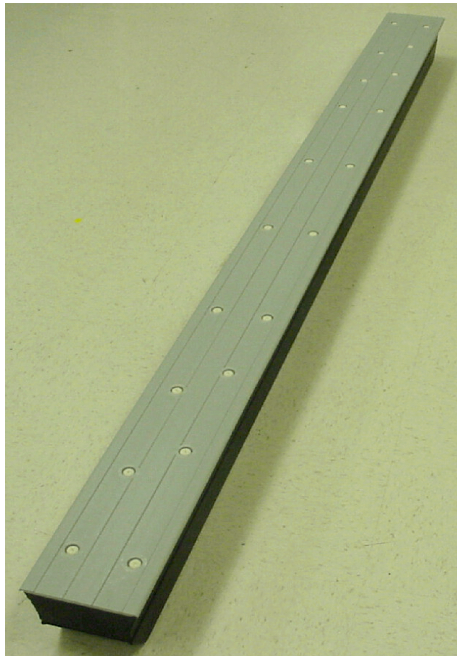


ULD Reader Installation Guide

Singapore Airlines
AFT 5



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Regulatory Approvals

Federal Communications Commission (FCC) Notice

The Federal Communications Commission has established technical standards regarding radio frequency energy emitted by computer devices. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference with radio/TV reception. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.



Changes or modifications to this equipment that are not expressly approved by Savi Technology could void the warranty and the authority to operate this equipment.

Savi Technology is not responsible for radio/TV interference caused by using unauthorized cable or by making unauthorized changes to this equipment.




Product Safety

Using this equipment in a manner not specified by the manufacturer can impair the protection that the equipment provides.

Conventions in this Guide

The following table explains guide conventions and typography usage.

Guide Conventions

<i>Example</i>	<i>Meaning and Use</i>
	<i>Caution notices call attention to the possibility of damaging the product, the system, or your work (for example, potential loss of data).</i>
	<i>Warning notices call attention to the possibility of injury to people.</i>
	<i>Examples provide a scenario to further explain the preceding direction or procedure.</i>
Note:	<i>Notes call attention to facts or advice that deserve special attention.</i>
Terminal Locked	Bold type is used for prompts, window and field names, and other text as displayed on the screen.
A:\INSTALL	Bold type is also used for text you enter exactly as shown.
1005 DATA	Monospaced type is used for system messages, examples of data files, program code, and other text where column alignment is important.
<i>name.bmp</i> or <i>tag_id</i>	Italic type is used for emphasis of a word or phrase that is new or especially important.
<i>Continue with ...</i>	Italic type is also used for notes.
Ctrl + Z	Used for a keyboard control codes or manual key-strokes. This example tells you to hold the Ctrl key while you press the Z key.

Getting Assistance

If you have trouble with the product, after you have checked your connections and the *ULD Reader Installation Guide*, contact Savi Technical Support.

Technical Support

To contact Savi Technical Support:

- Telephone 1-888-994-SAVI (North America only) or 1-408-743-8000 between 8:00 a.m. and 5:00 p.m. Pacific Time.
- Send an e-mail to help@savi.com.

Whether you contact Savi by telephone or e-mail, please have the following product information ready, along with the exact sequence of operations (if possible) that caused the error:

- Equipment type and location
- Model number and version
- Serial number

Getting Assistance

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1

Introduction

This guide provides information for installing Unit Load Device (ULD) Readers for Singapore Airport Terminal Services (SATS) in support of the ULD Tracking System, for tracking cargo pallets and containers. SATS provides cargo handling services for major international airlines in Singapore.

There are five Air Freight Terminals (ATF) in operation today, with Terminal 6 currently under construction.

AFT5 handles all Singapore Airlines and SilkAir cargo, while AFT1 to AFT4 handle cargo from other airlines.

This document details the procedures for the installation within AFT5.

Summary

In AFT5, pallets and containers (ULDs), are handled by a Material Handling System (MHS). They are stored in a multi-level ULD storage system with a capacity of 1316 ULDs within the MHS. Electronic sensors are strategically located on conveyors and equipment to monitor movement of ULDs.

Signals are transmitted and analyzed by a DEC VAX mini computer through a comprehensive network. ULDs can be introduced into, transferred within, or removed from the storage system through 12 Workstations, 3 Turn-Table Transfer Vehicles (TTTV), 3 Elevated Transfer Vehicles (ETV), and 2 Bridge Vehicle (BV) stations.

The ETVs convey ULDs between the airside roller decks and landside workstations. The BVs travel along level D and F of the ULD storage system and transfer ULDs from the import zone to the export zone. The TTTVs provide a link between the ramp mobile equipment (dolly) and the airside roller decks.

