SCS
INSTASCAN® SCANNER
MODEL S416
OPERATIONS MANUAL

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This document represents a version 100199-2 of the Operations Manual. As a result, some items described herein may not currently be available.

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CHAPTER 1
INTRODUCTION

The S16 InstaScan scanners and the Dura-labels developed by SCS are state-of-the-art data gathering and inspection systems that combine sophisticated Interactive Identification technology in a compact form factor. This unique synergy allows our system to integrate seamlessly into — and significantly increase productivity for — a wide range of applications and environments.

This system consists of the following components:

> A scanner that writes information to and reads information from Dura-labels using a read/write head (antenna). The scanner conforms to FCC Part 15 specifications and can operate with one to six externally connected antennas.

> Dura-labels that contain information programmed by the scanner. These tags are designed to store information under extremely harsh environments without requiring a battery, and the read/write Dura-labels can store a permanent record of multiple events and transactions.

Communications between the InstaScan scanner and Dura-label are conducted using a revolutionary two-way technology that provides superior advantages over conventional communication methods. The specific data being communicated, and the amount of interaction you have with the scanner and Dura-label, are determined by your application.

Advantages

Data-gathering systems such as bar code readers and conventional radio frequency identification products use one-way communication: a sensor reads information from a device, without any interaction between the two devices.

Moreover, bar code systems are subject to line-of-sight limitations. As a result, airborne contaminants such as dust, dirt, oil, and mist, as well as label damage and objects residing outside the line of sight, result in inefficient and erroneous results.

The SCS Interactive Identification system overcomes these restrictions by using state-of-the-art technology. This technology allows the InstaScan and Dura-label to conduct ongoing two-way communications that are not restricted by line-of-sight constraints.
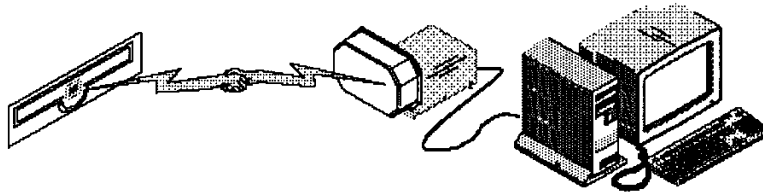
Figure 1. Interactive Identification Technology

This unique capability allows:

> Collective or selective data to be read from a single Dura-label.

> Collective or selective data to be read from multiple Dura-labels without requiring sorting or unpacking.

> Data to be written into a Dura-label.

> Classes of Dura-labels to be filtered according to user-defined criteria.

This technology employs a superior interrogation feature that enables applications to uniquely identify all Dura-labels in the scan field, without misidentification or identifying the same Dura-label multiple times.

Its technology also uses a robust protocol that maintains a uniform per-Dura-label scan time, regardless of the number of Dura-labels in the scan field. The protocol provides a flexible software application interface that can be customized to the specific needs of particular industries and markets.

These unparalleled capabilities make our system an ideal solution for logistics and warehousing, automatic sortation, pallet tracking, and anti-diversion/anti-counterfeiting applications.

S416 InstaScan Scanner

The S416 scanner supports up to six external antennas. Each antenna connects to its own co-axial connector on the front panel of the scanner.

