InfoSight OptiCode® Smart-Camera Barcode Reader

Operation and Maintenance Manual

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Revision 2.02

Manual for:
InfoSight Corporation - OptiCode Reader
Part Number ITM27821

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1 INTRODUCTION

The InfoSight OptiCode® Smart-Camera Barcode Reader is designed for high-speed reading and/or long-distance reading of industry standard and custom barcodes. The reader uses a "Smart-Camera" architecture that contains specialized hardware and software for the optimal reading of barcodes.

The major components of the standard OptiCode Reading System are:

A) OptiCode "Smart-Camera" Barcode Reader featuring:
   - High-speed barcode reading hardware in FPGA (field programmable gate array)
   - Microprocessor running standard or application-specific software
   - RS-170 (monochrome) video output including on-screen alpha-numeric display
   - RS-170 video input (for cascading multiple readers for connection to a single monitor)
   - 1 RS-232/RS-485 "Host" communications port (for data output, triggering, and configuration)
   - 1 RS-485 "Local" communications port (for interconnecting multiple readers to work as one, and for I/O expansion)
   - 5V I/O (2 inputs / 3 outputs standard) for triggering, read status and misc.
   - EEPROM for storage of reader configuration
   - C-Mount Lens Mount (also available with CS-Mount)

B) 5VDC power supply (100-240VAC 50/60 Hz. Input) – International plugs available
C) RS-170 video monitor (optional – required for lens adjustment)
D) Necessary C-Mount lens (optional – per application, may be supplied by end user)
E) Necessary lighting (optional – per application, may be supplied by end user)
F) Environmental enclosure (optional - per application)

2 INSTALLATION

Refer to the drawings for your system for specific details needed for installation.

2.1 Set Dip-Switches

The OptiCode Reading Systems are normally shipped from the factory with all internal dip-switches preset for your application. Refer to "APPENDIX A – HARDWARE CONFIGURATION" for dip-switch locations and settings.

2.2 Mount Hardware

1) Mount camera and lens, as well as any enclosures, pan/tilt mounts, etc. necessary for your application. Refer to the system drawings. The camera will need an unobstructed view of the barcode at a distance that is appropriate for the lens.

2) The OptiCode Reader (camera) requires 5VDC regulated power using a 2.5mm center-positive DC plug. If the included wall-mount power-supply is used, an AC power outlet will need to be installed within 5 feet of the camera (check the power-supply for outlet type). The standard power-supply requires 100-240VAC, 47-63 Hz., 0.5A. If your application uses more than one OptiCode Reader (camera), an outlet will need to be provided for a power-supply for each camera. Be sure the spacing between outlets is sufficient for the power-supplies.

3) A video monitor located at the camera location is necessary for lens adjustment. This monitor may be removed after the adjustments are made. If the monitor requires AC power, this will need to be available at the camera location (either an outlet, or extension cord if the monitor is to be removed after setup). A BNC cable (RG-59 coax) is connected from the "VIDEO OUT" jack on the camera to the monitor. For multi-camera installations, the monitor is connected to the camera with the unused "VIDEO OUT" jack (see "Multi-Camera Installation" below).

4) Install lighting appropriate for the application. Generally, fluorescent lights should NOT be used unless it is certain that a camera shutter rate of 120Hz or less is to be used (100Hz in areas with 50Hz power). The newer CFLs (compact fluorescent lamps) may be used since these operate at much higher frequencies. A faster shutter may be necessary if the barcode is to be read while either the barcode or the camera are moving. With higher shutter speeds, fluorescent lights will cause a "banding" effect on the video which will affect the ability to read barcodes.

2.3 Multi-Camera Installation

To extend the coverage area at a given barcode reader location, multiple OptiCode Smart-Camera Readers may be connected together to function like a single reader. In this configuration, one reader is designated as the "master", while the other readers are designated as "slaves". All "Host" communications and I/O connections are made to the "master". A reader is designated as the "master" by setting dip-switch SW4-1 to "ON". All other readers are designated as "slaves" by setting SW4-1 to "OFF". Refer to "APPENDIX A – HARDWARE CONFIGURATION" for dip-switch locations and settings.

Each reader in a multi-camera installation must be assigned a unique address in the range of 1 to 255 (1 to 247 if Modbus communications are used on the "Host" port). The reader address is set using the group of dip-switches labeled "SW3" (SW3-1 through SW3-8). Refer to "APPENDIX A – HARDWARE CONFIGURATION".

Once the system is running, the reader address is visible on the video screen (upper right, second line down). An “M” next to the address indicates the “master”.

The “master” communicates with the “slaves” via the “Local” RS-485 port. Connections are made from reader to reader in a “daisy-chain” using twisted-pair cable. One wire of the twisted pair goes to the pin labeled “A” on the “Local” connector of each camera (middle pin). The other wire goes to the pin labeled “B” (right-most pin). If shielded twisted-pair cable is used, the shield is connected to the pin labeled “S” (left-most pin).

If a single monitor is to be used, the video signals are daisy-chained by connecting “VIDEO OUT” of one reader to “VIDEO IN” of the next. “VIDEO OUT” of the last reader is connected to the monitor. For the video connections, it does not matter which camera is the “master”. The readers come pre-configured to multiplex (switch) between video sources at a rate of 5 seconds (controlled by the “master”). The configuration utility may be run to select a single camera for display or to change the multiplex rate. Alternatively, during setup, a single camera may be displayed by connecting the monitor to it's “VIDEO OUT” connector, and by disconnecting the cable from it's “VIDEO IN” connector (if applicable).

2.4 Connect Host Port – RS-232 or RS-485

Most applications will use RS-232 for host port data communications (default). A null-modem cable is supplied for RS-232 connections under 15 feet. With the standard baud rate of 9600 baud, RS-232 communications should be limited to under approximately 150 feet. For longer distances, or for use as part of an RS-485 network such as Modbus, the reader host port connections should be configured for RS-485. Refer to “APPENDIX A – HARDWARE CONFIGURATION” and “APPENDIX B – COMMUNICATIONS” for details.

2.5 Connect I/O (optional)

Hardware I/O connections are made on the 6-pin screw-type (“Phoenix”) connector on the back of the reader. Pin 1 is labeled “G” and is the common ground connection. Hardware I/O connections are 5VDC TTL compatible with programmable polarity. Default polarity for outputs is active high. Default polarity for inputs is active low (internal 10K pull-up resistors are provided).

Three outputs are provided. Pin 2 is an undefined output and not normally used. Pin 3 is the "NO READ" output and is used in "Manual" trigger mode only. Pin 4 is the "GOOD READ" output and is used in both "Manual" and "Automatic" trigger modes.

Two inputs are provided. Inputs may be activated by driving the inputs high or low using a standard 5VDC logic output source, or by using a contact closure or open-collector/open-drain output to common ground (Pin 1). Pin 5 is the "EDGE TRIGGER" input and is used to trigger a timed read. Pin 6 is the "READ BARCODE" input and is used as an enable signal for an untimed read. Normally, only 1 trigger input is used ("EDGE TRIGGER" or "READ BARCODE") and only when "Manual" trigger mode is used. Refer to section "3.3 Triggering the Reader" for further details regarding "Manual" trigger mode. Refer to section 4.2.6 "Display and Misc. Tab" for setting I/O polarity.

3 OPERATION

3.1 Start-Up

1) Confirm that all connections are properly made to the system as indicated in section "2 INSTALLATION", and as indicated by the system drawings.
2) An RS-170 video monitor is needed (at least temporarily) at the camera location for making reader adjustments. Refer to section"2 INSTALLATION" for further instructions on connecting the monitor.
3) Remove the lens cap.
4) Apply power to the reader.
5) Verify that a video image appears on the monitor screen. For the first few seconds after power-up of the reader electronics, a message should appear on the monitor, indicating a copyright message and software version. Verify that text appears on the screen of the monitor.
6) Point the camera at a valid barcode. Adjust lighting to point at the barcode. Be certain that the barcode is well lighted.
7) If your lens is a zoom lens, using the zoom control, size the barcode so it occupies about ½ to 2/3 of the video screen (horizontally). Focus the image. Adjust the lens iris for more or less light. The reader reads barcodes best if the iris is not fully open, therefore adjust the iris for a slightly dim barcode. Some experimentation will be useful to find the light settings that work best for the reader.

8) Verify that the reader can read the barcode.

9) Refer below for more details on reader operation.

3.2 The Video Screen

The video monitor allows the operator to view the camera video and the on-screen text display indicating reader functionality.

When the reader is first powered up, a message indicating Copyright and Software Version will appear for a few seconds. The reader will then revert to the normal screen described below.

The top two lines indicate "InfoSight OptiCode® Reader" as well as the text "MANUAL" (default) or "AUTO" at the upper right indicating the triggering mode. Refer to Section 3.3 "Triggering the Reader" for more on these modes. A musical note at the top right indicates that the audible "bell" is enabled. A three-digit number appears on the far-right of the second line down indicating reader address (used for multi-camera applications and for Modbus communications). If the reader has been configured as a multi-camera master, an "M" will appear at the start of the reader address.

The Reader will display statistical data on the Status Line of the On-Screen Display. The Status Line is the third line down from the top. Normally the Status Line displays three numbers in the form: " xxx / yyy zz" where: xxx is the number of successful decodes (hits) of a barcode in one second, yyy is the number of data lines which the reader attempted to decode (attempts), and zz is the calculated percentage of hits to attempts. The larger the "hits" (first number) and "percentage" (third number), the better the reader is reading. This line is used when making lens and lighting adjustments. A simpler read-statistics display option is available using the Configuration Utility and unchecking "Verbose Read Statistics" (see section "4 CONFIGURATION UTILITY").

The bottom line of the display will indicate (in white letters) the barcode currently being read. If no barcode is currently being read, a blinking cursor ">" will appear. Above the bottom line is a scrolling display in gray that indicates barcode data from previous barcodes. Data scrolls up this display as the reader is triggered and new data is read. If you feel the display is too "cluttered" with the scrolling display of

barcodes, you can uncheck the “Scroll Barcodes” option using the Configuration Utility (see section “4 CONFIGURATION UTILITY”).

White text on bottom line “R05186X03” indicates barcode currently being read. Gray text “240312”, “123456789206” and “R05186X03” indicates barcodes read previously when reader was triggered.

Blinking cursor “>” at bottom indicates no barcode currently being read.

3.3 Triggering the Reader (AUTO / MANUAL)

Triggering the reader causes the reader to initiate a new read. There are two modes for triggering the reader: Manual (recommended) and Automatic.

Setting the Trigger Mode:

The triggering mode is indicated at the top right of the monitor screen. "MANUAL" indicates that the reader has been setup to be manually triggered. "AUTO" indicates automatic operation where new barcodes read by the reader (different from the last barcode read) are automatically entered as a "GOOD READ".

The triggering mode is set with a dip-switch (SW4-2) on the CPU board (top side of reader) inside the reader. Refer to "APPENDIX A – HARDWARE CONFIGURATION" for more on setting dip-switches.

Manual Triggering:

Once the trigger mode has been set to "MANUAL", the reader may be triggered in several ways:

1) Asserting the "READ BARCODE" input signal. Refer to section "2.5 Connect I/O".
2) Pulsing the "EDGE TRIGGER" input signal for a timed read. Refer to section "2.5 Connect I/O".
3) Sending a trigger message to the reader through the "Host" (Uart 1) serial port. This message may either be for a timed trigger or an untimed trigger. Refer to "APPENDIX B - COMMUNICATIONS".

The third line of the monitor will display "READING …" to indicate the reader has been triggered and is in "Read mode". "Read mode" will remain active until:

1) A barcode is successfully read.
2) The "READ BARCODE" signal is turned off.
3) A timeout occurs in the case of a timed trigger.
4) An "Untrigger" message is received through the "Host" (Uart 1) serial port if the reader was triggered with a serial trigger.

A successful read will result in the reader turning on the "GOOD READ" output which will remain on until the "READ BARCODE" input signal is turned off or an "Untrigger" message is received if non-timed serial triggering is used. In any case, when set, the "GOOD READ" output will be on for a minimum of ½ second.

Unless the "Output Method of the reader has been configured as "Polled", the reader will output the barcode data on occurrence of the "GOOD READ" condition. If the "Output Method" of the reader has been configured as "Polled", then once the "GOOD READ" signal has been turned on, the new barcode data may be read through the "Host" serial port using either InfoSight Extended Protocol or Modbus ASCII. Refer to section "4 CONFIGURATION UTILITY" - "4.2.2 Barcode Output Tab" and to "APPENDIX B - COMMUNICATIONS".

A no-read condition occurs when a trigger condition ends without a successful barcode read (no "GOOD READ" output). When a no-read occurs, the reader will turn on the "NO READ" output for ½ second.

Unless the "Output Method of the reader has been configured as "Polled", the reader will output "NO READ" on the occurrence of the "NO READ" condition. If the barcode data buffer is read (on the "Host" port) following a "NO READ" (using either InfoSight Extended Protocol or Modbus ASCII), the reader will respond with the ASCII string "NO READ" in place of valid barcode data. Refer to "APPENDIX B - COMMUNICATIONS".

If the barcode data buffer is read (on the "Host" port) when the "READ BARCODE" input is turned on, but no barcode has yet been read (no "GOOD READ"), the reader will respond with a NULL string (no data).

As an alternative to using I/O, the reader may be manually triggered through the "Host" serial communications port (serial trigger) using either Modbus or InfoSight Extended Protocol.

If Modbus is used as the "Host" port protocol, serial triggering is accomplished as follows: Coil 01 is "Read Enable" and works the same as the "READ BARCODE" I/O input. Coil 02 is "Timed Trigger" and works like the "EDGE TRIGGER" input. It will automatically turn off after a short timeout (the default timeout is 2 seconds). The "GOOD READ" and "NO READ" outputs may be read through the Modbus interface. Refer to "APPENDIX B - COMMUNICATIONS" for Modbus register mapping and supported function codes. Note that "Coils" and "Discrete Inputs" are

also mapped into the “Holding Registers” and “Input Registers” portion of the register map.

If Modbus is NOT used as the “Host” port protocol, serial triggering is accomplished using InfoSight Extended Protocol. InfoSight Extended Protocol may also be used to read the states of the “GOOD READ” and “NO READ” outputs. Refer to “APPENDIX B - COMMUNICATIONS”.

