DATALOGIC

MATRIX 450™

Reference Manual

⊙DATALOGIC

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

Matrix 450™ Reference Manual

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CONTENTS

REFERENCES

CONVENTIONS

This manual uses the following conventions:

"User" refers to anyone using a Matrix 450™ reader.
"Reader" refers to the Matrix 450™ reader.
"You" refers to the System Administrator or Technical Support person using this manual to install, configure, operate, maintain or troubleshoot a Matrix 450™ reader.

REFERENCE DOCUMENTATION

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

SUPPORT THROUGH THE WEBSITE

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

- **Products - Industrial Automation - Identification**

  Select your product from the links on the **Identification** page. The product page describes specific Info, Features, Applications, Models, Accessories, and Downloads including documentation, software drivers, and the VisiSet™ utility program, which allows device configuration using a PC through Serial and Ethernet interfaces.

- **Support & Services - Industrial Automation**

  Several links from the **Industrial Automation** list take you to additional services such as: Service Program which contains Maintenance Agreements and Warranty Extensions; Repair Centers; On-Line RMA Return Material Authorizations; Technical Support through email or phone, Partner Program; Downloads for additional downloads.

PATENTS

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

Design patents: EP 1,950,486.

Utility patents: US6,512,218 B1; US6,616,039 B1; US6,808,114 B1; US6,997,385 B2; US7,053,954 B1; US7,102,116 B2; US7,282,688 B2; US7,387,246 B2; US7,433,590 B2; US7,468,499 B2; US8,058,600 B2; US8,113,430 B2; EP996,284 B1; EP999,514 B1; EP1,014,292 B1; EP1,128,315 B1; EP1,396,811 B1; EP1,413,971 B1; EP1,804,089 B1; JP4,435,343 B2; CN ZL200680050007,8.

Additional patents pending.

COMPLIANCE

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

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

EMC COMPLIANCE

In order to meet the EMC requirements:

* connect reader chassis to the plant earth ground by means of a flat copper braid shorter than 100 mm;
* 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".

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.

LT-03X LASER SAFETY

The LT-03x Series Lighting Systems contain two aiming Laser LEDs used to position the reader.

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

LASER LIGHT
DO NOT STARE INTO BEAM
CLASS 2 LASER PRODUCT
MAX, OUTPUT RADIATION 1 mW
EMITTED WAVE LENGTH 630~680 nm
TO IEC 608025-1:2007

N2468

This product is covered by one or more of following patents:
U.S. Pat.: 6,808,114 B1; 6,997,385 B2; 7,387,246 B2.
See product manual and package for entire patent listing.
DATALOGIC AUTOMATION S.r.l.
Via Lavino, 265 - 40050 Monte San Pietro (BO) Italy - www.automation.datalogic.com

218441

AVOID EXPOSURE LASER LIGHT IS EMITTED FROM THIS APERTURE

LT-03X LED SAFETY

LT-03x LED emission according to EN 62471.

HANDLING

The Matrix 450™ 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).

NO
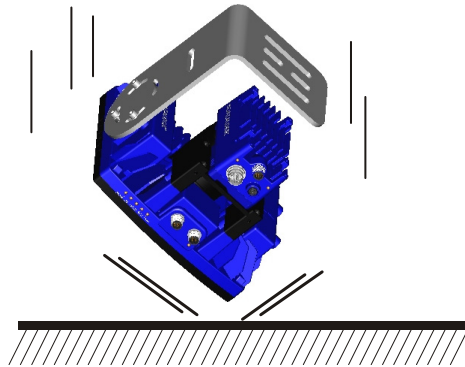
- do not fine tune the positioning by striking the reader or bracket.

NO
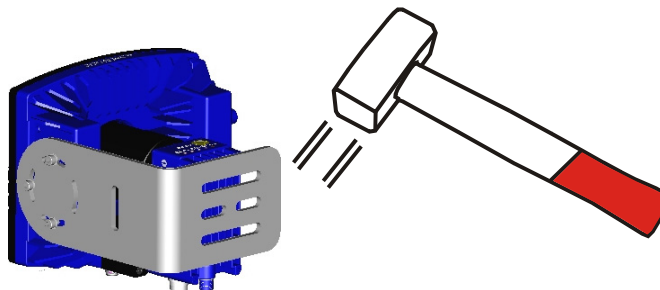
- do not weld the reader into position which can cause electrostatic, heat or reading window damage.
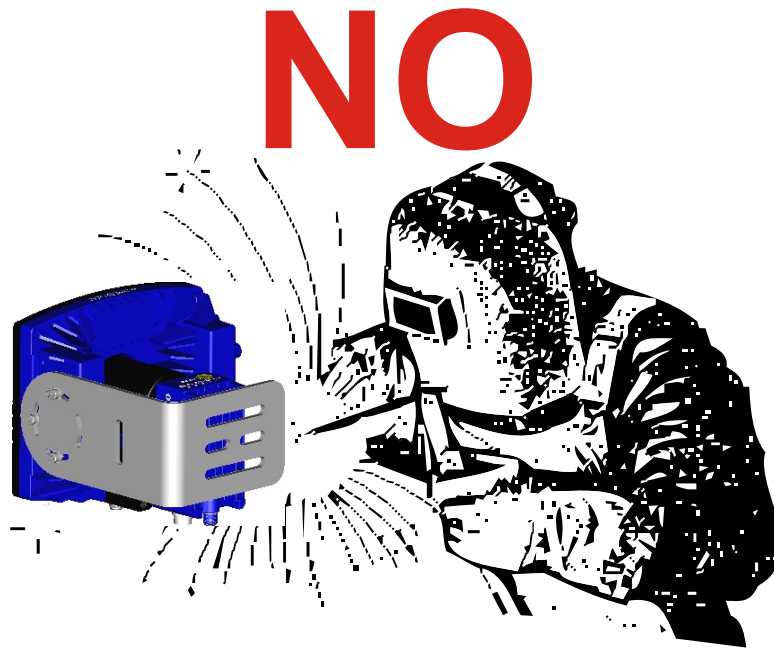
- do not spray paint near the reader which can cause reading window damage.

GENERAL VIEW

Matrix 450™ + LT-03x
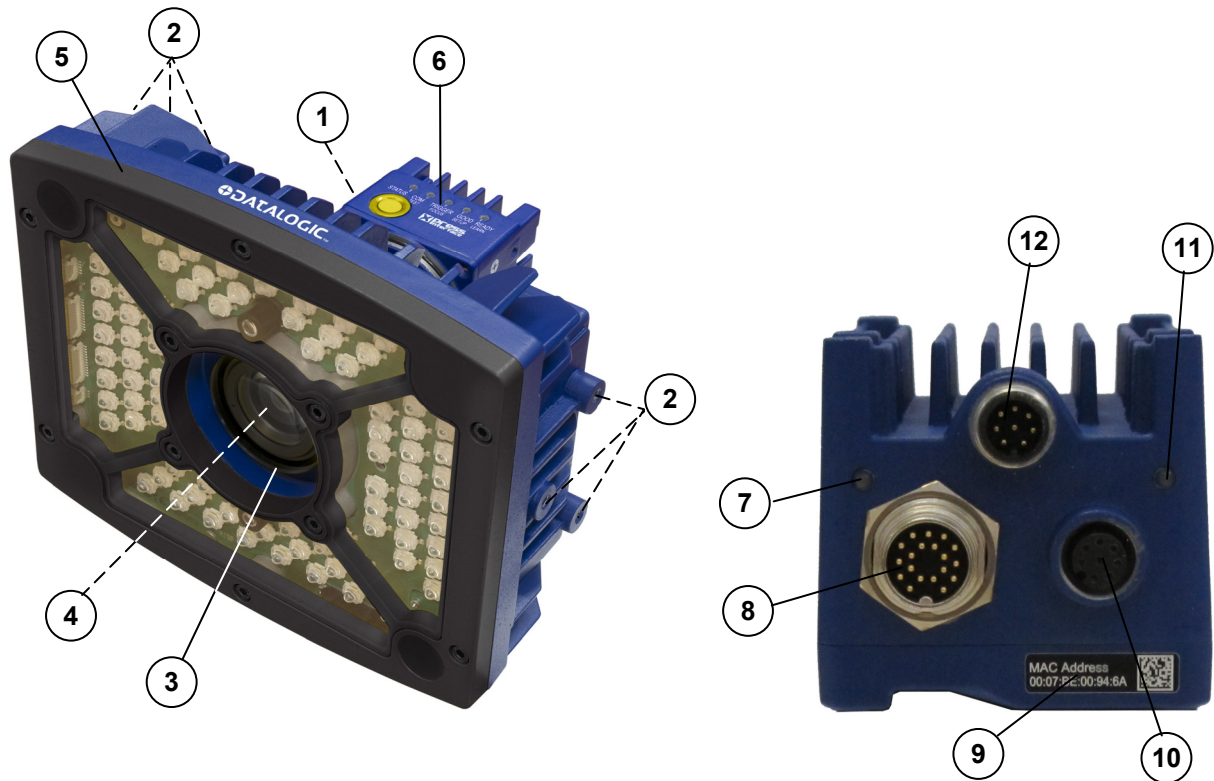
Figure A

1	Device Class Label	**7**	Power LED
2	Mounting Holes (6)	**8**	Power - Serial Interfaces - I/O Connector
3	Lens Cover	**9**	MAC Address Label
4	Lens (separate accessory)	**10**	Ethernet Connector
5	LT-03x Lighting System (separate accessory)	**11**	Ethernet Network Presence LED
6	HMI X-PRESS™ Interface	**12**	Lighting System Signal - Power Connector

1 RAPID CONFIGURATION

STEP 1 – ASSEMBLE THE READER

The first step to perform is to assemble the accessories that make up the Matrix 450™ reader. The lens and lighting system or external illuminator must be used. This procedure shows an LT-03x series lighting system.

> ⚠️
> **CAUTION**
>
> *Matrix 450™ must be disconnected from the power supply during this procedure.*

1. In a dust-free environment, remove the Matrix 450™ 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 LNS-12xx lens by slowly screwing it onto the base until it arrives at the mechanical stop.

> ☞
> **NOTE**
>
> *The lens mount is equipped with a special slip mechanism and together with the LT-03x design facilitates the focusing procedure during installation, for example if the locking knobs on the lens are obstructed by the body of the illuminator. See note in Step 4 "Focusing the Reader" or Step 8.*
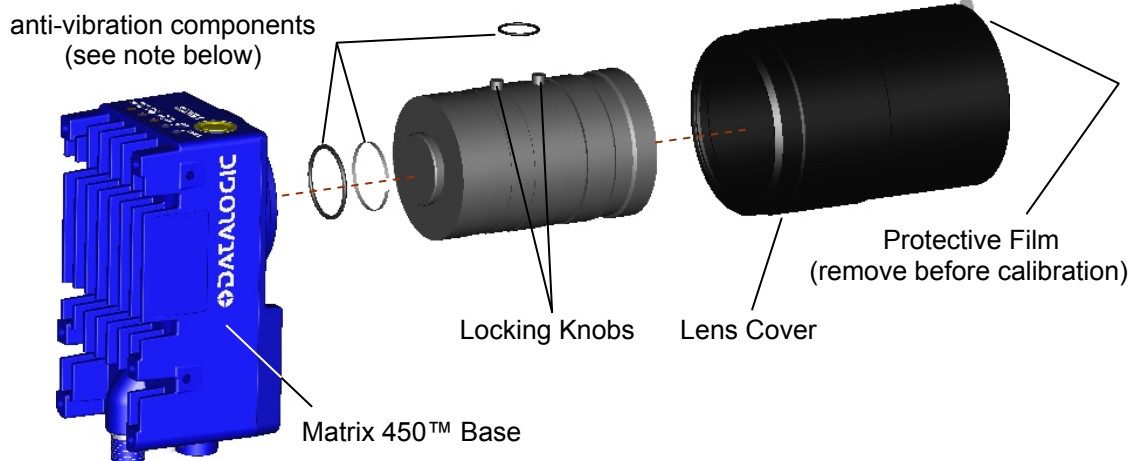
Figure 1 – Assembling Matrix 450™ and LNS-12xx Lens

> ☞
> **NOTE**
>
> *The anti-vibration components are already mounted to all Datalogic LNS-12xx Lenses.*

4. To keep dust and dirt off of the lens during mounting, temporarily replace the lens cover.
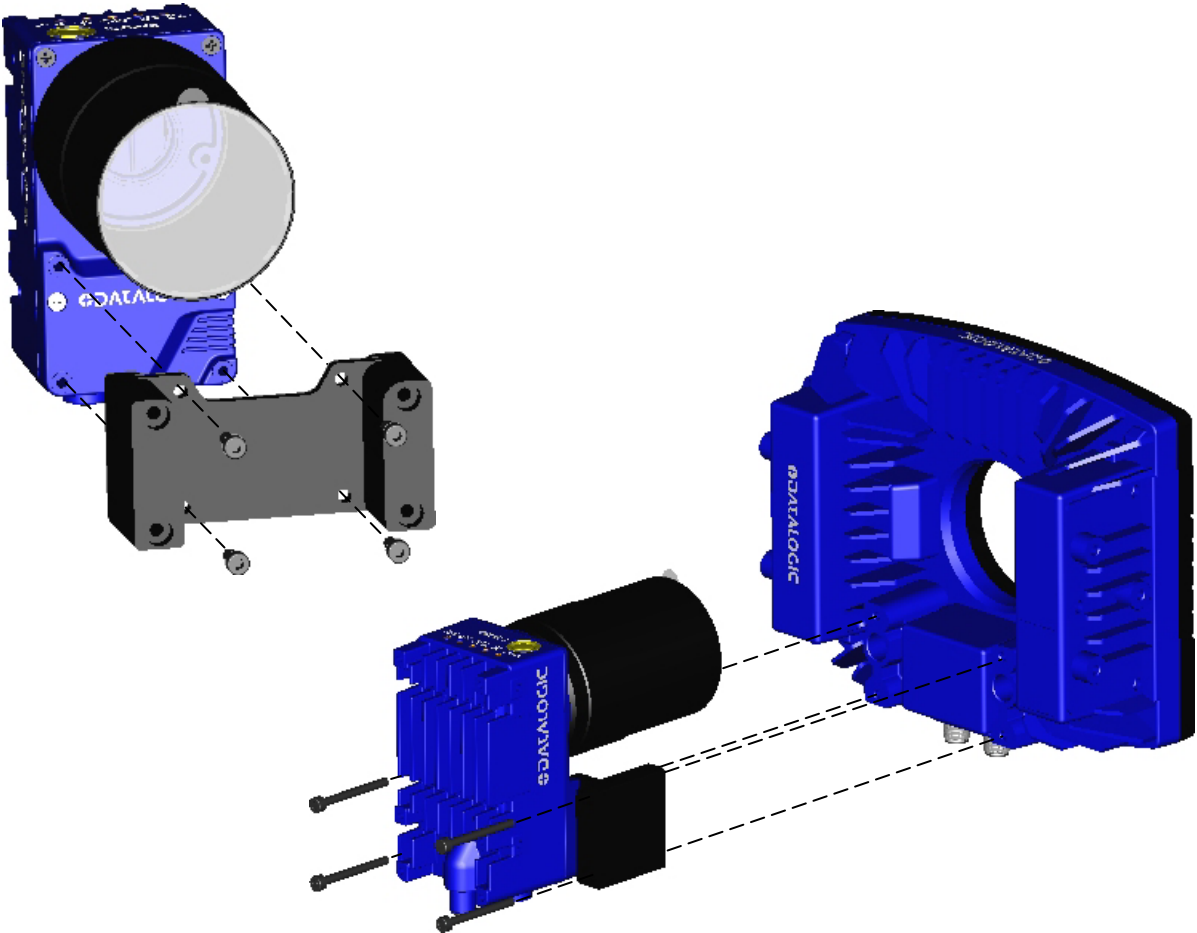
Figure 2 – Assembling Matrix 450™ to LT-03x

NOTE	*The mating bracket can be mounted in the reverse direction to create a compact version of the Matrix 450™ + LT-03x assembly. The compact assembly however will reduce access to the lens for the focusing procedure.*

REQUIRED ACCESSORIES

The following table shows the correct lens/illuminator combinations to be used for Matrix 450™ imager assembly.

Lenses			Illuminators		
93ACC0041	LNS-1216	16 mm C-Mount Lens 5MP with anti-vibration components	93A400034	LT-032	ULTRA POWER LT NARROW BLUE 40°
93ACC0034	LNS-1225	25 mm C-Mount Lens 5MP with anti-vibration components	93A400032	LT-030	ULTRA POWER LT SUPERNARROW BLUE 20°
			93A400033	LT-031	ULTRA POWER LT SUPERNARROW WHITE 20°
			93A400034	LT-032	ULTRA POWER LT NARROW BLUE 40°
93ACC0035	LNS-1235	35 mm C-Mount Lens 5MP with anti-vibration components	93A400032	LT-030	ULTRA POWER LT SUPERNARROW BLUE 20°
			93A400033	LT-031	ULTRA POWER LT SUPERNARROW WHITE 20°
93ACC0036	LNS-1250	50 mm C-Mount Lens 5MP with anti-vibration components	93A400032	LT-030	ULTRA POWER LT SUPERNARROW BLUE 20°
			93A400033	LT-031	ULTRA POWER LT SUPERNARROW WHITE 20°

STEP 2 – CONNECT THE SYSTEM

In the typical standalone layout shown in the figure below a serial host is connected to the Matrix 450™ + LT-03x. The reader operates in One Shot or Phase Mode and can use an external trigger to signal image acquisition.

The CBX is used to facilitate the connection between the Matrix 450™ + LT-03x assembly and the serial host interface, external trigger, serial aux configuration, and optional input and output devices.
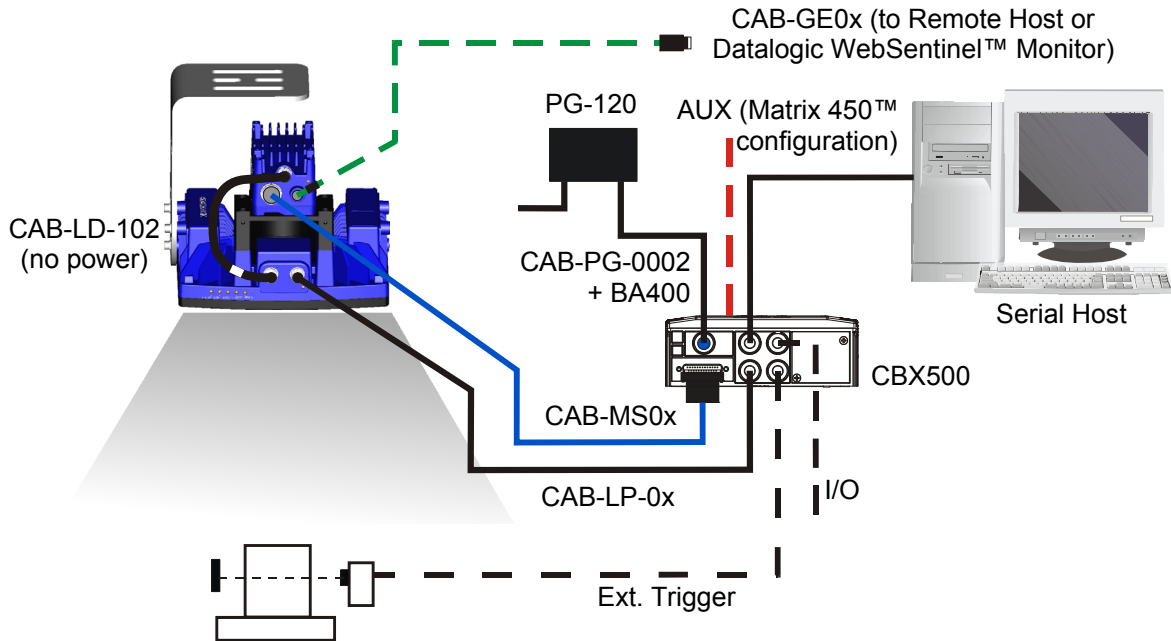
Matrix 450™ Standalone Layout to Serial Host

- **Power Supply Connection**
  Use the PG-120 power Kit (3 versions for European, UK or US plug) and CAB-PG-0002 + BA400 connector to connect the PG-120 to the CBX. An alternative power supply to the PG-120 is the PWR-120.

- **CBX Connection**
  Use CAB-LP-0x to supply power from the CBX to the LT-03x. Connect Brown/White wires to Vdc and Black/Blue wires to GND. Connect the cable shield to Earth ground.

  Use CAB-MS0x between Matrix 450™ and the CBX for: power, serial host, external trigger device (photocell), serial aux, additional I/O connections.

  Optionally: use the CAB-GE0x for the Gigabit Ethernet connection towards a remote host or Datalogic WebSentinel™ monitoring station.

- **Matrix 450™ LT-03x Connection**
  Use the CAB-LD-102 (no power) cable (provided with the LT-03x), to connect the communication signals between the Matrix 450™ and the LT-03x while isolating the power. Through the CBX internal power switch you can control power to the Matrix 450™ independently from the LT-03x.

> 👆 **NOTE**   *Matrix 450™ does not support sourcing power towards the CBX in order to power I/O devices. These devices must be powered through the CBX or from an external source.*

Alternatively, Matrix 450™ + LT-03x can be connected directly to an Ethernet host through the Gigabit Ethernet connection (CAB-GE0x). If an external trigger is not necessary, the layout is simplified. The LT-03x is powered directly from the PG-120 through the CAB-PG-0105 cable. The CAB-LD-002 (with power) cable (provided with the LT-03x), is used to supply power to the Matrix 450™ from the LT-03x.
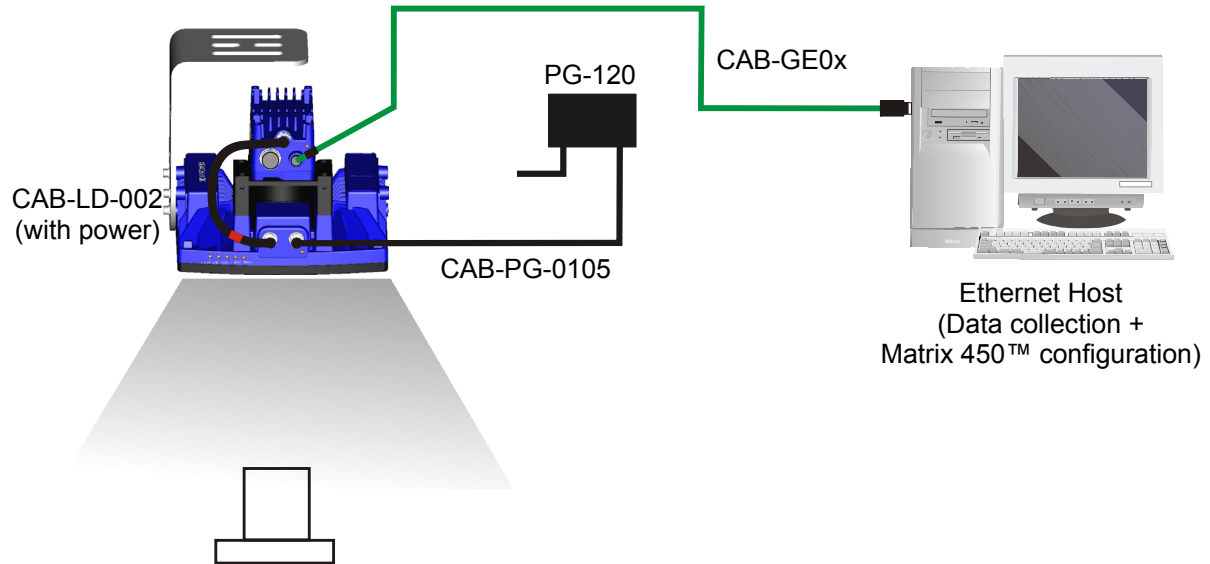
Matrix 450™ Standalone Layout to Ethernet Host

Matrix 450™ + LT-03x can also be used in an ID-NET™ Master/Slave configuration. See Chapter 6 of this Reference Manual for details, and par. 4.1.1 or 5.4.1 for power supply recommendations.

NOTE

If using separate power sources for LT-03x and Matrix 450™, make sure that LT-03x is powered up before Matrix 450™ in order to be correctly recognized.

CBX100/CBX500 Pinout for Matrix 450™

The table below gives the pinout of the CBX100/CBX500 terminal block connectors. Use this pinout when the Matrix 450™ 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.*

STEP 3 – MOUNT AND POSITION THE READER

1. To mount the Matrix 450™ + LT-03x assembly, use the L-shaped mounting bracket to obtain the most suitable position for the reader. The most common mounting configurations are shown in the figure below. Other mounting solutions are provided in Chapter 3 of this Reference Manual.
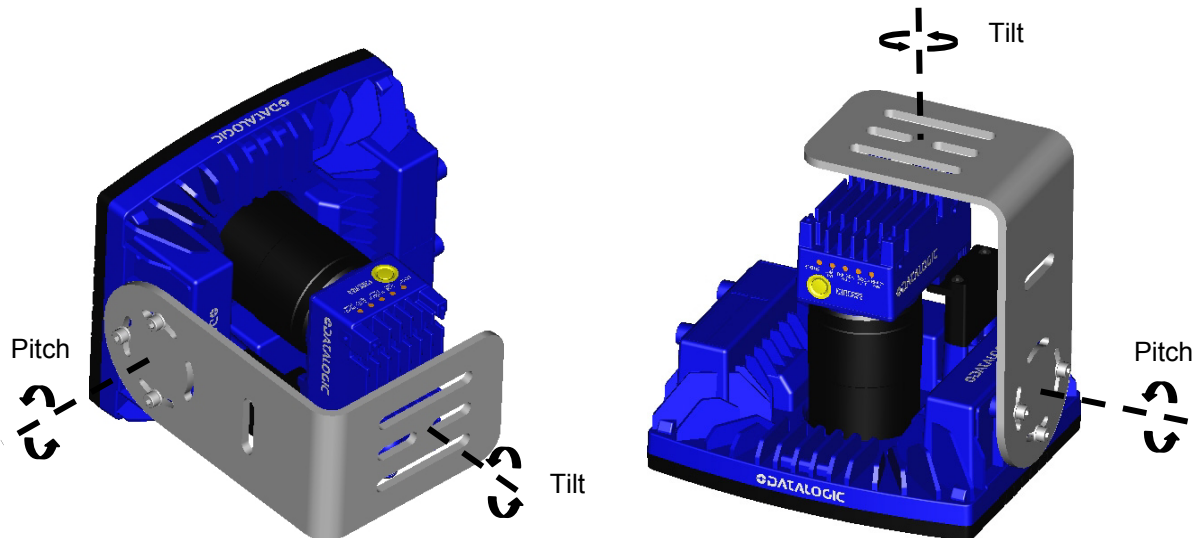
Figure 3 –Positioning with LT-03x L-shaped Mounting Bracket

⚠ **CAUTION**	*Do not mount the Matrix 450™ + LT-03x assembly with the Matrix 450™ body mounting bracket accessory. The body mounting bracket is not designed to support the LT-03x.*

2. When mounting the Matrix 450™ + LT-03x assembly, 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. Assure at least 10° Pitch or Skew to avoid direct illuminator light reflection which will reduce performance.

3. Refer to the Reading Diagrams to determine the correct reading distance according to your application requirements.

☞ **NOTE**	*Rapid Configuration of the Matrix 450™ 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.*

Both the X-PRESS™ interface and the VisiSet™ Setup Wizard are easy setup methods valid for single code applications with uniform labels that do not require reading at the extreme ends of the reading ranges shown in the diagrams.

For advanced applications including those that operate at the extreme ends of the reading ranges, use the VisiSet™ Calibration Tool. *See the Help On Line for more details.*

STEP 4 – FOCUS THE READER

Matrix 450™ 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:

> **NOTE** *Once the lens is fully tightened to the mechanical stop (Step 1), it can be rotated counterclockwise (up to one full turn without loosening the lens), so that the diaphragm scale and locking knobs can be easily accessed from behind the LT-03x.*

   a. Remove the anti-vibration o-ring from the two Locking Knobs on the lens and loosen them.

   b. Adjust the Focus ring to the "**Far position**" and the Diaphragm ring to the "**F2.8**" number setting which is the preferred setting for installation using the X-PRESS™ interface.

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.

red   yellow   yellow   green   green

STATUS	COM	TRIGGER	GOOD	READY
	TEST	FOCUS	SETUP	LEARN
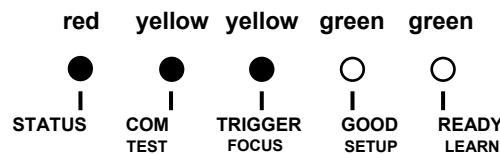
Figure 4 – X-PRESS™ Interface: Focus Function

5. Release the button to enter the Focus function. The Blue Diamonds™ and laser pointers turn on.

> **NOTE** *If the reading surface is too dark, in order to increase the contrast, it may be helpful to place a piece of white paper at the Blue Diamonds™ positions to see them better.*

The procedure is as follows:

   a. <u>At the correct reading distance</u> (see the Reading Diagrams in Chapter 7 of this Reference Manual), adjust the Focus ring towards the "Near position" until the Blue Diamonds™ are perfectly in focus, see Figure 5.

   b. 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.

   c. Set the Diaphragm to the aperture stop (F-number) stated in the conditions relative to the selected reading diagram and then tighten the Diaphragm Locking Knob.

   d. Replace the anti-vibration o-ring onto the two Locking Knobs.

> **NOTE** *If necessary you can use the Fine Focusing Tool in the VisiSet™ Setup Wizard for fine focusing. See Step 8.*
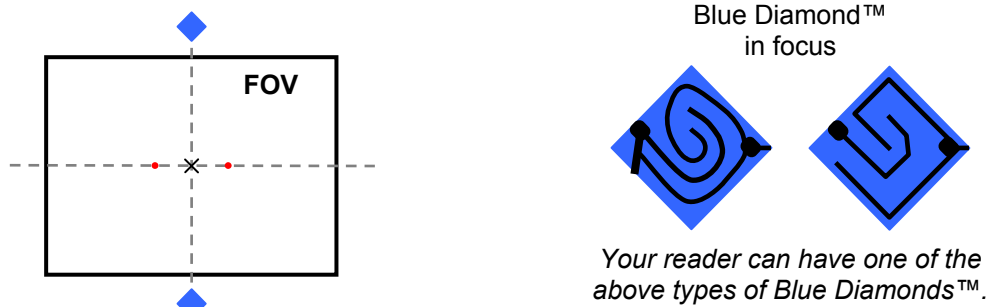
Figure 5 – Focus Function Using Blue Diamonds™

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 450™ must acquire information regarding image density or PPI (pixels per inch). This calibration takes place through the X-PRESS™ Interface and the **Focusing and PPI Setup 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™ and laser pointers turn on.

Figure 6 – X-PRESS™ Interface: Locate Function

3. From the **Focusing and PPI Setup Chart**, position the 1 mm code at the center of the Horizontal FOV (aligned with the laser pointers).

Figure 7 –Aligning the Focusing and PPI Setup Chart Using Laser Pointers as Reference
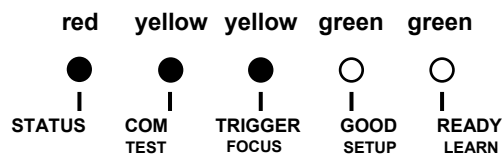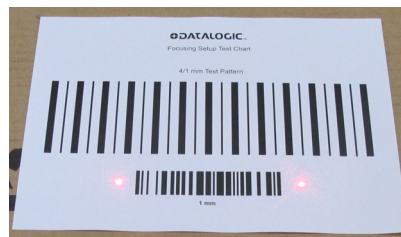
4. Exit the Focus function by pressing the X-PRESS™ push button once. The Blue Diamonds™ and laser pointers turn off.

Setup

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

red   yellow yellow green   green

● ● ● ● ○

| | | | |
STATUS COM   TRIGGER GOOD   READY
        TEST   FOCUS   SETUP LEARN

Figure 8 – X-PRESS™ Interface: Setup Function

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 450™ emits 3 high pitched beeps.

    If the calibration cannot be reached after a timeout of about 5 (five) seconds Matrix 450™ 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 450™ emits a long low pitched beep.

7. Exit the Setup function by pressing the X-PRESS™ push button once.

Learn

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

red   yellow yellow green   green

● ● ● ● ●

| | |
STATUS COM   TRIGGER GOOD   READY
        TEST   FOCUS   SETUP LEARN

Figure 9 – X-PRESS™ Interface: Learn Function

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 450™ emits 3 high pitched beeps.

    If the calibration cannot be reached after a timeout of about 3 (three) minutes Matrix 450™ 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 450™ emits a long low pitched beep.

10. Exit the Learn function by pressing the X-PRESS™ push button once.

STEP 6 – X-PRESS™ CONFIGURATION

Once Matrix 450™ has calibrated image density, you can configure it for optimal code reading relative to your application.

Locate

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

red	yellow	yellow	green	green
●	●	●	○	○
STATUS	COM	TRIGGER	GOOD	READY
	TEST	FOCUS	SETUP	LEARN
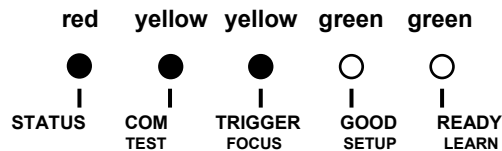
Figure 10 – X-PRESS™ Interface: Locate Function

2. Release the button to enter the Focus function. The Blue Diamonds™ and laser pointers turn on.

3. **Select a code from your application**. Position the code at the center of the Horizontal FOV (aligned with the laser pointers).

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

Setup

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

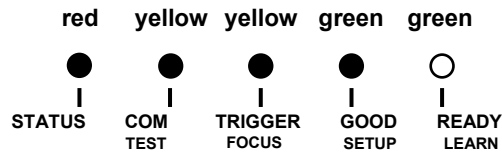| red	yellow	yellow	green	green
●	●	●	●	○
STATUS	COM	TRIGGER	GOOD	READY
	TEST	FOCUS	SETUP	LEARN
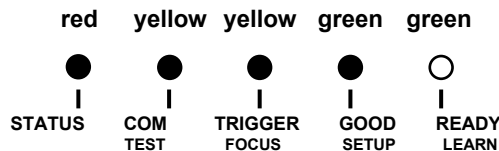
Figure 11 – X-PRESS™ Interface: Setup Function

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 450™ emits 3 high pitched beeps.

   If the calibration cannot be reached after a timeout of about 5 (five) seconds Matrix 450™ will exit without saving the parameters to memory, the Setup LED <u>will not</u> remain on continuously but it will just stop blinking. In this case Matrix 450™ emits a long low pitched beep.

7. Exit the Setup function by pressing the X-PRESS™ push button once.

Learn

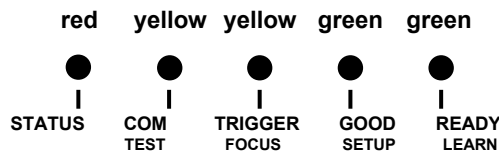8. Enter the Learn function by pressing and holding the X-PRESS™ push button until the Learn LED is on.

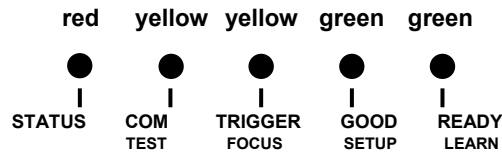| red	yellow	yellow	green	green
●	●	●	●	●
STATUS	COM	TRIGGER	GOOD	READY
	TEST	FOCUS	SETUP	LEARN

Figure 12 – X-PRESS™ Interface: Learn Function

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 450™ emits 3 high pitched beeps[1].

    If the autolearning cannot be reached after a timeout of about 3 (three) minutes Matrix 450™ 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 450™ emits a long low pitched beep.

10. Exit the Learn function by pressing the X-PRESS™ push button once.

☞

If you have used this procedure to configure Matrix 450™ go to step 9.

NOTE

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 one 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.

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[1] *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 the reader to be considered as a remote object to be configured and monitored.

To install VisiSet™, turn on the PC that will be used for the configuration, running Windows: 98/2000, NT 4.0+SP4 or later, XP, Vista, 7 or 8, then insert the VisiSet™ Mini-DVD, wait for the CD to autorun and follow the installation procedure.

This configuration procedure assumes a laptop computer, running VisiSet™, connected to either the reader's auxiliary serial port (through the CBX) or to the reader's on-board Ethernet port (previously configured using the programming barcode procedure).

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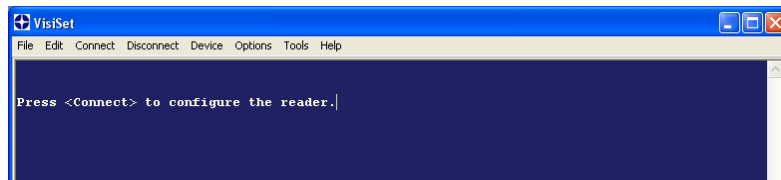

Figure 13 - VisiSet™ Opening Window

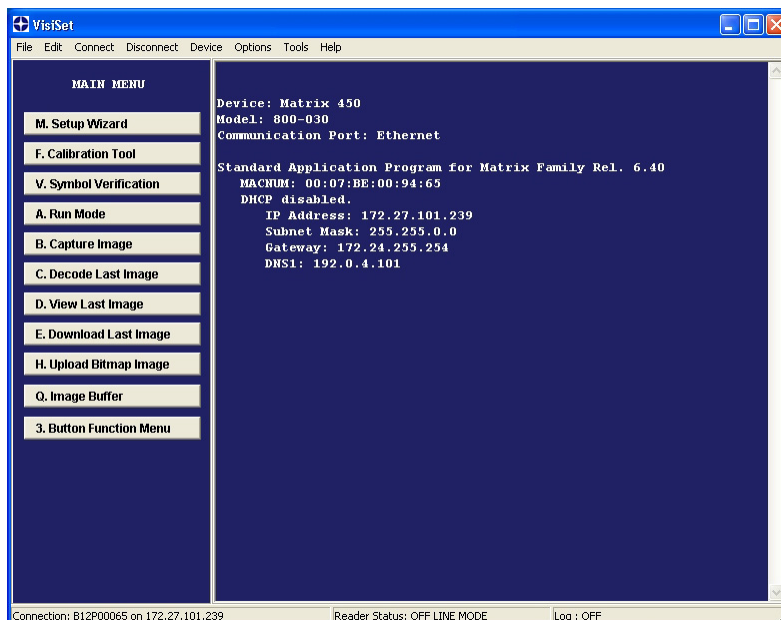Set the communication parameters from the "Options" menu. Then select "Connect", the following window appears:

Figure 14 - 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.
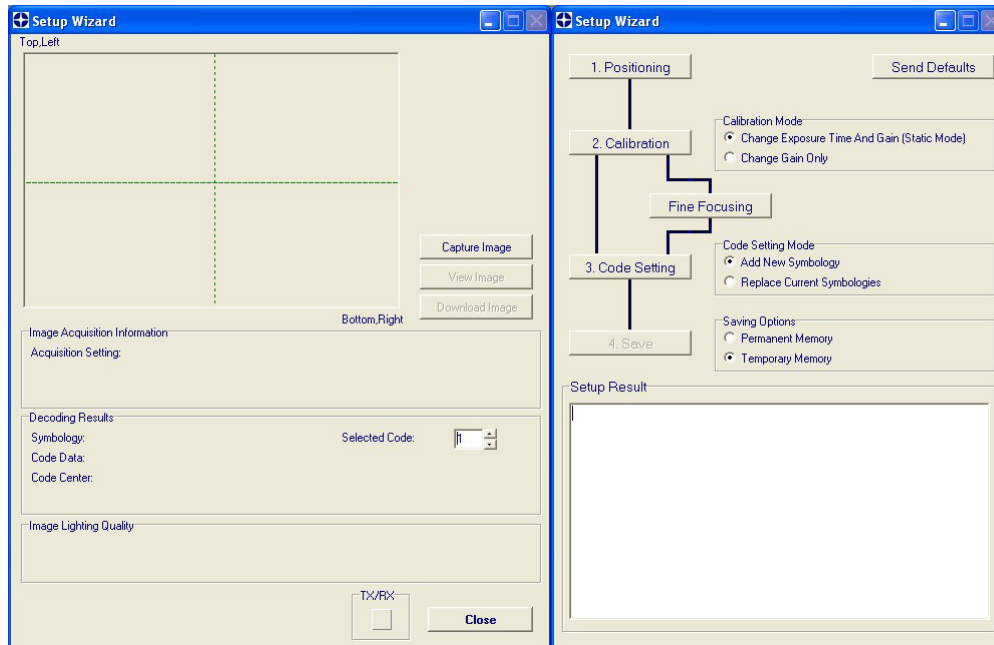
2. Remove the lens cover and prepare the correct accessory lens for your application:

☝ NOTE	*Once the lens is fully tightened to the mechanical stop (Step 1), it can be rotated counterclockwise (up to one full turn without loosening the lens), so that the diaphragm scale and locking knobs can be easily accessed from behind the LT-03x.*

a. Remove the anti-vibration o-ring from the two Locking Knobs on the lens and loosen them.

b. Adjust the Focus ring to the "**Far position**" and the Diaphragm ring to the "**F4**" number setting which is the preferred setting for installation using the VisSet™ Setup Wizard.

c. Place the **Focusing and PPI Setup Chart** in front of the reader at the correct reading distance (see the Reading Diagrams in Chapter 7 of this Reference Manual).

1

3. Press the "Positioning" button. The reader continuously acquires images and gives visual feedback in the view image window. Move the Focusing Pattern to center it on the X-axis reference line at the center of the FOV and on the four delimiters (red points) in the acquired images which indicate the region in which the calibration algorithm is active. See figure below.