This scanner is ideal for applications where Dura-labels are placed in various orientations.
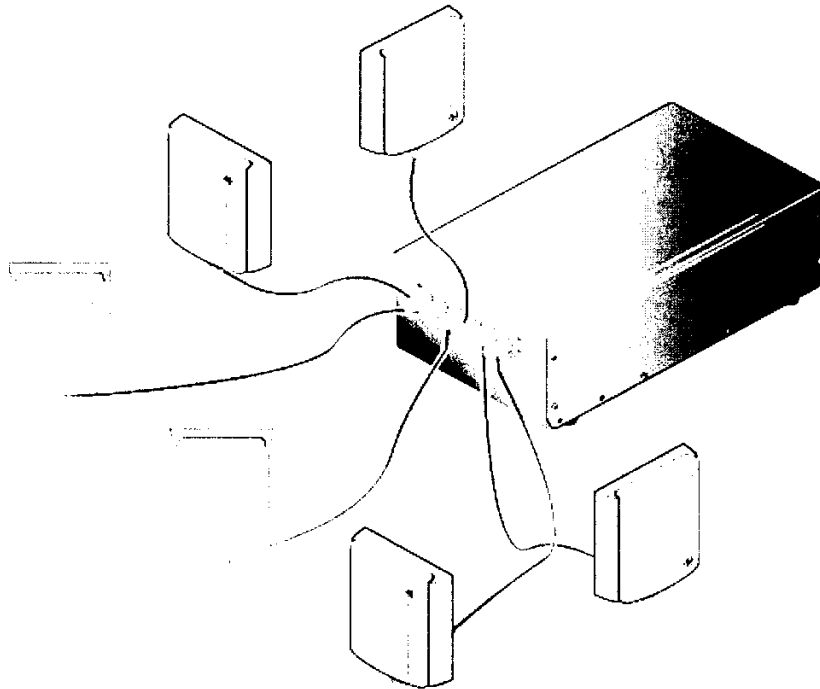
Figure 2. S416 InstaScan Scanner

Package Contents

The following items are included in your package:

>One Sf16 InstaScan Scanner

>One or more external antenna(s) and matching number of RF Cables

>Power Cord (U.S. customers only)

>RS-232 serial cable

>A Diagnostic Label

>The SCS Software Development Diskette

>A SCS API Manual

>This Operations Manual

Please verify that you have received all of these items. If any item is missing or damaged, contact SCS as soon as possible.

What Else You Need

To complete your system, you need an IBM or compatible personal computer with the following *minimum* system requirements:

486 processor or better

Compatible screen and keyboard

9-pin RS-232 port

Windows users: 8 MB of RAM (12 MB recommended)
DOS users: 8 MB of RAM

MS-DOS version 3.3 or higher

OR

Windows 95, Windows CE

The applications you use to interface with your system may have additional hardware and software requirements. For more information, consult the manual that came with your applications.

Conventions in This Manual

This Operations Manual uses the following conventions:

>   Steps you are to perform are numbered. Any result that
>   occurs after performing a step appears below the step.

>   Text you are to enter appears in a Courier typeface. The
>   carriage return key (designated as ⏎ on some keyboards) is
>   referred to as the Enter key.

Summary of Chapters

Besides Chapter 1, this Operations Manual contains the following
additional chapters:

>   *Chapter 2, Installation* – describes how to install the scanner
>   and Dura-label(s)

>   *Chapter 3, RF Communication* - provides information on radio
>   frequency (RF) communications

>   *Chapter 4, Troubleshooting* – describes how to identify,
>   resolve, and avoid problems when using the scanner and
>   Dura-label. This chapter also contains Customer Service
>   information and merchandise return instructions

>   *Chapter 5, Specifications* – lists scanner specifications

CHAPTER 2
INSTALLATION

This chapter provides instructions for installing the S416 scanner and Dura-label(s).

LEDs and Connectors

The scanner provides the connectors and LEDs described in the following sections and shown in Figure 3.
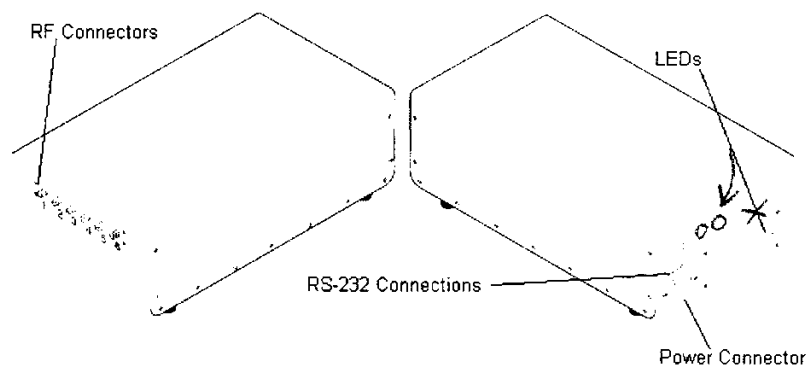
Figure 3. LEDs and Connectors

