



*RFID Labeling Reference Manual*

---

*Thermal RFID Printers*

# Software License Agreement

CAREFULLY READ THE FOLLOWING TERMS AND CONDITIONS BEFORE USING THIS PRINTER. USING THIS PRINTER INDICATES YOUR ACCEPTANCE OF THESE TERMS AND CONDITIONS. IF YOU DO NOT AGREE TO THESE TERMS AND CONDITIONS, PROMPTLY RETURN THE PRINTER AND ALL ACCOMPANYING HARDWARE AND WRITTEN MATERIALS TO THE PLACE YOU OBTAINED THEM, AND YOUR MONEY WILL BE REFUNDED.

## Definitions.

“Software” shall mean the digitally encoded, machine-readable data and program. The term “Software Product” includes the Software resident in the printer and its documentation. The Software Product is licensed (not sold) to you, and Printronix, Inc. either owns or licenses from other vendors who own, all copyright, trade secret, patent and other proprietary rights in the Software Product.

## License.

1. Authorized Use. You agree to accept a non-exclusive license to use the Software resident in the printer solely for your own customary business or personal purposes.
2. Restrictions.
  - a. To protect the proprietary rights of Printronix Auto ID Technology, Inc., you agree to maintain the Software Product and other proprietary information concerning the typefaces in strict confidence.
  - b. You agree not to duplicate or copy the Software Product.
  - c. You shall not sublicense, sell, lease, or otherwise transfer all or any portion of the Software Product separate from the printer, without the prior written consent of Printronix Auto ID Technology, Inc.
  - d. You may not modify or prepare derivative works of the Software Product.
  - e. You may not transmit the Software Product over a network, by telephone, or electronically using any means; or reverse engineer, decompile or disassemble the Software.
  - f. You agree to keep confidential and use your best efforts to prevent and protect the contents of the Software Product from unauthorized disclosure or use.
3. Transfer. You may transfer the Software Product with the printer, but only if the recipient agrees to accept the terms and conditions of this Agreement. Your license is automatically terminated if you transfer the Software Product and printer.

## Limited Software Product Warranty

Printronix Auto ID Technology, Inc. warrants that for ninety (90) days after delivery, the Software will perform in accordance with specifications published by Printronix Auto ID Technology, Inc. Printronix Auto ID Technology, Inc. does not warrant that the Software is free from all bugs, errors and omissions.

## **Remedy**

Your exclusive remedy and the sole liability of Printronix Auto ID Technology, Inc. in connection with the Software is replacement of defective software with a copy of the same version and revision level.

## **Disclaimer of Warranties and Limitation of Remedies**

1. THE PARTIES AGREE THAT ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE AND MERCHANTABILITY ARE EXCLUDED.  
Printronix Auto ID Technology, Inc. does not warrant that the functions contained in the Software will meet your requirements or that the operation of the Software will be uninterrupted or error free. Printronix, Inc. reserves the right to make changes and/or improvements in the Software without notice at any time.
2. IN NO EVENT WILL PRINTRONIX AUTO ID TECHNOLOGY, INC. BE LIABLE FOR LOST PROFITS, LOST DATA, BUSINESS INTERRUPTIONS, OR ANY OTHER DIRECT, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OF OR INABILITY TO USE THIS PRODUCT, EVEN IF PRINTRONIX, INC. HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, OR ANY DAMAGES CAUSED BY THE ABUSE OR MANIPULATION OF THE SOFTWARE. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.
3. Printronix Auto ID Technology, Inc. will not be liable for any loss or damage caused by delay in furnishing a Software Product or any other performance under this Agreement.
4. Our entire liability and your exclusive remedies for our liability of any kind (including liability for negligence except liability for personal injury caused solely by our negligence) for the Software Product covered by this Agreement and all other performance or nonperformance by us under or related to this Agreement are limited to the remedies specified by this Agreement.
5. California law governs this Agreement.

## **Termination of License Agreement**

This License shall continue until terminated. This license may be terminated by agreement between you and Printronix Auto ID Technology, Inc. or by Printronix Auto ID Technology, Inc. if you fail to comply with the terms of this License and such failure is not corrected within thirty (30) days after notice. When this License is terminated, you shall return to the place you obtained them, the printer and all copies of the Software and documentation.

## **U.S. Government Restricted Rights**

Use, duplication or disclosure by the Government is subject to restrictions as set forth in the Rights in Technical Data and Computer Software clause at FAR 242.227-7013, subdivision (b) (3) (ii) or subparagraph (c) (1) (ii), as appropriate. Further use, duplication or disclosure is subject to restrictions applicable to restricted rights software as set forth in FAR 52.227-19 (c) (2).

### **Acknowledgement of Terms and Conditions**

YOU ACKNOWLEDGE THAT YOU HAVE READ THIS AGREEMENT, UNDERSTAND IT, AND AGREE TO BE BOUND BY ITS TERMS AND CONDITIONS. NEITHER PARTY SHALL BE BOUND BY ANY STATEMENT OR REPRESENTATION NOT CONTAINED IN THIS AGREEMENT. NO CHANGE IN THIS AGREEMENT IS EFFECTIVE UNLESS WRITTEN AND SIGNED BY PROPERLY AUTHORIZED REPRESENTATIVES OF EACH PARTY. BY USING THIS PRINTER, YOU AGREE TO ACCEPT THE TERMS AND CONDITIONS OF THIS AGREEMENT.

COPYRIGHT © 2018 PRINTRONIX AUTO ID TECHNOLOGY, INC. All rights reserved.

### **Trademark Acknowledgements**

Alien and Alien Technology are registered trademarks of Alien Technology Corporation.

Avery is a trademark of Avery Dennison Corporation.

Printronix, PGL, and PrintNet are registered trademarks of Printronix, Inc.

T800, T4000, T6000, T8000, SL5000r, SL5R Energy Star, and SL4M are trademarks of Printronix Auto ID, Inc.

Uniform Code Council, Inc. is a registered trademark of Uniform Code Council, Inc.

Zebra and ZPL are trademarks of Zebra Technologies Corporation.

# Table of Contents

Software License Agreement .....	2
Trademark Acknowledgements .....	4
<b>1 Reference Notes .....</b>	<b>7</b>
Overview .....	7
What to Expect when Running an RFID Application .....	7
Factors Affecting Smart Label Performance .....	7
Overstruck Smart Labels .....	7
Smart Label Characteristics .....	7
General Tag Type .....	7
Technology Tag Class .....	7
LabelSize .....	8
Website Support .....	8
<b>2 Setting up the RFID Printer .....</b>	<b>9</b>
Media > Media Handling  .....	9
Sensors > Control  .....	9
RFID > Control  .....	9
<b>3 RFID Calibration .....</b>	<b>10</b>
Antenna System .....	10
Selecting the Antenna Position (T6000) .....	10
Selecting the Antenna Position (T800) .....	11
RFID Calibration Procedure .....	12
<b>4 Smart Label Operation .....</b>	<b>13</b>
Overview .....	13
Enable RFID .....	13
Supported UHF Gen2 Tag Types .....	14
Higgs 3 EPC/USR Lengths and PC Values .....	14
Overstrike Error Messages .....	15
RFID Menu Overview  .....	17
Configuring  the RFID .....	18
<b>5 RFID Commands .....</b>	<b>31</b>
RFWTAG .....	31
RFRTAG .....	40
VERIFY .....	42
ZGL RFID Commands .....	45

Read Tag ^RT .....	45
Write Tag ^WT .....	46
Write or Read Format ^RF .....	46
Calibrate Transponder ^HR .....	47
Define EPC Data Structure ^RB .....	47
Enable RFID Motion ^RM .....	47
Specify RFID Retries for a Block ^RR .....	48
RFID Setup ^RS.....	48
Tag Password ^RZ.....	48
Host Verification ^HV .....	50
EPC Programming Examples .....	50
STGL RFID Commands .....	52
RFID Write .....	52
RFID Write(IP0), RFID Read(IP1).....	53
PTX SETUP Commands .....	53
<b>7 RFID Inlay Pitch.....</b>	<b>55</b>
RFID Inlay Pitch.....	55
Short-Pitch RFID Labels.....	56
On-Pitch RFID Labels.....	57
<b>A Errors and Troubleshooting.....</b>	<b>59</b>
Error Messages .....	59
Troubleshooting.....	60
<b>B Contact Information.....</b>	<b>62</b>
Printronic Customer Support Center .....	62
Corporate Offices .....	63

# 1 *Reference Notes*

## Overview

This manual covers the Printronix T800 T4000 and T6000 Multi-protocol RFID printers, Class Gen 2, RFID tags, and labels. For the latest version of this reference manual, visit the [Services & Support page at www.PrintronixAutoID.com](http://www.PrintronixAutoID.com).

## What to Expect when Running an RFID Application

### Factors Affecting Smart Label Performance

Smart labels are based on an EEPROM technology that requires some time to be programmed. You may notice this minor pause between labels. This time is necessary to better ensure consistent quality and improved reliability.

When dealing with smart labels, it is possible that an occasional RFID tag may need to be written and verified more than once (retry) before being considered acceptable. In this event each retry time will be added to the inter-label pause.

Static electricity can damage the smart labels. Open the media cover of the printer and touch an unpainted metal part of the printer before you handle smart labels. This will discharge any static electricity that may have built up on your hands.

### Overstruck Smart Labels

If an RFID tag within a smart label is deemed unacceptable after execution of the defined number of retries, what occurs next depends upon the *RFID > Control > Error Handling* setting. See section “Error Handling” on page 19.

### Smart Label Characteristics

**IMPORTANT:** Purchase additional smart labels directly from Printronix Auto ID to assure the highest level of performance and reliability. See the section “Printronix Customer Support Center”.

Currently supported smart labels have the following characteristics:

#### General Tag Type

- UHF 869/915 MHz radio frequency

#### Technology Tag Class

EPC Class Gen 2 tags – 96 to 256 data bits EPC Read/Write, 512 bits User Memory.

## Label Size

Printronix Auto ID RFID printers are compatible with the latest chips (IC's) and inlays from the major suppliers in the RFID industry. The printers are equipped with an *Auto-Calibration* feature for easy setup eliminating the need to specify exact inlay placement or RFID power settings. The calibration routine has been tested with most major inlays embedded in typical label sizes and will work with many other inlays as well. Here are a few things to consider for optimum performance.