Automatic Triggering:

To set the trigger mode to “AUTO”, refer to “Setting the Trigger Mode” above. When in this mode, the reader will continuously scan for new barcodes, and when a code is found which is different from the last code found, the “GOOD READ” output is turned on for ½ second and the new barcode data is available for output. See section “4 CONFIGURATION UTILITY” - “4.2.2 Barcode Output Tab” and also “APPENDIX B – COMMUNICATIONS” - “Barcode Data Output”. For information on connecting to the “GOOD READ” output, see section “2.5 Connect I/O”.

The new code is indicated at the bottom of the video screen, while previous codes are scrolled up the screen. The “READ BARCODE” and “EDGE TRIGGER” inputs and the “NO READ” output have no function in this mode. Automatic mode is not normally recommended because it is too easy for the operator to unintentionally “scan” the wrong barcode and because there is no way to detect a “NO READ” condition.

3.4 Modbus Communications

Modbus communications with the “Host” port are always available and are optional. If the “Host” port connects the reader to a network with more than one slave device (normally an RS-485 network), then Modbus communications are necessary.

If Modbus communications are used, the barcode “Output Method” for the reader must be set to “Polled”. See section “4 CONFIGURATION UTILITY” - “4.2.2 Barcode Output Tab”.

Modbus communications with the OptiCode Reader use the ASCII mode of the Modbus Serial Line protocol. Communications are RS-232 or RS-485, 9600 baud, 8 data bits, 1 stop bit, No Parity. Refer to “APPENDIX B – COMMUNICATIONS”.

The OptiCode Reader is programmed to be a Modbus slave (server). The Modbus address is set using an 8-switch dip-switch SW3 located on the CPU board on the top side of the reader (refer to "APPENDIX A – HARDWARE CONFIGURATION" for dip-switch settings). The address is indicated on the upper right of the video monitor (second line down).

Normally, the only Modbus accesses that are necessary are to read the barcode data. The barcode data registers occupy 128 16-bit words, however it is only necessary to read as many registers as are necessary to hold the data encoded in the barcode (normally reading 16 registers is more than enough). The starting register address for the barcode data is 257 (the first 256 registers are reserved for reader configuration and should not be used). The barcode data is stored in big-endian format with the most significant barcode character in the high-byte of register 257 and the second-most significant character in the low-byte of register 257, etc. The barcode data is terminated by a NULL character (0x00) in the next byte location after the data. The barcode data registers are mapped as both Input Registers and Holding Registers, so the data may be read using either Modbus function code 03 (Read Holding Registers) or function code 04 (Read Input Registers). Refer to the Modbus Application Protocol Specification (available at www.Modbus-IDA.org) for details regarding the use of function codes.

The complete register mapping and list of supported function codes may be found in "APPENDIX B – COMMUNICATIONS".

3.5 InfoSight Extended Protocol Communications

If the "Host" port communications are single-ended (not part of a multi-slave network) then no protocol is necessary for barcode data output, however InfoSight Extended Protocol is available. Besides barcode data transfer, InfoSight Extended protocol may be used to trigger the reader (serial trigger), read the state of the reader I/O, and to read the current firmware version and date. It may also be used to verify communications with the reader. Refer to the section on InfoSight Extended Protocol in "APPENDIX B – COMMUNICATIONS".

It should be noted that if you use InfoSight Extended Protocol for things other than barcode data output, you may still select "No Protocol" as the barcode "Output Method". See section "4 CONFIGURATION UTILITY" - "4.2.2 Barcode Output Tab" and also "APPENDIX B – COMMUNICATIONS" - "Barcode Data Output".

3.6 Firmware Upgrades

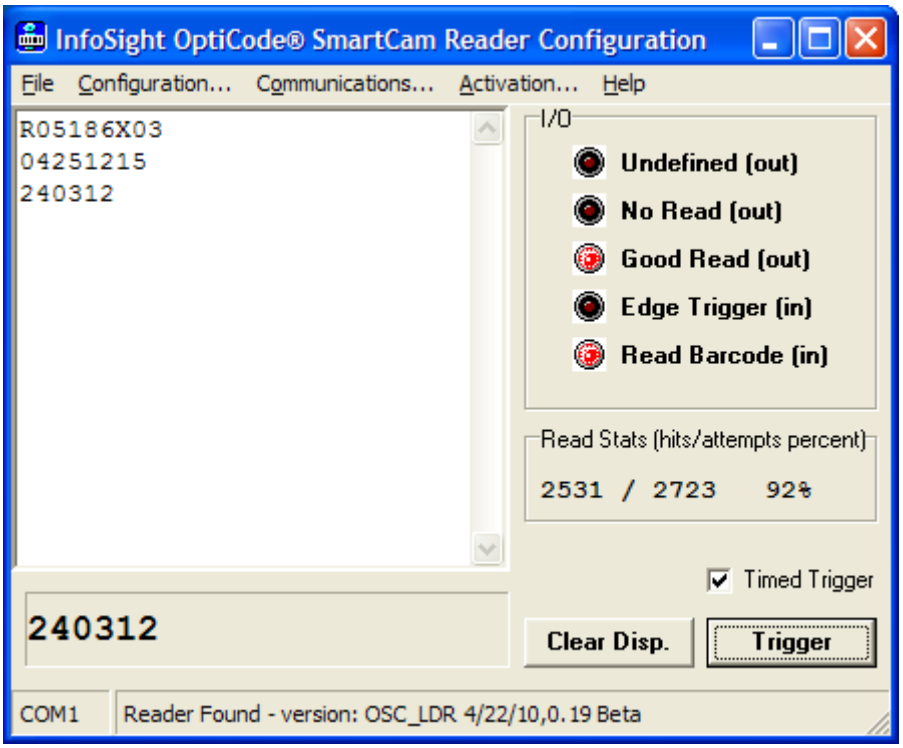
Beginning with reader v2.00 firmware, a bootloader is programmed into the reader allowing future firmware upgrades to be performed by customers without the use of programming hardware. Should a firmware upgrade become necessary, a PC application will be provided along with the program file and instructions for the firmware upgrade process.

4 CONFIGURATION UTILITY

Normally the OptiCode Reader comes pre-configured for the application. A Windows® based utility program is provided to allow advanced re-configuration of the reader, saving of the configuration, testing of the reader, and reader activation.

4.1 Configuration Utility – Main Window

The main window of the configuration utility provides a convenient testing interface for the reader. It shows a log of received barcodes as well as a larger display of the last barcode read. The status bar indicates the COM port selected and will indicate if the utility is currently able to communicate with the reader.



Configuration Utility Main Window

Menu Bar:

File – Open: Used to load a reader configuration file (.osc file extension). Should only be used when the Reader Configuration Utility is communicating with a reader (indicated by "Reader Found" on the status bar).

File – Save/Save As...: Used to save the current reader configuration to a file (.osc file extension). Check to be sure the Reader Configuration Utility is communicating with a reader (indicated by "Reader Found" on the status bar).

File – Store Configuration as User Defaults: Causes the current reader configuration to be stored as the "User Default Configuration". The "User Default Configuration" file is stored in the reader, so communications must be established with the reader in order to store the new user-default values. The "User Default Configuration" file includes the reader "Activation Code" so make sure the reader is programmed with the correct "Activation Code" prior to storing the "User Default Configuration". Refer to section 4.4 "Configuration Utility – Reader Activation Window" for more on reader activation.

File – Exit: Closes the program

Configuration...: Opens the "Reader Configuration" window

Communications...: Opens the "Communications" window

Activation...: Opens the "Reader Activation" window

Help – About: Opens the "Help – About" window

I/O:

The I/O box indicates the state of the reader I/O ports. The "Read Barcode" indicator is a special case as it will be active not only when the "Read Barcode" hardware input is active, but also when a timed trigger event is active or when a serial trigger is active. A timed trigger event may be initiated by a pulse on the "Edge Trigger" hardware input or by reception of a timed trigger message on the "Host" (Uart 1) serial port.

Read Stats (hits/attempts percent):

Read statistics from the reader are displayed as an indication of how well the reader is reading a barcode that is currently in the field of view. This is the same information that is displayed on the video monitor when "Verbose Read Statistics" is enabled. Refer to section "3.2 The Video Screen" for a detailed description of read statistics.

"Clear Disp." Button:

Clicking this button will clear the list of previously received barcodes.

"Trigger" / "Read On" / "Read Off" Button:

Use this button to send trigger messages to the reader for testing. The reader must be in "MANUAL" trigger mode for this to have an effect.

"Timed Trigger" Check Box:

When checked, the trigger button will read "Trigger" and (when clicked) will cause a timed serial trigger message to be sent to the reader. When unchecked, the trigger button will alternate between "Read On" and "Read Off" and (when clicked) will alternately cause untimed trigger on and trigger off messages to be sent to the reader.

4.2 Configuration Utility – Reader Configuration Window

The configuration window is used to make configuration changes in the reader. Click on the appropriate tab at the top to select the desired configuration category.

Read Stats (hits/attempts percent):

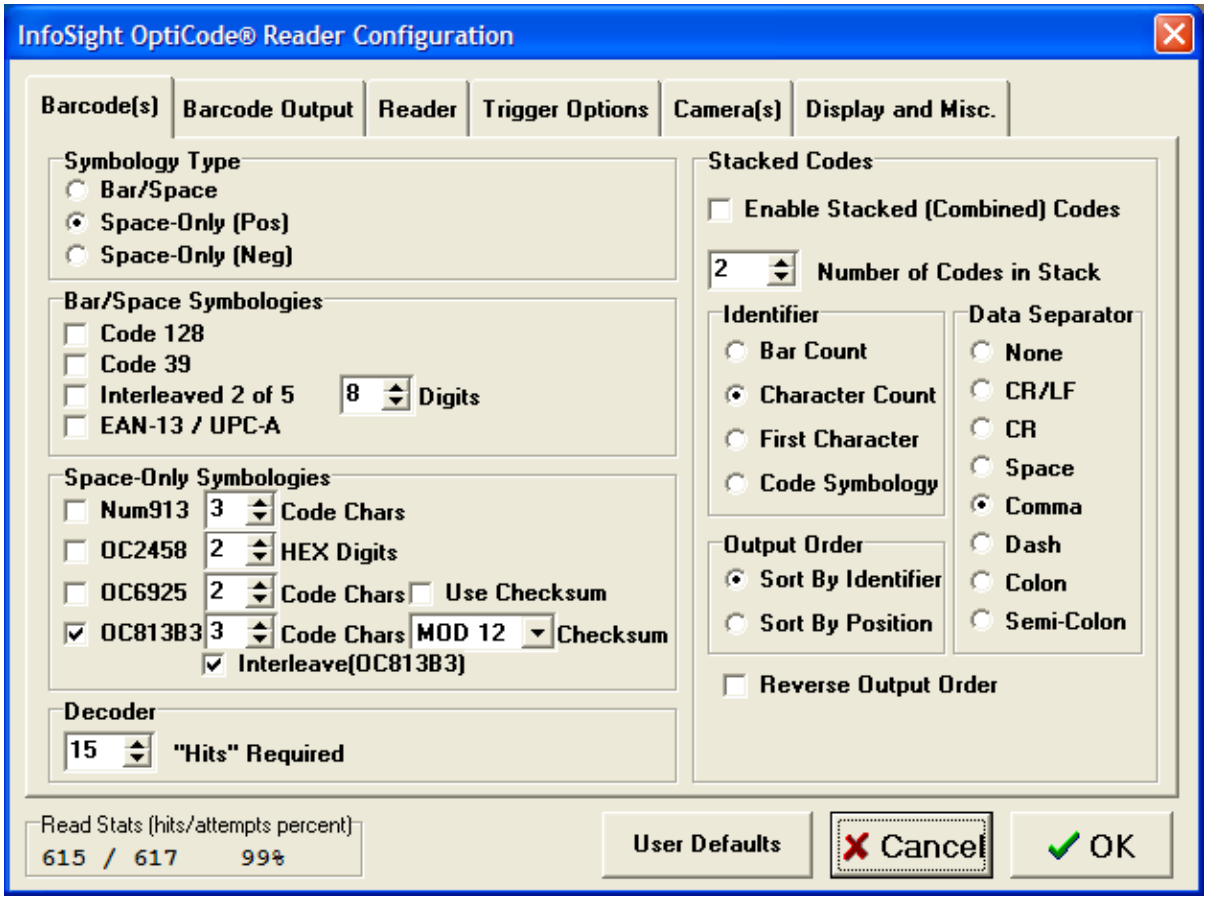
Read statistics from the reader are displayed as an indication of how well the reader is reading a barcode that is currently in the field of view. This is the same information that is displayed on the video monitor when "Verbose Read Statistics" is enabled. Refer to section "3.2 The Video Screen" for a detailed description of read statistics.

"User Defaults" Button: Use this button to restore the reader to the user-specific default settings. Refer to section 4.1 "Configuration Utility – Main Window" for how to store a new user-default configuration.

"Cancel" Button: Clicking this button will restore the reader to it's previous settings (prior to opening the "Reader Configuration" window.

"OK" Button: Clicking this button will cause the current settings to be saved in the reader.

4.2.1 "Barcode(s)" Tab



Configuration Window - "Barcode(s)" Tab

Symbology Type: (only one type may be selected)

Bar/Space

Most standard linear barcodes encode their data in the widths of both the bars and the spaces between the bars.

Space-Only (Pos and Neg)

Space-only codes encode their data in the center-to-center spacing of the bars. The bars are generally all the same width. These codes are often engraved, molded, or ink-sprayed; and are often custom-designed for a specific application. The "Pos" setting detects the bars on the positive edges (dark to light transition). The "Neg" setting detects the bars on the negative edges (light to dark transition).

Bar/Space Symbologies:

Each check box enables decoding of the indicated symbology. For best reader performance, only enable the symbologies that may be used with your application. To decode these symbologies, "Symbology Type" must be set to "Bar/Space" (above). If your application requires a type not listed, contact InfoSight.

Interleaved 2 of 5: To reduce possible miss-reads when using this type code, the number of digits encoded must be specified (even number of digits only).

Space-Only Symbologies:

Each check box enables decoding of the indicated symbology. For best reader performance, only enable the symbologies that may be used with your application. To decode these symbologies, "Symbology Type" must be set to either "Space-Only (Pos)" or "Space-Only (Neg)" (above).

Num913: A custom designed barcode typically ink-sprayed on pipe. "Code Chars" must be set according to your specific code format (normally 3 for pipe codes).

OC2458: A custom designed barcode used for various applications including ladle tracking. "HEX Digits" set to 2 for ladle tracking.