    Press the Positioning button again to stop positioning.
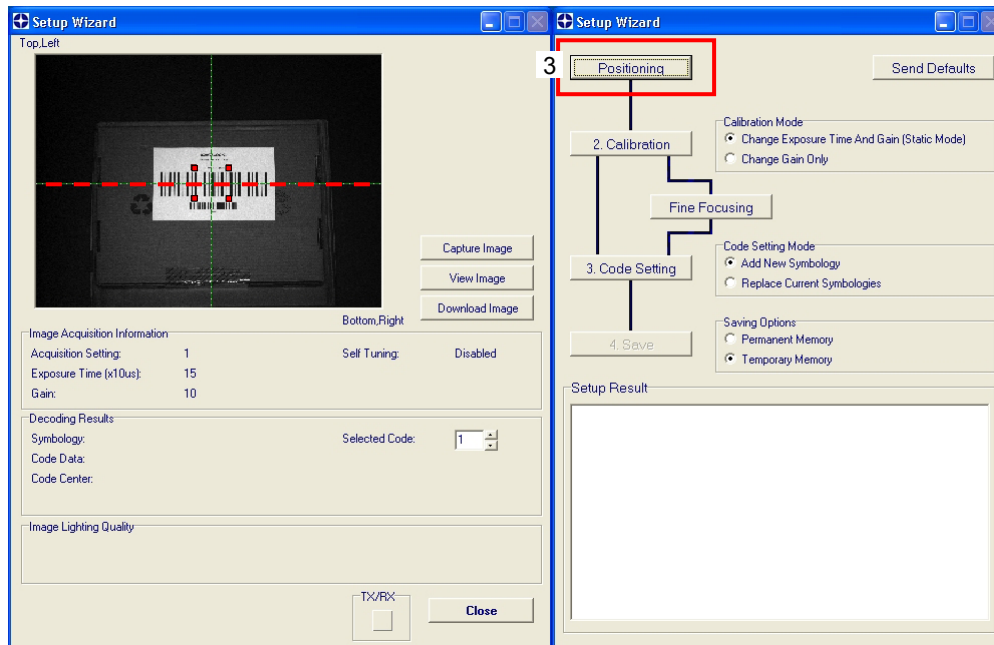
4. Select a Calibration Mode choice and press the "Calibrate" button. The reader flashes once acquiring the image and auto determines the best exposure and gain settings. If the code symbology is enabled by default, the code will also be decoded.
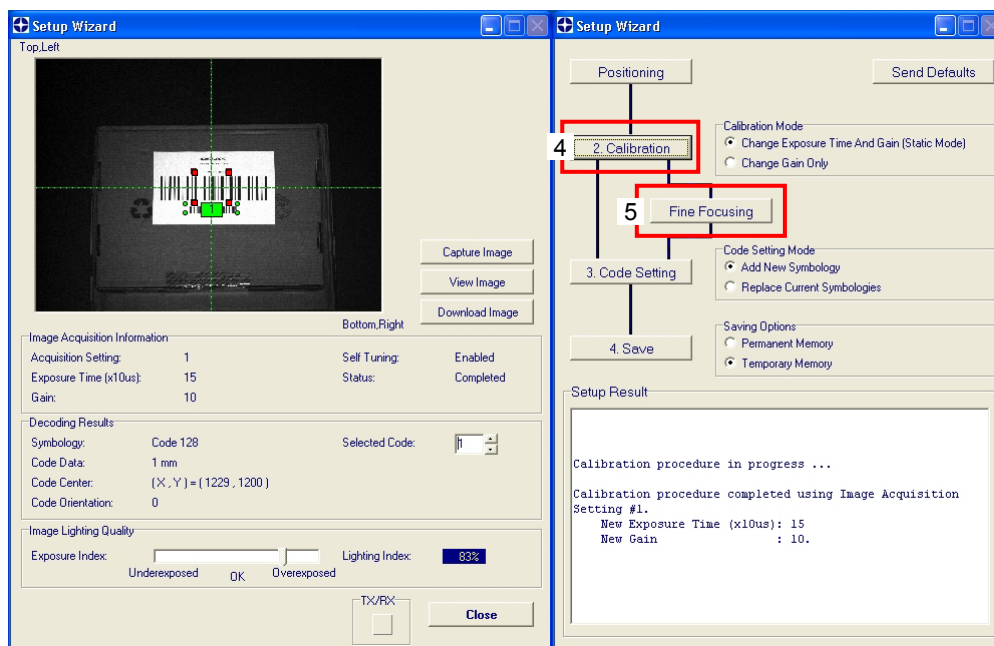
5. Press the "Fine Focusing" button to activate the Fine Focusing Tool.
    The reader continuously acquires images and gives visual feedback on the focusing quality in the Focusing Tool window.

> *In the Focusing Tool window, use the Zoom feature to make Fine Tuning easier.*
>
> **NOTE**

a. 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.

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

c. 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) see bottom figure.

d. Tighten the Focus Locking Knob on the lens.

e. Set the Diaphragm to the aperture stop (F-number) stated in the conditions relative to the selected reading diagram and then tighten the Diaphragm Locking Knob.

f. Replace the anti-vibration o-ring onto the two Locking Knobs.

g. Replace the lens cover, screwing it tightly to the base.

h. Press the "Close" button to return to the Setup Wizard.
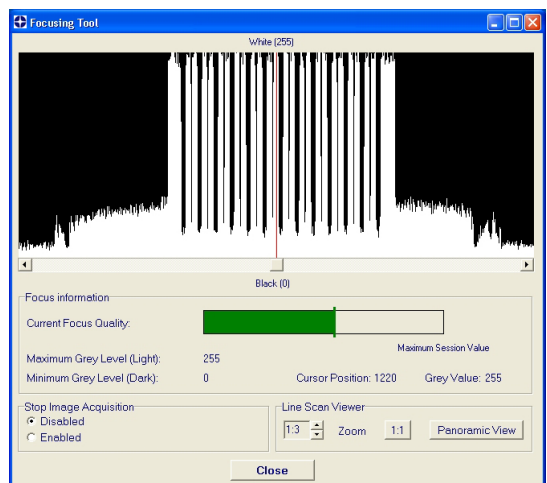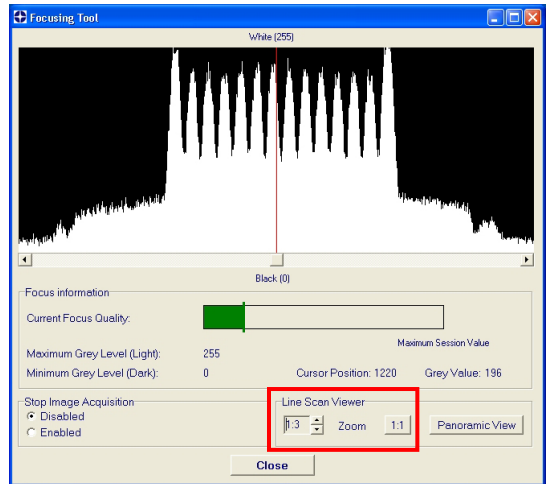
6. From the **Focusing and PPI Setup Chart**, select the 1 mm code and position it at the center of the Horizontal FOV (aligned with the laser pointers).
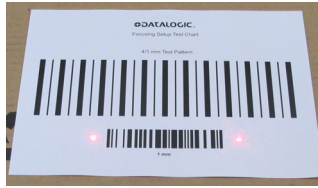
a. Select a Calibration Mode choice and press the "Calibrate" button.

b. Select a Code Setting Mode choice and press the "Code Setting" button.

This step performs image density calibration in order for Matrix 450™ 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.
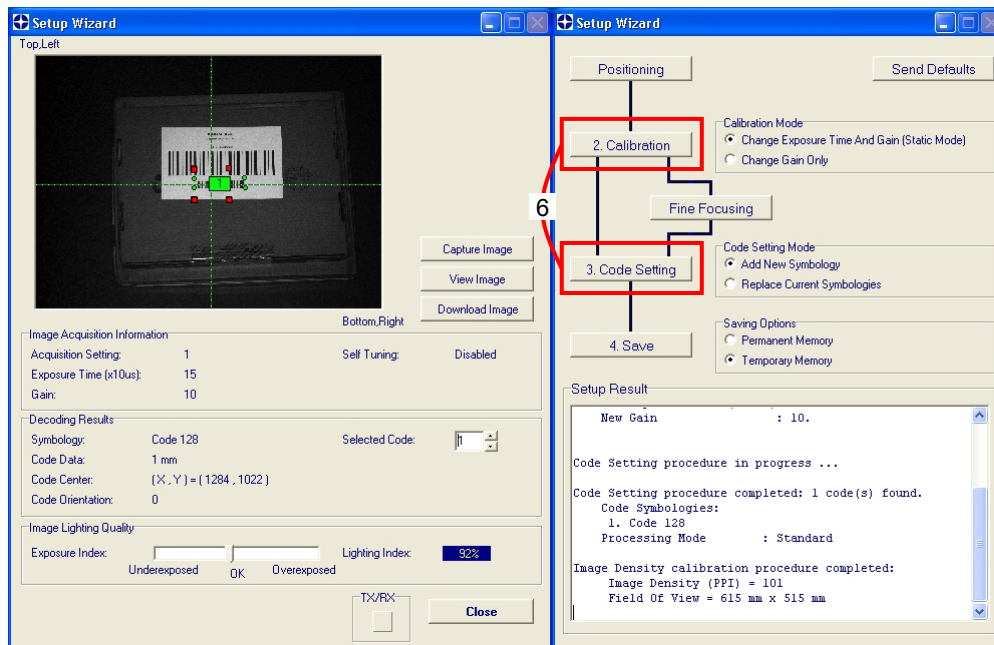
7. Substitute the Focusing and PPI Setup Chart with **the application specific code**, placing it in front of the reader at the same reading distance, then repeat step 6a and 6b.
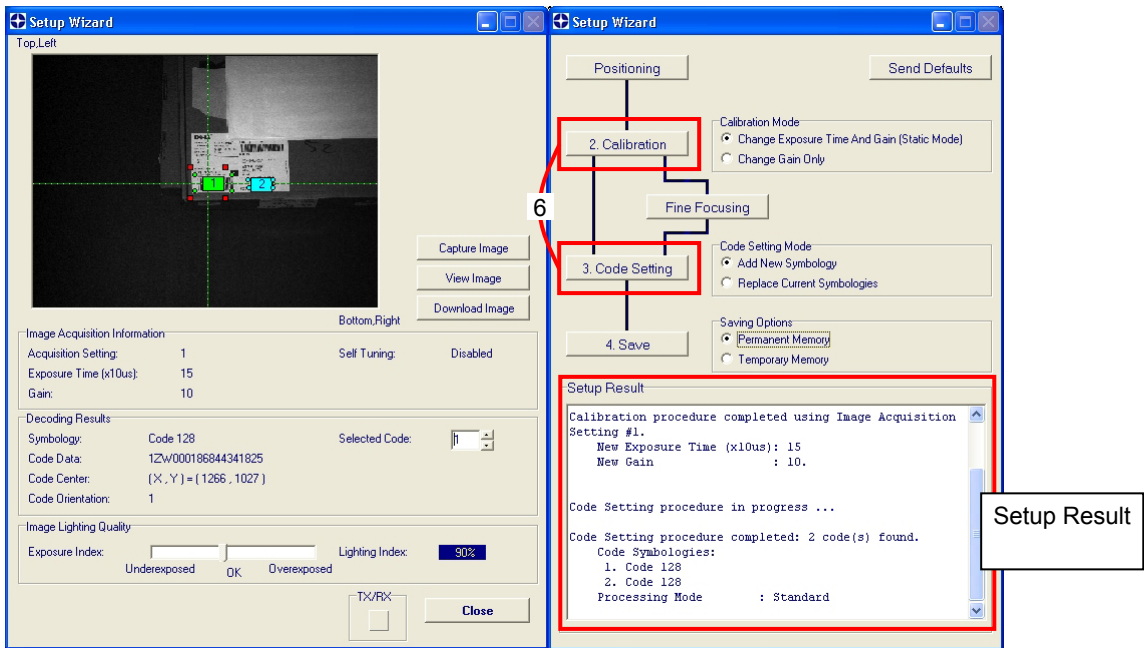
8. Select a Saving Options choice and press the "Save" button.
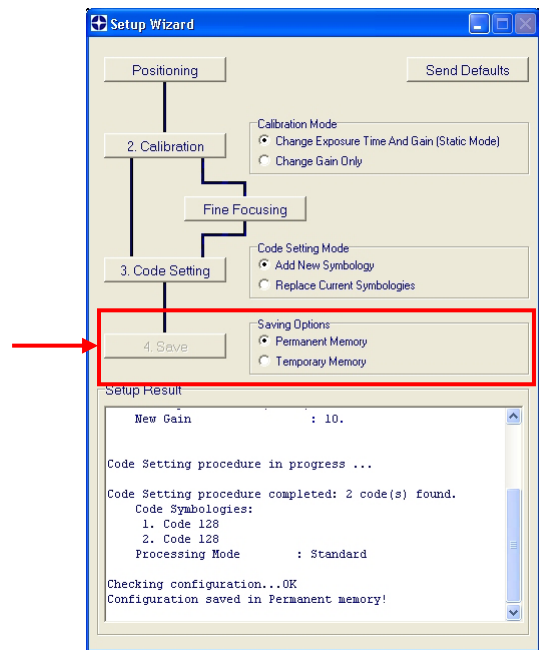
9. Close the Setup Wizard.

☞ **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.*

1

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 when codes are placed in the reading area (FOV), the Bar-Graph shows the Good Read Rate. In case of no read condition, only the STATUS LED is on and blinks.
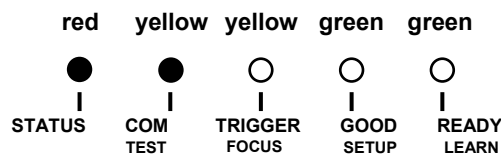
Figure 15 – X-PRESS™ Interface: Test Function

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

> ☞
>
> *By default, the Test exits automatically after three minutes.*
>
> **NOTE**

The Bar Graph has the following meaning:
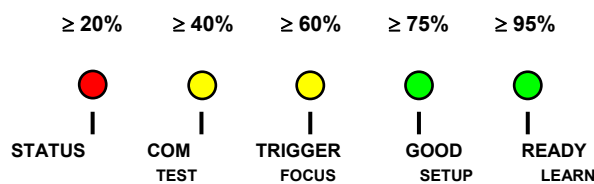
ADVANCED READER CONFIGURATION

For further details on advanced product configuration, refer to this Reference Manual and the Matrix 450™ Help On Line on the installation Mini-DVD.

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):
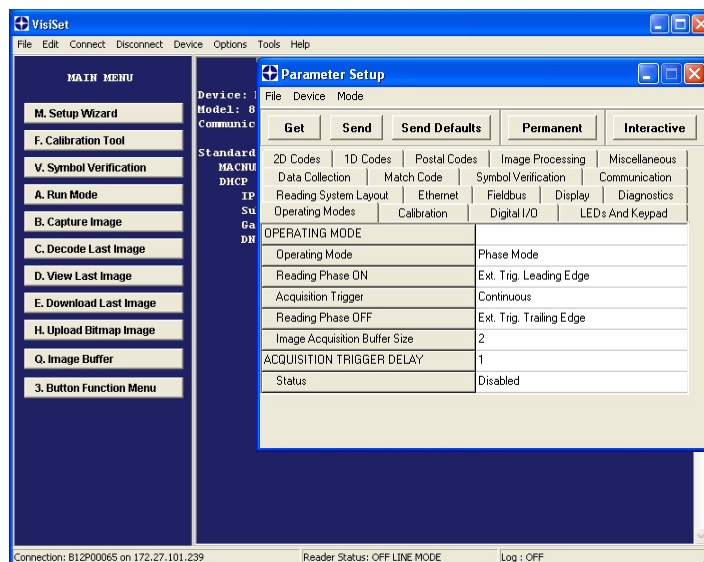
Figure 16 - VisiSet™ Parameter Setup Window

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 Mini-DVD.

Alternative Layouts

If you need to install an Ethernet network, ID-NET™ network, Fieldbus network, etc., refer to Chapter 6 of this 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 Mini-DVD.

2 INTRODUCTION

2.1 PRODUCT DESCRIPTION

Matrix 450™ is a 5.0 megapixels **2D Imager** dedicated to middle range applications in the **Transportation and Logistic industry.** Matrix 450™ is an extremely powerful reader, capable to address ID applications never covered before by a 2D-Imager.

It features a 5.0 megapixel CCD sensor, 1.1 GHz core, 512 megabytes of working memory, integrated Gigabit Ethernet, a 96-LED illuminator lighting system providing flashing and continuous high-power lighting, outstanding decoding libraries, real-time image streaming and saving.

This product offers superior reading performance, maximum reliability and extreme ease, in installation, in use and maintenance. For that, it guarantees a fast return on investment and a very minimum total cost of ownership.

Matrix 450™ meets the requirements of reading in motion over conveyors. Each single shot – at such high resolution – has large coverage, enough to scan the whole practical area over many slot sorters, like cross-belts, tilt-trays, bombay and small-drop systems. Multiple reading attempts are generally not needed, so the highest reading throughput and ease of use are always guaranteed.

Matrix 450™ is also the perfect solution for automated identification in **manual material handling applications**. thanks to the dedicated functionalities – high power continuous lighting, white illumination, aiming laser pointers, patented colored spot indicators, http live image mirroring – actually make Matrix 450™ a comprehensive solution for operator attended scanning in presentation mode, like manual object sorting or manual conveyor loading/unloading.

The ID-NET™ reader clustering permits effectively extending the reading area for single-side and multi-side applications. Captured images are stored on-board and optionally transferred to external supports through the integrated Gigabit ethernet connectivity. No moving parts, rugged metal construction, IP65 enclosure rate and operative temperature up to 50°C guarantee a long life cycle even in harsh industrial environments.

Matrix 450™ has been developed for use in numerous applications:

- Manual Postal Sorting
- Automated Postal Sorting
- Loading/Unloading
- Multimedia and Flats
- Induction Lines
- Order Fullfillment
- Reverse Logistics
- Static Scan
- Manual Presentation Scanning

Standard Application Program

A Standard Application Program is factory-loaded onto Matrix 450™. This program controls code reading, data formatting, serial port and Ethernet interfacing, and many other operating and control parameters. It is completely user configurable from a Laptop or PC using the dedicated configuration software program VisiSet™, provided on Mini-DVD with the reader.

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

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

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

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

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

Excellent Performance

- 5.0 MPixels

- Adjustable focus through C-Mount lenses

- Powerful Illuminator Lighting Systems

- Outstanding decoding capability on 1D, 2D, Stacked, Postal symbologies

- Omni-directional reading

- Frame Rate up to 15 frames/sec

- Region Of Interest Windowing for higher frame rate

- Up to 100 readable codes in a single frame

Ease of Setup

- Quick installation without PC by using X-PRESS™ interface for easy and intuitive setup

- 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)

Ease of Use

- X-PRESS™ interface LEDs provide operational and performance feedback

- Green Spot and beeper for immediate Good Read feedback

- Red Spot and beeper for immediate No 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, mounting brackets, connection boxes, cables and photocells

- Ethernet Connectivity with TCP/IP socket for reader parameter configuration, data and image transfer, FTP client, etc.

- 3 serial communication interfaces (Main, Auxiliary, ID-NET™)

- General purpose optocoupled I/Os

Industrial Strength

- Industrial compact 2D reader

- Rugged full metal construction

- Sealed circular connectors

- IP65 protection class

- 50 °C max operating temperature

- Supply voltage ranges from 10 to 30 Vdc for Matrix 450™ (LT-03x requires 24 Vdc)
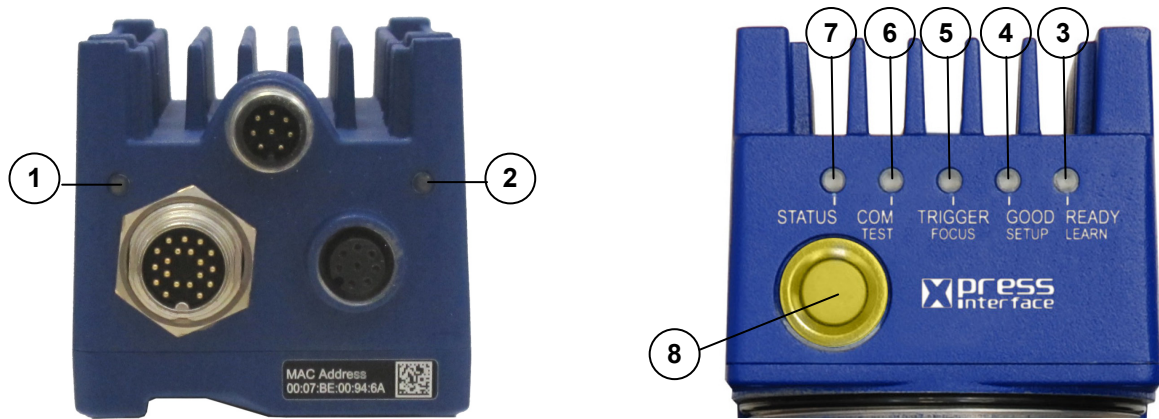
2.2 INDICATORS AND KEYPAD BUTTON

Figure 17 - Indicators

The following LED indicators are located on the reader:

POWER	blue LED indicates that the reader is connected to the power supply (Figure 17, 1)
NET	yellow LED indicates connection to the on-board Ethernet network (Figure 17, 2)

In <u>normal operating mode</u> 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 17, 3)
GOOD	green LED confirms successful reading (Figure 17, 4)
TRIGGER	yellow LED indicates the status of the reading phase (Figure 17, 5)
COM	yellow LED indicates active communication on the main serial port * (Figure 17, 6)
STATUS	red LED indicates a NO READ result (Figure 17, 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 <u>X-PRESS™ Configuration mode</u> the colors and meaning of these five LEDs are described in par. 2.5.

The keypad button (Figure 17, 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
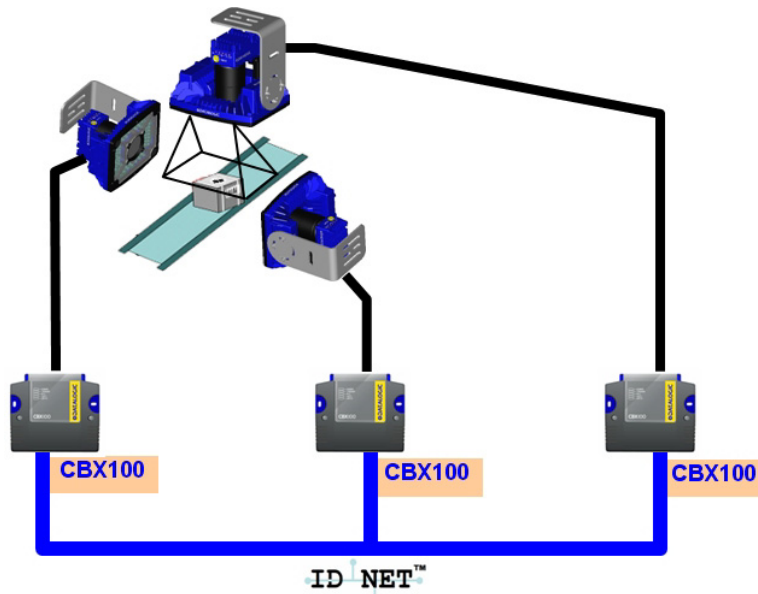
ID-NET™ interface allows local connection of multiple readers reading different sides of the same target. All readers share a single presence sensor and activate/deactivate simultaneously.

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.
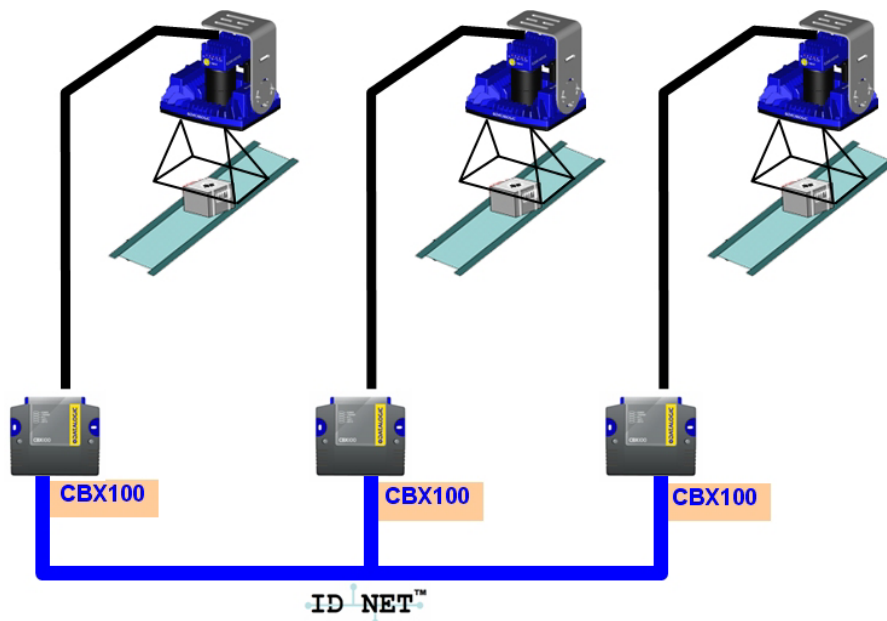
2.3.1 How To Setup/Configure the Reader Network

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 5.6).
3. Power up the entire system.

Configuration of Slaves

1. Connect a PC equipped with VisiSet™ to the Main, Auxiliary or Ethernet interface of the planned Slave reader.
2. Launch VisiSet™ and connect to the Slave reader.
3. From the VisiSet™ Device Menu select "Parameter Setup".
4. Set the Role of the Slave reader (Synchronized or Multidata) from the Reading System Layout > Device Network Setting > Topology Role parameter.

5. Set the Slave Address according to the desired value **1-31** from the Reading System Layout > Device Network Setting > Slave Address parameter. Each reader must have a different Address on the ID-NET™ Network.

6. If necessary, set the ID-NET™ baudrate from the Reading System Layout > Device Network Setting > Network Baud Rate parameter, (500 kbs default).

7. Configure the other device parameters via VisiSet™ [Operating Mode, Calibration, Data Collection parameters, etc.].

8. The Slave device is now Configured. Physically connect it to the Master/Slave network. If using the CBX connection box equipped with a BM100 Backup module, you can perform Device Backup at the Slave (see par. 2.4 for details).

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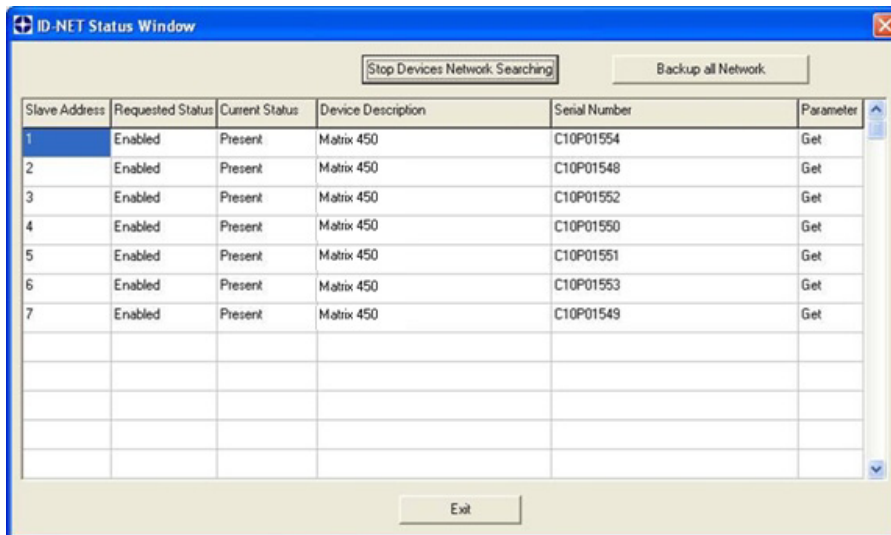

<u>Configuration of Master</u>

1. Connect a PC equipped with VisiSet™ to the Main, Auxiliary or Ethernet interface of the planned Master reader.

2. Launch VisiSet™ and connect to the Master reader.

3. From the VisiSet™ Device Menu select "Parameter Setup".

4. Set the Role of the Master reader (Synchronized or Multidata) from the Reading System Layout > Device Network Setting > Topology Role parameter.

5. Enable the planned Slave device N from the Reading System Layout > Expected Slave Device #N > Status parameter and, if desired, set the related identification string from the Expected Slave Device #N > Device Description parameter. Repeat this step for all planned Slave devices.

6. If necessary, set the ID-NET™ baudrate from the Reading System Layout > Device Network Setting > Network Baud Rate parameter, (500 kbs default).

7. Configure the other device parameters via VisiSet™ [Operating Mode, Calibration, Data Collection parameters, etc.].

8. The Master device is now Configured. Physically connect it to the Master/Slave network. If using the CBX connection box equipped with a BM100 Backup module, perform a Network Backup at the Master (see par. 2.4 for details).

9. From the VisiSet™ Device Menu select "ID-NET™ Status Window" and click on the "Look For Devices On Network" button to check the status of the expected Slave devices within the ID-NET™ network.

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. **This feature requires a minimum ID-NET™ Network Baud Rate of 38400**.

1. Connect a PC equipped with VisiSet™ to the Main, or Auxiliary interface of the Master reader.

2. Launch VisiSet™ and connect to the Master reader.

3. From the VisiSet™ Device Menu select "ID-NET™ Status Window" and click on the "Look For Devices On Network" button to check the status of the expected Slave devices within the ID-NET™ network.
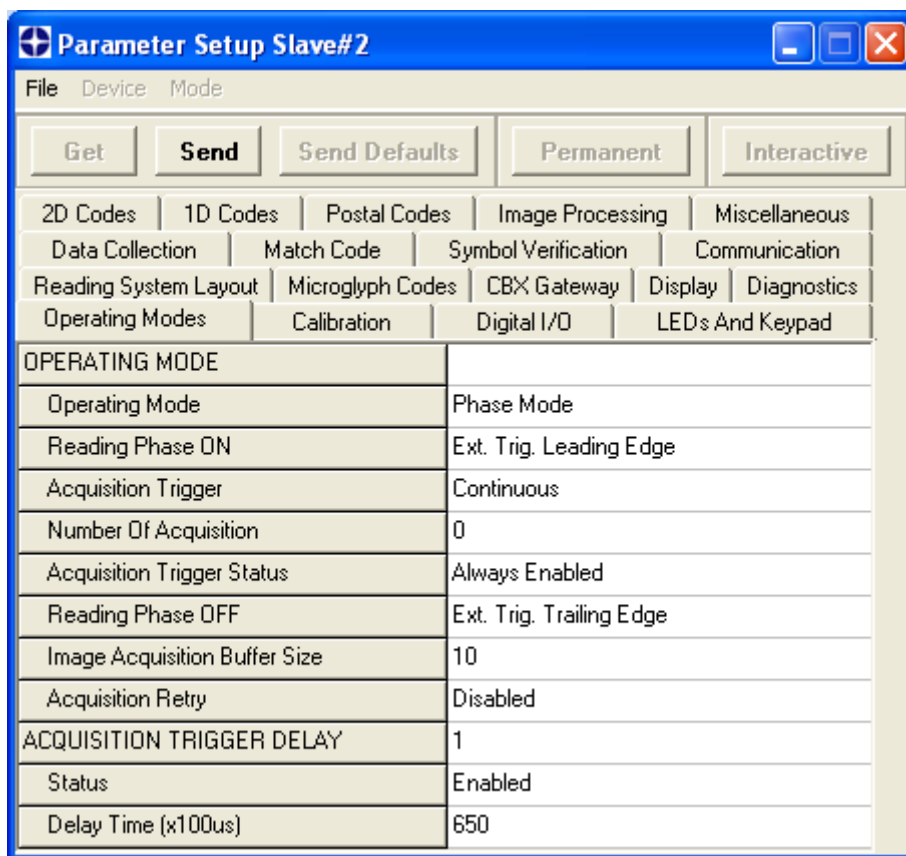
4. Click anywhere in the row of the specific slave in the ID-NET Status Window when its Current Status is "Present". The Parameter Setup window will be displayed after a time based on the network speed, with the configuration of the selected slave.

5. From the specific Slave Parameter Setup Window, change any parameter (not in interactive mode), save the configuration to a file, or load a configuration from a file.

6. Send the modified configuration to the slave.

OPERATING MODE	
Operating Mode	Phase Mode
Reading Phase ON	Ext. Trig. Leading Edge
Acquisition Trigger	Continuous
Number Of Acquisition	0
Acquisition Trigger Status	Always Enabled
Reading Phase OFF	Ext. Trig. Trailing Edge
Image Acquisition Buffer Size	10
Acquisition Retry	Disabled
ACQUISITION TRIGGER DELAY	1
Status	Enabled
Delay Time (x100us)	650

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

2.4 EXTERNAL MEMORY BACKUP AND RESTORE THROUGH VISISET™

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

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

- CBX + BM100 and/or BM2x0 (sw release 2.02.01 and later)

- QL500 (Ethernet TCP/IP) (sw release 2.02.01 and later)

- QLM-Series Gateways (reading device sw release 6.50 and later)

|	
☞ **NOTE**	• *Before executing a Backup on a BM100 backup module make sure the Write Protection switch is set to Unlocked.* • *If BM100 and BM2x0 are both installed B&R is automatically performed only on the BM100 module.* • *BM2x0 can execute B&R only with Network up and running (network cable connected).* • *QL500 can backup up to 10 nodes (Master + 9 slaves).*

Backup

To perform a Backup:

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

2. You will be warned that the previous backup will be overwritten. Confirm by clicking Yes.
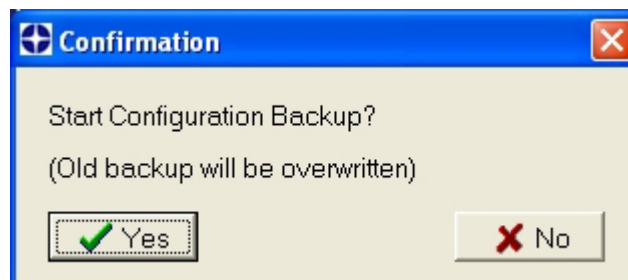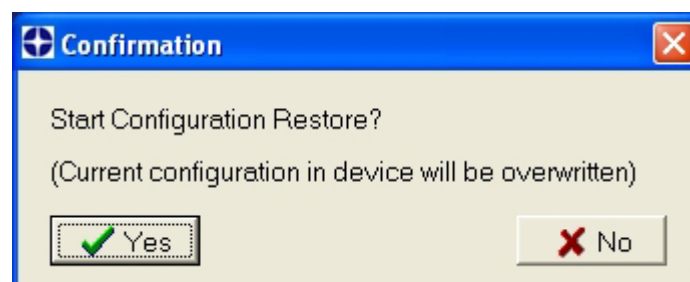
The VisiSet™ Main window shows information as the backup procedure is performed and a message indicating successful completion.
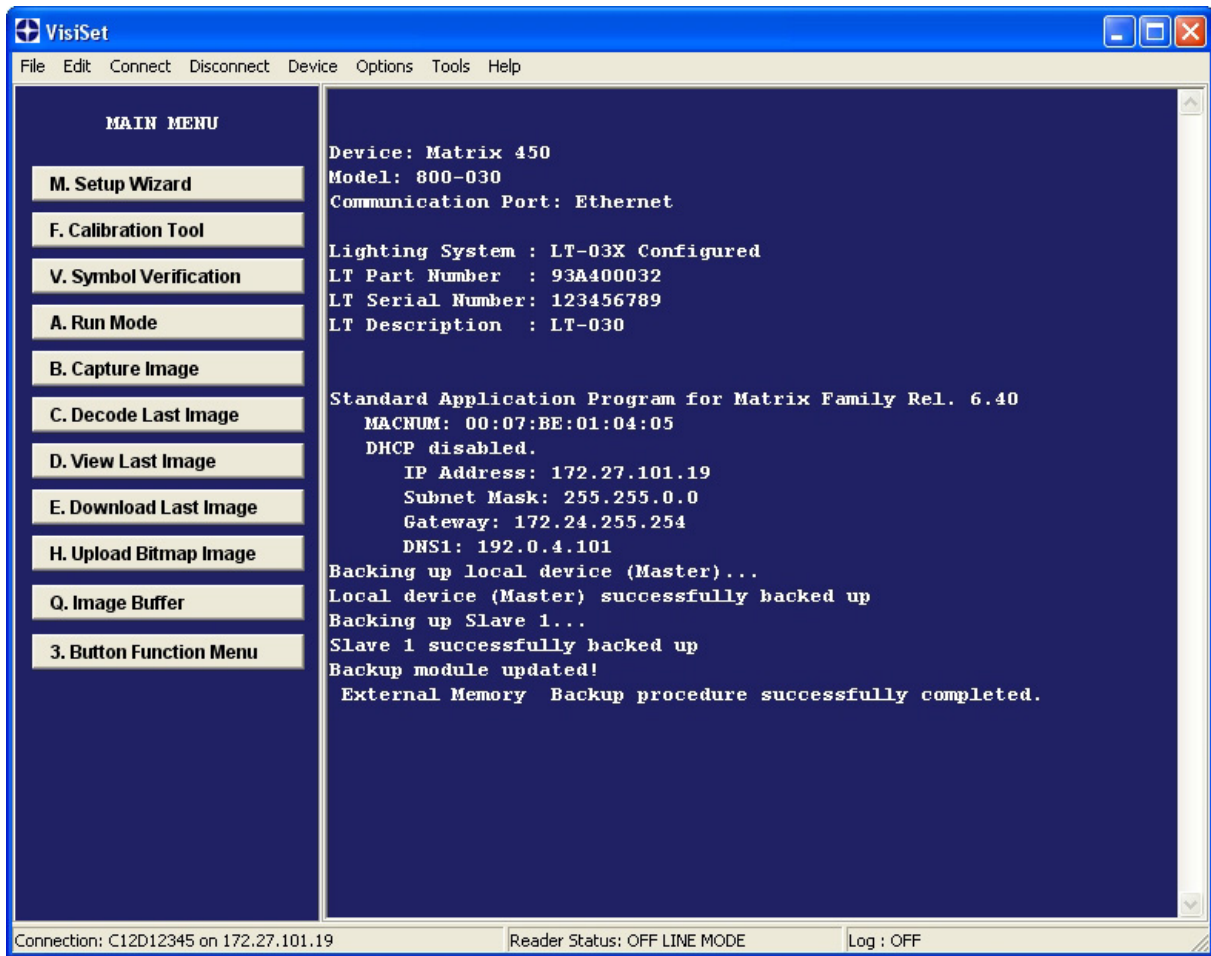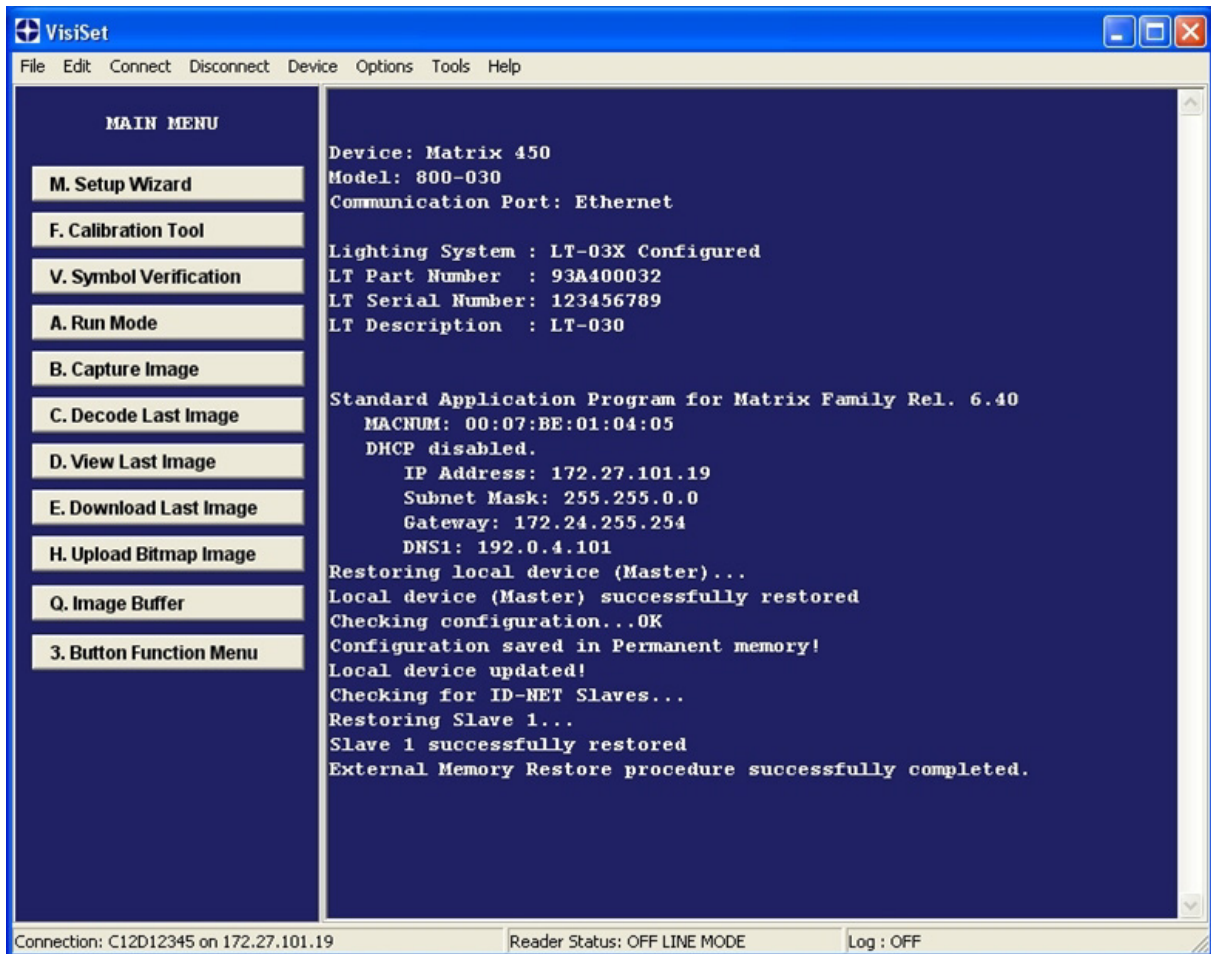

Restore

To perform a Restore:

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

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

Replacement

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

1. Remove the device to be replaced.

2. Connect the new device (make sure the new device has been previously set to default).

3. Run the Restore procedure by selecting the "External Memory Restore" item (see: Restore procedure).

Erase

To Erase any previous Backup:

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

2. You will be warned that all device configurations in the current backup will be erased. Confirm by clicking Yes.
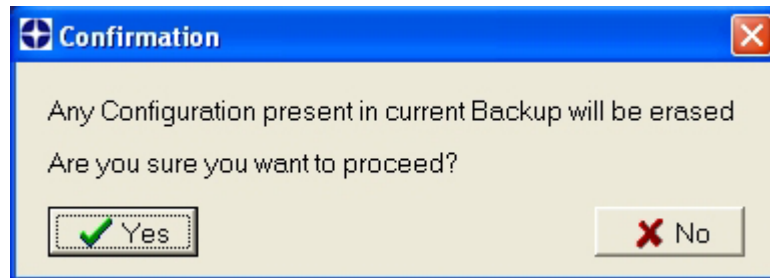
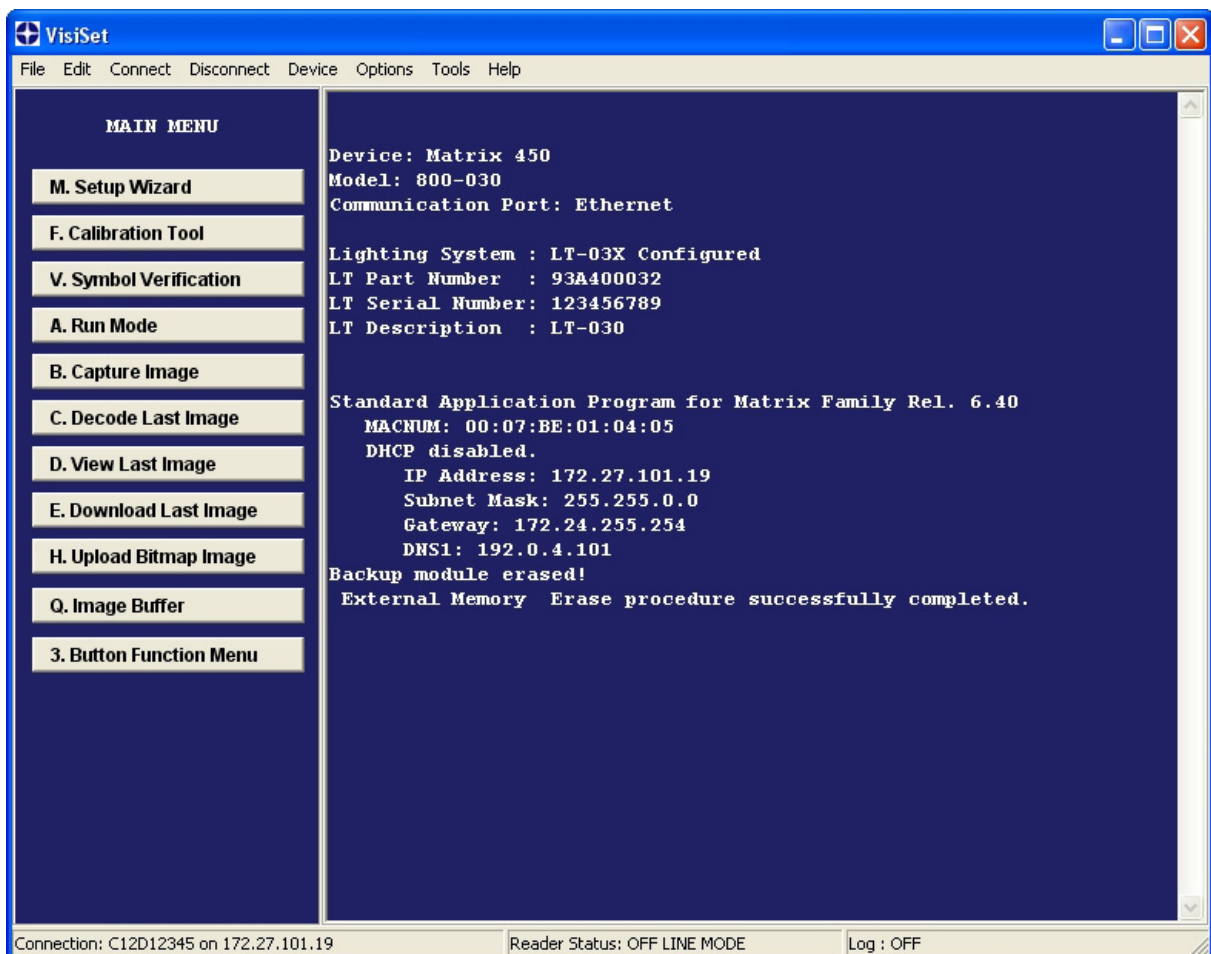The VisiSet™ Main window shows a message indicating successful completion.

