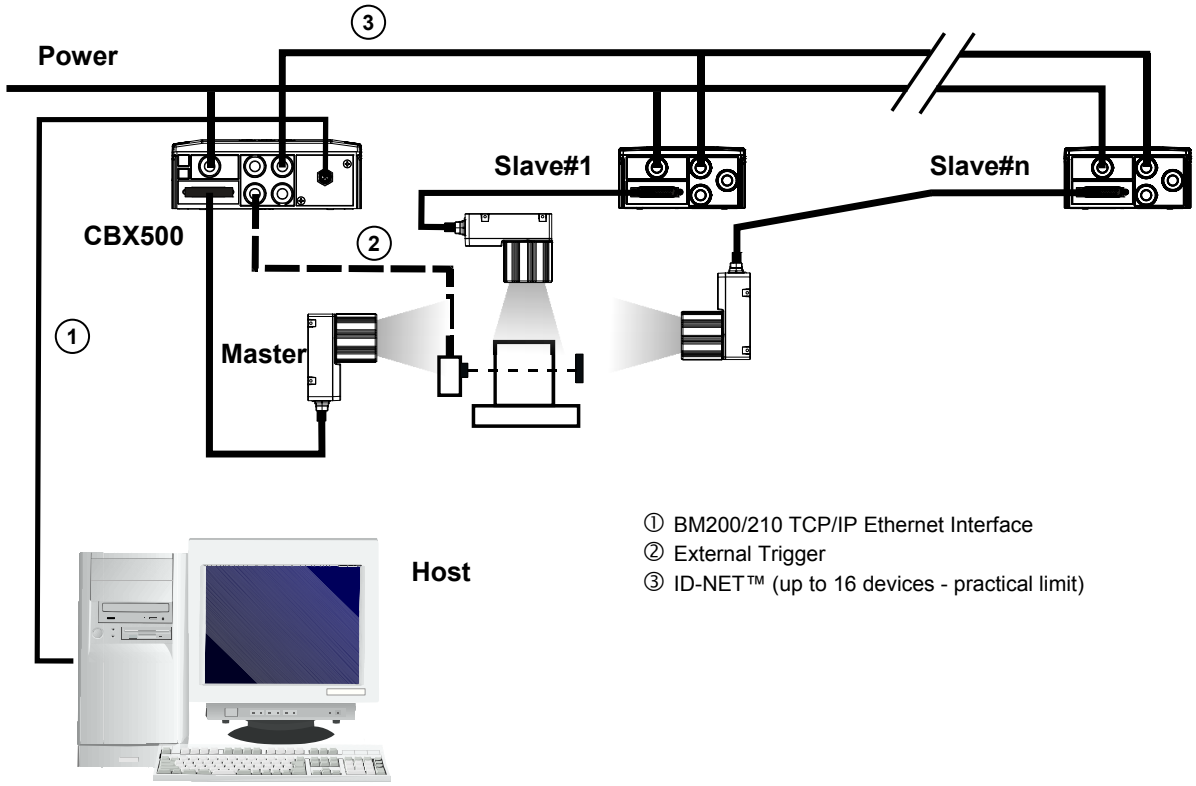


Figure 108 – ID-NET™ M/S Synchronized Layout with BM200/210 TCP/IP Ethernet Interface to Host

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.

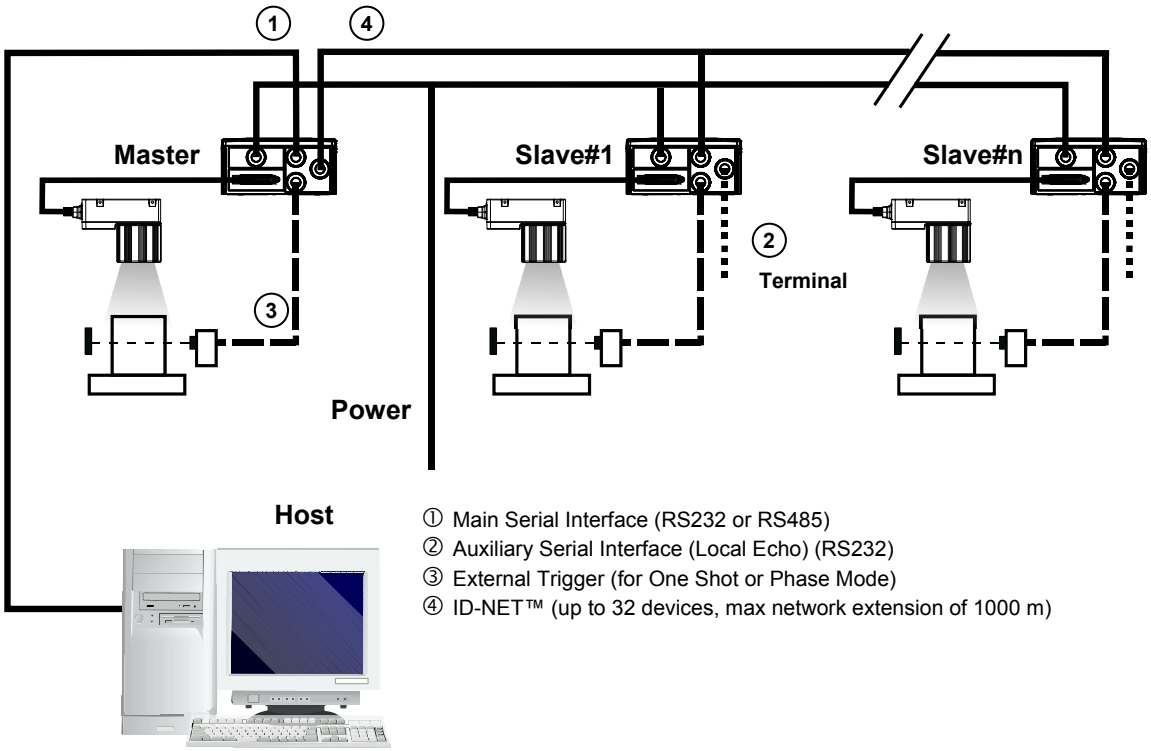


Figure 109 – ID-NET™ M/S Multidata

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.

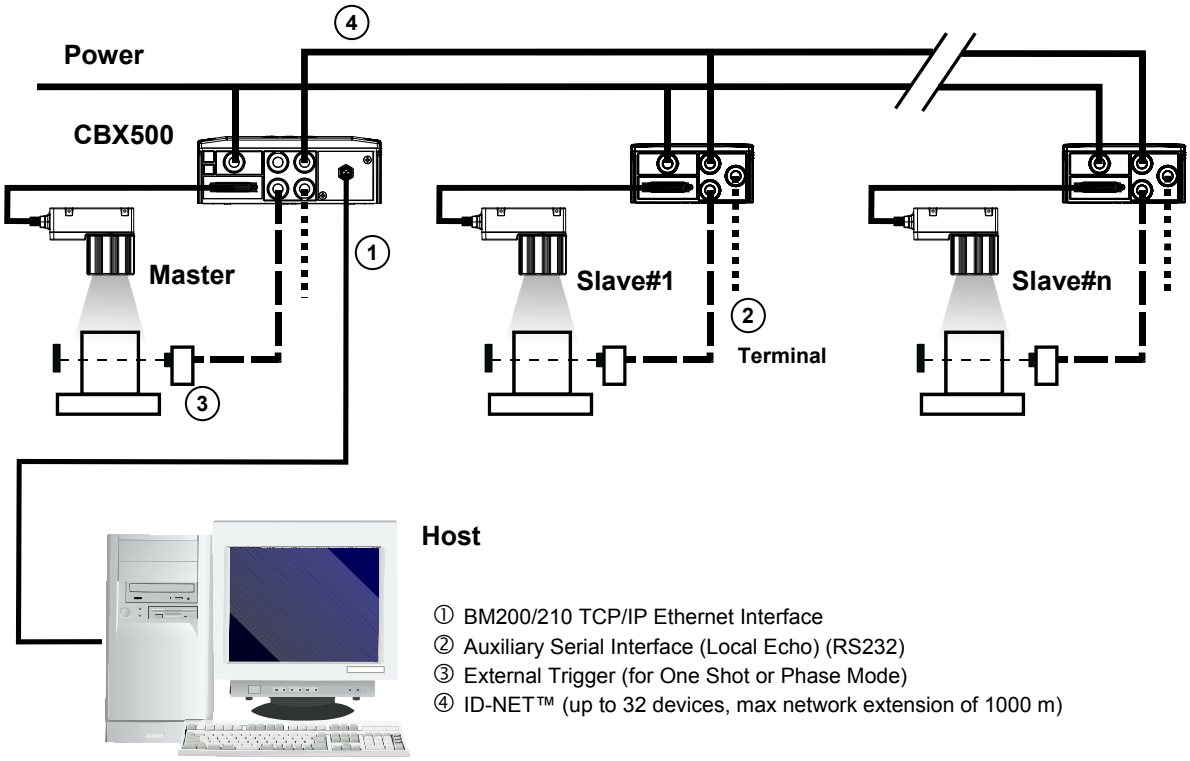


Figure 110 – ID-NET™ M/S Multidata Layout with BM200/210 TCP/IP Ethernet Interface to Host

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.

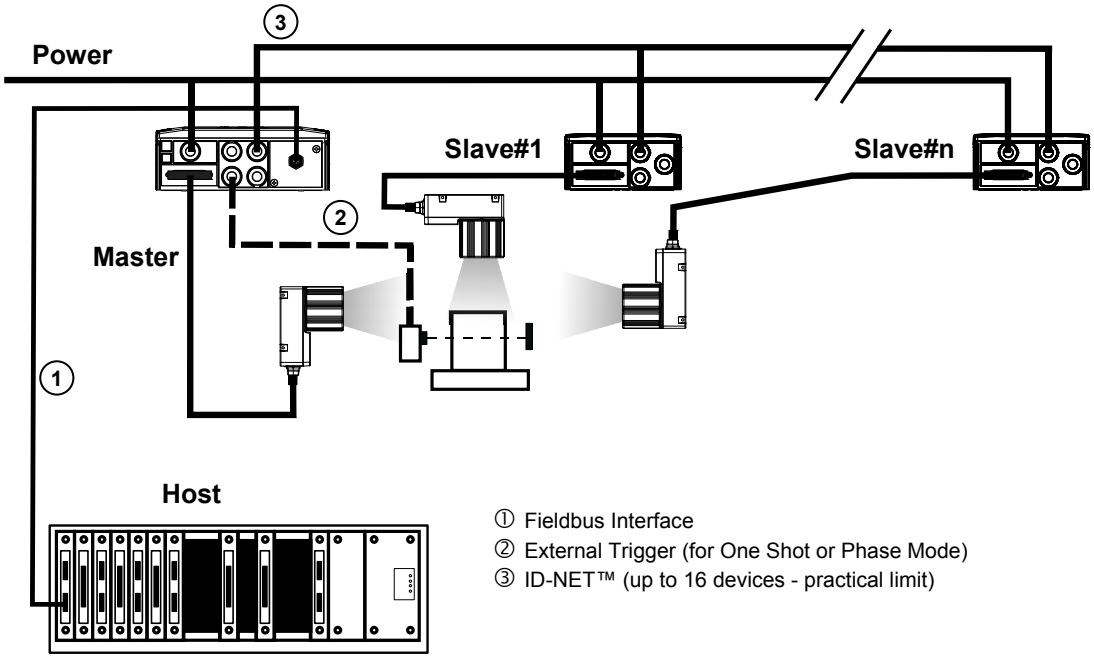


Figure 111 – ID-NET™ Fieldbus M/S Synchronized Layout

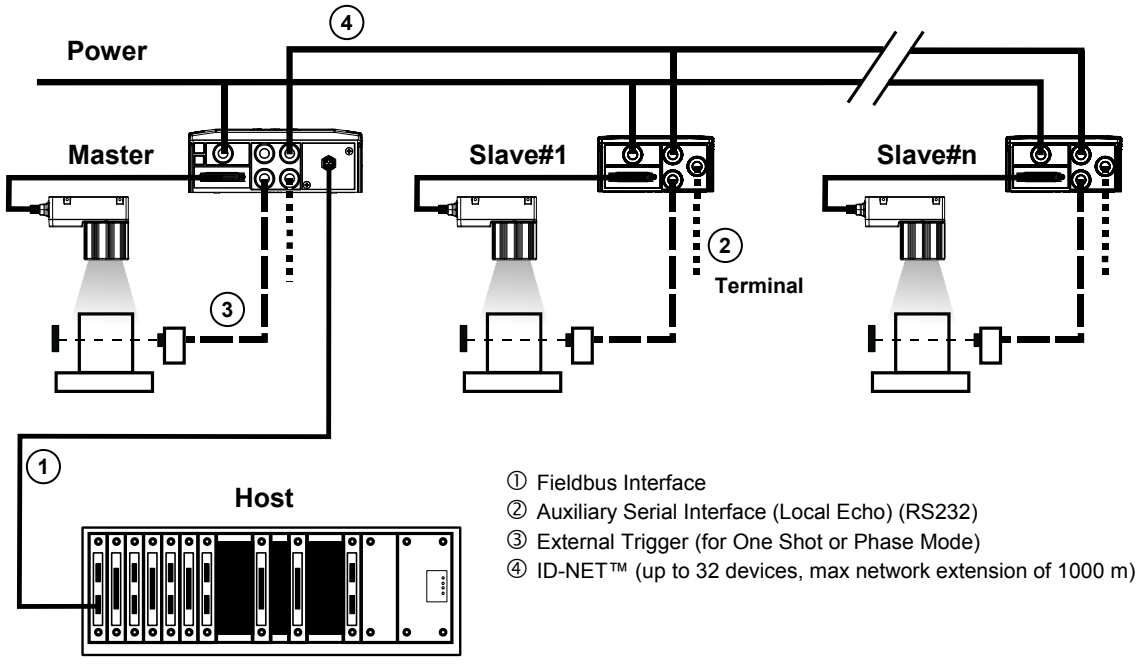


Figure 112 – ID-NET™ Fieldbus M/S Multidata

6.4 RS232 MASTER/SLAVE

NOTE

This interface is provided for backward compatibility. We recommend using the more efficient ID-NET™ network for Master/Slave or Multiplexer layouts.