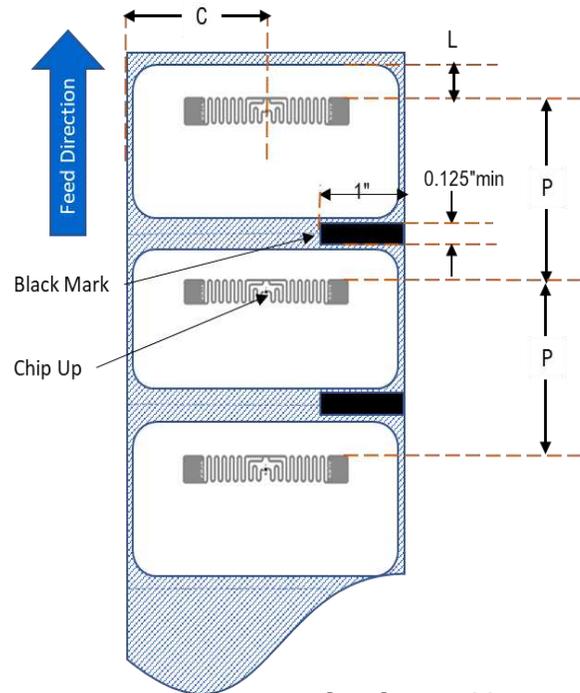
### Referring to the diagram at right:

Inlays should be centered horizontally across the media (dimension "C"). Consistent, tag-to-tag placement of the inlays is more important than how close to center the inlays are actually placed.

The pitch (overall distance from inlay to inlay) is shown as dimension "P". On-pitch tags and tags with pitch less than 1" may require the printer to back-feed during the encoding and printing process, thus slowing the throughput of the printer. The pitch should be greater than 1", if possible to avoid this condition.

The inlay should be set back from the lead edge of the media (dimension "L") a constant distance tag to tag. For labels longer than 1" this distance should be greater than 0.5" to avoid back-feeding.

Always test RFID media on your printer before purchasing large quantities of media



C = Center-Line  
L = Lead Edge  
P = Pitch

## Website Support

Printronix RFID printers support a number of RFID protocols and coupler configurations.

For a complete list of Certified RFID Smart Labels available from Printronix, go to [www.PrintronixAutoID.com](http://www.PrintronixAutoID.com) media and supplies.

Refer to [www.PrintronixAutoID.com/rfid-inlay-placement/](http://www.PrintronixAutoID.com/rfid-inlay-placement/) for the latest specifications.

## Disclaimer:

The guidelines and suggestions for developing converted RFID labels, are provided by Printronix Auto ID on an "as is" basis and without warranty, expressed or implied. Printronix Auto ID disclaims any implied warranty of merchantability or fitness for a particular purpose. Printronix Auto ID will not be liable under any circumstances for any damages or losses related in any way to use of these guidelines, specifications or other information, including damages which may be incurred as a result of labels not working properly in a specific application. All specifications are subject to change without notice. Testing of the converted labels in the printer is strongly recommended prior to production quantities

# 2 *Setting up the RFID Printer*

## Media > Media Handling

- **Continuous.** Only forward media motion occurs. When the print job ends the trailing edge of the last label printed remains at the TOF position under the printhead (not aligned at the Tear Bar). If the RFID menu has *Control > Tag Position* set at a negative value, (ex., -0.2 inches), the printer will move in reverse for a 0.2 inch distance as each tag is encoded. The last label printed will still remain at the TOF position under the printhead (not aligned at the Tear Bar).
- **Tear-Off Strip.** When a print job is sent, the leading edge of the first label will be pulled back to the TOF position under the printhead. If the RFID menu has Tag Position set at a negative value, (ex., -0.2 inches), the printer will move in reverse for a 0.2 inch distance as each tag is encoded. When the print job is complete the printer will place the trailing edge of the last printed label at the tear bar for easy removal.

## Sensors > Control

- **Gap.** Select Gap sensing when a liner gap exists between die cut RFID labels.
- **Mark.** Select Mark sensing when a black mark exists on the underside of the RFID label liner.

**IMPORTANT:** When the correct sensing is done, perform an Auto-Calibrate.

## RFID > Control

- **RFID Active.** Select Enable to enable the RFID encoder module.
- **Open the print head to reveal RFID antenna. Position RFID antenna to line up with the RFID chip on the tag. Close the print head and clear printer fault.**
- **RFID Profiling.** Run RFID calibration to get the RFID chip type, program position, read/write power, and memory bank sizes.

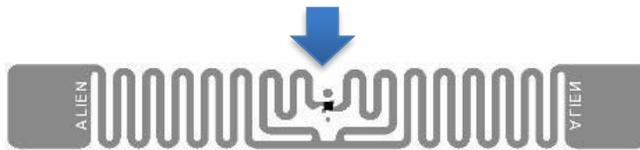
# 3 *RFID Calibration*

## Antenna System

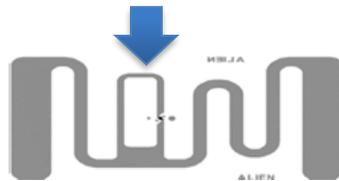
The T800, T4000 and T6000 printers have an RFID antenna coupler design that supports a wide variety of tag types. The T4000 has a fixed position antenna mounted at the exit of the printer (as part of the tear or cutter options). The T800 and T6000 antenna is affixed to the media guard and can be moved horizontally into seven different detent positions.

### Selecting the Antenna Position (T6000)

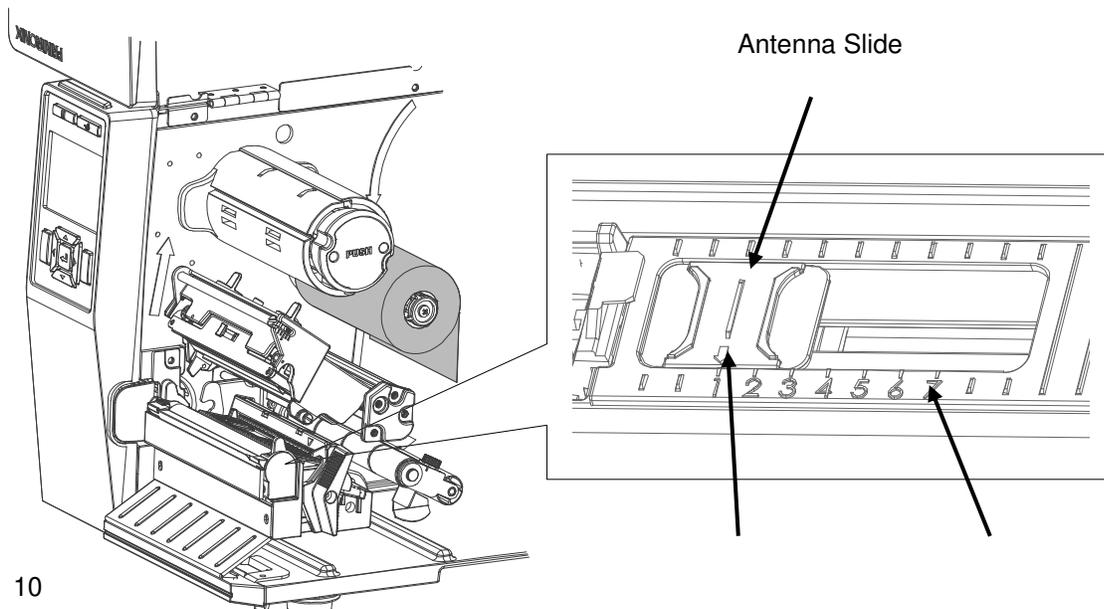
- 1) Visually inspect the label to determine the best position for the antenna, locating the antenna loop within the tag. In most cases, the antenna loop will be directly above or below the chip



The loop may be off to one side of the chip in some tags:

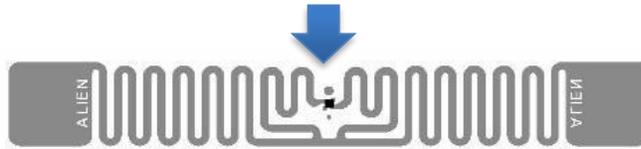


- 2) Rotate the deck lock lever fully clockwise to open the pivoting deck to access the antenna slide. Move the slide so that the position indicator aligns with the loop in the tag.

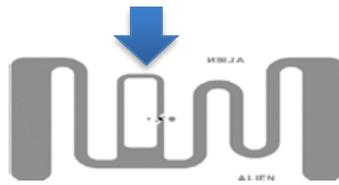


## Selecting the Antenna Position (T800)

- 1) Visually inspect the label to determine the best position for the antenna, <sup>Position Indicator</sup> locating the antenna loop <sup>Numbered Position Strip</sup> within the tag. In most cases, the antenna loop will be directly above or below the chip



The loop may be off to one side of the chip in some tags:



- 2) Rotate the deck lock lever fully clockwise to open the pivoting deck to access the antenna slide. Move the slide so that the position indicator aligns with the loop in the tag.

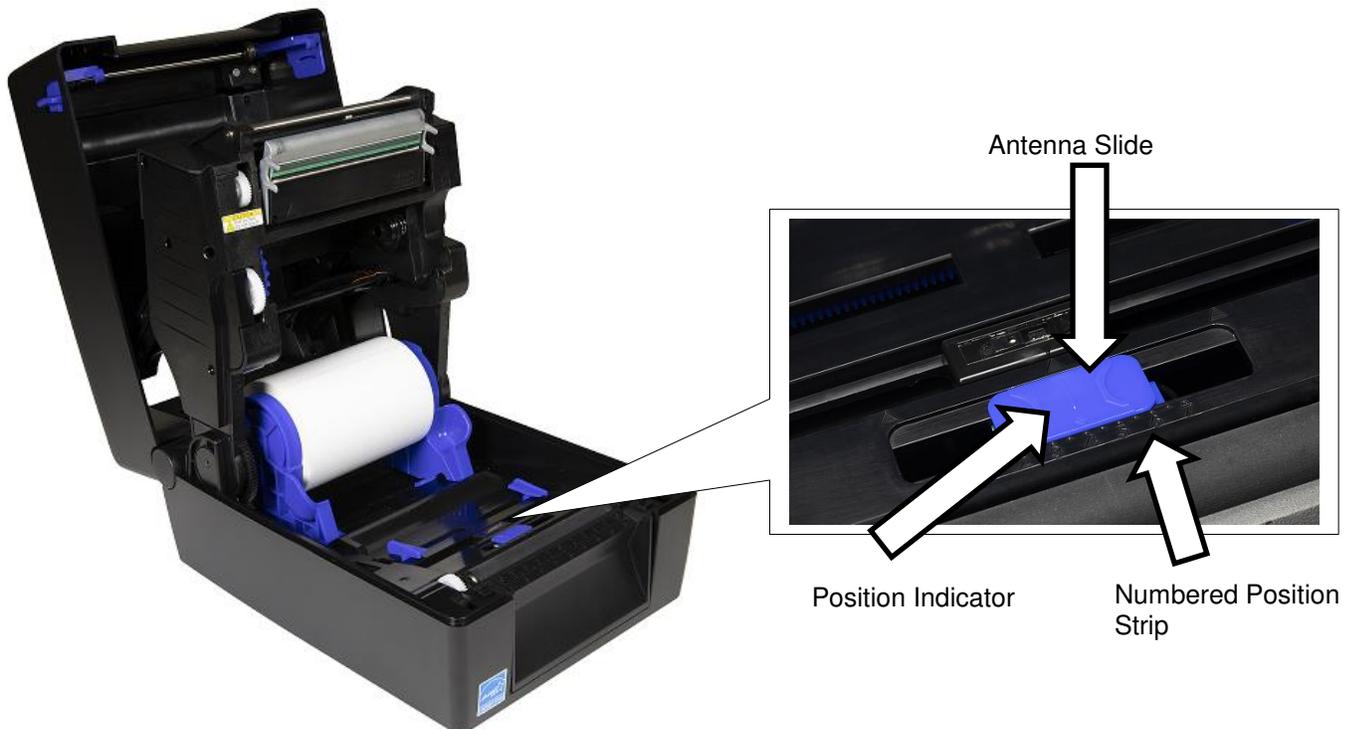
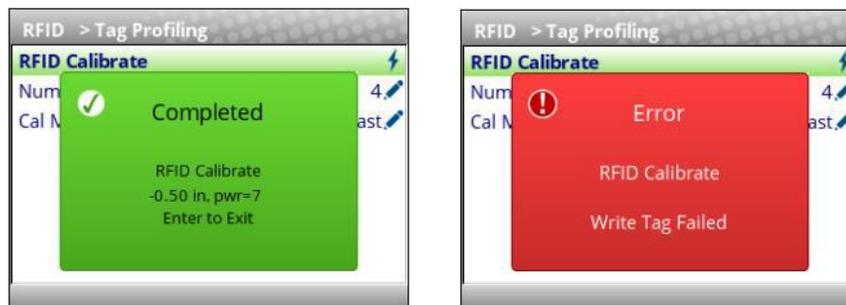