To manage the ULD tracking within AFT5, a SAVI RFID system is to be installed which integrates with the existing ICS. This new Savi system comprises 26 readers and 12,000 ULD tags. It provides 99.9% successful reads to the Inventory Control System (ICS) when ULDs are moving at speeds of up to 0.5 meters per second.

The Savi ULD Reader is to be installed between and below the conveyor system rollers on the transfer vehicles.

The reader output interface is an RS-232 interface to a host PC-computer.

2

ULD Reader Installation

This chapter provides information for installing ULD Readers, including the following topics:

- Mechanical Description
- Existing Bracket Removal and Reader Bracket Installation
- Reader Installation
- Installation Tools
- Installation Materials
- Reader Locations

This chapter also provides installation sheets which consist of:

- Hardware diagrams for the installation locations
- Sign-off fields to be filled out and signed when work is complete for a specific location

Mechanical Description

The Reader and the two Reader Brackets securing it to the conveyor comprise the basic components set for each ULD Reader system. This section provides diagrams and a brief description of these components:

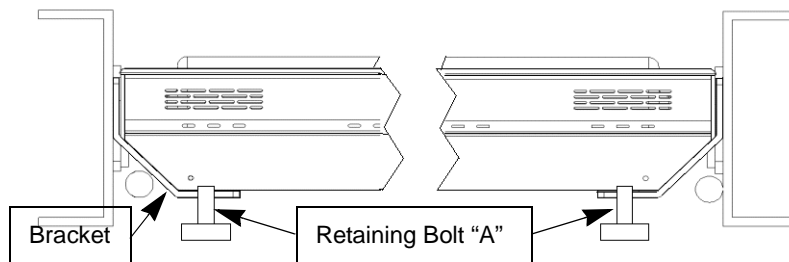
- ULD Reader on page 2-2
- ULD Reader Bracket on page 2-2

ULD Reader

Figure 2-1 provides a side view of a ULD Reader. Readers are installed between rollers and below the conveyor system. This figure also shows the relationship between the Reader and the ULD Reader Brackets and Retaining Bolts securing the components together.

Different locations require specific Reader configurations. Information on where and how many Readers are installed for specific locations is covered in “Reader Locations” on page 2-18.

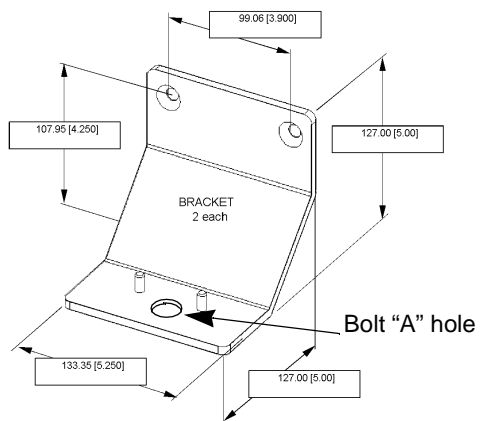
Figure 2-1 Savi ULD Reader - Side View



ULD Reader Bracket

The Reader rests on, and is attached to the roller suspension rail with ULD Reader Brackets. Figure 2-1 shows a side view of a ULD Reader Bracket supporting a Reader. Figure 2-2 on page 2-3 shows a dimensioned perspective of a Reader Bracket.

Figure 2-2 ULD Reader Bracket - Perspective View



Bracket Removal and Installation

Deck plates are removed before installation procedures are performed. Installation procedures include:

- Reader Bracket Installation for TTTV, ETV, and BV on page 2-4
- Reader Bracket Installation for Workstations on page 2-7

Removing Deck Plates

- **To remove a deck plate:**

1. Determine the mounting location of the Reader (see “Reader Locations” on page 2-18).
2. As required, remove two Allen or flat-head screws from each end of the deck plate (four screws total).
3. Using a pry bar, loosen the deck plate and lift straight up, until the plate is free of existing brackets.

Make sure that personnel are stationed at each end of the deck plate while you perform this step.

4. Avoiding contact with rollers, lift and remove the deck plate.

Store the deck plate for later use.

5. Inspect existing brackets and bracket mounting holes for dimensional and welding anomalies.

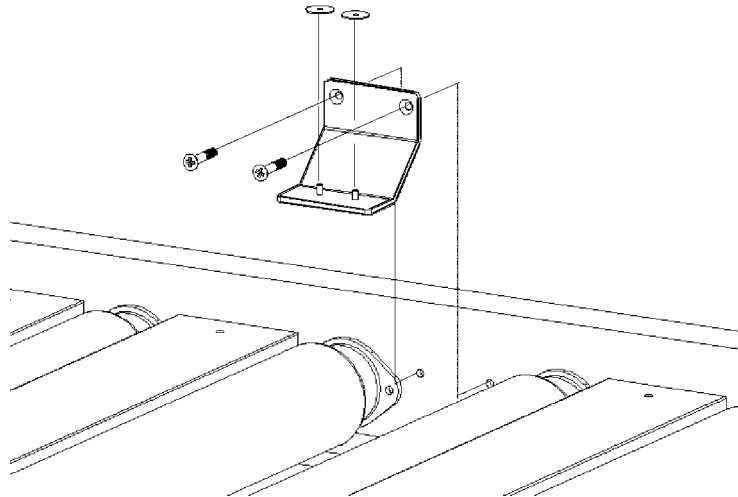
Reader Bracket Installation for TTTV, ETV, and BV

This activity consists of removing the existing bracket and installing the Reader Bracket (bracket) for TTTV, ETV and BV locations.

