CASI-RUSCO...*Security Solutions for the 21st Century*

Model 94x, 97x Proximity Reader Installation Guide

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The customer accepts full maintenance responsibility. (A full scope of software and hardware maintenance contracts are available to the customer.)

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WARNING: This is a Class A product. In a domestic environment, this product may cause radio interference; in which case, the user may be required to take adequate measures.

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Introduction

This manual is an installation guide for the CASI-RUSCO Models 940, 941, 970, 971, 972, and 973 Proximity Perfect Readers. Throughout this guide, the abbreviation 94x represents Reader Models 940 and 941. The abbreviation 97x represents Reader Models 970, 971, 972, and 973.

The 94x and 97x Readers while similar in functionality offer a variety of features making them suitable for different applications. The 94x and 97x Readers are designed to mount on standard U.S. gang boxes. The 94x Readers are single-gang box size. The 97x Readers are sized for larger dual gang box installation, offer greater badge read range, and a keypad option.

Models 940 and 970 give the greatest all-around badge read range for their respective sizes, making them ideal for most installations.

Models 941 and 971 are tuned for installation on metal mounting plates. The standard metal mounting plate shields the reader from the effects of a metal wall, which would otherwise dramatically reduce the read range. The optional back-to-back metal mounting plate shields the reader from the effects of a metal wall and makes the reader unidirectional; ideal for direct back-to-back reader installations.

Models 972 and 973 are dual gang size readers, identical to the 970 and 971 respectively, except for their built-in twelve-position keypad. This feature makes these readers ideal for installations requiring keypad PIN entry in addition to a valid badge read.

Product Features

The CASI-RUSCO Model 94x / 97x Proximity Perfect Reader offers:

- State-of-the-art architecture.
- The ability to read all Proximity Perfect, ProxLite™, and Entrée badges and key tags.
- Proximity Perfect badge read ranges up to 10 inches (254 mm) for 970 Readers and up to 8 inches (203 mm) for 940 Readers (See Table 2 “Read Range by Model Number,” on page 5).
- Field changeable DIP switches allow all 94x and 97x Readers to operate in one of four distinct operating modes: Wiegand, F / 2F, Supervised, and Silent Supervised. Silent Supervised mode is ideal for installations where no audible or visual indication of communication loss with the microcontroller is desired at the reader.

  In the unsupervised modes, the reader communicates with the microcontroller over a unidirectional Wiegand or F / 2F data link that carries Proximity Perfect badge data only.

  In the supervised modes, the reader communicates with the microcontroller over a bidirectional F / 2F data link, that carries the following:

  Proximity Perfect badge data

  Supervision messages

  Exit request and door switch status

  Microcontroller acknowledgments and commands
- Intelligent bidirectional communication between the reader and microcontroller, which can be accomplished up to 5,500 feet.
- Weather-resistant housing for outdoor use.
- Standard 12V operation.
- A clear, logical user interface with three LEDs and a beeper.
- Rugged molded ABS construction with integral backplate.
- Built-in tamper alarm also detects removal from wall.
- External tamper alarm option.
- Tactile keypad (Models 972 and 973 only) for Personal Identification Number (PIN) input.
- Switch selectable beeper enable / disable and volume control.
- UL verified for indoor use only.

Switch Settings

Two banks of four DIP switches located on the back of the reader are used to select the reader power level, operating mode, and beeper sound level.

CAUTION: Power should be removed from the reader while switch settings are changed.

Selecting Reader Power Level

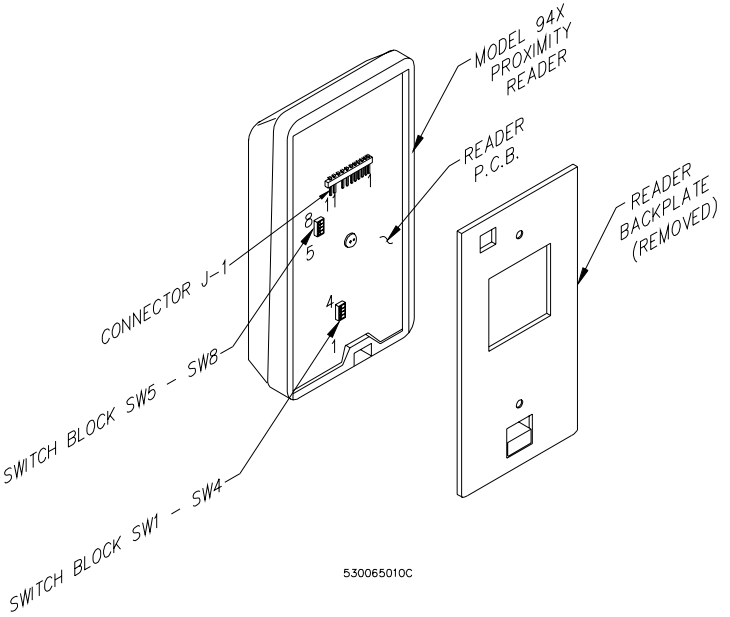
The reader's power requirement is selected using four DIP switches. The optimum power level will vary with each installation. Higher power levels give improved read range for Proximity Perfect badges, while lower power levels allow greater cabling distance between the reader and the microcontroller. A detailed explanation is provided below. The figure on the next page shows the location of the DIP switches. The tables that follow the figure give the switch settings along with the read ranges and cable distances.

Explanation of Read Range/Cable Distance/Power Level:
Maximum badge read range is determined by the distance at which the field transmitted by the reader is just strong enough to *wake up* the badge. Therefore, the higher the reader's transmission power, the greater the badge read range will be. The trade-off for increased read range is a decrease in the maximum cabling distance between the reader and the microcontroller. The trade-off between read range and cabling distance is common to all proximity badge readers. The power selection switches on the 94x/97x readers allow the optimum power setting to be selected to suit individual installations.

For example: On the high power setting, giving the greatest badge read range, the reader typically requires 200mA of supply current from the microcontroller. If there is 1,000 feet of 22-AWG cable between the reader and the microcontroller, the total reader power and power return path is 2,000 feet. Since 22-AWG cable has a typical resistance of 16 ohms per 1,000 feet, the total resistance in the reader's power and power return wire is 32 ohms. By Ohms Law (V=IR), it follows that the total voltage dropped in the reader power and power return wires will be 6.4V (6.4V = 200mA x 32 Ohms). Therefore, the reader supply voltage will drop from 12V at the microcontroller to 5.6V (12V - 6.4V) at the reader. Such a supply voltage is too low for the reader to function reliably.

If the low power setting is selected, the badge read range is reduced. However, the reader now typically requires only 75mA of supply current; therefore, the voltage drop in the power and power return wires is much less. In this case, the reader supply voltage will only be reduced to 9.6V; high enough for reliable operation.

FIGURE 1: Model 94x/97x Reader, J1 Connector and DIP Switch Locations



CAUTION: Power should be removed from the reader while switch settings are changed.

The table below shows the switch settings for each of the three power levels.

TABLE 1: Power Level Switch Settings

Power Level	Switch 1	Switch 2	Switch 3	Switch 4
LOW	OFF	ON	ON	OFF
MEDIUM	ON	OFF	OFF	ON
HIGH	ON	ON	ON	ON

The table below gives the read ranges for each of the readers based on the power level settings. All read ranges are typical maximums.

TABLE 2: Read Range by Model Number

Power Level	970 & 972	971 & 973	940	941
LOW	7 in 178 mm	5 in 127 mm	5 in 127 mm	4 in 102 mm
MEDIUM	9 in 229 mm	6 in 152 mm	7 in 178 mm	5 in 127 mm
HIGH	10 in 254 mm	7 in 178 mm	8 in 203 mm	6 in 152 mm

in = inches
mm = millimeters

The table below gives the maximum cabling distances between the reader and the microcontroller for each of the three power levels.