Figure 1 Selecting the Antenna Position

# RFID Calibration Procedure

There are a few steps to do the RFID calibration:

- 1) The first step is to perform Media Calibration. It is necessary to have label length set properly; or the results of the RFID calibration will not be optimal. Refer to Label Calibration in printer's *Administrator's Manual*.
- 2) Verify the RFID antenna is set at the position of the center of the RFID chip or antenna loop on the tag.
- 3) Go to RFID menu > Tag Profiling > Run Calibrate and press the Enter key to execute the calibration.
- 4) Depending on the tag type and tag length, the calibration can take several minutes. At the end of calibration either a Green or Red window pops up. A green window signifies successful calibration and a red window means calibration has failed.



- 5) If calibration fails, you will see a red screen. Press the Pause or Enter key to clear the failure notice. In most cases when this error occurs, it is necessary to re-position the antenna slide. In some cases it may be due to an incompatibility between the tag and the reader.
- 6) After calibration is complete, press the Enter key to continue.
- 7) When going next online, choose the option to save your settings into your configuration so that the RFID calibration values will be preserved.

# 4 *Smart Label Operation*

## Overview

This chapter describes how to use the RFID encoder. The RFID encoder is designed to be transparent to the printer operation. It provides the capability of programming smart labels (with embedded RFID tags) while printing the label format. The smart labels are provided with the printer or purchased separately from Printronix Auto ID.

There are several ways to program RFID tags in smart labels:

- Incorporate RFID commands into new or existing Printronix PGL<sup>®</sup> programs.
- Incorporate RFID commands into new or existing ZPL<sup>™</sup> programs. By selecting the Printronix ZGL emulation you can seamlessly upgrade from Zebra<sup>™</sup> printers.
- Incorporate RFID commands into new or existing SATO<sup>®</sup> printer language programs. By selecting the Printronix STGL emulation you can seamlessly upgrade from SATO printers.

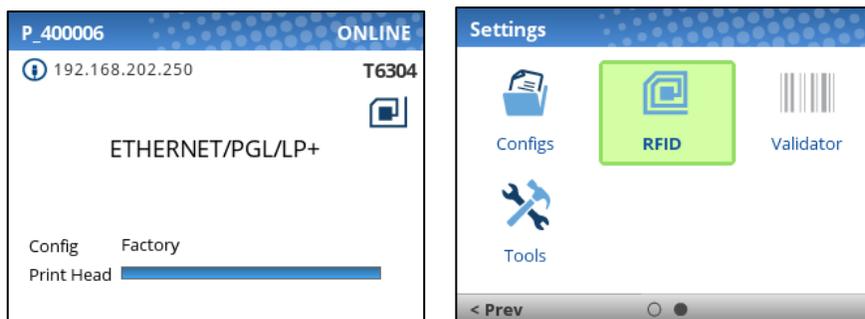
## Enable RFID

**IMPORTANT** If you make any changes to the default configuration menu items, you will be prompted to save the configuration when you attempt to put the printer online. See the *Administrator's Manual* for more information.

Software can automatically detect an installed RFID encoder when the printer is powered up. The state of the RFID feature can be observed from the ONLINE screen as shown in the Figure 2 below:

- The ONLINE screen will show the “enabled” RFID symbol  under the model number when the RFID encoder is installed AND enabled via the menu *RFID > Control > RFID Active*.
- The ONLINE screen will show the “disabled” RFID symbol  under the model number when the RFID encoder is installed and disabled via the menu *RFID > Control > RFID Active*.
- If the RFID encoder is not installed, then no RFID symbol will be present on the ONLINE screen and the full color RFID icon shown in the Settings section in Figure 2 is replaced with a grayed out version which the user cannot select.

**Figure 2 RFID Icon**



Once the RFID is installed, the RFID section under Settings can be selected and the RFID configured. However, it may not be enabled by default:

- If the printer is powered up with the menu *Configs > Control > Power-Up Config* set to Factory, the *RFID > Control > RFID Active* will be set to “Enable” automatically.
- If the printer is powered up with *Configs > Control > Power-Up Config* to something other than Factory, the *RFID > Control > RFID Active* could be set to “Disable”.

To enable the RFID feature, change the menu *RFID > Control > RFID Active* to “Enable” and save the configuration as described in the *Administrator’s Manual*.

## Supported UHF Gen2 Tag Types

For tag type specifications, go to [www.PrintronixAutoID.com/rfid-inlay-placement/](http://www.PrintronixAutoID.com/rfid-inlay-placement/). Select the desired Printronix specification for more information.

### Higgs 3 EPC/USR Lengths and PC Values

Higgs 3 tags differ from other RFID tags in that its memory bank size is not fixed. To accommodate EPC lengths longer than 96 bits, Higgs 3 borrows memory from the USR bank. The default is 96 bits. If EPC values longer than 96 bits are to be written by the application, the menu item *RFID > Custom Tag > Higgs 3 EPC Len* should be changed to accommodate the data.

When the EPC length is selected, the USR length sets automatically (see Table 1). Since the PC value indicates the length of the EPC in the Higgs 3, the PC value must be programmed when programming the EPC (if the EPC value has changed from its factory state).

**Table 1 EPC/USR Lengths and PC Values**

EPC Length	USR Length	PC Value
96	512	0x3000
112	448	0x3800
128	448	0x4000
144	448	0x4800
160	448	0x5000

176	384	0x5800
192	384	0x6000
208	384	0x6800
224	384	0x7000
240	320	0x7800
256	320	0x8000
272	320	0x8800
288	320	0x9000
304	256	0x9800
320	256	0xA000
336	256	0xA800
352	256	0xB000
368	192	0xB800
384	192	0xC000
400	192	0xC800
416	192	0xD000
432	128	0xD800
448	128	0xE000
464	128	0xE800
480	128	0xF000

## Overstrike Error Messages

When an error occurs with the RFID functions within a job, the user can choose different styles of Overstrike Style, including having the error printed on the label per Table 2. The **x** in the error messages represents a number code that identifies the area in the printer software or RFID encoder where the failure occurred.

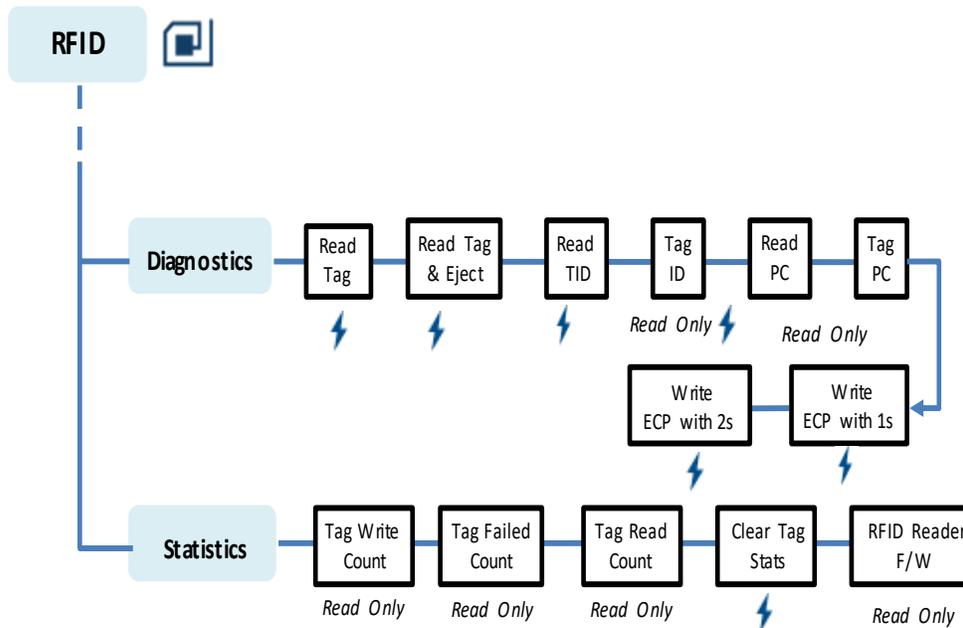
**Table 2 Printed Overstrike Error Messages**

Error Message	Explanation
Tag R/W Err x Check media	The printer software attempted to write to or read from the RFID tag, but the RFID encoder indicated that the tag could not be written to or read from.

<p>Tag Comm Err x Check cable</p>	<p>The printer software temporarily lost communication with the RFID encoder, or communication between the printer software and the RFID encoder was not synchronized and had to be forced.</p>
<p>Precheck Fail x Check media</p>	<p>This failure occurs only when the <i>Precheck Tags</i> is enabled. It indicates that the RFID tag was automatically failed since it did not contain the correct pre-programmed quality code.</p>



Figure 5 RFID Diagnostics, Statistics Submenus



- The **Diagnostics** submenu is used to run test procedures to help determine the accuracy and troubleshoot the RFID system. Those menus are described starting on page 27.
- The **Statistics** submenu is general read-only and used to gather and report statistics on how the RFID system is reporting on print jobs sent to the printer. Those items are described starting on page 29.