The RS232 master/slave connection is used to collect data from several readers to build either a multi-point or a multi-sided reading system; there can be one master and up to 9 slaves connected together.

The Slave readers use RS232 only on the main and auxiliary serial interfaces. Each slave reader transmits the messages received by the auxiliary interface onto the main interface. All messages will be passed through this chain to the Master.

The Master reader is connected to the Host on the RS232/RS485 main serial interface.

There is a single reading phase and a single message from the master reader to the Host computer.

In this layout the Master operating mode can be set only to Phase Mode.

The Phase ON/OFF signals must be brought only to the Master. It is not necessary to bring them to the Slave readers.

The main and auxiliary ports are connected as shown in the figure below.

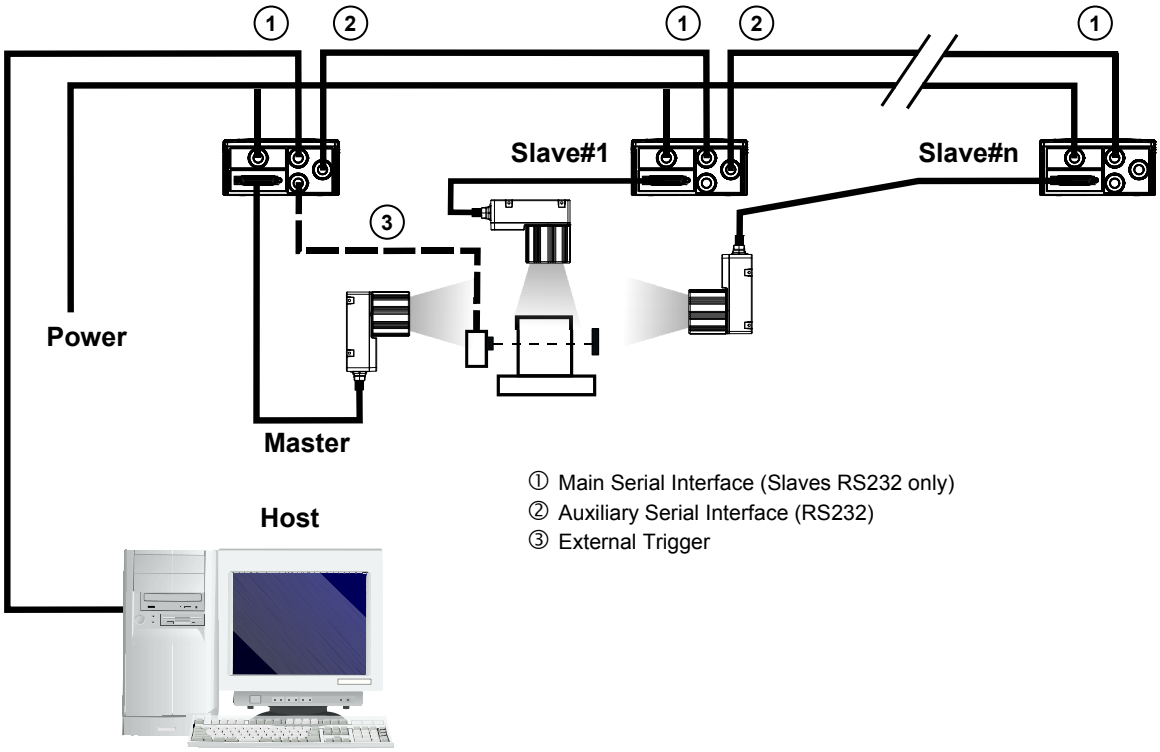


Figure 113 – RS232 Master/Slave Layout

6.5 MULTIPLEXER

NOTE

This interface is provided for backward compatibility. We recommend using the more efficient ID-NET™ network for Master/Slave or Multiplexer layouts.

Each reader is connected to a Multiplexer (for example MX4000) with the RS485 half-duplex main interface through a CBX connection box.

Before proceeding with the connection it is necessary to select the MUX32 communication protocol and the multidrop address for each reader.

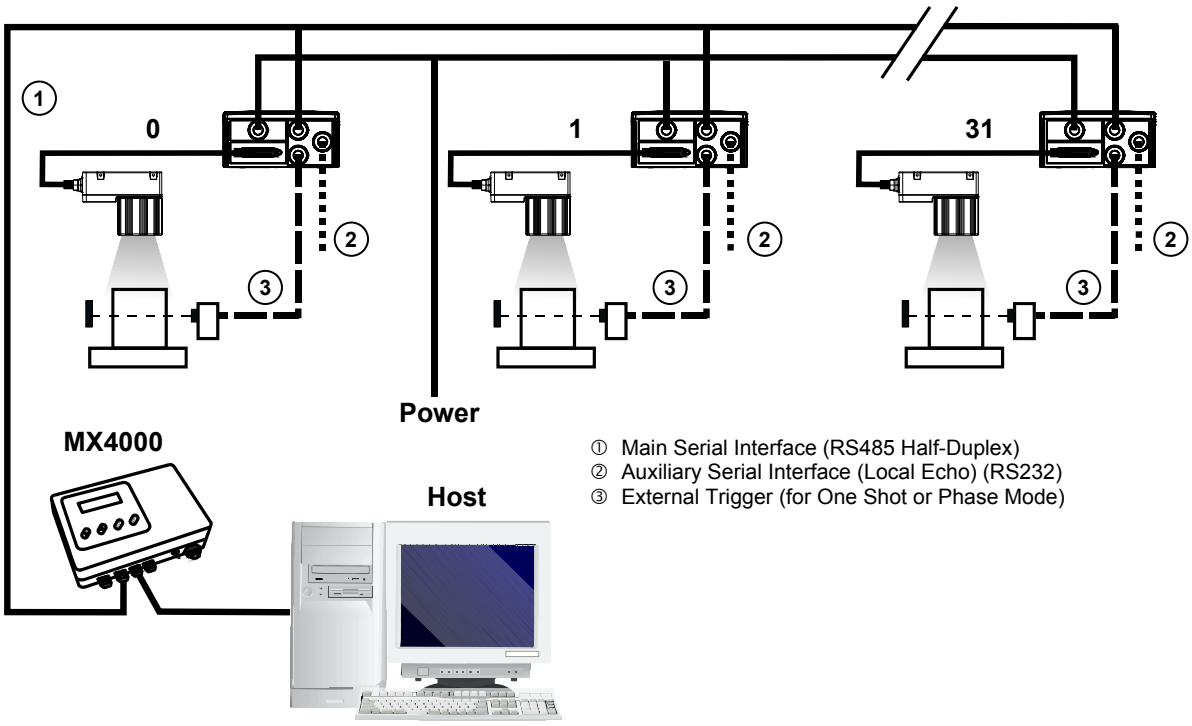


Figure 114 - Multiplexer Layout

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.

Each reader has its own reading phase independent from the others. 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.

6.6 ETHERNET CONNECTION

(Matrix 400 XXX-010 models only)

For Matrix 400 XXX-010 models, 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 with a crossover adapter.

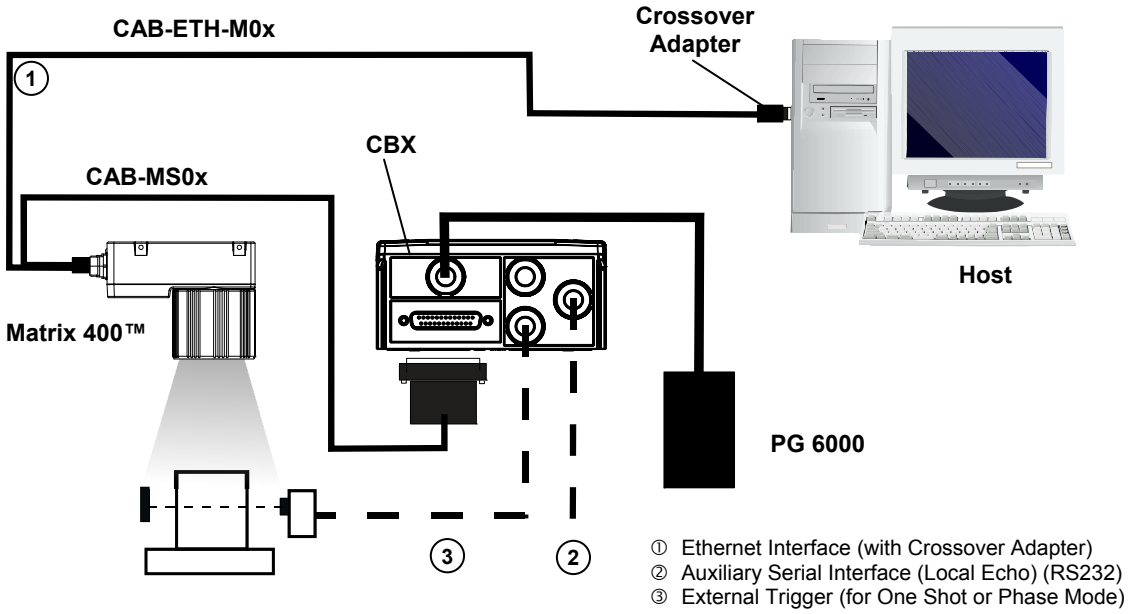
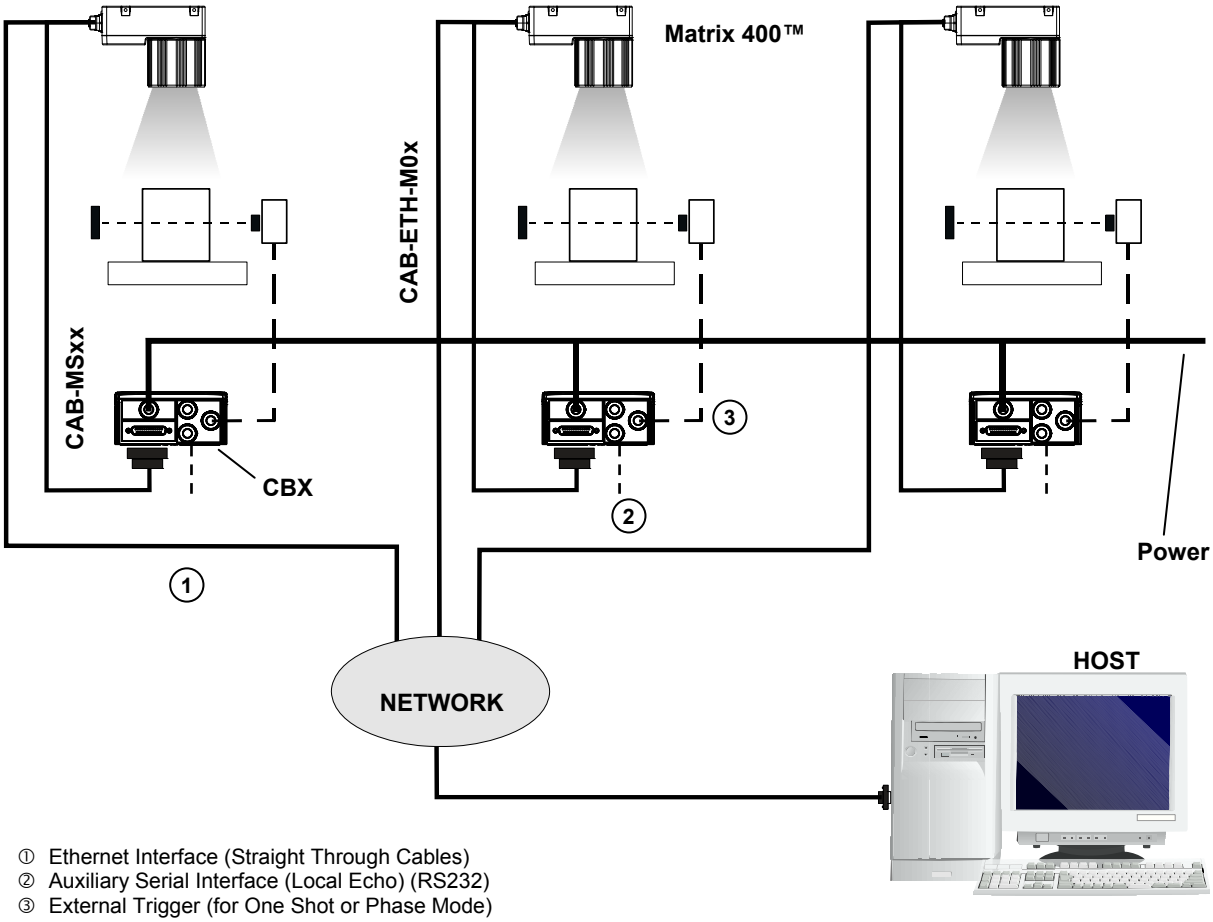


Figure 115 - Ethernet Point-to-Point Layout

When using a Local Area Network (LAN), one or more Matrix 400 XXX-010s can be connected to the network by using **CAB-ETH-M0x** straight through cables:



① Ethernet Interface (Straight Through Cables)
② Auxiliary Serial Interface (Local Echo) (RS232)
③ External Trigger (for One Shot or Phase Mode)

Figure 116 - Ethernet Network Layout

7 READING FEATURES

7.1 OPTICAL ACCESSORY SELECTION

Referring to Figure 117 and the formula below, use the data in the following table to calculate the FOV for your application.

Model	Lens	Viewing Angle **Horizontal**	Viewing Angle **Vertical**	Viewing Angle **Diagonal**	**Min Focus Distance** mm
Matrix 400 400-0x0 (SXGA)	LNS-1109 9 mm	48.5°	39.5°	60°	**85**
	LNS-1112 12.5 mm	37°	30°	46.5°	**85**
	LNS-1116 16 mm	28.5°	23°	36°	**85**
	LNS-1125 25 mm	18.5°	15°	23.5°	**135**
	LNS-1135 35 mm	13°	10,5°	16.5°	**235**
	LNS-1150 50 mm	9°	7°	11.5°	**500**
Matrix 400 600-0x0 (UXGA)	LNS-1006 6 mm	59.5°	46.5°	71°	**85**
	LNS-1109 9 mm	40.5°	31°	49.5°	**85**
	LNS-1112 12.5 mm	31°	23.5°	38°	**85**
	LNS-1116 16 mm	24°	18°	30°	**85**
	LNS-1125 25 mm	15°	11.5°	19°	**135**
	LNS-1135 35 mm	11°	8.5°	13.5°	**235**
	LNS-1150 50 mm	7.5°	5.5°	9.5°	**500**

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

$$FOV_x = 2\left[(d + 35\ mm)\tan(\alpha_x/2)\right]$$

where:

FOV_x = horizontal, vertical or diagonal FOV

α_x = horizontal, vertical or diagonal viewing angles.