OC6925: A custom designed barcode typically ink-sprayed on pipes or billets. The "Use Checksum" option uses one of the code characters as a modulo-25 check character. "Use Checksum" and "Code Chars" must be set according to your specific code format.

OC813B3: A custom designed barcode typically ink-sprayed on pipes for billets. The "Checksum" option allows one of the code characters to be used as a combination data character and check character. The "Interleave(OC813B3)" option enables reading of OC813B3 codes with the "interleave" option, a feature to reduce chances of miss-reads. "Checksum", "Code Chars" and "Interleave (OC813B3)" must be set according to your specific code format.

Decoder - "Hits" Required:

Specifies the number of identical valid decodes (hits) required before the reader will report a "GOOD READ" and output the barcode data. A higher number here can reduce the chances of a miss-read (incorrect data), but also reduces the chances of reading a marginal barcode that is barely readable.

Stacked Codes:

The reader has the capability of combining the data from 2 or more barcodes for output as a single "GOOD READ".

Enable Stacked (Combined) Codes: Must be checked to enable this feature. Must NOT be checked if reading single codes.

Number of Codes in Stack: Set to a value from 2 to 4 to define how many barcodes are combined into a "stacked code".

Identifier: Each barcode in a stacked (combined) code must have have a unique identifier to differentiate it from the other codes in the stack (select one):

Bar Count, Character Count, First Character, or Code Symbology

Note: If "First Character" is used as the Identifier, this character will not be included in the barcode data output from the reader (beginning with v2.00 firmware).

Output Order: Specifies the order in which the barcode data will be combined for output.

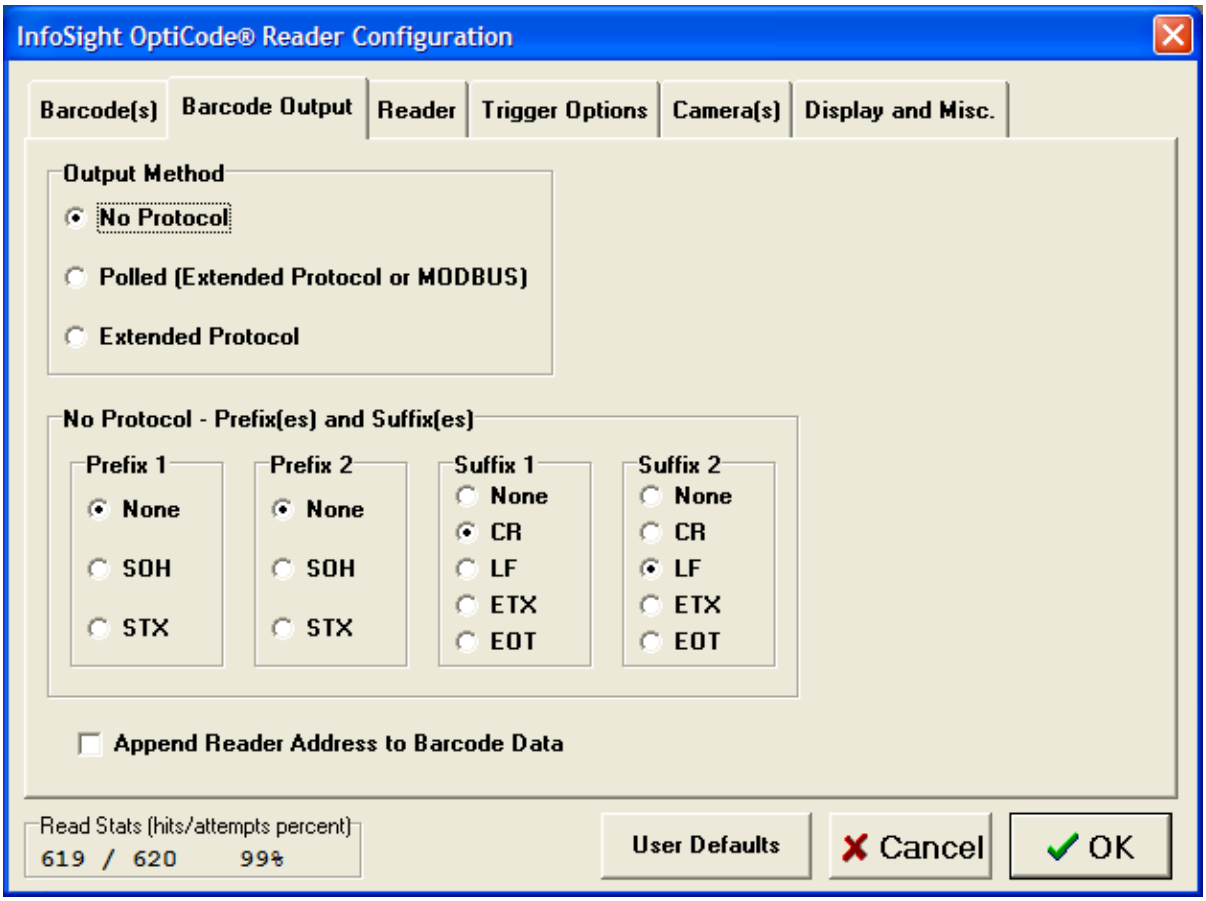
Sort By Identifier: Recommended – Most reliable method.

Sort By Position: Should NOT be used with omni-directional scan modes. Only use when scanning horizontally.

Reverse Output Order : Reverses the order in which the codes are combined.

Data Separator: A separator may be inserted between the data of combined codes if desired. Note, CR is an ASCII Carriage Return (0x0D) and LF is an ASCII Line Feed (0x0A).

4.2.2 "Barcode Output" Tab



Configuration Window - "Barcode Output" Tab

Output Method:

Selects how the barcode data is transmitted out the "Host" (Uart 1) serial port.

No Protocol:

This is how most barcode readers output their data. To prevent collisions on a network, this method should ONLY be used when the "Host" (Uart 1) serial port is connected to a single device. See "No Protocol – Prefix(es) and Suffix(es)" below.

Polled (Extended Protocol or Modbus):

For this method, the "Host" computer must "poll" the reader for it's data. Data is returned from the reader only when requested from the host (either by Extended Protocol or Modbus). This is necessary when more than one reader (or other slave/client device) is connected to the "Host" port to

prevent data "collisions". Refer to "APPENDIX B – COMMUNICATIONS" for further information about using InfoSight Extended Protocol and Modbus.

Extended Protocol:

Barcode data is output within a standard (non-addressed) InfoSight Extended Protocol message. To prevent collisions on a network, this method should ONLY be used when the "Host" (Uart 1) serial port is connected to a single device. Refer to "APPENDIX B – COMMUNICATIONS" for further information about using InfoSight Extended Protocol.

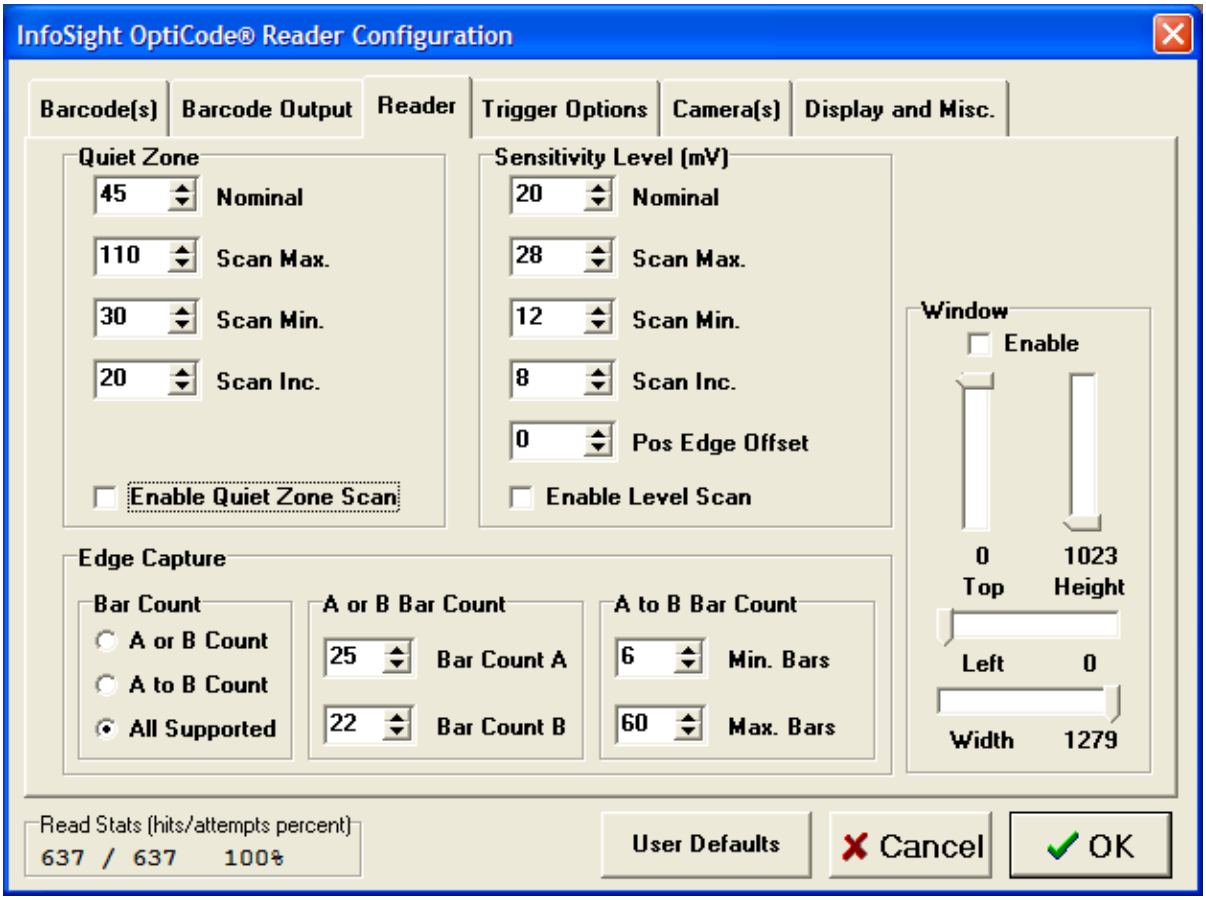
No Protocol – Prefix(es) and Suffix(es):

When "No Protocol" is selected for the output method, one or two prefixes and suffixes may be included with the data.

Append Reader Address to Barcode Data:

When checked, the reader address will be appended to the barcode data that is output to the "Host" (Uart1). The appended address consists of a comma followed by a three digit (with leading zeros) number indicating the reader address. This feature may be useful for networked applications that include multiple readers. The reader address is set using the group of dip-switches labeled "SW3" (SW3-1 through SW3-8). Refer to "APPENDIX A – HARDWARE CONFIGURATION".

4.2.3 "Reader" Tab



Configuration Window - "Reader" Tab

Quiet Zone (settings are in image "pixels"):

Linear barcodes require "quiet zones" at both the leading and trailing edges of the barcode (before and after the bars). For "standard" barcodes, the minimum quiet-zone is usually specified as 10 times the "X" dimension (usually the width of the narrowest bar, or for space-only codes: the minimum bar-center to bar-center spacing). To allow the reader to read through a broad range of "zoom" settings, a larger barcode quiet-zone is recommended.

The configuration settings for "Quiet Zone" are specified in image "pixels". For reference, the image sensor resolution is 1280 pixels wide by 1024 pixels high. If the "Quiet Zone" setting is too high, the reader may be unable to read a barcode with relatively small quiet zones, especially when the scale of the barcode is small on the video screen. If the "Quite Zone" setting is too low, the reader may "mistake" the larger spacings between bars as being quiet zones, especially when the scale of the barcode is large on the video screen.

InfoSight can assist with an optimal "Quiet Zone" setting based on your barcode and application.

Nominal: This is the quiet zone setting used by the reader when the "Enable Quiet Zone Scan" check box is NOT checked.

Scan Max.: The maximum quiet zone setting used by the reader when "Enable Quiet Zone Scan" is checked.

Scan Min.: The minimum quiet zone setting used by the reader when "Enable Quiet Zone Scan" is checked.

Scan Inc.: Sets the minimum amount the quiet zone setting is incremented when "Enable Quiet Zone Scan" is checked. With each increment of the quiet zone scan, the quiet zone will increment by either "Scan Inc" or 1/8 the current quiet zone value, whichever is greater (up to the "Scan Max" value).

Enable Quiet Zone Scan:

Quiet zone scanning increments at the current frame rate which is determined by the scan mode (see "APPENDIX C – SPECIFICATIONS". Quiet zone scanning is best used for stationary or very slowly moving barcodes. Because omni-directional scanning requires a reduced frame rate, quiet zone scanning will be slowed down in those modes. Quiet zone scanning is also slowed down when "Level Scan" is enabled (below).

Sensitivity Level (mV):

The "Sensitivity Level" sets the threshold for the edge detection hardware in the reader. A smaller setting makes the reader more sensitive to low levels of light. If the barcode is very bright on the video screen, the "Sensitivity Level" must not be set too low. A "dim" barcode on the video screen may require a lower setting. The lowest settings should be avoided as they can reduce read rates due to electrical noise.

Nominal: This is the sensitivity setting used by the reader when the "Enable Level Scan" check box is NOT checked.

Scan Max.: The maximum sensitivity setting used by the reader when "Enable Level Scan" is checked.

Scan Min.: The minimum sensitivity setting used by the reader when "Enable Level Scan" is checked.

Scan Inc.: Sets the minimum amount the level setting is incremented when "Enable Level Scan" is checked. With each increment of the level scan, the level setting will increment by either "Scan Inc" or 1/8 the current level value, whichever is greater (up to the "Scan Max" value).

Enable Level Scan:

Level scanning increments at the current frame rate which is determined by the scan mode (see "APPENDIX C – SPECIFICATIONS". Level scanning is best used for stationary or very slowly moving barcodes. Because omni-directional scanning requires a reduced frame rate, level scanning will be slowed down in those modes. Level scanning is also slowed down when "Quiet Zone Scan" is enabled (above). For an alternative to level scanning, see "ASC (Auto Shutter Control)" in section 4.2.5 "Camera(s) Tab.

Edge Capture:

Barcodes will have differing numbers of bars depending on their symbology (ie Code 128, Code 39, etc.) and data format. Since most applications use a specific symbology and data format, the resulting number of bars is usually fixed. In order to more efficiently identify barcodes within the video image and to reduce the chances of miss-reads, the reader can be configured to look for a specific number of bars, or a number of bars within a specified range.