## Configuring the RFID

Configuring the RFID is done by selecting the RFID icon  within the Settings section. The RFID comes equipped with a default setting for each configuration option, and it works without having to change any of these options. However, in some cases it is necessary to adjust these options, which are described below.

**IMPORTANT** If you are unable to select the RFID icon or the icon is grey, then the RFID is not properly installed. Refer to Section “Printronix Customer Support Center” for help on how to solve this problem.

**IMPORTANT** If you make any changes to the default configuration menu items, you will be prompted to save the configuration. Use the UP and DOWN Arrow Keys to unlock the control panel. See “Auto Save Configuration” in the *Administrator’s Manual*.

### Enabling and Disabling

Software can automatically detect an installed RFID when the printer is powered up. If the printer is powered up with *Configs > Control > Power-Up Config* set to “Factory”, the RFID icon can be selected and *RFID > Control > RFID Active* is set to “Enable”.

If Power-Up Config. is not set to Factory, the RFID icon can be selected, but *RFID > Control > RFID Active* could be set to “Disable”. Set this menu to “Enable” and save the configuration as described in the *Administrator’s Manual*. In the same manner, the RFID can be disabled.

## Control Submenu

A number of RFID options which define specific parameters for certain print jobs can be set from the RFID > Control submenu.

### RFID Active

<b>RFID &gt; Control &gt; RFID Active</b>	
Software can automatically detect an installed RFID reader when the printer is powered up. If the printer is powered up with <i>Configs &gt; Control &gt; Power-Up Config</i> set to “Factory”, the RFID icon can be selected and this option is set to “Enable”.	
If <i>Power-Up Config</i> is not set to Factory, the RFID icon can be selected, but this option could be set to “Disable”.	
Disable	The RFID function is disabled and not active.
Enable	The RFID function is enabled and active.
Factory Default	Depends on <i>Configs &gt; Control &gt; Power-Up Config</i> setting. See above.

## Error Handling

<b>RFID &gt; Control &gt; Error Handling</b>	
This menu item selects the error handling mode for RFID failures.	
Overstrike	Each failed label prints with the Overstrike pattern and the form retries on a new label until the Label Retry count is exhausted. Whether or not an error message will display or the failed label will reprint depends upon the <i>Max Retry Error</i> setting.
None	No specific action is taken when a tag fails to be programmed.
Stop	The printer will halt and display the error message “RFID Error: Check Media.” The label is discarded and reprinting of the label (if desired) must be initiated from the host. When the error is cleared, the label with the failed tag moves forward until the next label is in position to be printed.
Factory Default	Overstrike

## Label Retry

<b>RFID &gt; Control &gt; Label Retry</b>	
This menu item selects the number of label retries that the RFID encoder will attempt before declaring a fault. This may indicate a problem with the RFID encoder, the coupler assembly, the printer setup, or the label stock.	

Minimum	1
Maximum	10
Factory Default	10
<b>IMPORTANT</b>	Label Retry only applies when the <i>Error Handling</i> mode is set to Overstrike.

### Max Retry Error

RFID > Control > Max Retry Error	
This menu item determines if errors are declared when the <i>Label Retry</i> count is exceeded.	
Disable	Errors are not declared and the print content for the current label is discarded.
Enable	Errors are declared when the tag cannot be programmed within the <i>Label Retry</i> count.
Factory Default	Enable

### Auto Retry

RFID > Control > Auto Retry	
This menu item selects the number of automatic (internal) retries that the printer will attempt on the same tag before taking action per the menu <i>Error Handling</i> . Not included on T4000.	
Minimum	1
Maximum	9
Factory Default	2

### Overstrike Style

RFID > Control > Overstrike Style	
This menu item selects the style of the overstrike pattern.	
Grid	A grid pattern prints when it overstrikes. On the T6000, this will be a partial grid pattern.
Error Type Msg	An error message prints that indicates which error occurred per Table 2.
Factory Default	Grid
<b>IMPORTANT</b>	<b>If you are using a validator, set the RFID Overstrike Style different than <i>VALIDATOR &gt; Control &gt; Overstrike Style</i>. This will help you differentiate errors.</b>

### EPC Write Ctrl

RFID > Control > EPC Write Ctrl	
This option controls how the printer encodes the RFID tag EPC field.	
Data Length	Only the amount of data provided in the application is encoded.
Full EPC Length	The maximum EPC length for the particular tag type

	in use is written to the tag (padded with zeroes if necessary).
Factory Default	Data Length
<b>IMPORTANT</b>	<b>If <i>Auto Write PC</i> is enabled, the PC field encodes information about the length of the EPC written.</b>

### Auto Write PC

<b>RFID &gt; Control &gt; Auto Write PC</b>	
This option controls whether the printer automatically writes the RFID tag PC field to encode information about the length of the EPC field or whether the application is required to specify. Not included on T4000.	
Disable	The PC is not automatically written unless part of the application data.
Enable	The PC is automatically written regardless of the application data.
Factory Default	Enable

### Tag Position

<b>RFID &gt; Control &gt; Tag Position</b>	
This menu determines how far the RFID tag encoding position of the currently installed tag should be offset from Top of Form.	
Minimum	-1.0 inches
Maximum	5.0 inches
Factory Default	0.0 inches (Top of Form)
<b>IMPORTANT</b>	<b>The units display in inches or millimeters, depending on <i>SYSTEM &gt; Control &gt; Media Units</i>.</b>  <b>This value will be set when RFID calibration is executed. Normally, this value should be left at the value chosen by RFID calibration because this was determined to be the optimal programming position.</b>

### AutoID Mgr Rpt

<b>RFID &gt; Control &gt; AutoID Mgr Rpt</b>	
This menu item enables AutoID and label information to be sent out the network port. This information can be used by an RFID tag data and labels manager program.	
Disable	No data is sent out the network port.
Enable	Data is sent out the network port.
Factory Default	Disable

## Non-RFID Warning

RFID > Control > Non-RFID Warning	
This menu item enables a warning to appear if the printer receives a print job that does not contain any RFID commands when RFID media is installed in the printer.	
Disable	No warnings will be produced when data is received.
Enable	Warnings will be produced when the condition is met.
Factory Default	Disable

## Custom Tag Submenu

A number of RFID options which define specific parameters for custom RFID tags can be set from the *RFID > Custom Tag* submenu.

## Write Power

RFID > Custom Tag > Write Power	
This menu item selects the write power level to be used in the RFID encoder. 1 is the lowest power level setting, and 7 for T800, 30 for the T4000, and 25 is the highest for T6000. Normally, this value is set automatically by the RFID calibration process and should not be changed.	
Minimum	1
Maximum	25 (T6000) / 7 (T800) / 30 (T4000)
Factory Default	Depends on the type of RFID encoder installed.

## Read Power

RFID > Custom Tag > Read Power	
This menu item selects the read power level to be used in the RFID encoder. 1 is the lowest power level setting, and 7 for T800, 30 for the T4000, and 25 is the highest for T6000. Normally, this value is set automatically by the RFID calibration process and should not be changed.	
Minimum	1
Maximum	25 (T6000) / 7 (T800) / 30 (T4000)
Factory Default	Depends on the type of RFID encoder installed.

## USR Size

RFID > Custom Tag > USR Size	
This menu item selects the size in bytes of the USR block within the RFID tag memory. Normally, this value is set automatically by the RFID calibration process and should not be changed.	
Minimum	0
Maximum	128
Factory Default	0
<b>IMPORTANT</b>	<b>This value will be hidden if Higgs3 tags are de-</b>

	tected, and the Higgs 3 USR Len menu will be un-hidden instead.
--	---

**Higgs 3 USR Len**

<b>RFID &gt; Control &gt; Higgs 3 USR Len</b>	
<p>Higgs 3 tags differ from other RFID tags in that its memory bank size is not fixed. To accommodate EPC lengths longer than 96 bits, Higgs 3 borrows memory from the USR bank. This display only menu indicates the size in bits of the USR block within the RFID tag memory.</p>	
Minimum	128
Maximum	512
Factory Default	512
<b>IMPORTANT</b>	<p><b>This menu will only be shown if a Higgs 3 tag is detected. Otherwise, it will be hidden.</b></p> <p><b>When an EPC length is selected by the user in this menu, the value in this USR length menu will change automatically per Table 1. The USR length in this menu must be set to a value that is equal to or longer than all USR value lengths to be written by the application. If the value displayed in this menu is too short in length, the Higgs 3 EPC Len menu must be reduced so that this menu value will increase.</b></p>

## USR Address

RFID > Custom Tag > USR Address	
This menu item selects the starting location of the USR block within the RFID tag memory. Normally, this value is set automatically by the RFID calibration process and should not be changed.	
Minimum	0
Maximum	32
Factory Default	0

## TID Size

RFID > Custom Tag > TID Size	
This menu item indicates the size of the memory block within the RFID tag memory that contains the Tag ID. Normally, this value is set automatically by the RFID calibration process and should not be changed.	
Minimum	4
Factory Default	4

## Tag Length

RFID > Custom Tag > Tag Length	
This menu item selects the number of bytes in the EPC block within the RFID tag memory. Normally, this value is set automatically by the RFID calibration process and should not be changed.	
Minimum	8
Maximum	32
Factory Default	12
<b>IMPORTANT</b>	<b>This value will be hidden if Higgs3 tags are detected, and the Higgs 3 EPC Len menu will be un-hidden instead.</b>

## Higgs 3 EPC Len

RFID > Control > Higgs 3 EPC Len	
Higgs 3 tags differ from other RFID tags in that its memory bank size is not fixed. To accommodate EPC lengths longer than 96 bits, Higgs 3 borrows memory from the USR bank. This menu item selects the number of bits dedicated to the EPC block within the RFID tag memory.	
Minimum	96
Maximum	480
Factory Default	96
<b>IMPORTANT</b>	<b>This menu will only be shown if a Higgs 3 tag is detected. Otherwise, it will be hidden.</b>

	<p>When an EPC length is selected by the user in this menu, the USR length will change automatically per Table 1. The EPC length in this menu must be set to a value that is equal to or longer than all EPC value lengths to be written by the application.</p> <p>Since the PC value indicates the length of the EPC in the Higgs 3, the PC value must be programmed when programming the EPC (if the EPC value has changed from its factory state). The PC value to be programmed for each of the supported EPC lengths is shown in Table 1.</p>
--	---