You must perform the procedure, “Removing Deck Plates” on page 2-4 before performing this procedure.

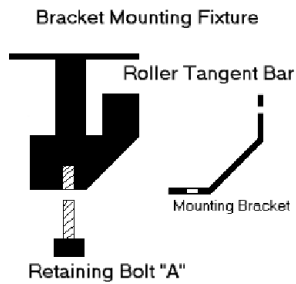
- **To remove the existing bracket and install the Reader Bracket for TTTV, ETV, and BV:**
 1. With open-end and adjustable wrenches, remove the U-bracket from the roller suspension rail.
 2. Inspect the bracket mounting holes for any dimension and concentricity anomalies.
 3. If required, hand-grind the bracket mounting surface smooth.
 4. Clean the bracket mounting surface and mounting holes with Xylene, then wipe clean with alcohol.
 5. Place the Reader Bracket in position with (2) mounting bolts.

Figure 2-3 Reader Bracket and Mounting Bolts



6. Attach a lock washer and nut on each bolt and hand tighten.
7. Attach the Bracket Mounting Fixture to the Reader Bracket, using Retaining Bolt "A" (m10 - 1.5 carriage bolt).

Figure 2-4 Bracket Mounting Fixture



8. Align the Reader Bracket until the Roller Tangent Bar indicates proper positioning with the roller tangent.
9. Tighten the mounting bolts to secure the Reader Bracket.
10. Apply three *spot welds* to the Reader Bracket.
11. Remove Retaining Bolt "A".

Refer to Figure 2-4.

12. Remove the Bracket Mounting Fixture.
13. Repeat preceding steps for the opposing bracket.

Reader Bracket Installation for Workstations

This activity consists of removing the existing bracket and installing the Reader Bracket (bracket) at Workstations 1 through 12.

You must perform the procedure, “Removing Deck Plates” on page 2-4 before performing this procedure.

Note: The existing brackets at the Workstation locations (1 through 12) are welded into place.

- **To remove the existing bracket and install the Reader Bracket for Workstations 1 through 12:**

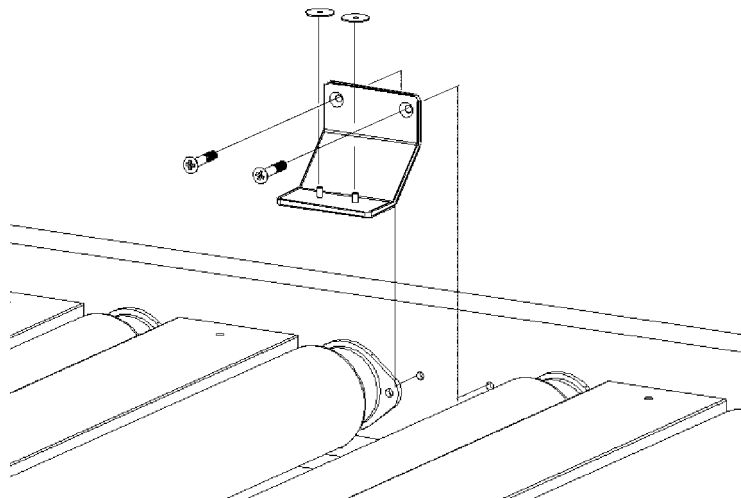
1. Remove the existing brackets using an acetylene torch or grinder operated by a qualified on-site welder.



Heat Shields must be placed between the mounting bracket and the bearings that support the rollers, to avoid Roller Bearing damage.

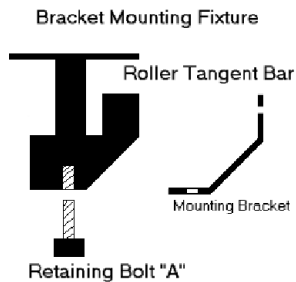
2. After the existing bracket has been removed, inspect the bracket mounting holes for any dimension and concentricity anomalies.
3. If required, hand-grind the bracket mounting surface smooth.
4. Clean the bracket mounting surface and mounting holes with Xylene, then wipe with alcohol.
5. Place the Reader Bracket in position with two (2) mounting bolts.