Bar Count:

"A or B" Count: Select this to require a specific bar count. Two different counts may be specified.

"A to B" Count: Select this for the reader to look within a specified range of bar counts.

"All Supported": This option will capture barcodes of any valid bar count (within the resolution limits of the reader).

A or B Bar Count: Set "Bar Count A" and "Bar Count B" to the number of bars in your barcodes.

A to B Bar Count: Set "Min. Bars" and "Max. Bars" to the range of possible bar counts in your barcodes.

Window:

The "Window" function allows the creation of a window on the video display in order to restrict the area where a barcode will be read. This is useful in applications where it is possible for bacodes other than the one you wish to read to be within the field of view of the reader. When adjusting the window, the area outside the window will appear darker than the area within the window. See also "Scan Range" in section "4.2.5 Camera(s) Tab"

Enable: Check this to enable the window function. When NOT checked, the entire field of view will be active.

Top: Sets the top edge of the window. A setting of "0" is the top of the screen. A setting of "1023" is the bottom of the screen. Use this to adjust the vertical position of the window.

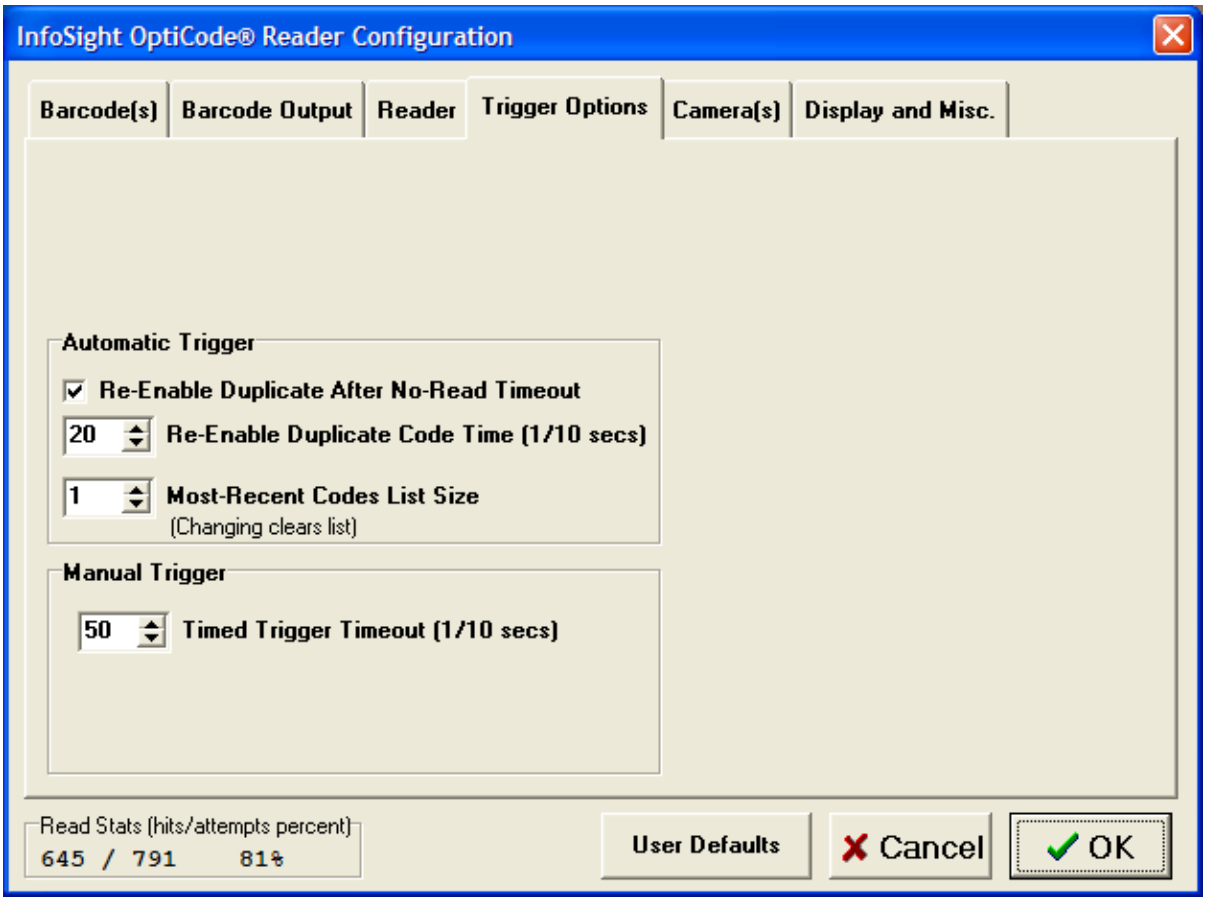
Height: Sets the height of the window.

Left : Sets the left edge of the window. A setting of "0" is the far left of the screen. A setting of "1279" is the far right of the screen. Use this to adjust the horizontal position of the window.

Width: Sets the width of the window.

4.2.4 "Trigger Options" Tab

The trigger mode "AUTO" (automatic) or "MANUAL" is set with a dip-switch within the reader (see APPENDIX). This tab allows adjustments related to these two modes.



Configuration Window - "Trigger Options" Tab

Automatic Trigger:

To prevent continuous re-transmission of barcode data that has already been sent, the reader keeps a small "Most-Recent" list of codes previously transmitted.

Re-Enable Duplicate After No-Read Timeout: Checking this causes the reader to clear the "Most-Recent" list after a specified time of no-read activity. This is necessary if it is desired to read an identical barcode more than once.

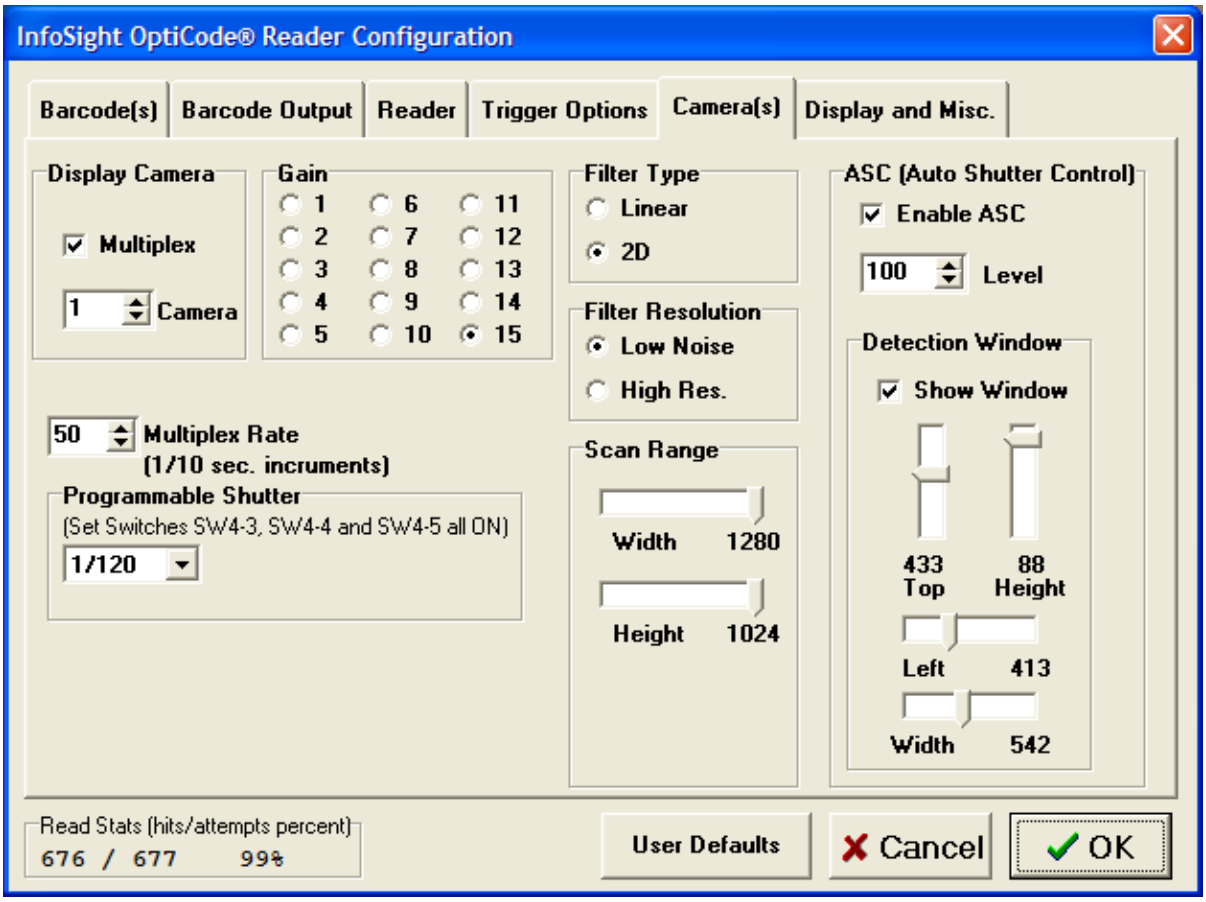
Re-Enable Duplicate Code Time: Specifies the amount of time of no-read activity before a duplicate barcode may be read again (set in 1/10 second increments). Requires "Re-Enable Duplicate After No-Read Timeout" to be checked (above).

Most-Recent Codes List Size: Specifies the size of the "Most-Recent" list. Since this list is small (maximum 32 in rev. 1.0 readers), this list is mainly intended to prevent re-transmission when more than one barcode can occur within the field-of view at once.

Manual Trigger:

Timed Trigger Timeout (seconds): Specifies the maximum number of seconds allowed by a timed trigger (hardware edge-trigger or serial timed trigger).

4.2.5 "Camera(s)" Tab



Configuration Window - "Camera(s)" Tab

Display Camera: When multiple readers are cascaded together to act as a single read station (master/slave configuration), it is possible to view the video from each reader on a single monitor. Note that one reader must be configured as the master and all others as slaves (set with a dip-switch). This utility must be connected to the master to make these adjustments.

> **Multiplex:** Causes the readers to display sequentially at a timed rate. The sequence is in order of reader address (set with dip-switches).
>
> **Camera:** Specifies a single reader for display ("Multiplex" must be unchecked).

Multiplex Rate: Specifies the rate at which the camera displays will multiplex (in 1/10 second increments). This setting is in effect when the "Multiplex" check box is checked.

Programmable Shutter: This list box allows the setting of a much broader range of shutter speeds than the three internal dip-switches allow. To use this option, the three internal shutter speed dip-switches must each be set to "ON" (SW4-3, SW4-4 and SW4-5). See "APPENDIX A – HARDWARE CONFIGURATION: Dip-Switch and Jumper Settings".

Gain: Specifies the amplifier gain for the image-sensor within the reader. This is normally set to maximum (15), but if the lighting is sufficient, the gain may be reduced in order to minimize electrical noise within the sensor.

Filter Type: Specifies whether the filter used on the camera video is one dimensional (Linear) or two dimensional (2D). Changes in this setting are often accompanied by changes in "Gain" and sometimes "Sensitivity Level" ("Reader" tab).

> **"Linear":** This filter is normally only used in horizontal-only applications where the barcode is moving laterally (left-to-right or right-to-left) across the screen and moving rapidly. This filter can be necessary due to the "rolling" shutter of the image sensor where each scan line is captured sequentially. This setting is normally used along with very fast shutter speeds.
>
> **"2D":** This two-dimensional filter setting is the best for most applications.

Filter Resolution: Specifies the resolution of the filter used on the camera video. Changes in this setting are often accompanied by changes in "Gain" and sometimes "Sensitivity Level" ("Reader" tab).

> **"Low Noise":** This is the best choice for most reading applications. A low noise filter can allow better use of maximum gain ("Gain" typically set to 15) and the use of lower "Sensitivity Level" settings (increased sensitivity).
>
> **"High Resolution":** This setting is necessary when using the reader near the limits of it's resolution (minimum width bars and spaces very small on the video display). Because this filter allows more "noise" to pass, use of this filter is sometimes accompanied by a lower camera "Gain" setting and a higher "Sensitivity Level".

Scan Range:

"Scan Range" allows you to limit the scan range of the image array. This is normally used to increase the frame rate of the scan. When used, the reduced scan is centered in the image array. If this feature is not needed, the "Width" and "Height" settings should be set to their maximum values or 1280 and 1024.

Width: Sets the width of the scan.

Height: Sets the height of the scan.

ASC (Auto Shutter Control), requires v2.00 or greater firmware:

ASC (Automatic Shutter Control) is a new feature of the OptiCode Smart-Camera beginning with reader version 2.00 firmware and the version 2.00 Configuration Utility. ASC (when enabled) is used to maintain a consistent light level to the image sensor when the barcode lighting varies. This is achieved by using a "Detection Window" where the average video intensity level is monitored. This value is compared with the ASC "Level" setting, and the electronic shutter speed is increased or decreased automatically in order to make the average video intensity track the "Level" setting. The "Detection Window" is normally adjusted to cover the area in the video screen where the barcode is expected, however it may be placed in any area in the active video that is a consistent indicator of the ambient light. When ASC is used, the shutter setting ("Programmable Shutter" or dip-switches) is used as a minimum shutter speed so that moving barcodes may still be captured.

Enable ASC: Enables Automatic Shutter Control.

Level: Sets the average video level that ASC tries to maintain.

Show Window: When checked (and ASC is also checked), a white outline will be visible on the video screen indicating the "Detection Window".

Top: Sets the top of the ASC detection window.

