



METROLOGIC INSTRUMENTS, INC.  
MS7120 Orbit<sup>®</sup> Presentation  
Laser Scanner  
Installation and User's Guide





# LOCATIONS

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## INTRODUCTION

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Orbit® is an aggressive, omnidirectional laser bar code scanner. Lightweight and rugged, Orbit is small in size, but BIG in performance. Designed for applications where counter space is limited, Orbit is the ideal presentation scanner for retail, convenience, liquor and specialty stores. In addition, Orbit's unique, contoured shape allows it to be picked-up and used as a hand-held scanner when scanning large or bulky items.

Engineered with a large, easy-to-find optimal scan area, Orbit increases the first pass read rate for maximum productivity. The scanning head can be tilted vertically a full 30° for added flexibility when scanning various sized objects. These features increase the scanning throughput without increasing the scanner size.

SCANNER	INTERFACE
7120-00	Laser Emulation, RS-232 Transmit/Receive
7120-9	OCIA and RS-232 Transmit/Receive (Full RS232 Configurable)
7120-11	IBM 46XX and Full RS-232C
7120-41	Full RS-232C/Light Pen Emulation
7120-47	Keyboard Wedge, Stand-Alone Keyboard and RS-232 Transmit/Receive
7120-62	Ruby with Verifone, RS232
7120-67	Full RS-232C (OCIA Configurable)

Orbit offers a great deal of features to the consumer:

- Fully automatic scanning operation
- PowerLink compatible
- Data editing
- 7 beeper tones
- Programmable depth of field
- Easy programming

## SCANNER AND ACCESSORIES

<b>BASIC KIT</b>	
<b>Part #</b>	<b>Description</b>
MS7120	Orbit® Presentation Laser Scanner
00-02407	MetroSelect® Programming Guide
00-02408	MS7120 Installation and User's Guide*

\* Available on the Metrologic website - [www.metrologic.com](http://www.metrologic.com)

<b>OPTIONAL ACCESSORIES</b>	
<b>Part #</b>	<b>Description</b>
AC to DC Power Transformer- Regulated 5.2VDC @ 650 mA output.	
45-45593	120V United States
45-45591	220V-240V Continental European
45-45592	220V-240V United Kingdom
46-46803	220V-240V Australia
46-46983	220V-240V China
54-54xxx	PowerLink Cable with built in power jack <i>Standard</i> - 2.1m (7') straight cord, short strain relief
53-53xxx	PowerLink Cable with built in power jack <i>Optional</i> - 2.7m (9') coiled cord, long strain relief
xxx specifies connection to the host.	
54-54002	Keyboard Wedge PowerLink Cable with Adapter Cable
54-54020	Stand Alone Keyboard PowerLink Cable

Other items may be ordered for the specific protocol being used. To order additional items, contact the dealer, distributor or call Metrologic's Customer Service Department at 1-800-ID-METRO or 1-800-436-3876.

## SCANNER AND ACCESSORIES

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OPTIONAL ACCESSORIES	
Part #	Description
MVC**	Metrologic Voltage Converter Cable +12VDC to +5.2VDC or -12VDC to +5.2VDC
MX009-2**	MX009 USB Converter Cable
** Contact a Metrologic customer service representative for additional information on the MVC and MX009 cable series and the host connections available.	
45-45619	Counter/Wall Mount Kit

Other items may be ordered for the specific protocol being used. To order additional items, contact the dealer, distributor or call Metrologic's Customer Service Department at 1-800-ID-METRO or 1-800-436-3876.

## OPERATIONAL NOTES

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Metrologic recommends using the external power supply provided with the scanner when operating the MS7120. When using power supplied by the host, the host system should supply a minimum of 250 mA of current @ 5VDC.

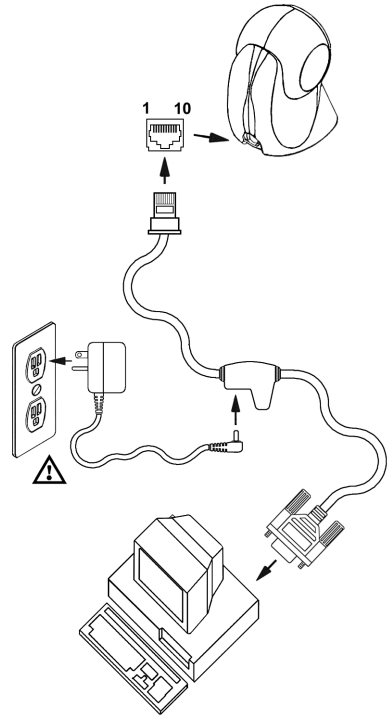
Orbit is shipped from the factory programmed with default settings. To configure the MS7120 scanner to meet the host system's specific needs, refer to the MetroSelect Programming Guide (MLPN 00-02407B) for instructions on how to enter the program mode and select the appropriate bar codes.

## INSTALLATION FOR RS232, OCIA AND IBM 46XX INTERFACES

1. Turn off the host system.
2. Plug the male 10-pin RJ45 end of the PowerLink cable into the 10-pin jack on the MS7120.
3. Connect the 9 pin female end of the PowerLink cable to the host device.

**Note:** Skip to #6 if receiving power from the host system.

4. Plug the power supply's L-shaped plug into the power jack on the PowerLink cable.
5. Check the AC input requirements of the power supply to make sure the voltage matches the AC outlet. The outlet should be installed near the equipment and be easily accessible. Connect AC power to the transformer.
6. Turn on the host system.



**Note:**

- a. When the scanner first receives power, the green LED will turn on. Then the scanner will beep once and the red LED will flash simultaneously.
- b. Plugging the scanner into the serial port of the PC does not guarantee that scanned information will appear at the PC. A software driver and correct configuration setting are also required for proper communication to occur.

**Caution:**



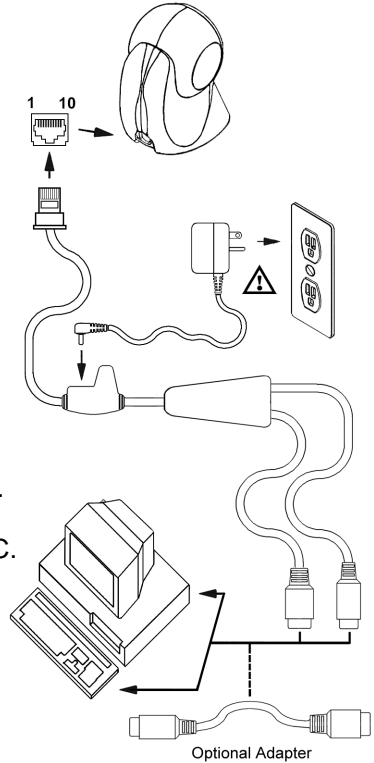
To maintain compliance with applicable standards, all circuits connected to the scanner must meet the requirements for SELV (Safety Extra Low Voltage) according to EN 60950.

To maintain compliance with standard CSA C22.2 No. 950/UL 1950 and norm EN 60950, the power source should meet applicable performance requirements for a limited power source.



## INSTALLATION FOR KEYBOARD WEDGE INTERFACE

1. Turn off the PC/Host.
2. Connect the male 10-pin RJ45 end of the PowerLink cable to the jack on the MS7120.
3. Connect the L-shaped plug of the power supply into the power jack on the PowerLink cable.
4. Make sure the AC input requirements of the power supply matches the AC outlet. Plug the power supply into the AC outlet. The outlet should be near the equipment and easily accessible.
5. Disconnect the keyboard from the PC. Note the type of connector on the keyboard and keyboard port on the PC.
6. The "Y" end of the PowerLink cable terminates to female 5-pin DIN and a male 6-pin mini DIN connector. If necessary attach the supplied adapter cable to the appropriate end of the "Y" cable.
7. Connect one end of the "Y" cable to the Keyboard and other end of the "Y" to the Keyboard port on the PC.
8. Power up the PC.



### Manufacturer's Recommendation:

Powering Orbit directly from the computer can sometimes cause interference with the operation of the scanner or the computer. Not all computers supply the same current through the keyboard port, explaining why a scanner will work on one computer and not another. Metrologic recommends using an external power supply. For additional information contact a Metrologic customer service representative.

#### Caution:

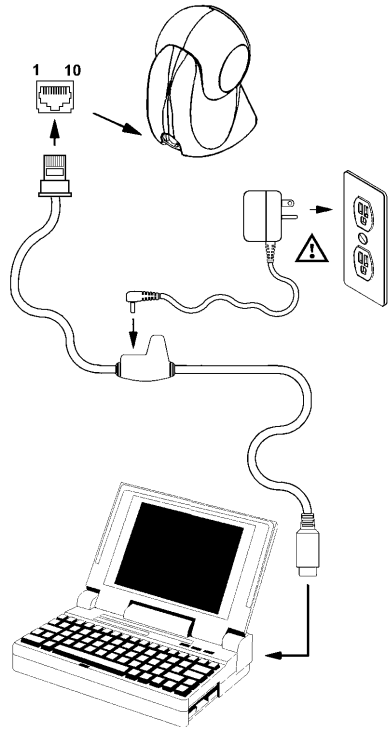


To maintain compliance with applicable standards, all circuits connected to the scanner must meet the requirements for SELV (Safety Extra Low Voltage) according to EN 60950.