TABLE 3: Cable Distances

Power Level	13.6 Volts (see Note 1) 18 AWG	22 AWG	12 Volts (see Note 1) 18 AWG	22 AWG
LOW	5500 ft 1676 m	2000 ft 610 m	3500 ft 1067 m	1500 ft 457 m
MEDIUM	2200 ft 671 m	900 ft 274 m	1100 ft 335 m	450 ft 137 m
HIGH	600 ft 183 m	250 ft 76 m	See Note 2	See Note 2

NOTES:

1. **Reader supply voltage measured at microcontroller: 13.6V is nominal when line powered, 12V is nominal when battery powered.**
2. **Not recommended for 12V, battery-backed installations.**
3. **All cable distances are typical maximums.**
4. **Readers powered by a local 12VDC power supply will have a maximum cable distance of 5,500 feet (1676 m) of 22-AWG telephone wire for all power level settings.**

Selecting Operating Mode

The table below shows the DIP switch settings for each of the four operating modes.

TABLE 4: Operating Mode DIP Switch Settings

Operating Mode	Switch 5	Switch 6
Wiegand[1]	OFF	OFF
F/2F[2]	ON	OFF
Supervised F/2F[2]	OFF	ON
Silent supervised F/2F[2]	ON	ON

NOTES:

1. **In the Wiegand operating mode, 2801, 2804, and 3201 Proximity Perfect badge data is sent using 2801, 2804, and 3201 Wiegand format, respectively. Proximity Perfect badge data encoded using the 40-bit format and ProxLite badge data is sent using 40-bit Wiegand format. Keyboard information is sent using 8-bit Wiegand format.**

2. **In operating modes other than Wiegand, Proximity Perfect badge data is sent using a 10-digit F/2F format. Badge data for Proximity Perfect badges encoded using the 40-bit format are sent using a 13-digit F/2F format. All ProxLite badge data is sent using a 12-digit F/2F format.**

Selecting Beeper Sound Level

The table below shows the DIP switch settings for the three beeper sound levels.

TABLE 5: Beeper Sound Level DIP Switch Settings

Beeper Sound Level	Switch 7	Switch 8
Normal	**ON**	**ON**
Low	**ON**	**OFF**
Off	**OFF**	**ON**

Connecting the Reader

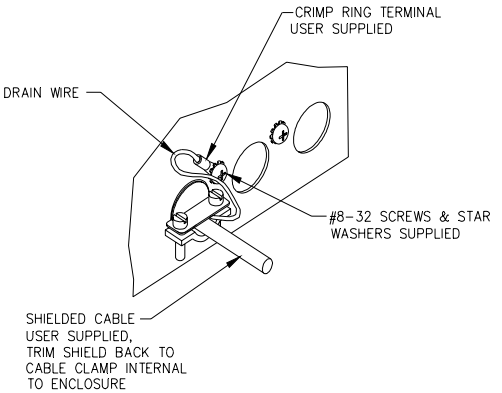
CE/FCC Compliancy

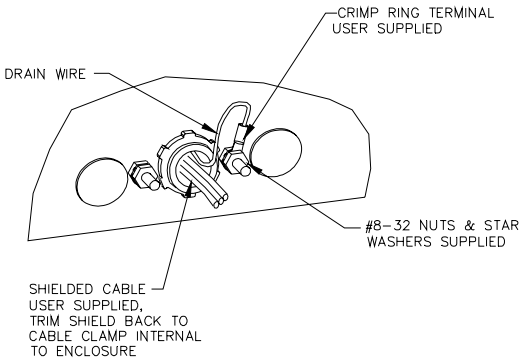
NOTE: As of January 1, 1996, all new European installations MUST be CE compliant.

To make the Model 94x/97x Reader installation CE and FCC compliant, the following condition must be met:

- The cable connecting the model 94x/97x Reader to the Micro/5 must have its shield grounded at the Micro/5 according to Figure 2.

FIGURE 2: Typical Installation Using Shielded Cable/Drain Wire





Manufacturers Declaration of Conformity

(Subject to the conditions on page 8)

Manufacturer's Name:	**CASI-RUSCO**
Manufacturer's Address:	**791 Park of Commerce Boulevard Boca Raton, FL USA 33487**
EU Representative:	**Interlogix Europe & Africa Excelsiorlaan 28 B- 1930 Zaventum Belgium**
Product Identification:	**Product: Proximity Reader Model Number: Model 94x/97x Brand: CASI-RUSCO**
Means of Conformity:	• **Hereby, CASI-RUSCO, declares that this equipment is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.** • **Hierbij verklaart CASI-RUSCO dat het apparoat in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 1999/5/EG.** • **Par la présente CASI-RUSCO déclare que l'appareil est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 1999/5/CE.** • **Hiermit erklärt CASI-RUSCO, dass sich diese auspüstung in Übereinstimmung mit den grundlegenden Anforderungen und den anderen relevanten Vorschriften der Richtlinie 1999/5/EG befindet". (BMWi)**
Notices:	**Approved for use in the following countries:** **A, B, CZ, DK, FIN, F, D, GR, H, IS, IRL, I, LU, NL, N, PL, P, E, S, CH, GB**

Pinouts

The table below shows the pinouts for connecting the reader to the microcontroller. Connector J1, pin 1 is to the right as you view the connector from behind the reader. See Figure 1, “Model 94x / 97x Reader, J1 Connector and DIP Switch Locations,” on page 4.

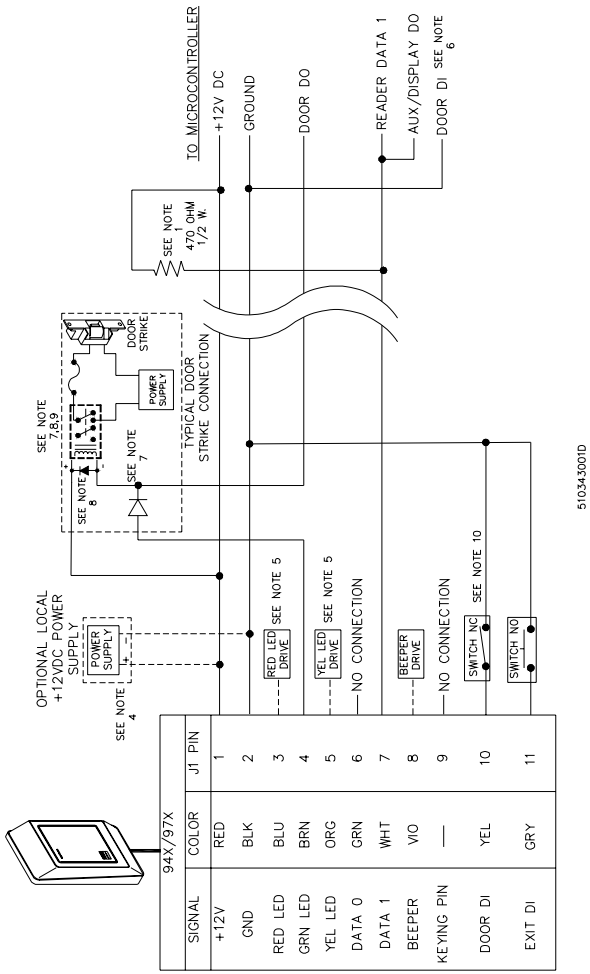
TABLE 6: Pinouts

Connector J1 Pin #	Signal	Pigtail Wire Color
1	+12VDC	Red
2	Ground	Black
3	Red LED External Drive	Blue
4	Green LED External Drive	Brown
5	Yellow LED External Drive	Orange
6	Reader Data 0	Green
7	Reader Data 1	White
8	Beeper External Drive	Violet
9	Keying Pin	
10	Door DI (Door Contact Switch)	Yellow
11	Exit DI (Exit Request Button)	Gray

Wiring Diagrams

See the wiring diagrams that follow for details on connecting the reader to the microcontroller based on the mode of the reader.