### EPC Address

<b>RFID &gt; Custom Tag &gt; EPC Address</b>	
This menu item selects the starting location of the EPC block within the RFID tag memory. Normally, this value is set automatically by the RFID calibration process and should not be changed.	
Minimum	0
Maximum	32
Factory Default	0

### Block Size

<b>RFID &gt; Custom Tag &gt; Block Size</b>	
This menu item selects the maximum number of bytes written to the USR block within the RFID tag memory at one time. Normally, this value is set automatically by the RFID calibration process and should not be changed.	
Minimum	0
Maximum	32
Factory Default	8

### Read Tries

<b>RFID &gt; Custom Tag &gt; Read Tries</b>	
This menu item selects how many times the RFID encoder will try each read command. Not included on T4000.	
Minimum	1
Maximum	10 or Infinite
Factory Default	Infinite

### Write Tries

<b>RFID &gt; Custom Tag &gt; Write Tries</b>	
This menu item selects how many times the RFID encoder will try each	

write command. Not included on T4000.	
Minimum	1
Maximum	10
Factory Default	9

## Sensitivity

RFID > Custom Tag > Sensitivity	
This menu item defines the sensitivity of RFID signals. When set to 0 means low sensitivity. RFID tags that are marginal in signal will have higher chance to fail if not programmed at the perfect location. It is recommended not to change this value. Not included on T4000.	
Minimum	0
Maximum	3
Factory Default	3
<b>IMPORTANT</b>	<b>This option affects RFID read and write operation. Only change it when you absolute know it's needed.</b>

## Tag Profiling Submenu

This submenu is used to do RFID calibration. The user must do the tag calibration when installing a new tag in the printer. RFID calibration operation determines the RFID chip type, the write/read power, program position, length of the EPC/User field.

## RFID Calibration

RFID > Tag Profiling > RFID Calibrate	
The executable item performs RFID calibration.	
<b>IMPORTANT</b>	<p><b>This item should be executed when changing the RFID tag type.</b></p> <p><b>The calibration process will set a number of RFID menus in the printer configuration, and after RFID calibration is complete, the configuration should be stored to preserve the results of the calibration in that configuration.</b></p>

## Number of Tags to use

RFID > Tag Profiling > Number of Tags to use	
The menu item determines how many tags to use for calibration. However, this value does not include tags moved when seeking gaps during the calibration process. Depending on the difficulty in calibrating the installed tags, the number of labels used could be more or less, but generally, the larger number chosen in this menu, the more tags that will be averaged together to determine the calibration result. Usually, this value should be left at the default value.	
Minimum	0

Maximum	10
Factory Default	3

## Cal Mode

<b>RFID &gt; Tag Profiling &gt; Cal Mode</b>	
<p>The menu item can be changed to Full mode for calibrating difficult tags. Most tags will calibrate correctly using the faster Quick mode, but certain tags that require a large amount of power or that are difficult to encode might require the Full setting.</p> <p>If calibration fails with the Quick setting, try running a Full calibration instead. Also, if too many tags fail to encode during print jobs after a Quick calibration, try recalibrating the RFID tags in Full mode to see if the issue is resolved. Not included on T4000.</p>	
Quick	This mode indicates a normal RFID calibration.
Full	This mode indicates a fuller RFID calibration that makes fewer adaptive assumptions during the calibration process. It is usually slower to execute than Quick mode, but it will provide more accurate results with difficult RFID tags.
Factory Default	Full

## Test EPC Length

<b>RFID &gt; Tag Profiling &gt; Test EPC Length</b>	
<p>The menu item determines the size of the EPC data that will be used to perform the RFID Calibration. This menu can be increased to improve the accuracy of the RFID Calibration, but it should not be increased to a value greater than the maximum EPC length that the current Tag Type can support.</p>	
Minimum	16
Maximum	256
Factory Default	96

## Test Operation

<b>RFID &gt; Tag Profiling &gt; Test Operation</b>	
<p>The menu item determines the actual RFID operations that will be performed during the RFID Calibration. The calibration will test multiple areas of the current RFID label with write commands and (if selected) read commands. Not included on T4000.</p>	
Write	The RFID Calibration will perform RFID Write commands
Write and Read	The RFID Calibration will perform RFID Write commands and RFID Read commands
Factory Default	Write

## Diagnostics Submenu

The following items are in the *RFID > Diagnostics* section and used to check correct behavior with the RFID system or the tags being used. The printer does not move the tag to proper position before performing read/write. To perform diagnostics with RFID tag, you need to manually position the tag at the reader's antenna. This is a quick way to find out the tag type or data in the RFID memory bank.

### Read Tag

RFID > Diagnostics > Read Tag	
This executable menu reads the tag in range of the internal RFID coupler and reports the tag data to the debug port and momentarily displays it on the control panel's LCD. It is primarily intended for development verification by checking that the system is working.	
<b>IMPORTANT</b>	<b>This menu item does not position the RFID tag over the coupler. Make sure to position the tag over the coupler to receive an accurate reading.</b>

### Read Tag & Eject

RFID > Diagnostics > Read Tag & Eject	
This executable menu works exactly the same as <i>Read Tag</i> executable, except that after the printer reads the tag, it feeds the label to the next top-of-form.	
<b>IMPORTANT</b>	<b>This menu item does not position the RFID tag over the coupler. Make sure to position the tag over the coupler to receive an accurate reading.</b>

### Read TID

RFID > Diagnostics > Read TID	
This executable menu reads the TID (Tag ID) from the tag in range of the internal RFID coupler and displays the value read in the <i>Tag ID</i> menu.	
<b>IMPORTANT</b>	<b>This menu item does not position the RFID tag over the coupler. Make sure to position the tag over the coupler to receive an accurate reading.</b>

### Tag ID

RFID > Diagnostics > Tag ID	
This menu item displays the first TID (Tag ID) read since power-up, or if using the <i>Read TID</i> menu, the most recently read TID. If no tag is in range of the internal RFID coupler, "Unknown" displays.	

### Read PC

RFID > Diagnostics > Read PC	
This executable menu reads the PC (Protocol Control) field from an RFID tag in range of the internal RFID coupler and displays the value read in the <i>Tag PC</i> menu.	
<b>IMPORTANT</b>	<b>This menu item does not position the RFID tag over the coupler. Make sure to position the tag</b>

	over the coupler to receive an accurate reading.
--	--

## Tag PC

RFID > Diagnostics > Tag PC	
This menu item displays the last PC (Protocol Control) field read from an RFID tag. If no tag is in range of the internal RFID coupler, "Unknown" displays.	

## Write EPC with 1s

RFID > Diagnostics > Write EPC with 1s	
This executable menu writes all ones to the tag in range of the internal RFID coupler. It is primarily intended for development verification by checking that the system is working.	
<b>IMPORTANT</b>	<b>This menu item does not position the RFID tag over the coupler. Make sure to position the tag over the coupler to receive an accurate writing.</b>

## Write EPC with 2s

RFID > Diagnostics > Write EPC with 2s	
This executable menu writes all twos to the tag in range of the internal RFID coupler. It is primarily intended for development verification by checking that the system is working.	
<b>IMPORTANT</b>	<b>This menu item does not position the RFID tag over the coupler. Make sure to position the tag over the coupler to receive an accurate writing.</b>

## Statistics Submenu

The following items are in the *RFID > Statistics* section and used to store statistics about the RFID system activities. The statistics can be reset by executing the menu **Clear Tag Stats** operation within this section.

### Reporting Statistics

After any completed print job, you can request a report from the printer which describes the RFID statistics since the printer was turned on, or since the last time the *RFID > Statistics > Clear Tag Stats* was executed.

### Requesting an RFID/ODV Report

This procedure prints a summarized RFID report. (This report also includes Validator data if the printer has a Validator installed.)

1. Press the PAUSE key to take the printer OFFLINE.
2. If necessary, press the UP+DOWN ARROW keys at the same time to unlock the front panel.
3. Edit the menu *Tools > Print Tests > Run Tests*.
4. Find the printer test named "Valid. Report" and press the ENTER key.

5. Lock the panel again using the UP+DOWN ARROW keys.
6. Press PAUSE again to put the printer ONLINE.

### Tag Write Count

<b>RFID &gt; Statistics &gt; Tag Write Count</b>
This menu item displays on the LCD the number of tags attempted to be written since the last <b>Clear Tag Stat</b> operation has been initiated.

### Tag Failed Count

<b>RFID &gt; Statistics &gt; Tag Failed Count</b>
This menu item displays on the LCD the number of failed RFID tags since the last <b>Clear Tag Stat</b> operation has been initiated.

### Tag Read Count

<b>RFID &gt; Statistics &gt; Tag Read Count</b>
This menu item displays the number of tags read since the last <b>Clear Tag Stat</b> operation.

### Clear Tag Stat

<b>RFID &gt; Statistics &gt; Clear Tag Stat</b>
This executable menu item clears the Count menu items in this submenu.

### Resetting RFID Data

The RFID statistics are kept since the last time the *RFID > Statistics > Clear Tag Stats* was executed. For example, you print a large batch of labels reading and writing RFID tags and then print an RFID/ODV report. Then you print/encode another batch of labels and print another report. The report will contain information on both batch jobs. However, if you reset the RFID data between batch jobs, the second report will only contain information on the second batch job.

To reset RFID Data, execute the menu *RFID > Statistics > Clear Tag Stats*.

### RFID Reader F/W

<b>RFID &gt; Statistics &gt; RFID Reader F/W</b>
Shows the RFID firmware version installed in the encoder.

### Checking Firmware Revision

For troubleshooting purposes, you may need to reference the RFID firmware revision number. This can be found in two different places within the Settings section:

- RFID > Statistics > RFID Reader F/W.
- TOOLS > About > RFID Reader F/W.

# 5 *RFID Commands*

This section will cover different emulations that support RFID within the Printronix RFID thermal products:

- Incorporate RFID commands into new or existing Printronix PGL<sup>®</sup> programs.
- Incorporate RFID commands into new or existing ZPL<sup>™</sup> programs. By selecting the Printronix ZGL emulation you can seamlessly upgrade from Zebra<sup>™</sup> printers.
- Incorporate RFID commands into new or existing SATO<sup>®</sup> printer language programs. By selecting the Printronix STGL emulation you can seamlessly upgrade from SATO printers. PGL RFID Commands.

**IMPORTANT** With all examples make sure *MEDIA > Image > Label Length* matches the physical length of the installed media.

## RFWTAG

**Purpose** The RFWTAG command is used to program an RFID tag (embedded in a smart label) using structured data format. The data structure of an RFID tag can consist of one or more bit fields. Each bit field specifies its own field length, the data format, the field type plus additional options if the type is incremental, and finally the field value.