To maintain compliance with standard CSA C22.2 No. 950/UL 1950 and norm EN 60950, the power source should meet applicable performance requirements for a limited power source.

## INSTALLATION FOR STAND ALONE KEYBOARD INTERFACE

1. Turn off the host system.
2. Plug the male 10-pin RJ45 end of the PowerLink cable into the 10-pin jack on the MS7120.
3. Connect the PowerLink cable to the keyboard port on the host system.
4. Plug the power supply's L-shaped plug into the power jack on the PowerLink cable.
5. Check the AC input requirements of the power supply to make sure the voltage matches the AC outlet. The outlet should be installed near the equipment and be easily accessible. Connect AC power to the transformer.
6. Turn on the host system.



### Manufacturer's Recommendation:

Powering Orbit directly from the computer can sometimes cause interference with the operation of the scanner or the computer. Not all computers supply the same current through the keyboard port, explaining why a scanner will work on one computer and not another. Metrologic recommends using an external power supply. For additional information contact a Metrologic customer service representative.

#### Caution:



To maintain compliance with applicable standards, all circuits connected to the scanner must meet the requirements for SELV (Safety Extra Low Voltage) according to EN 60950.

To maintain compliance with standard CSA C22.2 No. 950/UL 1950 and norm EN 60950, the power source should meet applicable performance requirements for a limited power source.

## **INSTALLATION NOTES FOR USB INTERFACE**

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Metrologic's MX009 USB cable is a device that converts serial RS232 formatted data to either USB Keyboard or USB Point-of Sale communication protocol.

Please refer to the *MX009 USB Converter Cable Programming Guide* (MLPN 00-02574A) supplied with your MX009 cable for detailed installation and programming guidelines.

## **INSTALLATION NOTES FOR MS7120-00 LASER EMULATION**

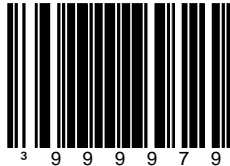
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### **MS7120-00 Only**

The MS7120-00 leaves the factory with the *Laser Emulation Mode* enabled. If you recall defaults while re-configuring your scanner the *Laser Emulation Mode* will no longer be enabled.

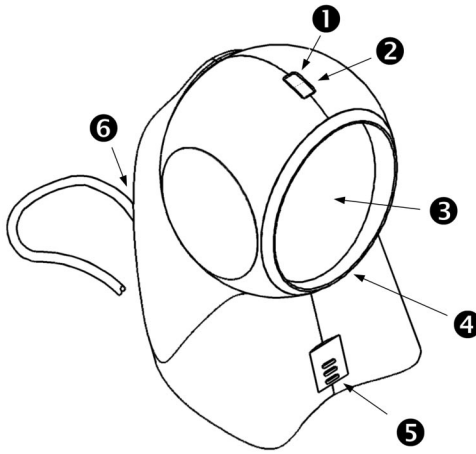
Scan the following barcode to re-enable the Laser Emulation interface. The scanner you are using must be labeled as an MS7120-00 to support this feature.

Enable Laser Emulation Mode



## SCANNER PARTS

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### 1 Red LED

On a successful read of a bar code, the red LED will turn *ON*. After communication to the host is complete, the red LED will turn *OFF*. Refer to *Visual Indicators and Audible Indicators* for additional information.

### 2 Green LED

During normal operation, the green LED is *ON*. This indicates that the laser is on and the unit is ready to scan. The LEDs are also used as diagnostic indicators and mode indicators. Refer to *Visual Indicators and Audible Indicators* for additional information.

### 3 Output Window

Laser Light emits from this aperture.

### 4 Orbit<sup>®</sup> Face

Tilts 30° vertically for variable positioning of the scan pattern.

### 5 Speaker

### 6 Cable Jack

10-pin modular

## AUDIBLE INDICATORS

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When the MS7120 scanner is in operation, it provides audible feedback. These sounds indicate the status of the scanner. Eight settings are available for the tone of the beep (normal, 6 alternate tones and no tone). To change the tone, refer to the MetroSelect® Programming Guide (MLPN 00-02407B) or the MetroSet2 help files.



### One Beep

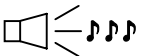
When the scanner *first* receives power, the green LED will turn on, then the red LED will flash and the scanner will beep once. (The red LED will remain on for the duration of the beep.) The scanner is now ready to scan.

When the scanner *successfully* reads a bar code, the red LED will flash and the scanner beeps once (if programmed to do so). If the scanner does not beep once and the red light does not flash, then the bar code has *not* been successfully read.



### Razzberry Tone

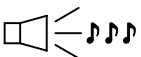
This is a failure indicator. Refer to failure modes page 11.



### Three Beeps - during operation

During operation of the scanner, the red LED will flash while the scanner simultaneously beeps three times (while going into programming mode).

The red LED will continue to flash until the unit exits program mode. Upon exiting program mode, the scanner will beep three times and the red LED will stop flashing. When configured, 3 beeps can also indicate a communications timeout during normal scanning mode. When using one-code-programming, the scanner will beep three times (the current selected tone), followed by a short pause then by a high tone and a low tone. This tells the user that the single configuration bar code has successfully configured the scanner.



### Three Beeps - on power up

This is a failure indicator. Refer to failure modes page 11.

## VISUAL INDICATORS

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There is a red LED and a green LED on the head of the MS7120. When the scanner is on, the flashing or constant illumination of the LEDs indicates the status of the current scan and the scanner.



### **No Red or Green LED**

The LEDs will not be illuminated if the scanner is not receiving power from the host or transformer.



### **Steady Green**

When the laser is active, the green LED is illuminated. The green LED will remain illuminated until the laser is deactivated.

During the power save mode, the laser will turn on and off. During this period, the green LED remains illuminated.



### **Steady Green and Single Red Flash**

When the scanner successfully reads a bar code, the red LED will flash and the scanner will beep once. If the red LED does not flash or the scanner does not beep once, then the bar code has not been successfully read.



### **Steady Green and Steady Red**

After a successful scan, the scanner transmits the data to the host device. Some communication modes require that the host inform the scanner when data is ready to be received. If the host is not ready to accept the information, the scanner's red LED will remain on until the data can be transmitted.



### **Steady Green and Flashing Red**

This indicates the scanner is in program mode. A razzberry tone indicates that an invalid bar code has been scanned in this mode.

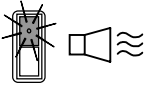


### **Steady Red, Green off**

This indicates the scanner may be waiting for communication from the host.

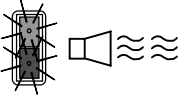
## FAILURE MODES

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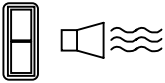
### **Flashing Green and One Razzberry Tone**

This indicates the scanner has experienced a laser subsystem failure. Return the unit for repair at an authorized service center.



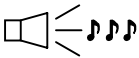
### **Flashing Red and Green and Two Razzberry Tones**

This indicates the scanner has experienced a motor failure. Return the unit for repair at an authorized service center.



### **Continuous Razzberry Tone with both LEDs off**

If, upon power up, the scanner emits a continuous razzberry tone, then the scanner has an electronic failure. Return the unit for repair at an authorized service center.

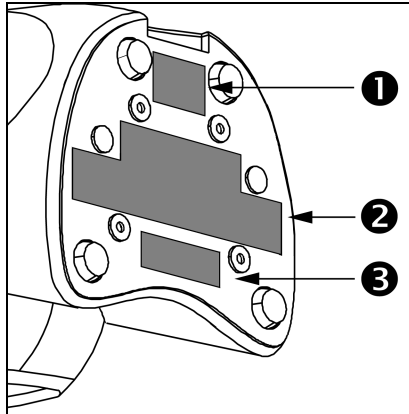


### **Three Beeps - on power up**

If the scanner beeps 3 times on power up then, the nonvolatile memory that holds the scanner configuration has failed. Return the unit for repair at an authorized service center.

## LABELS

Each scanner has three labels on the bottom of the unit. These labels contain information such as; the model number, date of manufacture, serial number, laser class and caution statements. The following illustrations show the location and content of the three labels.



## MAINTENANCE

Smudges and dirt can interfere with the proper scanning of a bar code. Therefore, the output window will need occasional cleaning.