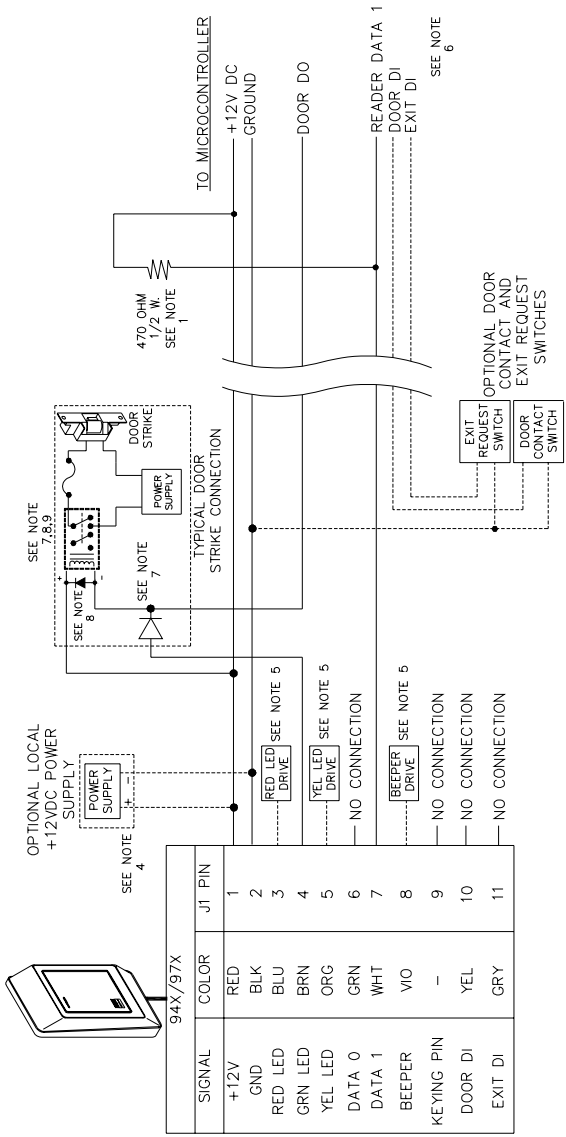
FIGURE 3: Wiring Diagram, Model 94x/97x
Supervised F/2F Mode



NOTES (Unless otherwise specified):

1. For Micro/2/4/5 only: a 470 ohm, 1/2W, pull-up resistor is required between +12VDC and READER DATA 1. The pull-up resistor should be installed at the microcontroller's terminal block. Resistors are supplied with the reader.
2. Shielded cable is recommended in electrically noisy environments.
3. If using shielded cable, connect all shields together at the micro end. Connect to ground stud in the lower left corner of Micro/2/4/5 cabinets using 14-AWG wire. No shield connections at the reader.
4. If using a local power supply, do not connect +12V line from the microcontroller to the reader. However, the negative side of the power supply must be connected to the micro (pin 2 on the reader port). Keep the wiring from power supply to reader less than 50 feet.
5. Switching the external indicator drives to GND activates the indicator. High impedance or +12V deactivates indicators. These drives may also be connected to user supplied, external indicating circuitry.
6. Refer to the appropriate system manual to determine whether this connection is required for door switch operation.
7. Blocking diodes may be 1N4148 or similar, supplied by the installer and located in a secured area.
8. Protection diodes may be 1N4002, 1N4003, or 1N4004 (installer supplied) for the door strike assembly.
9. Fuse, power supply, door strike, and relay are provided by the installer.
10. If the door contact switch is not used, link reader pin 10 to pin 2.

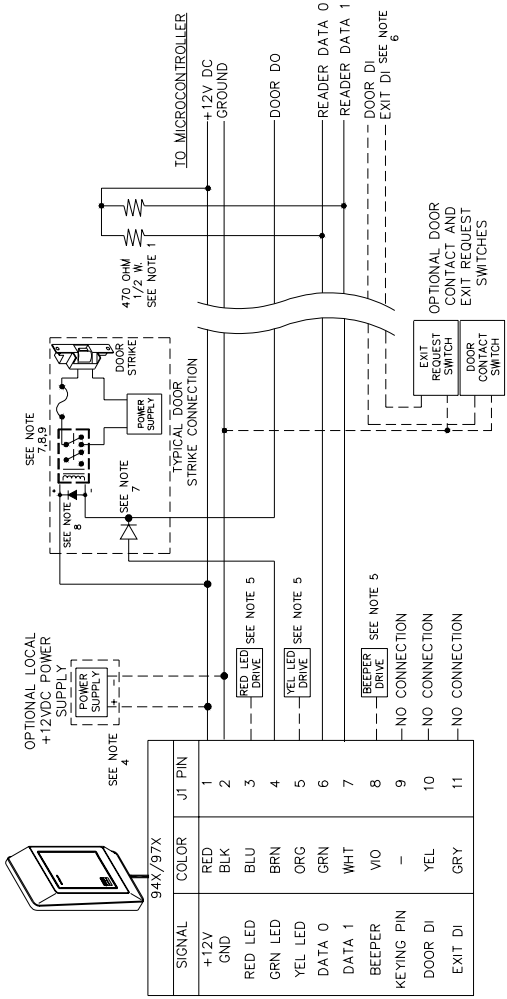
FIGURE 4: Wiring Diagram, Model 94x/97x Unsupervised F/2F Mode



NOTES (Unless otherwise specified):

1. **For Micro/2/4/5 only: a 470 ohm, 1/2W, pull-up resistor is required between +12VDC and READER DATA 1. The pull-up resistor should be installed at the microcontroller's terminal block. Resistors are supplied with the reader.**
2. **Shielded cable is recommended in electrically noisy environments.**
3. **If using shielded cable, connect all shields together at the micro end. Connect to ground stud in the lower left corner of Micro/2/4/5 cabinets using 14-AWG wire. No shield connections at the reader.**
4. **If using a local power supply, do not connect +12V line from the microcontroller to the reader. However, the negative side of the power supply must be connected to the micro (pin 2 on the reader port). Keep the wiring from power supply to reader less than 50 feet.**
5. **Switching the external indicator drives to GND activates the indicator. High impedance or +12V deactivates indicators. These drives may also be connected to user supplied, external indicator driving circuitry.**
6. **Refer to the appropriate system manual for specific wiring details.**
7. **Blocking diodes may be 1N4148 or similar, supplied by the installer, and located in a secured area.**
8. **Protection diodes may be 1N4002, 1N4003, or 1N4004 (installer supplied) for the door strike assembly.**
9. **Fuse, power supply, door strike, and relay are provided by the installer.**

FIGURE 5: Wiring Diagram, Model 94x/97x Unsupervised Wiegand Mode



NOTES (Unless otherwise specified):

1. For Micro/2/4/5 only: two 470 ohm, 1/2W, pull-up resistors are required; one between +12VDC and READER DATA 1, the other between +12VDC and READER DATA 0. The pull-up resistors should be installed at the microcontroller's terminal block. Resistors are supplied with the reader.
2. Shielded cable is required. Belden 8725 wire is recommended. Do not pair DATA 1 and DATA 0.
3. If using shielded cable, connect all shields together at the micro end. Connect to ground stud in the lower left corner of Micro/2/4/5 cabinets using 14-AWG wire. No shield connections at the reader.
4. If using a local power supply, do not connect +12V line from the microcontroller to the reader. However, the negative side of the power supply must be connected to the micro (pin 2 on the reader port). Keep the wiring from power supply to reader less than 50 feet.
5. Switching the external indicator drives to GND activates the indicator. High impedance or +12V deactivates indicators. These drives may also be connected to user supplied, external indicator driving circuitry.
6. Refer to the appropriate system manual for specific wiring details.
7. Blocking diodes may be 1N4148 or similar, supplied by the installer, and located in a secured area.
8. Protection diodes may be 1N4002, 1N4003, or 1N4004 (installer supplied) for the door strike assembly.
9. Fuse, power supply, door strike, and relay are provided by the installer.

Mounting the Reader

The reader comes with a backplate suitable for mounting directly onto standard U.S. electrical gang boxes (Model 94x onto single-gang box and Model 97x onto dual-gang box). The reader may also be mounted directly onto a hollow wall.

Back-to-Back Readers: Models 941, 971 and 973 Readers are suitable for back-to-back installation (to provide in/out access control). Using the standard metal mounting plates, the two readers should be mounted with their centers offset by at least 10 inches to provide interference-free operation. Using the optional back-to-back metal mounting plates allows the two readers to be mounted directly opposite each other on a 4-inch thick wall.