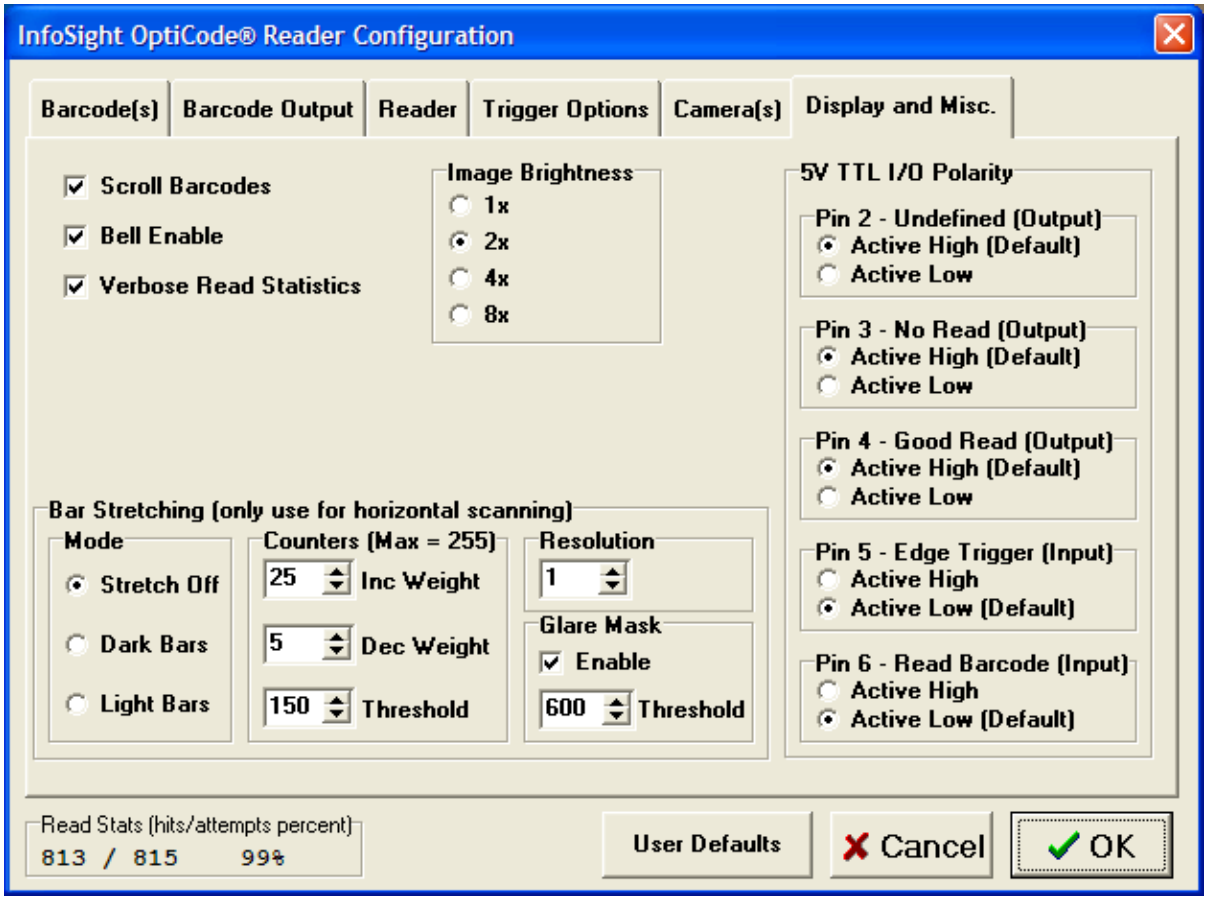
Height: Sets the height of the ASC detection window.

Left: Sets the left side of the ASC detection window.

Width: Sets the width of the ASC detection window.

Since ASC will not use a shutter speed slower than the shutter setting, it is best to provide extra light and video signal. This may be accomplished by additional lighting, opening up the lens iris, setting camera gain to its maximum of 15 and by lowering the shutter setting if the barcode movement allows it. One way of setting up ASC is to adjust the reader for optimum reading under the lowest ambient light conditions and then turn-on the ASC. The ASC will then increase the shutter speed as the ambient light increases.

4.2.6 "Display and Misc." Tab



Configuration Window - "Display and Misc." Tab

Scroll Barcodes: When checked, previous barcode data will "scroll-up" the display with each new read showing a history of the data from the last five barcodes read. When unchecked, only the data from a barcode currently being read will be displayed.

Bell Enable: Enables the audible tone that the reader makes when it gets a "GOOD READ". Jumper J1 on the CPU board (top board in reader) must also be in place for the bell to function (comes from the factory with jumper J1 in place).

Verbose Read Statistics: When checked, the reader will display barcode read statistics in the form of: HITS/ATTEMPTS PERCENTAGE where "HITS" is the number of valid reads per second, "ATTEMPTS" is the number of read attempts per second (possible barcode data captured by the hardware), and "PERCENTAGE" is the percentage of hits to attempts. When unchecked, the reader will only display "HITS" per second. Read statistics are useful when

adjusting the lens,lighting and other reader adjustments, and for checking the readability of a barcode.

Image Brightness: Sets the brightness for the camera video on the display screen. This allows better viewing of a dim image when the read threshold is set very low. This setting affects the display only. It has no effect on the reading process.

Bar Stretching: This feature may be used to "stretch" bars downward as a method of reading damaged barcodes or as a method of creating bars from dots such as created by dot-peen or drills. This may also be used to increase the bar-height in codes that have a very low aspect ratio. This feature should only be used for barcodes that are always oriented horizontally. Bar stretching works best for space-only symbologies (see 4.2.1 "Barcode(s)" Tab).

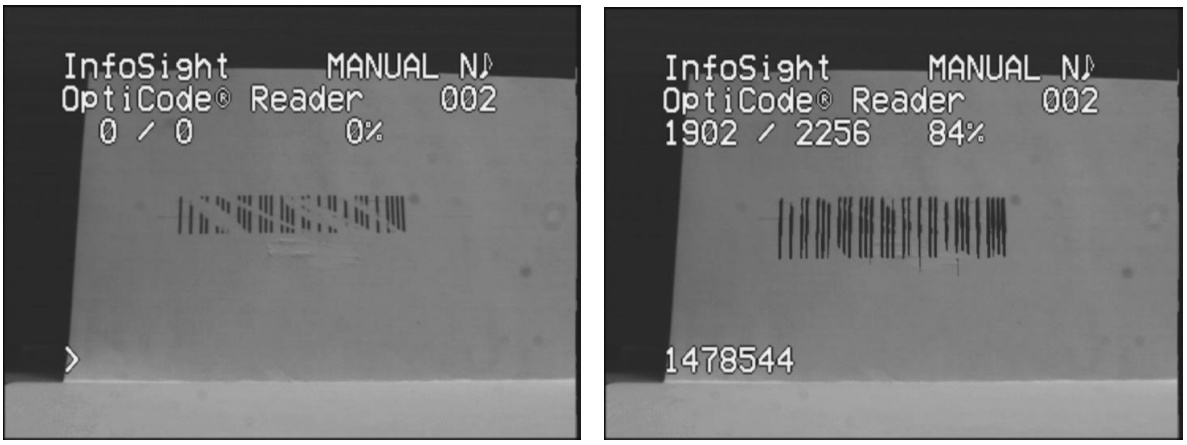


Image on left shows a badly damaged NUM913 code. Image on right shows the same damaged code being successfully read using bar stretching.

Mode: Normally set to "Stretch Off". To enable bar stretching, select "Dark Bars" or "Light Bars" as appropriate.

Counters (Max = 255): For each horizontal pixel position in the video image, a counter is used to determine if a bar is to be indicated on a given scan line. When a bar is "seen", the counter is increased by the "Inc Weight" (up to a maximum of 255). When a bar is not "seen", the counter is decreased by the "Dec Weight" (down to a minimum of 0). If the counter for the current pixel is greater than or equal to the "Threshold" setting, a bar is indicated at that pixel location. Since the counter has a maximum value of 255, the maximum amount of "stretching" below the actual bar is determined by (255 – "Threshold") / "Dec Weight". This indicates that the amount of stretching may be increased by either lowering the "Dec Weight" or lowering the "Threshold". If the actual bar is expected to

be very short, the “Inc Weight” is set to a higher setting in order to detect the bar in fewer scan lines. For increased “noise” immunity, a smaller “Inc Weight” or larger “Threshold” is used.

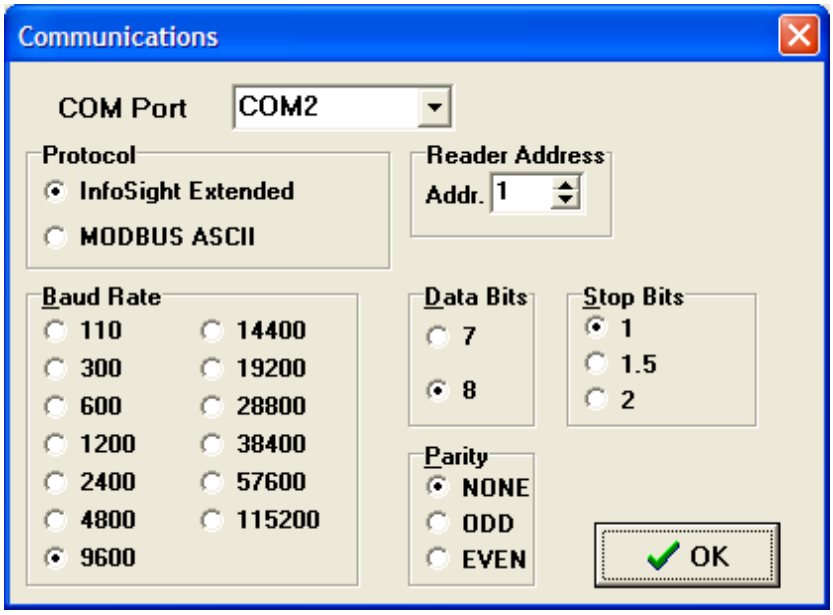
Resolution: Ranges from 0 to 255. The highest resolution is 0. Default setting is 1. Bar stretching for “coarser” bars may benefit by setting this to a higher setting (lower resolution).

Glare Mask: Ranges from 0 to 1020. The Glare Mask “Threshold” setting is used to help reduce the effects of noise due to glare by ignoring video data that is brighter than the threshold setting. This is only in effect when Bar Stretching is used (see “Mode” above). The Glare Mask “Enable” check box must also be checked to use this feature.

5V TTL I/O Polarity: The polarity for each I/O pin on the rear-panel external I/O connector may be set. Since there are internal 10K pull-up resistors on the inputs, any un-used input should be set to the default setting of active low.

4.3 Configuration Utility – Communications Window

Use this window to set-up how this utility will communicate with the reader. This window will NOT make any changes to the reader itself.



Communications Window

COM Port: Used to specify the PC's COM port used to communicate with the reader. This may be a USB or other adapter using a VCP (virtual COM port) driver, or may be a standard RS-232 or RS-485 serial port.

Protocol:

InfoSight Extended: Use this protocol when there is only one device (the reader) connected to the PC's COM port. For multi-camera applications, using this protocol will cause configuration changes to be made globally to all readers (except for reader "Window" settings, "Scan Range" settings, "Automatic Shutter Control" settings and reader "Activation").

Modbus ASCII: Use this protocol if the reader's "Host" port is connected to an RS-485 network with more than one reader or other slave (server) device, or to address a single reader that is part of a multi-camera configuration. This setting is useful for setting reader "Window", "Scan Range", "Automatic Shutter Control" and reader

"Activation" in individual readers that are part of a multi-camera configuration. Note that the current Modbus master (client) must be disabled or disconnected as the PC running this application will serve as the master. Alternatively, the reader may be temporarily removed from the network (un-plugging the "Host" connector), and the PC running this utility may then be plugged into that port.

Reader Address: Set this to match the address set by the reader's dip-switches. The reader's address may be seen on the upper-right of the video display (second line). This setting is only used if "Modbus ASCII" is selected for the protocol.

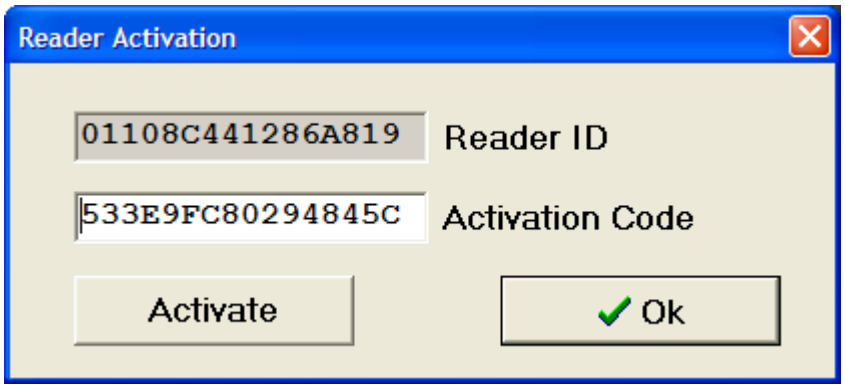
Baud Rate: Must match the baud-rate programmed into the reader (normally 9600).

Data Bits: Must match the data-bits setting programmed into the reader (normally 8)

Parity: Must match the parity setting programmed into the reader (normally NONE)

Stop Bits: Must match the stop-bits setting programmed into the reader (normally 1)

4.4 Configuration Utility – Reader Activation Window



Reader Activation Window

Reader activation is necessary in order to make the reader functional. This is done at the factory and normally no other steps need to be taken. The activation code is stored within the reader and is used to activate the reader on power-up. The reader will display "ACTIVATING ..." for approximately two seconds on power-up. If the reader fails to activate properly, "ACTIVATION FAILURE" will appear on the video display, and the reader will be unable to read barcodes. If for some reason, the

activation code becomes corrupted, the “Reader Activation” window may be used to re-activate the reader.

If the reader fails to activate properly, the first thing you should try is cycling power and waiting a few seconds. If the reader still fails to activate, the activation code must be re-entered. To do this, select “Activation ...” from the menu bar on the Main Window of the configuration utility. In the “Reader Activation” window are two items: “Reader ID” which cannot be changed, and “Activation Code” which can. The “Reader ID” is a 16 character hexadecimal number (0 through 9 and A through F). This number is sent out by the reader and should match the “Reader ID” number printed on the reader case. The necessary “Activation Code” is also printed on the reader case. Enter the activation code in the appropriate box in the “Reader Activation” window, and click on “Activate”. If for some reason the activation code on the case becomes unreadable, provide InfoSight with the “Reader ID” number and we can look up the correct activation code.