1. Spray glass cleaner onto lint free, non-abrasive cleaning cloth.
2. Gently wipe the scanner window.

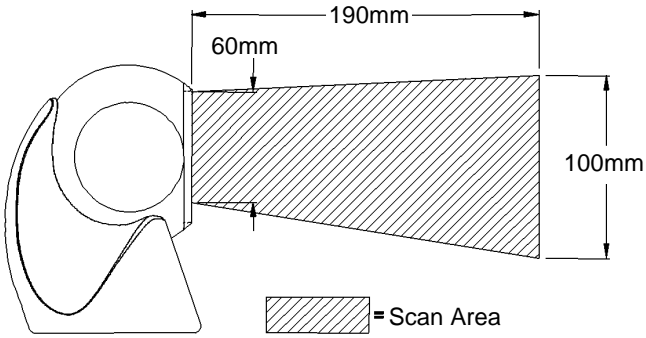


# SCAN VOLUME SPECIFICATIONS

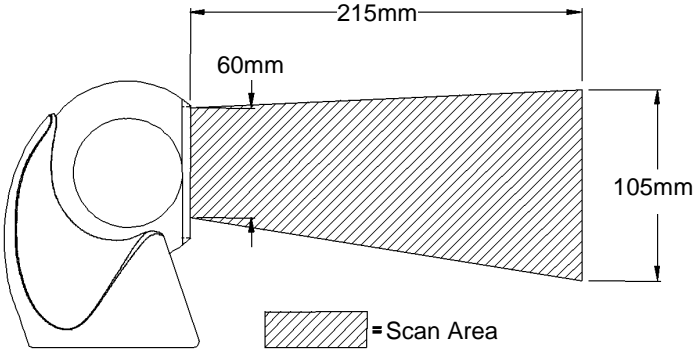
---

Specifications based on 100% UPC Bar Codes.

## Optimal Low Density (Default)



## Optimal High Density

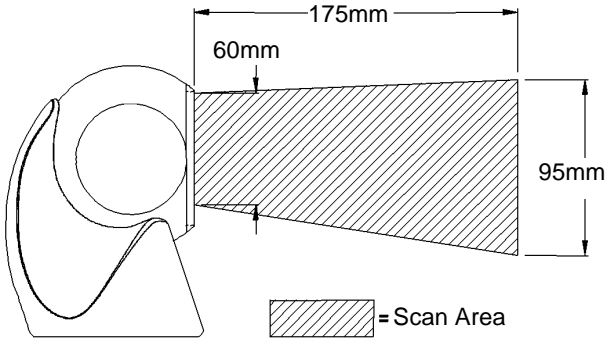


# SCAN VOLUME SPECIFICATIONS (CONT.)

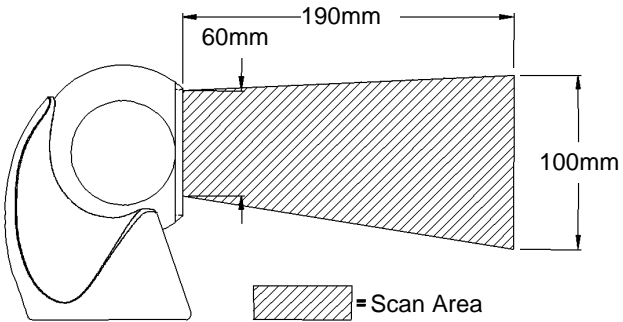
---

Specifications based on 100% UPC Bar Codes.

## Close



## Normal

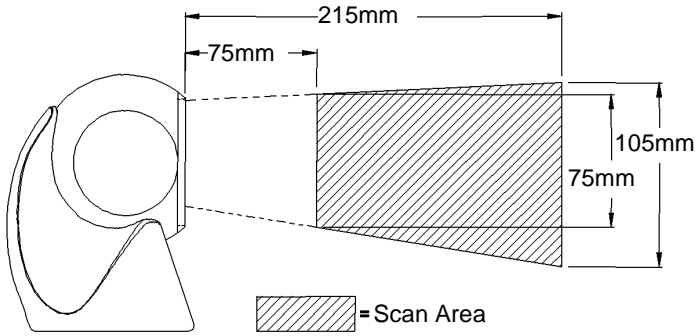


# SCAN VOLUME SPECIFICATIONS (CONT.)

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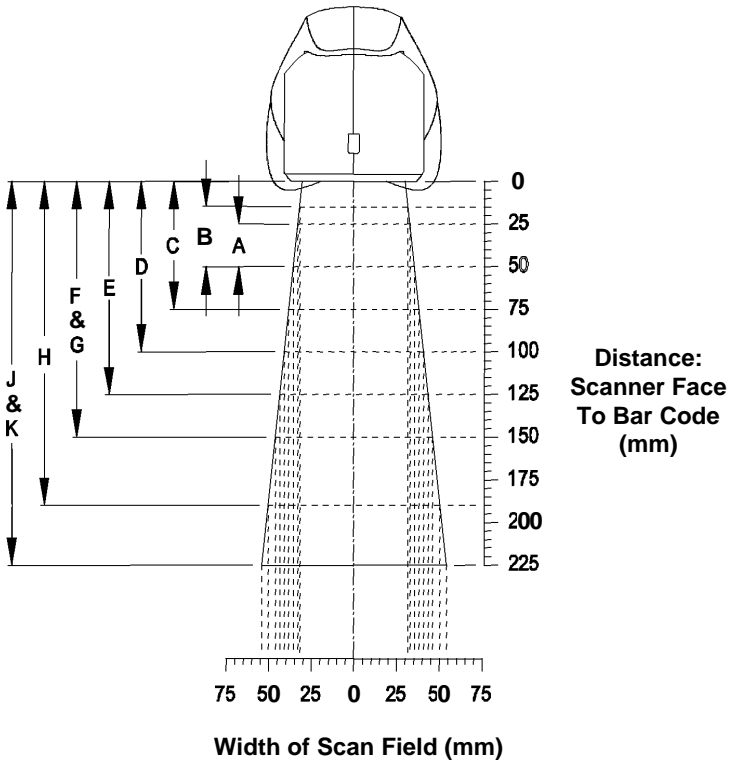
Specifications based on 100% UPC Bar Codes.

## Far



# DEPTH OF FIELD BY MINIMUM BAR CODE ELEMENT WIDTH

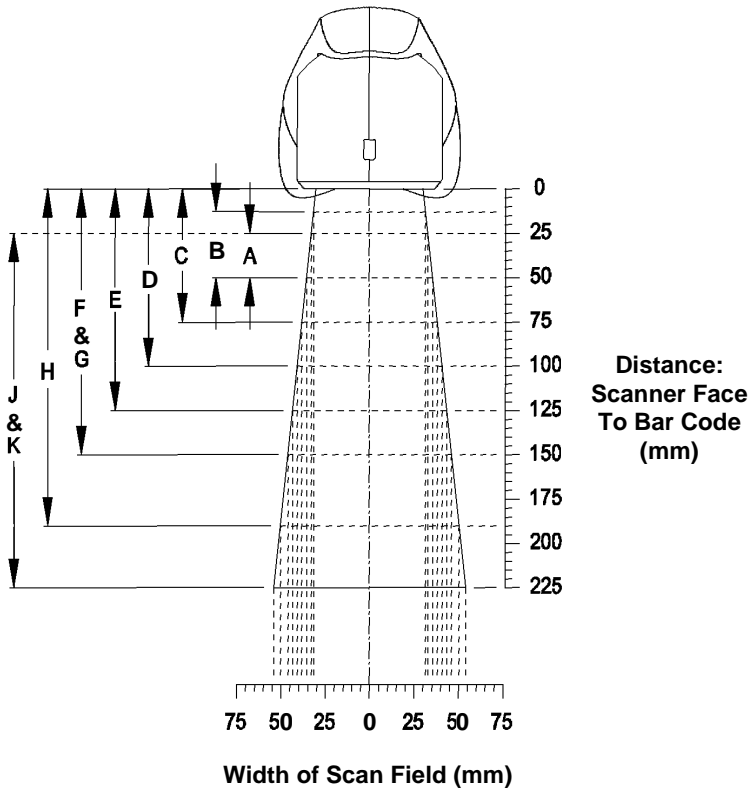
## Optimal Low Density (Default)



Minimum Bar Code Element Width										
	A	B	C	D	E	F	G	H	J	K
mm	.13	.15	.16	.17	.19	.23	.25	.33	.53	.66
mils	5.2	5.7	6.3	6.8	7.5	9	10	13	21	26