Rear Panel

The scanner rear panel has three LEDs (as shown in Figure 4) indicating power, activity, and data read status (see Table 1 which describe the meanings of the LEDs).

On LED (Red)

Read LED (Green)

Activity/Error LED (Red)
yellow
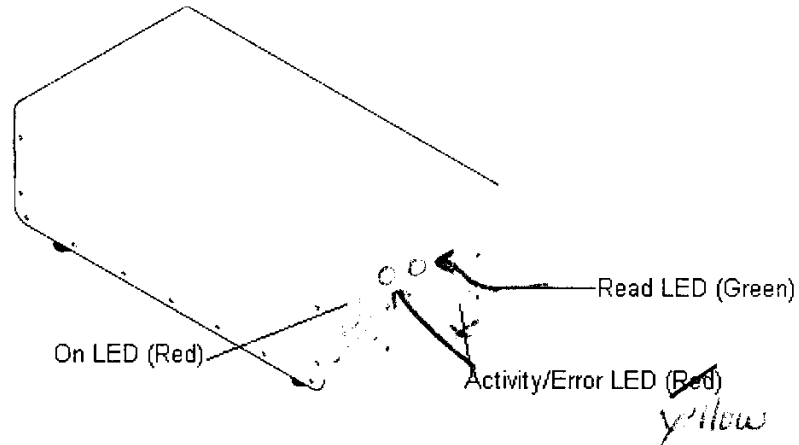
Figure 4. Rear Panel

The scanner rear panel has an On/Off switch with an integral Power ON LED.

> In the ON (up) position, the scanner is turned on. The red Power ON LED (integral to the power switch) should go ON, indicating that the scanner is receiving power.

> In the OFF (down) position, the scanner is turned off and not receiving power, even if connected to a power outlet.

The rear panel also contains two connectors. The lower connector is a standard AC power receptacle. The power cord provided with the scanner should be plugged into this connector and into the wall outlet. For more information, refer to "Connecting to an AC Outlet" on page 17.

The upper connector is the 9-pin RS-232 port. The RS-232 serial port connector allows the scanner to communicate with a personal computer through the PC's serial port. For more information on making this connection, refer to page 16.

Table 1. InstaScan Scanner LED Meanings

LED	Color	Status
Power ON	Red	ON = scanner is turned on and receiving power from an AC outlet.
Activity/Error	~~Red~~ *Yellow*	Flicker = scanner detects Dura-label information. Constant Flickering with no Dura-label in the scanning field = Noisy environment or possible interference, resulting in diminished Dura-label reading.
Read	Green	Blinking = scanner is reading information from the Dura-label

Front Panel

The front panel has six co-axial connectors for connecting external antennas. Note that the scanner can also operate with fewer than six antennas.

For instructions on connecting antennas to the scanner, refer to page 15.
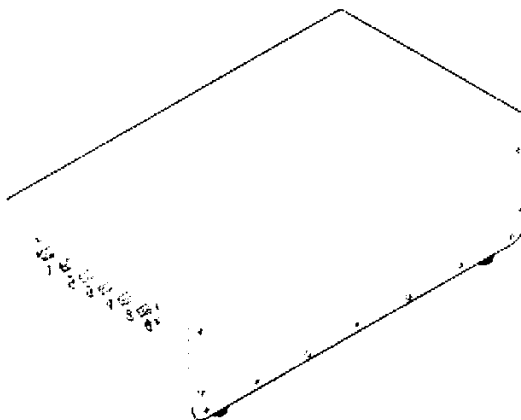
Figure 5. Front Panel