List

To see a List of the current Backup:

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

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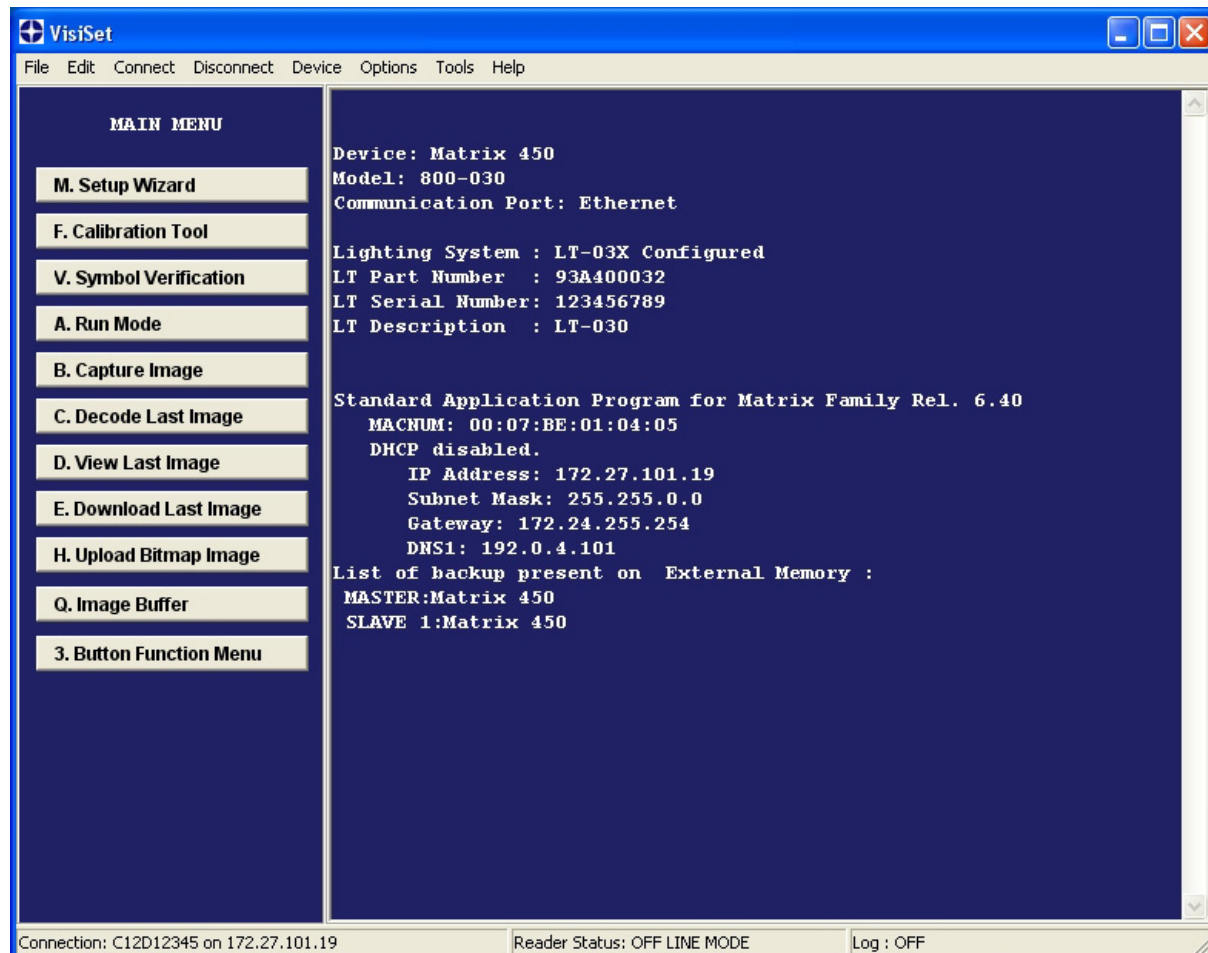
The following is a list of possible error messages displayed on the VisiSet™ main window in case of an External Memory function failure:

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

2.5 X-PRESS™ HUMAN MACHINE INTERFACE

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

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

- Learn to self-detect and auto-configure for reading unknown codes.

- Setup to perform Exposure Time and Gain calibration.

- Focus/Locate to turn on the Blue Diamonds™ to aid focusing and the laser pointer LEDs to aid positioning.

- Test with bar graph visualization to check static reading performance.

2.5.1 X-PRESS™ Functions

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

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

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

3. **Release** the button to enter the specific function.
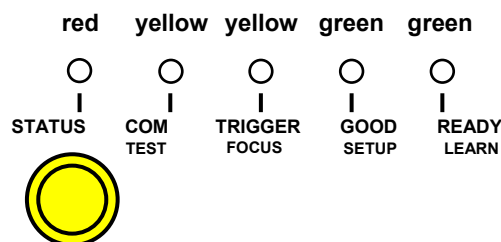
Once button is pressed, the cycle of LEDs activation is as follows:

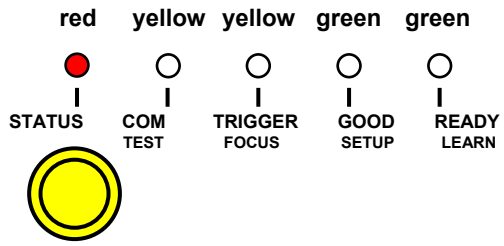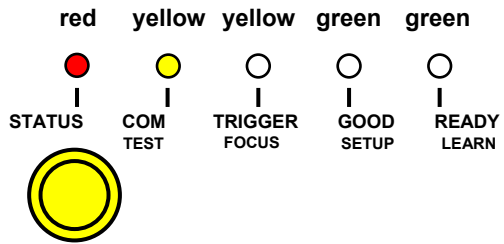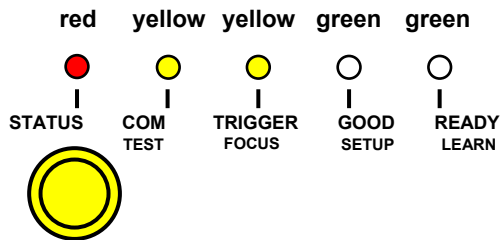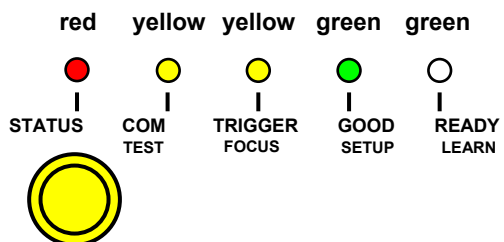| red	yellow	yellow	green	green
●	○	○	○	○
STATUS	COM	TRIGGER	GOOD	READY
	TEST	FOCUS	SETUP	LEARN

Release Button to Exit

↓

red	yellow	yellow	green	green
●	●	○	○	○
STATUS	COM	TRIGGER	GOOD	READY
	TEST	FOCUS	SETUP	LEARN

Release Button to Enter Test Mode

↓

red	yellow	yellow	green	green
●	●	●	○	○
STATUS	COM	TRIGGER	GOOD	READY
	TEST	FOCUS	SETUP	LEARN

Release Button to Enter Focus/Locate Mode

↓

red	yellow	yellow	green	green
●	●	●	●	○
STATUS	COM	TRIGGER	GOOD	READY
	TEST	FOCUS	SETUP	LEARN

Release Button to Enter Setup Mode

↓

red	yellow	yellow	green	green
●	●	●	●	●
STATUS	COM	TRIGGER	GOOD	READY
	TEST	FOCUS	SETUP	LEARN
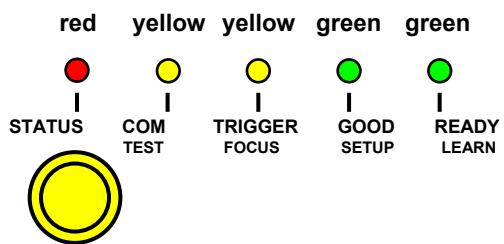
Release Button to Enter Learn Mode

↓

red	yellow	yellow	green	green
●	○	○	○	○
STATUS	COM	TRIGGER	GOOD	READY
	TEST	FOCUS	SETUP	LEARN
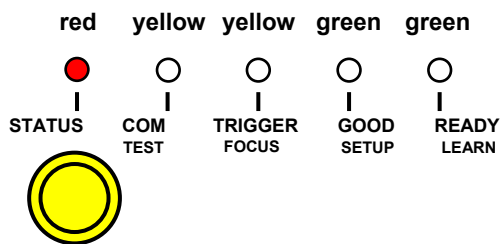
Release Button to Exit

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:

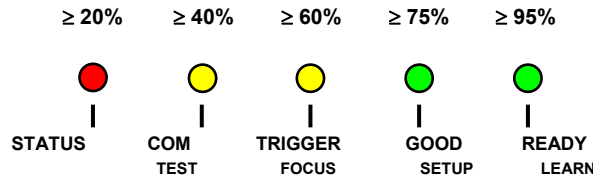| ≥ 20%	≥ 40%	≥ 60%	≥ 75%	≥ 95%
🔴	🟡	🟡	🟢	🟢
STATUS	COM	TRIGGER	GOOD	READY
	TEST	FOCUS	SETUP	LEARN

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

👆

By default, the Test exits automatically after three minutes.

NOTE

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 450™ emits 3 high pitched beeps.

If the calibration cannot be reached after a timeout of about 5 (five) seconds Matrix 450™ will exit without saving the parameters to memory, the Setup LED <u>will not</u> remain on continuously but it will just stop blinking. In this case Matrix 450™ 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.
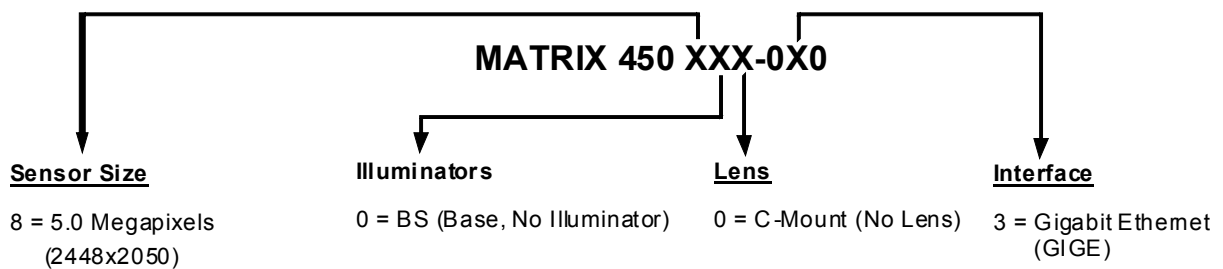
The Learn LED will blink until the procedure is completed.

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 450™ emits 3 high pitched beeps.

If the calibration cannot be reached after a timeout of about 3 (three) minutes, Matrix 450™ will exit without saving the parameters to memory, the Learn LED <u>will not</u> remain on continuously but it will just stop blinking. In this case Matrix 450™ emits a long low pitched beep.

2.6 MODEL DESCRIPTION

The Matrix 450™ reader is available in different versions according to the following characteristics:

MATRIX 450 XXX-0X0

Sensor Size

8 = 5.0 Megapixels
(2448x2050)

Illuminators

0 = BS (Base, No Illuminator)

Lens

0 = C-Mount (No Lens)

Interface

3 = Gigabit Ethernet
(GIGE)

2.7 ACCESSORIES

The following accessories can be used with the Matrix 450™ reader.

Accessory	Description	Order No.
Lenses		
LNS-1216	16 mm C-Mount Lens 5MP with anti-vibration components	93ACC0041
LNS-1225	25 mm C-Mount Lens 5MP with anti-vibration components	93ACC0034
LNS-1235	35 mm C-Mount Lens 5MP with anti-vibration components	93ACC0035
LNS-1250	50 mm C-Mount Lens 5MP with anti-vibration components	93ACC0036
LPK-45-000	Anti-vibration Kit for C-Mount Lenses	93ACC0051
Lighting Systems		
LT-030	Ultra Power LT Super Narrow Blue 20°	93A400032
LT-031	Ultra Power LT Super Narrow White 20°	93A400033
LT-032	Ultra Power LT Narrow Blue 40°	93A400034
External Illuminators		
LT-300	Ring Lighting System	93A401008
Cables		
CAB-LD-002	LT Driver Cable With Power (0.2M)	93A050032
CAB-LD-102	LT Driver Cable No Power (0.2M)	93A050044
CAB-LP-03	Lighting Power Cable (3M)	93A050033
CAB-LP-05	Lighting Power Cable (5M)	93A050037
CAB-PG-0002	Vdc Power PG-120 To BA400 or QL (2M)	93ACC1870
CAB-PG-0105	Vdc Power PG-120 To LT-03x (5M)	93A050043
CAB-MS003	M16-IP67 Cable To QL (0.35M)	93A051387
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-GE01	M12-IP67 To RJ45 Ethernet Cable (1M)	93A050034
CAB-GE03	M12-IP67 To RJ45 Ethernet Cable (3M)	93A050035
CAB-GE05	M12-IP67 To RJ45 Ethernet Cable (5M)	93A050036
CBL-1480-01	Thin M12/5P Male/Female (1M)	93A050049
CBL-1480-02	Thin M12/5P Male/Female (2M)	93A050050
CBL-1490	Term. Resist. Thin M12/5P/Male	93A050046
CBL-1496	Term. Resist. Thin M12/5P/Female	93A050047
Connectivity		
CBX100	Compact Connection Box	93A301067
CBX500	Modular Connection Box	93A301068
BM100	Backup Module for CBX100/500	93ACC1808
BM150	Display Module for CBX500	93ACC1809
Various Fieldbus and Non-Filedbus Host Interface Modules and All-In-One Connection Box Kits are available		
BA100	DIN Rail Adapters	93ACC1821
BA200	Bosch Adapters	93ACC1822
Various M12 Panel Connectors for CBX Connection Boxes are available		
BA900	Two Cable Glands Panel	93ACC1847
QL100	Quick Link Slave ID-NET T-Connector	93ACC1860
QL150	Quick Link Slave ID-NET + Service T-Connector	93ACC1868
QL200	Quick Link Slave ID-NET + Power T-Connector	93ACC1861
QL300	Quick Link Master ID-NET - Serial Host Connector	93ACC1862
QL500	Quick Link Master ID-NET - Ethernet Host Connector	93ACC1864
QLM500	Quick Link Metal Master ID-NET - EtherNet/IP Gateway	93ACC0037
QLM600	Quick Link Metal Master ID-NET - Profibus Gateway	93ACC0033
QLM700	Quick Link Metal Master ID-NET - Profinet IO Gateway	93ACC0038
Various M12 Service Cables and Field Mount Connectors are available for Quick Link Series Connectors		
Power Supplies		
PG-120-K01	AC/DC Power Supply Kit (EU)	93ACC0046
PG-120-K02	AC/DC Power Supply Kit (UK)	93ACC0047
PG-120-K03	AC/DC Power Supply Kit (US)	93ACC0048
PWR-120	JBOX Power Unit 110/230 Vac 24Vdc	93ACC1530
PWR-240	JBOX Power Unit 110/230 Vac 24Vdc	93ACC1070
PWR-480A	JBOX Power Unit 110/230 Vac 24Vdc	93ACC1850

Accessory	Description	Order No.
Sensors		
MEP-593	Photocell Kit PNP (PH-1)	93ACC1791
MEP-543	Photocell Kit-NPN	93ACC1728
Brackets		
BK-45-000	LT-03x L-shaped Mounting Bracket	93ACC0049
BK-45-010	Matrix 450™ Body Mounting Bracket	93ACC0050
BK-4990	Generic LT Bracket for LT-300	93ACC1805
Software Management		
Datalogic WebSentinel-Images-005	Supervisor (manages up to 5 arrays)	93A100027
Datalogic WebSentinel-Images-064	Supervisor (manages up to 64 arrays)	93A100028
Datalogic WebSentinel-Images-256	Supervisor (manages up to 256 arrays)	93A100029

The following table shows the correct lens/illuminator combinations to be used for Matrix 450™ imager assembly.

Lenses			Illuminators		
93ACC0041	LNS-1216	16 mm C-Mount Lens 5MP with anti-vibration components	93A400034	LT-032	ULTRA POWER LT NARROW BLUE 40°
93ACC0034	LNS-1225	25 mm C-Mount Lens 5MP with anti-vibration components	93A400032	LT-030	ULTRA POWER LT SUPERNARROW BLUE 20°
			93A400033	LT-031	ULTRA POWER LT SUPERNARROW WHITE 20°
			93A400034	LT-032	ULTRA POWER LT NARROW BLUE 40°
93ACC0035	LNS-1235	35 mm C-Mount Lens 5MP with anti-vibration components	93A400032	LT-030	ULTRA POWER LT SUPERNARROW BLUE 20°
			93A400033	LT-031	ULTRA POWER LT SUPERNARROW WHITE 20°
93ACC0036	LNS-1250	50 mm C-Mount Lens 5MP with anti-vibration components	93A400032	LT-030	ULTRA POWER LT SUPERNARROW BLUE 20°
			93A400033	LT-031	ULTRA POWER LT SUPERNARROW WHITE 20°

2.8 APPLICATION EXAMPLES

2.8.1 Manual Postal Sorting

Manual object sorting solutions are largely implemented by major postal companies and couriers for the final stage of the process, generally for trans-shipments from main hubs to

local facilities for final delivery. Also several regional and small logistic companies perform the sortation task manually, since the intensity of the traffic is not compatible with high-end automated handling infrastructures.

Flyers, small parcels and letter packs are manually moved across the Matrix 450™ scanning zone, where two laser pointers mark the center. The Sort-to-Light mode is one of the most common solutions: the code(s) is communicated to the host machine, sometimes even a traditional PC, which illuminates a lamp indicator for sorting to destination, whether bin, chute or cassette.

Matrix 450™ results in significant saving on labor and increases efficiency: faster handlings, zero mis-sorts, stable and predictable throughput, without dependencies on operator skills.

2.8.2   Loading/Unloading

Matrix 450™ can be applied in an over-the-belt style for unattended scanning in motion and also in a semi-automated style, performed in presentation mode to the overhead reader during the manual item handling. The continuous high power illumination, white color, is a crucial advantage, offering the maximum comfort in proximity to the working areas.

Having no moving parts – beyond eliminating any annoying operational noise – is synonymous with maximum robustness to mechanical stress and the guarantee of a longer product life-cycle.

Thanks to the integrated effective beeper and the spot indicators, it provides real-time feedback, with no need to integrate further dedicated hardware. The always-on laser spots are an effective tool for scanning area indication and also to easily check the proper positioning of the reader without any special tool or technical skills.

2.8.3 Automated Postal Sorting

Matrix 450™ represents a real change in small item sorting applications operated through slot conveyors, like cross-belts or small drop sorters. Easier installation, easier maintenance, superior performance, longer life-cycle make Matrix 450™ a unique and compelling solution for over-the-belt reading.

Thanks to 5.0 megapixel image captures, each single shot frames the entire practical area. One-reader-one-shot is the optimal condition to obtain the maximum reading throughput, thanks to faster decoding processing. Under this operating condition, also the synchronization between image acquisition and target slot is more than simple. And the image capture can be simply associated with the data of each sorted item, for any reporting or analysis purposes.

Matrix 450™ can also be applied in scanning applications of large conveyors or multi-sided reading. Through the ID-NET clustering, multiple readers can be effectively combined to extend the scanning area. The building block approach is a real advantage to build up cost-effective solutions serving the specific requirements with the maximum precision.

2.8.4 Multimedia and Flats
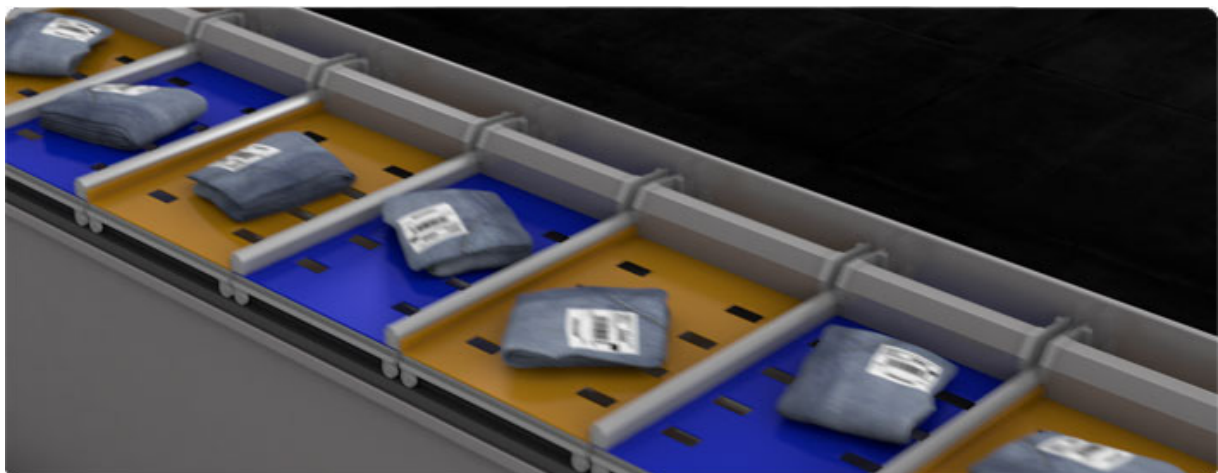
With small and medium object size, like multimedia or apparel, the automated handling is generally operated through slot conveyors, like cross-belt, bombay or push trays. Typical applications use high resolution codes, with challenging low aspect ratios. Matrix 450™

definitively represents a top solution for this application segment, capable of superior performance, higher reliability and easier integration with respect to any other traditional solution.

Because of the outstanding intrinsic DOF with fixed focus, it does not need any height measurement, therefore definitely simplifying the integration and eliminating any extra hardware. Low aspect ratio codes have no impact on the simplicity of the Matrix 450™ reading solution, since regular image capture contains any scanning pattern inside the reading area, and therefore always the maximum level of data integrity. Due to this, installation is extremely fast and easy, and does not require any special skills for the correct synchronization and check of scanning coverage.

2.8.5   Order Fulfillment

Here, Matrix 450™ offers top performance and maximum ease of use in manual order fulfillment. The large scanning zone, fast acquisition, and high power continuous lighting, which is all a proper combination of key features resulting in prompt reading while the object is rapidly moved into the scanning area, leveraging unrivalled and stable throughput. Unlike any traditional solution, Matrix 450™ can manage the largest variety of codes thanks to the high resolution 2D-sensor. Therefore, maximum independence among code types, 1D or 2D, code resolution and code height is always guaranteed. Thanks also to the white lighting, a large variety of colored codes are supported. Image captures can be optionally used for mirroring the scanning process to a possible side panel.

2.8.6   Static Scan

Matrix 450™ is a valid solution for scanning large stationary objects, from pallets to stacked trays.

There are multiple advantages in using Matrix 450™. First of all, no parts in movement – no scan rotor and no oscillating mirror – delivers crucial advantages in terms of maximum tolerance to vibration and shock, as for example a forklift may generate. Then, a comfortable no-flashing white illumination replaces the laser beam. And also the green spot and the beeper are easy feedback for the operator, to validate a successful reading. In order to extend the illuminator life-cycle and also to save energy, the continuous illumination can be optionally activated on a trigger basis, simply switched off during inactive periods.

2.8.7   Manual Presentation Scanning

In **Manual Material Handling** applications, manual presentation scanning is more and more the preferred method for item identification obtaining **maximum productivity and operational efficiency**: while the stationary overhead reader continuously scans the working area, the operator can easily and quickly handle objects of various dimensions and weights, since no point-and-shot is required for scanning. No extra tools or infrastructure is necessary in the working area; no extra operations for part identification other than passing the object through the scanning zone. No training is required for users.

The large coverage area and fast acquisition rate – by **Matrix450™** – permits rapidly handling objects in sequence with great tolerance.

White illumination and continuous high power mode enable top performance with the maximum comfort for operators.

A couple of red laser spots clearly indicate the center of the reading zone. And the **Green-Red spots**, directly projected on the scanned object, communicate the **reading result** or even specific conditions when **driven by external commands**.

Thanks to the continuous image acquisition, the http image mirroring produces a sort of real-time video, useful feature for local visualization on-screen or also for remote monitoring. The live streaming uses the **standard http** protocol for transmission and then a standard web browser is all that is required for the display.

The complete set of integrated functionalities makes **Matrix 450™** a comprehensive solution for manual scanning, easy to deploy, easy to use and with minimum cost for maintenance.

3 INSTALLATION

3.1 PACKAGE CONTENTS

Verify that the Matrix 450™ reader and all the parts supplied with the equipment are present and intact when opening the packaging; the list of parts includes:

❑ Matrix 450™ reader with Lens Cover

❑ Quick Reference Guide

❑ Test Charts (2):
- Focusing and PPI Setup Chart
- Grade A Code 128 Test Chart

❑ Matrix family Mini-DVD
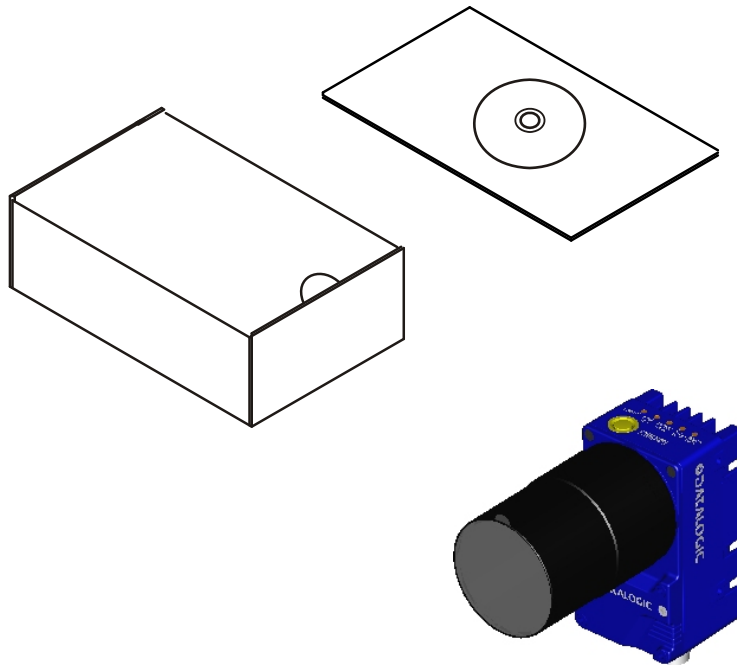
Figure 18 - Matrix 450™ Package Contents

3.2 MECHANICAL DIMENSIONS

Matrix 450™ is designed to be used with one of the LT-03x Series Lighting Systems. In this configuration the L-shaped LT-03x mounting bracket must be used to support the whole assembly, (refer to Figure 20).

In alternative applications Matrix 450™ can be installed with an External Illuminator or custom lighting system (LT-03x is not mounted). In this configuration Matrix 450™ can be installed to operate in different positions using the body mounting bracket accessory shown in Figure 24.

The fourteen screw holes (M4) on the body of the reader can also be used for custom mounting solutions.

Refer to par. 3.3 for various mounting solutions and correct positioning, and par. 7.1 and 7.2 for FOV vs. Reading Distance considerations.
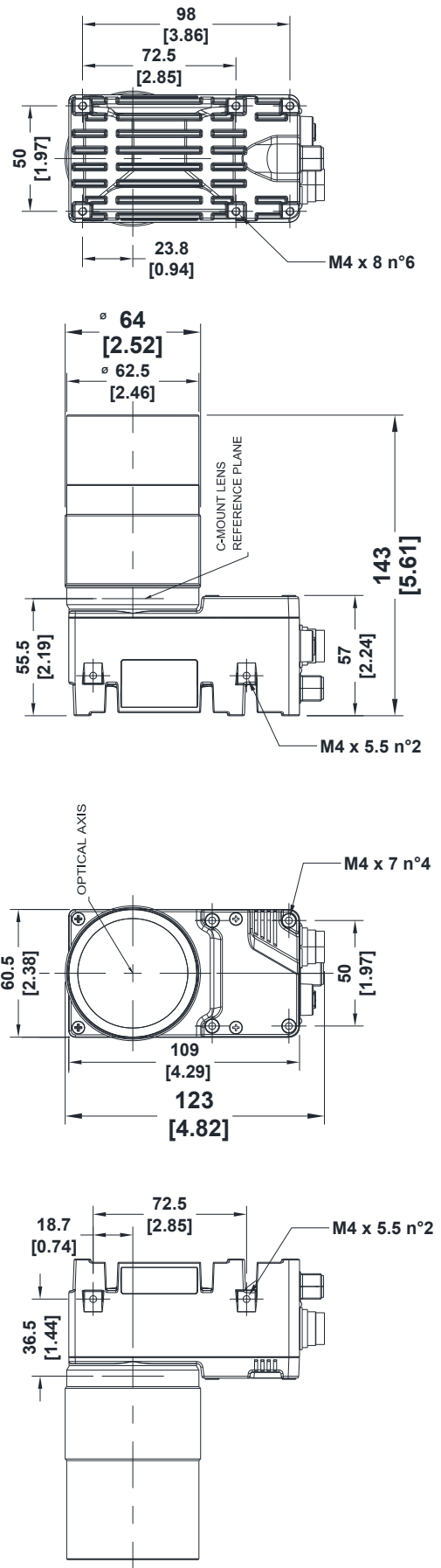
Figure 19 – Matrix 450™ Overall Dimensions

compact assembly

standard assembly
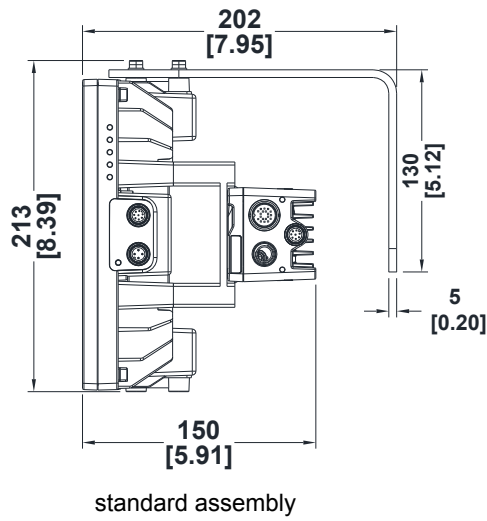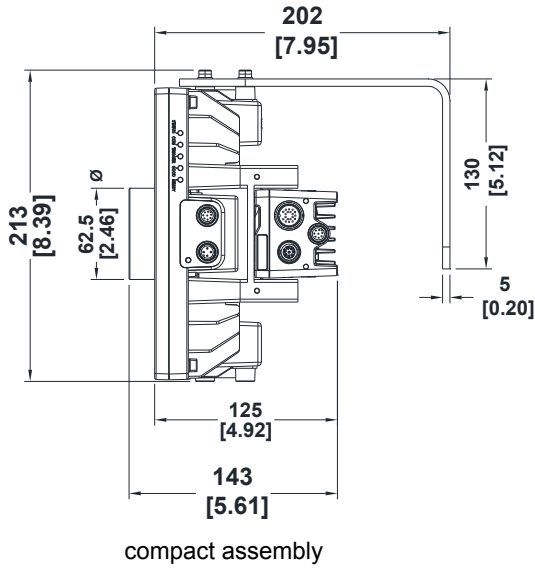
$$\frac{mm}{in}$$
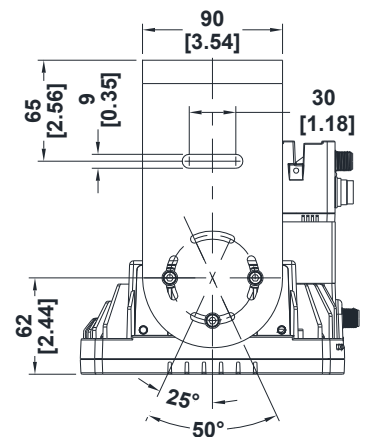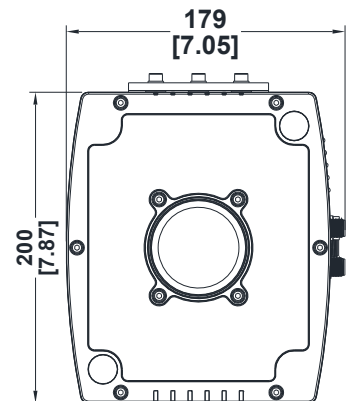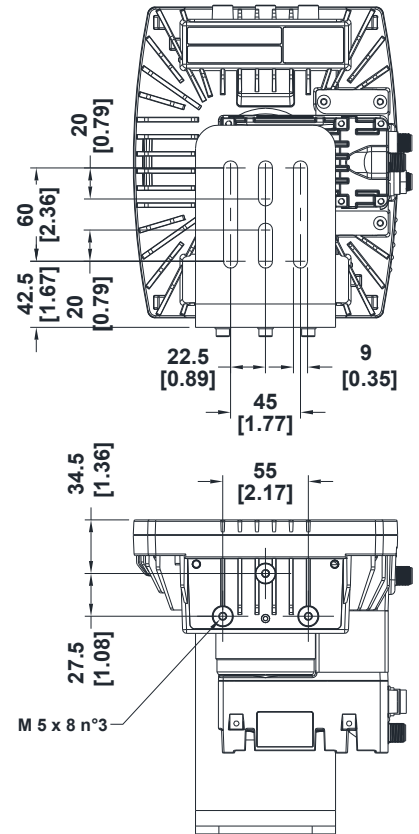
Figure 20 – Matrix 450™ + LT-03x + L-Bracket Overall Dimensions

3.3 MOUNTING AND POSITIONING MATRIX 450™

Using the LT-03x L-shaped mounting bracket you can obtain rotation on the various axes of the reader as shown in the diagrams below:
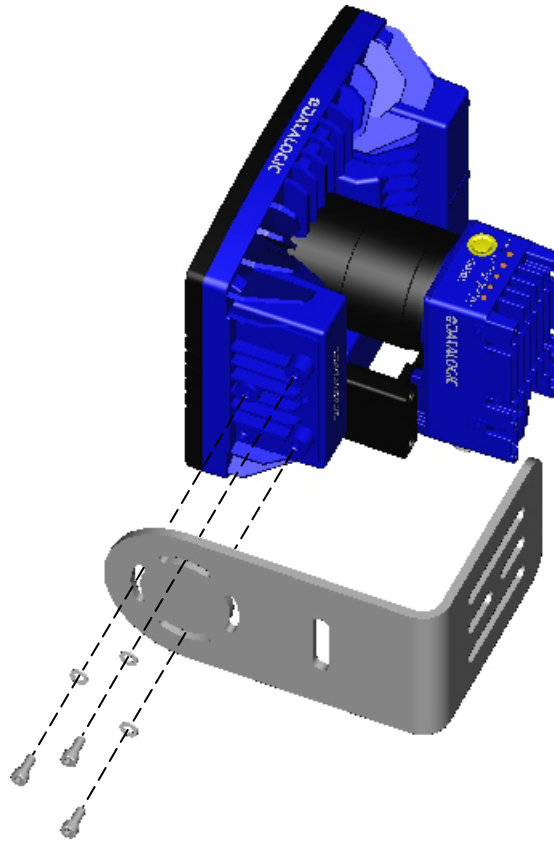
Figure 21 –Mounting LT-03x Bracket
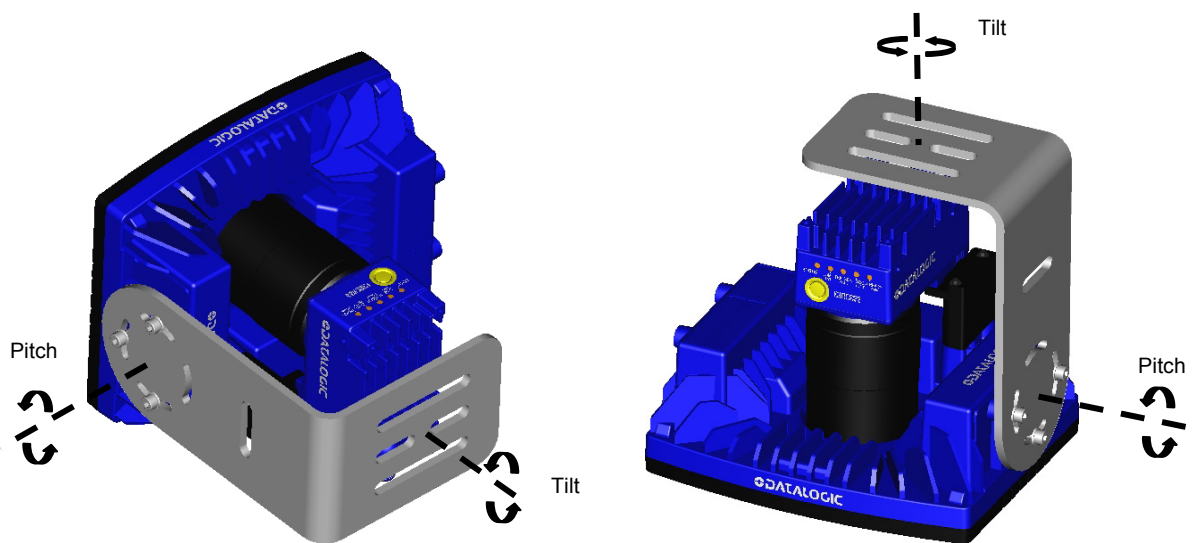
Figure 22 – Matrix 450™ Positioning with LT-03x Bracket

When operating in high vibration environments use two L-shaped mounting brackets and mount the anti-vibration kit for C-mount lenses, see par. 2.7. You can obtain rotation on the various axes of the reader as shown in the diagram below:
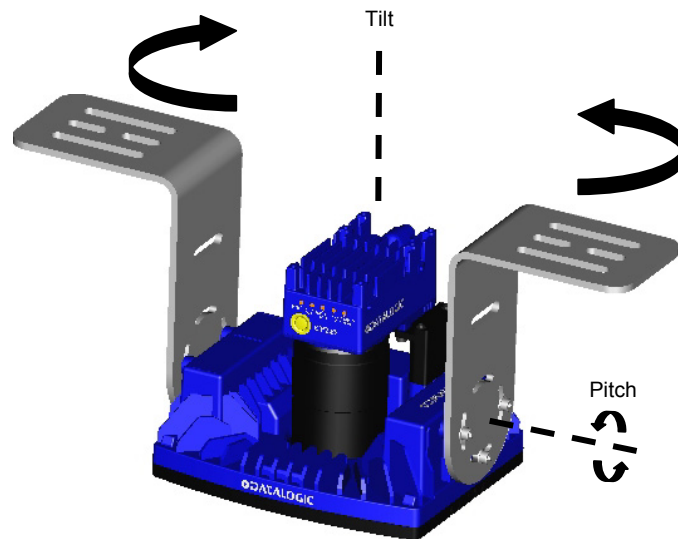
Figure 23 – Matrix 450™ Positioning with Two LT-03x Brackets

In applications where the LT-03x Series Lighting Systems <u>are not used</u>, Matrix 450™ can be mounted using the body mounting bracket accessory shown in the diagrams below; and you can obtain rotation on the various axes of the reader.
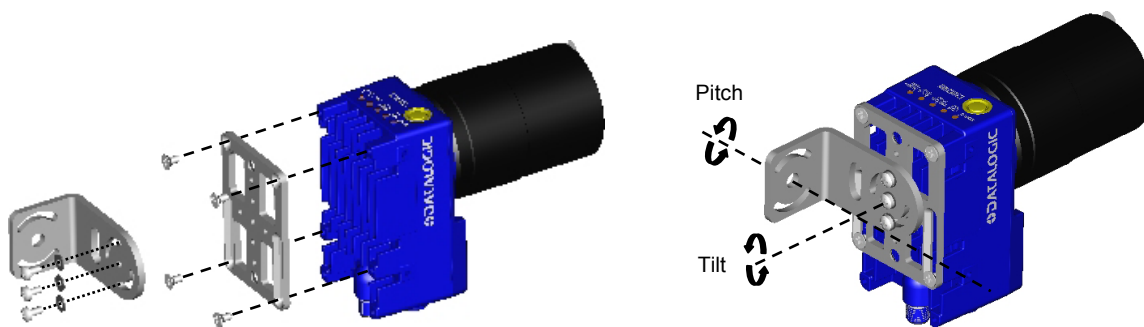
Figure 24 –Positioning with Matrix 450™ Body Mounting Bracket (Back)

Matrix 450™ is able to decode code labels at a variety of angles; however significant angular distortion may degrade reading performance.