# DEPTH OF FIELD BY MINIMUM BAR CODE ELEMENT WIDTH

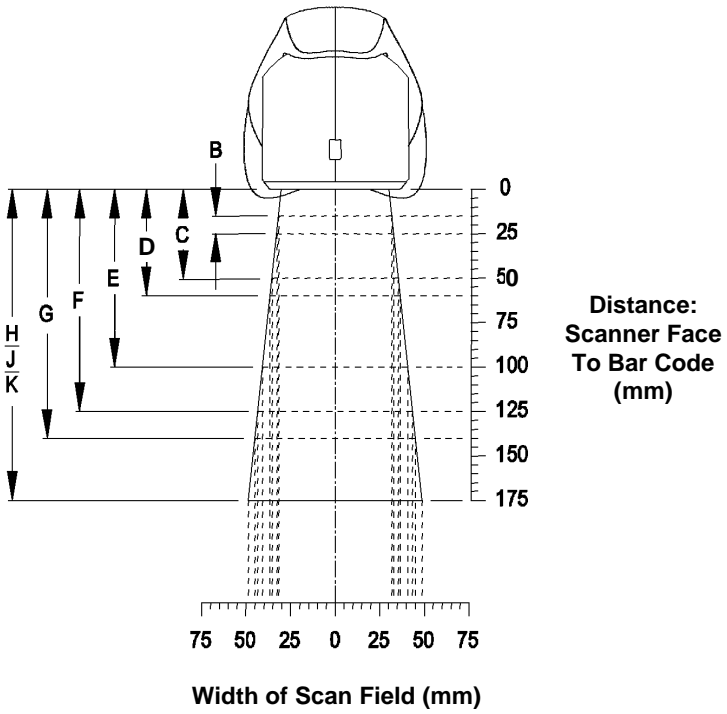
## Optimal High Density



Minimum Bar Code Element Width										
	A	B	C	D	E	F	G	H	J	K
mm	.13	.15	.16	.17	.19	.23	.25	.33	.53	.66
mils	5.2	5.7	6.3	6.8	7.5	9	10	13	21	26

# DEPTH OF FIELD BY MINIMUM BAR CODE ELEMENT WIDTH

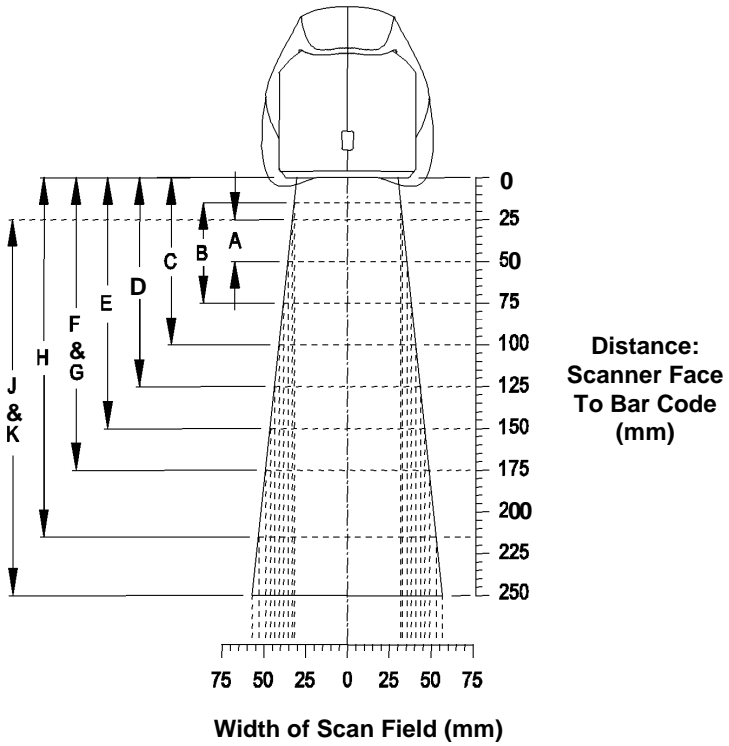
**Close**



<b>Minimum Bar Code Element Width</b>									
	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>	<b>H</b>	<b>J</b>	<b>K</b>
<b>mm</b>	.15	.16	.17	.19	.23	.25	.33	.53	.66
<b>mils</b>	5.7	6.3	6.8	7.5	9	10	13	21	26

# DEPTH OF FIELD BY MINIMUM BAR CODE ELEMENT WIDTH

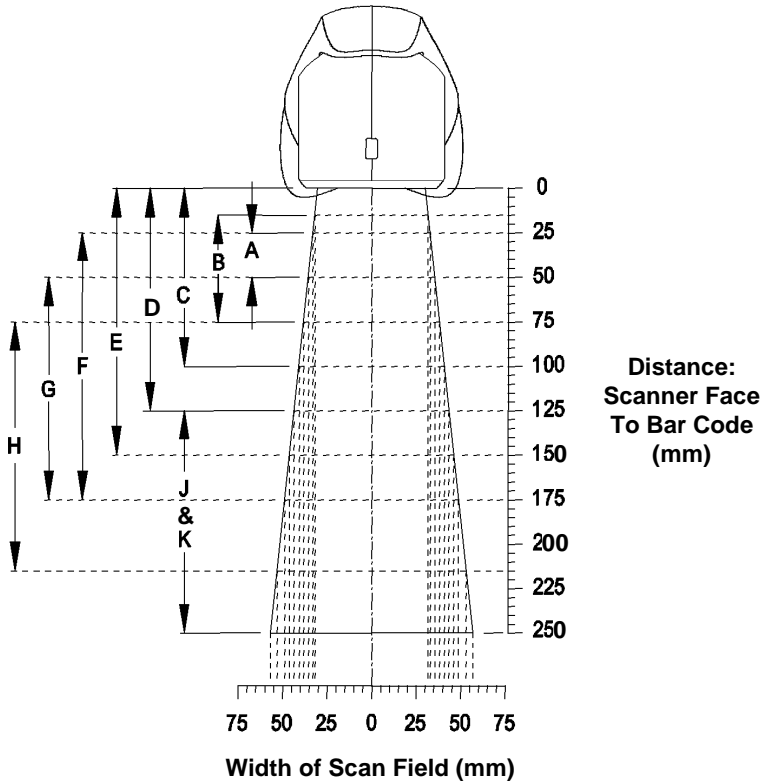
Normal



Minimum Bar Code Element Width										
	A	B	C	D	E	F	G	H	J	K
mm	.13	.15	.16	.17	.19	.23	.25	.33	.53	.66
mils	5.2	5.7	6.3	6.8	7.5	9	10	13	21	26

# DEPTH OF FIELD BY MINIMUM BAR CODE ELEMENT WIDTH

Far



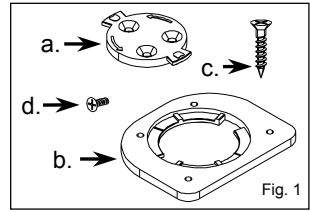
Minimum Bar Code Element Width										
	A	B	C	D	E	F	G	H	J	K
mm	.13	.15	.16	.17	.19	.23	.25	.33	.53	.66
mils	5.2	5.7	6.3	6.8	7.5	9	10	13	21	26



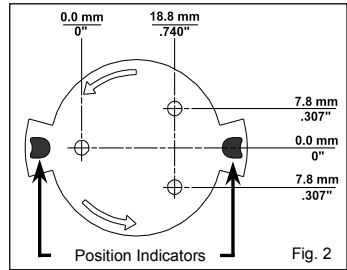
# INSTALLING THE OPTIONAL WALL/COUNTER MOUNT

Kit #45-45619 contains:

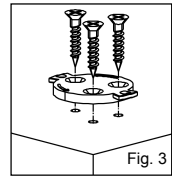
- a. Locking Plate  
[MLPN 50-50302] ..... Qty. 1
- b. Base Cover  
[MLPN 50-50301] ..... Qty. 1
- c. Wood Screw, #7 x 1.00"  
[MLPN 18-18013] ..... Qty. 3
- d. Flathead Screw, M3 x 8 mm  
[MLPN 18-18004] ..... Qty. 4



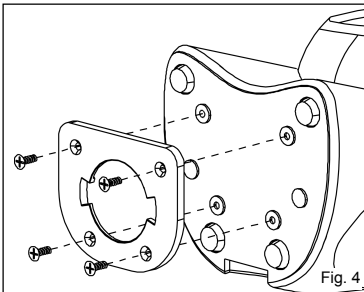
1. **Drill mounting holes**  
Note the position Orbit will rest (fig. 2). Use the dimensions provided in figure 2 or the locking plate [MLPN 50-50302] as a template to drill three #39 pilot holes.



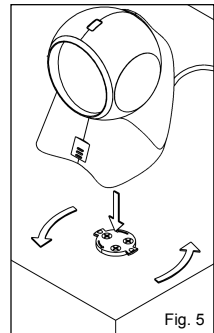
2. **Mount locking plate to wall/counter**  
Secure the locking plate [MLPN 50-50302] to the counter or wall with the three #7 x 1.00" wood screws [MLPN 18-18013] provided.