Scanner Installation Steps

The scanner installation consists of the following steps:

1. Position the scanner – locate near desired antenna locations.

2. Connect external antennas – see page 15.

3. Place the antenna for optimum read/write operation – see page 15.

4. Connect the scanner to a computer serial port – see page 16.

5. Power-up the scanner – see page 17.

6. Configure the scanner - see page 18.

7. Align the scanner – see page 20.

Connecting External Antennas

The front panel has six co-axial antenna connectors. Each connector accommodates a single external antenna. Figure 2 shows the external antenna connections to the scanner.

☝ *The S416 scanner can be used with fewer than six antennas. If using fewer than six antennas, begin connecting antennas from left to right.*

Placing the Antenna

Antenna placement is critical to ensuring that information is written to and read from Dura-labels accurately. Observe the following guidelines when placing the antenna:

> Locate the antenna away from metal objects, microwave ovens, and other devices that may induce radio frequency interference. In addition, make sure there are no metallic surfaces between, or in relative proximity to, the scanner and Dura-label. For additional placement considerations, refer to "RF Communications" on page 26.

> When reading, the scanner should be placed no more than 14 inches from the objects bearing the Dura-labels. When writing, the scanner should be no more than 1 inch from objects bearing the Dura-labels.

☝ *See Application notes on SDK provided with shipment.*

The front of the antenna must be free of obstructions. Otherwise, information may not be written to and read from Dura-labels accurately.

☝ *Dura-labels must reside within the scan field for at least 10 milliseconds for information to be retrieved from them.*

Connecting to a PC Serial Port or RS 232

The scanner has a 9-pin female (DB-9F) RS-232 connector that connects to a serial port or RS-232 connector on an IBM or compatible personal computer. The serial port can operate up to 19,200 baud.

To make this connection, you need:

An appropriately configured serial cable.

One of the following adapters, if your computer's serial port does not have a 9-pin connector:

- A 15-pin to 9-pin adapter, if your computer has a 15-pin serial port connector.

- A 25-pin to 9-pin adapter, if your computer has a 25-pin serial port connector.

These adapters are available from most computer and electronics stores.

Use the following procedure to connect the scanner to your computer's serial port.

1. Attach the male connector on the serial cable to the 9-pin serial connector on the scanner rear panel.

2. Connect the other end of the cable to your computer's serial port. Use an adapter, if appropriate, to make this connection.

Connecting to an AC Outlet

The following procedure describes how to connect the scanner to an AC Outlet.

1. Verify that the On/Off switch on the scanner's rear panel is in the OFF (down) position.
2. Connect the power cord to the AC receptacle in the scanner rear panel.
3. Connect the other end of the power cord to the wall outlet.
4. Set the On/Of switch to the ON (up) position. The Power ON LED light will illuminate.

Configuring the Scanner

Use the following procedure to configure the scanner for communications and verify that the RS-232 connection is operating properly.

1. Insert the supplied Software Development Diskette into an available floppy disk drive.

2. If you are in Microsoft Windows, display an MS-DOS prompt either by exiting to a DOS shell or exiting Windows.

3. At an MS-DOS prompt, switch to the floppy disk drive containing the diskette, If the diskette is in drive A, for example, type the following command at the MS-DOS prompt and press the Enter key:

    A:

4. Type the following command and press Enter:

    cd \tools

5. Type this next command and press Enter:

    CHKLINK if using **COM1** or **CHKLINK /C 2** if using **COM2**

    The following message appears on your computer screen:

    SCANNER/PC LINK OK: VSxx:xx VHxx:xx

    Where **VSxx:xx** is the scanner software version number and **VHxx:xx** is the hardware version number.