When mounting Matrix 450™, take into consideration these **ideal** label position angles: **Pitch or Skew 10° to 20° and Tilt 0°**.

Note: Since Matrix 450™ 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 25 and in Figure 26. Position the reader in order to avoid the direct reflection of the light emitted by the Matrix 450™ 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°.
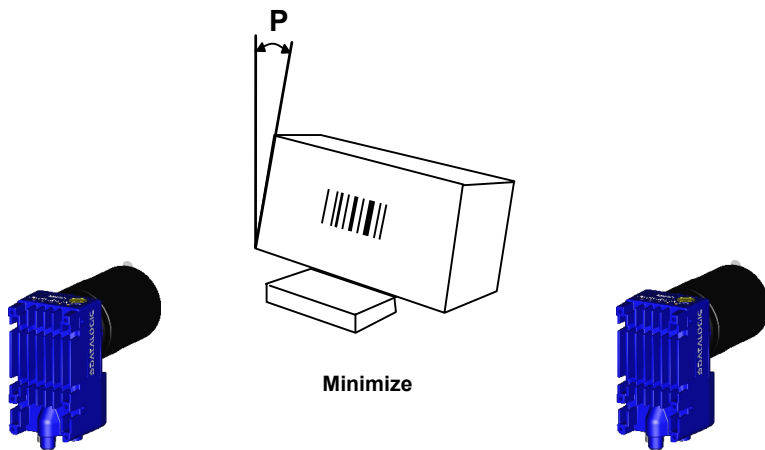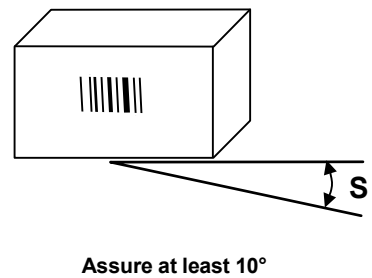

Figure 25 - Pitch angle

Figure 26 - Skew angle

The **Tilt** angle is represented by the value **T** in Figure 27. Matrix 450™ can read labels with any tilt angle.
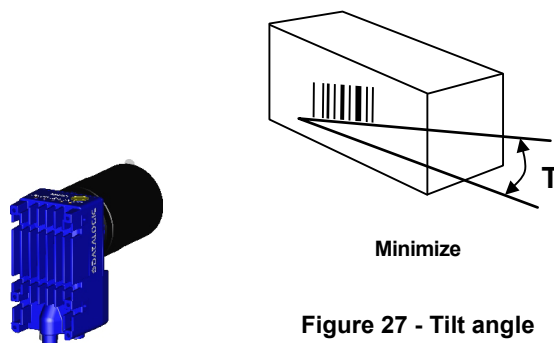

Figure 27 - Tilt angle

See par. 7.1 and 7.2 for FOV vs. Reading Distance considerations.

4 CBX ELECTRICAL CONNECTIONS

All Matrix 450™ 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 450™ 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 450™ 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.

4.1 POWER SUPPLY

To power the reader and/or I/O devices through the CBX, power must be supplied to the CBX100/500 spring clamp terminal pins as shown in Figure 28:
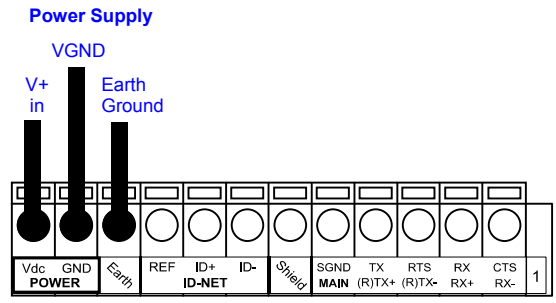

Figure 28 - Power Supply Connections

The power must be between 10 and 30 Vdc only.

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

4.1.1 Recommended Power Supplies

The following accessory power supplies are recommended for Matrix 450™ + LT-03x assemblies:

Accessory Power Supplies	
Power Supply	**Number of Matrix 450™+LT-03xs Supported**
PG-120	2
PWR-120	2
PWR-240	4
PWR-480A	8

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).
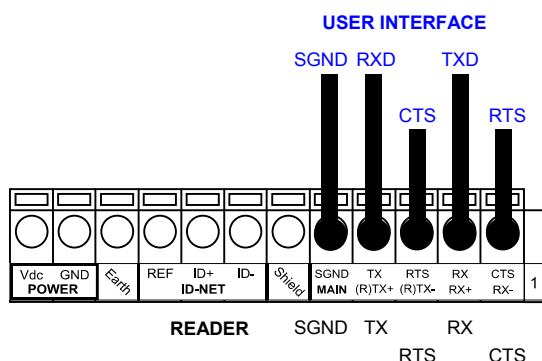

Figure 29 – RS232 Main Interface Connections Using Hardware Handshaking

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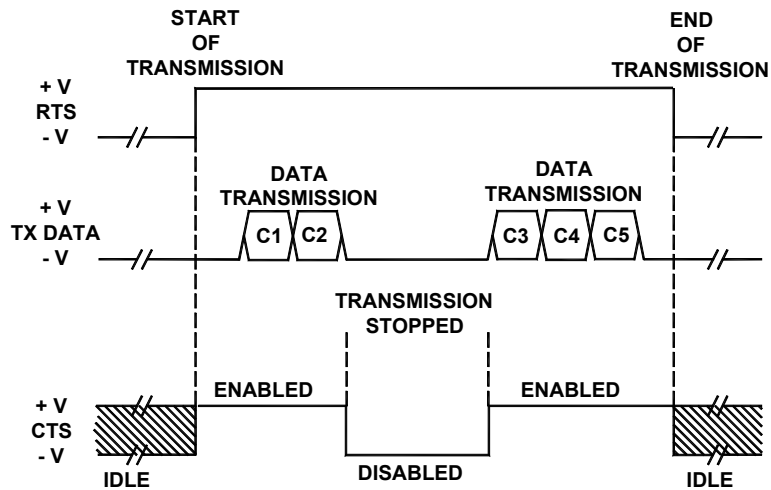

Figure 30 - RS232 Control Signals

If the RTS/CTS handshaking protocol is enabled, the Matrix 450™ 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:

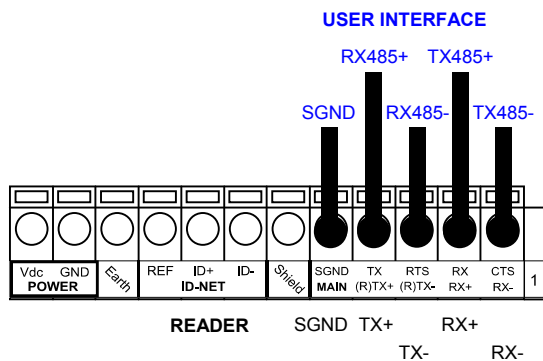| CBX100/500	Function
TX+	RS485 Transmit Data +
RX+	RS485 Receive Data +
TX-	RS485 Transmit Data -
RX-	RS485 Receive Data -
SGND	Signal Ground

Figure 31 - RS485 Full-duplex Connections

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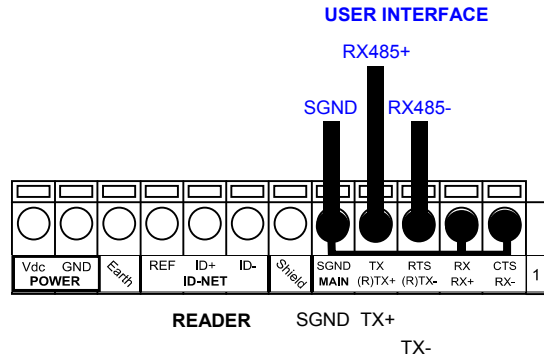
NOTE

Figure 32 - RS485 Full-duplex Connections using Only TX Signals

4.2.3 RS485 Half-Duplex Interface

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

NOTE

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, exploiting a proprietary protocol based on polled mode called MUX32 protocol, where a master device polls slave devices to collect data.

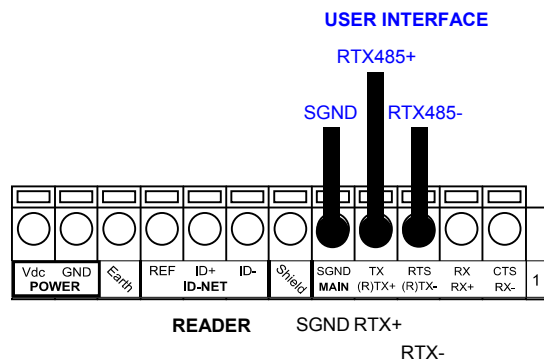| CBX100/500	Function
RTX+	RS485 Receive/Transmit Data +
RTX-	RS485 Receive/Transmit Data -
SGND	Signal Ground

Figure 33 - 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 34 shows a multidrop configuration with Matrix 450™ readers connected to a Multiplexer.

> ⚠️
> **CAUTION**
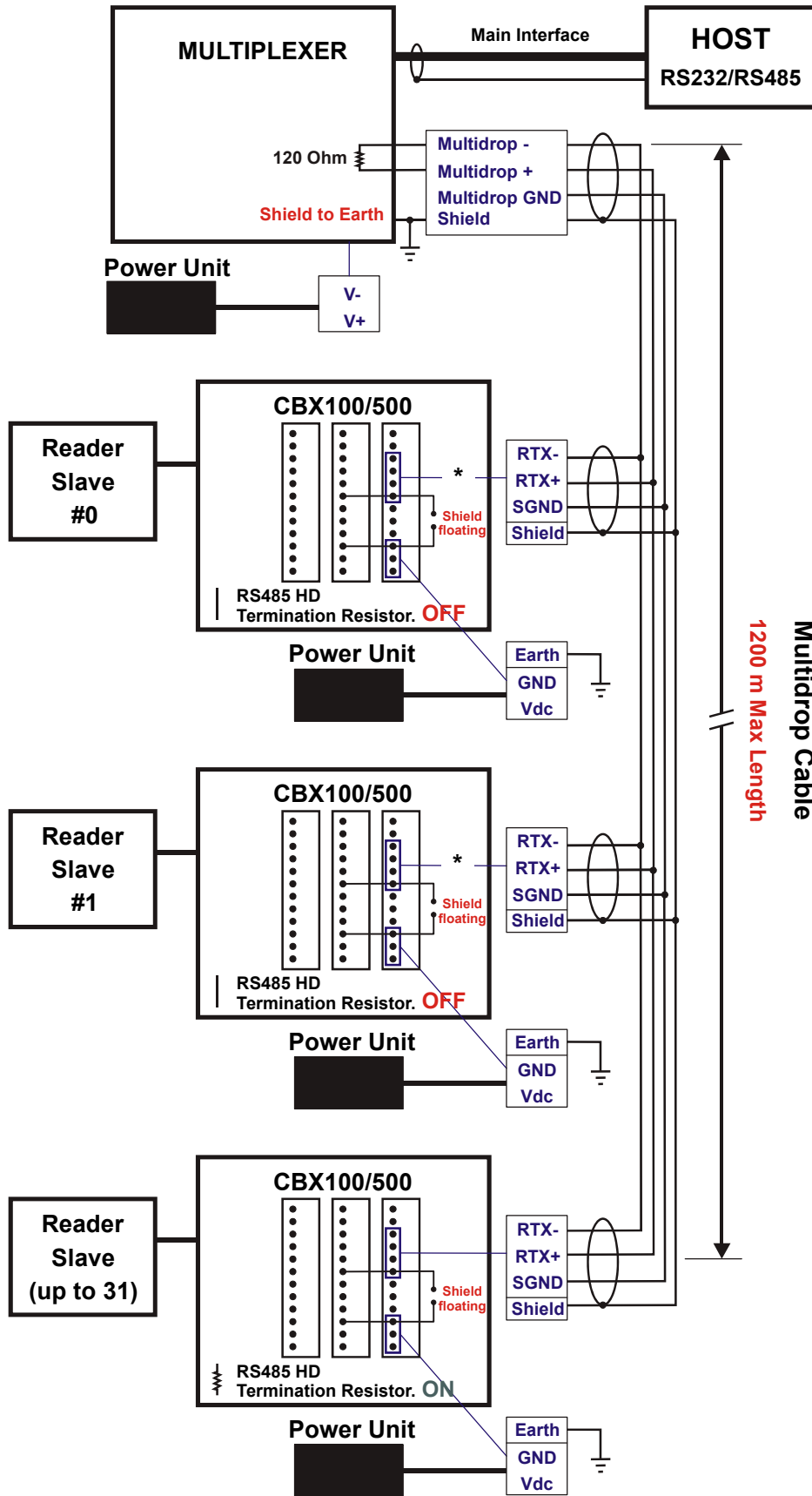> *This is an example of multidrop wiring. Consult the multiplexer manual for complete wiring instructions.*

Figure 34 - Matrix 450™ 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 36, Figure 37 and Figure 38.

- 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.
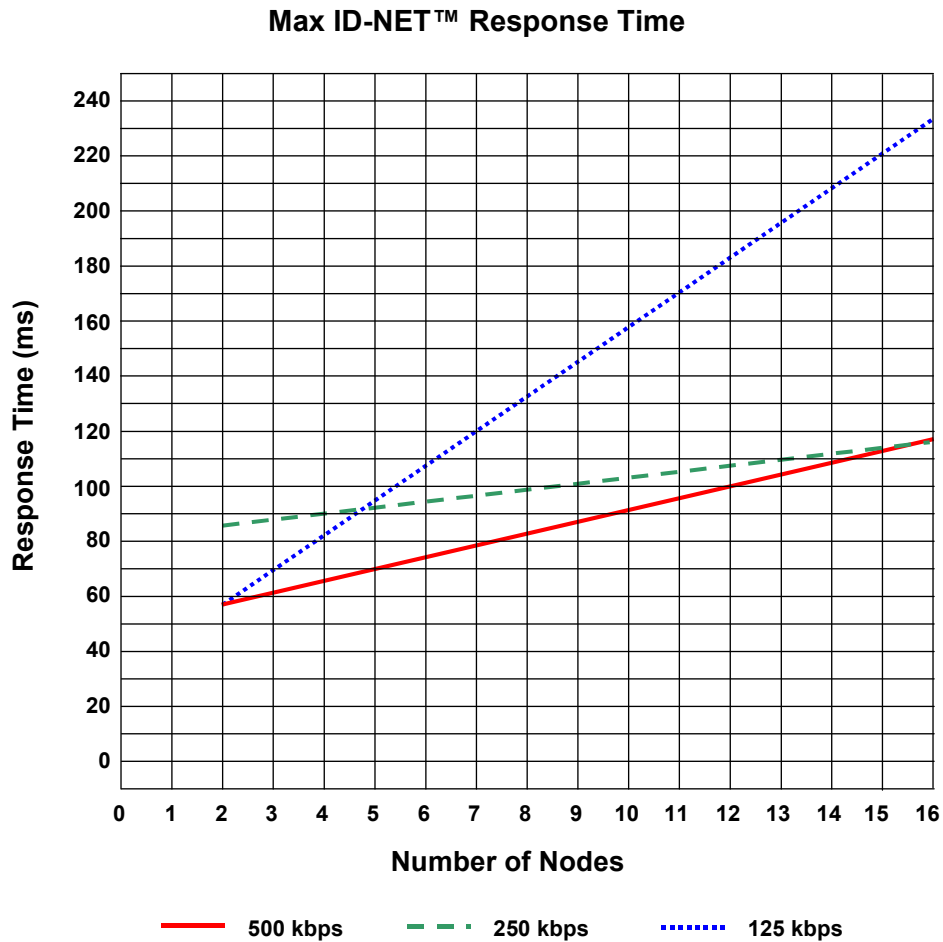
Max ID-NET™ Response Time

Figure 35 – ID-NET™ Response Time

CONDITIONS:

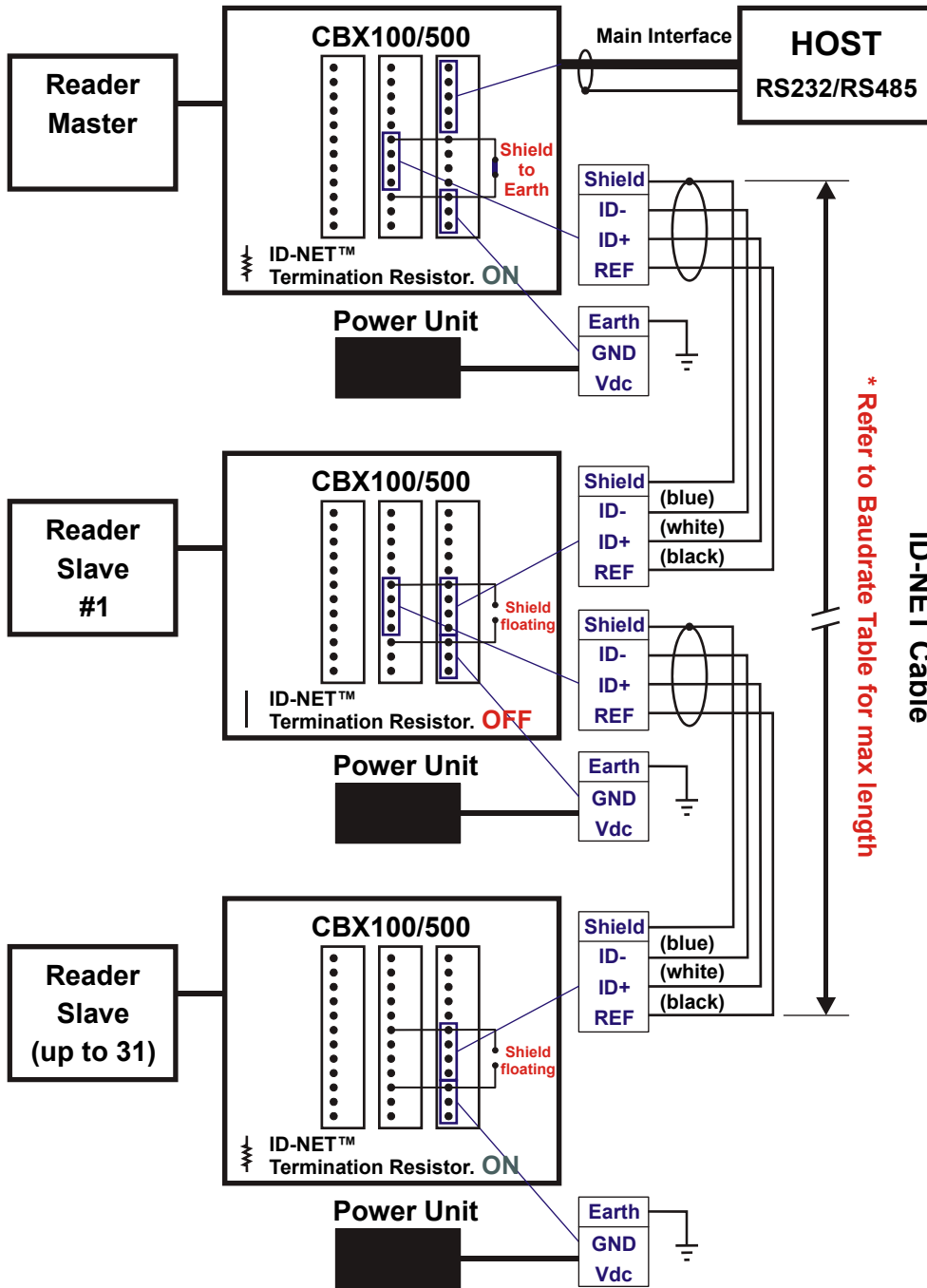- ID-NET™ M/S Synchronized layout
- message length = 50 bytes per node

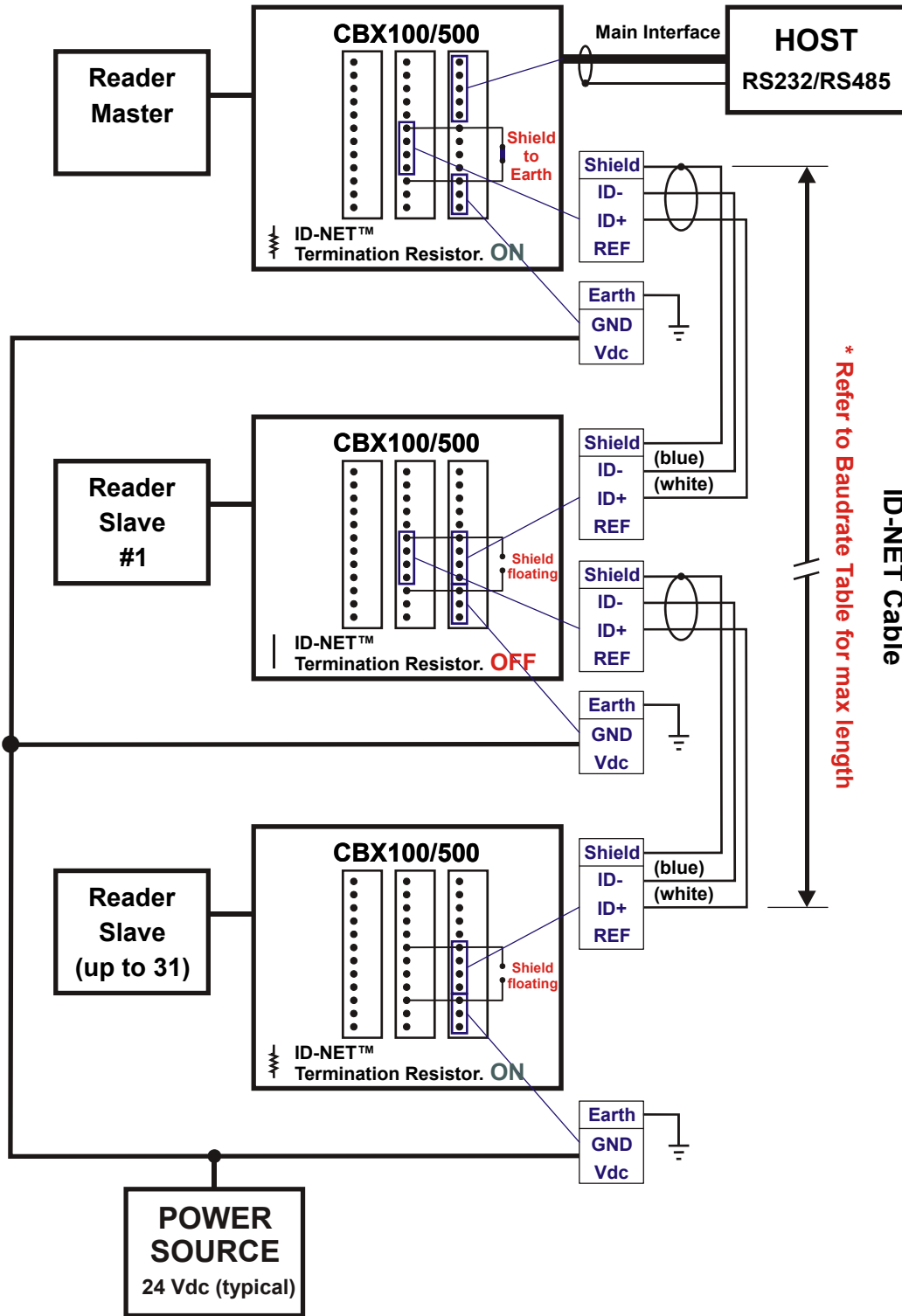**Figure 36 – ID-NET™ Network Connections with Isolated Power Units**

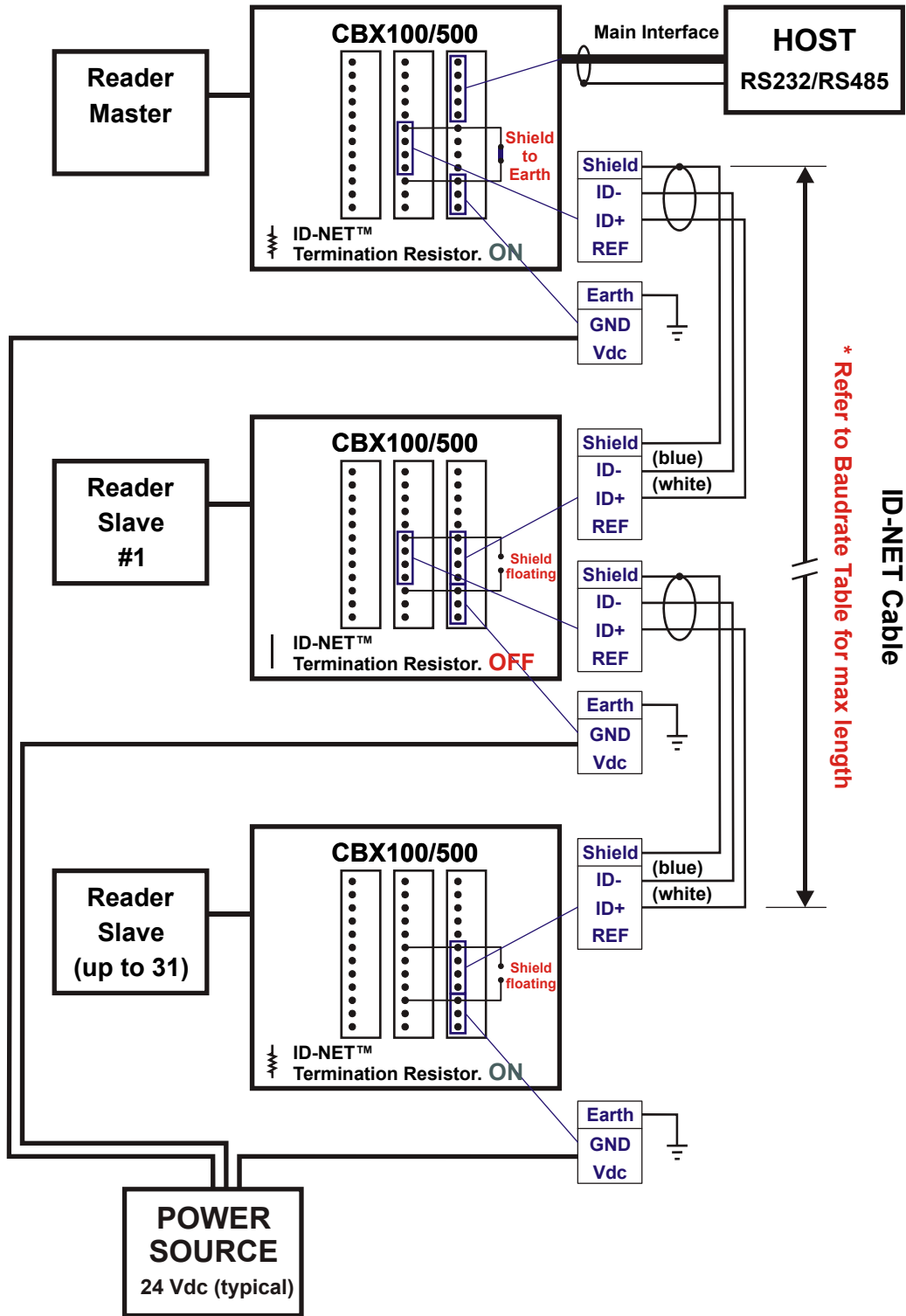Figure 37 - ID-NET™ Network Connections with Common Power Branch Network

Figure 38 – 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.
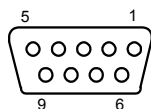

Figure 39 - 9-pin female connector

If permanent system wiring is required, the following pins are used to connect the RS232 auxiliary interface:

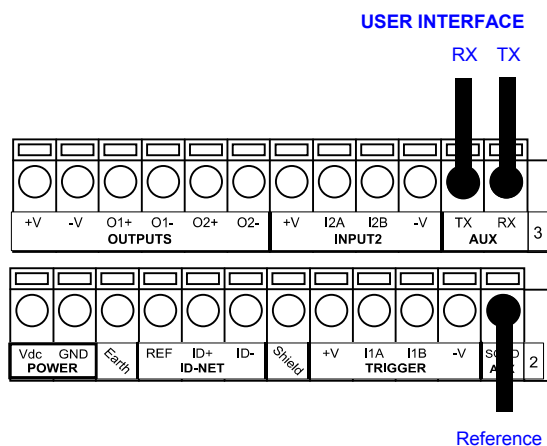| CBX100/500	Function
RX	Auxiliary Interface Receive Data
TX	Auxiliary Interface Transmit Data
SGND	Auxiliary Interface Reference

Figure 40 - RS232 Auxiliary Interface Connections

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

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 $\cong$ 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 17, 5) is on when the active state of the External Trigger corresponds to ON.

EXTERNAL TRIGGER INPUT CONNECTIONS USING CBX POWER

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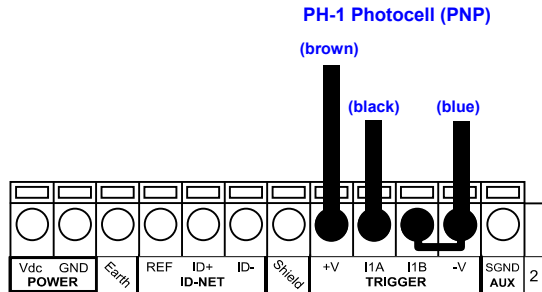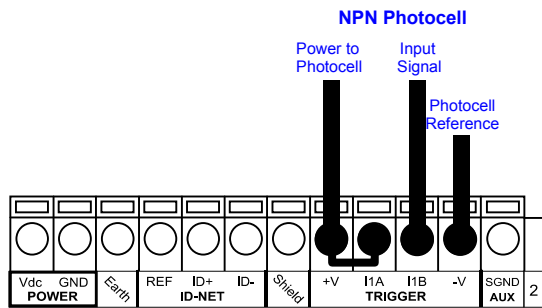

Figure 41 – PH-1 External Trigger Using CBX Power

Figure 42 - NPN External Trigger Using CBX Power
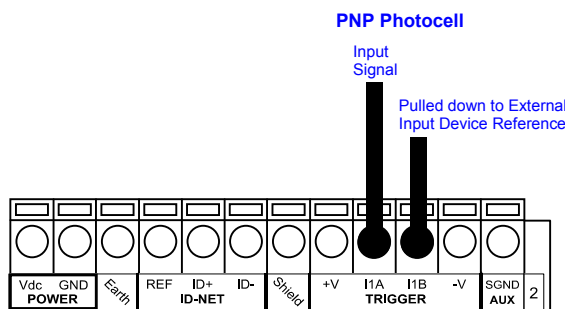
EXTERNAL TRIGGER INPUT CONNECTIONS USING EXTERNAL POWER
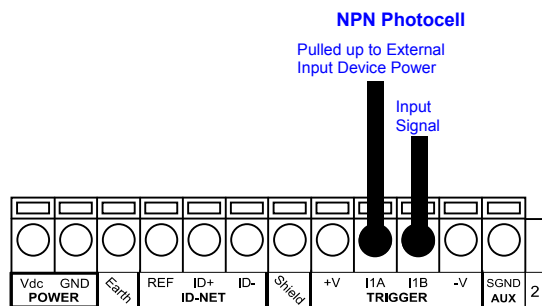

Figure 43 - PNP External Trigger Using External Power

Figure 44 - NPN External Trigger Using External Power

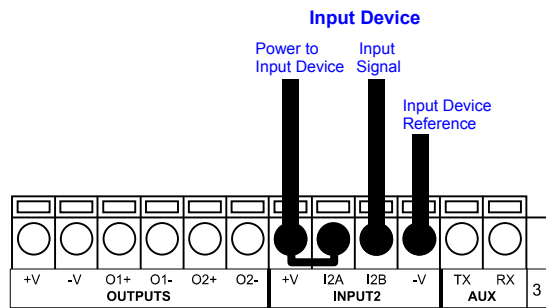| CBX100/500	Function
+V	Power Source - Inputs
I2A	Input 2 A (polarity insensitive)
I2B	Input 2 B (polarity insensitive)
-V	Power Reference - Inputs

INPUT 2 CONNECTIONS USING CBX POWER

> ⚠️ **CAUTION**
>
> *Power is available directly to the Input Device, independently from the Power Supply Switch inside the CBX.*
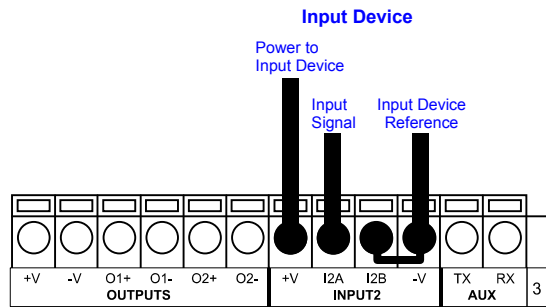
PNP Input 2 Using CBX Power

NPN Input 2 Using CBX Power
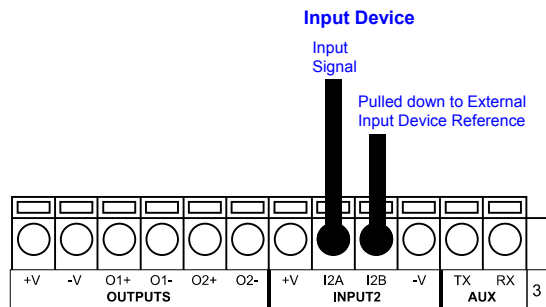
INPUT 2 CONNECTIONS USING EXTERNAL POWER

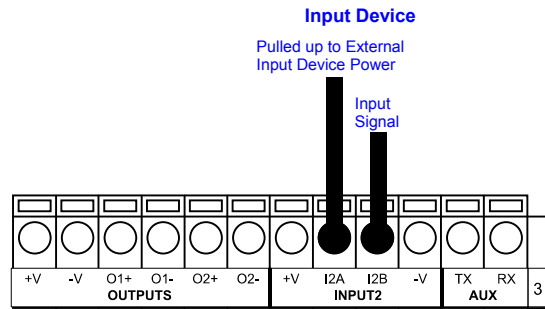**Figure 45 - PNP Input 2 Using External Power**

Figure 46 - 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 CBX POWER

⚠️ **CAUTION**   *Power is available directly to the Output Device, independently from the Power Supply Switch inside the CBX.*
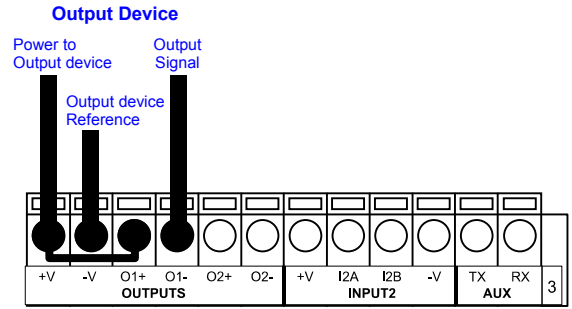
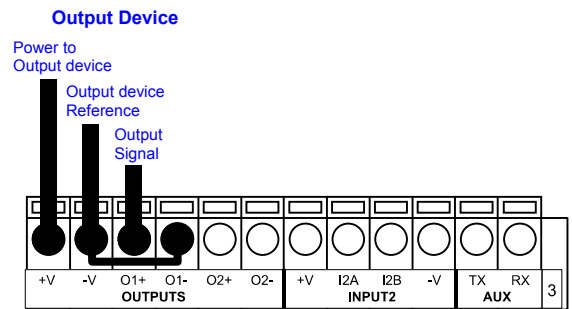**Figure 47 - Open Emitter Output Using CBX Power**

Figure 48 - Open Collector Output Using CBX Power

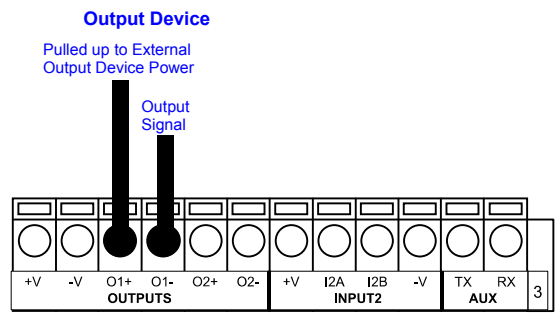## OUTPUT CONNECTIONS USING EXTERNAL POWER

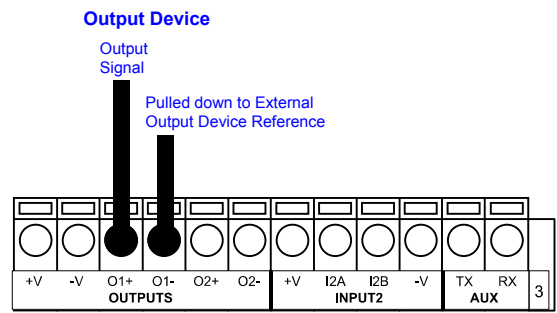**Figure 49 - Output Open Emitter Using External Power**

Figure 50 - Output Open Collector Using External Power

4.7 EXTERNAL ILLUMINATORS

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-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".
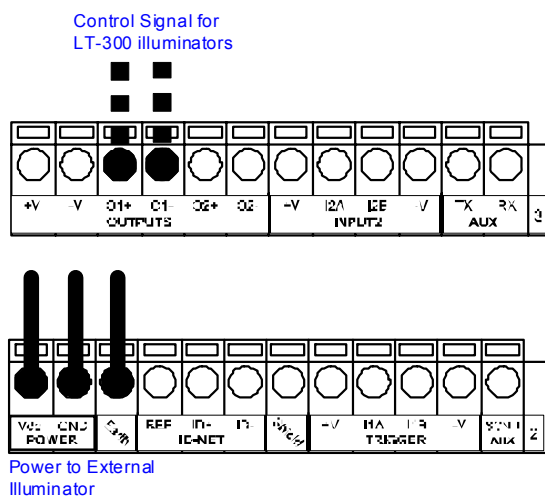
Figure 51 – External Lighting System Connections

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

Illuminator	Wire Color	CBX/Matrix Signal	Meaning
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 +
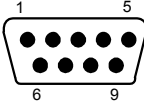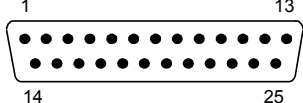
The LT-300 Ring Lighting System is designed for reading codes produced by Dot Peening or Laser Etching on flat, reflective parts. Applications using this illuminator with Matrix 450™ could require alternative mounting solutions to be provided by the customer.

Figure 52 - LT-300 Ring Lighting System

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 450™ ELECTRICAL CONNECTIONS

5.1 MATRIX 450™ POWER, SERIAL HOST, I/O CONNECTOR

The Matrix 450™ 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. **Matrix 450™ cannot source power through this connector**.
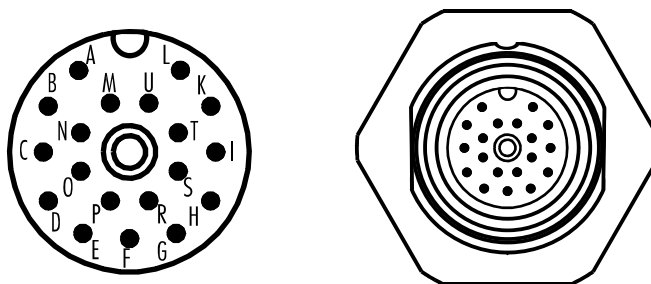
Figure 53 – M16 19-pin Male Connector

Matrix 450™ M16 19-pin 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 INTERFACE (SW SELECTABLE)	TX	TX+	RTX+
U		RX	*RX+	
N		RTS	TX-	RTX-
T		CTS	*RX-	

* Do not leave floating, see par. 5.5.2 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 MATRIX 450™ LIGHTING SYSTEM CONTROL CONNECTOR

Matrix 450™ controls the LT-03x series lighting system from this connector through software. Matrix 450™ can also receive power from this input, normally from the LT-03x lighting system through the CAB-LD-002 cable. **Matrix 450™ cannot source power through this connector**.
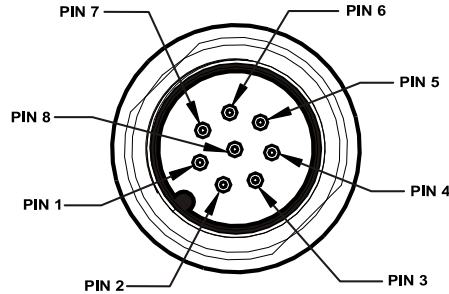

Figure 54 - M12 8-pin Male Lighting System Control Connector

Matrix 450™ M12 8-pin Lighting System Connector Pinout		
Pin	Name	Function
1	SPOT1	Red Spot control signal
2	STROBE	Illuminator control signal
3	SPOT2	Green Spot control signal
4	AIMING	Aiming Lasers control signal
5	LDA	I2C channel data signal
6	LDL	I2C channel clock signal
7	GND	Power supply input voltage negative
8	VDC (*)	Power supply input voltage positive

(*) in the CAB-LD-102 LT Driver No Power cable, this pin isn't connected. In this way the Matrix 450™ is powered ONLY from pin A of the M16 19-pin male connector.