3. **Attach the base plate to Orbit**  
Secure the base cover [MLPN 50-50301] to the bottom of Orbit (fig. 4) using the four M3 x 8 mm screws [MLPN 18-18004] provided.



4. **Mount Orbit to locking plate**  
Hold Orbit 90° clockwise from the desired position then lower it over the locking plate until it sits flush to the countertop. Twist Orbit counter clockwise 90°, as shown in figure 5, to lock unit in place.



## TROUBLESHOOTING GUIDE

The following guide is for reference purposes only. Contact a Metrologic representative at 1-800-ID-METRO or 1-800-436-3876 to preserve the limited warranty terms on page 39.

### All Interfaces

<b>MS7120 Series Troubleshooting Guide</b>		
<b>SYMPTOMS</b>	<b>POSSIBLE CAUSE(S)</b>	<b>SOLUTION</b>
No LEDs, beep or motor spin	No power is being supplied to the scanner	Check transformer, outlet and power strip. Make sure the cable is plugged into the scanner
No LEDs, beep	No power is being supplied to the scanner from host	Some host systems cannot supply enough current to power Orbit. Use the power supply included with the scanner.
3 beeps on power up	Non-volatile RAM failure	Contact a Metrologic Representative, if the unit will not hold the programmed configuration
Continuous razz tone on power up	RAM or ROM failure	Contact a Metrologic Representative, if the unit will not function
Razz tone and green LED flash at power up	VLD failure	Contact a Metrologic Representative
Razz tone and both LEDs flash at power up	Scanner motor failure	Contact a Metrologic Representative
Unit scans, Communicates and beeps twice	Same symbol timeout set too short	Adjust same symbol timeout for a longer time

## TROUBLESHOOTING GUIDE (CONTINUED)

SYMPTOMS	POSSIBLE CAUSE(S)	SOLUTION
The unit powers up, but does not scan and/or beep	Beeper disabled. No tone selected	Enable beeper. Select tone
The unit powers up, but does not scan and/or beep	Scanning a particular symbology that is not enabled	UPC/EAN, Code 39, interleaved 2 of 5, Code 93, Code 128 and Codabar are enabled by default. Verify that the type of bar code being read has been selected
The unit powers up, but does not scan and/or beep	The scanner has been programmed for a character length lock, or a minimum length and bar code being scanned does not satisfy the programmed criteria	Verify that the bar code that is being scanned falls into the criteria. (Typical of Non-UPC/EAN codes.) ( <i>The scanner defaults to a minimum of 4 character bar code</i> )
The unit scans a bar code, but locks up after the first scan (red LED stays on)	The scanner is configured to support some form of host handshaking but is not receiving the signal	If the scanner is setup to support ACK/NAK, RTS/CTS, XON/XOFF or D/E, verify that the host cable and host are supporting the handshaking properly
The unit scans, but the data transmitted to the host is incorrect	The scanner's data format does not match the host system requirements	Verify that the scanner's data format matches that required by the host. Make sure that the scanner is connected to the proper host port

## TROUBLESHOOTING GUIDE (CONTINUED)

SYMPTOMS	POSSIBLE CAUSE(S)	SOLUTION
Scanner beeps at some bar codes and NOT for others of the same bar code symbology	The print quality of the bar code is suspect	Check print mode. The type of printer could be the problem. Change print settings. For example change to econo mode or high speed
Scanner beeps at some bar codes and NOT for others of the same bar code symbology	The aspect ratio of the bar code is out of tolerance	Check print mode. The type of printer could be the problem. Change print settings. ie change to econo mode or high speed
Scanner beeps at some bar codes and NOT for others of the same bar code symbology	The bar code may have been printed incorrectly	Check if it is a check digit/character/or border problem
Scanner beeps at some bar codes and NOT for others of the same bar code symbology	The scanner is not configured correctly for this type of bar code	Check if check digits are set properly
Scanner beeps at some bar codes and NOT for others of the same bar code symbology	The minimum symbol length setting does not work with the bar code	Check if the correct minimum symbol length is set

## TROUBLESHOOTING GUIDE (CONTINUED)

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### *Keyboard Wedge Only*

<b>SYMPTOMS</b>	<b>POSSIBLE CAUSE(S)</b>	<b>SOLUTION</b>
The unit scans the bar code but there is no data	Configuration is not correct	Make sure the scanner is configured for the appropriate mode. Check internal jumper
The unit scans but the data is not correct	Configuration is not correct	Make sure that the proper PC type AT, PS2 or XT is selected. Verify correct country code and data formatting are selected. Adjust intercharacter delay SYMPTOM
The unit is transmitting each character	Configuration is not correct	Increase the interscan code delay setting. Adjust whether the F0 break is transmitted. It may be necessary to try this in both settings.
Alpha characters show as lower case	Computer is in Caps Lock mode	Enable Caps Lock detect setting of the scanner to detect whether the PC is operating in Caps Lock
Everything works except for a couple of characters	These characters may not be supported by that country's key look up table	Try operating the scanner in Alt mode

## TROUBLESHOOTING GUIDE (CONTINUED)

### RS-232 Only

SYMPTOMS	POSSIBLE CAUSE(S)	SOLUTION
Power-up OK and scans OK but does not communicate properly to the host	Com port at the host is not working or configured properly	Check to make sure that the baud rate and parity of the scanner and the communication port match and the program is looking for "RS-232" data
Power-up OK and scans OK but does not communicate properly to the host	Cable not connected to the proper com port	Check to make sure that the baud rate and parity of the scanner and the communication port match and the program is looking for "RS-232" data
Power-up OK and scans OK but does not communicate properly to the host	Com port not operating properly	Check to make sure that the baud rate and parity of the scanner and the communication port match and the program is looking for "RS-232" data
The host is receiving data but the data does not look correct	The scanner and host may not be configured for the same interface font	Check that the scanner and the host are configured for the same interface font
Characters are being dropped	Intercharacter delay needs to be added to the transmitted output	Add some intercharacter delay to the transmitted output by using the MetroSelect <sup>®</sup> Programming Guide MLPN 00-02407 or the MetroSet2 program

## RS-232 DEMONSTRATION PROGRAM

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If an RS-232 scanner is not communicating with your IBM compatible PC, key in the following BASIC program to test that the communication port and scanner are working. This program is for demonstration purposes only. It is only intended to prove that cabling is correct, the com port is working, and the scanner is working. If the bar code data displays on the screen while using this program, it only demonstrates that the hardware interface and scanner are working. At this point, investigate whether the application software and the scanner configuration match. If the application does not support RS-232 scanners, a software wedge program that will take RS-232 data and place it into a keyboard buffer may be needed. This program tells the PC to ignore RTS-CTS, Data Set Ready (DSR) and Data Carrier Detect (DCD) signals. If the demonstration program works and yours still does not, jumper RTS to CTS and Data Terminal Reading (DTR) to DCD and DSR on the back of your PC.

```
10   CLS
20   ON ERROR GOTO 100
30   OPEN "COM1:9600,S,7,1,CS0,DS0,CD0,LF" AS #1
35   PRINT "SCAN A FEW BAR CODES"
40   LINE INPUT #1, BARCODE$
50   PRINT BARCODE$
60   K$ = INKEY$: IF K$ = CHR$(27) THEN GOTO 32766
70   GOTO 40
100  PRINT "ERROR NO. "; ERR; " PRESS ANY KEY TO TERMINATE."
110  K$ = INKEY$: IF K$ = "" THEN GOTO 110
32766 CLOSE: SYSTEM
32767 END
```

## APPLICATIONS AND PROTOCOLS

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The model number on each scanner includes the scanner number and factory default communications protocol.

SCANNER	VERSION IDENTIFIER	COMMUNICATION PROTOCOL(S)
7120	00	Laser Emulation RS-232 Transmit/Receive
7120	9	OCIA and RS-232 Transmit/Receive (Full RS232 Configurable)
7120	11	IBM 46XX and Full RS-232C
7120	41	Full RS-232C/Light Pen Emulation
7120	47	Keyboard Wedge, Stand-Alone Keyboard and RS-232 Transmit/Receive
7120	62	Ruby with Verifone, RS232
7120	67	Full RS-232C (OCIA Configurable)

The MS7120 Hand-Held Laser Scanner with Built-in PC Keyboard Wedge Interface is designed to be used for keyboard emulation only. Many RS-232 programmable functions available in other Metrologic scanners are also available as keyboard wedge functions.

The following are the most important selectable options specific to the keyboard wedge.

### Keyboard Type

- \*\* AT (includes IBM® PS2 models 50, 55, 60, 80)
- XT
- IBM PS2 (includes models 30, 70, 8556)

### Keyboard Country Type

- \*\* USA
- German
- Spanish
- Belgium
- Italian
- Swiss
- French
- Japan
- United Kingdom

\*\* Default setting. Refer to pages 31-35 for default settings. Refer to the MetroSelect® Programming Guide (MLPN 00-02407B) or the MetroSet2 help files for information on how to change the default settings.