Figure 2-5 Reader Bracket and Mounting Bolts



6. Place a lock washer on each bolt.
7. Place a nut on each bolt and hand-tighten.
8. Attach the Bracket Mounting Fixture onto the Reader Bracket, using the Retaining Bolt "A" (m10 - 1.5 carriage bolt).

Figure 2-6 Bracket Mounting Fixture



9. Align the Reader Bracket until the Roller Tangent Bar indicates proper positioning with roller tangent.
10. Tighten the mounting bolts.
11. Apply three (3) *spot welds* to the bracket.

12. Remove the Retaining Bolt “A”.

Refer to Figure 2-6.

13. Remove the Bracket Mounting Fixture.

14. Repeat the preceding steps for the opposing bracket.

Reader Installation

Reader installation consists of temporarily installing a Reader Housing to ensure proper fit, and installing the Reader.

Temporary Reader Housing Installation

You need to temporarily install a Reader Housing to verify proper fit before you begin the formal process of installation.

- **To temporarily install the Reader:**
 1. Set the sample Reader Housing in place and check for proper alignment.
 2. Remove the sample Reader Housing.
 3. Permanently weld the Reader Bracket.
 4. Paint the Reader Bracket to protect it from the elements.
 5. Replace the sample Reader Housing with the new temporary deck plate.

Final Reader Installation

Preliminary Requirements

Before actually installing the Reader, run the data communication and 230VAC power cables from the control console to the required location under the Reader housing.

Place a protective tarp and work blocks next to the prepared Reader location cell, and place the Reader on two 2x4 wooden work blocks with the top (Dock Plate) facing up.

Installing the Reader

- **To install the Reader:**
 1. Remove one (1) m10 screw from each end of the Reader's Deck Plate.
 2. Attach a Lifting Handle to each of the Reader's threaded holes, by inserting and turning the matching threaded end of the Lifting Tool until snug.

Figure 2-7 on page 2-11 illustrates the lifting points where the lifting tools are attached to the Reader. Figure 2-8 on page 2-11 is an example of a single Lifting Handle tool.

Figure 2-7 Reader Lifting Points

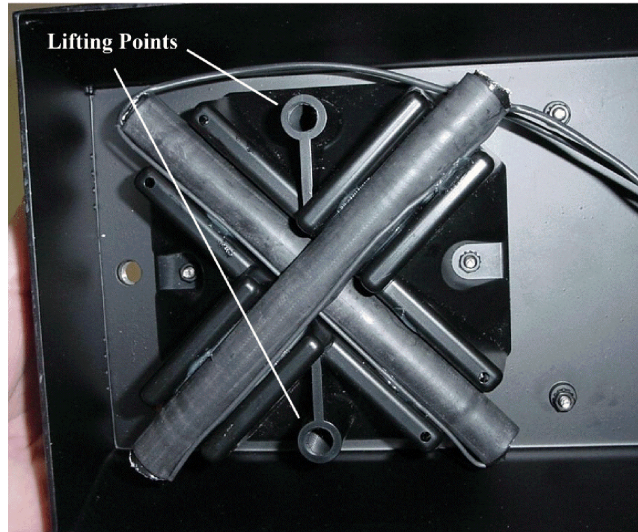
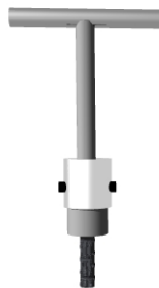


Figure 2-8 Lifting Tool (Handles)



3. Lift the Reader and *carefully* lower it onto the mounting Reader Brackets.



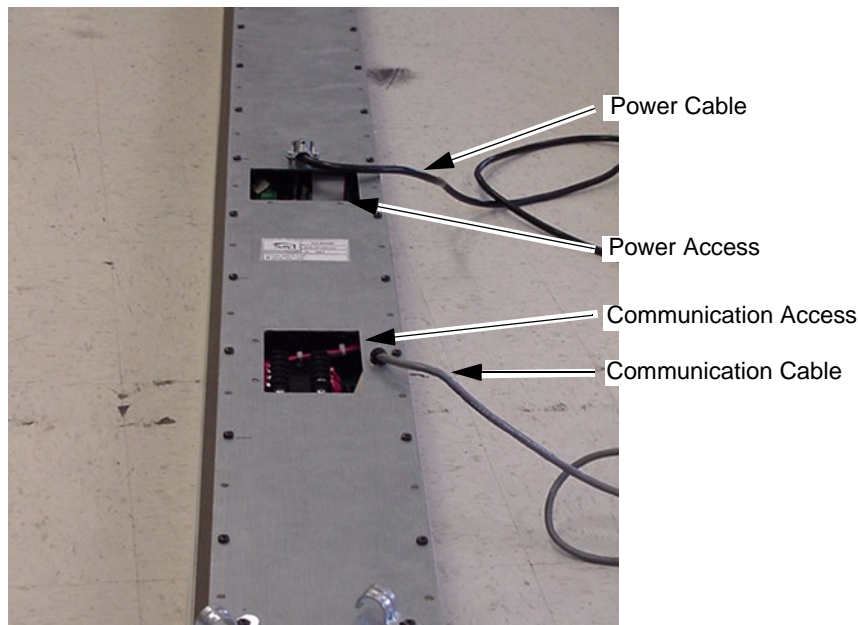
A third technician needs to be in a position to guide the Reader to the bracket pins. These pins are at the Access Panel end of the Reader. The mounting holes at this end of the Reader are NOT slotted.