Important:

- Readers should not be mounted within three feet of a computer terminal. Some terminals radiate electrical noise that may reduce the effective maximum read range.
- Never mount Models 940, 970 or 972 on or near metal. Metal effects the tuning of the reader and may severely degrade its performance, decreasing read range and increasing current draw.
- Models 941, 971 and 973 are factory tuned to work with a metal back and must be mounted with the metal mounting plate to operate correctly.
- A gasket is supplied with the reader to form a weather-resistant seal between the mounting surface and the inside of the reader for outdoor installations. The gasket should be located on the inside surface of the reader's plastic backplate. For outdoor installations, where the reader is mounted in direct exposure to weather, a bead of silicone caulking should be applied between the reader and the wall to prevent water from entering the back of the reader.

External Tamper Feature: The Model 94x/97x Readers are also equipped with an external tamper feature. This feature can be activated by removing the key on the backplate prior to mounting.

Model 94x Only: Apply the mounting method as shown in Figure 6, to mounting instructions in Figure 7, Figure 8, Figure 9, and Figure 10, if you are using the external tamper feature.

NOTE: In order for this feature to work properly, the reader mounting surface must be flush with the backplate.

The figures listed below begin on the next page. Refer to the appropriate figure for the type of reader you are mounting.

Figure 6, “Recommended Additional Mounting Instructions for External Tamper Switch Activation,” on page 19.

Figure 7, “Model 940 Reader - Gang Box Mounting,” on page 20.

Figure 8, “Model 940 Reader - Direct Wall Mounting,” on page 21.

Figure 9, “Model 941 Reader - Gang Box Mounting,” on page 22.

Figure 10, “Model 941 Reader - Direct Wall Mounting,” on page 23.

Figure 11, “Model 970 / 972 Reader - Gang Box Mounting,” on page 24.

Figure 12, “Model 970 / 972 Reader - Direct Wall Mounting,” on page 25.

Figure 13, “Model 971 / 973 Reader - Gang Box Mounting,” on page 26.

Figure 14, “Model 971 / 973 Reader - Direct Wall Mounting,” on page 27.

FIGURE 6: Recommended Additional Mounting Instructions for External Tamper Switch Activation