# DESIGN SPECIFICATIONS

## MS7120 SPECIFICATIONS

### OPERATIONAL

Light Source:	VLD 640-660 nm
Depth of Field:	0 mm to 190 mm (0" to 7.5") at default (programmable)
Scan Speed:	1200 scans/second
Scan Pattern:	5 fields of 4 parallel lines (omnidirectional)
Scan Lines:	20
Min Bar Width:	0.13 mm (5.2 mil)
Decode Capability:	Autodiscriminates all standard bar codes; for other symbologies call Metrologic
System Interfaces:	PC Keyboard Wedge, RS-232, OCIA, Light Pen Emulation, IBM 46xx, Stand Alone Keyboard, Laser Emulation, USB (with an <i>MX009 USB converter cable</i> ),
Print Contrast:	35% minimum reflectance difference
Number of Characters Read:	up to 80 data characters (Maximum number will vary based on symbology and density)
Roll, Pitch, Yaw:	360°, 60°, 60°
Beeper Operation:	7 tones or no beep
Indicators (LED):	Green* = laser on, ready to scan Red* = good read, decoding * Indicator colors can be reversed

### MECHANICAL

Height:	150 mm (5.9")
Depth:	105 mm (4.1")
Width-Orb:	80 mm (3.1")
Width-Base:	102 mm (4.0")
Weight:	380 grams (13.4 oz.)
Termination:	10-pin modular RJ45
Cable:	Standard 2.1 m (7') straight; Optional 2.7 m (9') coiled cable
Tilt - Orb:	30° vertical

*Continued next page*

# DESIGN SPECIFICATIONS

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## MS7120 SPECIFICATIONS

### ELECTRICAL

Input Voltage: 5.2VDC  $\pm$  0.25V

Power: 1.1 W

Operating Current: 220 mA (270 IBM)

DC Transformers: Class II; 5.2VDC @ 650 mA

Laser Class: CDRH: Class IIa; EN 60825-1:1994/A11:1996 Class 1

EMC: FCC, ICES-003 & EN 55022 Class B

### ENVIRONMENTAL

Operating Temperature: 0°C to 40°C  
(32°F to 104°F)

Storage Temperature: -40°C to 60°C  
(-40°F to 140°F)

Humidity: 5% to 95% relative humidity, non-condensing

Light Levels: 4840 LUX (450 foot candles)

Shock: Designed to withstand 1 m (3.1') drops

Contaminants: Sealed to resist airborne particulate contaminants

Ventilation: None required

*Specifications subject to change without notice.*

## DEFAULT SETTINGS

Many functions of the scanner can be "programmed" - that is, enabled or disabled. The scanner is shipped from the factory programmed to a set of default conditions. The default parameter of the scanner has an asterisk ( \* ) in the charts on the following pages. If an asterisk is not in the default column then the default setting is Off or Disabled. Every communication does not support every parameter. If the communication supports a parameter listed in the charts on the following pages, a check mark will appear.

PARAMETER	DEFAULT	OCIA	RS-232*	LIGHT PEN	IBM 46XX	KBW	LASER EMULATION
UPC/EAN	*	✓	✓	✓	✓	✓	✓
Code 128	*	✓	✓	✓	✓	✓	✓
Code 93	*	✓	✓	✓	✓	✓	✓
Codabar		✓	✓	✓	✓	✓	✓
Interleaved 2 of 5 (ITF)	*	✓	✓	✓	✓	✓	✓
MOD 10 Check on ITF		✓	✓	✓	✓	✓	✓
Code 11		✓	✓	✓	✓	✓	✓
Code 39	*	✓	✓	✓	✓	✓	✓
Full ASCII Code 39		✓	✓	✓	✓	✓	✓
MOD 43 Check on Code 39		✓	✓	✓	✓	✓	✓
MSI-Plessey		✓	✓	✓	✓	✓	✓
MSI-Plessey 10/10 Check Digit		✓	✓	✓	✓	✓	✓
MSI-Plessey MOD 10 Check Digit	*	✓	✓	✓	✓	✓	✓
Paraf Support		✓	✓	✓	✓	✓	✓
ITF Symbol Lengths	Variable	✓	✓	✓	✓	✓	✓
Minimum Symbol Length	4	✓	✓	✓	✓	✓	✓
Symbol Length Lock	None	✓	✓	✓	✓	✓	✓
Bars High as Code 39	*			✓			✓
Spaces High as Code 39				✓			✓
Bars High as Scanned				✓			✓
Spaces High as Scanned				✓			✓
DTS/SIEMENS		✓					

## DEFAULT SETTINGS

Parameter	Default	OCIA	RS-232*	Light Pen	IBM 46XX	KBW	Laser Emulation
DTS/NIXDORF	*	✓					
NCR F		✓					
NCR S		✓					
Poll Light Pen Source				✓			
Beeper Tone	Normal	✓	✓	✓	✓	✓	✓
Beep/Transmit Sequence	Before Transmit	✓	✓	✓	✓	✓	✓
Communication Timeout	None	✓	✓	✓	✓	✓	✓
Razzberry Tone on Timeout		✓	✓	✓	✓	✓	✓
Three Beeps on Timeout		✓	✓	✓	✓	✓	✓
No Beeps on Timeout	*	✓	✓	✓	✓	✓	✓
Enter Power Save Mode	10 mins.	✓	✓	✓	✓	✓	✓
Same Symbol Rescan Timeout: 200 msec		✓	✓	✓	✓	✓	✓
Same Symbol Rescan Timeout: 500 msec Programmable in 50 msec steps (MAX 6.35 seconds)	*	✓	✓	✓	✓	✓	✓
Same Symbol Rescan Timeout: 1250 msec		✓	✓	✓	✓	✓	✓
Same Symbol Rescan Timeout: 2000 msec		✓	✓	✓	✓	✓	✓
Intercharacter Delay Programmable in 1 msec steps (MAX 255 msec)	1 msec 10msec in KBW	✓	✓		✓	✓	
Number of Scan Buffers	1	✓	✓	✓	✓	✓	✓
Transmit UPC-A Check Digit	*	✓	✓	✓	✓	✓	✓
Transmit UPC-E Check Digit			✓	✓	✓	✓	✓
Expand UPC-E		✓	✓	✓	✓	✓	✓
Convert UPC-A to EAN-13		✓	✓		✓	✓	
Transmit Lead Zero on UPC-E		✓	✓	✓	✓	✓	✓

## DEFAULT SETTINGS

Parameter	Default	OCIA	RS-232*	Light Pen	IBM 46XX	KBW	Laser Emulation
Convert EAN-8 to EAN-13		✓	✓		✓	✓	
Transmit UPC-A Number System	*	✓	✓	✓	✓	✓	✓
Transmit UPC-A Manufacturer ID#	*	✓	✓	✓	✓	✓	✓
Transmit UPC-A Item ID#	*	✓	✓	✓	✓	✓	✓
Transmit Codabar Start/Stop Characters		✓	✓		✓	✓	
CLSI Editing (Enable)		✓	✓		✓	✓	
Transmit Mod 43 Check Digit on Code 39		✓	✓		✓	✓	
Transmit Code 39 Stop/Start Characters		✓	✓		✓	✓	
Transmit Mod 10/ITF		✓	✓		✓	✓	
Transmit MSI-Plessey Check Characters		✓	✓		✓	✓	
Parity	Space		✓				
Baud Rate	9600		✓				
8 Data Bits			✓				
7 Data Bits	*		✓				
Transmit Sanyo ID Characters			✓			✓	
Nixdorf ID			✓			✓	
LRC Enabled			✓			✓	
UPC Prefix			✓			✓	
UPC Suffix			✓			✓	
Transmit AIM ID Characters			✓			✓	
STX Prefix			✓			✓	
ETX Suffix			✓			✓	

## DEFAULT SETTINGS

Parameter	Default	OCIA	RS-232*	Light Pen	IBM 46XX	KBW	Laser Emulation
Carriage Return	*		✓			✓	
Line Feed - disabled by default in KBW	*		✓			✓	
Tab Prefix			✓			✓	
Tab Suffix			✓			✓	
"DE" Disable Command			✓				
"FL" Laser Enable Command			✓				
DTR Handshaking Support			✓				
RTS/CTS Handshaking			✓				
Character RTS/CTS	*		✓				
Message RTS/CTS			✓				
XON/XOFF Handshaking			✓				
ACK/NAK			✓				
Two Digit Supplements		✓	✓	as code 39	✓	✓	as code 39
Five Digit Supplements		✓	✓	as code 39	✓	✓	as code 39
Bookland		✓	✓	as code 39	✓	✓	as code 39
977 (2 digit) Supplemental Requirement		✓	✓	✓	✓	✓	✓
Supplements are not Required	*	✓	✓	✓	✓	✓	✓
Two Digit Redundancy	*	✓	✓	✓	✓	✓	✓
Five Digit Redundancy		✓	✓	✓	✓	✓	✓
100 msec to Find Supplement Programmable in 100msec steps (MAX 800 msec)	*	✓	✓	✓	✓	✓	✓