    ✋ *If you receive the error message "Problem with scanner/PC link," refer to page 31 for troubleshooting procedures.*

6.   Type the following command and press Enter:

CHKREAD if using **COM1** or **CHKREAD /C 2** if using **COM2**

A running series of zeros appear on your computer screen:

00   type <esc> to stop

.

.

00   type <esc> to stop

7.   Place the supplied Diagnostic Label in front of the antenna. Do not place your finger over the Label. It should glow red when powered. Remove Diagnostic Label from scanner field.

8.   Place an SCS Dura-label into the field. The Activity LED on the scanner flickers and the display changes to a running series of zeroes and ones:

01   type <esc> to stop

.

.

01   type <esc> to stop

This indicates that the scanner is identifying Dura-labels correctly and is ready for operation.

9.   To exit **CHKREAD**, press the Esc key.

Aligning the Scanner

After verifying that the scanner is operating properly, use the following procedure to align the scanner. Aligning the scanner ensures optimal performance.

1. At the DOS prompt, type the following command and press Enter:

   CHKREAD or **CHKREAD /C2** if using **COM2**

   A running series of zeros appear on your computer screen.

2. Hold an SCS Dura-label within the scanning area, at the point where you intend to scan.

3. Adjust the position and orientation of the antenna mounting until the display on your computer screen changes to:

01	**Type <esc> to stop**
.	
.	
01	**Type <esc> to stop**
.	
.	
01	**Type <esc> to stop**

4. To exit **CHKREAD**, press the ESC key.

5. Remove the Software Development diskette from the floppy disk drive.

   This completes the scanner installation procedure.

Installing Dura-labels

Dura-labels have a diminutive form factor that allows them to be installed in areas that cannot accommodate conventional read/write tags. In addition, Dura-labels can communicate with the scanner without having to be in the line-of-sight. This unique combination provides tremendous flexibility when determining a location for placing Dura-labels.

In textile applications, for example, Dura-labels can be inserted into the front tail of a shirt or the waistline of pants using a heat seal patch and a heat press. Because this system does not require line-of-sight scanning, the Dura-label system does not have to be visible to the scanner.

When considering locations for installing Dura-labels, make sure they are within 14 inches of the scanner antenna for at least 10 milliseconds (16 bit word), so data can be read from the Dura-label. Avoid locations where metal or water is present because radio-frequency communication does not penetrate metal and is absorbed by water.

Reading Information from your Dura-labels

Once you have installed your Dura-labels, and have set-up your scanner system, you are ready to begin.

Insert the Software Development Disk into your A: drive. Turn your scanner power on. Type:

cd \tools

Then type the following command:

A: READ_ID /w 2

This will begin the "READ_ID" program which will display the information programmed into Memory Word 2 from the Dura-labels that pass through the scanner field. This memory location contains your Dura-labels' unique serial number or "ID".

This program will continually read the unique serial numbers from any labels that pass within 14 inches of the scanner.

Adding Information to Your Dura-label

Read/write Dura-labels can be written to using the scanner. Each bit of memory is write once, multiple read. Meaning after you have written to a specific bit, it is permanent and cannot be overwritten or erased. To add more data to the Dura-label you must write to a different bit. Another feature included with each of the 58 user words of memory is a Write-Protect bit. This optional bit allows you to protect an entire word (16 bits) after any or all of the bits have been written.

Programming

Using either your own application software or the TAGWRITE.exe software supplied on the Software Development Diskette, users can program 58, 16 bit words of information to read/write Dura-labels. The following instructions are for using the TAGWRITE.exe program.

✍ *See application notes on SDK provided with shipment.*

1. Set-up your scanner and properly connect it to your computer's serial port. Refer to "Connecting to a PC Serial Port" on page 16 for more information.

2. Turn scanner power to ON. Refer to page 17.

3. From Windows screen, access MS-DOS prompt. Insert your Software Diskette Disk, select the A: drive and hit Enter. Type:

    cd \tools

4. Enter the following command:

    Tagwrite then hit Enter.