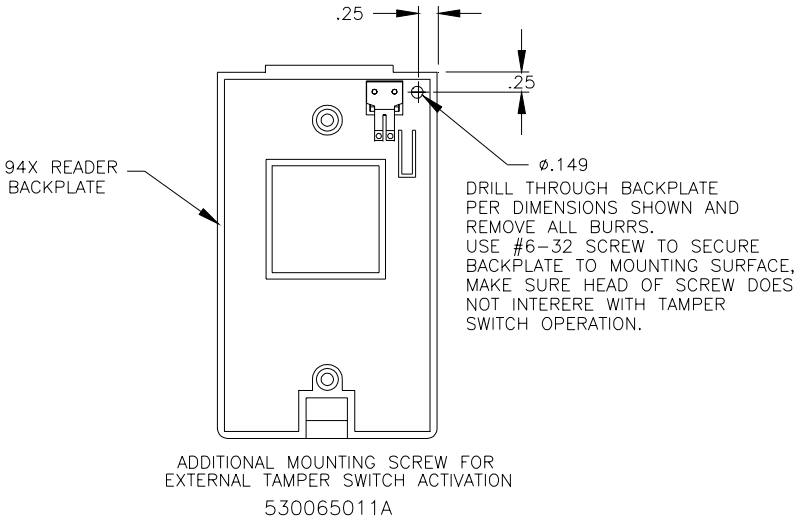


FIGURE 7: Model 940 Reader - Gang Box Mounting

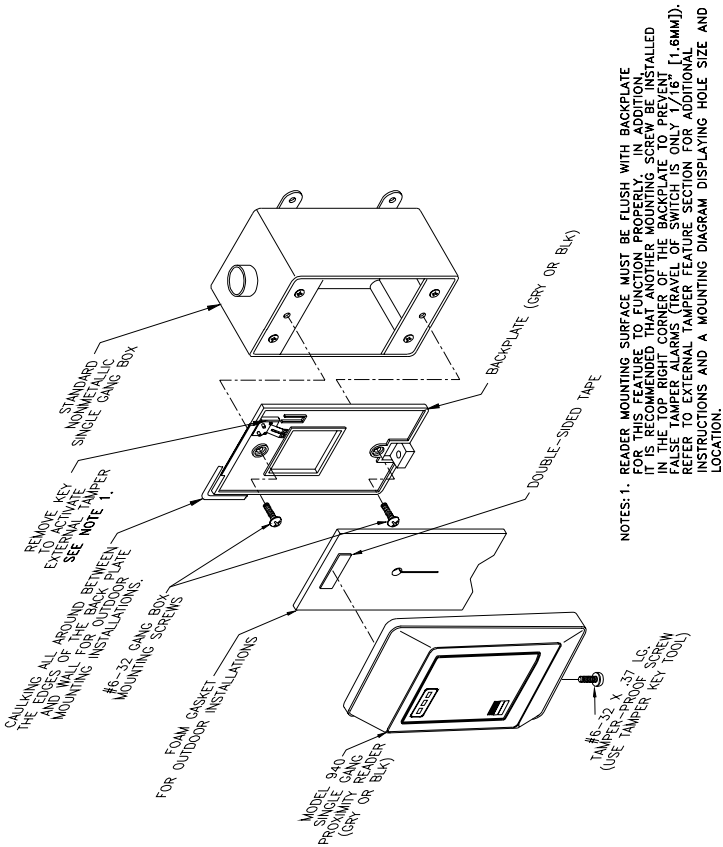


FIGURE 8: Model 940 Reader - Direct Wall Mounting

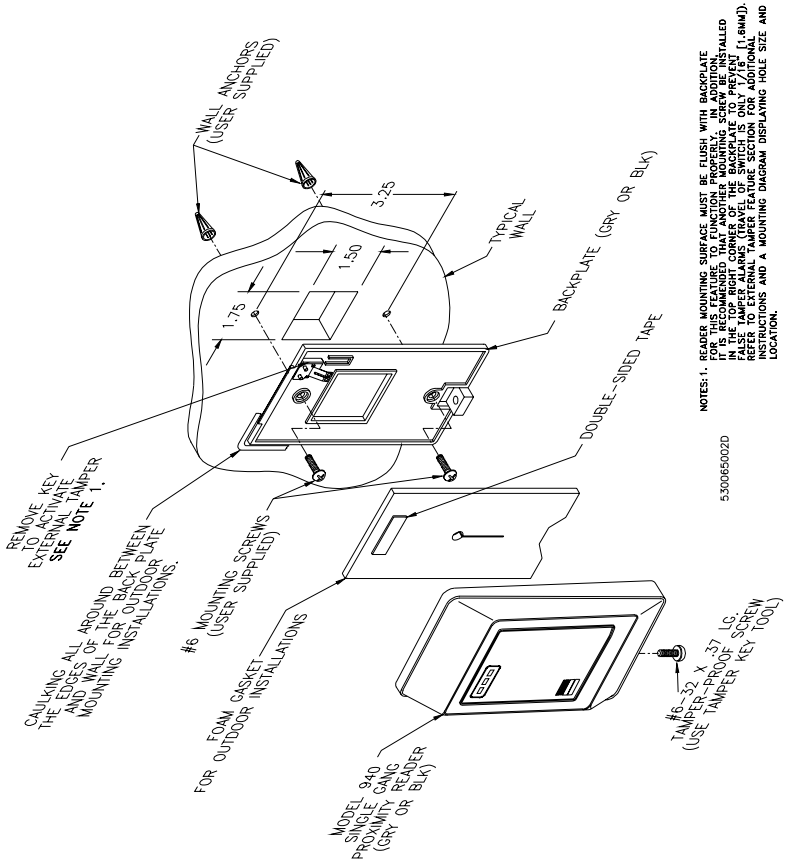


FIGURE 9: Model 941 Reader - Gang Box Mounting

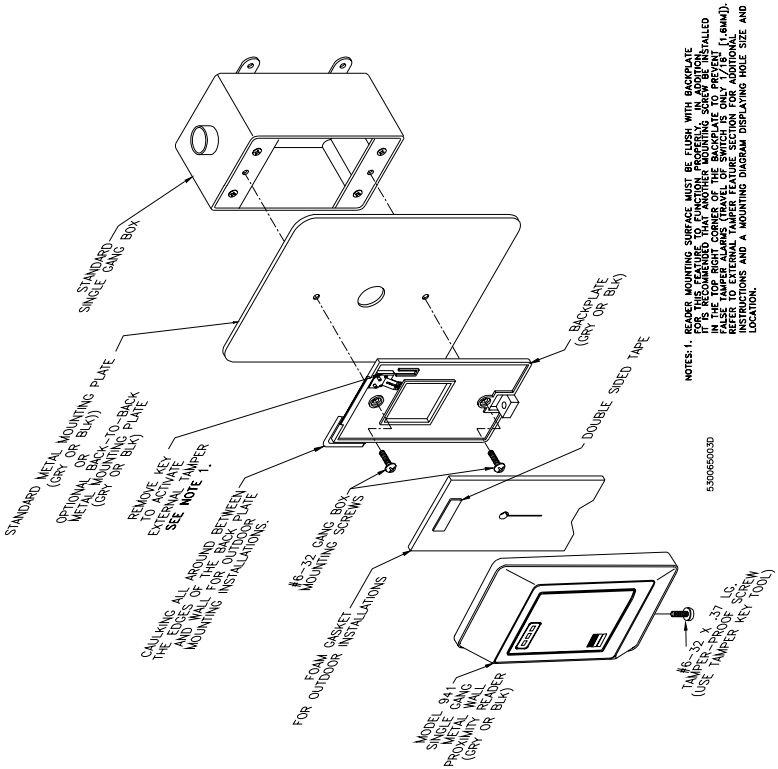


FIGURE 10: Model 941 Reader - Direct Wall Mounting

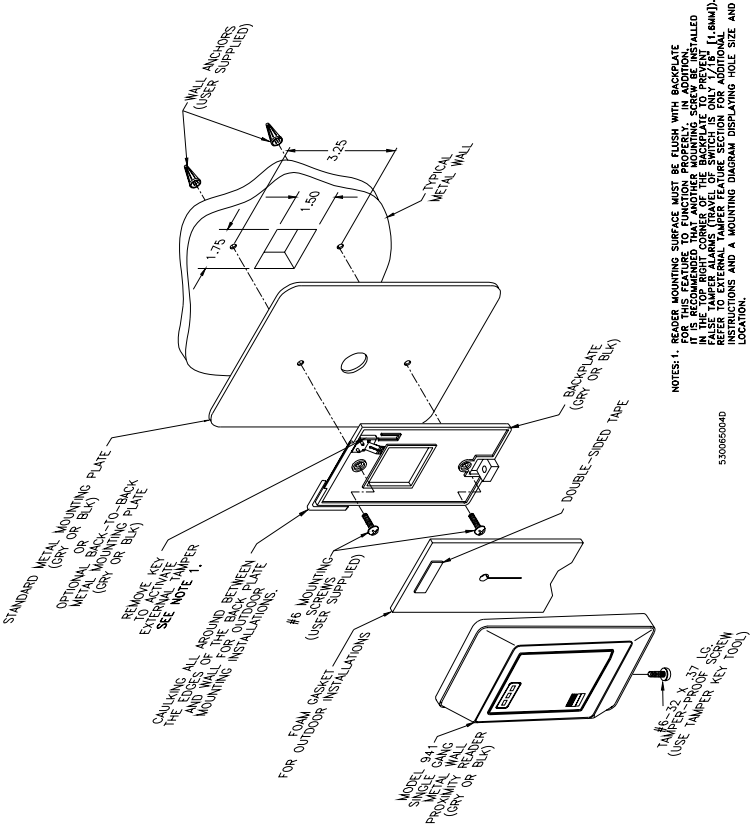


FIGURE 11: Model 970/972 Reader - Gang Box Mounting

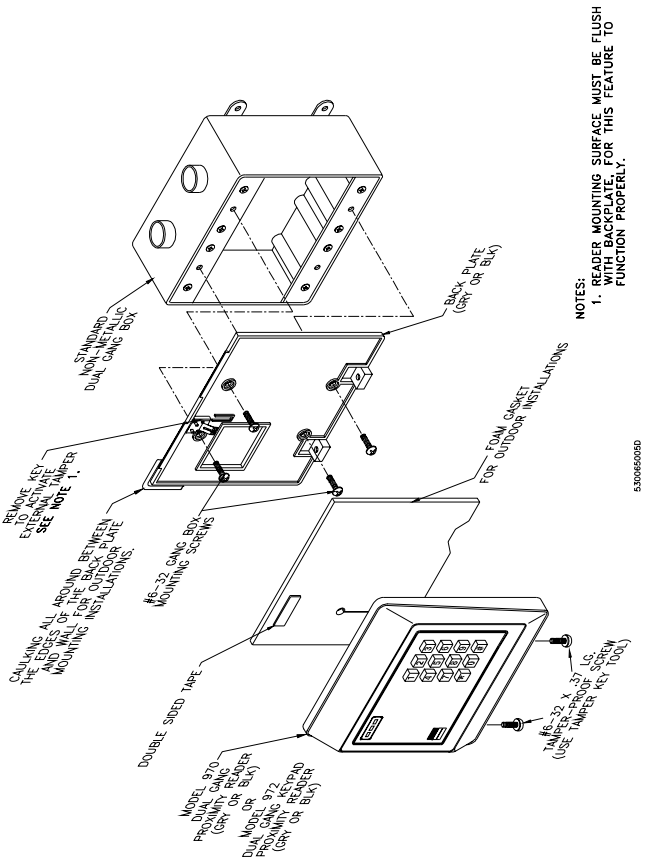


FIGURE 12: Model 970/972 Reader - Direct Wall Mounting

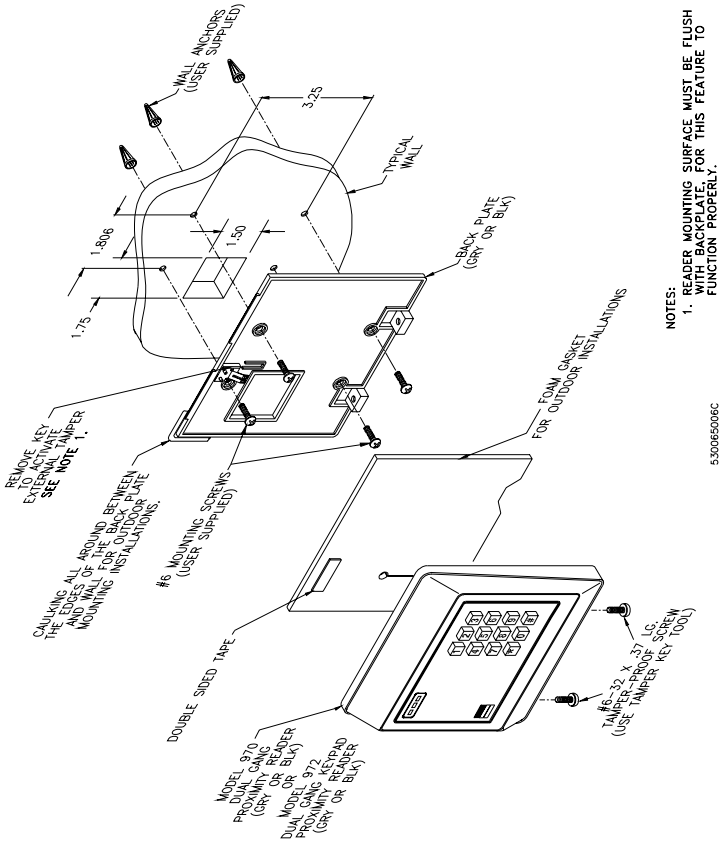


FIGURE 13: Model 971/973 Reader - Gang Box Mounting

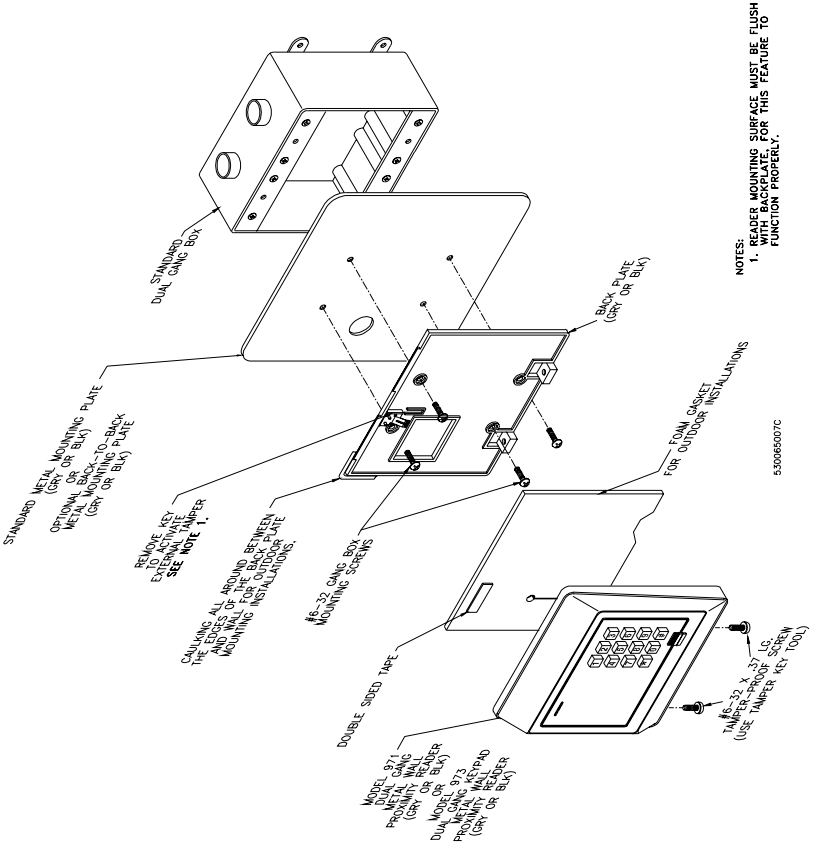
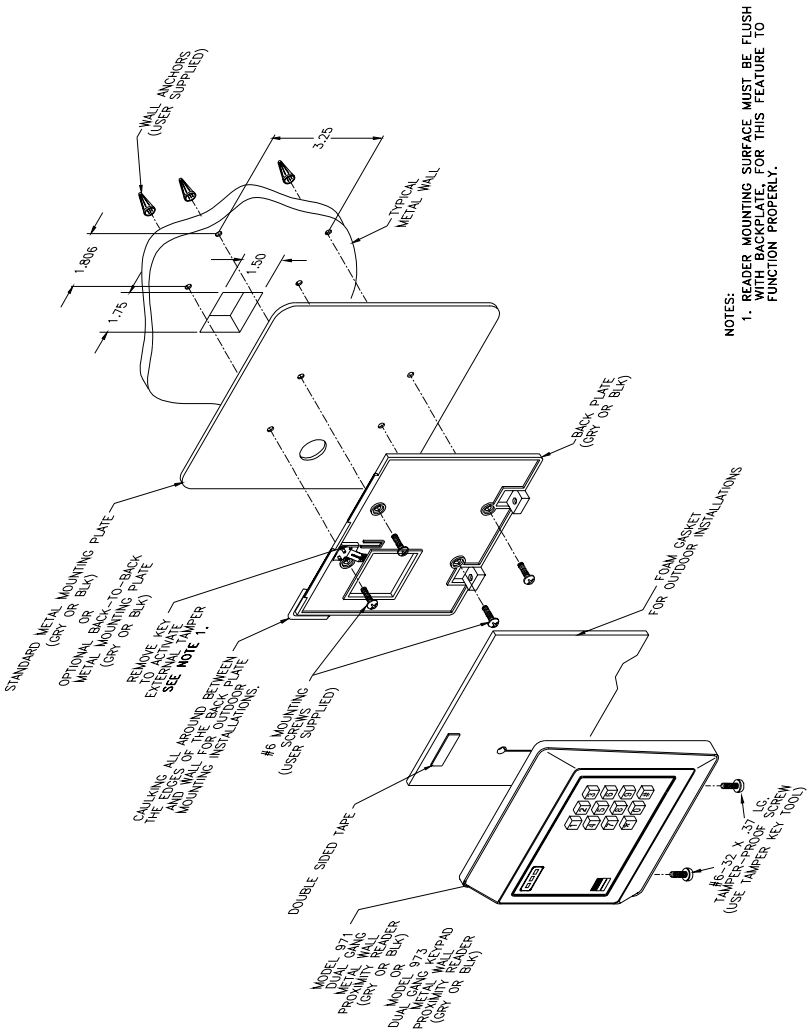


FIGURE 14: Model 971/973 Reader - Direct Wall Mounting



Testing the Reader

Follow the steps below to verify that the reader is working correctly.

1. Check all cabling and electrical connections from the reader to the microcontroller. Refer to the wiring diagrams on page 11, page 13, and page 15.

2. Verify that the microcontroller is properly configured. Refer to the appropriate CASI-RUSCO microcontroller manual.

3. Verify that the reader switches are properly set for the power setting, cabling type, distance, and desired mode of operation. See “Switch Settings” on page 3.

4. Apply power to the reader and verify that the yellow LED is on. You may want to use a multimeter to test the voltage at the reader’s pigtail connector J1, using ground (pin 2) as a reference. The power pin (pin 1), data lines (pins 6 and 7) and door DO (pin 4) should all read approximately 12V.

5. Check that the proper version of firmware is installed in the microcontroller. Refer to the appropriate microcontroller manual.

6. Close the tamper switch by joining the reader and backplate. **NOTE: If external tamper is activated, make sure the reader backplate mounting surface is flush with backplate.** When all wires are connected to the reader, ensure that the supervision function is operating properly (if a supervised mode is selected), by verifying that the reader is not sounding a short triple beep every 30 seconds, and the red LED is not flashing slowly (every 2 seconds). If such an alarm is present, refer to the troubleshooting guide at the end of this manual. **NOTE: In silent supervised mode, no indication of loss of supervision is provided, except badges will not be read.**