**NOTE:** The RFWTAG command is supported only on Thermal printers.

**Mode** CREATE

**Format** RFWTAG[;LOCKn[;format]];size[;mem bank]

(Bit Field)+

STOP

RFWTAG Specifies the RFWTAG command, enter **RFWTAG;**

LOCKn[;format] or PERMALOCKn[;format]

Optional parameter to lock the data block to prevent it from being overwritten. By default, the data are not locked initially. n is the passcode. The acceptable values for n are 1 to FFFFFFFF in hex, a 4 bytes data. When the LOCKn option is used to lock any memory bank, which at the same time is programmed with the write data, the same passcode will be written on ACS memory bank. The ACS memory bank will also be locked if ACS is not locked at the time of the operation. If ACS is already locked at the time of the operation, the passcode needs to match the current content of ACS so that the memory bank lock takes effect. The passcode (n) can also be in dynamic format. For dynamic format, enter LOCK<DFn>, where DFn is the dynamic field defined in EXECUTE mode. Both LOCK and PERMALOCK share the same syntax. For differences in functionality, see Note 12 on page 34.

*format* An optional parameter to specify the format for the passcode data.

Enter B for binary, D for decimal, and H for hexadecimal. The default is decimal if *format* is not specified.

<i>size</i>	A decimal number specifying the overall bit length of the memory bank.
<i>mem bank</i>	Specifies which tag logical memory area that this command will be applied. If omitted, it defaults to the EPC memory area. Other areas include Identification, User Data, Access area and Kill area. Enter one of the following values: <b>'EPC'</b> – EPC 12 bytes data area (default) <b>'TID'</b> – Tag identification 8 bytes area (currently not applicable for RFWTAG) <b>'USR'</b> – User 32 bytes area <b>'ACS'</b> – 4 bytes access code area <b>'KIL'</b> – 4 bytes kill code area <b>'PC'</b> – 2 bytes PC code area (Gen 2 tags only)

**NOTE:** New tags, such as RSI IN47 Crkscr, support 240 bits of EPC memory and 512 bits of USR memory.

<i>Bit Field</i>	A line description of a bit field and must have one of the following syntax formats: <ol style="list-style-type: none"><li>1. For non-incremental data (both static and dynamic) <i>length</i>;<b>[DFn]</b><i>format</i>;(D)<i>datafield</i>(D)</li><li>2. For incremental fixed data <i>length</i>;<b>I</b>;<i>format</i>;<b>STEP</b>[<i>idir</i>]<i>step</i>;<b>[RPT n]</b> [<b>RST n</b>];(D)<i>startdata</i>(D)</li><li>3. For dynamic incremental data <i>length</i>;<b>IDF n</b>;<i>format</i>;</li></ol>
<i>length</i>	A decimal number specifying the bit length of a field within a tag. The maximum length for each DF <sub>n</sub> field of NON-HEX format is 64 bits. For hexadecimal format, the bit length can be up to the maximum bit length specified for the corresponding memory bank.
<b>DF<sub>n</sub></b>	Optional parameter to indicate this field has dynamic data. Replace <i>n</i> with a number ranging from 1 to 512 to identify the field number of this particular field. If this option is used, <i>datafield</i> is ignored, and dynamic data must be entered via the DF command in the EXECUTE mode.
<b>IDF<sub>n</sub></b>	Enter <b>IDF</b> to indicate this field is a bit field with dynamical assignment of increment (or decrement) data. The <i>step</i> and <i>startdata</i> parameters will be supplied by the IDF command in the EXECUTE mode. Replace <i>n</i> with a number ranging from 1 to 512 to identify the field number of this bit field. Dynamically enter the <i>step</i> and <i>startdata</i> parameters using the IDF command in the EXECUTE mode.

- NOTE:**
1. The same field number cannot be used in both DF<sub>n</sub> and IDF<sub>n</sub>.
  2. If a field is defined as IDF<sub>n</sub>, it must be referenced as IDF<sub>n</sub> later for consistency. The same applies for DF<sub>n</sub>.
  3. If <IDF<sub>n</sub>> syntax is used for merging data into AF<sub>n</sub> or BF<sub>n</sub>, neither DF<sub>n</sub>, AF<sub>n</sub>, or BF<sub>n</sub> will

be incremented. The increment only takes place in the ~DFn command where the STEP is specified.

<i>format</i>	A letter specifying the format of the data field. <b>B</b> – binary, <b>D</b> – decimal, <b>H</b> – hexadecimal
(D)	Delimiter designating the start and end of static data for this bit field. Replace (D) with any printable character, except the SFCC and the slash character (/).
<i>datafield</i>	The static data of this static field. It is a mandatory parameter of bit field with static data.
<b>I</b>	Identifies this field is an incremental bit field.
STEP	Specifies that the incremental data field will use the step method. Enter <b>STEP</b> ; The STEP option replaces the STEPMASK option that is used in Alpha and Barcode.
<i>idir</i>	Enter a plus sign (+) or leave the field blank to increment (default). Enter a minus sign (–) to decrement.
<i>step</i>	A decimal number specifies the amount to increment/decrement each time the form is executed. The increment is at bit level and will automatically wrap based on the field size.
<b>RPT</b> <i>n</i>	The optional incremental repeat count parameters to specify the number of times a particular field value is repeated before it is incremented. The default repeat count parameter <i>n</i> is 1, which will increment the field value each time it prints. The repeat count can range from 1 to 65535.
<b>RST</b> <i>n</i>	The optional incremental reset count parameter to specify the number of times an incremented field is printed before it is reset to the starting value. By default, there is no reset count. The reset count parameter <i>n</i> can range from 1 to 65535.
<i>startdata</i>	Defines the value of the field or the starting value of the incremented field. If the field is dynamic, the value will be specified later in the EXECUTE mode. The data must be specified within a pair of delimiters (D). The delimiter (D) cannot be a “/” or SFCC character since the “/” will comment out the rest of the line and SFCC is reserved for PGL commands. If “R” or “S” is used as delimiters, the data pattern must not comprise of the keywords in the incrementing options. Since the delimiters could be different from one value to another, proper care must be taken to avoid one of the letters mentioned above.

- NOTE:**
1. The RFWTAG command cannot be mixed with RFWRITE in the same form.
  2. Each field structure must be specified in a single line and in the order it appears in the RFID tag from MSB bits to LSB bits (left to right). The sum of all the field lengths must match the size of the tag.
  3. The host data are read in as ASCII characters. They would be converted to binary representation for the base field on the field format. Therefore, if the converted value is larger than the maximum value that a field can hold, an error will be reported. If the data value is smaller than the specified field length, on the other hand, the field will be padded to the left with zero bits.
  4. Unlike the Alpha and Barcode command which use STEPMASK for incremental data, RFWTAG uses the STEP which will increment or decrement at bit level.
  5. 432 IGP dots in the ~CREATE line specifies a 6 inch label. 6 inches = 432 (IGP dots)/72 (dpi)  
Use 144 for 2 inch labels and 288 for 4 inch labels.
  6. ACS and KIL are similar to other memory banks. ACS contains the passcode which is used for LOCK and UNLOCK operations. KIL contains the killcode which is used to kill a tag. The user can write to or read from KIL memory bank, but the functionality of killing a tag is not currently applicable. Also, once ACS and KIL are locked, both cannot be written to or read from. For other memory banks, EPC, USR, and TID, once locked, they can be read from but not written to.
  7. There are two ways to program the ACS memory area. One is to write to the ACS memory area directly with RFWTAG. The other is to use the LOCK option while writing to other memory banks. If ACS is not previously locked, then LOCK option will lock the memory bank and also write the passcode to ACS and lock ACS. When write to ACS with RFWTAG, ACS is not automatically locked. To lock ACS, use LOCKn with RFWTAG, where the passcode (n) should be the same as the write data to ASC.
  8. There is only one passcode, the content of ACS memory bank, for each tag. The same passcode is used to lock or unlock any memory bank in that tag.
  9. For LOCKn and UNLOCKn, the passcode (n) (which includes the dynamic format <DFn>) does not accept incremental data. This also applies to the ACS and KIL memory banks. The write data to the ACS and KIL memory banks do not accept incremental data because the ACS memory bank contains passcodes for LOCK and UNLOCK operations, and the KIL memory bank contains a killcode to kill a tag. Incremental data do not apply to passcodes or killcodes.
  10. When LOCK<DFn> and UNLOCK<DFn> are used in the same form with the same dynamic data (the passcode), the dynamic format <DFn> needs to be a different dynamic number for LOCK and UNLOCK since it is designed with a unique dynamic number that can be linked to only one object type. In this case, LOCK is linked to RFWTAG object and UNLOCK is linked to RFWTAG object. Although both options use the same passcode, the dynamic format needs to be in a different dynamic number in the same form.
  11. Because PC field is related to EPC field, when PC RFWTAG is used in the form, it must be followed immediately by EPC RFWTAG, or else an error will be reported. Also, by specification, the first 5 bits of PC data need to comply with the length of EPC data, or else an error will be reported. For example, for 96 bits EPC, the 5 bits of PC data is 00110. For 64 bits EPC, the first 5 bits of PC data is 00100. Also, LOCK option is not and will not be supported for PC field, since PC field works with EPC field (which already supports LOCK option).
  12. Both LOCK and PERMALOCK requires the user to enter the password. Once the tag is permanently locked with the PERMALOCK command, it cannot be unlocked again; the tag can only be read from and never be written to once it is permanently locked. On the other

hand, after the tag is locked with the LOCK command, it can be unlocked again with the same password.

For PERMALOCK (ex, EPC), the password must match the current content of ACS bank for PERMALOCK to work. If the current content of ACS bank is null (0x0) which could be the case for the brand new tag, the password for PERMALOCK EPC will be 0x0. If you use a different password for PERMALOCK, you need to write (RFWTAG) the new content (password) to ACS first, and then use this new password to PERMALOCK EPC.

For LOCK (ex, EPC), the password may be different from the current content of ACS. When a new password is used to lock EPC where ACS is not locked, this new password is written to ACS and locks ACS at the same time while locking EPC. For new tags where ACS is not locked and has all null data, you can lock EPC with a new password directly without writing to ACS first.