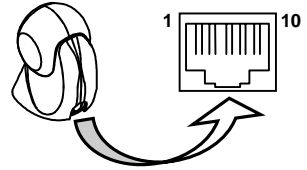
## DEFAULT SETTINGS

Parameter	Default	OCIA	RS-232 <sup>+</sup>	Light Pen	IBM 46XX	KBW	Laser Emulation
Coupon Code 128		✓	✓	as code 39	✓	✓	as code 39
Programmable Code Lengths	7 avail.	✓	✓	✓	✓	✓	✓
Programmable Prefix Characters	10 avail.		✓				
Suffix Characters			✓				
Prefixes for individual Code Types							
Editing		✓	✓	✓	✓	✓	✓
Inter Scan-Code Delay Programmable (100 msec steps)	800 msec					✓	
Function/Control Key Support							
Minimum Element Width Programmable in 5.6 µsec steps	1 msec			✓			✓
Depth of Field							
Variable Depth of Field	*	✓	✓	✓	✓	✓	✓
Normal Depth of Field	*	✓	✓	✓	✓	✓	✓
Extended Depth of Field		✓	✓	✓	✓	✓	✓
Long Depth of Field		✓	✓	✓	✓	✓	✓
Ultra Close Depth of Field		✓	✓	✓	✓	✓	✓

# SCANNER AND CABLE TERMINATIONS

## Scanner Pinout Connections

The MS7120 scanner interfaces terminate to a 10-pin modular jack. The serial # label indicates the interface enabled when the scanner is shipped from the factory. Some units have internal jumpers that can be moved to enable a different electrical interface. Current combinations are listed below.



<b>MS7120-9 OCIA</b> JP1 = Open and JP2 = Closed		<b>MS7120-67 RS-232/LTPN</b> JP1 = Closed and JP2 = Open	
Pin	Function	Pin	Function
1	Ground	1	Ground
2	RS-232 Transmit Output	2	RS-232 Transmit Output
3	RS-232 Receive Input	3	RS-232 Receive Input
4	RDATA	4	RTS Output
5	RDATA Return	5	CTS Input
6	Clock in	6	DTR Input/LTPN Source
7	Clock out	7	Reserved
8	Clock in Return/Clock out Rtrn	8	LTPN Data
9	+5VDC	9	+5VDC
10	Shield Ground	10	Shield Ground

<b>MS7120-47 Keyboard Wedge</b> JP1 = Open and JP2 = Closed		<b>MS7120-41 RS-232/LTPN</b> JP1 = Closed and JP2 = Open	
Pin	Function	Pin	Function
1	Ground	1	Ground
2	RS-232 Transmit Output	2	RS-232 Transmit Output
3	RS-232 Receive Input	3	RS-232 Receive Input
4	PC Data	4	RTS Output
5	PC Clock	5	CTS Input
6	KB Clock	6	DTR Input/LTPN Source
7	PC +5V	7	Reserved
8	KB Data	8	LTPN Data
9	+5VDC	9	+5VDC
10	Shield Ground	10	Shield Ground

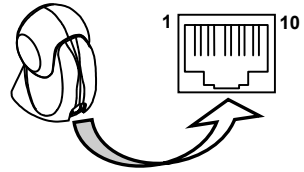
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Options listed are program/cable selections



# SCANNER AND CABLE TERMINATIONS

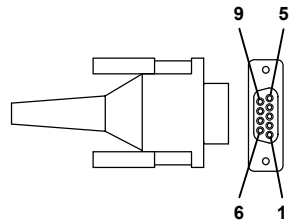
MS7120-11 IBM 46XX/RS-232	
Pin	Function
1	Ground
2	RS-232 Transmit Output
3	RS-232 Receive Input
4	RTS Output
5	CTS Input
6	DTR Input
7	IBM 46XX transmit
8	IBM 46XX Receive
9	+5VDC
10	Shield Ground



Options listed are program/cable selections

## Cable Connector configurations

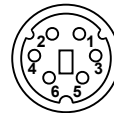
PowerLink Cable MLPN 54-54xxx* or 53-53xxx*	
Pin	Function
1	Shield Ground
2	RS-232 Transmit Output
3	RS-232 Receive Input
4	DTR Input
5	Power/Signal Ground
6	Reserved
7	CTS Input
8	RTS Output
9	+5VDC



9-Pin D-Type Connector

xxx\* specifies connection to the host.

Stand Alone Keyboard Cable MLPN 54-54020	
Pin	Function
1	PC Data
2	NC
3	Power Ground
4	+5VDC PC Power to KB
5	PC Clock
6	NC

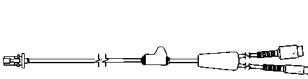


6-Pin Male Mini-DIN Conn.

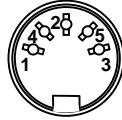
# SCANNER AND CABLE TERMINATIONS

## Cable Connector Configuration

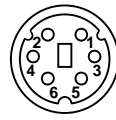
The PowerLink cable is terminated with a 5-pin DIN female connector on one end, and a 6-pin mini DIN male on the other.



PowerLink Cable

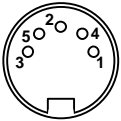


5-Pin DIN, Female



6-Pin DIN, Male

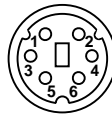
Metrologic will supply an adapter cable with a 5-pin DIN male connector on one end and a 6-pin mini DIN female connector on the other.



5-Pin Din, Male



Adapter Cable



6-pin Mini Din, Female

According to the termination required, connect the appropriate end of the adapter cable to the PowerLink cable, leaving the necessary termination exposed for connecting to the keyboard and the keyboard port on the PC. The pin assignments are as follows:

### PowerLink Cable

5-pin Female DIN	
Pin	Function
1	Keyboard Clock
2	Keyboard Data
3	No Connect
4	Power Ground
5	+5 Volts DC
6-pin Male Mini-DIN	
Pin	Function
1	Keyboard Data
2	No Connect
3	Power Ground
4	+5 Volts DC
5	PC Clock
6	No Connect

### Adapter Cable

5-pin Male DIN	
Pin	Function
1	PC Clock
2	PC Data
3	No Connect
4	Power Ground
5	+5 Volts DC
6-pin Female Mini-DIN	
Pin	Function
1	Keyboard Data
2	No Connect
3	Power Ground
4	+5 Volts DC
5	Keyboard Clock
6	No Connect

## LIMITED WARRANTY

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The MS7120 Orbit® scanners are manufactured by Metrologic at its Blackwood, New Jersey, U.S.A. facility. The MS7120 scanners have a two (2) year limited warranty from the date of manufacture. Metrologic warrants and represents that all MS7120 scanners are free of all defects in material, workmanship and design, and have been produced and labeled in compliance with all applicable U.S. Federal, state and local laws, regulations and ordinances pertaining to their production and labeling.

This warranty is limited to repair, replacement of Product or refund of Product price at the sole discretion of Metrologic. Faulty equipment must be returned to the Metrologic facility in Blackwood, New Jersey, U.S.A. or Puchheim, Germany. To do this, contact Metrologic's Customer Service/Repair Department to obtain a Returned Material Authorization (RMA) number.

In the event that it is determined the equipment failure is covered under this warranty, Metrologic shall, at its sole option, repair the Product or replace the Product with a functionally equivalent unit and return such repaired or replaced Product without charge for service or return freight, whether distributor, dealer/reseller, or retail consumer, or refund an amount equal to the original purchase price.

This limited warranty does not extend to any Product which, in the sole judgement of Metrologic, has been subjected to abuse, misuse, neglect, improper installation, or accident, nor any damage due to use or misuse produced from integration of the Product into any mechanical, electrical or computer system. The warranty is void if the case of Product is opened by anyone other than Metrologic's repair department or authorized repair centers.

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### **USA Corporate Headquarters**

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Munich, Germany

TEL: 49-89-89019-0

FAX: 49-89-89019-200

# NOTICES

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## Notices

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate 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 that may cause undesired operation.

## Notice

This Class B digital apparatus complies with Canadian ICES-003.

## Remarque

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

### Caution

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous laser light exposure. Under no circumstances should the customer attempt to service the laser scanner. Never attempt to look at the laser beam, even if the scanner appears to be nonfunctional. Never open the scanner in an attempt to look into the device. Doing so could result in hazardous laser light exposure. The use of optical instruments with the laser equipment will increase eye hazard.