7. Select a known good Proximity Perfect or ProxLite test badge. Be sure the badge is properly entered in the host system, and the micro badge data format matches the reader. If the reader is used with a keypad (Models 972 and 973 only), assign a proper PIN.

8. Check that the door is secure. Present the badge to the reader. Observe that the reader beeps briefly and the yellow LED blinks off.

9. If the reader is used with a keypad (Models 972 and 973 only), enter a PIN. Refer to the host manual for instructions on entering the PIN. Observe that the green LED turns on indicating a valid access has been granted by the host.

10. Open the door. This verifies that the door strike operates correctly.

Troubleshooting Guide

If the operation of a component is in doubt, substitute a known good component and retry the system. Always verify wiring against wiring diagrams before powering up the system.

The troubleshooting guide is divided into three sections. The first section is applicable to all installations, the second section provides additional diagnosis for unsupervised readers, and the last section provides additional diagnosis for supervised readers.

All Installations

All LEDs are on and the beeper is on (if enabled): Usually, an indication that the reader's voltage is too low. This may be caused if the wrong reader voltage is selected at the microcontroller or the cabel is too long between the reader and the microcontroller.

1. Measure the reader supply voltage at the microcontroller. It should read between 12 and 15VDC. If the voltage is correct, continue to step 2 below. If the voltage is incorrect, refer to the appropriate microcontroller manual and correct the voltage.

2. Set the reader to low power mode if the cable distance is too long (See Table 1 "Power Level Switch Settings," on page 5). This may correct the problem.