### Example 1

The following example programs an SGTIN-64 value into the RFID tag that is embedded in a 4x6 smart label. Assume that the SGTIN-64 value is provided as a single number.

```
~CREATE;SGTIN-64;432
RFWTAG;64
64;H;*87D0034567ABCDEF* /EPC number
STOP
END
~EXECUTE;SGTIN-64;1
~NORMAL
```

### Example 2

Same as Example 1, except the EPC number is broken into its component parts. Assume that the SGTIN-64 value has the Header = 2d, Filter Value = 5d, EPC Manager Index = 15383d, Object Class = 703710d or 0xABCDE, and the Serial Number = 0123456d.

```
~CREATE;SGTIN-64;432
RFWTAG;64
2;B;*10*           /Header
3;D;*5*           /Filter Value
14;D;*15383*      /EPC Manager Index
20;H;*ABCDE*      /Object Class
25;D;*0000123456* /Serial Number
STOP
END
~EXECUTE;SGTIN-64;1
~NORMAL
```

### Example 3

Same as Example 2, except it uses a dynamic method. This example also shows how to program another RFID tag without redefining the data structure of the SGTIN-64.

```
~CREATE;SGTIN-64;432
RFWTAG;64
2;DF1;B           /Header
3;DF2;D           /Filter Value
14;DF3;D          /EPC Manager Index
20;DF4;H          /Object Class
25;DF5;D          /Serial Number
```

```

STOP
ALPHA
AF1;18;10;5;3;3
STOP
END
~EXECUTE;SGTIN-64
~DF1;*10*           /Header
~DF2;*5*            /Filter Value
~DF3;*15383*        /EPC Manager Index
~DF4;*ABCDE*        /Object Class
~DF5;*0000123456*   /Serial Number
~AF1;<DF5>           /Print serial number on label
~NORMAL
~EXECUTE;SGTIN-64
~DF1;*10*           /Header
~DF2;*5*            /Filter Value
~DF3;*15383*        /EPC Manager Index
~DF4;*ABCDE*        /Object Class
~DF5;*0000123456*   /Serial Number
~AF1;<DF5>           /Print serial number on label
~NORMAL

```

#### Example 4

This example shows how to program a roll of 1500 smart labels with SGTIN-64 values, where the Header = 2d, Filter Value = 5d, EPC Manager Index = 15383d, Object Class = 703710d or 0xABCDE, and the Serial Number starting from 0000000 to 0001499d.

```

~CREATE;SGTIN-64;432
RFWTAG;64
2;B;*10*           /Header
3;D;*5*            /Filter Value
14;D;*15383*       /EPC Manager Index
20;H;*ABCDE*       /Object Class
25;I;D;STEP1;*0*   /Serial Number
STOP
END
~EXECUTE;SGTIN-64;ICNT1500
~NORMAL

```

#### Example 5

This example shows how to program a 96 bit RFID tag. A SGTIN-96 format is used and the EPC number is broken into its component parts. Assume that the SGTIN-96 value has the Header = 48, Filter Value = 5d, EPC Manager Index = 123456d, Object Class = 777777d or 0xBDE31, and the Serial Number = 123456d.

**NOTE:** 96 bit tags must be broken up as in Examples 2, 3, and 4, and no field can be more than 64 bits in length if the format is binary or decimal. There is no restriction on the bit length if the format is hexadecimal.

```

~CREATE;SGTIN-96;432
RFWTAG;96
8;B;*00110000*     /Header
3;D;*5*            /Filter Value

```

```
3;D;*6*           /Partition
20;D;*123456*     /EPC Manager Index
24;D;*777777*     /Object Class
38;D;*123456*     /Serial Number
```

```
STOP
```

```
END
```

```
~EXECUTE;SGTIN-96;1
```

```
~NORMAL
```

### Example 6

This example shows memory bank usage, where multiple RFWTAG and RFRTAG can be used.

```
~CREATE;SGTIN;216
```

```
SCALE;DOT;203;203
```

```
RFWTAG;96;EPC
```

```
96;IDF1;H
```

```
STOP
```

```
RFRTAG;96;EPC
```

```
96;DF3;H
```

```
STOP
```

```
RFWTAG;256;USR
```

```
256;IDF2;H
```

```
STOP
```

```
RFRTAG;256;USR
```

```
256;DF4;H
```

```
STOP
```

```
ALPHA
```

```
IAF1;24;POINT;90;60;16;6
```

```
IAF2;64;POINT;130;60;16;4
```

```
STOP
```

```
BARCODE
```

```
C3/9;X1;IBF1;64;170;60
```

```
PDF
```

```
STOP
```

```
VERIFY;DF1;H;*EPC W= *;\r\n*
```

```
VERIFY;DF3;H;*EPC R= *;\r\n*
```

```
VERIFY;DF2;H;*USR W= *;\r\n*
```

```
VERIFY;DF4;H;*USR R= *;\r\n*
```

```
END
```

```
~EXECUTE;SGTIN;ICNT4
```

```
~IDF1;STEP+1;*313233343536373839414243*
```

```
~IDF2;STEP+1;*3132333435363738394142434445464748494A
```

```
4B4C4D4E4F*
```

```
~IAF1;<DF3>
```

```
~IAF2;<DF4>
```

```
~IBF1;<DF3>
```

```
~NORMAL
```

### Example 7

This example shows memory bank usage with LOCK and UNLOCK option, where multiple RFWTAG and RFRTAG can be used, and the passcode for lock and unlock can be in dynamic format.

```
~CREATE;SGTIN;432
SCALE;DOT;203;203
RFWTAG;LOCK<DF6>;D;96;EPC
96;DF1;H
STOP
RFRTAG;UNLOCK<DF6>;D;96;EPC
96;DF2;H
STOP
RFWTAG;LOCKA1B2C3;H;32;KIL
32;DF3;H
STOP
RFRTAG;UNLOCKA1B2C3;H;32;KIL
32;DF4;H
STOP
RFWTAG;LOCK<DF7>;H;32;ACS
32;DF6;D
STOP
RFRTAG;UNLOCK<DF7>;H;32;ACS
32;DF8;H
STOP
```

```
ALPHA
AF1;24;POINT;400;60;16;6
AF2;7;POINT;600;60;16;6
AF3;6;POINT;800;60;16;6
AF4;8;POINT;1000;60;16;6
STOP
```

```
VERIFY;DF1;H;*DF1 = *;\r\n*
VERIFY;DF2;H;*DF2 = *;\r\n*
VERIFY;DF4;H;*DF4 = *;\r\n*
VERIFY;DF5;H;*DF5 = *;\r\n*
VERIFY;DF6;H;*DF6 = *;\r\n*
VERIFY;DF7;H;*DF7 = *;\r\n*
VERIFY;DF8;H;*DF8 = *;\r\n*
END
```

```
~EXECUTE;SGTIN;FCNT3
~DF1;*313233343536373839414243*
~DF3;*3435363738*
~DF6;*3224115*
~DF7;*A1B2C3*
~AF1;<DF2>
~AF2;<DF6>
~AF3;<DF7>
~AF4;<DF8>
~NORMAL
```

### Example 8

This example shows the usage of RFWTAG with PC field which needs to be followed immediately by RFWTAG with EPC field. There is not restriction for RFRTAG with PC filed.

```
~NORMAL
~CREATE;TEST1;432
RFWTAG;16;PC
16;H;*3000*
STOP
RFWTAG;96;EPC
96;H;*313233343536373839414243*
STOP
RFWTAG;256;USR
256;H;*3132333435363738394142434445464748494A4B*
STOP
RFRTAG;16;PC
16;DF1;H
STOP
RFRTAG;96;EPC
96;DF2;H
STOP
VERIFY;DF1;H;*DF1 = *;\r\n*
VERIFY;DF2;H;*DF2 = *;\r\n*
END
~EXECUTE;TEST1
~NORMAL
```

### Example 9

This example shows the usage of PERMALOCK.

```
~NORMAL
~CREATE;RFID;432
ALPHA
IAF1;24;POINT;4;5;10;10
STOP
RFWTAG;32;ACS
32;H;*ABC*
STOP
RFWTAG;PERMALOCKABC;H;96;EPC
96;IDF1;H
STOP
RFRTAG;96;EPC
96;DF2;H
STOP
VERIFY;DF2;H;* *
END

~EXECUTE;RFID;ICNT5
IDF1;STEP+1;*2222222222222222220011*
IAF1;<DF2>
~NORMAL
```

## Example 10

This example shows the access of 240 bits EPC and 512 bits USR.

```
~CREATE;TEST;X;NOMOTION
RFWTAG;LOCK0C0D0E0F;H;240;EPC
240;I;H;STEP+1;*0102030405060708091011121314
15161718192021222324252627282930*
STOP
RFWTAG;LOCK0C0D0E0F;H;512;USR
512;I;H;STEP+1;*0102030405060708091011121314
151617181920212223242526272829303132333435
363738394041424344454647484950515253545556
5758596061626364*
STOP
RFWTAG;LOCK0C0D0E0F;H;32;KIL
32;H;*08090A0B*
STOP
RFRTAG;UNLOCK0C0D0E0F;H;32;ACS
32;DF31;H
STOP
VERIFY;DF31;H;#ACS=*;“\r\n”
RFRTAG;UNLOCK0C0D0E0F;H;32;KIL
32;DF22;H
STOP
VERIFY;DF22;H;*KIL=*;“\r\n”
RFRTAG;UNLOCK0C0D0E0F;H;240;EPC
240;DF1;H
STOP
VERIFY;DF1;H;*EPC=*;*\r\n
RFRTAG;UNLOCK0C0D0E0F;H;512;USR
512;DF7;H
STOP
VERIFY;DF7;H;*USR=*;*\r\n*
END
~EXECUTE;TEST;10
~NORMAL
```

## RFRTAG

**Purpose** To read the content of an RFID tag (embedded in a smart label) into a dynamic field. This command cannot be mixed with the RFREAD command.

**NOTE:** The RFRTAG command is supported only on Thermal printers.

**Mode** CREATE

**Format** RFRTAG[:UNLOCKn[:format]];size[:mem bank]

(Bit Field)+

STOP

RFRTAG Specifies the RFRTAG command, enter **RFRTAG**;

*size* A decimal number specifying the overall bit length of the RFID tag memory bank.

### UNLOCK $n$ [:*format*]

Optional parameter to unlock the data block so it can be overwritten later.  $n$  is the passcode. The acceptable values for  $n$  are 1 to FFFFFFFF in hex, a 4 bytes data. The value of  $n$  should be the same passcode used for the LOCK option to unlock the protected data block. When the UNLOCK $n$  option is used to unlock any memory bank, which at the same is programmed to read the tag, the operation UNLOCK $n$  will not unlock ACS memory area. The passcode ( $n$ ) can also be in dynamic format. For dynamic format, enter LOCK<DF $n$ >, where DF $n$  is the dynamic field defined in EXECUTE mode.

*format* is the optional parameter to specify the format for the passcode data. Enter B for binary, D for decimal, and H for hexadecimal. The default is decimal if *format* is not specified.