ULD Reader Installation

4. Attach the Reader to the Reader Brackets using Retaining Bolts “A” (see Figure 2-6 on page 2-8).
5. Check for Reader distance from the roller tangent (0.480 -0.5”) at both ends of the Reader.
6. Check for any interference.
7. Remove Retaining Bolts “A” from both brackets.
8. Remove the Reader, and place it with the top (Dock Plate) facing down onto the two 2x4 wooden work blocks for communication and power connection, pulling two meters of cable slack from the pit.
9. Remove the Terminal Access Panels for power and communication on the bottom of the Reader.

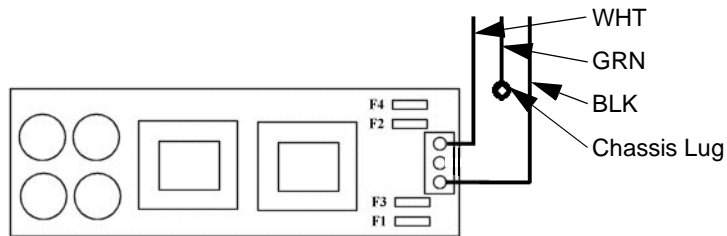
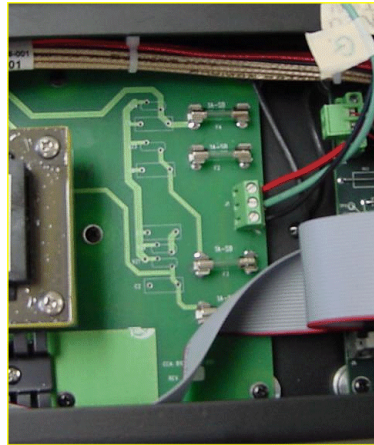
Figure 2-9 shows the Reader face down with its access panels for power and communication.

Figure 2-9 Terminal Access Panels



10. With power OFF to both the communication and power cables leading to the Reader, use a Multi-meter to perform a continuity check.
11. Attach the 230VAC wire connections to the terminal block, as shown in Figure 2-10.

Figure 2-10 Power Terminals



Terminal connections are as follows:

White (WHT) or Blue - Term # 1

Green (GRN) - Attached to the chassis lug.

Black (BLK) or Brown - Term # 3

12. Attach the communication cable to the terminal block (and PC), as described in the steps below and shown in Figure 2-11, Figure 2-12, and Figure 2-13.

- Insert the communication cable through the opening in the bottom cover.
- Clamp the Ferrite onto the communication cable.



The ferrite must be installed as described to meet FCC requirements.

ULD Reader Installation

- Connect the cable leads to the terminal block.
- Remove the excess cable from the compartment interior.
- Attach the strain relief and press into the housing.

Figure 2-11 Communication Terminals

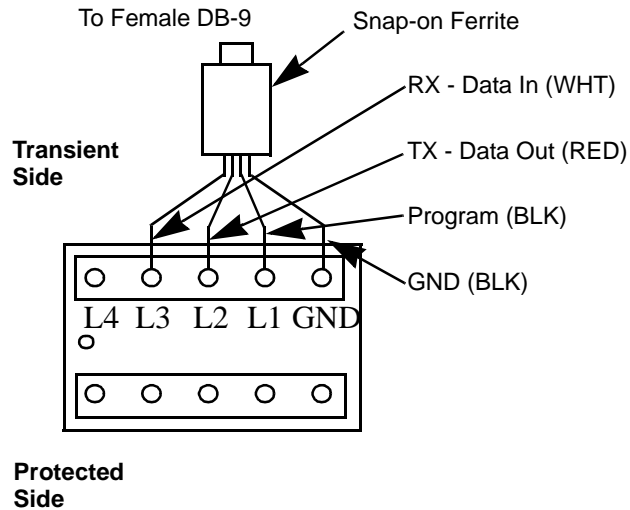
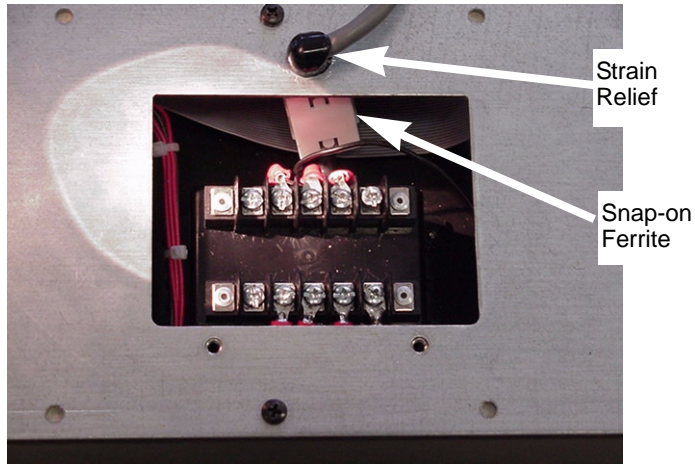