5.2.1 LT-03x Input Power Connector (on LT-03x)

The LT-03x lighting system must be powered from this connector.
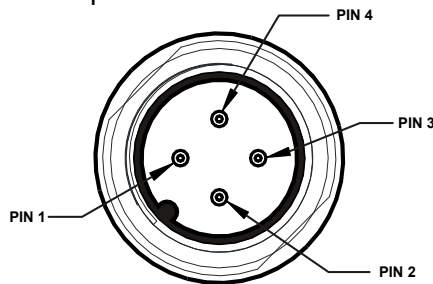
Figure 55 - M12 4-pin Male LT-03x Input Power Connector

LT-03x M12 4-Pin Input Power Connector pinout		
Pin	Name	Function
1	VDC	Power supply input voltage positive
2	VDC	Power supply input voltage positive
3	GND	Power supply input voltage negative
4	GND	Power supply input voltage negative

5.3   MATRIX 450™ GIGAETHERNET CONNECTOR (**)

An M12 8-pin female connector is provided for the on-board GigaEthernet connection. This interface is 1000BASE-T (also known as IEEE 802.3ab) compliant. See par. 5.8 for connection details.
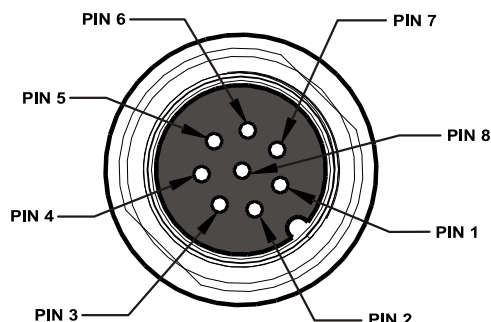

Figure 56 - M12 8-Pin Female GigaEthernet Network Connector

Matrix 450™ M12 8-Pin GigaEthernet Network Connector pinout		
Pin	**Name**	**Function**
1	DB-	Channel B bi-directional data (negative pin)
2	DD+	Channel D bi-directional data (positive pin)
3	DD-	Channel D bi-directional data (negative pin)
4	DA-	Channel A bi-directional data (negative pin)
5	DC+	Channel C bi-directional data (positive pin)
6	DA+	Channel A bi-directional data (positive pin)
7	DB+	Channel B bi-directional data (positive pin)
8	DC-	Channel C bi-directional data (negative pin)

(**) Due to the high speed signals it is strongly suggested to use CAT5e or CAT6 cables.

5.4   POWER SUPPLY

Power is supplied to the reader through the pins provided on the M16 19-pin connector (see Figure 57). **Matrix 450™ cannot source power through this connector**.
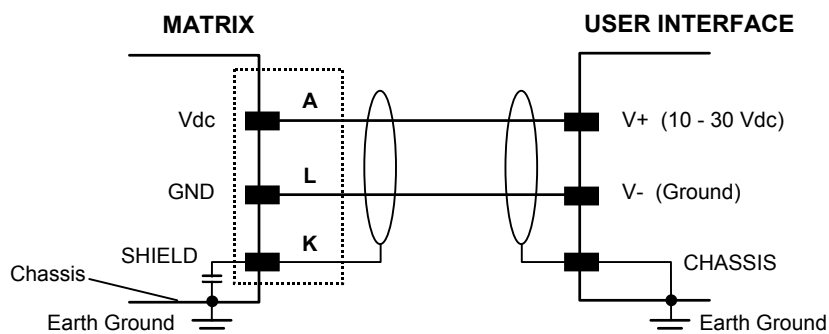

Figure 57 - Power Supply Connection

The allowed supply voltage range for Matrix 450™ is 10 to 30 Vdc, however the LT-03x Lighting System requires 24 Vdc.

5.4.1 Recommended Power Supplies

The following accessory power supplies are recommended for Matrix 450™ + LT-03x assemblies:

Accessory Power Supplies	
Power Supply	Number of Matrix 450™+LT-03xs Supported
PG-120	2
PWR-120	2
PWR-240	4
PWR-480A	8

NOTE

If using separate power sources for LT-03x and Matrix 450™, make sure that LT-03x is powered up before Matrix 450™ in order to be correctly recognized.

5.5 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.

5.5.1 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).
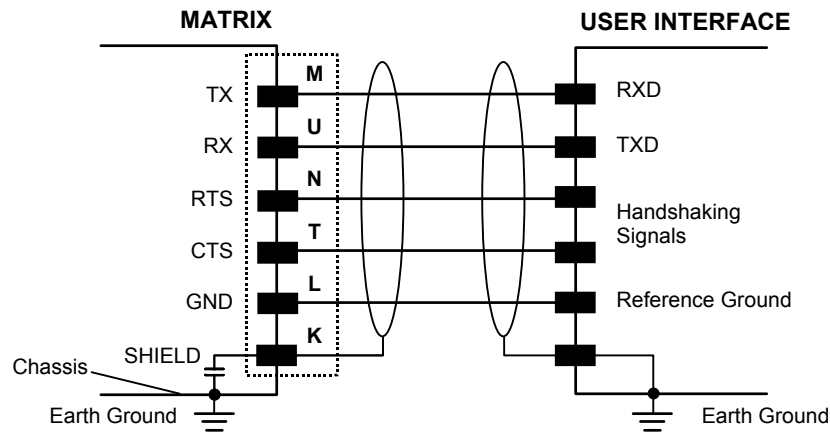
Figure 58 - RS232 Main Interface Connections

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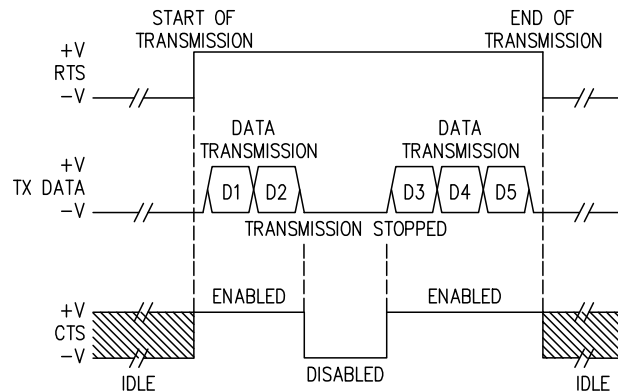

Figure 59 - RS232 Control Signals

If the RTS/CTS handshaking protocol is enabled, Matrix 450™ activates the RTS output to indicate a message is to be transmitted. The receiving unit activates the CTS input to enable the transmission.

5.5.2   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:

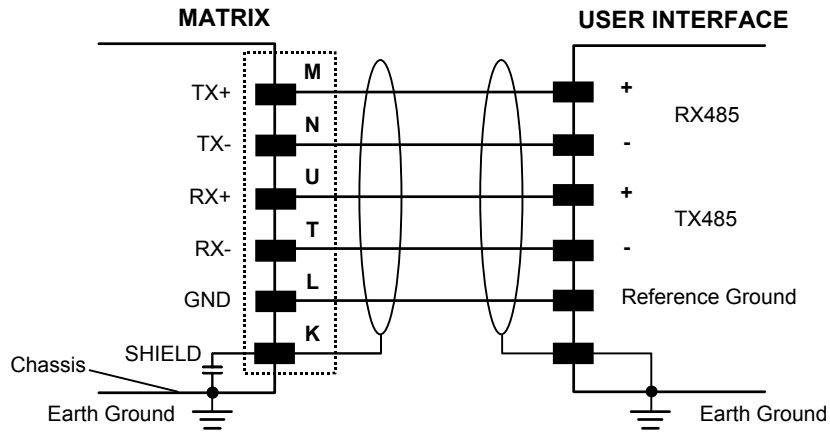| Pin	Name	Function
M	TX+	RS485 Transmit Data (+)
N	TX-	RS485 Transmit Data (-)
U	RX+	RS485 Receive Data (+)
T	RX-	RS485 Receive Data (-)
L	GND	Ground

Figure 60 - 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.
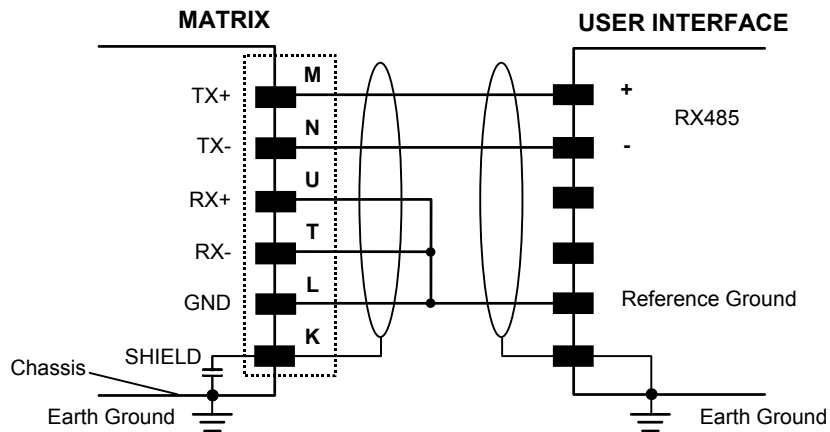

Figure 61 - RS485 Full-duplex Connections using Only TX Signals

5.5.3   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, 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
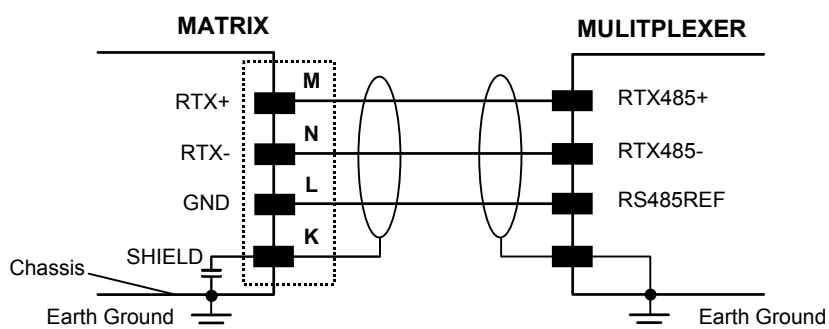
Figure 62 - RS485 Half-duplex Connections

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 450™ readers connected to a Multiplexer.

> **⚠ CAUTION**
>
> *This is an example of multidrop wiring. Consult the multiplexer manual for complete wiring instructions.*
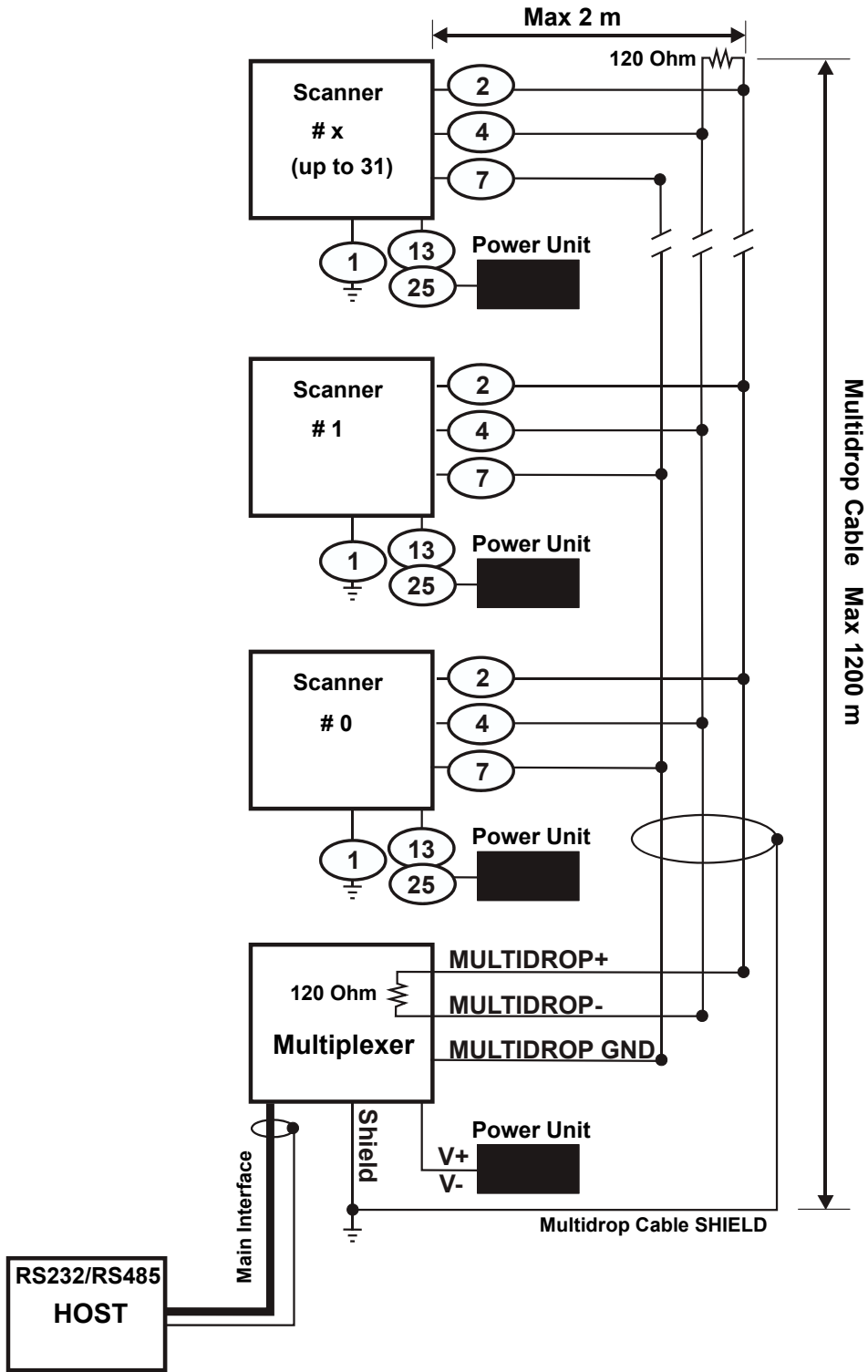
Figure 63 - Matrix 450™ Multidrop Connection to a Mutiplexer

5.6 ID-NET™ INTERFACE

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

5.6.1 ID-NET™ Cables

The following instructions are referred to Figure 65, Figure 66 and Figure 67.

- The general cable type specifications are: CAT5 twisted pair + additional CAT5 twisted pair, shielded cable AWG 24 (or AWG 22) stranded flexible.

  <u>We recommend using</u> 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.

5.6.2 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.
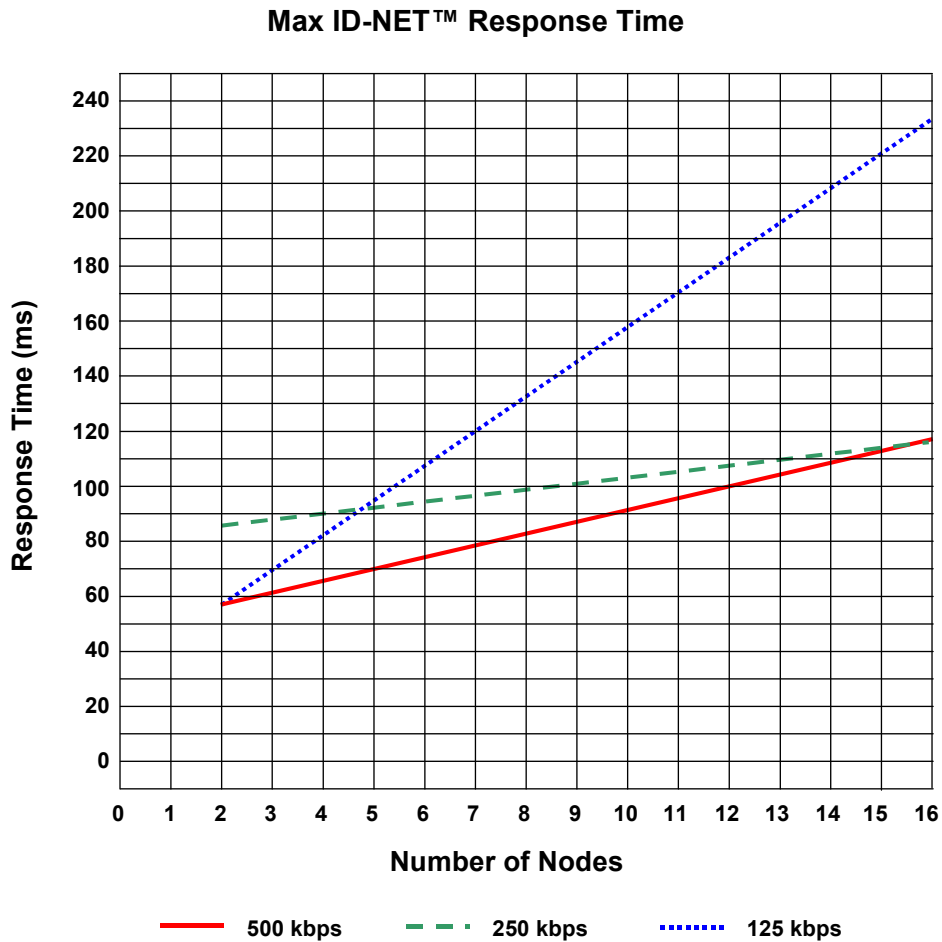
Max ID-NET™ Response Time

Figure 64 – ID-NET™ Response Time

CONDITIONS:

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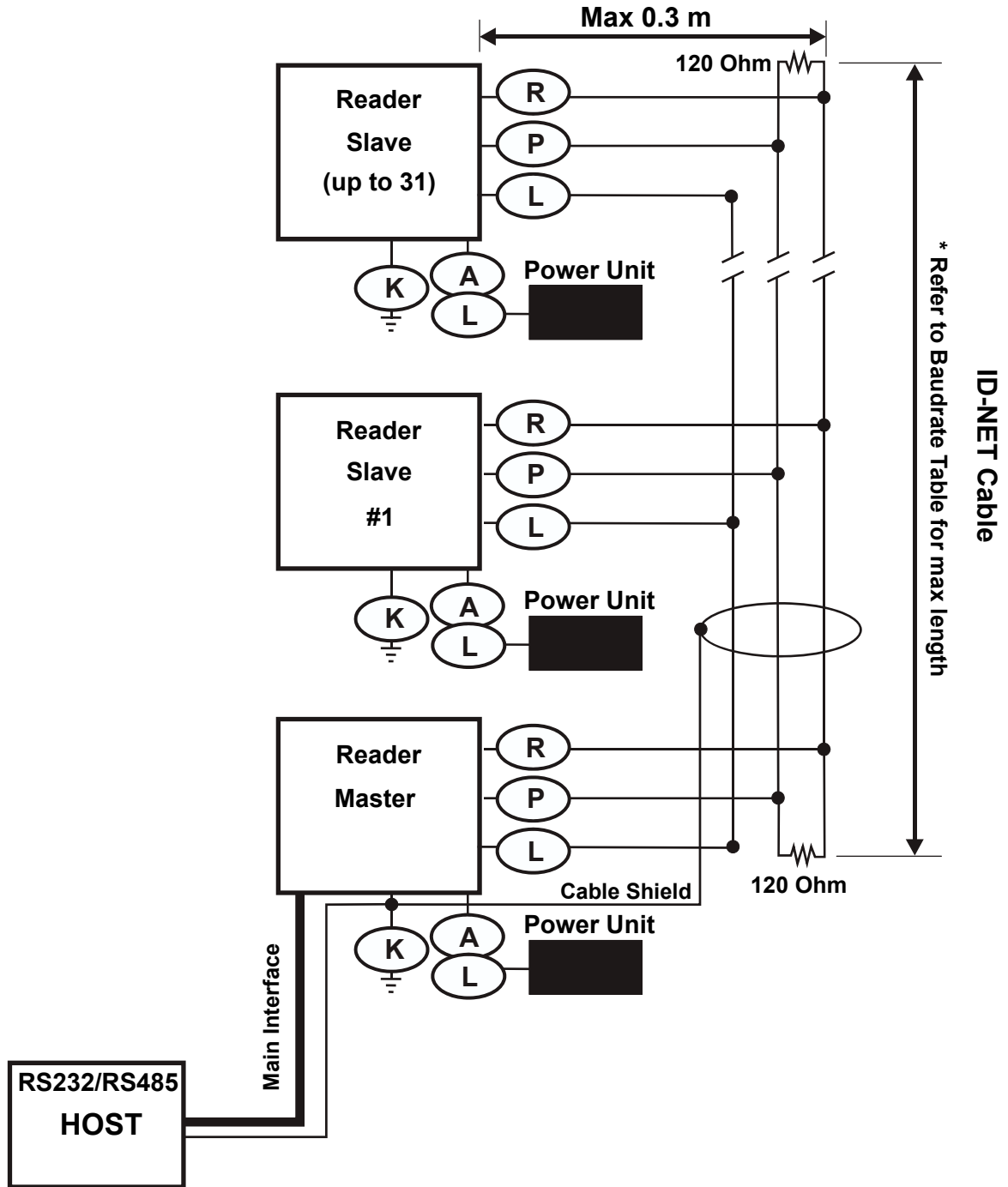- message length = 50 bytes per node

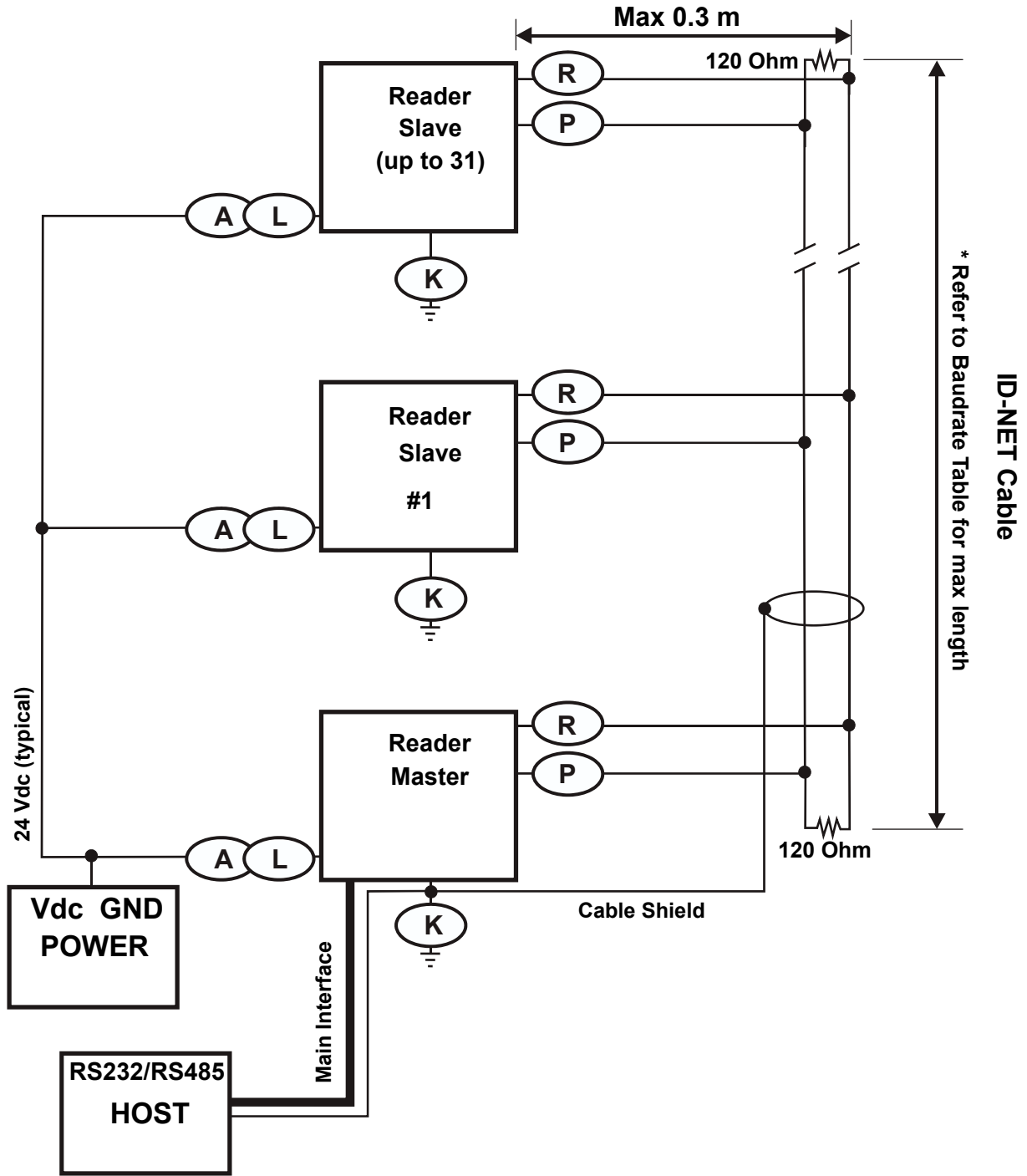**Figure 65 – ID-NET™ Network Connections with Isolated Power Units**

Figure 66 - ID-NET™ Network Connections with Common Power Branch Network
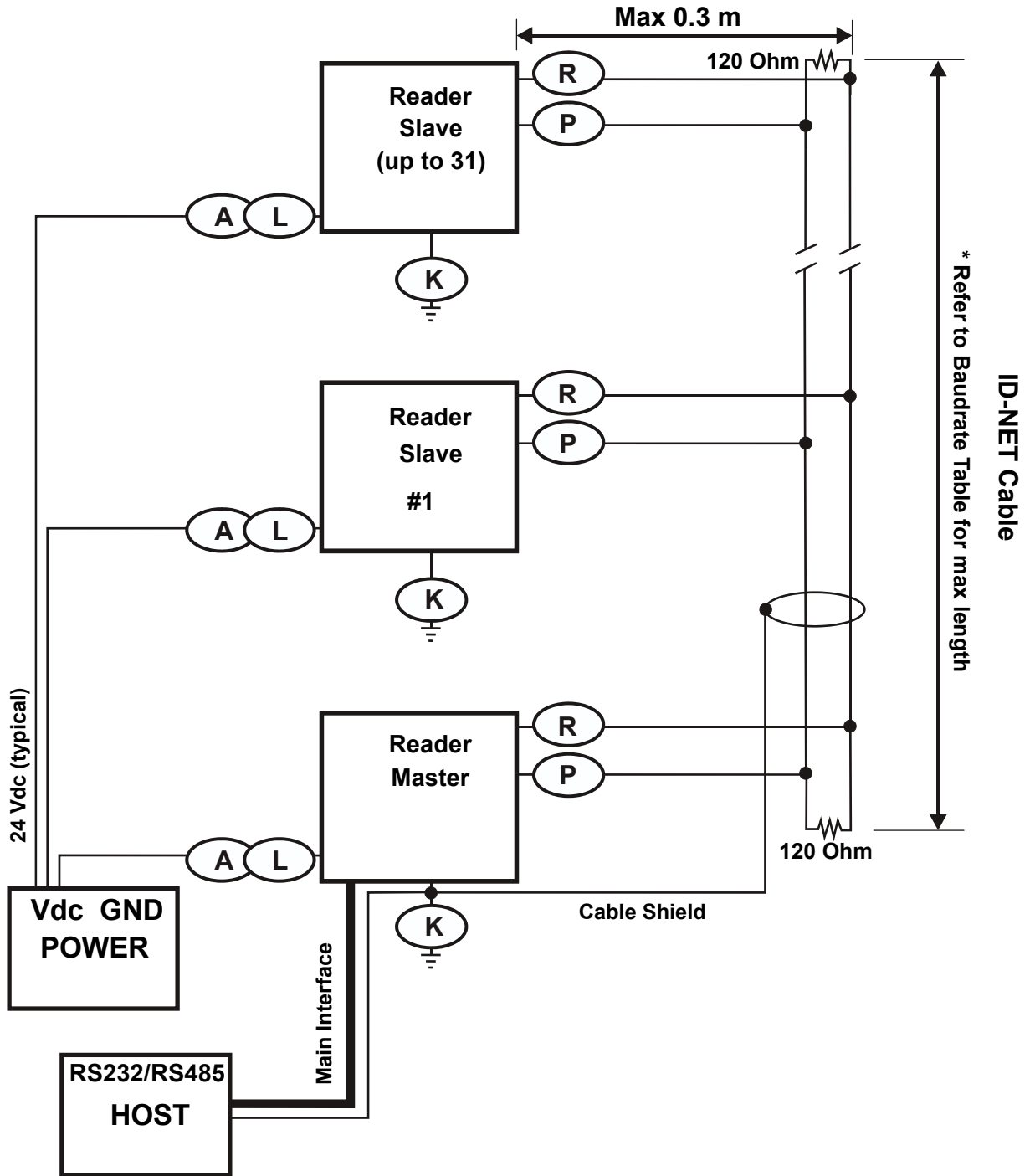
Figure 67 – ID-NET™ Network Connections with Common Power Star Network

5.6.3 ID-NET™ Network Termination

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

5.7 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 68 - RS232 Auxiliary Interface Connections Using 19-pin Connector

5.8 ETHERNET INTERFACE

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. There is no need to use a crossover adapter since Matrix 450™ incorporates an auto-cross function.
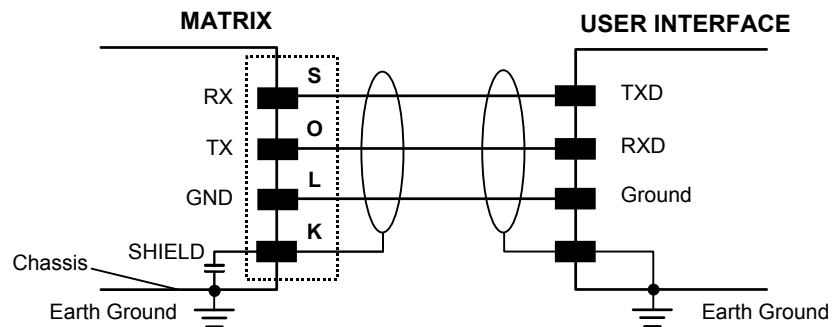
The following is an example of a connection to a LAN using a **CAB-GE0x** straight through cable:

M12 8-Pin GigaEthernet Connector Pinout		
Pin	**Name**	**Function**
1	DB-	Channel B bi-directional data (negative pin)
2	DD+	Channel D bi-directional data (positive pin)
3	DD-	Channel D bi-directional data (negative pin)
4	DA-	Channel A bi-directional data (negative pin)
5	DC+	Channel C bi-directional data (positive pin)
6	DA+	Channel A bi-directional data (positive pin)
7	DB+	Channel B bi-directional data (positive pin)
8	DC-	Channel C bi-directional data (negative pin)

Figure 69 - CAB-GE0x GigaEthernet Cable
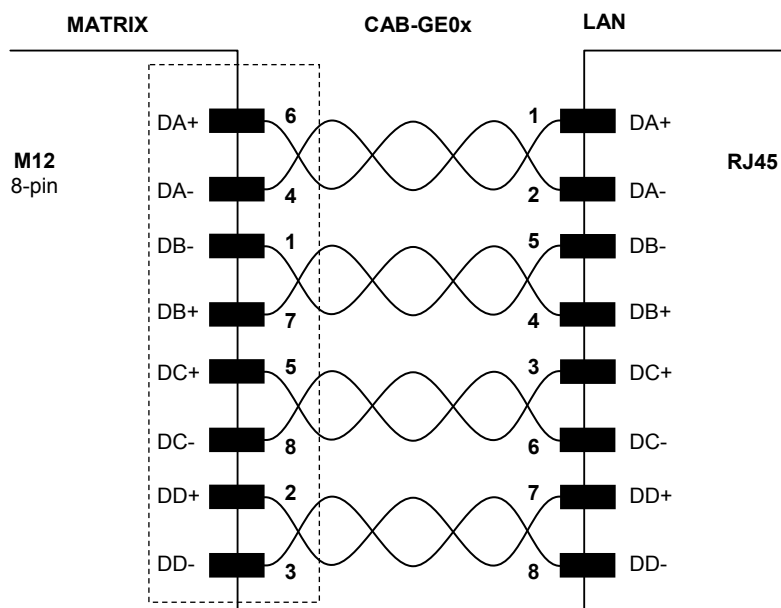
On the Matrix 450™ Ethernet interface the following communication channels are available:

- Data Socket
- Image Socket
- WebSentinel Socket
- Image FTP Client

- HTTP Server
- Ethernet IP
- Modbus TCP

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

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

The active states 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 $\cong$ 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 17, 5) is on when the active state of the External Trigger corresponds to ON.

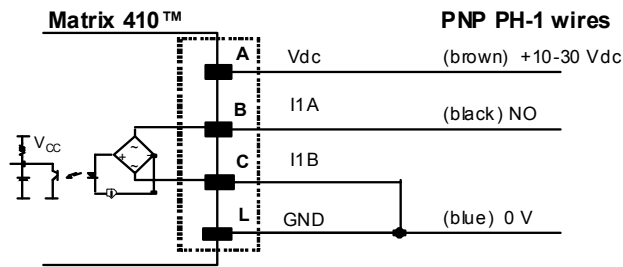## EXTERNAL TRIGGER INPUT PNP PH-1

Figure 70 - External Trigger Using PNP PH-1 Photocell

EXTERNAL TRIGGER INPUT CONNECTIONS USING MATRIX 450™ POWER
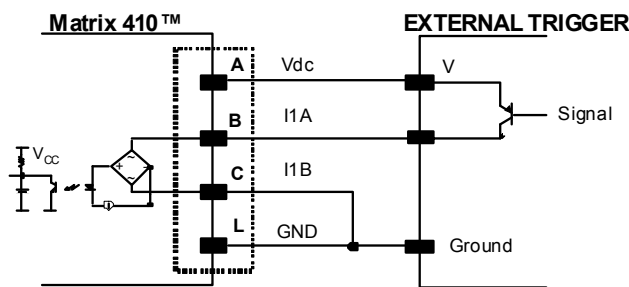
Figure 71 – External Trigger PNP Using Matrix 450™ Power
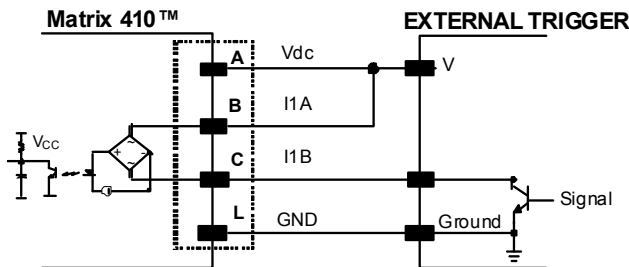
Figure 72 - External Trigger NPN Using Matrix 450™ Power

EXTERNAL TRIGGER INPUT CONNECTIONS USING EXTERNAL POWER
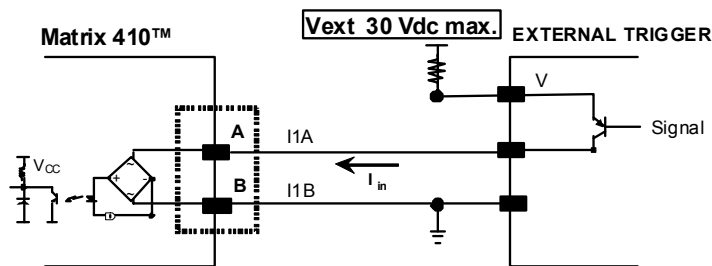
Figure 73 - External Trigger PNP Using External Power
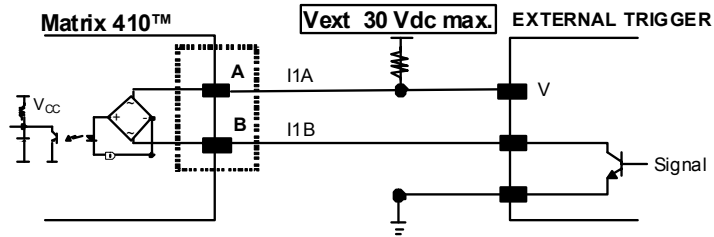
Figure 74 - External Trigger NPN Using External Power

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 450™ POWER

Figure 75 - Input PNP Using Matrix 450™ Power
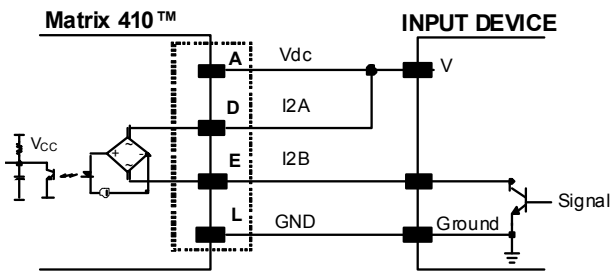
Figure 76 - Input NPN Using Matrix 450™ Power

INPUT 2 CONNECTIONS USING EXTERNAL POWER
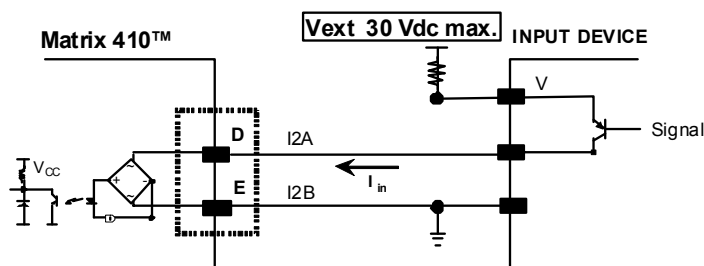
Figure 77 - Input PNP Using External Power

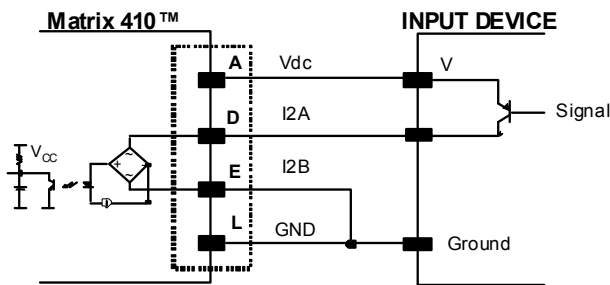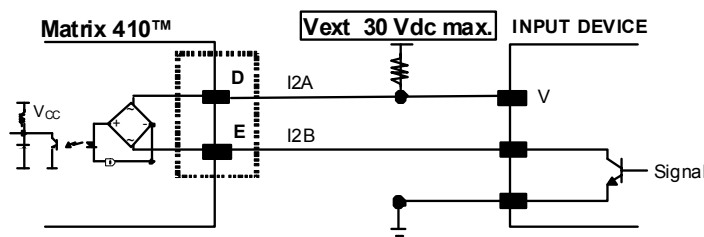**Figure 78 - Input NPN Using External Power**

5.10 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.
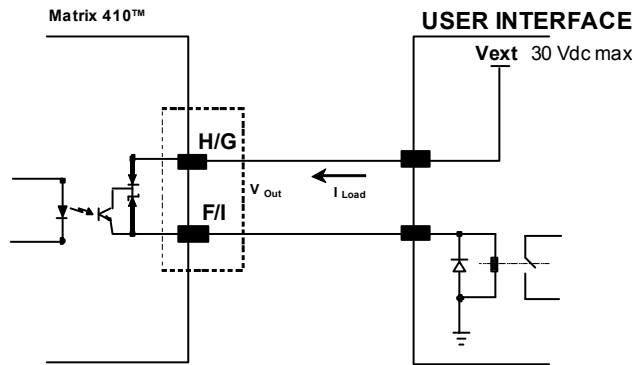
Figure 79 - Open Emitter Output Connection
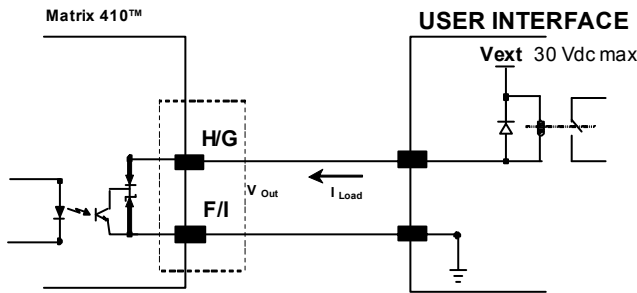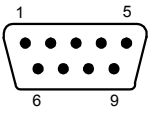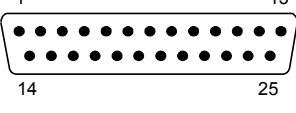
Figure 80 - Open Collector Output Connection

5.11 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.
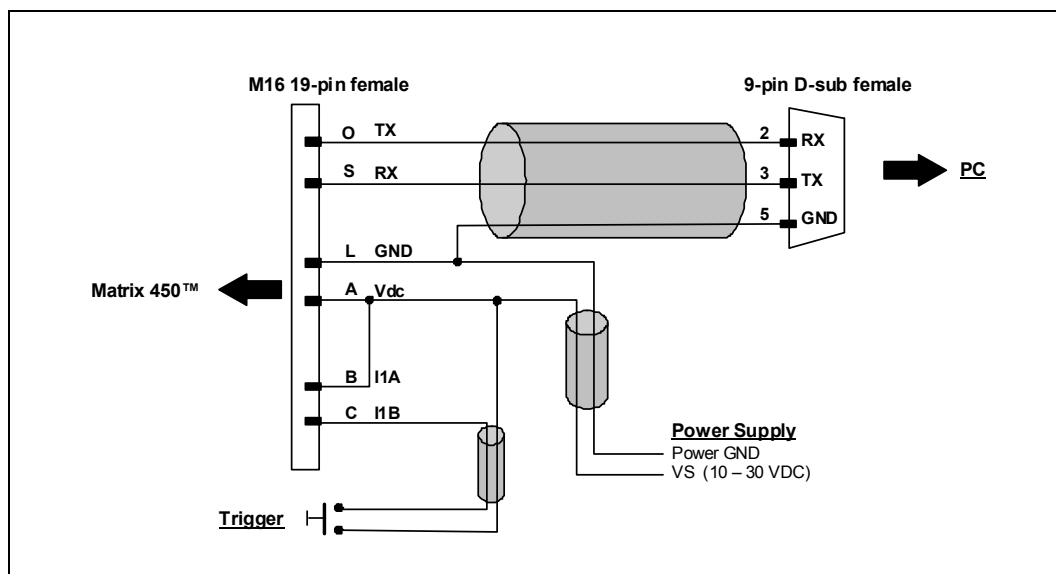
Figure 81- Test Cable for Matrix 450™

6 TYPICAL LAYOUTS

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

> ☛ **NOTE**
>
> *If using separate power sources for LT-03x and Matrix 450™, make sure that LT-03x is powered up before Matrix 450™ in order to be correctly recognized.*

6.1 POINT-TO-POINT

6.1.1 Serial Host

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.
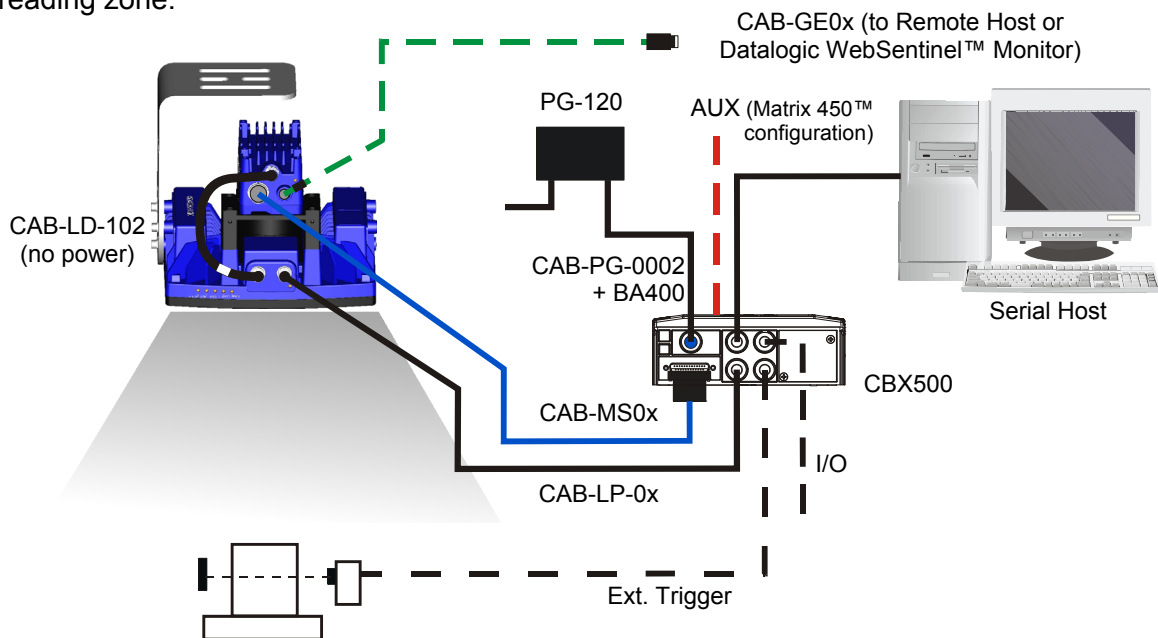
Figure 82 – Standalone Layout to Serial Host (Point-to-Point)

> ☛ **NOTE**
>
> *Matrix 450™ does not support sourcing power towards the CBX in order to power I/O devices (including the External Trigger). These devices must be powered from the CBX or from an external source.*

6.1.2 Embedded (On-Board) GigaEthernet

A point-to-point configuration can be made to the on-board Ethernet connection. In order to be recognized by VisiSet™, it is necessary to align the reader's Ethernet parameters using the programming barcode procedure. For further details, see the "Matrix Family Setup Procedure Using Programming Barcodes" document on the mini-DVD and 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-GE0x** cable. There is no need to use a crossover adapter since Matrix 450™ incorporates an autocross function.
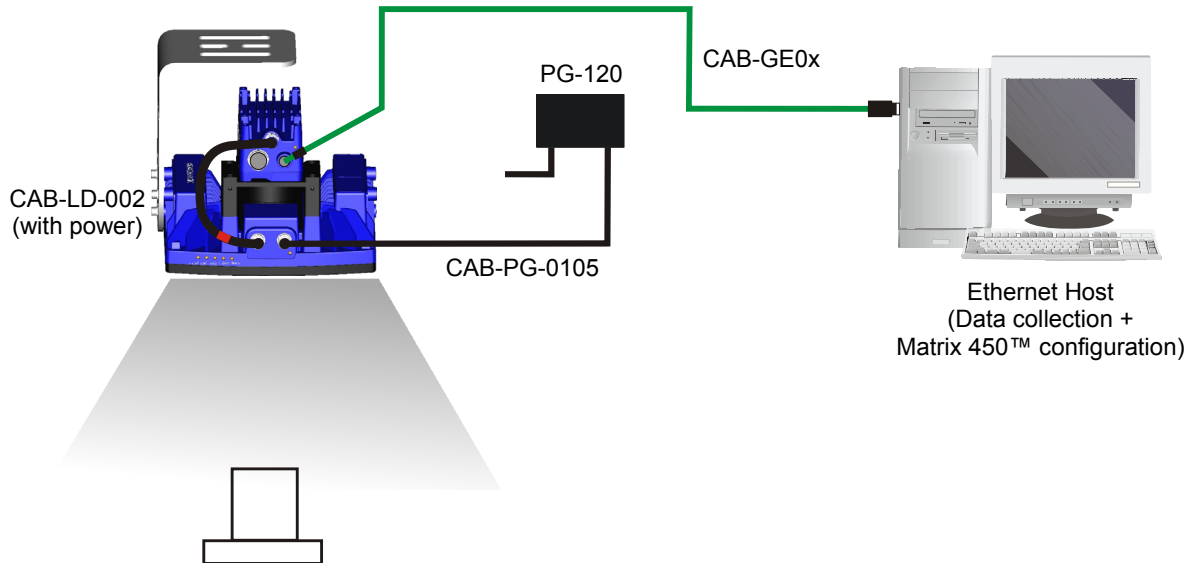
Figure 83 - Standalone Layout to Ethernet Host (Point-to-Point)

6.1.3   TCP/IP Ethernet (BM2x0)

In this layout the data is transmitted to the Host on the TCP/IP Ethernet interface (CBX500 with BM2x0 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.