5. Select *Write*

6. Place a Dura-label in the scanner field. Follow specified directions to select word location and refer to the write application notes provided on the SDK.

7. Choose to enter data in decimal or hexadecimal form

8. Select desired data and hit ENTER.

9. If all information is correct, choose *Yes.*

10. Data will be written and you will receive a confirmation message.

11. To write another label select *Change*, to quit TAGWRITE.exe select *Quit.*

Dura-labels must be written one at a time to ensure proper information transfer.

Page 24

Loading Your Application

After you install the Scanner and Dura-labels according to the instructions in this chapter, you can load your application and begin writing information to and reading information from the Dura-labels. Your application will determine the amount of interaction you have with the scanner and Dura-labels.

☞ *If you will be developing applications designed to interface to your system, refer to Software Development Diskette for programming information.*

CHAPTER 3
RF COMMUNICATIONS

In general, devices that communicate using radio frequencies, such as your system , can be sensitive to signal interference and signal attenuation. This chapter provides tips for optimizing radio-frequency (RF) communications with your scanner and Dura-label.

Topics in this chapter include:

Signal interference — see page 27.

Signal attenuation — see page 28.

Optimizing performance — see page 29.

Signal Interference

Signal interference is RF signals that interfere with the information being exchanged between the Dura-label and the scanner. Signal interference can severely diminish the scanner's ability to write information to and read it from a Dura-label. The Activity/Error LED on the scanner flickers constantly if the scanner detects signal interference.

The source of the interfering signals may be:

- An RF system, such as an RF local-area network (LAN) or another Interactive Identification system, located close to your system.

- Security gates, garage doors, or similar devices that emit RF signals.

- Appliances such as microwave ovens.

The effects of these noise sources are localized and can often be eliminated by relocating the scanner or its antenna.

Your system's communication capabilities are significantly reduced when the noise level perceived by the system exceeds the strength of signals received.

Signal Attenuation/Reflections

Signal attenuation is the loss of signal strength that occurs naturally over distances, but which can also be caused by RF barriers in the signal path.

Examples of such barriers include:

> Enclosed locations that have concrete walls, floors, and ceilings.
>
> Metal surfaces surrounding the antenna or Dura-label.
>
> Water or other fluids surrounding the antenna or Dura-label.

Almost every object (furniture, partitions, and people) in the path of a signal causes some degree of attenuation. The effects can be minimized by careful antenna placement.

The reflection from metal or metallic surfaces behind the Dura-label can also affect signal attenuation. In some cases, this may increase the read distance slightly, while inducing intermittent "dead" spots within the read field that permit little or no communication between the scanner and Dura-label.

Optimizing Performance

While it is not possible to predict how your system will perform in any given environment, observing the following guidelines will help optimize performance in your environments and applications:

Carefully plan the placement of the scanner antenna. The antenna can be extended approximately five feet from the scanner, depending on cable length purchased for the application. If your applications require longer distances, move the scanner to an appropriate location.

☙ *The scanner antenna should never be removed, altered, or modified except by an authorized technician. Any unauthorized antenna modifications can void your warranty.*

Consider the environment's RF characteristics, including construction materials, office plan (closed or open), and the presence of windows and ducting. The RF field pattern, and the reading distance, may be influenced by nearby metal objects, such as appliances, equipment, metal wall framing, and wire coat hangers.

Ensure that the scanner antenna is not pointed directly at fluorescent lighting.

Ensure that objects containing Dura-labels are no more than 14 inches from the antenna and remain in the scan field for at least 10 milliseconds.

To avoid mutual interference when installing more than one Dura-label in the same object, allow a sufficient distance between the Dura-label. The maximum interference occurs when Dura-labels within the same object are within two inches of each other and nearly equidistant from the scanner antenna.

Never apply chemicals to the Dura-label. Certain chemicals, such as alcohol, may have little or no effect at room temperature, but may become corrosive at higher temperatures.