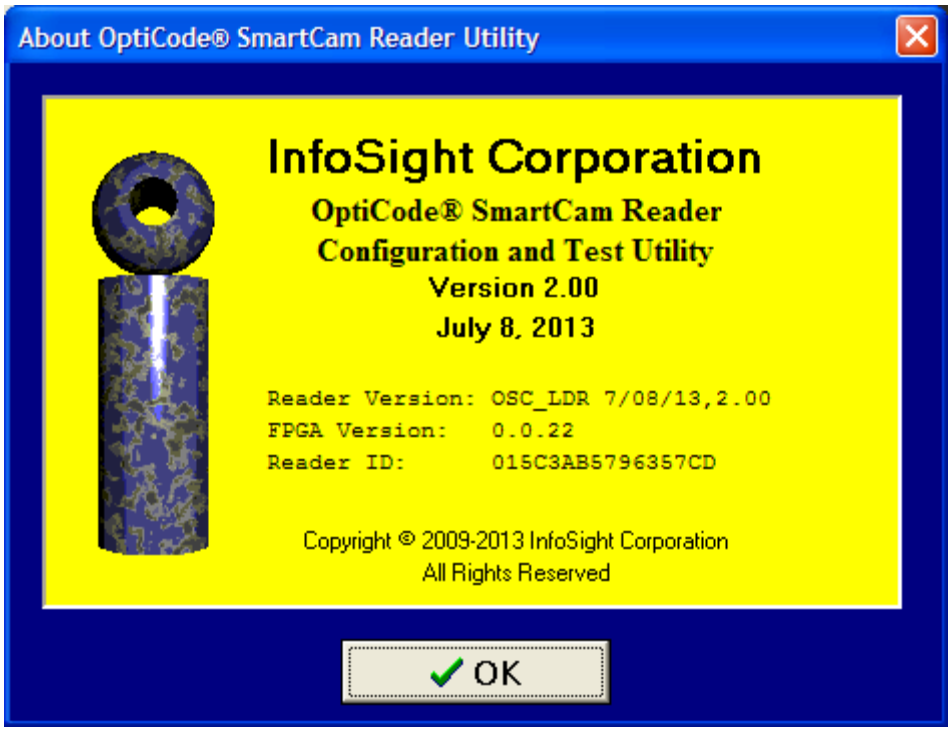
4.5 Configuration Utility – Help-About Window

The Help-About window will display the revision and date information for the Configuration and Test Utility. If the utility is currently communicating with a reader, the window will also display the following information from the reader:

Reader Version: This will indicate a firmware model, date, and revision number.

FPGA Version: A 3-number sequence (separated by decimals) indicating hardware model number, major revision and minor revision.

Reader ID: A 16-character hexadecimal number identifying the specific reader (used to obtain the reader activation code).



Help - About Window

5 MAINTENANCE

5.1 Routine Maintenance

The following should be performed as routine maintenance of the OptiCode Reading System:

1) Clean the lens and camera enclosure window (if applicable). If the lens becomes dirty, clean it as directed by the lens manufacturer. If no manufacturer lens cleaning recommendations are available, we suggest cleaning with Kodak Lens Cleaner and Kodak Lens Cleaning Tissue. **USE OF OTHER CLEANERS MAY DAMAGE THE COATING ON THE LENS.**

2) Check camera/lens adjustment. See "Camera / Lens Adjustment" below.

3) Check lighting: Well-illuminated barcodes are a key to robust operation of the OptiCode Reader.

5.2 Calibration

5.2.1 OptiCode Reader Electronics Calibration:

The OptiCode Smart-Camera Reader electronics requires no calibration. There are some adjustments that can be made using the "Configuration Utility" that can improve reader functionality. Refer to section "4 CONFIGURATION UTILITY". There are also some dip-switches that need to be set for your specific application. Refer to "APPENDIX A – HARDWARE CONFIGURATION".

5.2.2 Camera / Lens Adjustment:

1) The main adjustments that affect the reader's ability to read a barcode are adjustments of the camera and lens.
2) Make sure a valid barcode is at the reading location. The barcode should be well lighted and oriented horizontally if possible (or oriented in a position compatible with the scan-mode ... see "APPENDIX A – HARDWARE CONFIGURATION" for dip-switch settings for scan-mode). Adjust the camera enclosure so the barcode is centered on the video screen.
3) If you have a zoom lens, adjust the lens so the barcode fills at least 1/2 of the screen horizontally.
4) Focus the lens.
5) Adjust the f-stop for a reasonably illuminated image on the video screen.
6) The reader should be reading the barcode at this time. The status line on the video screen (near the top) will indicate numbers indicating how well the reader is reading. The number farthest to the right indicates percentages of good reads (the larger the number the better). The larger the f-stop setting (less light), the more depth-of-field. Increasing the depth of field will allow the reader to read barcodes that may be a little closer or farther away from the focal point. The idea here is to increase the f-stop setting as far as possible, while still allowing enough light to get to the camera to reliably read the barcode. As you can see, the brighter the lighting of the barcode, the higher the f-stop setting may be, resulting in a greater depth-of-field.
7) The only other adjustment to the camera to consider is a possible increase or decrease in electronic shutter speed. If there is too much barcode or camera movement to read barcodes, an increase in shutter speed could be necessary, however it should be noted that the faster the electronic shutter is set, the more

light required to read barcodes. Refer to "APPENDIX A – HARDWARE CONFIGURATION" for dip-switch selection of shutter speed.

5.2.3 Lighting Adjustment:

If you have installed adjustable lighting, adjust the lighting for maximum illumination of the barcodes. If a spotlight is used, point the spotlight so that the barcode is centered in the spotlight beam.

6 TROUBLESHOOTING

Problem: A barcode is displayed on the monitor, but the reader cannot read it, or the reader can barely read it.

Solution(s): There are several things that may cause the reader to be unable to read a barcode well:

1) The lens (or the glass window protecting the lens) may be dirty.
2) The lens may be out of focus.
3) The lens iris setting (f-stop) may not be set to an optimum light level. If the iris is open too far (particularly while viewing barcodes at long distances), irregularities in lens optics may not allow the barcode to be adequately focused. For this reason the iris should be adjusted so a slightly dim barcode is viewed on the monitor. Note also that a more open iris reduces the depth-of-field requiring more frequent focus. On the other hand, if the iris is closed too far, there might not be enough light getting to the camera. Experiment to see what iris settings work best.
4) The lighting may not be adequate. Inadequate lighting may result in poor depth-of-field. Be sure the light is turned on and pointed at the barcode.
5) The camera (or barcode) may not be positioned properly. If the barcode is not horizontal in the display, the scan mode may not be set properly. Refer to "APPENDIX A – HARDWARE CONFIGURATION" for dip-switch settings for scan mode. If possible, adjust the camera or barcode so the barcode is centered in the video display.
6) Be sure that the lens zoom setting is adjusted so the barcode fills at least 1/2 of the screen horizontally.
7) The barcode may be damaged or dirty.

8) The barcode may not be within specification (improperly spaced bars, insufficient quiet zones, incorrect check character, wrong number of bars, etc.).

9) The switches on the camera may not be set properly (see "APPENDIX A – HARDWARE CONFIGURATION").

10) The reader might be configured improperly (see section "4 CONFIGURATION UTILITY").

Problem: The reader is not communicating barcode data with the user's PLC or computer. The reader is reading barcodes.

Solution(s):

1) Make sure the reader is being triggered properly (refer to section 3.3 "Triggering the Reader").

2) Verify that "Host" port communications are working. Refer to "APPENDIX B – COMMUNICATIONS".

3) If using Modbus communications, be sure the reader's Modbus address (indicated on the video display – upper right, second line down) is set to the address expected by the PLC or computer. The reader's Modbus address (reader communications address) is set using the dip-switch group labeled "SW3". Refer to "APPENDIX A – HARDWARE CONFIGURATION" for more on setting the reader communications address.

4) Make sure that the "Barcode Output" settings are correct (see section "4 CONFIGURATION UTILITY". Note that if "Polled" is used as the "Output Method", your PLC or computer must "poll" the reader for barcode data using either Modbus or InfoSight Extended Protocol. Refer to "APPENDIX B – COMMUNICATIONS".

Problem: The reader will not "trigger".

Solution(s):

1) The reader must be in manual trigger mode to trigger the reader. Verify that the text in the upper-right of the video display indicates "MANUAL" and not "AUTO". Trigger mode is set to "MANUAL" by setting dip-switch SW4-2 to "OFF". See "APPENDIX A – HARDWARE CONFIGURATION" for more on setting the dip-switches. See also section "3.3 Triggering the Reader".

2) If triggering the reader using I/O, verify that either the "READ BARCODE" or "EDGE TRIGGER" inputs are connected as specified and working properly. See "APPENDIX A – HARDWARE CONFIGURATION".

3) If triggering the reader serially, verify that the "Host" port is connected and that "Host" port communications are working. Refer to "APPENDIX A – HARDWARE CONFIGURATION" and "APPENDIX B – COMMUNICATIONS".

Problem: No video on the display.

Solution(s): Refer to the drawings for your system.

1) Check the camera wiring (Refer to section "2 INSTALLATION").
2) Check the BNC video cable running from the BNC labeled "VIDEO OUT" on the back of the camera (reader) to the "VIDEO IN" connector of the monitor.
3) Make certain that the monitor is turned on and that the Contrast and Brightness controls are turned up sufficiently.
4) Make sure the 5VDC power supply is plugged into an active AC power source, and that the power supply is connected to the jack in the back of the camera (reader) labeled "POWER 5VDC".

Problem: There is text visible on the monitor, but there is no video image from the camera.

Solution(s): The presence of text on the monitor indicates that the reader is probably working, but the image is being blocked.

1) Make sure a lens cap is not covering the lens and that the camera / lens is not obstructed.
2) Make certain that the lens iris (f-stop) is open to allow sufficient light to the camera.
3) Make sure that the barcode is illuminated.

APPENDIX A – HARDWARE CONFIGURATION

Rear-Panel Connectors

The following electrical connectors are provided on the rear-panel of the reader:

"HOST" DB-9P Connector: Serial interface connector for barcode data output and other reader control functions. This connector provides an interface for both RS-232 and RS-485. For RS-232, accepts a "null-modem" cable. Refer to "Dip-Switch and Jumper Settings" below to configure this connector for your interface. See also section "2 INSTALLATION" and "APPENDIX B – COMMUNICATIONS".

```
PIN-1       Not used
PIN-2       RS-232 RxD (receive data - input)
PIN-3       RS-232 TxD (transmit data - output)
PIN-4       RS-485 A (requires SW1-1 ON when using RS-485)
PIN-5       Signal Ground (for RS-232, optional for RS-485)
PIN-6       Not used
PIN-7       RS-232 RTS (request to send – output, not used)
PIN-8       RS-232 CTS (clear to send – input, not used)
PIN-9       RS-485 B (requires SW1-2 ON when using RS-485)
```

"LOCAL" Connector: Serial interface connector for local network. Only needed for multi-camera applications. "A" and "B" connections should be made using twisted-pair cable. See also section "2.3 Multi-Camera Installation.

```
PIN-1  "S"        Signal Ground / Shield (optional)
PIN-2  "A"        Local RS-485 A
PIN-3  "B"        Local RS-485 B
```

"POWER 5VDC" Connector: Accepts 2.5mm center-positive DC plug. Power must be regulated 5VDC +/- 0.5V. Power supply must be capable of delivering a minimum of 0.5A.

"VIDEO IN" BNC Connector: Used only in multi-camera applications. Reader video is "daisy-chained" by connecting "VIDEO OUT" from one reader to "VIDEO

IN" of the next. "VIDEO OUT" of last reader goes to monitor. Accepts RG-59 BNC cable. See also section "2.3 Multi-Camera Installation.

"VIDEO OUT" BNC Connector: RS-170 (monochrome) video out. For single-camera applications, connects to monitor. When used in multi-camera applications, reader video is "daisy-chained" by connecting "VIDEO OUT" from one reader to "VIDEO IN" of the next. "VIDEO OUT" of last reader goes to monitor. Accepts RG-59 BNC cable. See also section "2.3 Multi-Camera Installation.

6-Pin "I/O" Connector: Hardware I/O connections (optional). Polarity programmable. See also section "2.5 Connect I/O". See section "4.2.6 Display and Misc. Tab" to change I/O polarity.

PIN-1	"G" Signal Ground
PIN-2	Undefined output, 5VDC, default active high
PIN-3	"NO READ" output, 5VDC, default active high
PIN-4	"GOOD READ" output, 5VDC, default active high
PIN-5	"EDGE TRIGGER" input, 5VDC, default active low (internal 10K ohm pull-up resistor)
PIN-6	"READ BARCODE" input, 5VDC, default active low (internal 10K ohm pull-up resistor)

Dip-Switch and Jumper Settings

All internal dip-switches are located on the CPU board on the top side of camera. The dip-switches are accessible through slots in the top cover plate by removing the top-side mounting plate.

Note: * = Standard factory default setting, may be set differently depending on the application

Dip-Switch SW1 (RS-232 / RS-485 Communications):

SW1-1	Host (Uart 1): ON = RS-485 / *OFF = RS-232
SW1-2	Host (Uart 1): ON = RS-485 / *OFF = RS-232
SW1-3	Host (Uart 1) RS-485 Bias Resistor: *ON/OFF
SW1-4	Host (Uart 1) RS-485 Bias Resistor: *ON/OFF
SW1-5	Host (Uart 1) RS-485 End Termination: *ON/OFF
SW1-6	Local (Uart 2) RS-485 Bias Resistor: *ON/OFF
SW1-7	Local (Uart 2) RS-485 Bias Resistor: *ON/OFF
SW1-8	Local (Uart 2) RS-485 End Termination: *ON/OFF

Note: RS-485 networks are connected in a "daisy-chain" configuration. Normally the bias resistors and end termination are set to "ON" for the devices at each end of the chain. For all other devices in the chain, they are normally set to "OFF". SW1-1 and SW1-2 must be set to "ON" for "Host" RS-485 communications.

Push-Button Switch SW2 (CPU Reset):

This switch is used at the factory for board testing.

Dip-Switch SW3 (Reader Communications Address):

SW3-1 (least significant bit) through SW3-8 (most significant bit) are set as the binary communications address of the reader. This address should be non-zero (at least one switch ON). If Modbus communications are used, the address must be in the range from 1 to 247. The factory default setting is 1 (* SW3-1 ON, all other SW3 switches OFF). Each reader must have a different address. For fastest communications, lower addresses are recommended. The address is shown on the far right of the second line down on the video display.

Dip-Switch SW4 (Reader Settings):

SW4-1 **Multi-Reader:** ON = Master / *OFF = Slave or Single Reader

Note: When "master" is selected, an "M" will be displayed on the left side of the reader address which is located on the top right of the video display, second line down. "Master" refers to the network master of the "LOCAL" RS-485 network in multi-camera applications.