3. If the problem is still present, while in low power mode, measure the voltage between J1 pin 1 (power) and J1 pin 2 (ground). This voltage should be greater than 8VDC and less than or equal to the reader supply voltage. If the voltage is too low, correct the wiring. If the voltage is correct, replace the reader.

None of the LEDs are on: Check that the beeper is enabled (See Table 5 "Beeper Sound Level DIP Switch Settings," on page 7), then present a known good Proximity Perfect or ProxLite test badge to the reader while listening for the beeper.

If the beeper sounds, the reader is faulty and should be replaced. If the beeper does not sound, check the power connections to the reader and check the reader supply voltage at connector J1 pin 1.

The green LED is always on: The green LED indicates that the door strike is open. It is controlled by the input on connector J1 pin 4.

1. Disconnect the wire on J1 pin 4. If the green LED stays on, the reader is faulty and should be replaced. If the green LED goes off then the problem is most likely not in the reader.

2. Reconnect the wire on J1 pin 4 and measure the voltage at J1 pin 4. Low voltage turns on the green LED. If the voltage is low, check to see if the host system is turning on the door strike.

The beeper doesn't sound and the yellow LED doesn't blink when a badge is presented to the reader OR the badge read range is very poor: When the beeper sounds and the yellow LED blinks off, it indicates that a badge has been read and its data sent to the microcontroller.

NOTE: The beeper will not sound if it has been disabled. (See Table 5 "Beeper Sound Level DIP Switch Settings," on page 7.)

1. Models 941, 971 and 973: Check that the metal backplate is installed correctly. See the appropriate installation drawing in this manual for details.

   All other models: Be sure they are not mounted on or near a metal wall or large metal object.

2. Check that the reader is not mounted within 3 feet (1 meter) of a computer terminal or within 10 inches (250 mm) of another Proximity Perfect reader. The only exception to this 10-inch (250 mm) limit is for 941, 971, and 973 Readers installed on the optional, back-to-back, metal mounting plates.

3. Present a Proximity Perfect test badge (known to be working) to the reader. If the beeper and yellow LED still fail to indicate a valid badge read and send, replace the reader with a reader that you know is working correctly. If this corrects the problem, the original reader is faulty and should be replaced. If this does not correct the problem, the badge is probably defective.

The door does not open and the green LED does not turn on when a badge is presented:

1. Verify that the badge and reader are properly entered into the system.

2. Verify that the door strike and the green LED are wired correctly. Since the green LED and the door strike are separate indicators, this problem is not an indication of a defective reader.

The green LED does not turn on, but the door strike unlocks the door when a valid badge is presented:

1. Verify that the door DO is wired correctly. Refer to the appropriate wiring diagram.

2. Disconnect the wire from J1 pin 4 (green LED) and connect J1 pin 4 to J1 pin 2 (ground). If the green LED is now on, the reader is good and the connection to the reader is defective. If the green LED does not turn on, replace the reader.

Green LED turns on but the door does not open: Verify correct door strike wiring and operation. The reader is functioning properly.

The beeper is always on and/or the yellow LED is off: The yellow LED blinks off and the beeper sounds while a key is pressed (Models 972 and 973 only), as long as the reader DIP switches are not set to disable the beeper.

Unsupervised Modes Only

The reader sounds a short triple beep every 30 seconds and the red LED flashes quickly (every 400 ms): Indicates a tamper violation. Verify that the reader housing is properly secured to the backplate. If an external tamper is used, review the appropriate recommended mounting instructions. If the reader is secure and mounted properly, then the reader is faulty and should be replaced.

Supervised Modes Only

Reader sounds a short triple beep every 30 seconds and the red LED flashes slowly (every 2 seconds): The reader has lost communication with the microcontroller.

1. Check the reader to microcontroller wiring. Refer to the appropriate installation drawing. Verify that the AUX DO is jumpered to the READER DATA 1 on the microcontroller.

2. Verify that the correct pull-up resistor is installed on the microcontroller. See Figure 3, “Wiring Diagram, Model 94x/97x Supervised F/2F Mode,” on page 11.

3. Verify that the microcontroller has the correct firmware for a supervised reader. Refer to the manual that came with your microcontroller for instructions.

4. Try the reader on a different reader input of the microcontroller. If this corrects the problem, then the microcontroller is probably causing the problem.

5. Replace the reader with one you know is working correctly. If this corrects the problem, then the reader is probably faulty and should be replaced.

6. If none of the above steps have identified the problem, there may be a significant noise source present in the installation that is interfering with the reader-to-microcontroller communications. If this is the case, use shielded wire for reader-to-microcontroller connections.

The beeper sounds and the yellow LED blinks off more than once when a valid badge is presented: The beeper sounds and the yellow LED blinks off every time badge data is sent to the microcontroller. When a badge is presented to the reader, data is transmitted from the badge to the reader. The reader interprets and checks the data received to make sure it has not been corrupted. The reader then sends the data to the microcontroller and waits approximately 1/3 of a second for the microcontroller to acknowledge receipt. If no acknowledge is received during this time, the reader resends the data causing the beeper to sound again and the LED to blink off. After the third unacknowledged attempt, the reader stops trying and indicates a communications error. This feature is useful in troubleshooting marginal installations where a high level of electrical noise may cause the reader to make multiple attempts at communications.

1. If multiple beeps occur regularly, refer to the installation drawings to verify that the correct pull-up resistor has been added to the microcontroller.

2. Replace the reader with one you know is working correctly. If this solves the problem, the original reader is probably faulty and should be replaced. If the problem persists, use shielded cable between the microcontroller and the reader.

The reader sounds a short triple beep every 30 seconds and the red LED flashes quickly (every 400 ms): Indicates a tamper violation. Verify that the reader housing is properly secured to the backplate. If an external tamper is used, review the appropriate recommended mounting instructions. If the reader is secure and mounted properly,

then the reader is faulty and should be replaced.

The beeper and/or red LED are always on: The microcontroller may command the reader to turn on the red LED and the beeper as long as the reader DIP switches are not set to disable the beeper. If the door status switch input at J1 pin 10 is not tied to ground, the reader informs the system that the door is open. The system may then activate the alarm at the reader. If this is not the problem, then the system software probably told the reader to activate its alarm. Refer to the appropriate system manual for conditions that cause the software to activate the alarm. If it appears that no such system command is active, replace the reader with one you know works correctly. If this solves the problem, the original reader is faulty and should be replaced.

The green LED flashes quickly (every 400 ms): This indicates that the microcontroller has requested a PIN entry on a Model 972 or 973 Reader with a keypad. For all other models, check the reader configuration on your system to be sure a keypad reader was not selected.

Technical Specifications

Operating Temperature Range: -35° C to +66° C (-31° F to 151° F)

Humidity Range: 0% to 95%

Index of Protection: IP55

Physical Dimensions:

Models 94x -	4.75 in (H) x 2.90 in (W) x 0.90 in (D)
	121 mm (H) x 74 mm (W) x 23 mm (D)
Models 97x -	4.75 in (H) x 5.500 in (W) x 0.90 in (D)
	121 mm (H) x 140 mm (W) x 23 mm (D)

Parts List:

- Model 940 Reader (single-gang) gray
- Model 940 Reader (single-gang) black
- Model 941 Reader (single-gang metal mount) gray
- Model 941 Reader (single-gang metal-mount) black
- Model 970 Reader (dual-gang) gray
- Model 970 Reader (dual-gang) black
- Model 971 Reader (dual-gang metal-mount) gray
- Model 971 Reader (dual-gang metal-mount) black
- Model 972 Reader (dual-gang with keypad) gray
- Model 972 Reader (dual-gang with keypad) black
- Model 973 Reader (dual-gang metal mount w/keypad) gray
- Model 973 Reader (dual-gang metal mount w/keypad) black
- Optional Tamper Key Tool
- 94x Plastic Backplate (gray)
- 94x Plastic Backplate (black)
- 97x Plastic Backplate (gray)
- 97x Plastic Backplate (black)
- Standard 941 Metal Mounting Plate (gray)
- Standard 941 Metal Mounting Plate (black)
- Standard 971/973 Metal Mounting Plate (gray)
- Standard 971/973 Metal Mounting Plate (black)

- Optional Back-to-Back 941 Metal Mounting Plate (gray)
- Optional Back-to-Back 971/973 Metal Mounting Plate (black)
- 94x Weather-resistant Gasket
- 97x Weather-resistant Gasket
- Reader Cable

Refer to CASI-RUSCO Product Catalog for part numbers and ordering information.