### Atención

La modificación de los procedimientos, o la utilización de controles o ajustes distintos de los especificados aquí, pueden provocar una luz de láser peligrosa. Bajo ninguna circunstancia el usuario deberá realizar el mantenimiento del láser del escáner. Ni intentar mirar al haz del láser incluso cuando este no esté operativo. Tampoco deberá abrir el escáner para examinar el aparato. El hacerlo puede conllevar una exposición peligrosa a la luz de láser. El uso de instrumentos ópticos con el equipo láser puede incrementar el riesgo para la vista.

### Attention

L'emploi de commandes, réglages ou procédés autres que ceux décrits ici peut entraîner de graves irradiations. Le client ne doit en aucun cas essayer d'entretenir lui-même le scanner ou le laser. Ne regardez jamais directement le rayon laser, même si vous croyez que le scanner est inactif. N'ouvrez jamais le scanner pour regarder dans l'appareil. Ce faisant, vous vous exposez à une rayonnement laser qui est dangereux. L'emploi d'appareils optiques avec cet équipement laser augmente le risque d'endommagement de la vision.

## NOTICES

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### **⚠ Achtung**

Die Verwendung anderer als der hier beschriebenen Steuerungen, Einstellungen oder Verfahren kann eine gefährliche Laserstrahlung hervorrufen. Der Kunde sollte unter keinen Umständen versuchen, den Laser-Scanner selbst zu warten. Sehen Sie niemals in den Laserstrahl, selbst wenn Sie glauben, daß der Scanner nicht aktiv ist. Öffnen Sie niemals den Scanner, um in das Gerät hineinzusehen. Wenn Sie dies tun, können Sie sich einer gefährlichen Laserstrahlung aussetzen. Der Einsatz optischer Geräte mit dieser Laserausrüstung erhöht das Risiko einer Sehschädigung.

### **⚠ Attenzione**

L'utilizzo di sistemi di controllo, di regolazioni o di procedimenti diversi da quelli descritti nel presente Manuale può provocare delle esposizioni a raggi laser rischiose. Il cliente non deve assolutamente tentare di riparare egli stesso lo scanner laser. Non guardate mai il raggio laser, anche se credete che lo scanner non sia attivo. Non aprite mai lo scanner per guardare dentro l'apparecchio. Facendolo potete esporVi ad una esposizione laser rischiosa. L'uso di apparecchi ottici, equipaggiati con raggi laser, aumenta il rischio di danni alla vista.

### **The following notice applies to Model number MS7120-11 only.**

For Class B compliance with FCC Part 15, ICES-003, and EN55022, attach the provided ferrite choke to the PowerLink cable shipped with your MS7120-11 bar code scanner.

Ferrite Choke Installation:

1. Remove the provided ferrite choke from the protective envelope.
2. To open the ferrite, insert a small slotted screwdriver into the rectangular opening and pry the choke open.
3. Place the cable into the slot of one of the choke's two halves. Position the ferrite choke near the end of the data/power cable (*refer figure 1*).
4. Fold the two halves of the choke enclosure together until they snap into the closed position.

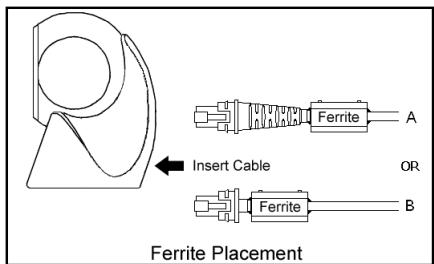


Figure 1

## NOTICES

### Die nachfolgende Mitteilung gilt nur für Modell Nr. MS7120-11

Zur Klassifizierung gemäß Klasse B nach FCC Teil 15, ICES-003 und EN55022, befestigen Sie den vorliegenden Ferritkern an dem mitgelieferte PowerLink Kabel Ihres MS7120-11 Barcode Scanners.

Ferritkern Installation:

1. Entfernen Sie den vorliegenden Ferritkern aus der Schutzhülle.
2. Um den Ferritkern zu öffnen, führen Sie einen kleinen Schlitzschraubendreher in die rechteckige Öffnung und stemmen Sie den Ferritkern auf.
3. Stecken Sie das Kabel in eine der beiden Hälften des Ferritkern. Legen Sie den Ferritkern an das Ende des Daten-/Stromkabels (s. Bild 1).
4. Klappen Sie die beiden Hälften des Ferritkern Ver-schlusses zusammen.

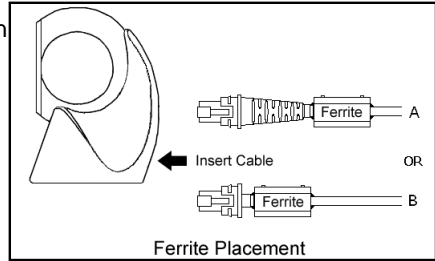


Bild 1

### Le seguenti informazioni sono valide solo per il modello MS7120-11

Per essere conformi alla Classe B delle norme FCC Parte 15, ICES-003, e EN55022, occorre attaccare, al cavo dati/alimentazione inviato con l'MS7120-11, il nucleo di Ferrite allegato.

Installazione del nucleo di ferrite:

1. Rimuovere il nucleo dalla busta protettiva.
2. Per aprire il nucleo inserire un piccolo cacciavite nella fessura presente e fare leva.
3. Posizionare il cavo nell'incavo di una delle due parti del nucleo di ferrite. Posizionare il nucleo vicino alla fine del cavo dati/alimentazione (figura 1)
4. Richiudere le due parti del nucleo di ferrite e fare pressione fino a che non aderiscono perfettamente.

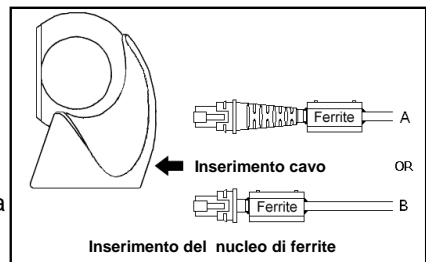


Figura 1

## NOTICES

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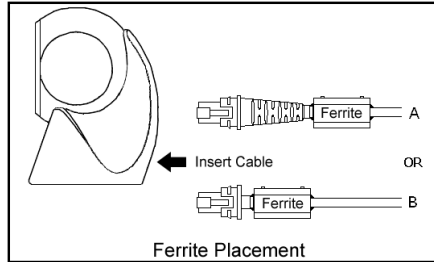
### Nota (exclusivamente para los modelos de la serie MS7120-11)

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De acuerdo con las normativas FCC apartado 15, ICES-003 y EN55022 para la Clase B, el obturador de ferrita del PowerLink que se suministra con el modelo de lector de códigos de barras MS7120-11.

#### Instalación del obturador de ferrita

1. Quitar el envoltorio protector del obturador de ferrita
2. Para abrir el obturador, introduzca un destornillador plano pequeño dentro de la abertura rectangular y deje el obturador abierto
3. Ponga el cable dentro de una de las dos mitades del obturador. Sitúe el obturador de ferrita cerca del fin del cable de alimentación (tal y como aparece en el esquema)
4. Junte de nuevo las dos mitades del obturador y apriete hasta que suene el clip para cerrarlo



## PATENTS

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### “Patent Information

This METROLOGIC product may be covered by one or more of the following U.S. Patents:

#### U.S. Patent No.;

4,960,985; 5,081,342; 5,216,232; 5,260,553; 5,340,971; 5,424,525;  
5,484,992; 5,525,789; 5,528,024; 5,557,093; 5,616,908; 5,627,359;  
5,637,852; 5,661,292; 5,777,315; 5,789,730; 5,789,731; 5,811,780;  
5,828,048; 5,844,227; 5,925,870; 6,029,894; 6,098,885; 6,209,789;  
6,257,492; 6,286,760; 6,299,067; D408,806;

4,360,798; 4,369,361; 4,387,297; 4,460,120; 4,496,831; 4,593,186;  
4,607,156; 4,673,805; 4,736,095; 4,758,717; 4,816,660; 4,845,350;  
4,896,026; 4,923,281; 4,933,538; 4,992,717; 5,081,342; 5,015,833;  
5,017,765; 5,059,779; 5,117,098; 5,124,539; 5,130,520; 5,132,525;  
5,140,144; 5,149,950; 5,180,904; 5,200,599; 5,229,591; 5,247,162;  
5,250,790; 5,250,791; 5,250,792; 5,260,553; 5,262,628; 5,280,162;  
5,280,164; 5,304,788; 5,321,246; 5,324,924; 5,340,973; 5,396,053;  
5,396,055; 5,408,081; 5,410,139; 5,424,525; 5,436,440; 5,449,891;  
5,468,949; 5,468,951; 5,479,000; 5,484,992; 5,525,789; 5,528,024;  
5,532,469; 5,545,889; 5,591,953; 5,616,908; 5,627,359

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Other worldwide patents pending.



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