CHAPTER 4
TROUBLESHOOTING

This chapter provides troubleshooting information you can use in the unlikely event you have a problem with your system. Customer Service information and merchandise return instructions are included in this chapter.

Solving Problems

The following table identifies scanner and Dura-label problems and provides suggestions for resolving the problem.

Table 2. Problem Solving

Problem	Probable Cause	Solution
The Power ON LED does not light when you turn on the scanner	The AC outlet may not be working.	Plug another electrical appliance, such as a lamp, into the outlet and turn it on. If the appliance does not work, plug the scanner into a different outlet.
	The AC outlet may be controlled by a wall switch.	Set the wall switch to provide AC power to the outlet, or use an outlet to be controlled by a switch.

Problem	Probable Cause	Solution
The Activity/Error LED does not light hen you configure the scanner.	You may have a faulty Dura-label.	Use your diagnostic label to ensure the LED is working.
	The scanner may be faulty.	Use the CHKLINK and CHKREAD utilities to verify scanner operation (see "Configuring the Scanner" on page 18).
	The Antenna cable may be faulty.	Contact SCS Customer Service (see page 34).
You receive an error message when configuring the scanner.	The scanner may not be turned on.	Verify that the Power ON LED is lit.
	The scanner's serial port connection to your computer may not be secure.	Verify the scanner-to-serial port connection. If you are using a serial port adapter, make sure the adapter connections are secure.
	The Check programs are accessing a different Com Port than the one connected.	Switch the serial cable to Com Port 1 or use the /C option after CHKREAD or CHKLINK to set the Com Port being used.

Problem	Probable Cause	Solution
Information could not be read from the Dura-label.	The Dura-label may be outside of the scanning area. The Dura-label may have passed too quickly past the scanner.	Make sure the Dura-label is no more than 18 inches from the scanner. Make sure the Dura-label is in the scanning area for at least 10 milliseconds.
Same as above, but the Activity/Error LED flickers constantly.	RF Interference is disrupting scanner-to-Dura-label communications.	See "RF Communications" on page 26 for suggestions on improving communications.

Contacting Customer Service

If you encounter a problem using your system that you cannot resolve, contact Customer Service:

Before contacting CUSTOMER SERVICE, please have the following information available:

1. *InstaScan Scanner Information:*

    - InstaScan Model Number

    - Serial Number, located on the bottom of scanner

    - Any modifications made to the scanner or Dura-labels system

    - Location where system is installed

2. *Computer Information:*

    - Computer Brand and Model number

    - Processor speed and available RAM COM Port used

☎ SCS Support (858) 485-9196
8:00 a.m. - 5:00 p.m. PST
Email - techsupport@SCS-Corp.com

Returning Your System

If SCS Customer Service determines you need to return your system for service, the Service Representative will give you a Return Merchandise Authorization (RMA). Write this number on the outside of the box containing the returned system, and on a slip of paper inside the box, so your return can be processed quickly.

Return only your scanner, antenna, cable, and adapter. Do not return accessories, such as the Diagnostic Label or the diskette containing the scanner configuration program.

Follow these steps to return your scanner and accessories for service:

1. Carefully pack your InstaScan Scanner and accessories in the original static-protected bubble wrap and container. If you no longer have the original container, use a protected box.

2. Use filler material to cover the items in the box.

3. Add a note with the RMA number inside the package.

4. Write the RMA number and the word FRAGILE on the outside of the package in large, legible writing.

5. Address the package to: SCS Corporation
                              10905 Technology Place
                              San Diego, CA 92127
   ATTN: RMA # _____ (indicate your RMA number here)

CHAPTER 5
SPECIFICATIONS

SCS Patents

SCS Corporation is currently holding the following patents. There are multiple patents outstanding.