SW4-2 Trigger Mode: ON = Automatic / *OFF = Manual Trigger

SW4-3	SW4-4	SW4-5	Camera Shutter Speed:
OFF	OFF	OFF	1/30 second
ON	OFF	OFF	1/60 second
OFF	ON	OFF	1/120 second *
ON	ON	OFF	1/240 second
OFF	OFF	ON	1/500 second
ON	OFF	ON	1/1000 second
OFF	ON	ON	1/2000 second
ON	ON	ON	Programmable

Note: The electronic camera shutter is needed in order to read barcodes when either the barcode or the camera are moving. The faster the movement (and the finer the barcode bars), the faster the required camera shutter speed. A faster shutter speed requires more light. If the barcode and camera are to be stationary during the read time, a lower shutter speed may be used (1/30 or 1/60 second). If a shutter speed faster than 1/120 second is used, the lighting must NOT be fluorescent or stroboscopic "banding" will occur reducing readability. The newer CFLs (compact fluorescent lamps) may be used since these operate at much higher frequencies. For a broader range of available shutter speeds including faster and slower settings, use the "Programmable" option along with the Configuration Utility. See section "4.2.5 Camera(s) Tab" for more on setting the "Programmable" shutter speed and for information on "Automatic Shutter Control" (ASC).

SW4-6	SW4-7	SW4-8	Scan Mode:
OFF	OFF	OFF	Horizontal
ON	OFF	OFF	90° omni-directional
OFF	ON	OFF	20° omni-directional
ON	ON	OFF	10° omni-directional *
OFF	OFF	ON	5° omni-directional
ON	OFF	ON	2.5° omni-directional
OFF	ON	ON	Near Horizontal
ON	ON	ON	Reserved for future use

Notes:

1) For omni-directional scanning, the shorter the bars relative to the width of the barcode, the finer the required omni-directional mode (2.5° is the finest). The finer the mode, the slower the frame capture rate of the reader. Care must be taken that too low of a frame capture rate is not used when the camera or barcode is moving, or a barcode could be missed. The frame capture rate (frames-per-second) for each scan mode is listed in "APPENDIX C – SPECIFICATIONS".

2) Near Horizontal mode is used to improve read rates for low aspect-ratio barcodes (bars short relative to barcode width) that are always read horizontally (such as ink-sprayed barcodes on pipes).

Jumper J1 (Bell Enable):

This jumper is normally *ON to enable the bell (audible read indicator), since the bell may be turned off with the reader configuration software.

Note: * = Standard factory default setting, may be set differently depending on the application

APPENDIX B – COMMUNICATIONS

"Host" Port RS-232 / RS-485 Communications

The "Host" port (Uart 1) RS-232 / RS-485 communications are pre-set at the factory for 9600 baud, 8 data bits, 1 stop bit and no parity. The "Host" connector is a DB-9P connector (wired as DTE) and requires a cable with a DB-9S plug. For RS-232 "Host" connections of fewer than 15 feet, a NULL-modem cable is provided. It is recommended that RS-232 cable lengths be limited to 150 feet or less. For longer lengths, it is recommended that RS-485 (included) or an RS-232 Current-Loop adapter (not included) be used. If the reader is to communicate with a PC, an optional Ethernet/USB adapter is available.

For "Host" RS-232 communications, the following signals must be connected:

- RxD in "Host" Pin 2
- TxD out "Host" Pin 3
- GND "Host" Pin 5

In addition, for "Host" RS-232 communications, dip-switches SW1-1 and SW1-2 should be set to "OFF".

For "Host" RS-485 communications, the following signals are connected:

- RS-485 "A" "Host" Pin 4
- RS-485 "B" "Host" Pin 9
- Shield (optional) "Host" Pin 5

In addition, for "Host" RS-485 communications, dip-switches SW1-1 and SW1-2 must be set to "ON". Refer to "APPENDIX A – HARDWARE CONFIGURATION" for other SW1 dip-switch settings relating to "Host" RS-485 bias and termination resistors.

Barcode Data Output

Refer to sections "3.3 Triggering the Reader (AUTO / MANUAL)" and "4.2.4 "Trigger Options" Tab". Barcode data is ready for output in one of two ways depending on the trigger mode:

1) When the trigger mode is “MANUAL”, barcode data is ready when the reader reads a barcode and is currently triggered and is in the “READING...” state. Note that in “MANUAL” mode, if a trigger condition ends without the reader having read a barcode, the string “NO READ” will be set as the barcode data.

2) When the trigger mode is “AUTO”, barcode data is ready when the reader reads a new barcode.

Refer to section 4.2.2 “Barcode Output” Tab. Barcode data is output in one of three ways depending on the method selected by “Output Method” in the Reader Configuration Utility:

1) If “No Protocol” is selected as the Output Method (normally the factory default), the barcode data will be transmitted out the “Host” port immediately. The data may be preceded by one or two characters selectable using the “Prefix 1” and “Prefix 2” options in the Configuration Utility. The data may be followed by one or two characters selectable using the “Suffix 1” and “Suffix 2” options in the Configuration Utility. Unless changed for your specific application, the factory default settings are for no prefixes, and for “Suffix 1” set to “CR” (carriage return) and “Suffix 2” set to “LF” (line feed).

2) If “Polled (Extended Protocol or Modbus)” is selected as the Output Method, the barcode data will not be transmitted until a master (client) device sends a barcode data request message to the reader (slave/server). Refer to “InfoSight Extended Protocol Communications” or “Modbus Communications” below for details on how to “poll” the reader depending on which protocol you are using.

3) If “Extended Protocol” is selected as the Output Method, a “Barcode Data” message (type 'B') will be sent out the “Host” port when barcode data is ready for output.

InfoSight Extended Protocol Communications

To trigger the reader, request and transfer barcode data, and to verify communications; a communications protocol, InfoSight Extended Protocol may be used. InfoSight Extended Protocol should only be used if the “Host” port is connected to a single device and is not part of a network. If the “Host” port is connected to a network (such as RS-485) that has multiple slave (server) devices, Modbus communications should be used. See “Modbus Communications” below.

For InfoSight Extended Protocol communications, the reader is the slave and transmits only in response to messages from the master with a few exceptions:

1) The reader will transmit barcode data without protocol if the “Output Method” is set to “No Protocol”. See “Barcode Data Output” above.
2) If the “Output Method” is set to “Extended Protocol”, the reader will transmit barcode data (to the “Host”) wrapped in an Extended Protocol message (type 'B') and expect a response (acknowledge message) from the “Host”. If no acknowledge (ACK) message is received within ½ second, the reader will re-send the message up to a total of three attempts. See “Barcode Data Output” above.
3) When running the configuration utility, the reader will source several messages in order to pass current configuration information to the PC running the utility (type 'c' messages). Because of this, when re-configuring the reader, it is best to disconnect the reader from the downstream device that receives barcode data.

Note: All transmissions are in standard ASCII utilizing the following control characters:

Character	Definition	Hex	Decimal
SOH	Start of Header	0x01	1
STX	Start of Text	0x02	2
ETX	End of Text	0x03	3
CR	Carriage Return	0x0D	13
ACK	Acknowlege	0x06	6
NAK	Negative ACK	0x15	21
DLE	Data Link Escape	0x10	16

Master Data Format

SOH TYPE STX [DATA TEXT] ETX [BCC] CR

Where,

TYPE - A single printable ASCII character that defines the meaning and the contents of the message [DATA TEXT] field. Message types may be custom defined for certain applications as required. Standard message types are defined later.

[DATA TEXT] - An optional field which contains the actual data of the transmission. Some message types require no data since the "message" is conveyed by the TYPE character. This field may contain up to 400 characters. This field may contain ASCII control characters; however if SOH, ETX or DLE need to be included

in the text, they are preceded by the DLE character to indicate that they are part of the data text field and not packet control characters.

BCC - This is an optional field used to improve link reliability by providing fault detection. The BCC is a modulo-256 checksum of the TYPE and DATA TEXT characters. The BCC is transmitted as a three digit ASCII decimal number in the range 000 to 255. Refer to "BCC Computation Example" below.

Slave Data Format (response)

The slave (reader) will respond to the master's transmission in one of two ways depending on whether errors were detected or not.

```
SOH  TYPE  ACK  STX  [DATA TEXT]  ETX  BCC  CR

                  or

SOH  TYPE  NAK  STX  [DATA TEXT]  ETX  BCC  CR
```

If no errors were detected in the reception of the packet, then the first response will be sent back to the master. If any errors were detected (e.g. Parity, Framing, Overrun, BCC, Format, etc.) then the second (NAK) message will be sent. Note that the ACK message does not necessarily imply that the DATA TEXT field itself is correctly presented, just that no communications errors occurred.

The TYPE character will always be the same as the received TYPE.

The DATA TEXT field is optional and depends on the message TYPE. The BCC field will always be present in the response.

Retries

If the host does not receive a response from the reader within three seconds, or it receives a NAK response, it should retransmit the entire packet. If, after three retries (four tries total), the host has not received a response, the host should declare the link to be "down".

Extended Protocol messages sent from the "Host" to the reader:

Type 'B', data text "?"

This is a request for barcode data from the "Host". This message is normally used if "Polled" has been configured as the "Output Method". See "Barcode Data Output" above. This is normally sent after a "GOOD READ" output has been detected either by monitoring the 5VDC output signal or by reading the

I/O through the “Host” port (see message type 'I' below). The reader will respond with barcode data in the data text field of the acknowledge message.

The message from the “Host”:

SOH B STX ? ETX 129 CR

A typical response from the reader might be:

SOH B ACK STX 123456789206 ETX 183 CR

Type 'I', no data text

This is a request for I/O status. The reader will respond (in the acknowledge message) with a three digit decimal encoding of an 8-bit number with bits defined as 1 being active. The bit positions are assigned as follows:

Bit 0: “Trigger Active” *
Bit 1: “EDGE TRIGGER” input
Bit 2: “GOOD READ” output
Bit 3: “NO READ” output
Bit 4: “UNDEFINED” output
Bits 5-7: Not currently used

* Bit 0 “Trigger Active” is active if the “READ BARCODE” input is active, if the reader is currently triggered with a serial trigger (see types 'S', 'T' and 'U' below) or if a timed trigger (serial or edge-trigger) is currently active.

The message from the “Host”:

SOH I STX ETX 073 CR

A typical response from the reader might be:

SOH I ACK STX 005 ETX 222 CR

Type 'S', no data text

This initiates an un-timed trigger of the reader. The reader should be in "MANUAL" trigger mode. The trigger condition will remain active until either a barcode is read or an un-trigger message is received (see type 'U' below). See "3.3 Triggering the Reader (AUTO / MANUAL)".

The message from the "Host":

SOH S STX ETX 083 CR

The response from the reader:

SOH S ACK STX ETX 083 CR

Type 'T', no data text

This initiates a timed trigger of the reader. The reader should be in "MANUAL" trigger mode. The trigger condition will remain active until a barcode is read, a timeout occurs (set using the Configuration Utility) or an un-trigger message is received (see type 'U' below). See "3.3 Triggering the Reader (AUTO / MANUAL)".

The message from the "Host":

SOH T STX ETX 084 CR

The response from the reader:

SOH T ACK STX ETX 084 CR

Type 'U', no data text

This is the command to un-trigger the reader. This command will deactivate both an un-timed and a timed trigger (see types 'S' and 'T' above). This command will have no effect if the "READ BARCODE" input is active. See "3.3 Triggering the Reader (AUTO / MANUAL)".

The message from the "Host":

SOH U STX ETX 085 CR

The response from the reader:

SOH U ACK STX ETX 085 CR

Type 'V', no data text

This is a request for the reader firmware version. The reader will respond (in the acknowledge message) with a string containing firmware model, firmware version number, firmware date, FPGA version number, and reader ID number. This message type is often used to verify that communications with the reader are active.

The message from the "Host":

SOH V STX ETX 086 CR

A typical response from the reader might be:

SOH V ACK STX OSC_LDR 9/22/09,0.10 Beta CR FPGA v0.0.07 CR ID 01108C441286C921 ETX 122 CR

The DATA TEXT field in the above response contains three strings separated by carriage-returns (CR):

"OSC_LDR 9/22/09,0.10 Beta" (Reader firmware version and date)
"FPGA v0.0.07" (FPGA model and version)
"ID 01108C441286C921" (Reader ID)

Other message types

There are other Extended Protocol message types such as those used by the configuration utility that are for internal use only and are not documented.

Extended Protocol messages sent from the reader to the "Host":

Type 'B', data text contains barcode data or "NO READ"

This message is only sent if "Extended Protocol" has been configured as the "Output Method". See "Barcode Data Output" above.

A typical message from the reader containing barcode data:

SOH B STX 123456789206 ETX 183 CR

The response from the "Host" should be:

SOH B ACK STX ETX 066 CR

BCC Computation Example

The following examples show BCC checksum calculation for both a barcode data request message (type ‘B’), and a typical response including barcode data.

To request barcode data from the reader, the following message is sent:

```
SOH    B    STX    ?    ETX    129    CR
```

The BCC is calculated as follows (note all math shown in hexadecimal):

1) First add the ASCII values for the message type (‘B’) and every character in the data text field (“?”):

```
          042H          B       - Message Type
+         03fH          ?       - Data Text
_____________
          081H
```

2) We are only interested in the lower eight bits of the sum (modulo-256), so we only keep the lower two hexadecimal digits. This results in a BCC of 081H. Note that when performing the summation in an eight bit variable (e.g. unsigned char in 'C') that the most significant bits are automatically truncated. If the master's programming language is incapable of doing eight bit addition, then the same result can be obtained by taking the MODULO 256 operation on a sixteen bit sum. The MODULO operation is division where the Remainder is kept and the Quotient is discarded.

3) Once the BCC value is obtained, it must be placed into the message packet after the ETX character. The BCC must be transmitted in its decimal ASCII form. The decimal equivalent of the hexadecimal value 081H is 129 decimal. Converting the value 129 into three ASCII characters yields 031H, 032H and 039H. These three characters become the transmitted BCC.