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

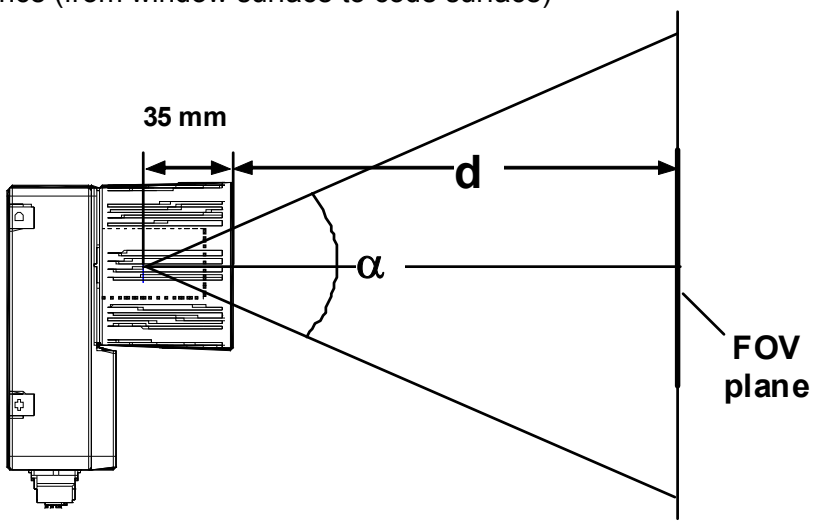


Figure 117 – Reading Distance References

Example:

The FOV for a **Matrix 400 600-0x0 base** using the **16 mm lens** at a **focus distance of 200 mm** is:

FOV_H = 2 [(200 mm + 35 mm) tan (24°/2)] = **100 mm**
FOV_V = 2 [(200 mm + 35 mm) tan (18°/2)] = **74 mm**

7.2 HORIZONTAL FOV VS. READING DISTANCE DIAGRAMS

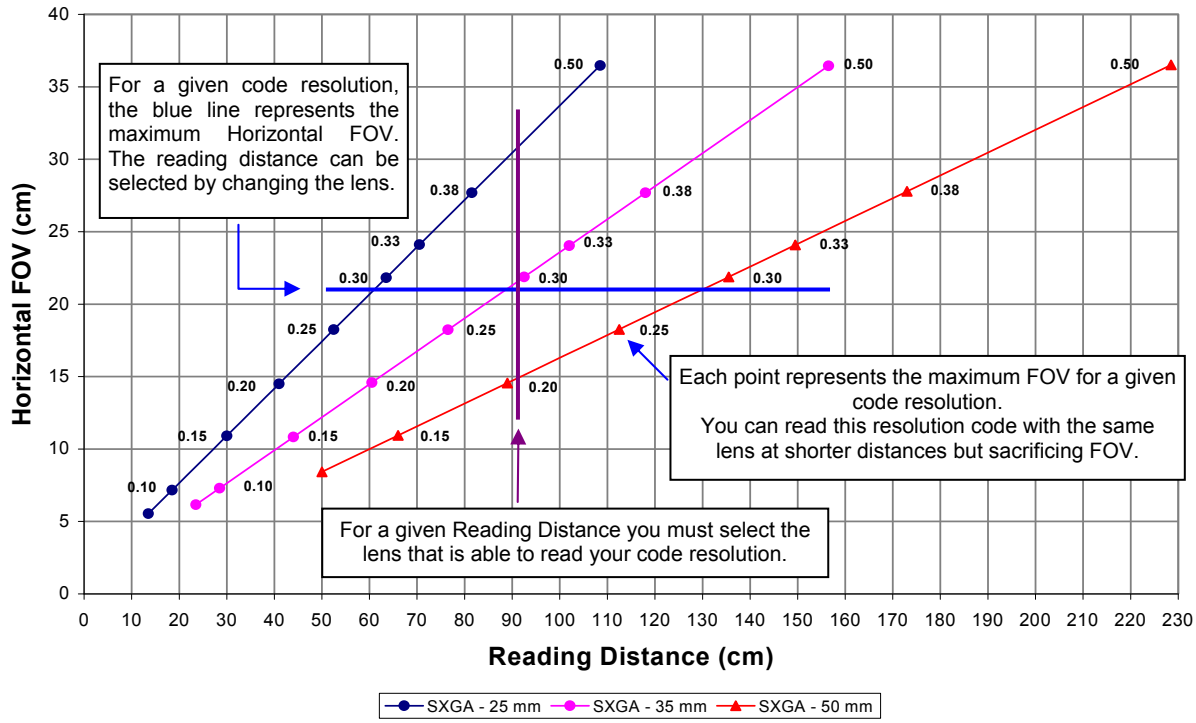
The following graphs represent the Horizontal Field of View (FOV) and Reading Distance based on the combination of a certain sensor (Matrix 400™ base model) and a certain lens.

Each point represents the maximum achievable Field of View with the selected code resolution (in this point DOF is limited).

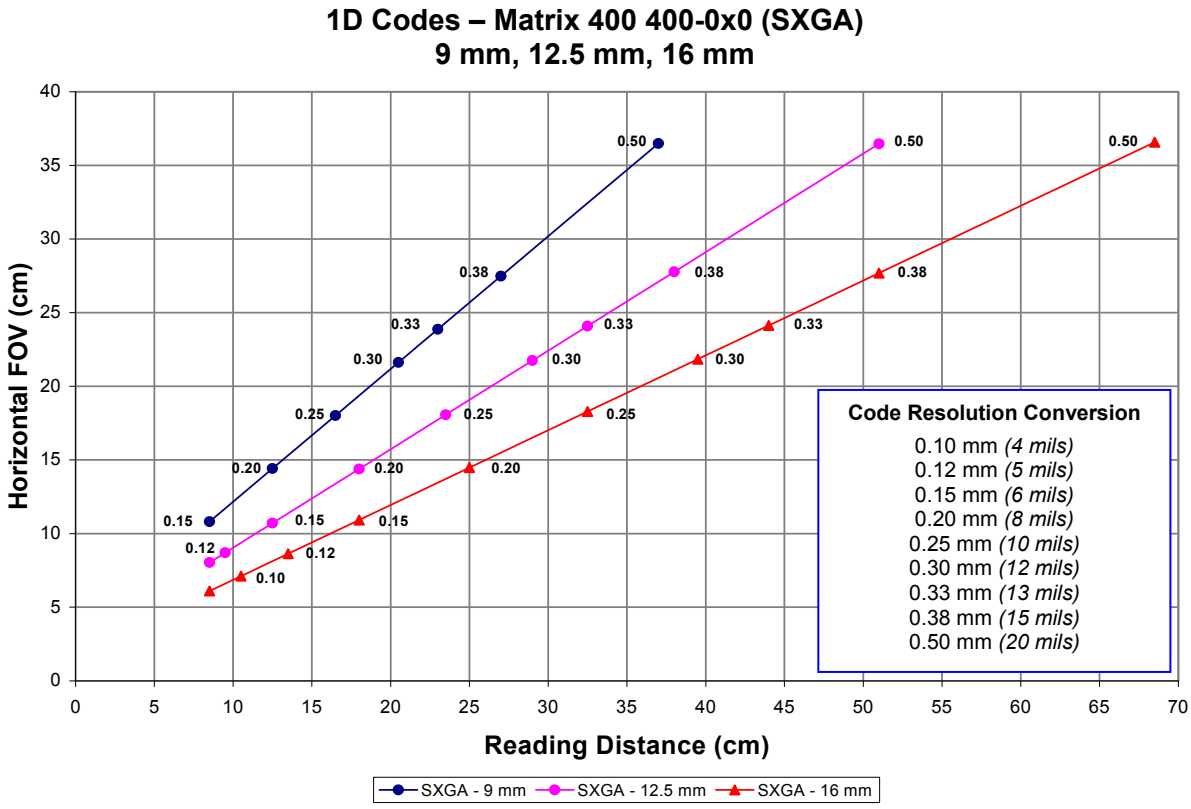
NOTE

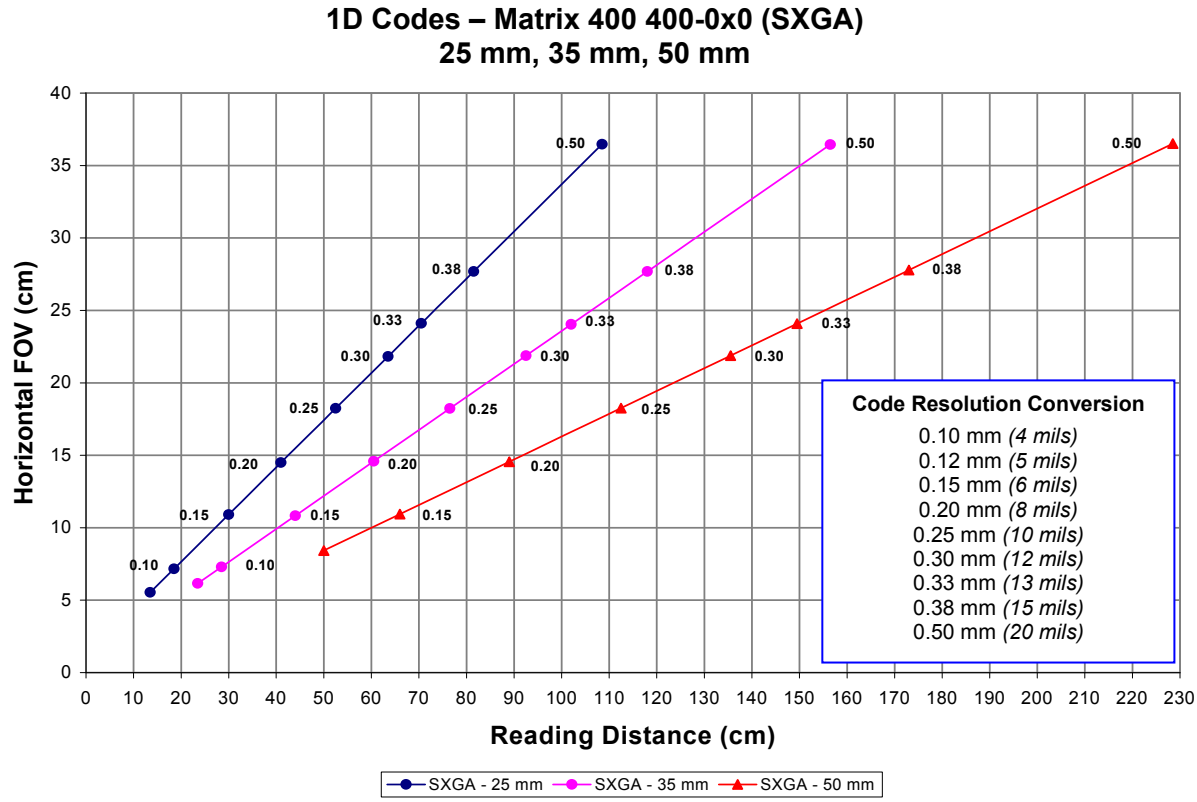
The following diagrams are given for typical performance at 25°C using high quality grade A symbols according to ISO/IEC 15416 (1D code) and ISO/IEC 15415 (2D code) print quality test specifications. Testing should be performed with actual application codes in order to maximize the application performance.