① BM200/210 TCP/IP Ethernet Interface
② Auxiliary Serial Interface (Local Echo) (RS232)
③ External Trigger (for One Shot or Phase Mode)
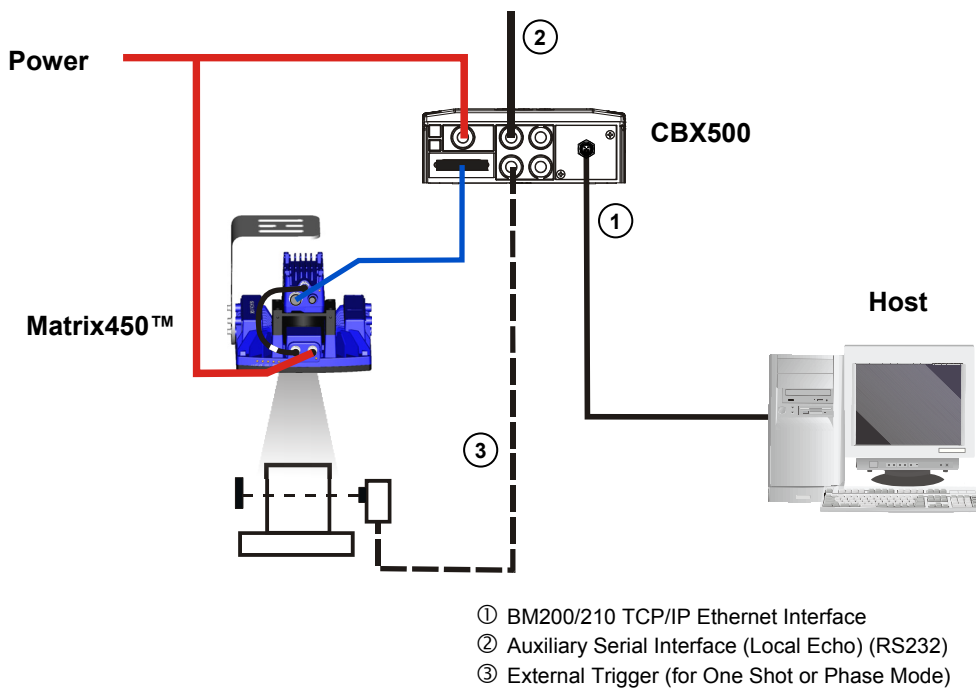
Figure 84 – BM200/210 TCP/IP Ethernet Interface Point-to-Point Layout

6.1.4   Fieldbus

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.

① Fieldbus Interface (Profibus, DeviceNet, etc.)
② Auxiliary Serial Interface (Local Echo) (RS232)
③ External Trigger (for One Shot or Phase Mode)
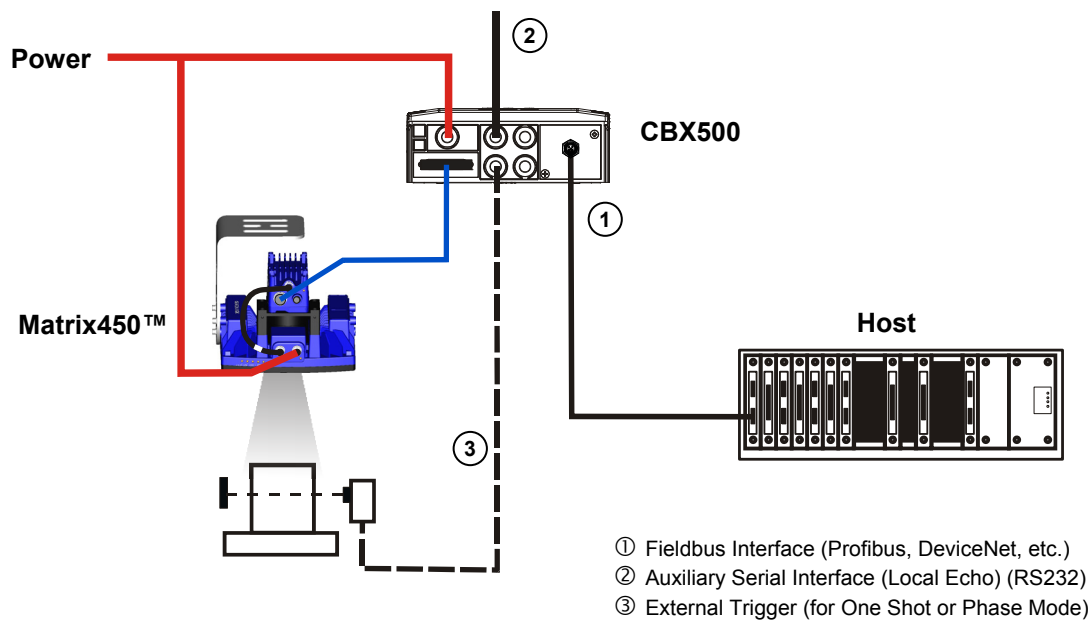
Figure 85 – Fieldbus Interface Point-to-Point Layout

6.2 ETHERNET NETWORKS

6.2.1 External Trigger Ethernet Host

When using a Local Area Network (LAN), one or more Matrix 450™ readers can be connected to the network by using **CAB-GE0x** cables. In the example below an External Trigger is used which is connected through a CBX connection box.
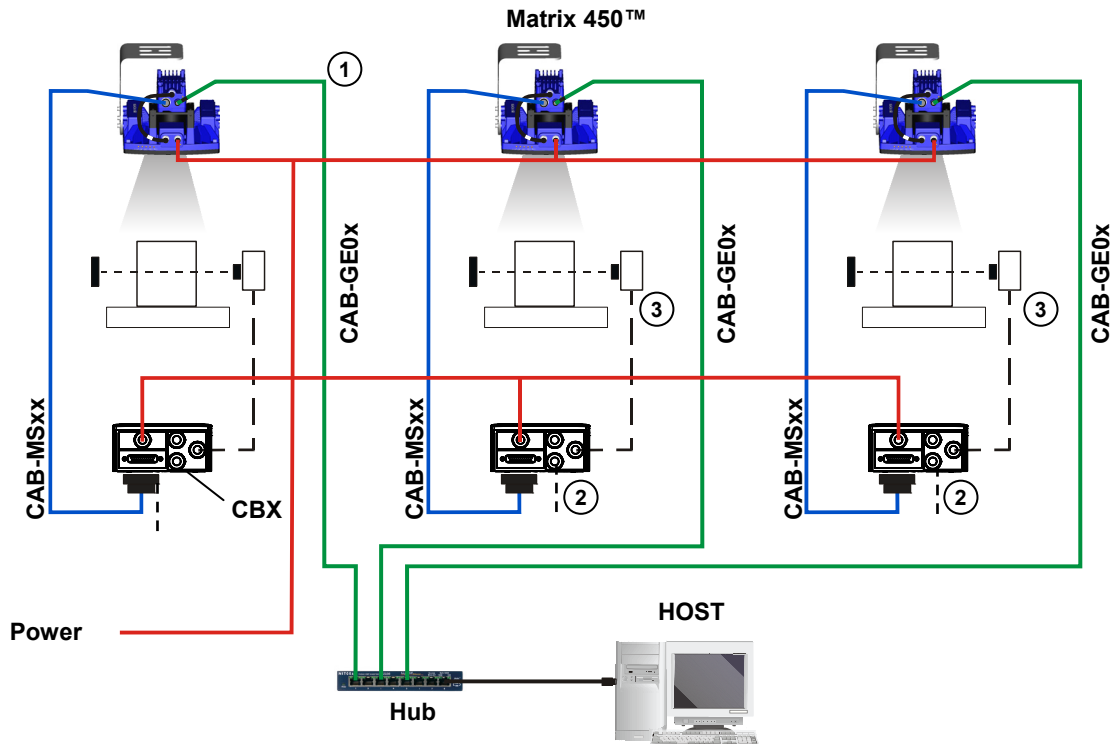
① Ethernet Interface
② Auxiliary Serial Interface (Local Echo) (RS232)
③ External Trigger (for One Shot or Phase Mode)

Figure 86 - Ethernet Network Layout

NOTE	*Matrix 450™ does not support sourcing power towards the CBX in order to power I/O devices (including the External Trigger). These devices must be powered from the CBX or from an external source.*

6.2.2   No Trigger Ethernet Host

The LAN connections are simplified when one or more Matrix 450™ readers work in Continuous reading mode or when the Trigger is supplied by the host. In this case the CBX connection boxes are not necessary.
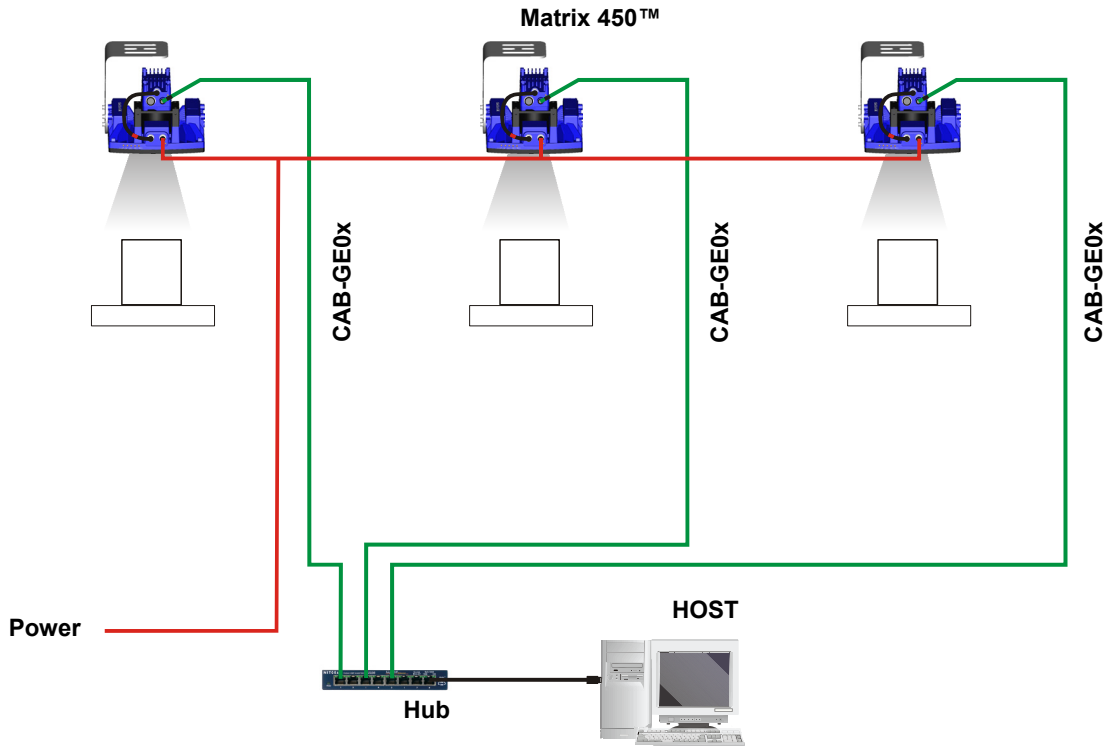
Figure 87 - Ethernet Network Layout

6.3 PASS-THROUGH NETWORKS

6.3.1 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:

① Main Serial Interface (RS232 only)
② Auxiliary Serial Interface (RS232)
③ External Trigger (for One Shot or Phase Mode)

Figure 88 – 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.*

6.3.2 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 450™ 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.

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

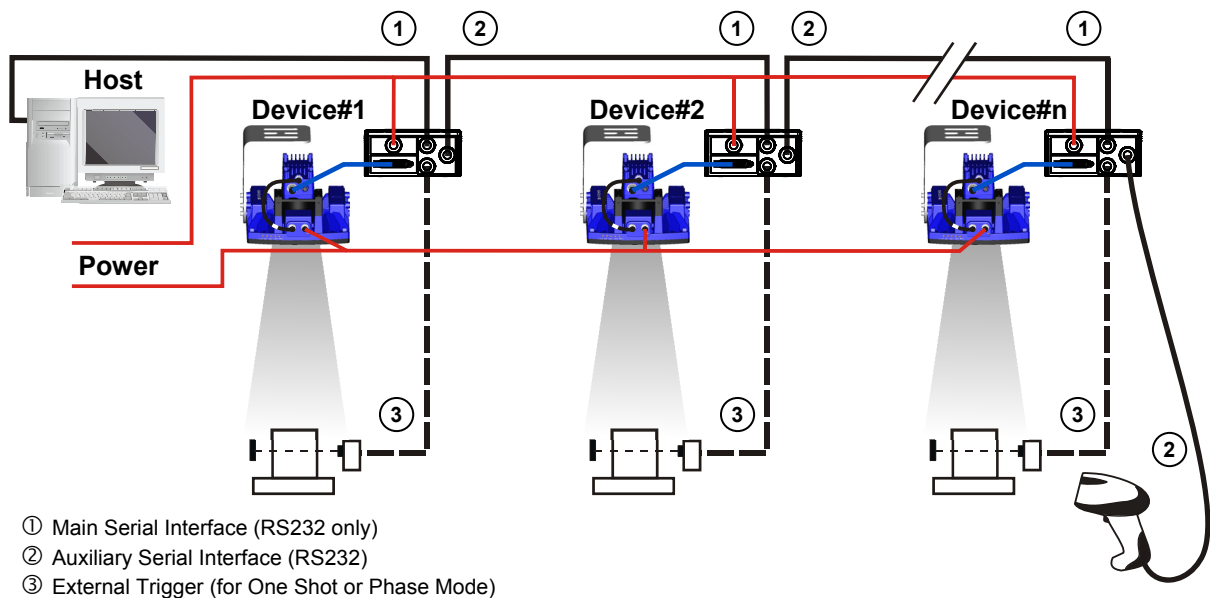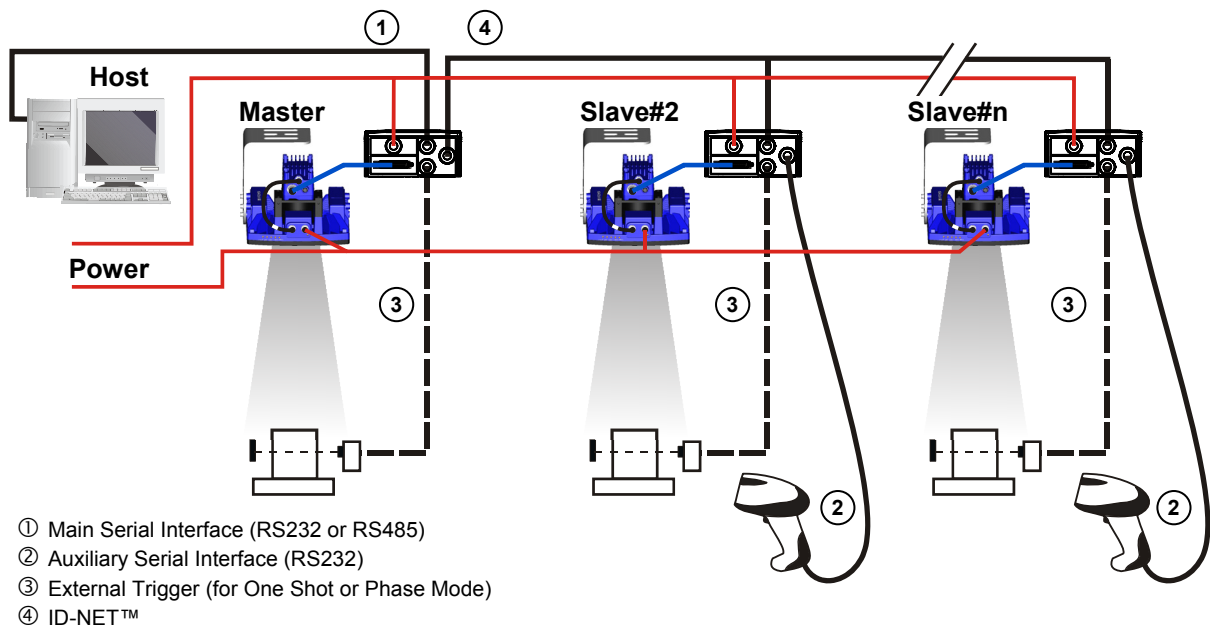**Figure 89 – Pass-Through On ID-NET™ Layout**

> **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.*

6.4 ID-NET™ NETWORKS

6.4.1 M/S Synchronized Serial Host

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 <u>Phase Mode</u>.

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

① Main Serial Interface (RS232 or RS485)
② External Trigger
③ ID-NET™ (up to 16 devices - practical limit)
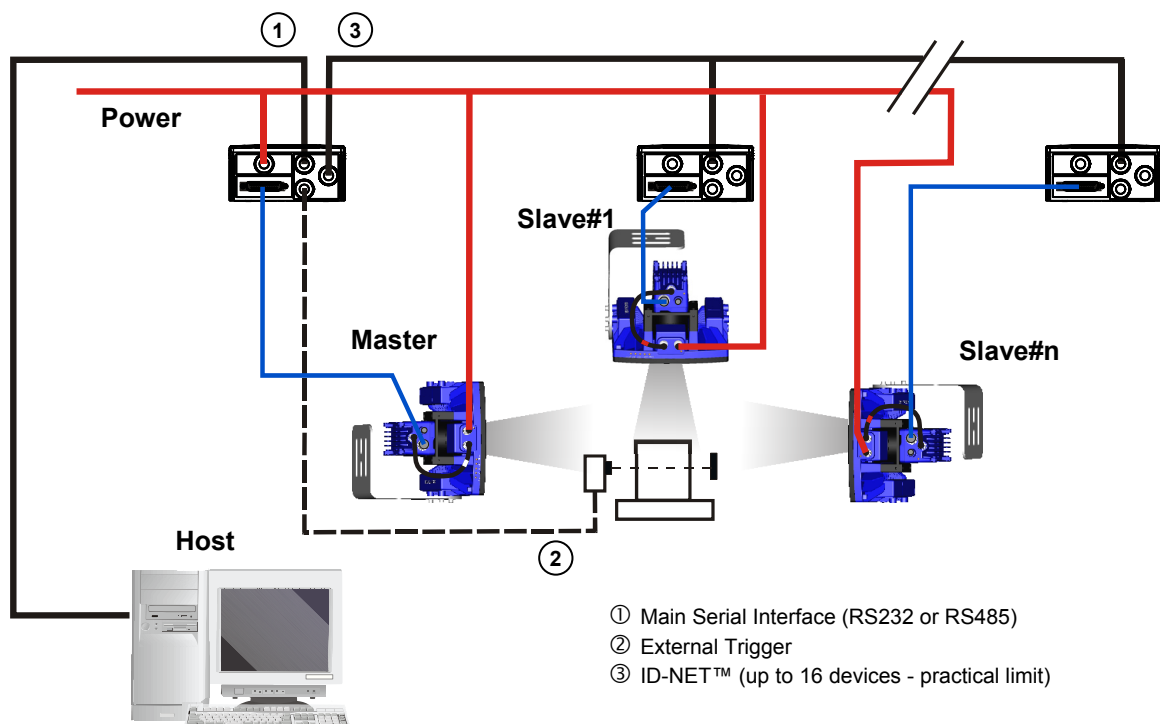
Figure 90 – ID-NET™ M/S Synchronized Layout

The Master reader can be connected to the CBX series connection box with the advantage of the External Memory Backup and Restore features (CBX + BM100 module). If the Backup and Restore function is not required, then a QL300 can be used to connect the master reader.

Power

CAB-AUX03

CAB-AUX03

CAB-AUX03

ID-NET™

QL150

QL150

CBL-1480-xx

CBL-1480-xx

CBX500

③ ⑤ ①

④

CBL-1490
ID-NET
Terminator

Master

Slave Nodes

PS

Main Interface

Host

The ID-NET network must be terminated through the internal switch of the CBX500 and inserting an ID-NET terminator into the last QL in the network.

① BA600 ID-NET™ Out
③ BA400 Ext. Power
④ BA500 Trigger
⑤ BA300 Service

Figure 91 - ID-NET™ Synchronized Layout
Matrix 450™ Master with CBX500 + Matrix 450™ Slaves with QL150

Power

CAB-AUX03

CAB-AUX03

ID-NET™

QL150

QL150

CBL-1480-xx

CBL-1480-xx

QL300

CBL-1496
ID-NET
Terminator

CBL-1490
ID-NET
Terminator

Master

Slave Nodes

PS

Main Interface

Host

The ID-NET network must be terminated inserting an ID-NET terminator into the QL300 (Master) and into the last QL in the network.
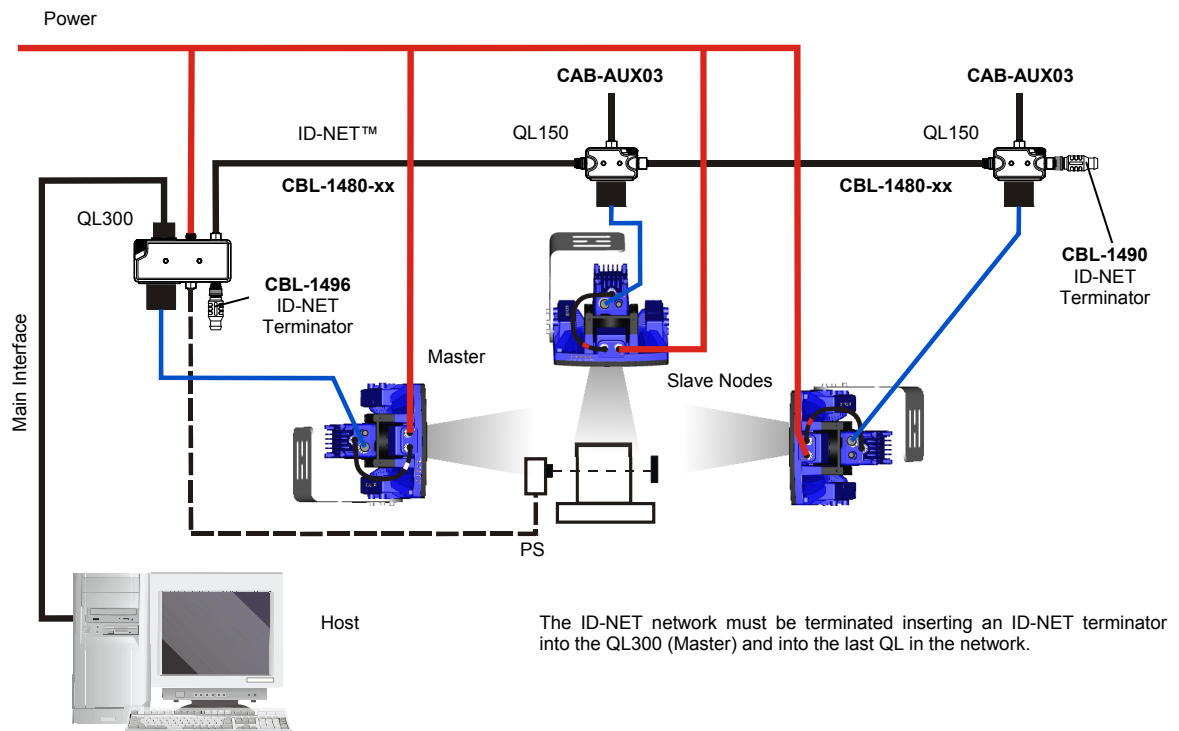
Figure 92 - ID-NET™ Synchronized Layout
Matrix 450™ Master with QL300 + Matrix 450™ Slaves with QL150

6.4.2 M/S Synchronized TCP/IP Host

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 having the BM2x0 Host Interface Module installed. It could also be connected to the QL500 and in both cases the External Memory Backup and Restore features are available.

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

① BM2x0 TCP/IP Ethernet Interface
② External Trigger (for One Shot or Phase Mode)
③ ID-NET™ (up to 16 devices - practical limit)

Figure 93 – ID-NET™ M/S Synchronized Layout with BM200/210 TCP/IP Ethernet Interface to Host

6.4.3 M/S Multidata Serial 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.

① Main Serial Interface (RS232 or RS485)
② Auxiliary Serial Interface *Local Echo((RS232)
③ External Trigger (for One Shot or Phase Mode)
④ ID-NET™ (up to 32 devices, max network extension of 1000 m)

Figure 94 – 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.*

6.4.4 M/S Multidata TCP/IP Host

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 BM2x0 Host Interface Module installed. It could also be connected to the QL500 and in both cases the External Memory Backup and Restore features are available.

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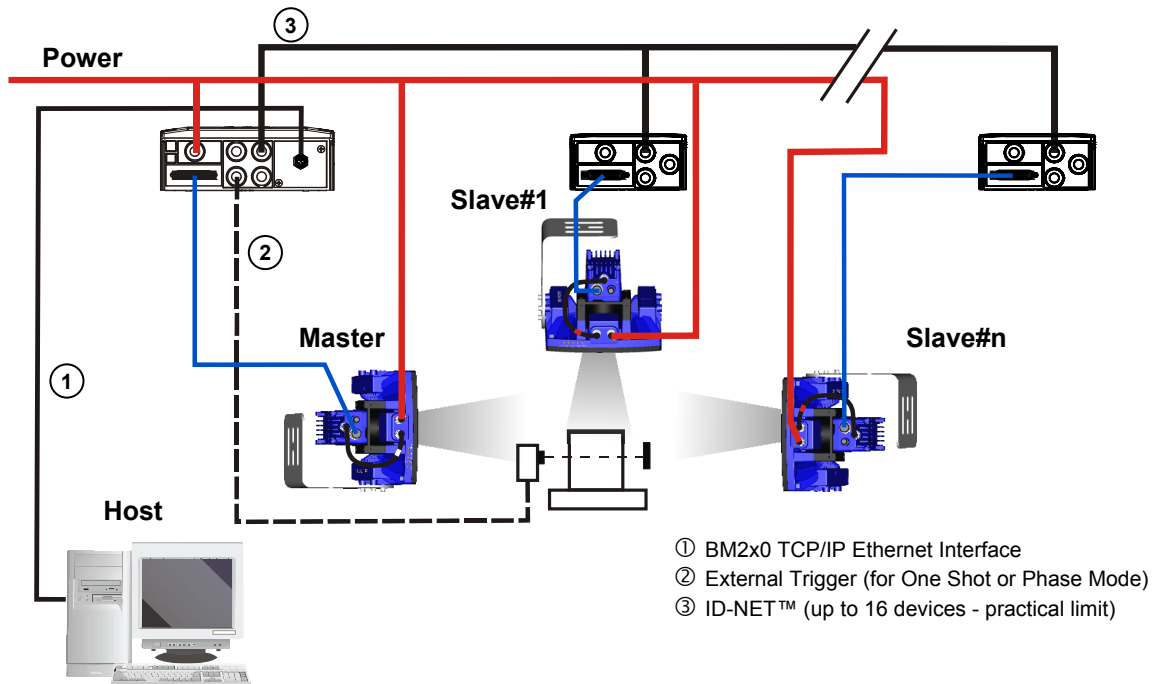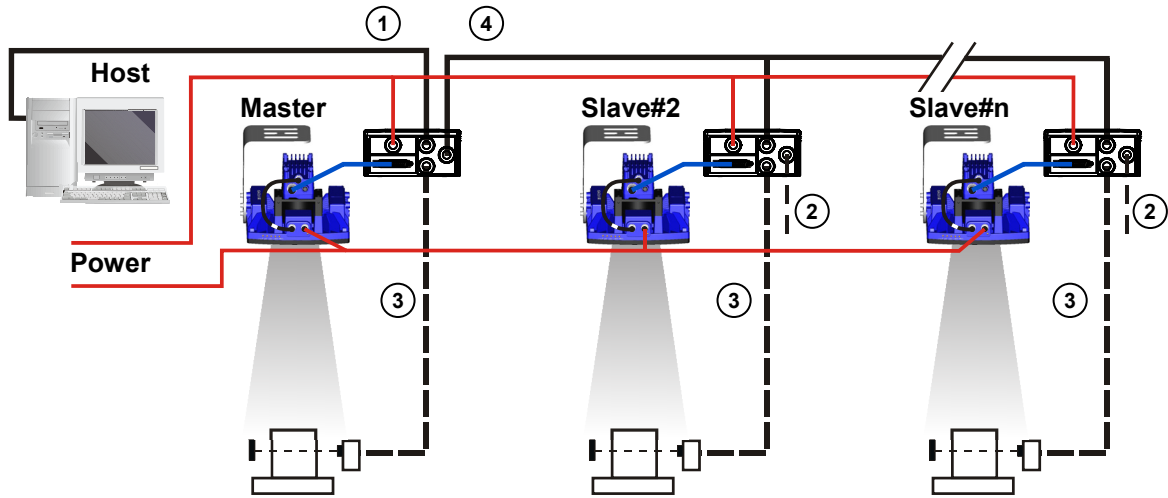

① BM2x0 TCP/IP Ethernet Interface
② Auxiliary Serial Interface (Local Echo) (RS232)
③ External Trigger (for One Shot or Phase Mode)
④ ID-NET™ (up to 32 devices, max network extension of 1000 m)

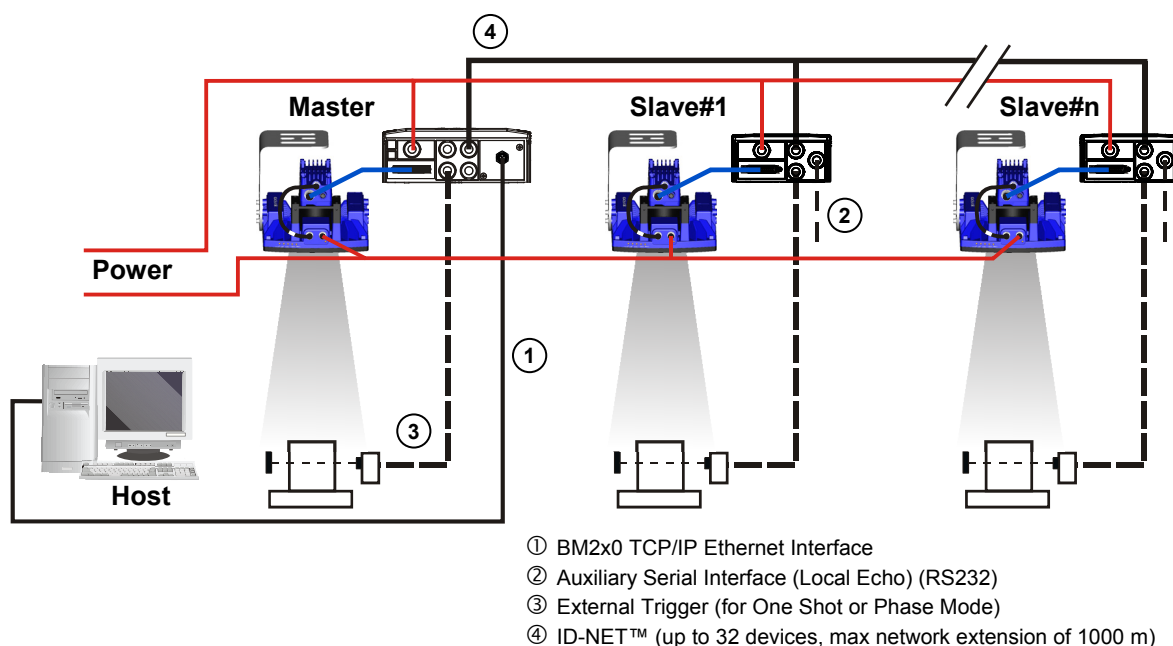**Figure 95 – ID-NET™ M/S Multidata Layout with BM200/210 TCP/IP Ethernet Interface to Host**

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.

6.4.5 M/S Synchronized and Multidata Fieldbus Host

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

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

① Fieldbus Interface
② External Trigger (for One Shot or Phase Mode)
③ ID-NET™ (up to 16 devices - practical limit)
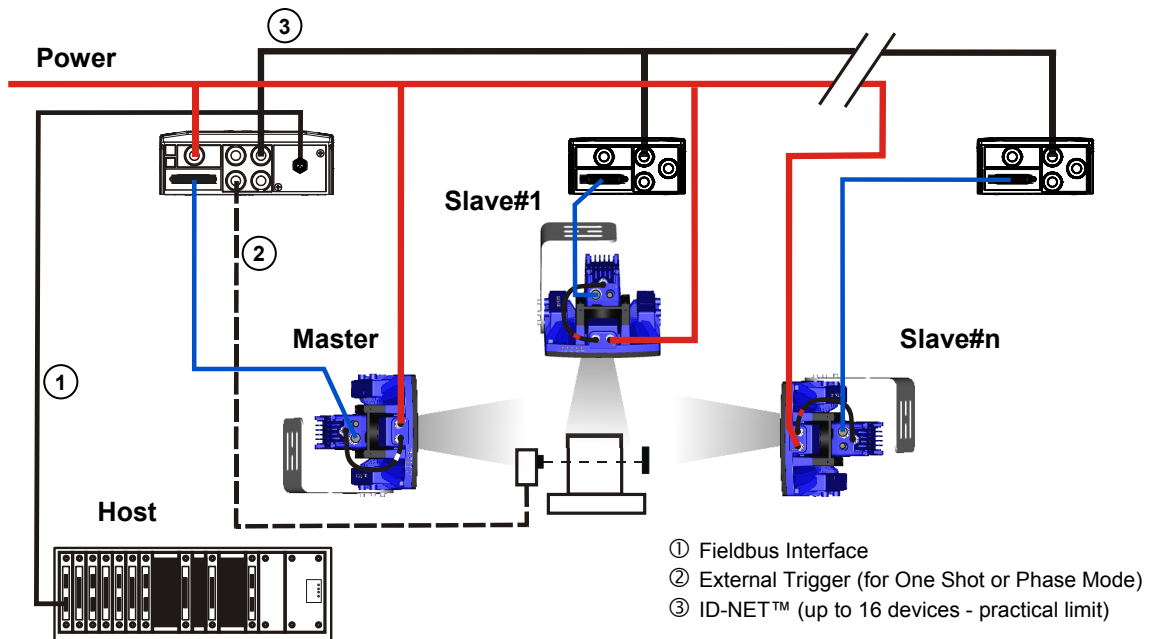
Figure 96 – ID-NET™ Fieldbus M/S Synchronized Layout

① Fieldbus Interface
② Auxiliary Serial Interface (Local Echo) (RS232)
③ External Trigger (for One Shot or Phase Mode)
④ ID-NET™ (up to 32 devices, max network extension of 1000 m)
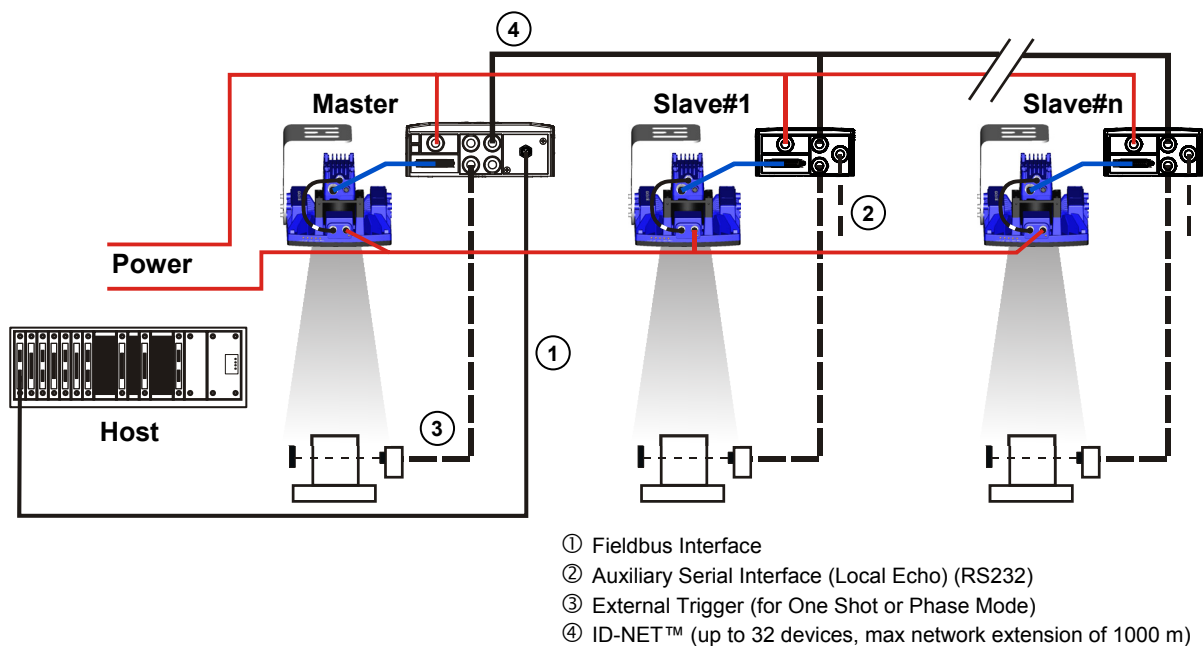
Figure 97 – ID-NET™ Fieldbus M/S Multidata

7 READING FEATURES

7.1 OPTICAL ACCESSORY SELECTION

Referring to Figure 98, 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[2] d** (mm)
Matrix 450 800-030	LNS-1216 16 mm	28.8°	24.5°	37.2°	**40**
	LNS-1225 25 mm	19.8°	16.7°	25.7	**50**
	LNS-1235 35 mm	13.4°	11.3°	17.5°	**150**
	LNS-1250 50 mm	9.2°	7.8°	12.1°	**340**

The viewing angle has a tolerance of $\pm$ 1° depending on the focus distance.

$$FOV_x = 2\left[(d + 44 \text{ mm}) \tan(\alpha_x/2)\right]$$

where:

FOV_x = horizontal, vertical or diagonal FOV

α_x = horizontal, vertical or diagonal viewing angles.

d = focus distance (from Lens Cover window surface to code surface)
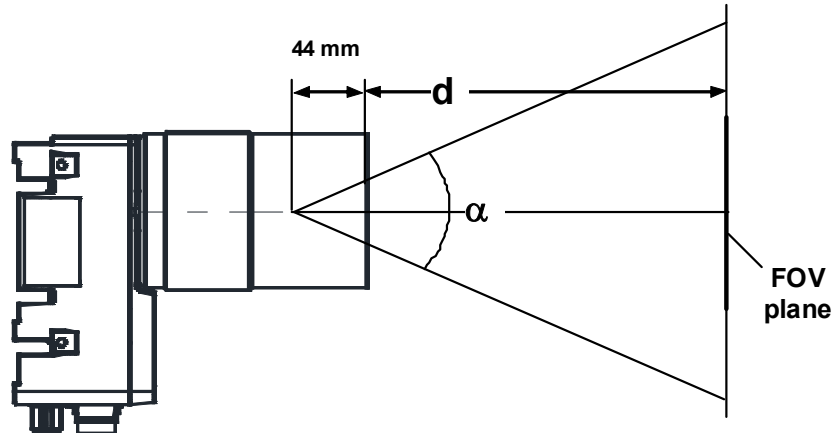
Figure 98 – Reading Distance References

Example:

The FOV for a **Matrix 450 800-030 base** using the **16 mm lens** at a **focus distance of 1000 mm** is:

$$FOV_H = 2 \left[(1000 \text{ mm} + 44 \text{ mm}) \tan(28.8°/2)\right] = \textbf{536 mm}$$
$$FOV_V = 2 \left[(1000 \text{ mm} + 44 \text{ mm}) \tan(24.5°/2)\right] = \textbf{453 mm}$$

---

[2] The minimum focus distance is used for applications that do not use the LT-03x lighting system.