The actual ASCII data transmitted (shown in hex) by the host for this message is:

001H 042H 002H 03fH 003H

031H 032H 039H 00DH

If the reader receives the message correctly, it will respond with a message such as:

SOH B ACK STX 123456789206 ETX 183 CR

The BCC for this response packet is calculated as follows:

```
          042H            B       - Message Type
+         031H            1       - Data Text
+         032H            2       - Data Text
+         033H            3       - Data Text
+         034H            4       - Data Text
+         035H            5       - Data Text
+         036H            6       - Data Text
+         037H            7       - Data Text
+         038H            8       - Data Text
+         039H            9       - Data Text
+         032H            2       - Data Text
+         030H            0       - Data Text
+         036H            6       - Data Text
_________________
          2b7H     Sum before applying modulo-256
```

Modulo-256 checksum (drop all but least-significant 2 hexadecimal digits:

BCC = 0b7H (hexadecimal) = 183 (decimal)

Modbus Communications

The OptiCode Reader is programmed to be a Modbus slave (server). To use Modbus communications, the reader must be set with a unique Modbus address in the range of 1 to 247. Also, if the reader is part of a multi-camera configuration, each reader must have a unique address. The reader address is set using the group of dip-switches labeled "SW3" (SW3-1 through SW3-8). Refer to "APPENDIX A – HARDWARE CONFIGURATION". The reader address is visible on the video screen (upper right, second line down).

Modbus communications are in Modbus ASCII mode.

Refer to the Modbus specification document "Modbus Application Protocol Specification" available at www.Modbus-IDA.org for further details.

Modbus Register Mapping

NOTE: Modbus inputs, coils and registers are numbered from 1 to n, while they are addressed from 0 to n-1.

DISCRETE INPUTS:

INPUT# (ADDR)	**Description**
01 (ADDR=0)	"Trigger Active" (“READ BARCODE” or other trigger active)
02 (ADDR=1)	“EDGE TRIGGER” (indicates state of reader input)
03 (ADDR=2)	“GOOD READ” (indicates state of reader output)
04 (ADDR=3)	“NO READ” (indicates state of reader output)
05 (ADDR=4)	“UNDEFINED OUTPUT” (indicates state of reader output)
06 through 16 (ADDR=5 through 15)	Not Used
17 (ADDR=16)	Dip-Switch SW3-1 (currently reader address 8sb)
18 (ADDR=17)	Dip-Switch SW3-2 (currently reader address 7sb)
19 (ADDR=18)	Dip-Switch SW3-3 (currently reader address 6sb)
20 (ADDR=19)	Dip-Switch SW3-4 (currently reader address 5sb)
21 (ADDR=20)	Dip-Switch SW3-5 (currently reader address 4sb)
22 (ADDR=21)	Dip-Switch SW3-6 (currently reader address 3sb)
23 (ADDR=22)	Dip-Switch SW3-7 (currently reader address 2sb)
24 (ADDR=23)	Dip-Switch SW3-8 (currently reader address msb)
25 (ADDR=24)	Dip-Switch SW4-1 (currently multi-camera master/slave)
26 (ADDR=25)	Dip-Switch SW4-2 (currently auto/manual trigger mode)
27 (ADDR=26)	Dip-Switch SW4-3 (currently shutter 3sb)
28 (ADDR=27)	Dip-Switch SW4-4 (currently shutter 2sb)
29 (ADDR=28)	Dip-Switch SW4-5 (currently shutter msb)
30 (ADDR=29)	Dip-Switch SW4-6 (currently scan mode 3sb)
31 (ADDR=30)	Dip-Switch SW4-7 (currently scan mode 2sb)
32 (ADDR=31)	Dip-Switch SW4-8 (currently scan mode msb)

COILS:

COIL# (ADDR)	Description
01 (ADDR=0)	Read Enable, untimed read trigger (on=enable, off=end) This is a manual trigger and requires the trigger mode set to "MANUAL". The "READ BARCODE" I/O input must be off (or disconnected) to use this. Also, when using the "READ BARCODE" I/O input, this coil must be off. This coil is off on power-up.
02 (ADDR=1)	Timed Trigger (on=trigger, off=cancel) This is a manual trigger and requires the trigger mode set to "MANUAL". The "READ BARCODE" I/O input and the "Read Enable" coil (above) must both be off (or disconnected) to use this. This coil turns off automatically (default time = 2 seconds).
03 (ADDR=2)	Not Used (reserved)
04 (ADDR=3)	Restore configuration from EEPROM memory (on=restore, this coil turns off automatically)
05 (ADDR=4)	Restore configuration to factory default values (on=restore, this coil turns off automatically)
06 (ADDR=5)	Restore configuration to user-defined default values (on=restore, this coil turns off automatically)
07 (ADDR=6)	Save configuration to EEPROM Memory (on=save, this coil turns off automatically)
08 (ADDR=7)	Save configuration as user-defined default values (on=save, this coil turns off automatically)

INPUT REGISTERS AND HOLDING REGISTERS:

REG RANGE (ADDR RANGE)	Description
1 to 128 (ADDR 0-127)	(Reserved, Do Not Use)
129 to 256 (ADDR 128-255)	Reader Configuration (Reserved, Do Not Use)
257 to 384 (ADDR 256-383)	Barcode Data (Read Only)
385 to 416 (ADDR 384-415)	Reader Firmware Version (Read Only)
417 (ADDR=416)	Coils (See above for bit order, coil 01 = bit 0, coil 02 = bit 1, etc.)
418 to 448 (ADDR 417-447)	Undefined Coils
449 (ADDR=448)	Discreet Inputs 1-16 (bit 0 == Discreet Input 1, etc.)

450 (ADDR=449)	Discreet Inputs 17-32
	(bit 0 == Discreet Input 17, etc.)
451 to 480 (ADDR 540-479)	Undefined Discreet Inputs

Modbus Function Codes

The OptiCode Reader supports the function codes listed below. Function codes not supported will return an "Illegal Function" exception code (01). Refer to the Modbus specification document "Modbus Application Protocol Specification" available at www.Modbus-IDA.org for details on the message format for the various function codes.

SUPPORTED MODBUS FUNCTION CODES:

CODE (HEX)	**Description**
01 (0x01)	Read Coils
02 (0x02)	Read Discrete Inputs
03 (0x03)	Read Holding Registers
04 (0x04)	Read Input Registers
05 (0x05)	Write Single Coil
06 (0x06)	Write Single Register
07 (0x07)	Read Exception Status (returns 0, no exceptions supported at this time)
08 (0x08)	Diagnostic – Sub-function 0 Return Query Data (no other sub-functions supported)
15 (0x0F)	Write Multiple Coils
16 (0x10)	Write Multiple Registers

APPENDIX C – SPECIFICATIONS

Reader Specifications

- Power In: 5VDC +/- 0.5V, 0.5A
- Operating Temperature: 0°C to +60°C
- Video In/Out: RS-170 (monochrome)
- "Host" (Uart 1) Communications:

  RS-232 / RS-485 (switch selectable)

  Optional Ethernet/USB adapter available (Modbus TCP/IP available)

  9600 Baud, 8 Data Bits, 1 Stop Bit, No Parity (others available on request)

  Protocols:

    InfoSight Extended Protocol

    Modbus ASCII (requires "Polled" barcode output – see below)

    Modbus TCP/IP over Ethernet available with optional adapter

  Barcode Output Protocol Options (change with configuration utility):

    No Protocol, prefix(es) and suffix(es) selectable

    Polled (see "Protocols" above)

    InfoSight Extended (direct output, peer-to-peer communications)

- "Local" (Uart 2) Communications (OptiCode reader "master" to OptiCode reader "slaves"):

  RS-485 (wired with twisted-pair and optional shield)

  115,200 Baud, 8 Data Bits, 1 Stop Bit, No Parity

  Protocol: InfoSight Extended (with modifications, proprietary)

- I/O:

  Inputs (2):

    5VDC, programmable polarity (default active low)

    Internal 10K ohm pull-up resistor provided

    Minimum input pulse width: 20ms

    May be activated with contact closure to GND (0V)

    Standard Inputs: "READ BARCODE", "EDGE TRIGGER"

Outputs (3):

5VDC, programmable polarity (default active high)

Minimum output pulse width: ½ second (500ms)

Standard Outputs: “GOOD READ”, “NO READ”, 1 undefined

I/O Connector, 6-pin (programmable polarity):

Pin 1: “G”, Signal ground (0V)

Pin 2: Undefined output, 5VDC (default active high)

Pin 3: “NO READ” output, 5VDC (default active high)

Pin 4: “GOOD READ” output, 5VDC (default active high)

Pin 5: “EDGE TRIGGER” input, 5VDC (default active low)

Pin 6: “READ BARCODE” input, 5VDC (default active low)

- Image Sensor:

  Monochrome

  Resolution: 1280H x 1024V (pixels)

  Optical format: 1/2-inch

  Shutter:

  Type: Electronic rolling shutter

  Rate: Dip-switch selectable (1/30 to 1/4000 sec. standard)

  Other shutter rates available as required by application

  Frame Rate: 30 fps (frames per second, maximum at full resolution)

  Responsivity: 2.1 V/lux-sec

- Lens Mount: C-Mount (CS-Mount available)

- Barcode Scan Modes (dip-switch selectable):

  Note, frames-per-second may be increased by limiting the scan range of the image array. See section “4.2.5 Camera(s) Tab” for info on setting the scan range.

  Mode 0 Horizontal, 30 fps (fps = frames-per-second)

  Mode 1 90° omni-directional, 15 fps

  Mode 2 20° omni-directional, 10 fps

  Mode 3 10° omni-directional, 7.5 fps

  Mode 4 5° omni-directional, 3.8 fps

  Mode 5 2.5° omni-directional, 2.1 fps

  Mode 6 Near horizontal omni-directional, 15 fps

  Mode 7 Reserved for future use

- Symbologies (Linear):

  Code 128

  Code 39

  Interleaved 2 of 5

  EAN-13 / UPC-A

  NUM913 (InfoSight)

  OC2458 (InfoSight)

  OC6925/OC6925C (InfoSight)

  OC813B3/OC813B3C (InfoSight)

  Other symbologies available on request (contact InfoSight)

5VDC Power-Supply Specifications

- Power In: 100-240VAC, 47-63 Hz., 0.5A
- Power Out: 5VDC, 2A

APPENDIX D – REVISION HISTORY

Manual Revisions

Revision 1.00 12/8/2010

Original manual release

Revision 1.01 2/9/2011

Corrected InfoSight Extended Protocol example response messages where "ACK" was incorrectly shown preceding the message type character instead of immediately after.

Revision 1.02 4/13/2011

Updated 4.2.1 "Barcode(s)" Tab to add "Interleave(OC813B3)" checkbox.

Revision 2.00 7/10/2013

a) Removed "Factory Defaults" from Reader Configuration Window and from the various configuration Tab images.

b) Updated 4.2.5 "Camera(s)" Tab to add ASC (Auto Shutter Control).

c) Updated 4.3 Configuration Utility – Communications Window to include "Scan Range" and "Automatic Shutter Control" along with "Window" settings as those settings that are not passed-through to slaves (requiring them to be set in the slaves using MODBUS ASCII).

d) Updated 4.2.1 "Barcode(s)" Tab, Stacked Codes ... Added Note: If "First Character" is used as the Identifier, this character will not be included in the barcode data output from the reader (beginning with v2.00 firmware). Also added missing description for "Number of Codes in Stack:".

e) Added section 3.6 "Firmware Upgrades" to discuss bootloader which is installed beginning with v2.00 firmware.

f) Added APPENDIX D - REVISION HISTORY

g) Updated APPENDIX B – COMMUNICATIONS – InfoSight Extended Protocol Communications – to indicate that the "DATA TEXT" field may now contain up to 400 characters.

Revision 2.01 2/12/2014

Updated APPENDIX D to include latest firmware revision v2.01

Revision 2.02 7/6/2015

Updated APPENDIX D to include latest firmware revision v2.02

OptiCode® Smart-Camera Firmware Revisions

v1.00 ***3/16/2011***

Original firmware release

v1.01 ***4/27/2011***

1. Added interleave option to OC813B3
2. Minor bug fixes

v1.02 ***6/20/2011***

Minor bug fixes

v1.03 ***8/29/2011***

Corrected an overflow problem with "Timed Trigger Timeout" (changed a byte to an integer)

v1.04 ***1/3/2012***

1. Corrected another problem with "Timed Trigger Timeout" where the setting did not work above 25 ½ seconds. It now works to the configuration maximum setting of 100 seconds.
2. Fixed a problem with RS485 HOST communications timing.

v2.00 ***7/8/2013***

1. Added a bootloader to allow future firmware upgrades by customers without the use of programming hardware.
2. Automatic Shutter Control (ASC) added (enabled by configuration utility). Use of this feature requires an upgrade to the v2.00 Configuration Utility.
3. Slight change to "Level Scanning" to guarantee the "Scan Max" value is used.
4. Maximum Extended Protocol data size increased from 350 to 400 to accommodate the additional configuration settings.
5. Changed a (currently unused) feature of "Stacked Codes" where if the first character of the barcode is used as the identifier, that character is omitted from the data output since it is used as an identifier and not data.
6. Corrected a problem with "Stacked Codes" when used with automatic triggering.

v2.01 ***10/30/2013***

Corrected an error in multi-camera mode where a slave could send stale data from the previous read when triggered for a new read.

v2.02 ***7/2/2015***

Added support for 5 code-character OC813B3 barcodes (43 bars). Reading of the 5-code-character version of the OC813B3 barcode also requires FPGA firmware version 0.0.23 or greater (requires reprogramming by InfoSight).

OptiCode® Smart-Camera Configuration Utility Revisions

v1.00 ***12/7/2010***

Original software release

v1.01 ***3/16/2011***

Minor bug fixes

v1.02 ***4/13/2011***

Added "Interleave" option for OC813B3 barcode.

v1.03 ***6/19/2012***

Corrected an overflow problem with "Timed Trigger Timeout"

v1.04 ***10/11/2012***

Corrected another problem with "Timed Trigger Timeout" where the setting did not work above 25 ½ seconds. It now works to the configuration maximum setting of 100 seconds.

v1.05 ***2/7/2013***

1. Increased communications timeout from 2 seconds to 10 seconds.
2. Increased Extended Protocol message timeout from ½ second to 3 seconds.
3. Increased Modbus message timeout from 1 second to 3 seconds.
4. Decreased rate at which I/O requests are sent to the reader to avoid too much traffic when communicating over a network.
5. Eliminated check of COM port list where application tried to open (then close) each port in the list to see if it was available. This created very long delays with virtual COM ports using Ethernet adapters when they were not present on the network.
6. COM Error message box now is displayed on failure to connect when the port is selected instead of when the Communications Dialog is exited.

v2.00 ***7/8/2013***

Release to correspond with reader firmware major revision v2.00

1. ASC (Auto Shutter Control) settings added to "Camera(s)" tab.
2. Maximum Extended Protocol data size increased to 400 to accommodate additional configuration settings.