Figure 2-12 Transient Suppressor Connection

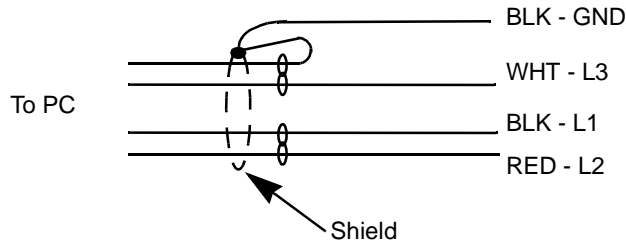
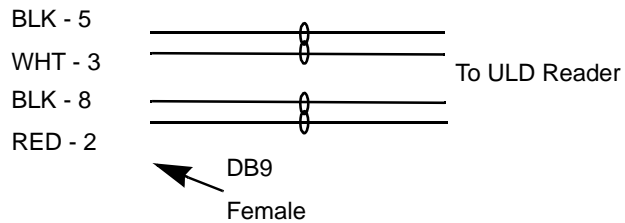


Figure 2-13 PC Connection



13. Secure the cables to the Strain Relief metal loops, located on the bottom of the Reader.
14. Reattach the Terminal Access Panel on the bottom of the Reader.
15. Turn the Reader with the top (Dock Plate) facing up.



A third technician needs to be in a position to guide the Reader to the Bracket pins and help manage the cables at the Access Panel end of the Reader.

16. Using the lifting handles, lower the Reader onto the permanently welded Reader Brackets.
17. Secure the Reader to the Reader Brackets using Retaining Bolts “A”.

Required Installation Tools

This section provides a listing of the required tools to perform the installation tasks outlined in this chapter. These tools include:

- Acetylene Torch (on-site access)
- Adhesives
- Arc Welder
- Phillips Screwdriver Set
- Standard Screwdriver Set
- Double Face Tape
- Soldering Gun/Pencil
- Solder
- Hand Grinder w/Misc. Wheels
- Socket Wrench Set (metric)
- Vice Grips
- Crescent Wrench Set
- Box/Open End Wrench Set
- Extension Cords
- Quad Power Box
- Wire Cutters/Strippers
- Multi-Meter
- Terminal Lug Crimper
- AMP DB-9 Connector Crimper
- Metric Tape Measure
- 2 ea. Mounting Bracket Alignment Fixtures
- 4 ea. Reader Lifting Tools

Installation Materials

The following materials are required to perform the installation tasks:

- 26 ea. Temporary Deck Plates
- 52 ea. Mounting Brackets
- 104 ea.(3/8 in. diameter) Nuts, Bolts and Washers
- A/R, AC Power Cable
- A/R, Data Cable
- 26 ea. DB-9 Female Connector
- A/R, Misc. Wire Lugs/Connectors
- 26 ea. ULD Readers

Reader Locations

This section consists of photographs illustrating Reader locations, including:

- TTTV 1 through 3 on page 2-18
- BV 1 and 2 on page 2-19
- ETV 1 through 3 on page 2-20
- Workstations 1 through 12 on page 2-21

TTTV 1 through 3

Each TTTV location requires two Readers. A Reader is to be placed at the front of the Stops on both the airside and the landside.

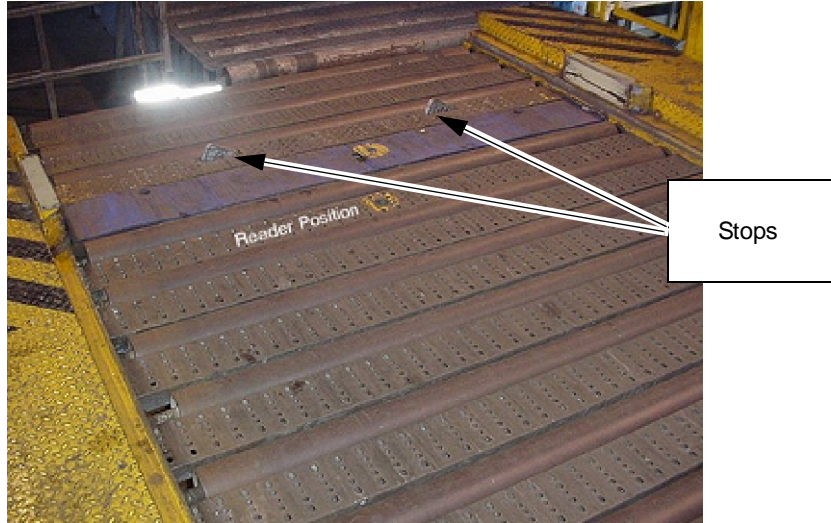
Figure 2-14 TTV 1 - 3 Location



BV 1 and 2

Each BV location requires one Reader.