7.2.1 How to Use the Diagrams

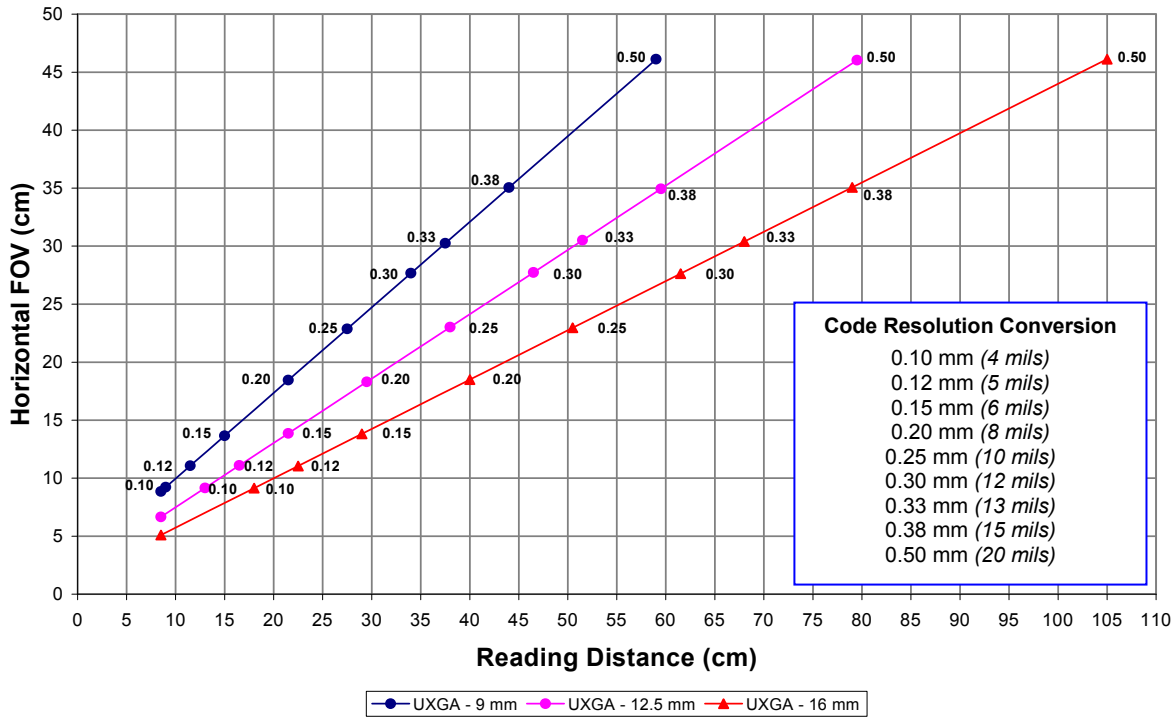


7.2.2 1D (Linear) Codes

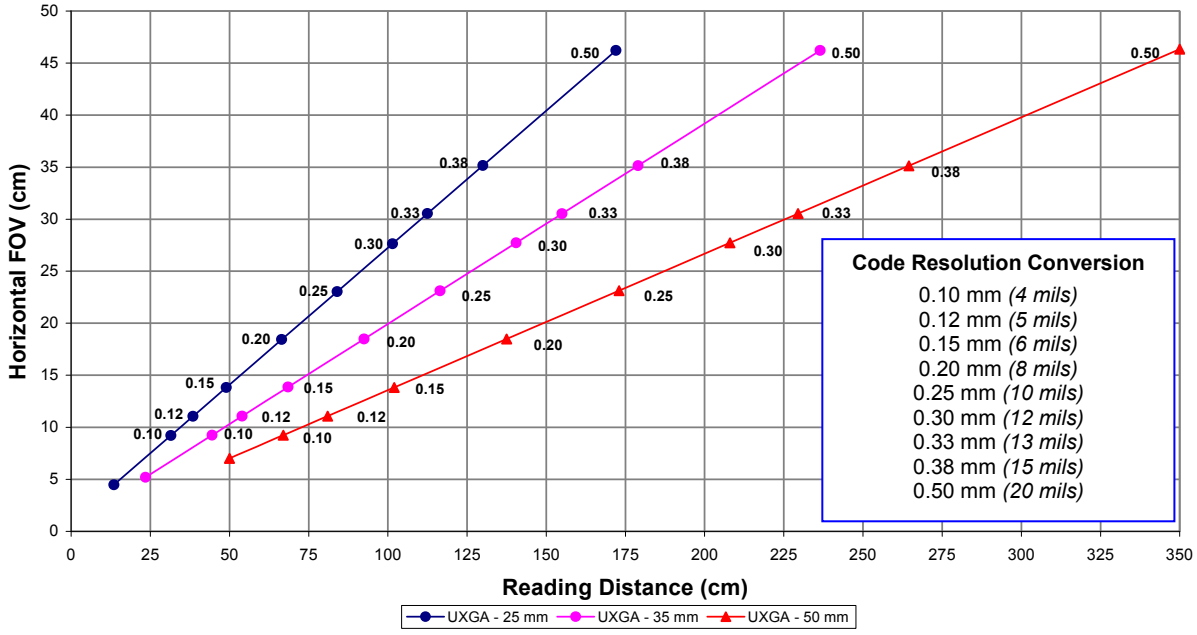




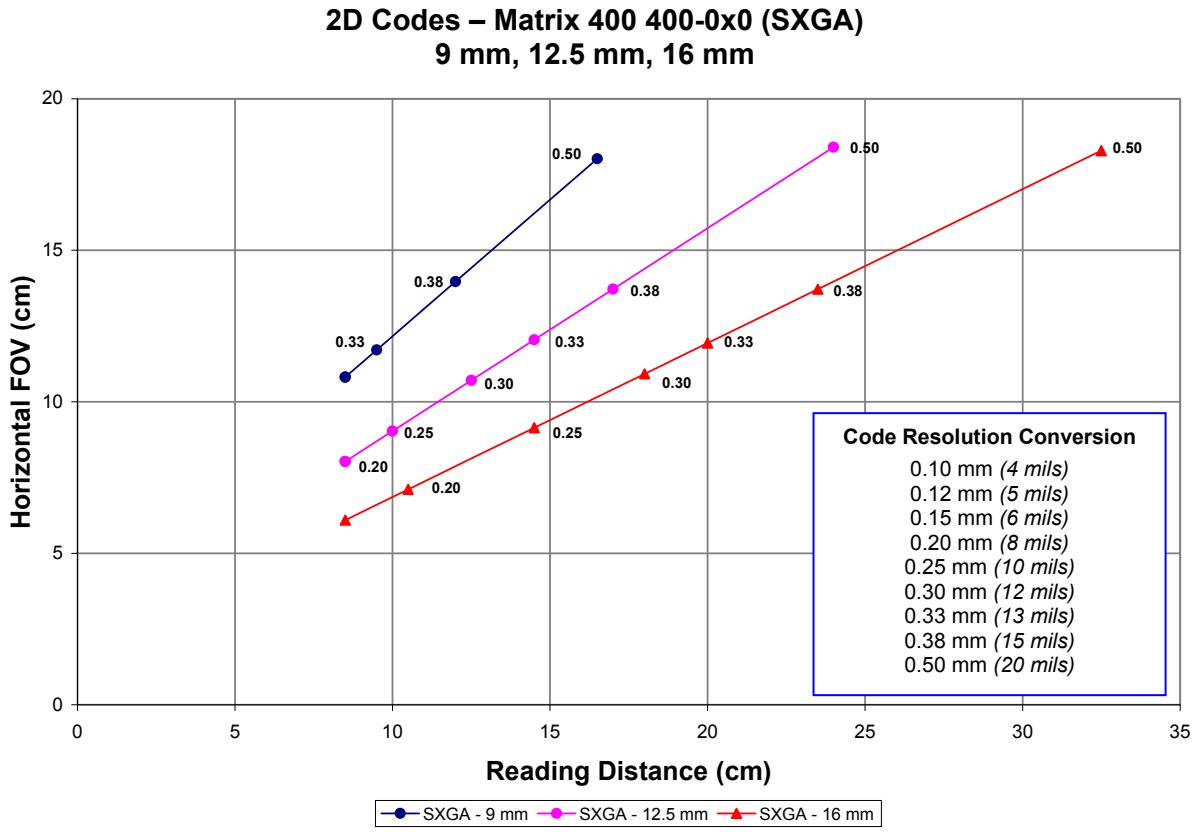
1D Codes – Matrix 400 600-0x0 (UXGA)
9 mm, 12.5 mm, 16 mm

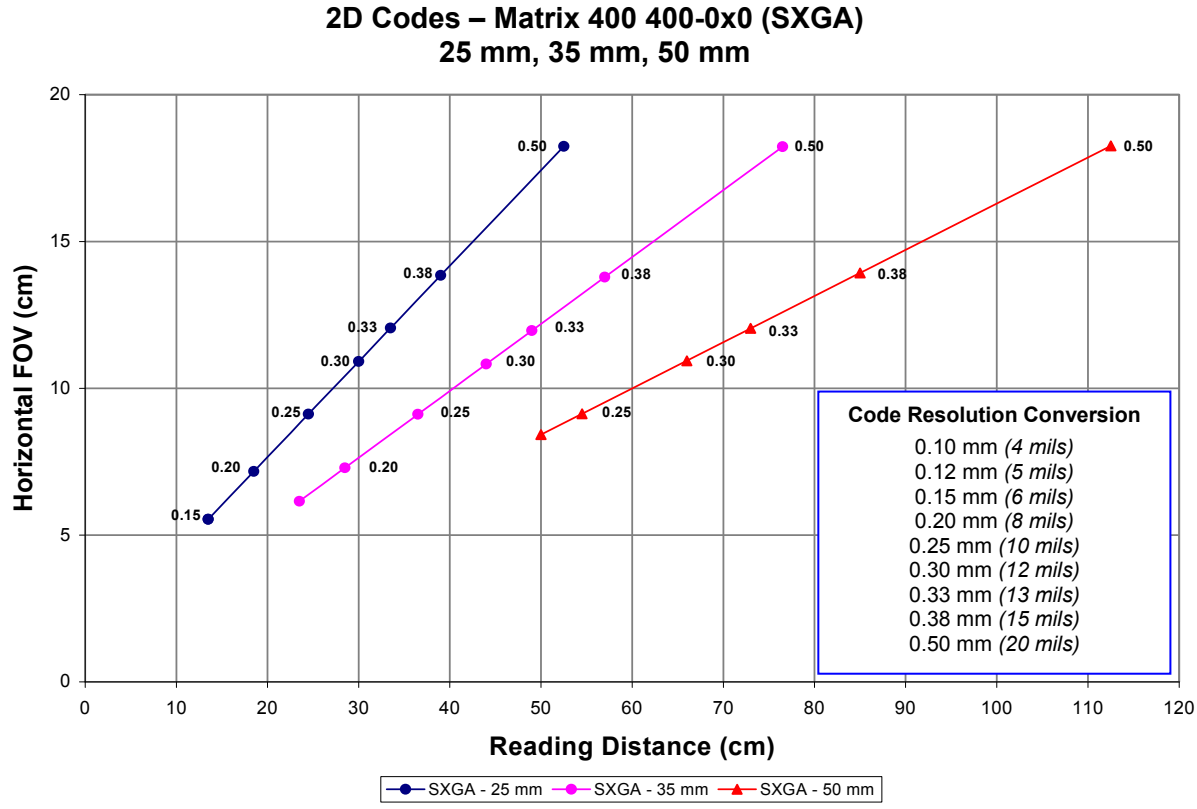


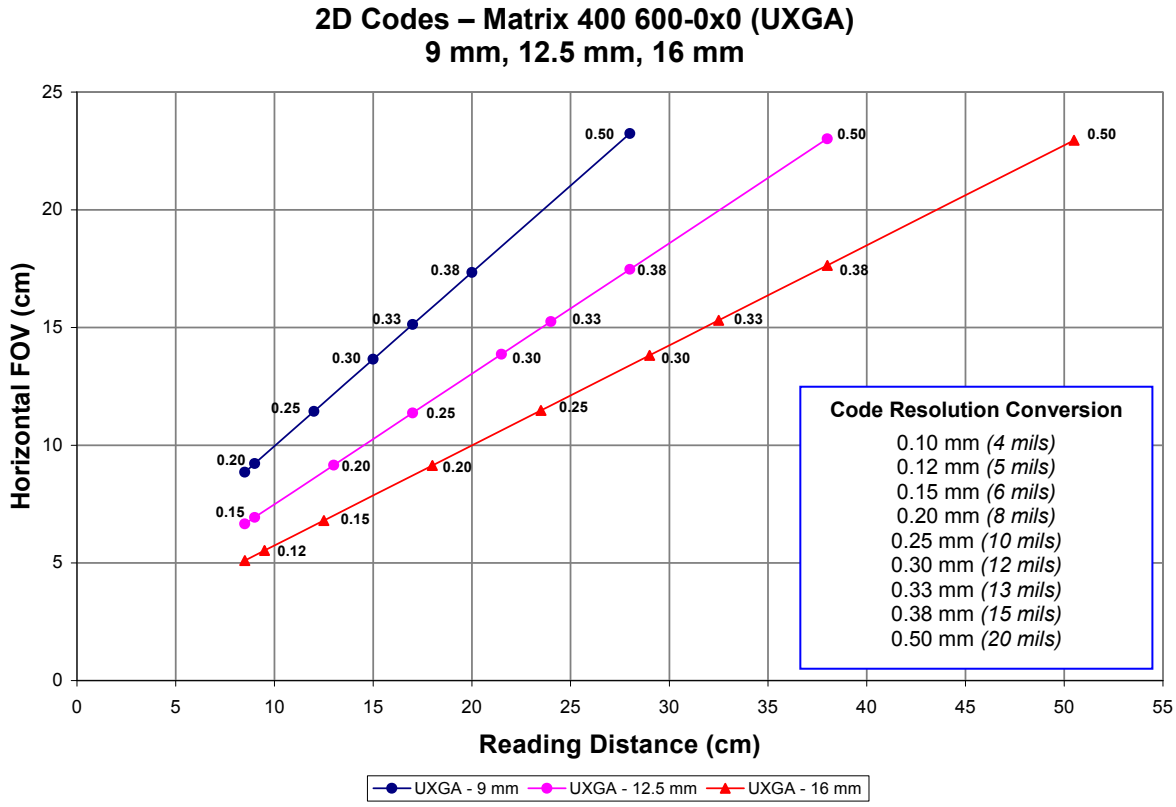
1D Codes – Matrix 400 600-0x0 (UXGA)
25 mm, 35 mm, 50 mm

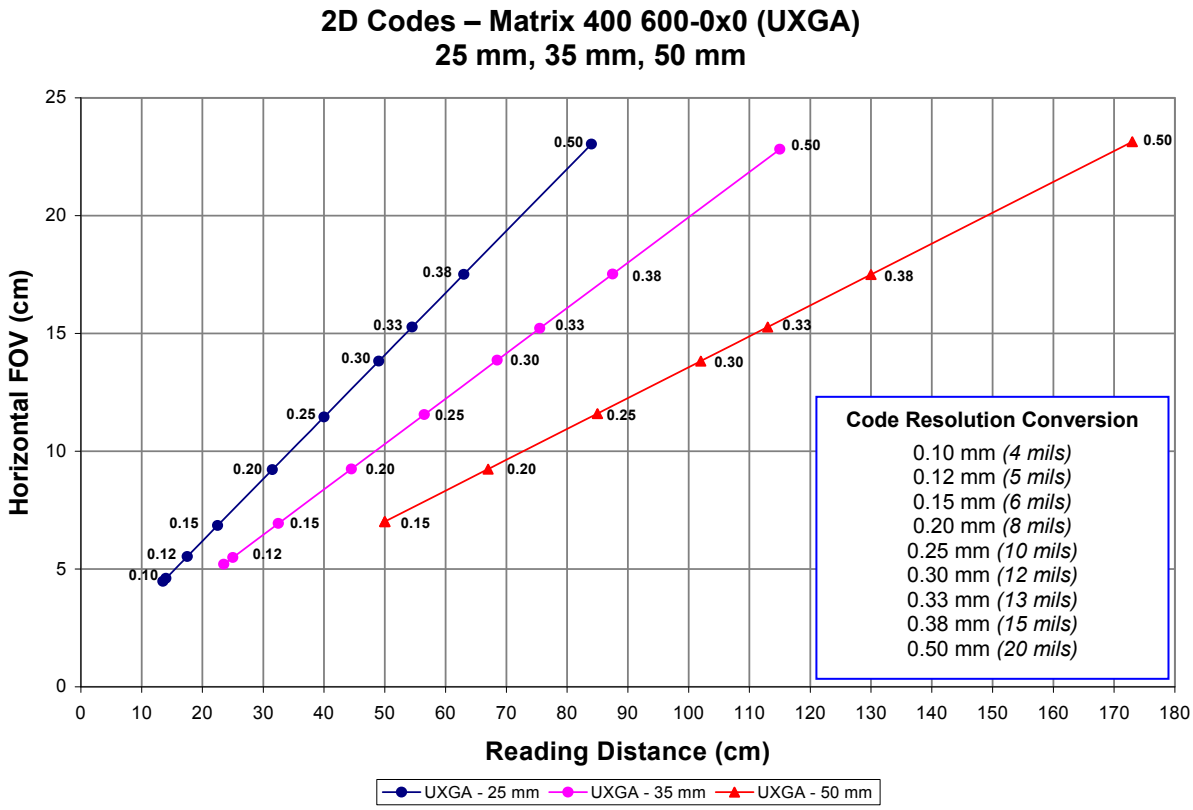


7.2.3 2D (Bi-dimensional) Codes






2D Codes – Matrix 400 600-0x0 (UXGA)
9 mm, 12.5 mm, 16 mm
Horizontal FOV (cm)
Reading Distance (cm)
Code Resolution Conversion
0.10 mm (4 mils)
0.12 mm (5 mils)
0.15 mm (6 mils)
0.20 mm (8 mils)
0.25 mm (10 mils)
0.30 mm (12 mils)
0.33 mm (13 mils)
0.38 mm (15 mils)
0.50 mm (20 mils)
UXGA - 9 mm
UXGA - 12.5 mm
UXGA - 16 mm