7.2 READING DIAGRAMS

- The following reading diagrams are to be considered as references and are given for typical performance at 25°C using high quality grade A symbols: Code 128 (1D code) and Data Matrix ECC 200 (2D code) from the Test Charts provided with the reader.

- Testing should be performed with the actual Matrix 450™ + LT-03x assembly using application codes in order to evaluate whether maximizing application performance requires adjustments to the HW/SW configuration with respect to the Reference Conditions given under each diagram.

- The ratio of the Vertical FOV width with respect to the Horizontal FOV width in the diagrams is about equal to 0.84; specifically 2050/2448. (i.e. $FOV_V \cong FOV_H$ x 0.84).

- The focus distance and reading distance ranges are measured from the Lens Cover window surface.

- When using a 25 mm focal length lens (LNS-1225), it is possible to use Super Narrow Angle Lighting Systems (LT-030 or LT-031) as well as the Narrow Angle Lighting System LT-032. It is suggested to use the LT-032 in applications with very low contrast codes and in all cases where the higher lighting power of the LT-030 isn't necessary. LT-030 and LT-031 Lighting Systems are especially effective in high speed code movement applications.

- When defining a HW/SW configuration for the Matrix 450™ + LT-03x assembly for conditions different from those of the reference diagrams, it is suggested to keep in mind the following rules:

  ♦ Changes in the diaphragm aperture influence the depth of field (reading distance range) and the luminosity of the image. Increasing the the diaphragm aperture by one stop (i.e. from F/8 to F/5.6 or from F/11 to F/8) doubles the luminosity of the image, but can cause significant reduction in the reading distance range.

  ♦ Changes in *Exposure Time* act directly proportional to the luminosity of the image and inversely proportional to the maximum code reading movement speed. Consequently, reducing the *Exposure Time* by half, reduces the luminosity of the image by half but doubles the theoretical code reading movement speed.

  ♦ Changes in *Gain* act directly proportional to the luminosity of the image. Increasing the *Gain* value however, can reduce the quality of the acquired image.

  ♦ The LT-030 lighting power (at the center of the field of view) is about equal to twice that of the LT-031 and 3.5 times that of the LT-032.
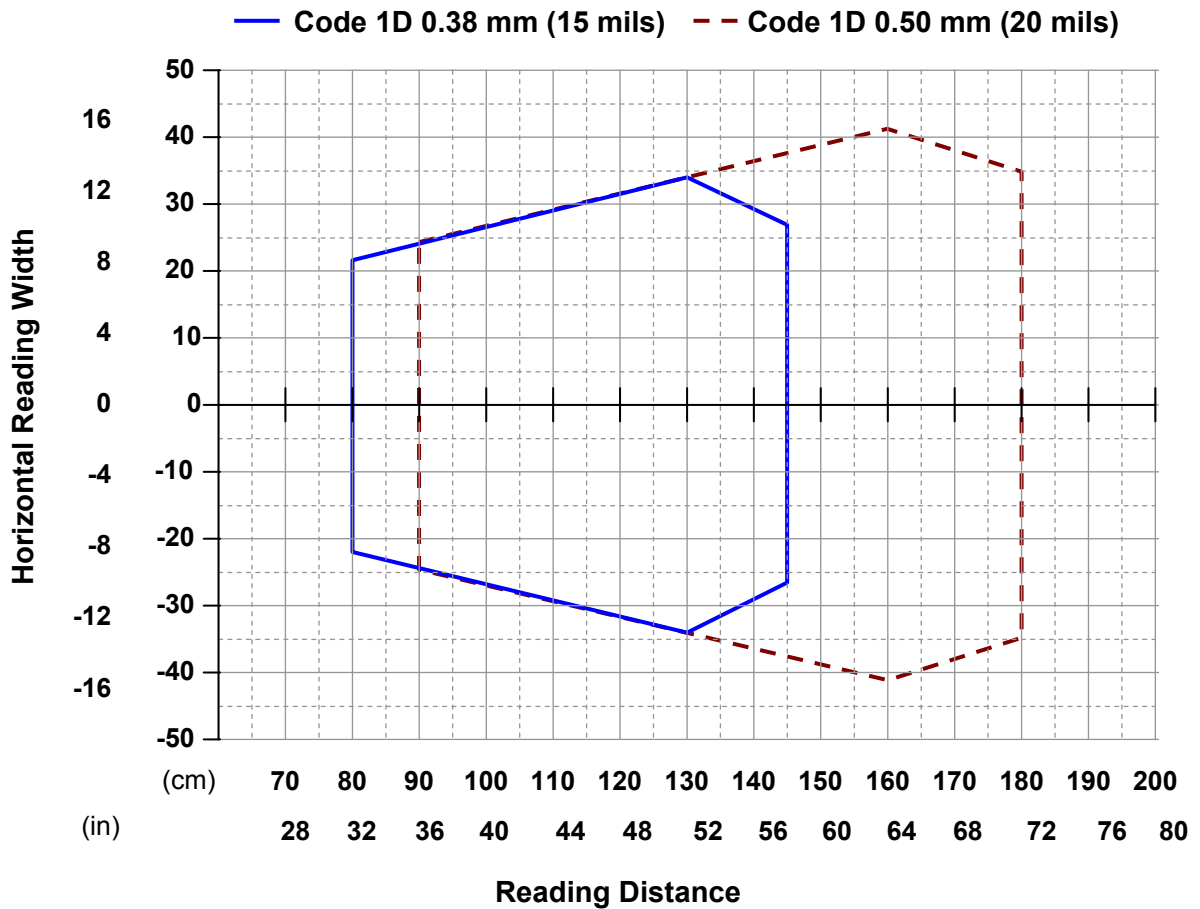
  For example, for the purpose of only changing the luminosity of the image, the following three adjustments are equivalent:

  increase the the diaphragm aperture by one stop;

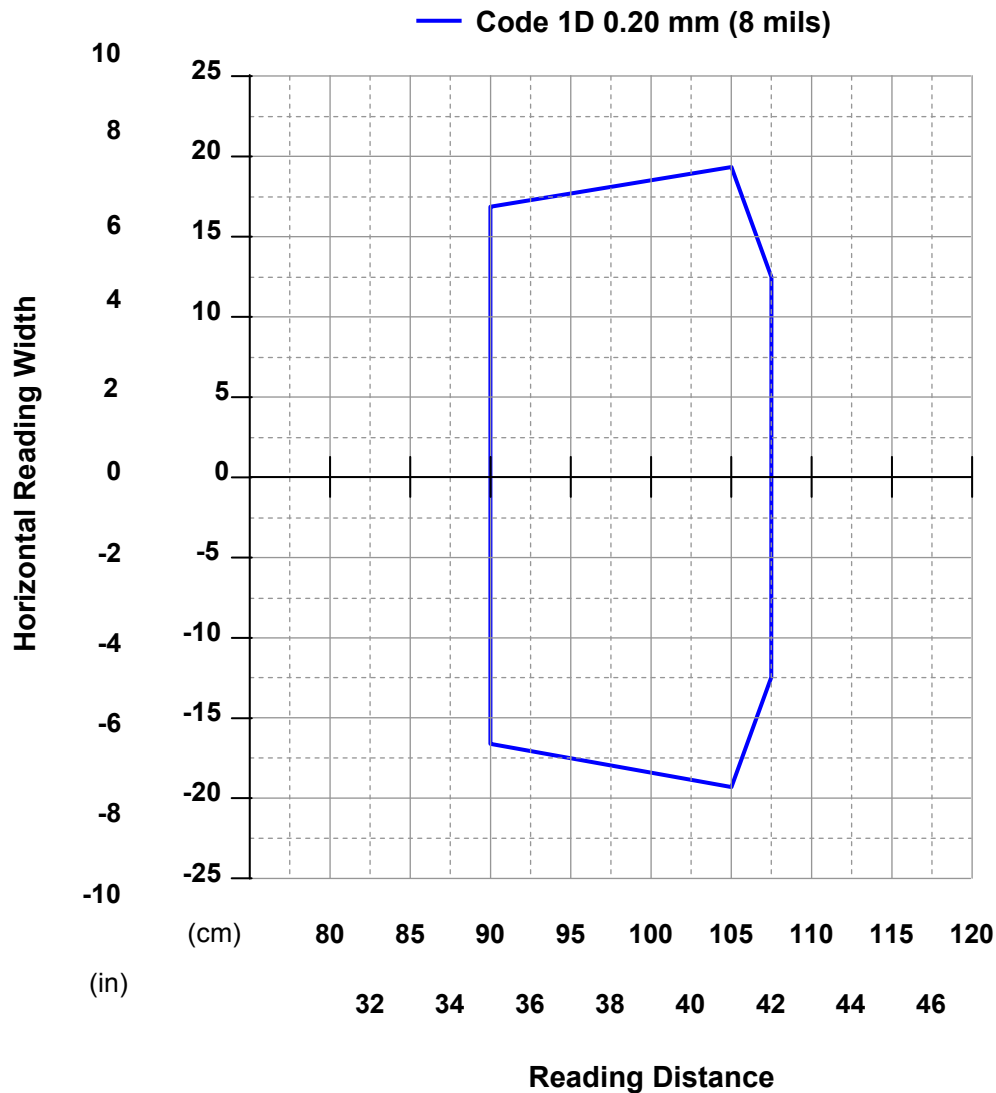 double the *Exposure Time*;

  double the *Gain*.

Matrix 450™ + LNS-1216

—— Code 1D 0.38 mm (15 mils)   – – Code 1D 0.50 mm (20 mils)

Horizontal Reading Width / **Reading Distance**

CONDITIONS:

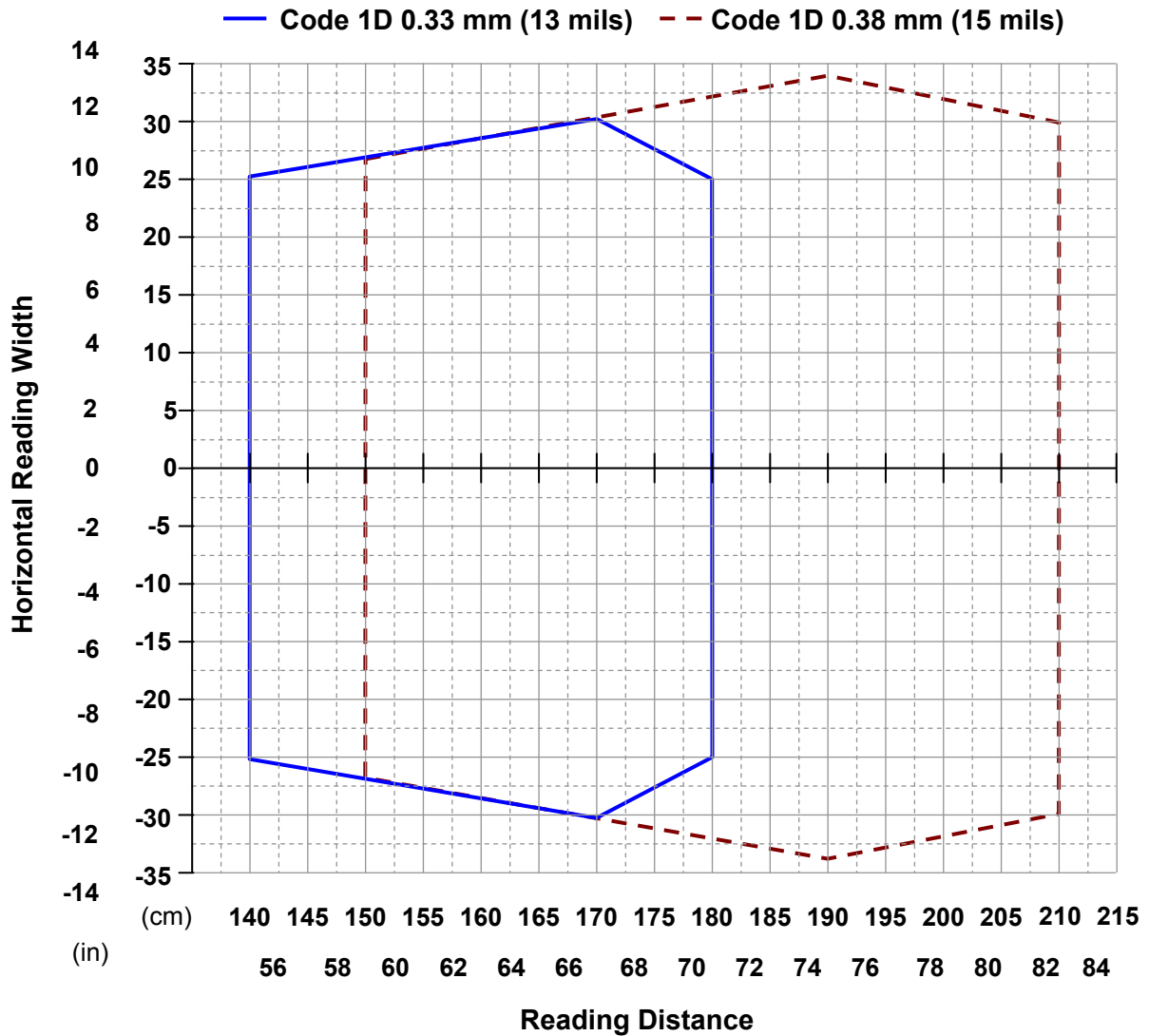| Hardware Settings		
Code Symbology	Code 128	
Code Resolution	0.38 mm (15 mils)	0.50 mm (20 mils)
Focal Length	16 mm	
Aperture Stop	F/8	
Focus Distance	1.200 mm (47.2 inches)	1.400 mm (55.1 inches)
PPI	94	84
Tilt Angle	45°	
Skew Angle	15°	
Lighting System	**LT-032**	**LT-032**
Software Parameters		
Exposure Time (×10µs)	19	25
Max code moving speed	1.8 m/s	1.8 m/s
Gain	13	14
LT-03x Lighting Mode	Very High Power Strobed or Continuous High Power	
Minimum Code Height (mm)	5	
Code 128 Narrow Margins	Enabled	
Image Processing Mode	Advanced Code Setting	

Matrix 450™ + LNS-1225

━━ Code 1D 0.20 mm (8 mils)

Reading Distance

CONDITIONS:

Hardware Settings			
Code Symbology	Code 128		
Code Resolution	0.20 mm (8 mils)		
Focal Length	25 mm		
Aperture Stop	F/5.6		
Focus Distance	1.000 mm (39.4 inches)		
PPI	170		
Tilt Angle	45°		
Skew Angle	15°		
Lighting System	**LT-030**	**LT-031**	**LT-032**
Software Parameters			
Exposure Time (×10µs)	6	12	12
Max code moving speed	3.0 m/s	1.5 m/s	1.5 m/s
Gain	10	10	17
LT-03x Lighting Mode	Very High Power Strobed or Continuous High Power		
Minimum Code Height (mm)	5		
Code 128 Narrow Margins	Enabled		
Image Processing Mode	Advanced Code Setting		

Matrix 450™ + LNS-1225

Code 1D 0.33 mm (13 mils) — — **Code 1D 0.38 mm (15 mils)**

Horizontal Reading Width

Reading Distance

CONDITIONS:

Hardware Settings						
Code Symbology	Code 128					
Code Resolution	0.33 mm (13 mils)			0.38 mm (15 mils)		
Focal Length	25 mm					
Aperture Stop	F/5.6					
Focus Distance	1.700 mm (66.9 inches)			1.900 mm (74.8 inches)		
PPI	100			90		
Tilt Angle	45°					
Skew Angle	15°					
Lighting System	**LT-030**	**LT-031**	**LT-032**	**LT-030**	**LT-031**	**LT-032**
Software Parameters						
Exposure Time (×10µs)	15	16	20	12	12	19
Max code moving speed	1.8 m/s	1.8 m/s	1.5 m/s	2.8 m/s	2.8 m/s	1.8 m/s
Gain	7	13	16	8	16	15
LT-03x Lighting Mode	Very High Power Strobed or Continuous High Power					
Minimum Code Height (mm)	5					
Code 128 Narrow Margins	Enabled					
Image Processing Mode	Advanced Code Setting					

Matrix 450™ + LNS-1225

—— **Code 1D 0.30 mm (12 mils)**   – – **Code 2D 0.61 mm (24 mils)**

Reading Distance

CONDITIONS:

Hardware Settings						
Code Symbology	Code 128			Data Matrix ECC 200		
Code Resolution	0.30 mm (12 mils)			0.61 mm (24 mils)		
Focal Length	25 mm					
Aperture Stop	F/5.6					
Focus Distance	1.600 mm (63.0 inches)			1.700 mm (66.9 inches)		
PPI	106			100		
Tilt Angle	45°					
Skew Angle	15°					
Lighting System	**LT-030**	**LT-031**	**LT-032**	**LT-030**	**LT-031**	**LT-032**
Software Parameters						
Exposure Time (×10µs)	12	12	18	16	16	22
Max code moving speed	2.3 m/s	2.3 m/s	1.5 m/s	3.2 m/s	3.2 m/s	2.5 m/s
Gain	7	14	16	6	12	16
LT-03x Lighting Mode	Very High Power Strobed or Continuous High Power					
Minimum Code Height (mm)	5					
Code 128 Narrow Margins	Enabled					
Module Size (mils)				24		
Image Processing Mode	Advanced Code Setting					

Matrix 450™ + LNS-1225

Code 1D 0.51 mm (20 mils)
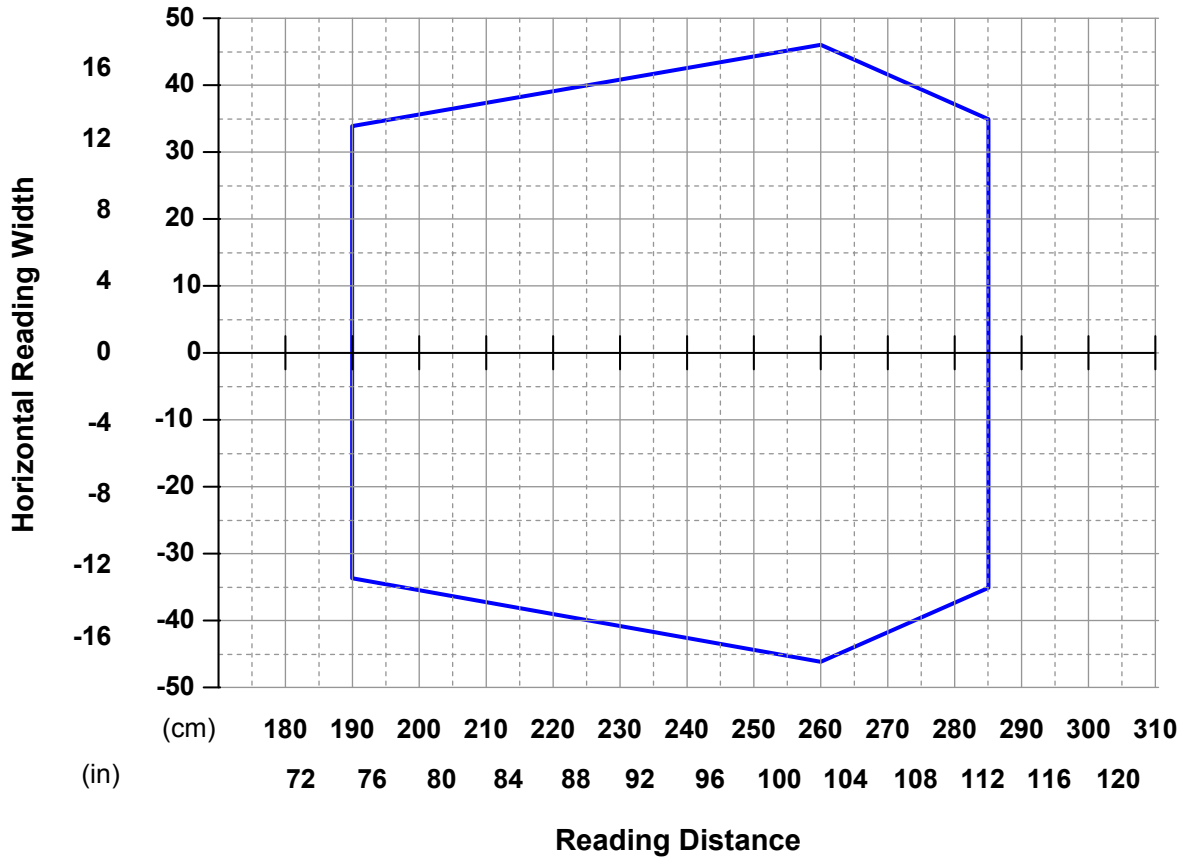
CONDITIONS:

Hardware Settings			
Code Symbology	Code 128		
Code Resolution	0.51 mm (20 mils)		
Focal Length	25 mm		
Aperture Stop	F/5.6		
Focus Distance	2.500 mm (98.4 inches)		
PPI	70		
Tilt Angle	45°		
Skew Angle	15°		
Lighting System	**LT-030**	**LT-031**	**LT-032**
Software Parameters			
Exposure Time (×10µs)	25	25	38
Max code moving speed	1.8 m/s	1.8 m/s	1.2 m/s
Gain	8	16	19
LT-03x Lighting Mode	Very High Power Strobed or Continuous High Power		
Minimum Code Height (mm)	5		
Code 128 Narrow Margins	Enabled		
Image Processing Mode	Advanced Code Setting		

Matrix 450™ + LNS-1235
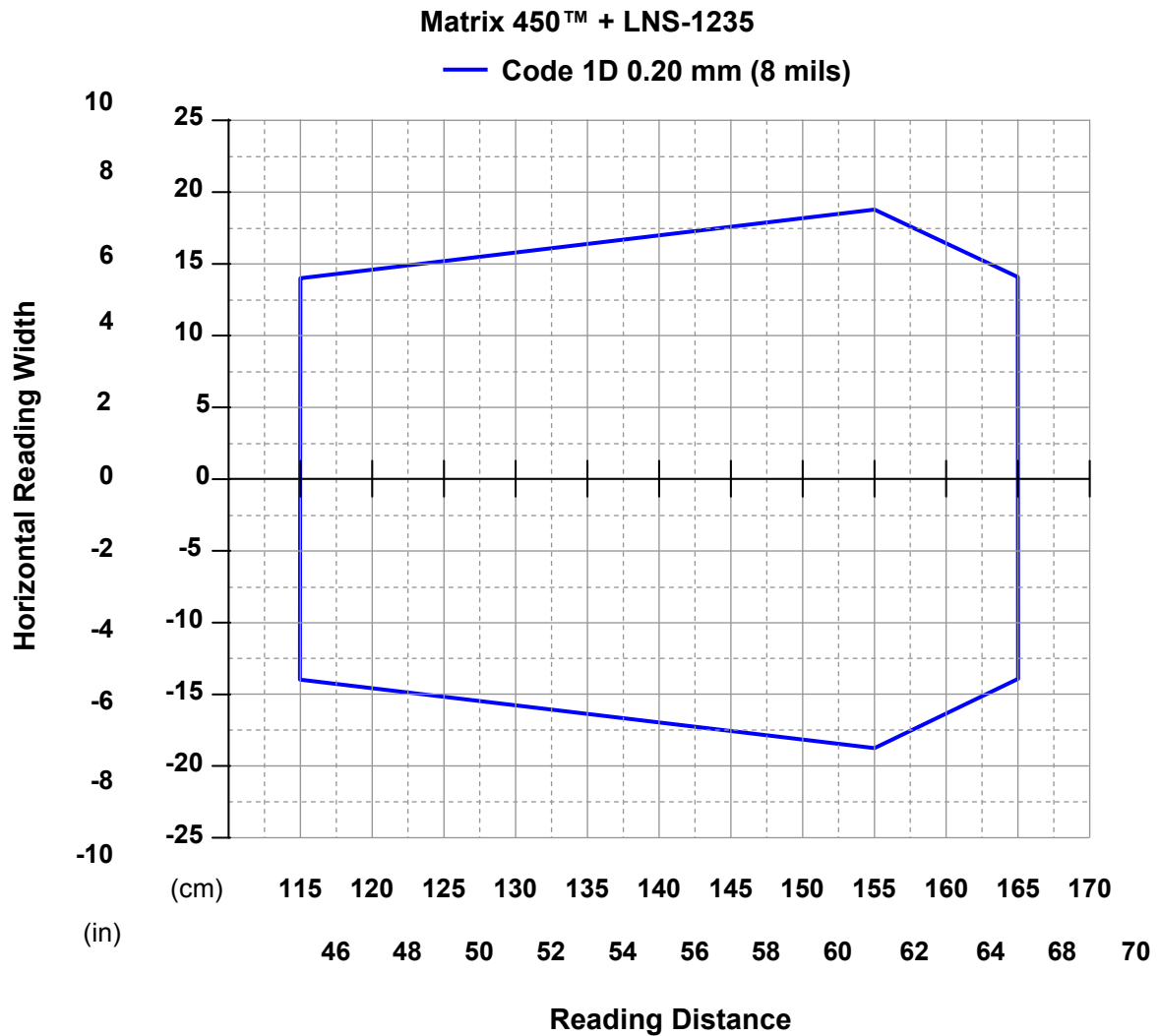
—— **Code 1D 0.20 mm (8 mils)**

CONDITIONS:

Hardware Settings		
Code Symbology	Code 128	
Code Resolution	0.20 mm (8 mils)	
Focal Length	35 mm	
Aperture Stop	F/11	
Focus Distance	1.450 mm (57.1 inches)	
PPI	175	
Tilt Angle	45°	
Skew Angle	15°	
Lighting System	**LT-030**	**LT-031**
Software Parameters		
Exposure Time (×10µs)	15	30
Max code moving speed	1.2 m/s	0.6 m/s
Gain	16	16
LT-03x Lighting Mode	Very High Power Strobed or Continuous High Power	
Minimum Code Height (mm)	5	
Code 128 Narrow Margins	Enabled	
Image Processing Mode	Advanced Code Setting	

Matrix 450™ + LNS-1235

——— **Code 1D 0.25 mm (10 mils)**   – – **Code 1D 0.30 mm (12 mils)**

Reading Distance
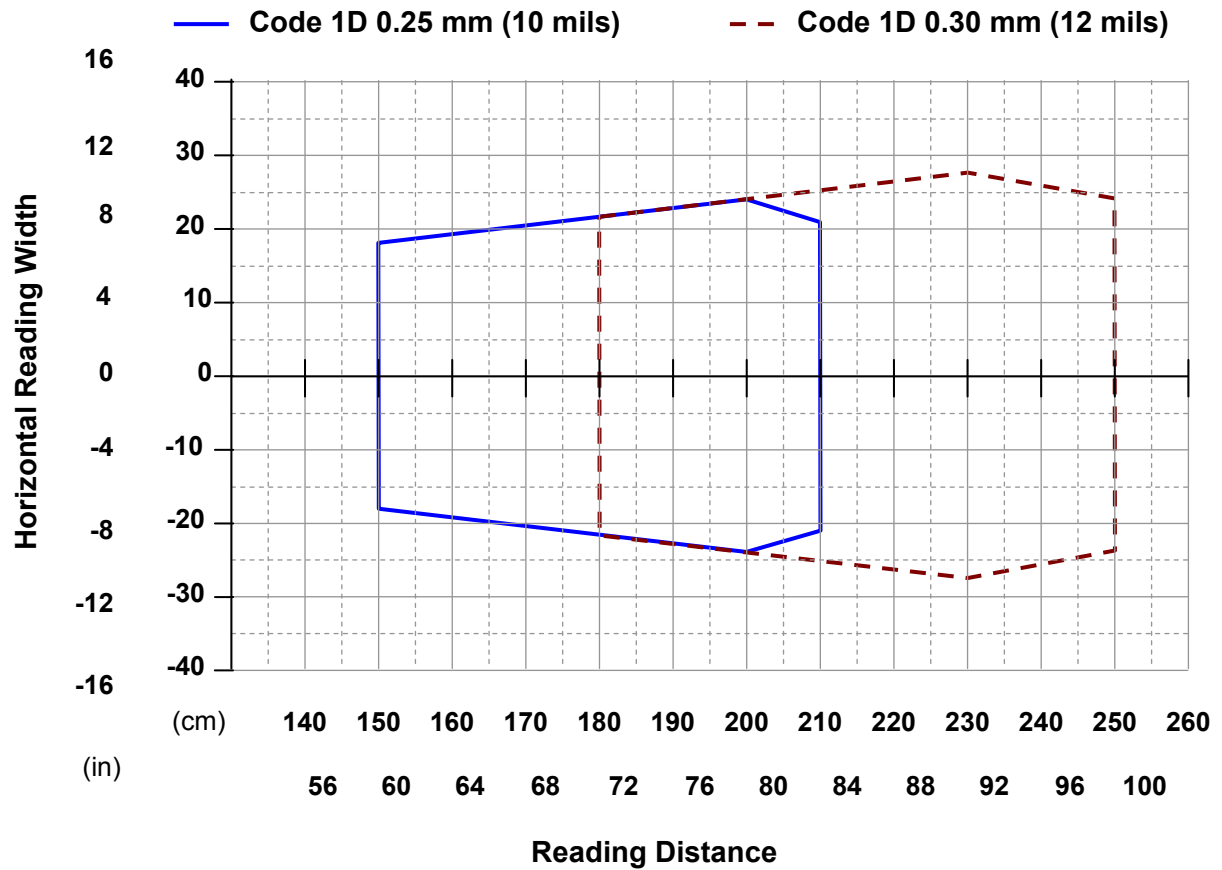
CONDITIONS:

Hardware Settings				
Code Symbology	Code 128			
Code Resolution	0.25 mm (10 mils)		0.30 mm (12 mils)	
Focal Length	35 mm			
Aperture Stop	F/11		F/8	
Focus Distance	1.800 mm (70.9 inches)		2.300 mm (90.5 inches)	
PPI	140		110	
Tilt Angle	45°			
Skew Angle	15°			
Lighting System	**LT-030**	**LT-031**	**LT-030**	**LT-031**
Software Parameters				
Exposure Time (×10µs)	20	40	15	27
Max code moving speed	1.0 m/s	0.5 m/s	1.8 m/s	1.0 m/s
Gain	22	22	18	22
LT-03x Lighting Mode	Very High Power Strobed or Continuous High Power			
Minimum Code Height (mm)	5			
Code 128 Narrow Margins	Enabled			
Image Processing Mode	Advanced Code Setting			

Matrix 450™ + LNS-1235

─── **Code 2D 0.51 mm (20 mils)**   ‒ ‒ **Code 2D 0.61 mm (24 mils)**

Horizontal Reading Width

Reading Distance
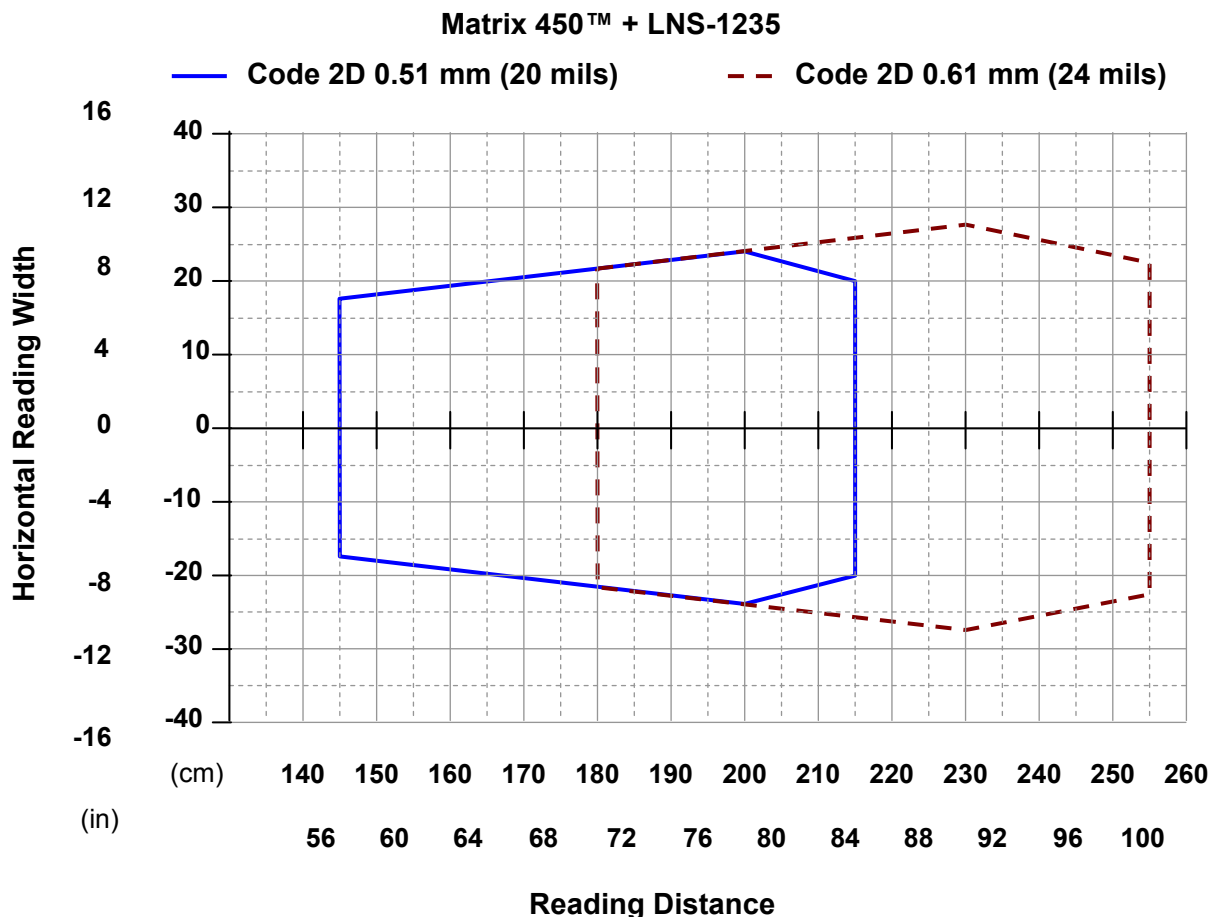
CONDITIONS:

Hardware Settings				
Code Symbology	Data Matrix ECC 200			
Code Resolution	0.51 mm (20 mils)		0.61 mm (24 mils)	
Focal Length	35 mm			
Aperture Stop	F/11		F/8	
Focus Distance	1.900 mm (74.8 inches)		2.300 mm (90.5 inches)	
PPI	135		110	
Tilt Angle	45°			
Skew Angle	15°			
Lighting System	**LT-030**	**LT-031**	**LT-030**	**LT-031**
Software Parameters				
Exposure Time (×10µs)	23	40	15	27
Max code moving speed	2.0 m/s	1.0 m/s	3.0 m/s	1.7 m/s
Gain	20	23	18	22
LT-03x Lighting Mode	Very High Power Strobed or Continuous High Power			
Module Size (mils)	20		24	
Image Processing Mode	Advanced Code Setting			

Matrix 450™ + LNS-1250

— **Code 1D 0.15 mm (6 mils)**

Reading Distance

Horizontal Reading Width
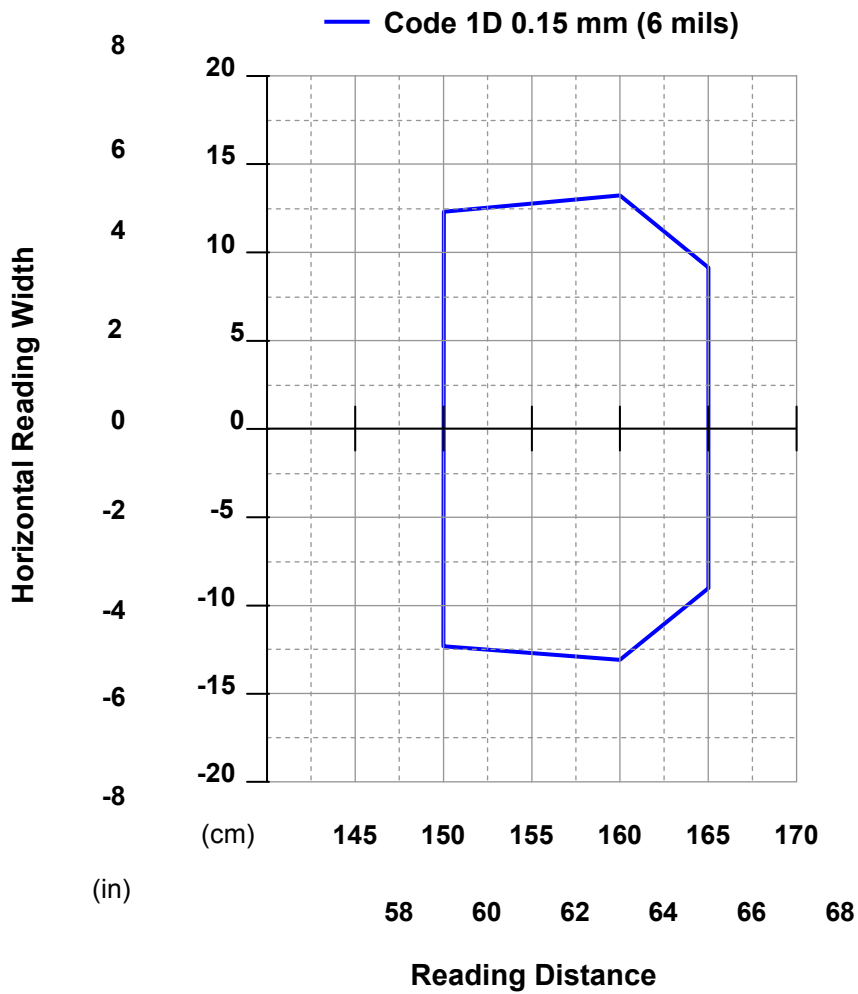
CONDITIONS:

Hardware Settings		
Code Symbology	Code 128	
Code Resolution	0.15 mm (6 mils)	
Focal Length	50 mm	
Aperture Stop	F/8	
Focus Distance	1.600 mm (57.1 inches)	
PPI	175	
Tilt Angle	45°	
Skew Angle	15°	
Lighting System	**LT-030**	**LT-031**
Software Parameters		
Exposure Time (×10µs)	7	13
Max code moving speed	1.8 m/s	1.0 m/s
Gain	16	18
LT-03x Lighting Mode	Very High Power Strobed or Continuous High Power	
Minimum Code Height (mm)	5	
Code 128 Narrow Margins	Enabled	
Image Processing Mode	Advanced Code Setting	

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 LT-03x lighting system and **2D codes** are used. The Maximum line speed allowed for linear codes or postal code reading applications heavily depends on the direction of symbol movement. When the direction of movement is parallel to the elements of the code, the maximum speed is greater.*

Assuming:

- **X**: Code Resolution (mm)

- **T$_{exp}$**: Exposure Time (s)

- **LS**: Line Speed (mm/s)

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

$$\textbf{LS} * \textbf{T}_{\textbf{exp}} \leq \textbf{X}$$

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

$$\textbf{X} / \textbf{T}_{\textbf{exp (max)}} = \textbf{LS}_{\textbf{(max)}}$$

Example:

A Matrix 450™ using:

> *LT-03x 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:

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

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

$$\textbf{X} / \textbf{LS}_{\textbf{(max)}} = \textbf{T}_{\textbf{exp (max)}}$$

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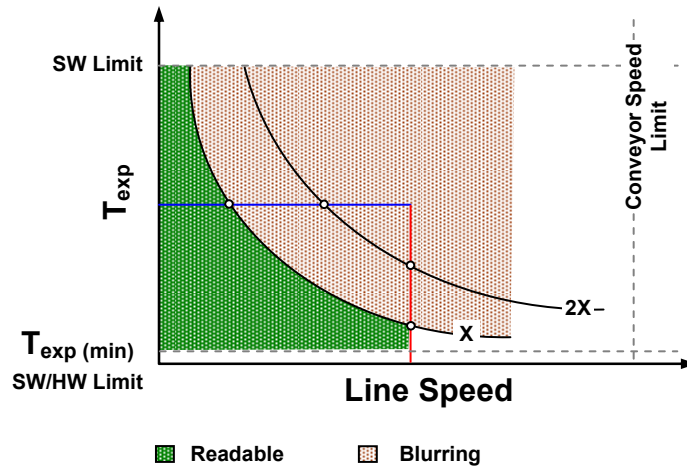
For example, the maximum target speed in the application is also affected by these conditions:

- **Code/Background Contrast**: maximum speed decreases when decreasing image contrast (poor quality codes, reflective transparent coverings, different supports and printing techniques).

- **Code Resolution**: maximum speed increases when decreasing code resolution, (i.e. **2X**). There is a decrement of overlapping effects between two adjacent elements.

- **Tilt Angle**: maximum speed decreases when increasing Tilt angle (from 0 to 45 degrees).

$T_{exp\ (min)}$ is the minimum *Exposure Time* value obtainable for the specific application. It can be evaluated in static reading conditions and depends on the Matrix reader hardware selected for the application (LT-03x lighting system model, optical lens, diaphragm aperture, reading distance) and on any external lighting system. It may also depend on code printing quality, and reader position.