- #4,424,579
- #4,442,507
- #4,933,735
- #5,148,256
- #5,296,722
- #5,407,851
- #5,496,763
- #4,796,074
- #5,095,362
- #5,583,819
- #5,686,341
- #5,856,788
- #5,963,144

Scanner Specifications

LEDs:	One Power ON LED, one Read LED, and one Activity/Error LED
Communication Method:	RS-232
Serial transmission rate:	Up to 19,200 baud
Connector:	One female DB-9F for RS-232 communications
Pin assignments:	Pin 1 – Not used Pin 2 - Transmit Data (Input) Pin 3 - Receive Data (Output) Pin 4 – Not used Pin 5 - Protective Ground Pin 6 – Not used Pin 7 - Not used Pin 8 - Not used Pin 9 - Not used
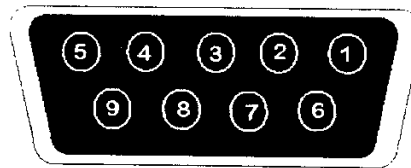
Power jack:	Standard AC power receptacle
Power Consumption:	15 watts (nominal)

Ambient operating temperature:	32° to 122° F (0° to 50° C)
Approved standards:	FCC Part 15
Maximum serial cable length:	30 feet (10 meters)
Dimensions:	4.5" high x 7" wide x 13" deep (11 cm x 18 cm x 33 cm)
Weight:	4.5 lbs. (2 kg)

Limited Warranty

SCS warrants its Dura-label to be free from defects in workmanship and materials, under normal use and service, for a period of ninety (90) days from receipt of products.

SCS warrants its Scanner to be free from defects in workmanship and materials, under normal use and service, for a period of ninety (90) days from date of receipt.

If a product does not operate as warranted during its applicable warranty period, SCS shall, at its option, repair the defective product or deliver to Customer an equivalent product to replace the defective item. All products that are replaced shall become the property of SCS. Replacement products may be new or reconditioned. The warranty for replacement or reconditioned product is the same as the equivalent newly purchased product.

SCS reserves the right to refuse to warranty repair any product that has been subjected to any abnormal electrical, mechanical, or environmental abuse.

FCC Part 15 Compliance

The FCC has established rules that permit the Scanner and Label system to be used within acceptable bounds of radio frequency emissions. Your Scanner and Label system complies with Part 15 of the FCC Rules.

Operation of the Scanner and Label system is subject to the following conditions: This device may not cause harmful interference; This device may accept any interference received, including interference that may cause undesired operation.

This device complies with the limits for a Class B digital device, pursuant to Part 15. The Class B limits help ensure that this device provides reasonable protection against harmful interference in residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions in this manual, may cause harmful interference to radio communications.

Radio Frequency (RF) exposure requirements for operators of this device

Operators of this device must have knowledge of their RF exposure conditions in order for the device to comply with FCC-adopted RF exposure limits for persons in the "controlled exposure environment". The average RF exposure for operators is 5.0 mW/cm², which requires them to maintain an estimated separation distance of 8 cm or 3" from the transmitter, while in operation. They should not remain closer than the suggested distance for any continuous 6 minute interval. Holding "Tags" in front of the transmitter for brief moments, at closer than 3" is allowed provided the average exposure in any 6 minute interval is less than 5.0 mW/cm². For example, if an operator spends 50% of the time with his/her hands or body closer than 3" to the transmitter while spending the other 50% of the time at more than 5" away, the allowed RF exposure limits will be satisfied. Operators should use their own judgment to limit their exposure to the allowed RF exposure limits with control of exposure conditions, separation distance from the transmitter, and duration of exposure. While this device is in operation, nearby persons who have no knowledge of being in the RF fields of this device should be at least 7" away from the transmitter in order for this devise to be compliant with the FCC-adopted RF exposure limits.

Disclaimer

Operation of any radio transmitting equipment, including the Scanner, may interfere with the functionality of inadequately protected medical devices. Consult a physician or the manufacturer of the medical device if you have any questions. Other electronic equipment may also be subject to interference.