Maximum Reader Range: Determined by the reader's power level setting. See Table 2 "Read Range by Model Number," on page 5.

Maximum Cabling Distance: The maximum cable distance between the reader and the microcontroller is influenced by a number of factors including wire gauge and reader power level setting. See Table 3 "Cable Distances," on page 6.

NOTE: The reader will work well with unshielded cable in most environments. No company, including CASI-RUSCO, can guarantee that data will be reliably transmitted over long distances on unshielded cable in every installation.

Power Supply: Nominal 12VDC, 75mA, 150mA or 200mA dependent on the power setting selected. See Table 1 "Power Level Switch Settings," on page 5.

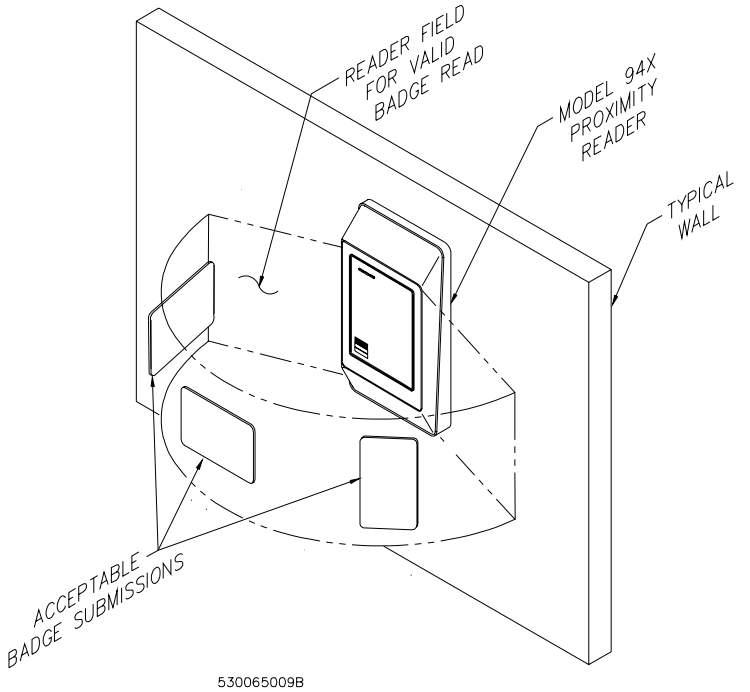
Color: Light gray and black

Pinouts: The reader is supplied with a ten-wire cable. On one end is a keyed connector that mates with the J1 connector on the back of the reader. The other ends are stripped ready for connection to the field wiring using a terminal block or in-line splice connectors.

Functional Specifications

Product Operation: The reader transmits a *wake-up* field extending all around the reader (the 941 and 971 generate virtually no back field). When a badge is presented, energy from the field powers the electronics inside the badge allowing it to transmit its unique data to the reader. The reader receives, interprets, and checks the data, sending only uncorrupted badge data to the microcontroller. Due to the nature of the *wake-up* field, the maximum read range will be realized only if the badge is presented to the reader on an imaginary semi-circle centered on the reader, as shown below.

FIGURE 15: Badge to Reader Presentation



While the reader will read and send another badge's data immediately, the risk of multiple badge reads is reduced by a

two-second *same-badge-send* delay.

In the supervised modes, the reader also monitors and reports the status of a normally closed door contact switch and a normally open exit request push button.

Application: Intended for areas requiring a moderately high level of security for controlled access.

Compatibility: Interfaces to all CASI-RUSCO systems.

Reader Technology Types: CASI-RUSCO Proximity Perfect Read / Write technology and CASI-RUSCO ProxLite Read Only technology.

Badge Formats: CASI-RUSCO Proximity Perfect badges encoded with 2801, 2804, 3201, or 40-bit data formats; or CASI-RUSCO ProxLite and Entrée badges and key tags.

- **Mounting:** The reader can be mounted directly onto a standard U.S. electrical gang box (Model 94x onto single-gang box, 97x onto dual-gang box). The reader can also be mounted directly onto a hollow wall. A sealing gasket is provided for weather-resistant outdoor installations. For outdoor installations, where the reader is mounted in direct exposure to weather, a bead of silicone caulking should be applied between the reader and the wall to prevent water from entering the back of the reader. See "Mounting the Reader" on page 17 for additional details.

Indicators: Red, yellow, and green LEDs, and a beeper are incorporated into the reader.

- **Red LED:** Turns on continuously to indicate a tamper in the Wiegand and F / 2F modes. In the supervised modes, the red LED flashes quickly (every 400 ms) to indicate a tamper condition.

  If communications with the microcontroller are lost while in the supervised modes, the red LED flashes slowly (every 2 seconds).

  In both supervised modes, the red LED may also be turned on and off by the microcontroller to indicate an alarm state. Consult the appropriate system manual for details on this operation.

- **Yellow LED:** Normally on when power is applied to the reader. Blinks off briefly to indicate that a badge has been read and sent to the microcontroller. Blinks off briefly to indicate that a keypress has been read and sent to the microcontroller (Models 972 and 973 only).
- **Green LED:** Indicates that the microcontroller has activated the door strike. In the unsupervised mode, the green LED flashes

quickly (every 400 ms) to indicate that the microcontroller has requested a PIN entry.

- **Beeper:** The beeper sounds briefly to indicate that a valid badge has been read and sent to the microcontroller. The beeper sounds continuously while a key is pressed (Models 972 and 973 only). A short triple beep sounds every 30 seconds to indicate a reader tamper. In the normal supervised modes, a short triple beep every 30 seconds indicates a disruption in communications with the microcontroller.

  In both supervised modes, the beeper may be sounded by the microcontroller to indicate an alarm state. Consult the appropriate system manual for details on this operation.

  An external device can be connected to all LEDs and the beeper at connector J1. In this case, the LEDs and beeper can be driven by the reader or the external device. Driving the appropriate J1 pin to a low voltage activates the indicator. This low voltage can be sensed by the external device even when the indicator is driven by the reader.

Supervised F/2F Mode Operation: In the supervised modes, the reader sends badge data or reader status data to the microcontroller approximately once every second and waits for an acknowledgment from the microcontroller. The reader continues sending the data every second until an acknowledgment is received. If an acknowledgement is not received after the third attempt, the reader stops reading badges, the red LED starts flashing slowly (every 2 seconds), and a short triple beep sounds every 30 seconds, unless silent supervised mode is selected. Once the reader receives an acknowledgment, it begins reading badges again, the beeper stops sounding and the red LED stops flashing.

Badge Read Operation: Each time the reader sends badge data, the yellow LED blinks off briefly and the beeper sounds. On systems set up for PIN entry, the green LED flashes to indicate that keypad data is expected.

Keypad Operation (Models 972/973 only): The reader sends each new keypress to the microcontroller and blinks the yellow LED off. The beeper sounds while a key is pressed. In unsupervised F/2F mode, the keypad has no function.

Reader Tamper Operation: The 94x/97x Readers incorporate an internal and external tamper. If the reader is separated from the backplate, or the reader and backplate are removed from the wall together, then the reader functions are disabled and a tamper condition is indicated by a triple beep every 30 seconds. In the

Wiegand and F/2F modes, the red LED stays on continuously during a tamper condition (this can be sensed by a low voltage on connector J1 pin 3). In both supervised modes, the red LED flashes quickly (every 400 ms) and all communications with the microcontroller are suspended, taking the reader offline.

Door Contact and Exit Request Inputs: The 94x/97x Readers have a normally closed door contact switch input and a normally open exit request switch input. In the supervised modes, the state of both switch inputs is periodically reported to the microcontroller, but changes to switch inputs are reported immediately. In the Wiegand and F/2F modes, these switch inputs have no function.

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