The *LT-03x Lighting Mode* parameter allows setting the operating mode of the LT-03x lighting system. The possible values are:

- *Disabled*: the LT-03x LED array is turned off all the time. This option can be useful if using an external lighting system;

- *Continuous High-Power*: the LT-03x LED array is turned on continuously at the **highest** power level. This option is useful if the LED array blinking (Strobed operating mode) disturbs the operator.

- *Very-High/High-Power Strobed*: the LT-03x LED array is on only during the image exposure time. Two different lighting levels can be set.

☝ **NOTE**	*To avoid LED array overheating, for settings other than disabled, the program automatically limits the range of allowed values for the **Exposure Time** parameter. Therefore, after changes to LT-03x Lighting Mode, recheck **Exposure Time**.*

8 SOFTWARE CONFIGURATION

Software configuration of your Matrix 450™ for static reading or simple code reading applications can be accomplished by the Rapid Configuration procedure using the X-PRESS™ HMI (which requires no external configuration program) or by using the VisiSet™ Setup Wizard for easy setup. These procedures are described in chapter 1.

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

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

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+SP4 or later, 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 450™ communication ports).

2. After Windows finishes booting, insert the Mini-DVD provided.

3. Launch VisiSet™ installation by clicking Install.

4. Follow the instructions in the installation procedure.

8.3 STARTUP

After completing the mechanical and electrical connections to Matrix 450™, you can begin software configuration as follows:

1. Power on the Matrix 450™ 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 450™ reader.

   Upon connection, Matrix 450™ 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 99.
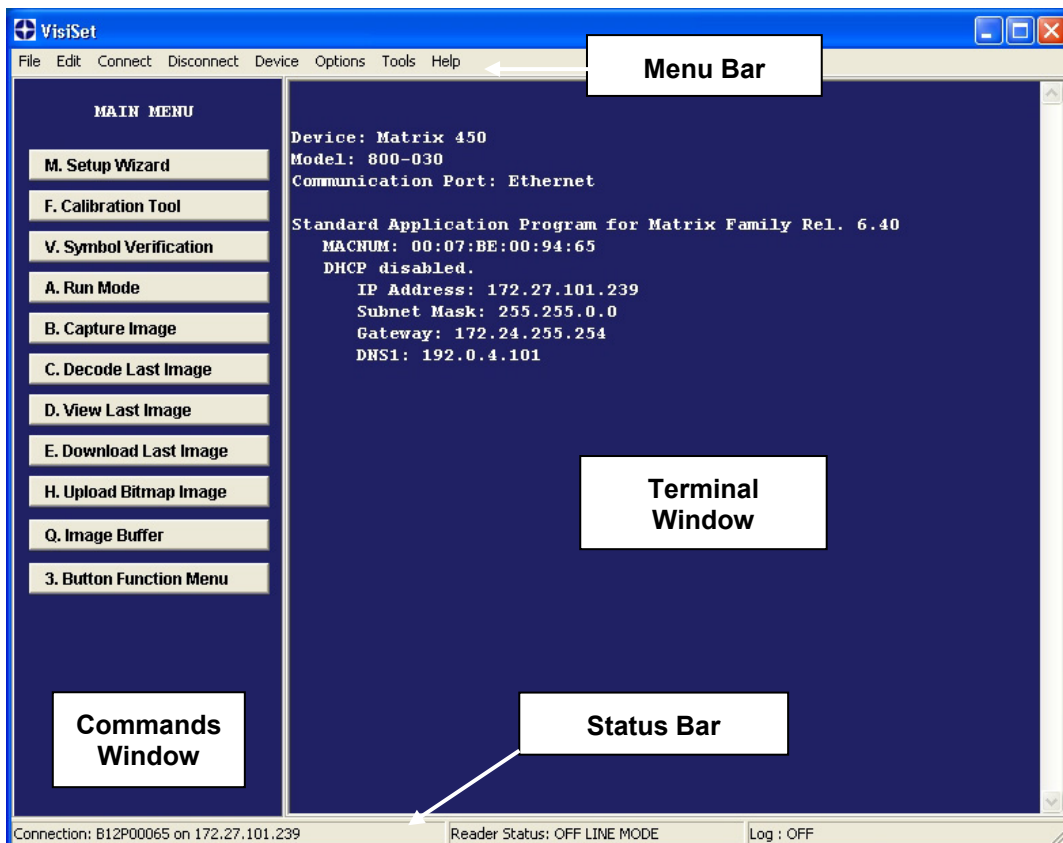
Figure 99 - Main Window

8

8.3.1 VisiSet™ Options

The **Options** item from the VisiSet™ menu (see Figure 99) presents a window allowing you to configure:

−   the logging function (**Log**)

−   VisiSet™ window properties (**Environment**)

−   VisiSet™ communication channel (**Communication**)
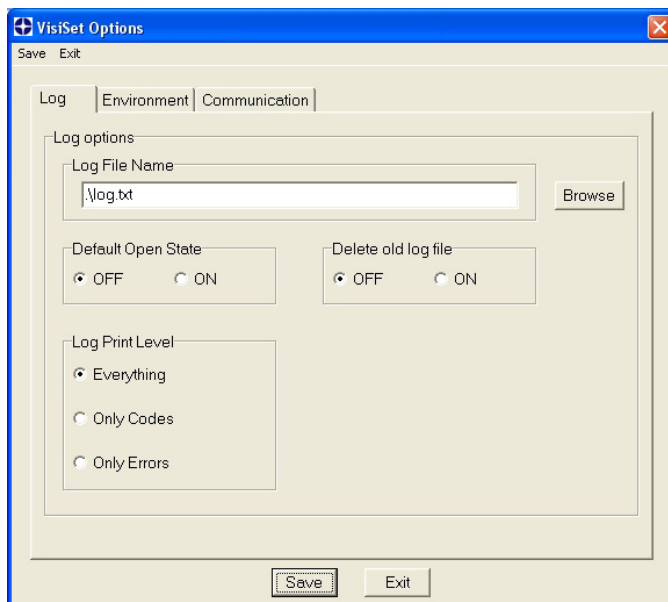
Figure 100 - Options - Log
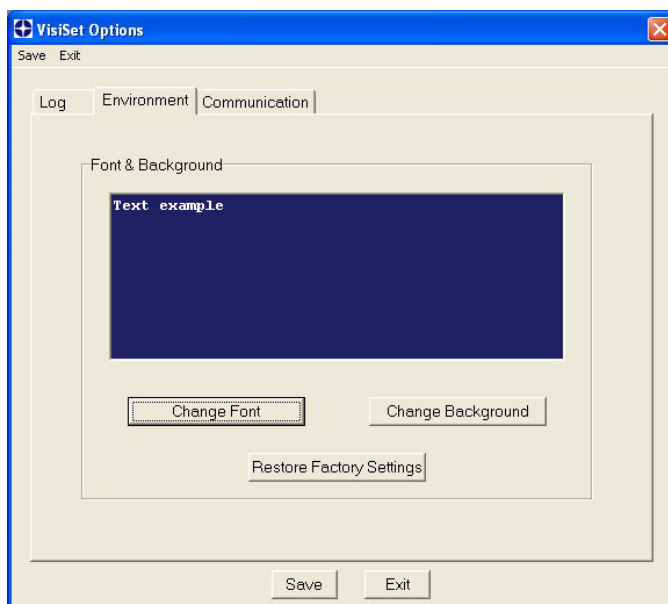
Figure 101 - Options - Environment
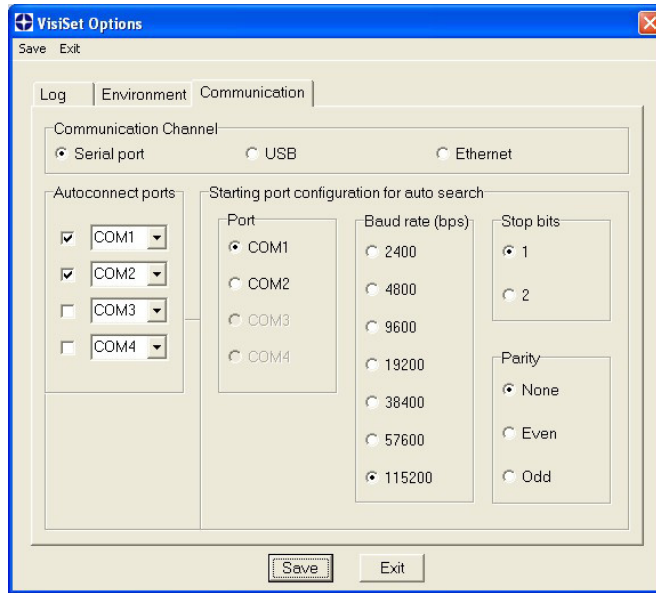
Figure 102 - Options – Communication: Serial Port
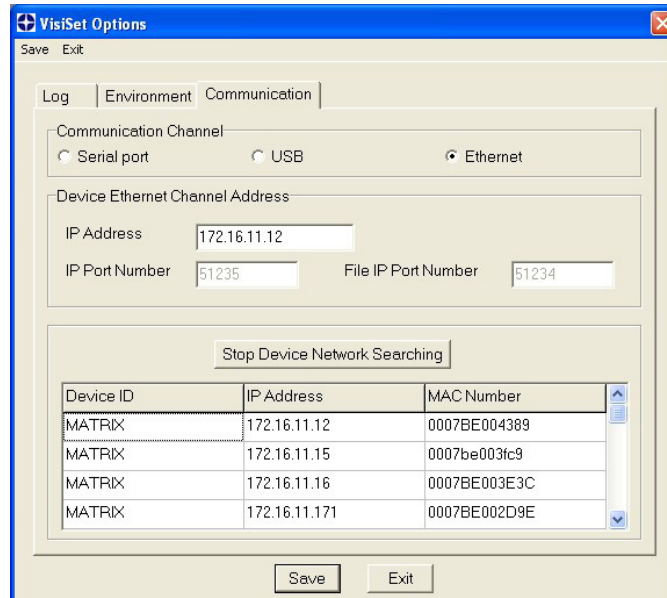
Figure 103 - Options – Communication: Ethernet

8.4 CONFIGURATION

Once connected to Matrix 450™ 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 450™ 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 450™ 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 99) or launch **Run** Mode from the VisiSet™ Main menu.

   Disconnect exits closing communication between Matrix 450™ and VisiSet™, and causes Matrix 450™ to enter Run Mode. The disconnected reader serial port is now available.

   Run command does not close communication between Matrix 450™ and VisiSet™, and causes Matrix 450™ 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 <u>selecting a different item from the prescribed list in the box</u>, or by <u>typing new values directly into the parameter box</u>.

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.
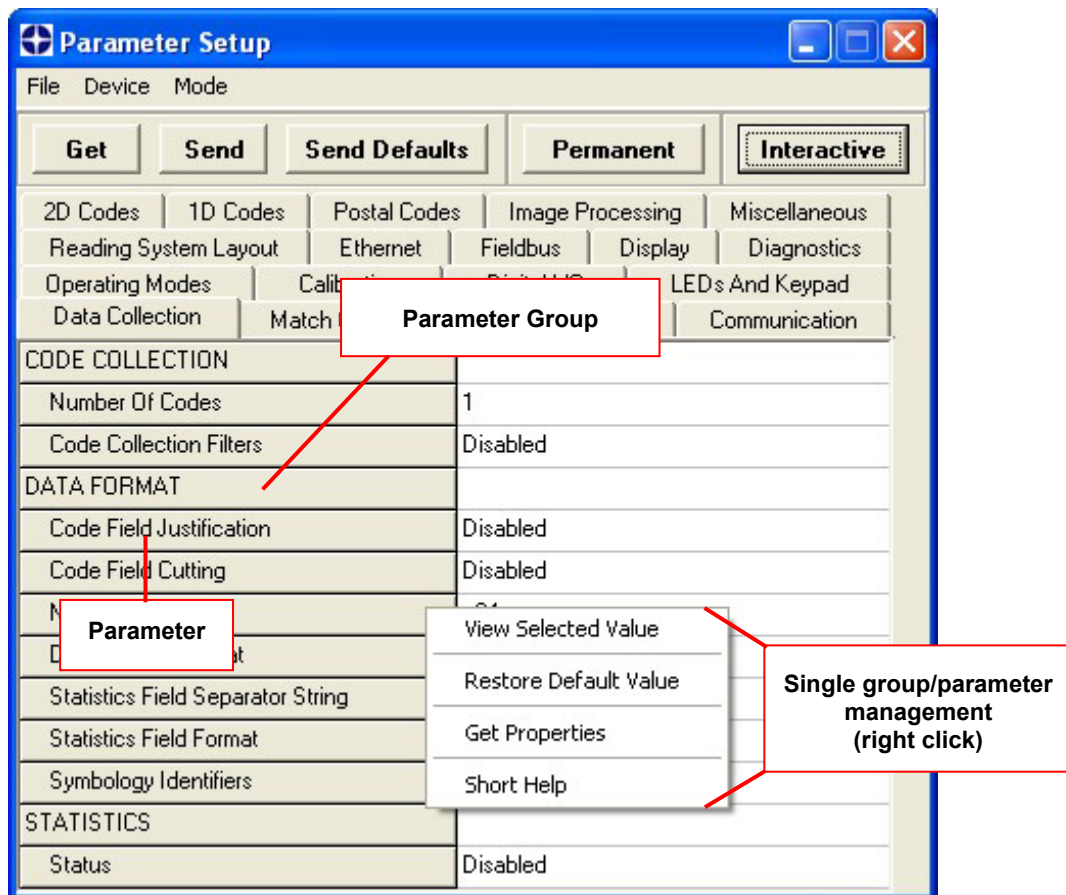
Figure 104 - Editing Parameters

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™.
❑ Reading System Layout	Allows configuring the device according to the desired layout: Standalone, ID-NET™ or Master/Slave RS232
❑ WebSentinel	Enables the Ethernet WebSentinel Agent for communication with the Datalogic WebSentinel™ plant array monitor.
❑ Ethernet	Sets the parameters related to the on board 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.
❑ 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.
❑ 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.

When all the configuration parameters are set correctly, save them to the Matrix 450™ reader by pressing the Send button. See Figure 104.

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 affected differently by the Send Configuration and Send Default Configuration commands.

Configuration Parameters regard parameters that are specific to the device. These parameters are influenced by the Send Configuration and Send Default Configuration commands, that is, they are overwritten by these commands. The same parameters are modified by the following "Send Configuration with Options" and "Send Default Configuration with Options" dialogs from the Device Menu:
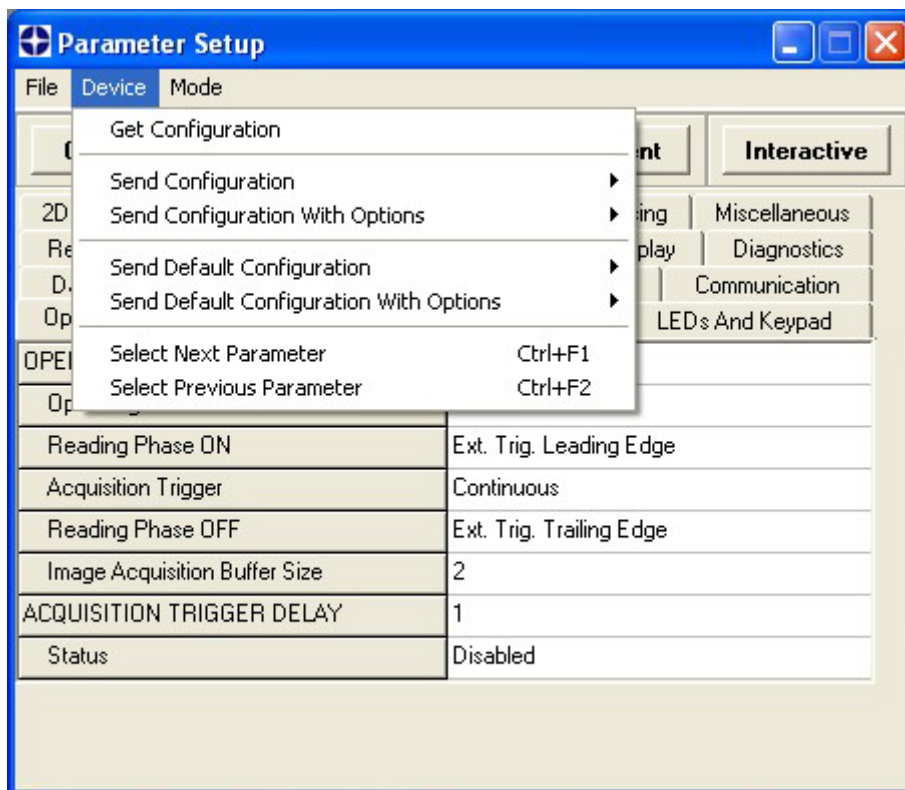
Environmental Parameters regard the device Identity and Position in a Network (ID-NET™, Master/Slave, Ethernet) and are not influenced by the "Send Default Configuration" and "Send Configuration" commands. This allows individual devices to be configured differently without affecting their recognized 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
- Acquisition Trigger String   (available only in Multidata configuration)
- Reading Phase ON String   (available only in Multidata configuration)
- Reading Phase OFF String   (available only in Multidata configuration)
- Header String   (available only in Slave Multidata configuration)
- Terminator String   (available only in Slave Multidata configuration)
- Link Failure String   (available only in Master Synchronized configuration)
- Link Failure Timeout (ms)   (available only in Master Synchronized configuration)

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

MAIN PORT
- Communication Protocol
- Multidrop Address

ETHERNET SYSTEM (on board)
- Status
- DHCP Client
- IP Address
- Subnet Mask
- Gateway Address
- DNS1 Address

HOST INTERFACE
- Host Interface Type

  CBX ETHERNET SYSTEM (CBX with Host Interface Modules)
  - Status
  - DHCP Client
  - IP Address
  - Subnet Mask
  - Gateway Address

PROFIBUS
- Node Address

DEVICENET
- Node Address

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

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

CANOPEN
- Node Address

CC-LINK
- Node Address

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

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

MATCH CODE
- Store Memory

LEDS AND AIMING
- LEDs Deactivation Timeout

DATA MATRIX ECC 200
- Decoding Time Improvement

1D CODES SETUP
- Tires Sigma ROI Algorithm

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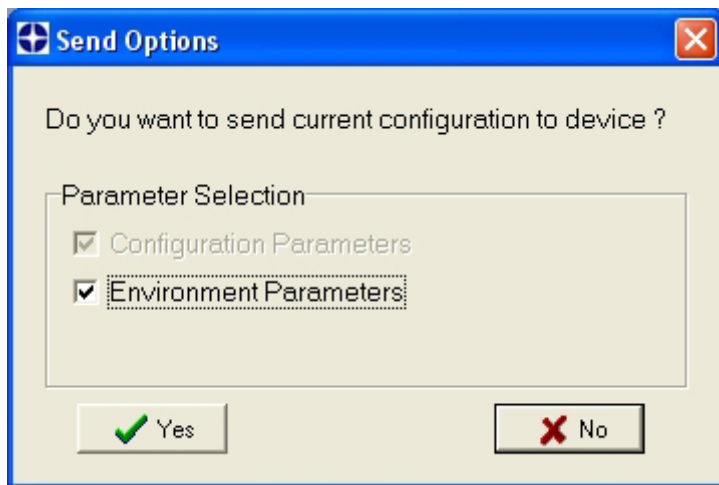
In order to return a device to its absolute default parameters including Environmental parameters, the following Send Default Configuration with Options" dialog must be used:
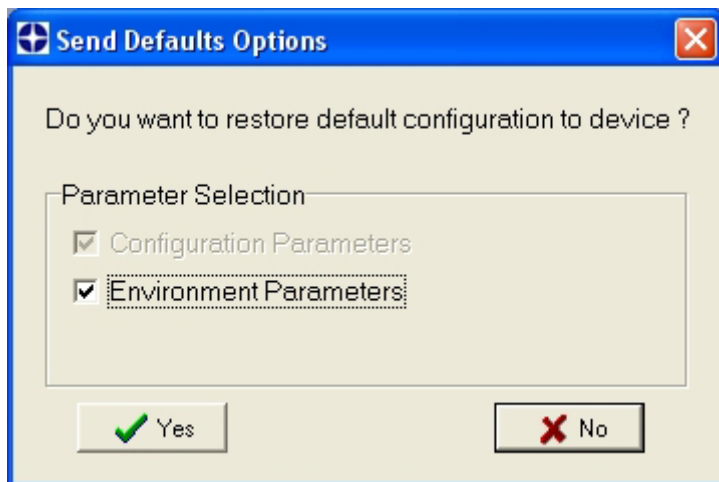
8.4.3 Calibration

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:
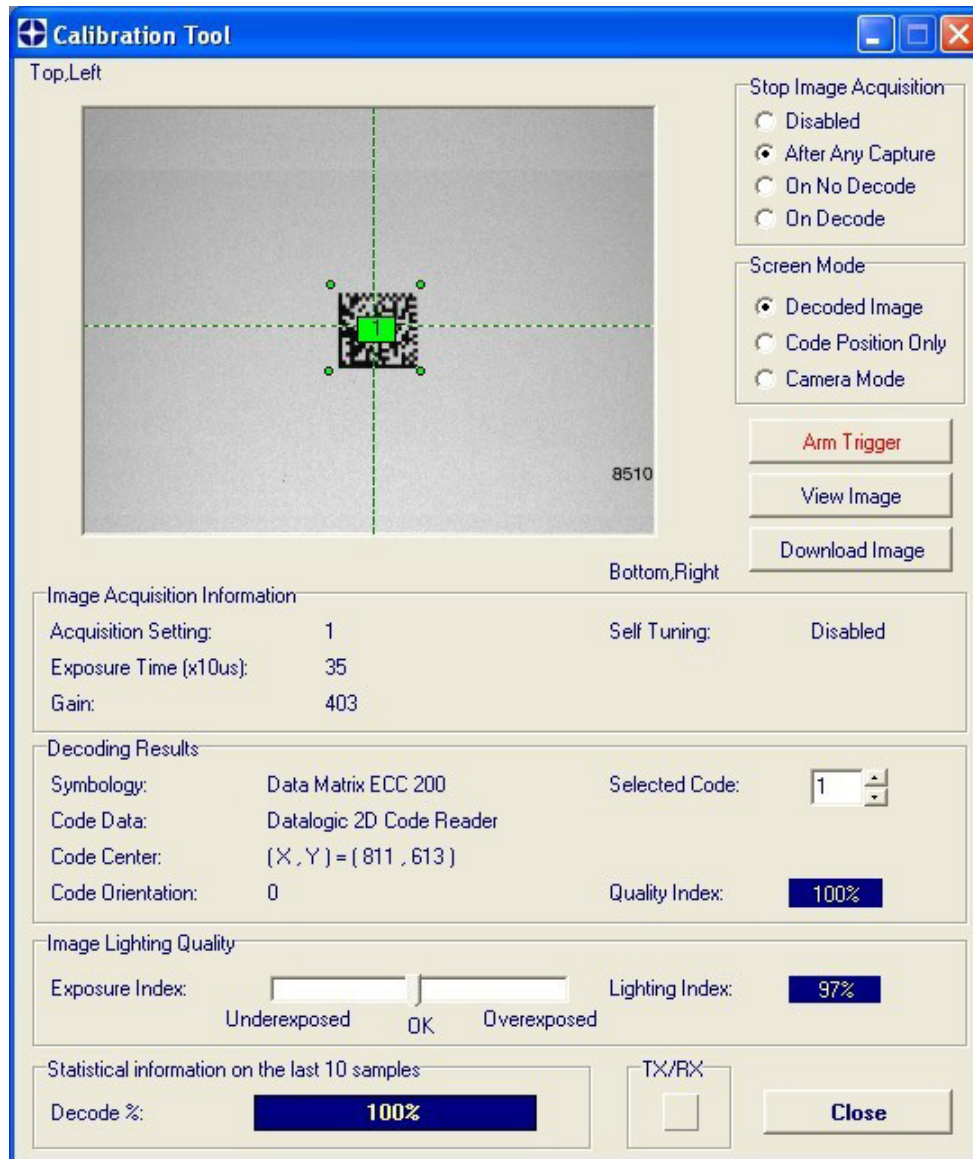
Figure 105 - Calibration OK

This tool provides a "real-time" image display while Matrix 450™ is reading. It also gives immediate results on the performance of the installed Matrix 450™ reader.

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

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

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

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

Under-exposure:

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

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

> **NOTE**
>
> *In general, a longer exposure time corresponds to a lighter image but is susceptible to blurring due to code movement. Exposure time is also limited by the LT-03x 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 106 - 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 107 - 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)**
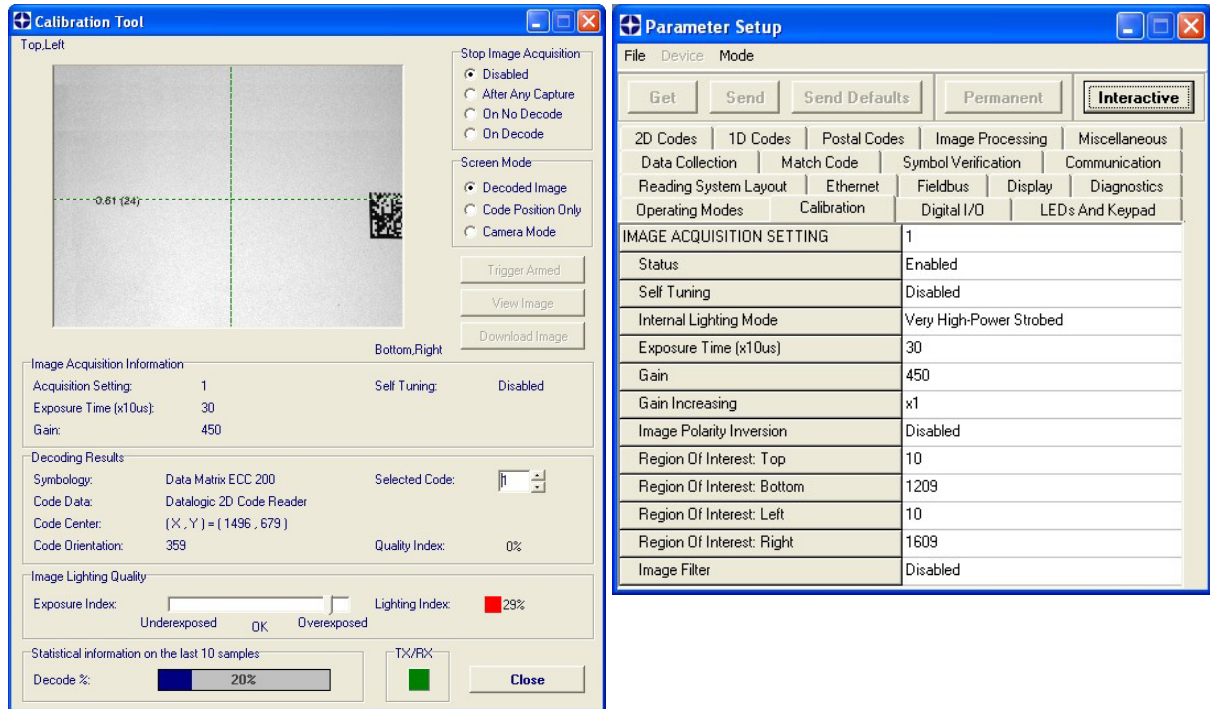
Figure 108 - Example out of FOV

8.4.4   Multi Image Acquisition Settings

When underlined variable conditions occur in the application, including multiple code label reading, 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 a particular set of parameters (LT-03x Lighting Mode, Exposure Time, Gain, etc.) and a second setting could enable a different set of these parameters. 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.

From
Not Readable

to
Readable

For more details see the Matrix 450™ 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 450™ 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 450™ the frame rate is dependent on the number of lines (or rows) in the defined window.

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

## 8.4.7   Direct Part Marking Applications

Decoding Method: Direct Marking

For **Data Matrix** 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.
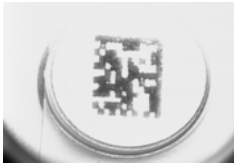
Washed out and Axial Distortion
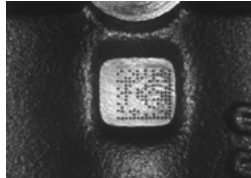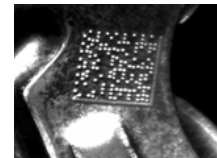

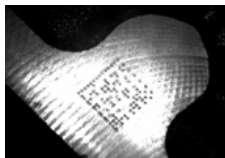**Dot Peening On Scratched Surface**
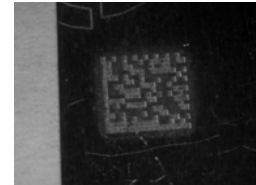
Low Contrast Problem

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 (i.e. direct part mark codes).

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

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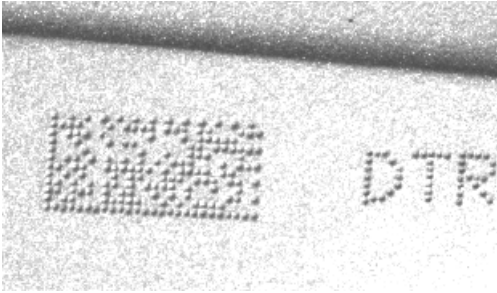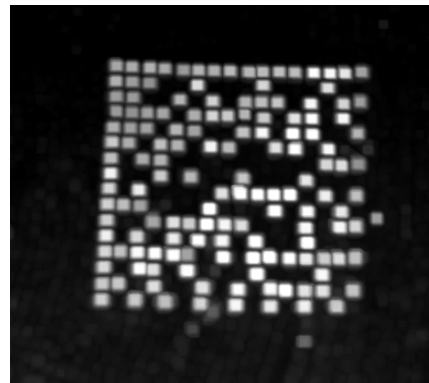

Before - No Read   After - Readable

Erode

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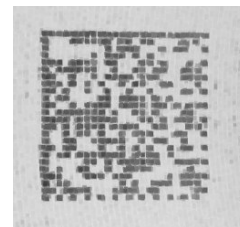

Before - No Read   After - Readable

Dilate

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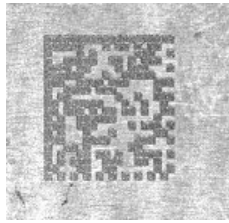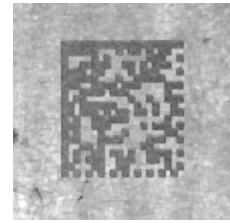

Before - No Read   After - Readable

Close

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

| Before - No Read | After - Readable |

Open

The *Contrast Stretching* filter maximizes image contrast.
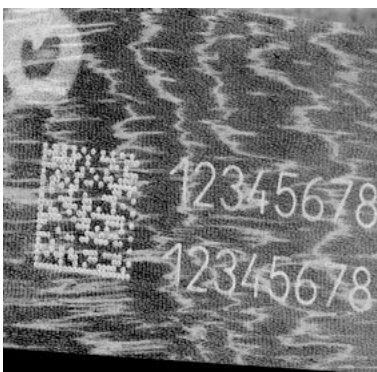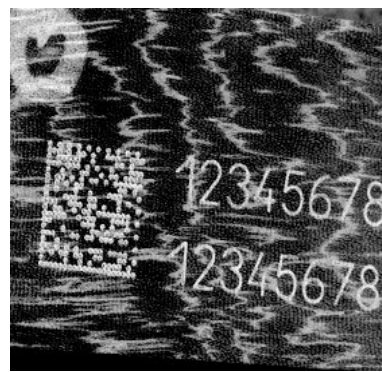
| Before - No Read | After - Readable |

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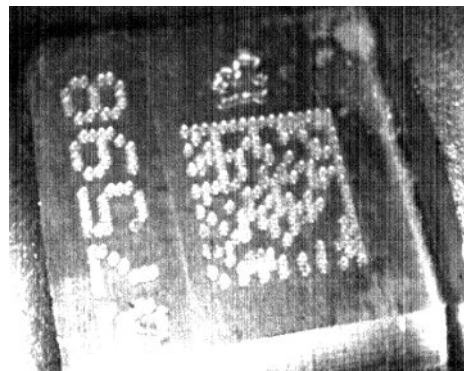
The *Histogram Equalization* filter makes the gray level distribution uniform.

Before - No Read   After - Readable

Histogram Equalization

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

Before - No Read   After - Readable

Smoothing

The *Sharpening* filter improves out of focus images.
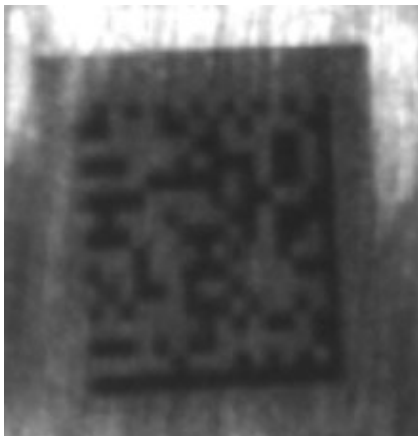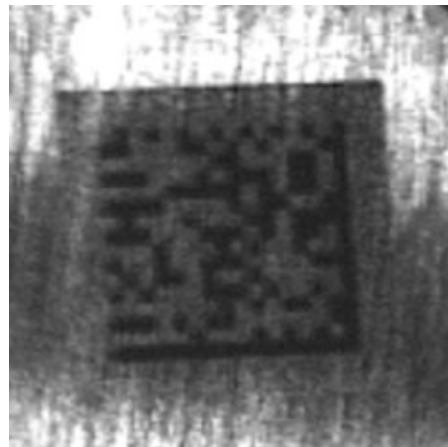
Before - No Read   After - Readable

Sharpening

The *Deblurring* filter improves blurred images.
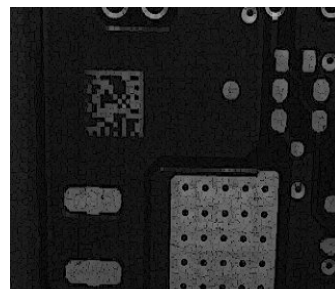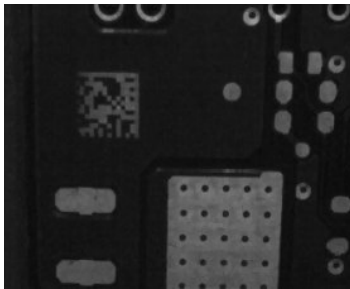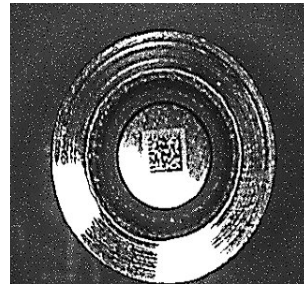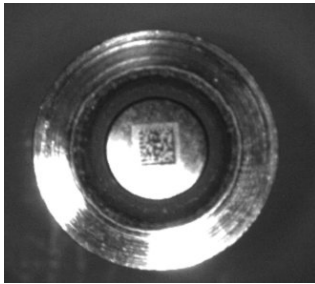
Before - No Read   After - Readable

Deblurring

The *Black Enhancement* filter produces a nonlinear increase in the black level for light images.
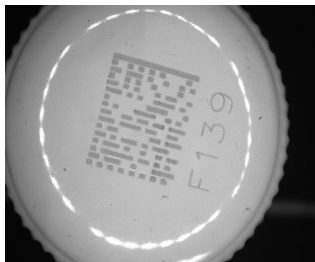
Before - No Read   After - Readable

Black Enhancement

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

Before - No Read   After - Readable

White Enhancement

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.
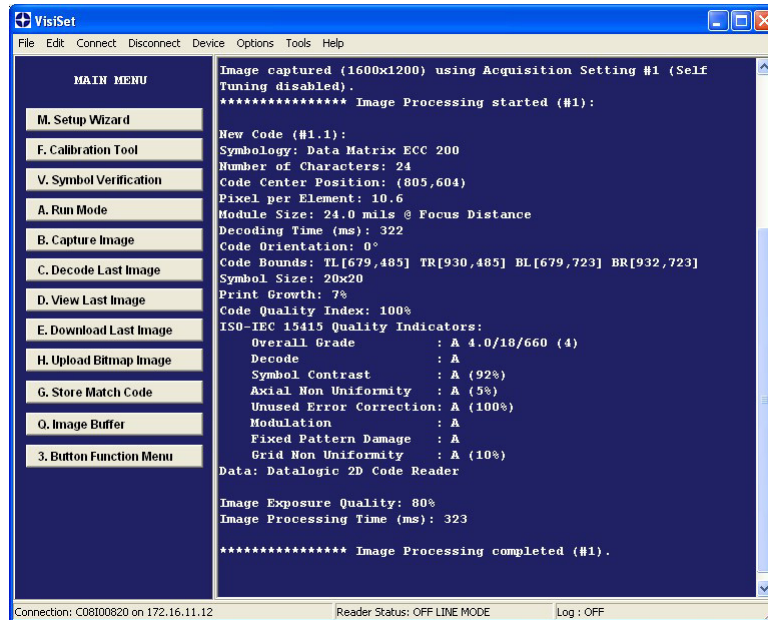
Figure 109 - Capture and Decoding Functions

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.
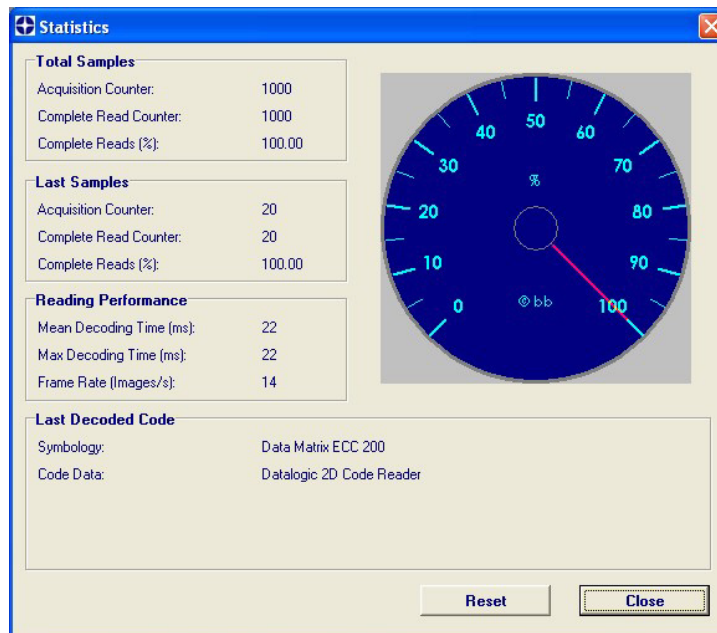
Figure 110 - Code Statistics

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 450™ 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 PG-120), 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	24 Vdc ± 20%
Consumption (max)	2.5 A (0.5 A Matrix 450™; 2 A LT-03x)
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	1000 Mbit/s, Gigabit Ethernet
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.	24 Vdc
V_{Out} (I_{Load} = 10 mA) Max.	1.8 Vdc
$P_D = V_{Out}$ x I_{Load} Max.	170 mW
OPTICAL FEATURES	
Image Sensor	CCD
Image Format	2448 x 2050
Frame Rate	15 frames/sec.
Pitch	± 35°
Tilt	0° - 360°
Lighting System	LT-03x Family Illuminators to EN 62471
Laser Safety Class (pointers)	Class 2 Laser Light to IEC60825-1
ENVIRONMENTAL FEATURES	
Operating Temperature[3]	0 to 50 °C (32 to 122 °F)
Storage Temperature	-20 to 70 °C (-4 to 158 °F)
Max. Humidity	90% non condensing
Vibration Resistance[4] EN 60068-2-6	1.5 mm @ 5 to 9 Hz; 0.5 g @ 9 to 150 Hz 2 hours on each axis 2 g @ 70 to 200 Hz; 2 hours on each axis
Shock Resistance EN 60068-2-27	30g; 11 ms; 3 shocks on each axis
Protection Class[5] EN 60529	IP65

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[3] High ambient temperature applications should use metal mounting bracket for heat dissipation.

[4] When operating in high vibration environments use two L-shaped mounting brackets and mount the anti-vibration kit for C-mount lenses, see par. 2.7.

[5] Requires correct connection to IP67 cables with seals and Lens Cover mounting.

PHYSICAL FEATURES	
Dimensions Matrix 450™ Matrix 450™ + LT-03x	 123 x 64 x 143 mm (4.8 x 2.5 x 5.6 in) 202 x 213 x 179 mm (8.0 x 8.4 x 7.1 in)
Weight (with lens and LT-03x)	3000 g. (6.6 lbs.)
Material	Aluminium

SOFTWARE FEATURES		
Readable Code Symbologies		
1-D and stacked	**2-D**	**POSTAL**
• PDF417 (Standard and Micro PDF417) • Code 128 (GS1-128) • Code 39 (Standard and Full ASCII) • Code 32 • MSI • Standard 2 of 5 • Matrix 2 of 5 • Interleaved 2 of 5 • Codabar • Code 93 • Pharmacode • EAN-8/13 - UPC-A/E (including Addon 2 and Addon 5) • GS1 DataBar Family • Composite Symbologies	• Data Matrix ECC 200 (Standard, GS1 and Direct Marking) • QR Code (Standard and Direct Marking) • MicroQR Code • MAXICODE • Aztec Code	• 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 • Host Mode Programming via serial or Ethernet link	
Parameter Storage	Permanent memory (Flash)	

USER INTERFACE	
LED Indicators	Power, Ready, Good; Trigger; Com, Status, (Ethernet Network); (Green Spot); (Red Spot); Laser Pointers
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.

Transmission Control Protocol/Internet Protocol (TCP/IP)

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

INDEX

CE

Datalogic Automation S.r.l.
Via Lavino 265
40050 Monte San Pietro
Bologna - Italy
www.automation.datalogic.com

declares that the

MATRIX 450; 2D Imager

and all its models

are in conformity with the requirements of the European Council Directives listed below:

2004 / 108 / EC EMC Directive

_____

This Declaration is based upon compliance of the products to the following standards:

EN 55022 (CLASS A ITE), DECEMBER 2010:   *INFORMATION TECHNOLOGY EQUIPMENT*
RADIO DISTURBANCE CHARACTERISTICS
LIMITS AND METHODS OF MEASUREMENTS

EN 61000-6-2, SEPTEMBER 2005:   *ELECTROMAGNETIC COMPATIBILITY (EMC)*
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ENVIRONMENTS

Monte San Pietro, March 7th, 2012

Paolo Morselli
Quality Manager

Morselli Paolo

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UNI EN ISO 9001

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IQNet
CERTIFIED MANAGEMENT SYSTEM

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Datalogic Automation S.r.l.
Via Lavino 265
40050 Monte San Pietro
Bologna - Italy
www.automation.datalogic.com

declares that the

LT-series; Lighting System

and all its models

are in conformity with the requirements of the European Council Directives listed below:

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Monte San Pietro, January 24th, 2012

Paolo Morselli
Quality Manager

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