Figure 2-15 BV 1 and 2 Location



ETV 1 through 3

Each ETV location requires two Readers. A Reader is to be placed at the front of the stops on both the airside and the landside.

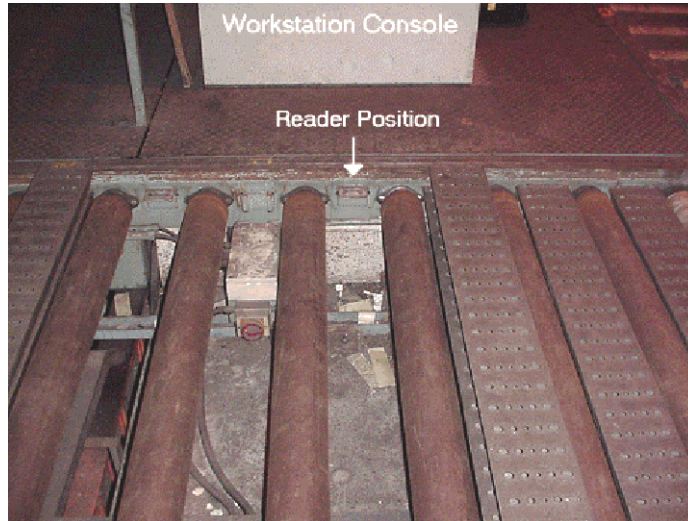
Figure 2-16 ETV 1 - 3 Location



Workstations 1 through 12

Each Workstation location requires one Reader.

Figure 2-17 Workstation 1 - 12 Location



Installation Sheets

The following installation sheets consist of hardware diagrams for the following locations:

- TTTV 1, Level 1 on page 2-23
- TTTV 2, Level 1 on page 2-24
- TTTV 3, Level 1 on page 2-25
- BV 1, Level 2 on page 2-26
- BV 2, Level 5 on page 2-27
- ETV 1, Level 1 on page 2-28
- ETV 2, Level 1 on page 2-29
- ETV 3, Level 1 on page 2-30
- Workstation 1 - 12, MCP 1, Level 1 on page 2-31

These installation sheets also consist of sign-off fields to be filled out and signed when work is complete.



Installation sheets must be completed and signed by the Installation Supervisor.

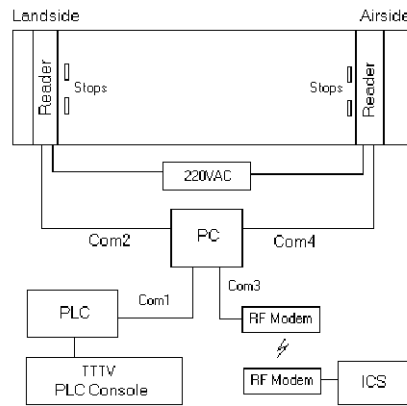
TTTV 1, Level 1

The Reader is positioned in front of the stops on the airside and the landside.

This location requires:

- 2 Readers
- 4 Brackets

Figure 2-18 TTTV1, Level 1 Hardware Diagram



Check list:

Station test:

Savi Supervisor sign-off:

Notes:

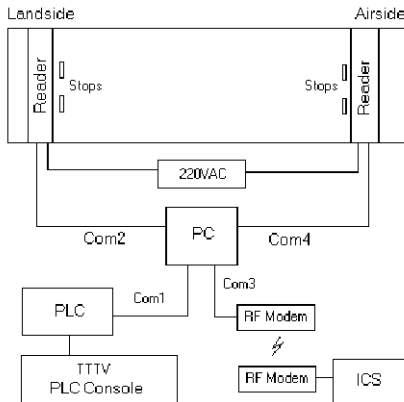
TTTV 2, Level 1

The Reader is positioned in front of the stops on the airside and the landside.

This location requires:

- 2 Readers
- 4 Brackets

Figure 2-19 TTTV 2, Level 1 Hardware Diagram



Check list:

Station test:

Savi Supervisor sign-off:

Notes:

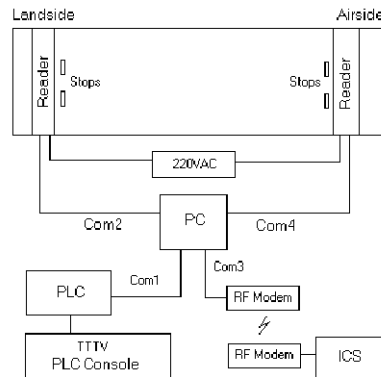
TTTV 3, Level 1

The Reader is positioned in front of the stops on the airside and the landside.