2D Codes – Matrix 400 600-0x0 (UXGA)
25 mm, 35 mm, 50 mm
Horizontal FOV (cm)
Reading Distance (cm)
Code Resolution Conversion
0.10 mm (4 mils)
0.12 mm (5 mils)
0.15 mm (6 mils)
0.20 mm (8 mils)
0.25 mm (10 mils)
0.30 mm (12 mils)
0.33 mm (13 mils)
0.38 mm (15 mils)
0.50 mm (20 mils)
UXGA - 25 mm
UXGA - 35 mm
UXGA - 50 mm

7.3 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)
- $\mathbf{T_{exp}}$: Exposure Time (s)
- **LS**: Line Speed (mm/s)

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

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

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

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

Example:

A Matrix 400™ 600-010 using:

Internal Lighting Mode = Very High Power Strobe
Exposure Time (x10 μs) = 10 (100 μs)
Code Resolution (X) = 0.254 mm (10 mils)

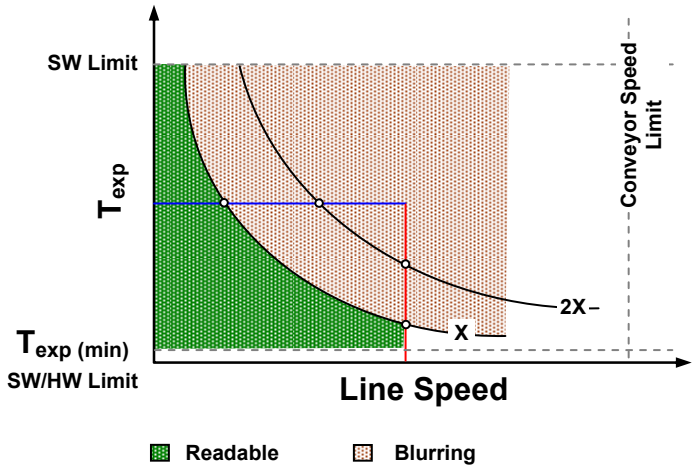
has a maximum line speed of:

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

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

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

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



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

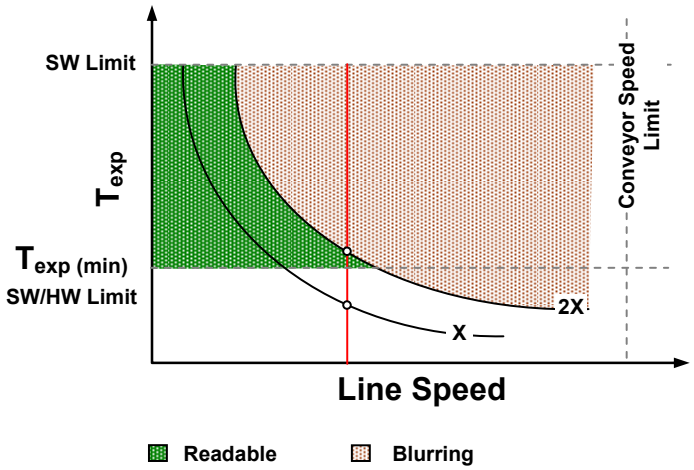
- **Code/Background Contrast**: maximum speed decreases when decreasing image contrast (poor quality codes, reflective transparent coverings, different supports and printing techniques).
- **Code Resolution**: maximum speed increases when decreasing code resolution, (i.e. **2X)**. There is a decrement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

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/Medium/Low-Power Strobed*: the built-in LED array is on only during the image exposure time. Four 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**.*



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

8 SOFTWARE CONFIGURATION

Software configuration of your Matrix 400™ 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 (Ethernet models only), 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 CD-ROM.

8.1 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 or 7
- 32 MB Ram
- 5 MB free HD space
- one free RS232 serial port with 115 Kbaud
- Video Adapter (1024 x 768) or better using more than 256 colors

8.2 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 400™ communication ports).
2. After Windows finishes booting, insert the CD-ROM provided.
3. Launch VisiSet™ installation by clicking Install.
4. Follow the instructions in the installation procedure.

8.3 STARTUP

After completing the mechanical and electrical connections to Matrix 400™, you can begin software configuration as follows:

1. Power on the Matrix 400™ 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 400™ reader.

   Upon connection, Matrix 400™ 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 118.

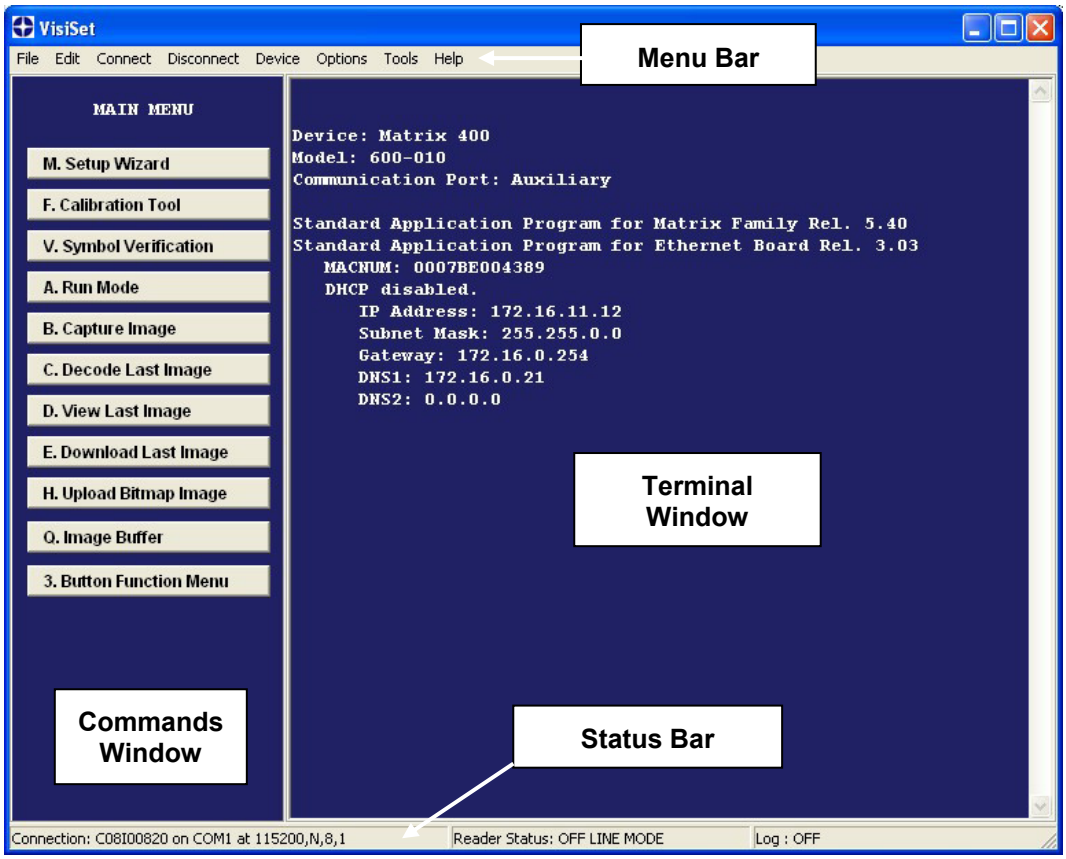


Figure 118 - Main Window

8.3.1 VisiSet™ Options

The **Options** item from the VisiSet™ menu (see Figure 118) presents a window allowing you to configure:

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

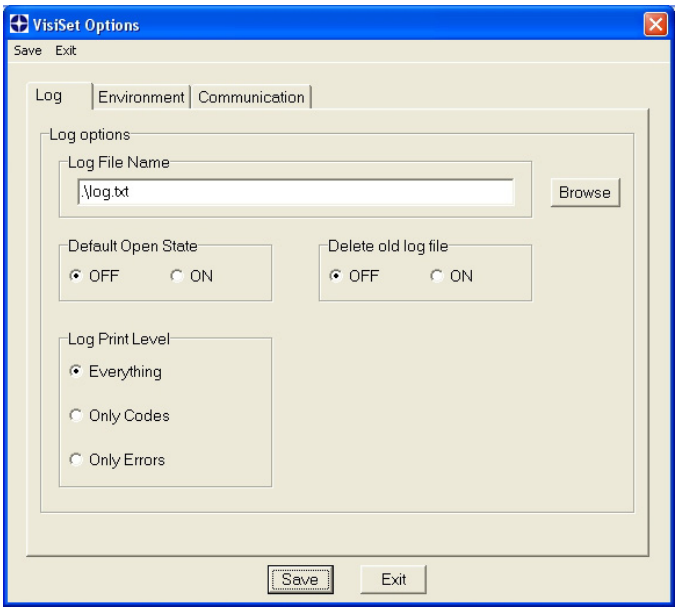


Figure 119 - Options - Log

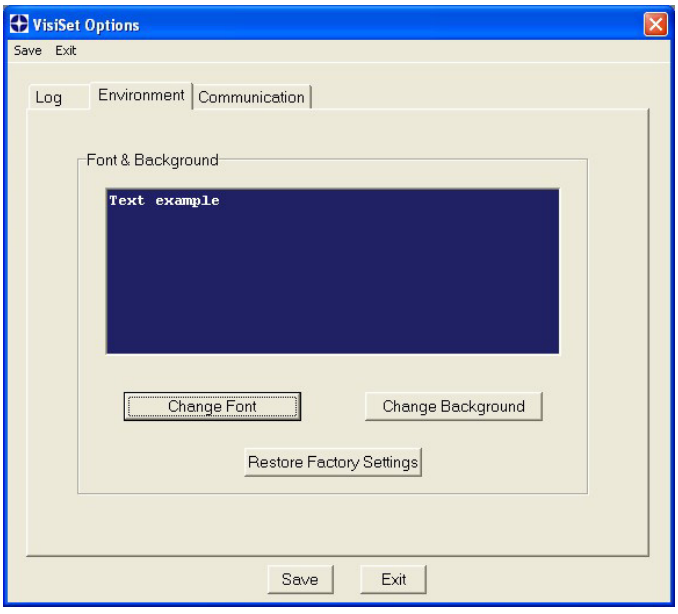


Figure 120 - Options - Environment

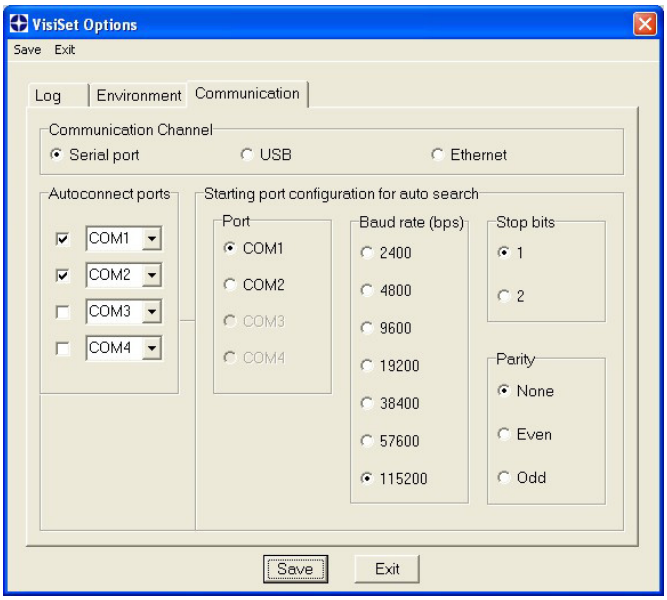


Figure 121 - Options – Communication: Serial Port

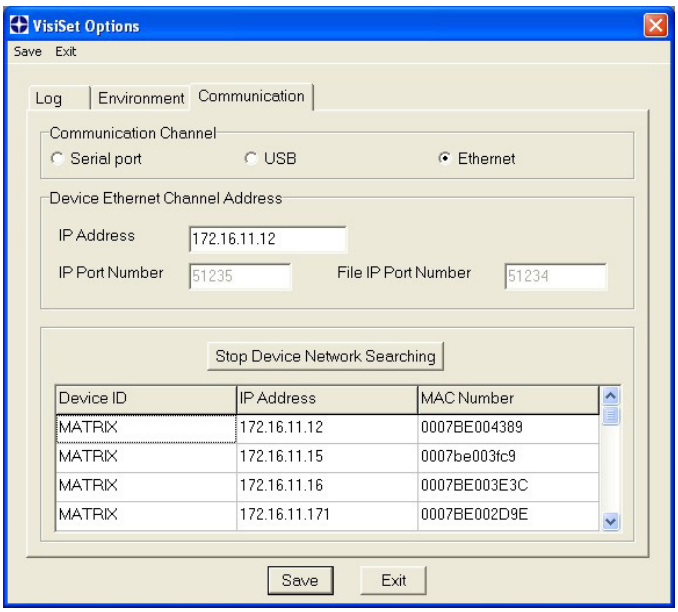


Figure 122 - Options – Communication: Ethernet

8.4 CONFIGURATION

Once connected to Matrix 400™ as described in par. 8.3, you can modify the configuration parameters as follows:

1. Press the Calibration Tool button from the Main Menu. Matrix 400™ 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. 8.4.1 and par. 8.4.3).

2. Edit the Matrix 400™ configuration parameters according to your application requirements.

3. Use the **Calibration Tool** to fine tune the reading performance. See par. 8.4.3.

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 118) or launch **Run** Mode from the VisiSet™ Main menu.

Disconnect exits closing communication between Matrix 400™ and VisiSet™, and causes Matrix 400™ to enter Run Mode. The disconnected reader serial port is now available.

Run command does not close communication between Matrix 400™ and VisiSet™, and causes Matrix 400™ 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).

8.4.1 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.

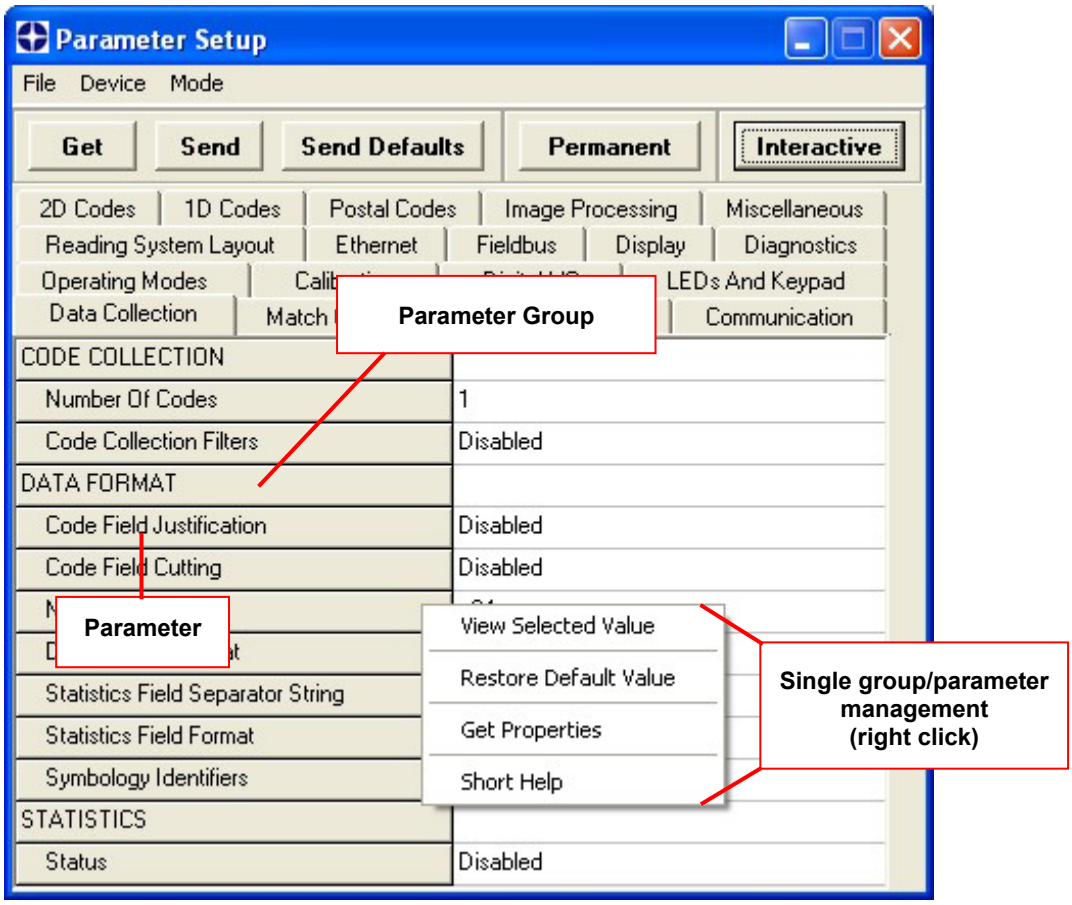


Figure 123 - Editing Parameters

Parameters to verify/modify:

❑ Operating Mode	Sets the parameters which customize the reader operating mode starting from three main modes: One Shot: acquires a single image based on the selected value for the Acquisition Trigger and Acquisition Trigger Delay. Continuous: continuously acquires images with a rate up to the maximum allowable frame rate per second for the given sensor depending on the decoding time and the Region of Interest settings. Phase Mode: acquires images during the reading phase depending on the selected value for the Acquisition Trigger and Acquisition Trigger Delay. The Reading Phase-ON and Reading Phase-OFF events mark respectively the beginning and end of the reading phase.
❑ Calibration	Calibrates the acquisition parameters to maximize the reading performance (see par. 8.4.3).
❑ Communication	Configures the parameters relative to each serial port regarding the transmission, message formatting and string receiving. Any change to the VisiSet™ communication port parameters (baud rate, data bits, etc.) is effective as soon as the reader is disconnected from VisiSet™.
❑ Ethernet	Sets the parameters related to the Ethernet interface and to its communication channels.
❑ CBX Gateway	Sets the parameters related to the External Host Interface Module through the CBX500 and to its communication channels.
❑ Display	Sets the Display language and Layout of the BM150 Display when using the CBX500 connection box.
❑ Diagnostics	Enables various diagnostic messages, formatting and actions.
❑ Reading System Layout	Allows configuring the device according to the desired layout: Standalone, ID-NET™ or Master/Slave RS232
❑ Image Processing	Sets the image processing parameters shared by all available symbologies.
❑ 1D & 2D, Postal Codes	Sets the characteristics of the code symbologies to be read.
❑ Data Collection	Defines the code-collection parameters and the output message format.
❑ Digital I/O	Configures the reader input/output parameters.
❑ Match Code	Allows setting a user-defined code and relative parameters to which the read code will be compared (matched).
❑ Miscellaneous	Sets the reader name and the saved image format.
❑ Symbol Verification	Sets the parameters relative to the various specifications in the Standards which regulate code validation.
❑ LEDs And Keypad	Sets the X-PRESS™ LED and Keypad parameters related to their selected Functions: Beeper, Green Spot, Setup, Positioning, etc.

When all the configuration parameters are set correctly, save them to the Matrix 400™ reader by pressing the Send button. See Figure 123.

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.

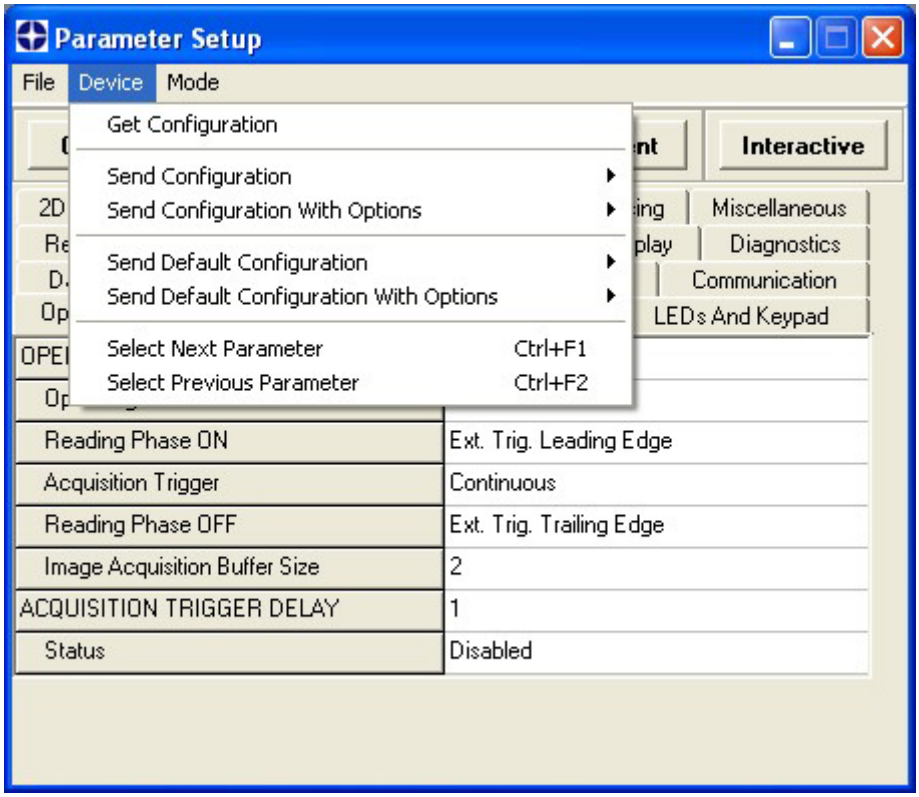
From the **File** menu, you can also **Save Configuration As Text File** for a human readable version.

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

8.4.2 Send Configuration Options

The device parameters are divided into two main classes, Configuration and Environmental which are effected 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™, Master/Slave RS232, MUX 32, Ethernet) 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

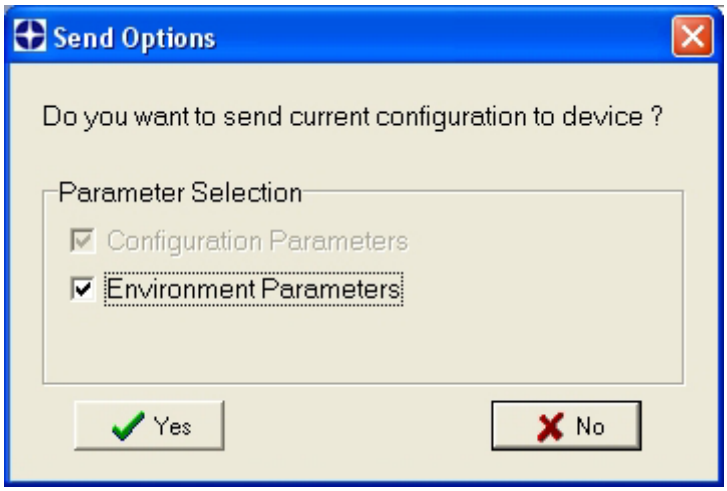
EXPECTED SLAVE DEVICES
- Status
- Device Description
- Device Network Name

MAIN PORT
- Communication Protocol
- Multidrop Address

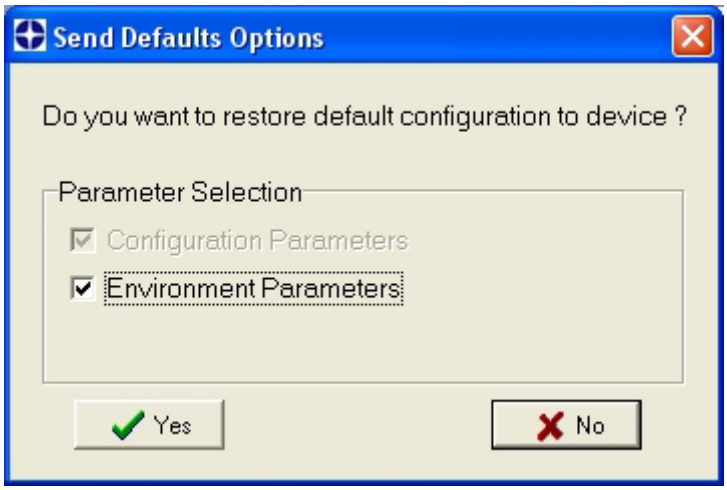
ETHERNET SYSTEM
- Status
- DHCP Client
- IP Address
- Subnet Mask
- Gateway Address
- DNS1 Address
- DNS2 Address

MISCELLANEOUS
- Reader Name
- User Name
- Line Name
- Lens Type & S/N
- Internal Lighting System & S/N
- Diaphragm Aperture
- Focus Distance (mm)

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:



8.4.3 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:

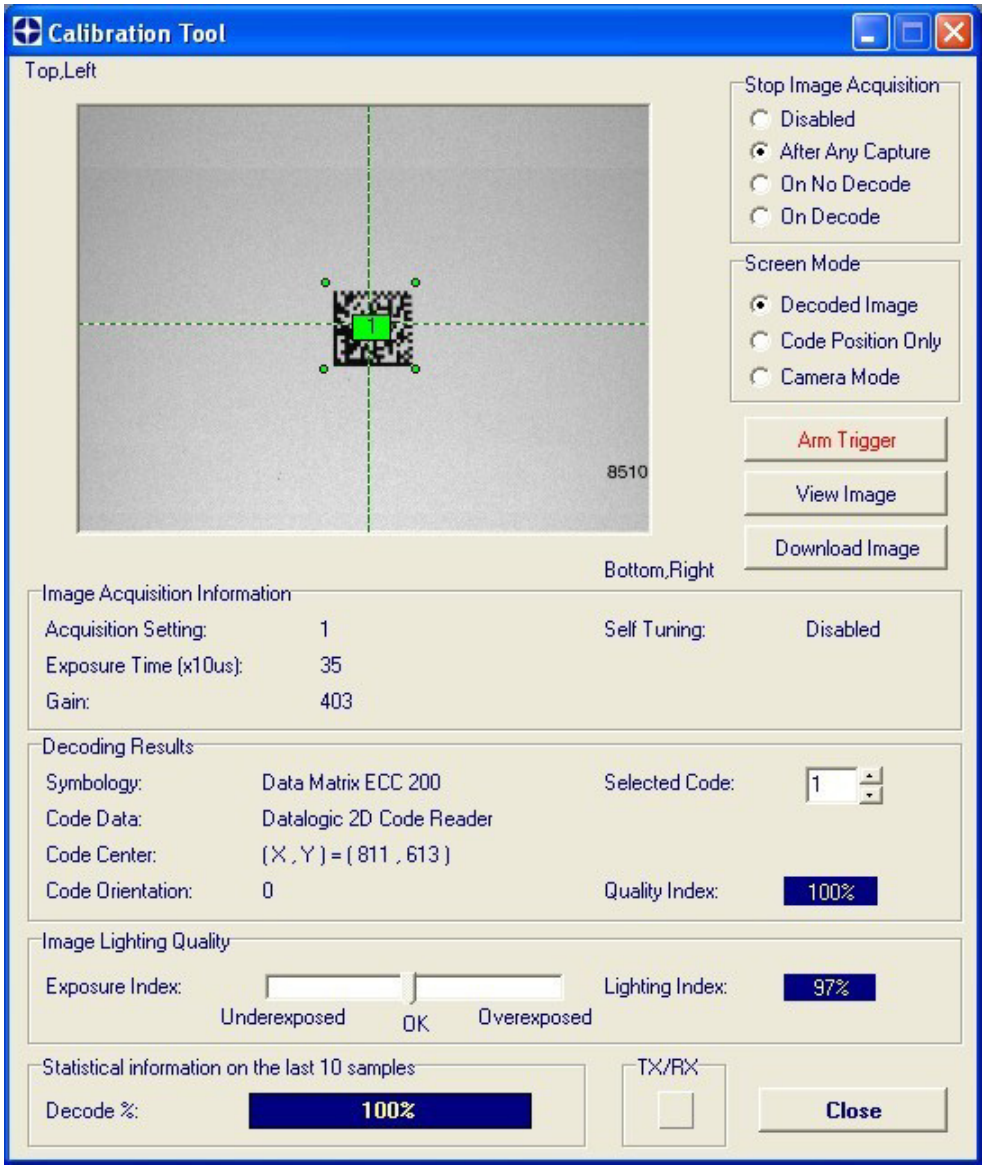


Figure 124 - Calibration OK

This tool provides a "real-time" image display while Matrix 400™ is reading. It also gives immediate results on the performance of the installed Matrix 400™ reader.