This location requires:

- 2 Readers
- 4 Brackets

Figure 2-20 TTTV 3, Level 1 Hardware Diagram



Check list:

Station test:

Savi Supervisor sign-off:

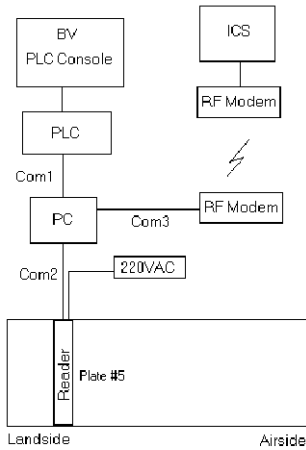
Notes:

BV 1, Level 2

This location requires:

- 1 Reader
- 2 Brackets

Figure 2-21 BV 1, Level 2 Hardware Diagram



Check list:

Station test:

Savi Supervisor sign-off:

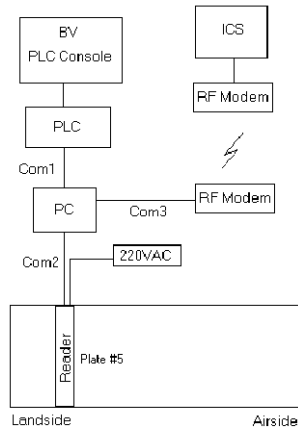
Notes:

BV 2, Level 5

This location requires:

- 1 Reader
- 2 Brackets

Figure 2-22 BV 2, Level 1 Hardware Diagram



Check list:

Station test:

Savi Supervisor sign-off:

Notes:

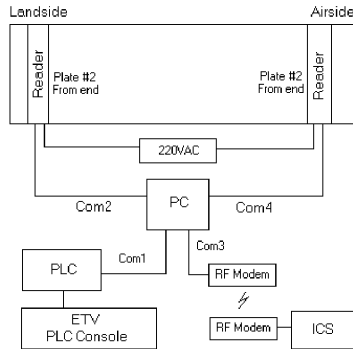
ETV 1, Level 1

The Reader is positioned in front of the stops on the airside and the landside.

This location requires:

- 2 Readers
- 4 Brackets

Figure 2-23 ETV 1, Level 1 Hardware Diagram



Check list:

Station test:

Savi Supervisor sign-off:

Notes:

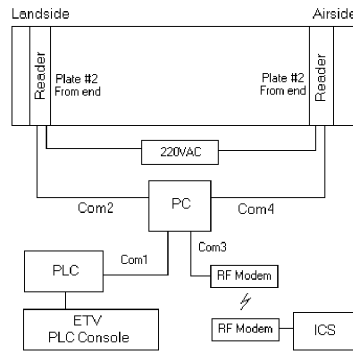
ETV 2, Level 1

The Reader is positioned in front of the stops on the airside and the landside.

This location requires:

- 2 Readers
- 4 Brackets

Figure 2-24 ETV 2, Level 1 Hardware Diagram



Check list:

Station test:

Savi Supervisor sign-off:

Notes:

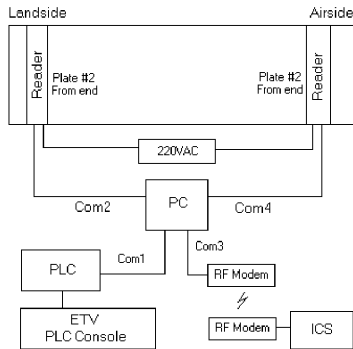
ETV 3, Level 1

The Reader is positioned in front of the stops on the airside and the landside.

This location requires:

- 2 Readers
- 4 Brackets

Figure 2-25 ETV 3, Level 1 Hardware Diagram



Check list:

Station test:

Savi Supervisor sign-off:

Notes:

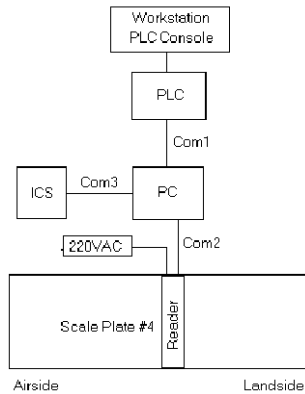
Workstation 1 - 12, MCP 1, Level 1

The Reader is positioned in front of the stops on the airside and the landside.

This location requires:

- 1 Reader
- 2 Brackets

Figure 2-26 Workstation 1-12, MCP 1, Level 1 Hardware Diagram



Check list:

Station test:

Savi Supervisor sign-off:

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