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 esposure 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.

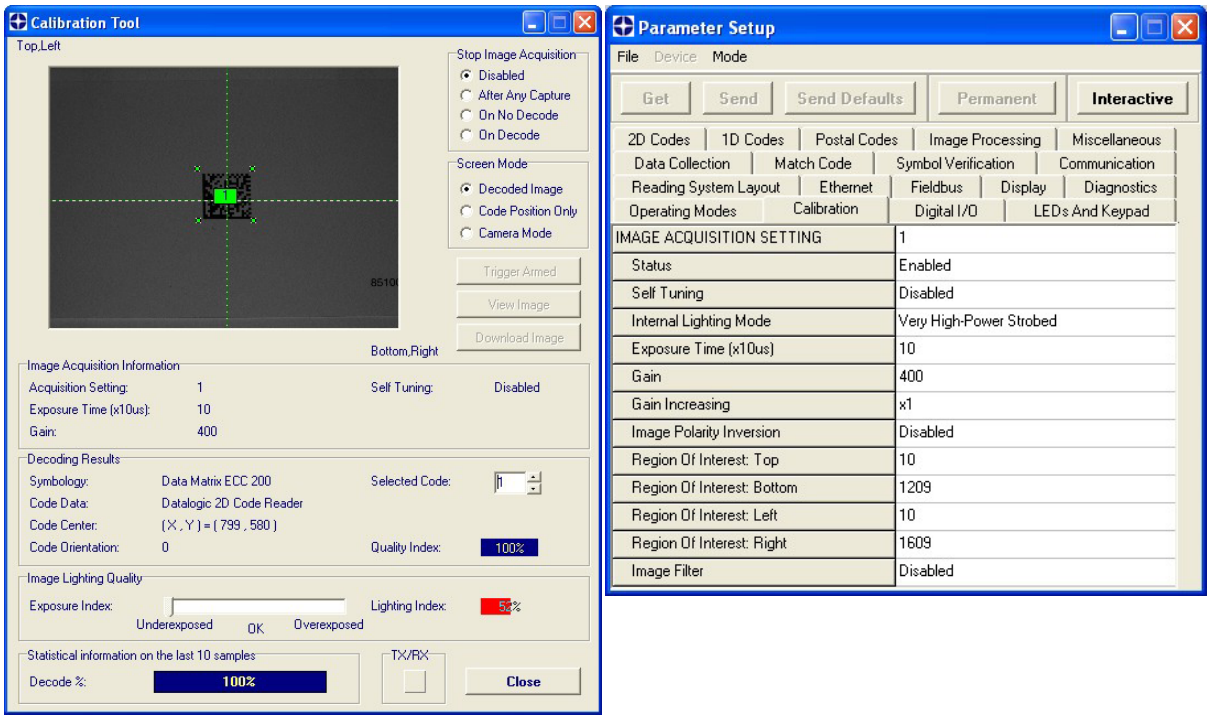


Figure 125 - Example Under Exposure: Too Dark

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**

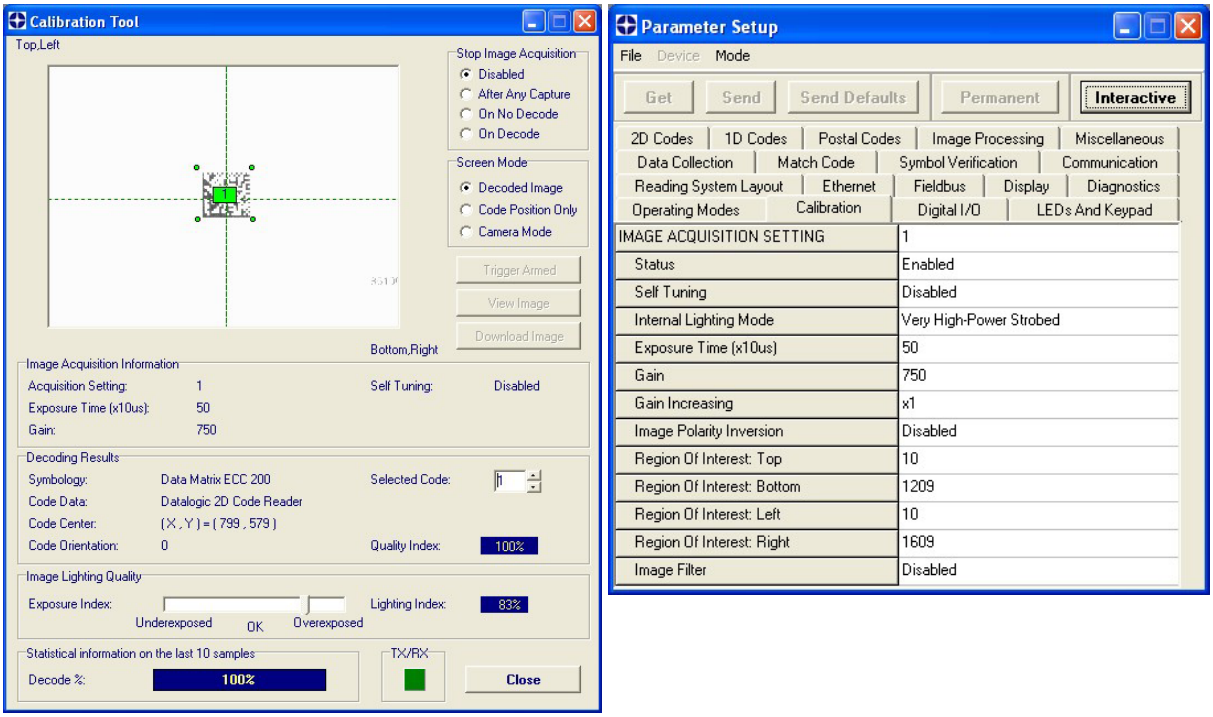


Figure 126 - Example Over Exposure: Too Light

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)**

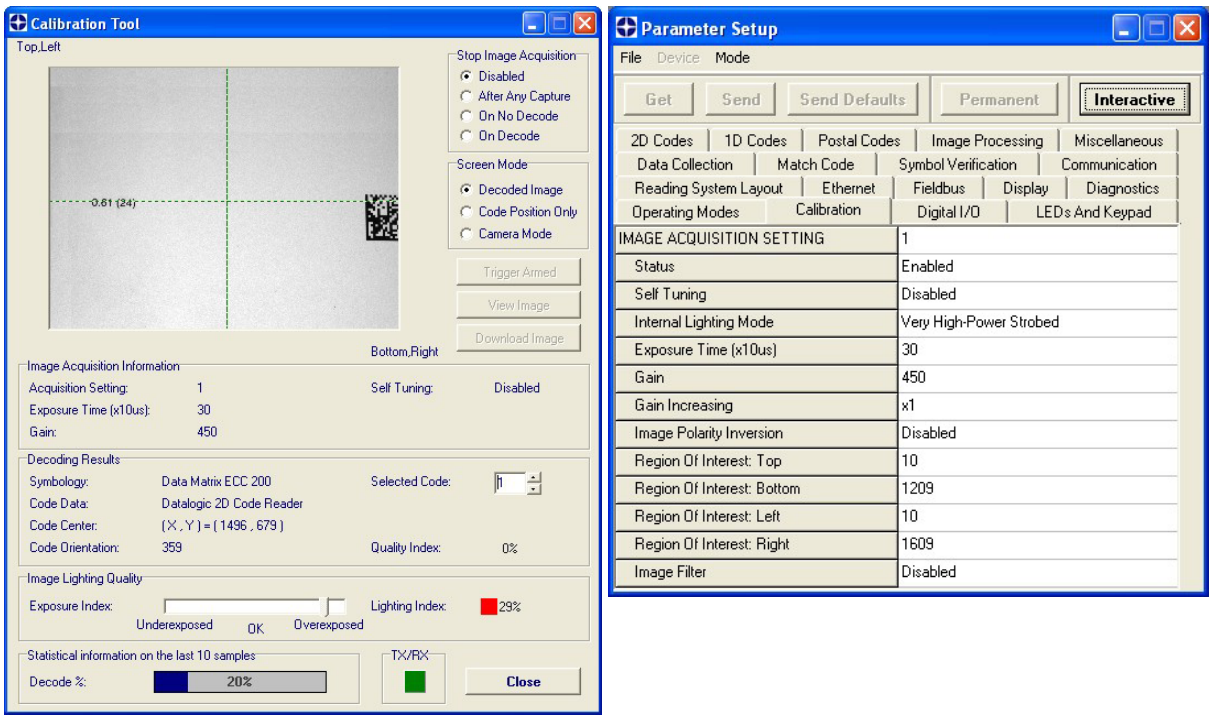


Figure 127 - Example out of FOV

8.4.4 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 an internal illuminator and a second setting could enable and use an external lighting system. These two groups will be used cyclically on each acquisition in order to automatically capture the correctly lighted image.

Image 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.

8.4.5 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 400™ 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 400™ Help On-Line.

8.4.6 Region Of Interest Windowing

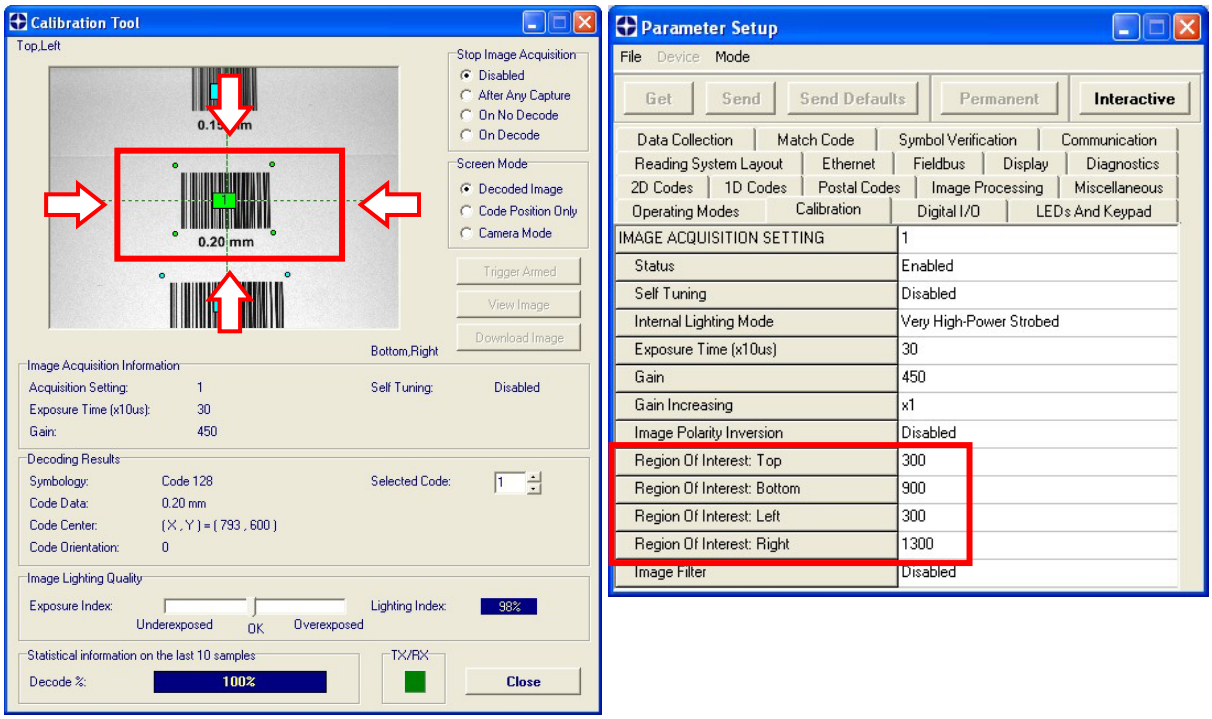
In order to satisfy very high throughput applications, higher frame rates can be achieved using the powerful ***Region Of Interest Windowing*** parameters in the Calibration parameter setup menu.

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 Matrix 400™ 600-0x0 models the frame rate is dependent on the number of lines (or rows) in the defined window.

In Matrix 400™ 400-0x0 models the frame rate is dependent on the number of rows and columns in the defined window.

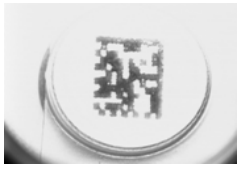
The smaller the window, the lower the frame period and consequently the higher the frame rate. In general the Image Processing time can be reduced by reducing the window dimensions.



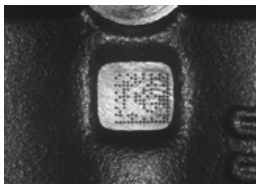
8.4.7 Direct Part Marking Applications

Decoding Method: Direct Marking

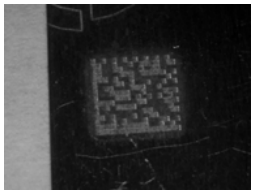
For **DataMatrix** and **QR** code the ***Decoding Method*** parameter selects the decoding algorithm according to the printing/marking technique used to create the symbol and on the overall printing/marking quality. The ***Direct Marking*** selection improves the decode rate for low quality Direct Part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



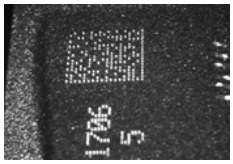
Washed out and Axial Distortion



Dot Peening On Scratched Surface

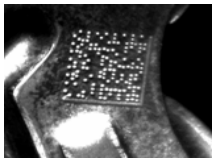


Low Contrast Problem

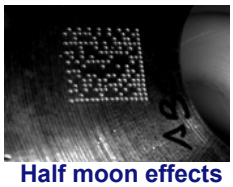


Background Problems

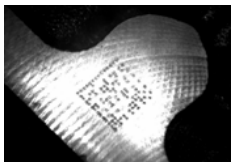
Marked On Curved Shiny Surface



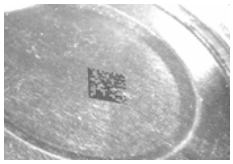
Axial distortion



Half moon effects



Shiny surface, noisy background



Low contrast, noisy background

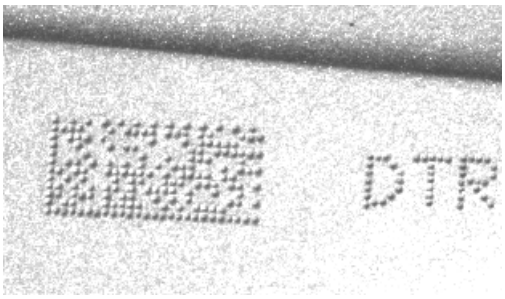
All the previous examples are successfully read selecting the ***Direct Marking Decoding Method***.

Image Filter

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

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

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

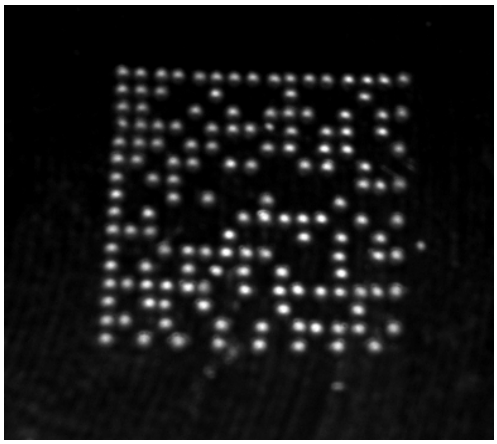


Before - No Read

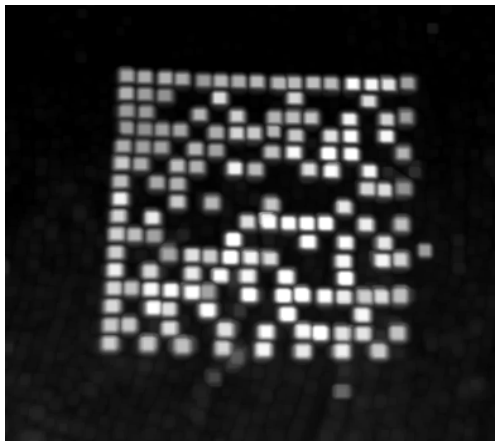
After - Readable

Erode

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



Before - No Read



After - Readable

Dilate

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

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

8.5 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.

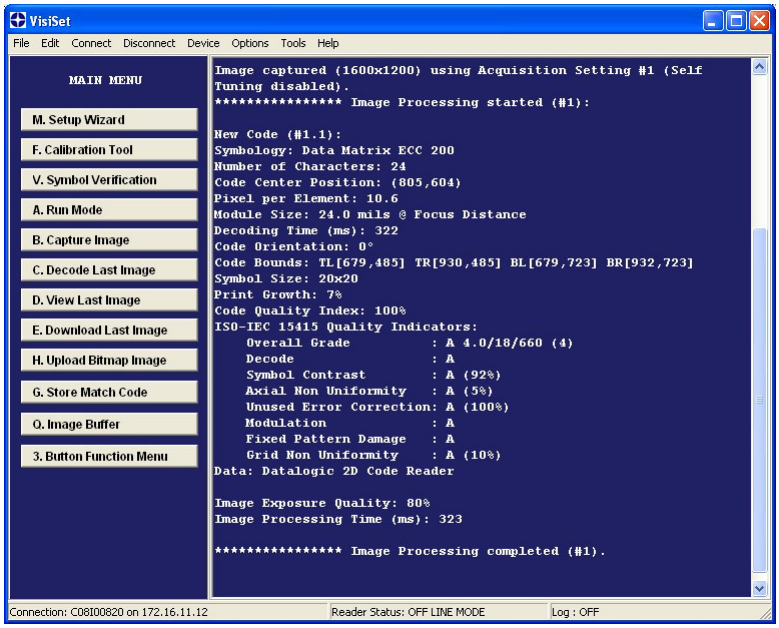


Figure 128 - Capture and Decoding Functions

8.6 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.

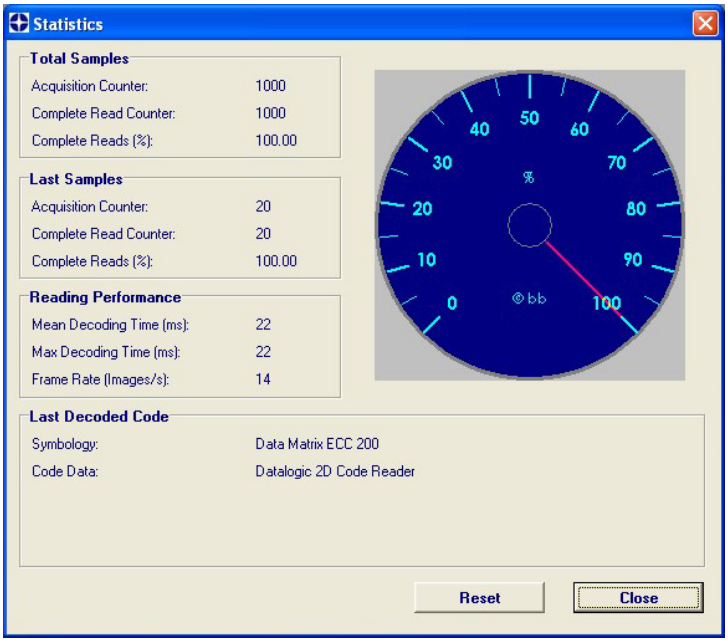


Figure 129 - Code Statistics

9 MAINTENANCE

9.1 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.

10 TROUBLESHOOTING

10.1 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 400™ M16 19-pin connector pay attention to the pin number of the signals (chp. 5).
- If you need information about a certain reader parameter you can refer to the VisiSet™ program help files. Either connect the device and select the parameter you're interested in by pressing the F1 key, or select **Help>Paramters Help** from the command menu.
- If you're unable to fix the problem and you're going to contact your local Datalogic office or Datalogic Partner or ARC, we suggest providing (if possible): Application Program version, Parameter Configuration file, Serial Number and Order Number of your reader. You can get this information while VisiSet™ is connected to the reader: the Application Program version is shown in the Terminal Window; the Parameter Configuration can be saved to an .ini file applying the **File>Save Configuration File** command in the Parameter Setup window; Serial Number and Order Number can be obtained by applying the respective command in the **Tools** menu.

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

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

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

11 TECHNICAL FEATURES

ELECTRICAL FEATURES		
Power		
Supply Voltage	10 to 30 Vdc	
Power Consumption	0.8 to 0.27 A, 8 W max.; 0.5 to 0.17 A, 5 W typical	
Communication Interfaces		
Main		
- RS232	2400 to 115200 bit/s	
- RS485 full-duplex	2400 to 115200 bit/s	
- RS485 half-duplex	2400 to 115200 bit/s	
Auxiliary - RS232	2400 to 115200 bit/s	
ID-NET™	Up to 1MBaud	
Ethernet (Ethernet Models only)	10/100 Mbit/s	
Inputs		
Input 1 (External Trigger) and Input 2	Opto-coupled and polarity insensitive	
Max. Voltage	30 Vdc	
Max. Input Current	10 mA	
Outputs		
Output 1 and Output 2	Opto-coupled	
V_{Out} (I_{Load} = 0 mA) Max.	30 Vdc	
V_{Out} (I_{Load} = 10 mA) Max.	1.8 Vdc	
$P_D = V_{Out} \times I_{Load}$ Max.	170 mW	
OPTICAL FEATURES	**4xx-xxx models**	**6xx-xxx models**
Image Sensor	CMOS	CCD
Image Format	SXGA (1280x1024)	UXGA (1600x1200)
Frame Rate	27 frames/sec.	15 frames/sec.
Pitch	± 35°	
Tilt	0° - 360°	
Lighting System	Internal or External Illuminator (accessories)	
LED Safety Class	Class 1 to EN60825-1	
ENVIRONMENTAL FEATURES		
Operating Temperature	0 to 50 °C (32 to 122 °F) (high ambient temperature applications should use metal mounting bracket for heat dissipation)	
Storage Temperature	-20 to 70 °C (-4 to 158 °F)	
Max. Humidity	90% non condensing	
Vibration Resistance EN 60068-2-6	14 mm @ 2 to 10 Hz; 1.5 mm @ 13 to 55 Hz; 2 g @ 70 to 200 Hz; 2 hours on each axis	
Bump Resistance EN 60068-2-29	30g; 6 ms; 5000 shocks on each axis	
Shock Resistance EN 60068-2-27	30g; 11 ms; 3 shocks on each axis	
Protection Class EN 60529	IP67 *	
PHYSICAL FEATURES		
Dimensions	125 x 65 x 86 mm (4.92 x 2.56 x 3.39 in.) with lens cover	
Weight	482 g. (17 oz.) with lens and internal illuminator	
Material	Aluminium	

* when correctly connected to IP67 cables with seals and the Lens Cover is correctly mounted.

SOFTWARE FEATURES

Readable Code Symbologies

1-D and stacked	2-D	POSTAL
• PDF417 Standard and Micro PDF417 • Code 128 (EAN 128) • Code 39 (Standard and Full ASCII) • Code 32 • MSI • Standard 2 of 5 • Matrix 2 of 5 • Interleaved 2 of 5 • Codabar • Code 93 • Pharmacode • EAN-8/13 - UPC-A/E (including Addon 2 and Addon 5) • GS1 DataBar Family • Composite Symbologies	• Data Matrix ECC 200 (Standard, GS1 and Direct Marking) • QR Code (Standard and Direct Marking) • Micro QR code • MAXICODE • Aztec Code • Microglyph (this symbology requires an activation procedure – contact your local Datalogic Automation distributor for details)	• 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 VERIFICATION

Standard	Supported Symbologies
ISO/IEC 16022	Data Matrix ECC 200
ISO/IEC 18004	QR Code
ISO/IEC 15415	Data Matrix ECC 200, QR Code
ISO/IEC 15416	Code 128, Code 39, Interleaved 2 of 5, Codabar, Code 93, EAN-8/13, UPC-A/E
AS9132A	Data Matrix ECC 200
AIM DPM	Data Matrix ECC 200, QR Code

USER INTERFACE

LED Indicators	Power, Ready, Good; Trigger; Com, Status, (Ethernet Network); (Green Spot)
Keypad Button	Configurable via VisiSet™

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.

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 low angles used to avoid direct reflection of the light in the reader's lens.

Decode
To recognize a barcode symbology *(e.g.,* Codabar, Code 128, Code 3 of 9, UPC/EAN, etc.) and analyze the content of the barcode scanned.

Depth of Field
The difference between the minimum and the maximum distance of the object in the field of view that appears to be in focus.

Diffused Illumination
Distributed soft lighting from a wide variety of angles used to eliminate shadows and direct reflection effects from highly reflective surfaces.

Direct Part Mark (DPM)
A symbol marked on an object using specific techniques like dot peening, laser etching, chemical etching, etc.

EEPROM
Electrically Erasable Programmable Read-Only Memory. An on-board non-volatile memory chip.

Element
The basic unit of data encoding in a 1D or 2D symbol. A single bar, space, cell, dot.

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

Flash
Non-volatile memory for storing application and configuration files.

Host
A computer that serves other terminals in a network, providing services such as network control, database access, special programs, supervisory programs, or programming languages.

Image Processing
Any form of information processing for which the input is an image and the output is for instance a set of features of the image.

Image Resolution
The number of rows and columns of pixels in an image. The total number of pixels of an image sensor.

Image Sensor
Device converting a visual image to an electric signal. It is usually an array of CCD (Charge Coupled Devices) or CMOS (Complementary Metal Oxide Semiconductor) pixel sensors.

IEC
(International Electrotechnical Commission): Global organization that publishes international standards for electrical, electronic, and other technologies.

IP Address
The terminal's network address. Networks use IP addresses to determine where to send data that is being transmitted over a network. An IP address is a 32-bit number referred to as a series of 8-bit numbers in decimal dot notation *(e.*g., 130.24.34.03). The highest 8-bit number you can use is 254.

ISO
(International Organization for Standardization): A network of the national standards institutes of several countries producing world-wide industrial and commercial standards.

LED (Light Emitting Diode)
A low power electronic light source commonly used as an indicator light. It uses less power than an incandescent light bulb but more than a Liquid Crystal Display (LCD).

LED Illuminator
LED technology used as an extended lighting source in which extra optics added to the chip allow it to emit a complex radiated light pattern.

Matrix Symbologies (2D Codes)
An arrangement of regular polygon shaped cells where the center-to-center distance of adjacent elements is uniform. Matrix symbols may include recognition patterns which do not follow the same rules as the other elements within the symbol.

Multidrop
A communication protocol for connecting two or more readers in a network with a concentrator (or controller) and characterized by the use of individual device addresses.

Multi-row (or Stacked) Symbologies
Symbologies where a long symbol is broken into sections and stacked one upon another similar to sentences in a paragraph.

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

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

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

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CE

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declares that the

MATRIX 400; 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), SEPTEMBER 1998:	*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 23th, 2010

Lorenzo Girotti
Product & Process Quality Manager

CSQ IQNet UNI EN ISO 9001 UNI EN ISO 14001