### *mem bank*

Specifies which tag logical memory area that this command will be applied. If omitted, it defaults to the EPC memory area. Other areas include Identification, User Data, Access area, and Kill area. Enter one of the following values:

'EPC' – EPC 12 bytes data area (default)

'TID' – Tag identification 8 bytes area

'USR' – User 32 bytes area

'ACS' – 4 bytes access code area

'KIL' – 4 bytes kill code area

'PC' – 2 bytes PC code area (Gen 2 tags only)

### *Bit Field*

A line description of a bit field; must have one of the following syntax formats:

*length*;DF $n$ ;*format*

*length* A decimal number specifying the bit length of a field within a tag. The maximum length is 64 bits for binary or decimal format. For hexadecimal format, the bit length can be up to the maximum bit length specified for the corresponding memory bank.

DF $n$  Indicate dynamic data field to store the read result. Replace  $n$  with a number ranging from 1 to 512 to identify the field number of this particular field.

*format* A letter specifying the representation format of the field data.

**B** – binary, **D** – decimal,  
**H** – hexadecimal

- NOTE:**
1. Multiple RFRTAG commands are allowed in the same form but the same DF $n$  field cannot be defined multiple times.
  2. The DF field length is restricted to 64 bits for binary or decimal format and must be a multiple of 8 bits. The sum of all field lengths must be equal to the tag size.
  3. The first field always start at the MSB bit. The bit length of a field dictates the start bit of the next field, etc. As a result, DF fields will not overlap each other.

4. RFRTAG does not allow incremental fields (with the "I" prefix).
5. 432 IGP dots in the ~CREATE line specifies a 6 inch label. 6 inches = 432 (IGP dots)/72 (dpi)  
Use 144 for 2 inch labels and 288 for 4 inch labels.

### Example

Same as Example 4 on page 36, except the increment is dynamic and the result is merged into Alpha to print on the smart label.

```

~CREATE;SGTIN-64;432
RFWTAG;64
2;B;*10*           /Header
3;D;*5*           /Filter Value
14;D;*15383*      /EPC Manager Index
20;D;*123456*     /Object Class
25;IDF1;H         /Serial Number STOP
RFRTAG;64
64;DF2;H;
STOP
ALPHA
IAF1;16;3;12;0;0
STOP
END
~EXECUTE;SGTIN-64;ICNT1500
~IDF1;STEP+1;*0*
~IAF1;<DF2>

~NORMAL

```

- NOTE:**
1. The <IDF1> usage does not increment the DF1 field. It merges the DF1 content into the AF1 field, keeping the same representation previously defined for IDF1.
  2. The use of IAF1 is to print alpha on every label. If AF1 is used instead, only the first label is printed. The AF1 field is not incremented either since it is using the result from the DF1 merge.

### VERIFY

**Purpose** Request the printer to send to the host the ASCII representation of a dynamic field. The dynamic field could be one of AFn, BFn, or DFn, but cannot be RFn.

**NOTE:** The Verify command is supported only on Thermal printers.

**Mode** CREATE

**Format** VERIFY;**field**;*format*;(D)ASCIIheader(D);(D)ASCIITrailer(D)

VERIFY	The command to verify data of a dynamic field, enter VERIFY;
field	The dynamic field AFn, BFn, or DFn that contains the data to be sent to the host.
<i>format</i>	A letter specifying the format of the outgoing data to be sent to the host.

**B** – binary, **D** – decimal, **H** – hexadecimal, **S** – string

Based on the incoming format of the data field, a format conversion may be performed if the outgoing format is not the same. The AFn and

BFn format is always S type. The DF<sub>n</sub> format could be either B, D, or H. Due to the possible conversion the outgoing data stream could be longer than the incoming one. The maximum length for the outgoing data is 512 bytes. If the format request will result in a data stream exceeding the maximum length, an error would be reported.

- ASCIIheader* A mandatory parameter to specify an ASCII string of characters, which is followed by the RFID data, to be sent by the printer to the host.
- ASCIItrailer* An optional parameter to specify an ASCII string of characters, which will follow the RFID data, to be sent by the printer to the host.
- (D) Delimiter designating the start and end of a character string. Replace (D) with any printable character, except the SFCC and the slash character (/). The string could be empty, i.e. there are not headers preceding the field data.

- NOTE:**
1. The DF<sub>n</sub> field must be defined previously in the CREATE mode before it can be specified in the VERIFY command otherwise it will be considered as a syntax error and the VERIFY command will abort.
  2. All RFID Read/Write commands are executed first in the order they appear in CREATE mode, followed by Alpha and Barcode commands, and finally VERIFY commands. The VERIFY commands are always executed last although they may appear before other commands in the CREATE mode. The reason for this is to make sure the data are sent back to the host only if other commands are completed and the form is not aborted.
  3. If the data comes from a DF<sub>n</sub> field, the DF<sub>n</sub> format is the original format before any conversion. If the VERIFY command specifies a different format, the data would then be converted to the new format. If the data comes from an AF<sub>n</sub> or BF<sub>n</sub>, the original format is S format.
  4. Below is the possible syntax for header and trailer string,
    - 1, VERIFY;DF2;H;\*Head = \* //Header only
    - 2, VERIFY;DF2;H;\*Head = \*, \*Tail\* //Header & trailer
    - 3, VERIFY;DF2;H;\*\*, \*Tail\* //Trailer only
    - 4, VERIFY;DF2;H;\*Head = \*\*, \*\* //Header only

To insert the CR/LF character, add “\r” and “\n” as CR/LF characters, such as

```
VERIFY;DF2;H;*Head=*; *Tail\r\n* //this will display “Head=<tag data>Tail<CR><LF>”
```

If the user wants to display “\r” or “\n” as normal text character, do the following:

```
VERIFY;DF2;H;*Header\r\n* //this will display “Header\r\n” on the screen, where double back slash “\” (0x5C 0x5C) will be replaced with one back slash ‘\’ (0x5C).
```

The characters \r and \n can be inserted anywhere in the header string and trailer string.

```
To summarize,
\r -> 0x0D //CR
\n -> 0x0A //LF
\\ -> \ //one back slash
```

### Example 1

This example requests the printer to send to the host the content of the RFID tag, in hexadecimal format, both before and after the RFWTAG command writes data to the tag. Also, the label is not moved.

```

~CREATE;VERIFY;432;NOMOTION
RFRTAG;64
64;DF1;H
STOP
VERIFY;DF1;H;*TagBefore=*
RFWTAG; 64
2;B;*01*
6;D;*29*
24;H;*466958*
17;H;*ABC*
15;D;*1234*
STOP
RFRTAG;64
64;DF2;H
STOP
VERIFY;DF2;H;*TagAfter=*
END
~EXECUTE;VERIFY;1
~NORMAL
TagBefore=A5A500005D055E04          <== Whatever data inside the tag before
TagAfter=5D466958055E04D2          <== Should match with RFWTAG command

```

**Example 2**

This example reads a roll of 1500 pre-programmed smart labels.

```

~CREATE;READONLY;432
RFRTAG;64
64;DF1;H
STOP
VERIFY;DF1;H;**
END
~EXECUTE;READONLY;1500
~NORMAL

A5A500005D055E04          <== Whatever data....
                           another 1498 lines of RFID
                           data.....
A5A50000000550D4          <== Whatever data

```

**Example 3**

This example requests the printer to program a roll of 2000 smart labels using the RFWTAG command with incremental field. Then, it sends the actual data from each of the 2000 tags to the host.

```

~CREATE;SIMPLE;432;NOMOTION
RFWTAG;64
2;B;*01*
6;D;*29*
24;H;*466958*
17;H;*ABC*
15;I;D;STEP+1;*0000*
STOP
RFRTAG; 64

```

```

64;DF1;H
STOP
VERIFY;DF1;H;*Data=*
END
~EXECUTE;SIMPLE;ICNT2000
~NORMAL
Data=5D466958055E0000          <== Should be the newly
                                programmed data.
Data=5D466958055E0001          ....another 1996 lines of
                                RFID data .....
Data=5D466958055E07CE
Data=5D466958055E07CF          <== Should be the newly
                                programmed data

```

## ZGL RFID Commands

### Read Tag ^RT

**Purpose** This command allows data from the RFID tag (embedded in the smart label) to merge into any previously defined dynamic data field. It is equivalent to the Field Number command (^FN) except that the data come from the RFID tag.

**Format** ^RT *x, start, length, hex, retries, motion, reserved*

^RT	Read Tag command.
x	Specified Field Number (value assigned to the field). The default is 0. The acceptable value range is 0 to 9999.
start	Location where data will be read from the RFID tag. The ZGL only supports Alien Technology Class 1a tags, which have only one 8-byte or 12-byte block. Therefore, <i>start</i> will be set to 0, regardless of the specified value.
length	The number of blocks to be read from the RFID tag. The ZGL only supports Alien Technology Class 1a tags, which have only one 8-byte or 12-byte block. Therefore, <i>length</i> will be set to 1, regardless of the specified value.
hex	This flag indicates whether the data, after being read from the RFID tag, should be translated into hexadecimal format. The default is 0, meaning the data will not be translated. The other acceptable value is 1, meaning the data will be translated into hexadecimal format.
retries	The number of automatic attempts to read data from the tag if previous reads failed. The ZGL absorbs the number and uses the value on the control panel's LCD.
motion	Set this flag to 1 to read data from the tag without moving the label. The printer may adjust the label position while it reads data from the tag, but this adjustment will reverse before any subsequent normal label movement. Even if this flag is set to 1, other commands (i.e., alpha or barcode) may move the label.
reserved	This is a reserved flag. The ZGL absorbs this number.

**Comments** This command is only executed by the demand for data from any dynamic field. The ZGL absorbs this command if there are no demands for the data

## Write Tag ^WT

**Purpose** This command programs data into an RFID tag (embedded in the smart label).

**Format** ^WT *start, retries, motion, protect, data format, reserved*

*^WT* Write Tag command.

*start* Starting block location where data will be programmed into the RFID tag. The ZGL only supports Alien Technology Class 1a tags, which have only one 8-byte or 12-byte block. Therefore, *start* will be set to 0, regardless of the specified value.

*retries* The number of automatic attempts to write data into the tag if previous writes failed. The ZGL absorbs the number and uses the value on the control panel's LCD.

*motion* Set this flag to 1 to program data into the tag without moving the label. The printer may adjust the label position while it writes data into the tag, but this adjustment will reverse before any subsequent normal label movement. Even if this flag is set to 1, other commands (i.e., alpha or barcode) may move the label.

*protect* This flag indicates whether the data should be protected from being overwritten later. The default is 0, meaning the data are not protected. Other acceptable values are 1 to 255, meaning the data are protected using this number as the LOCK password.

*Data format* 0 (ASCII) or 1 (hex). The default is 0.

*reserved* This is a reserved flag. The ZGL absorbs this number.

## Write or Read Format ^RF

**Purpose** This command allows you to write or read to an RFID tag.

**Format** ^RF*a,b,c,d,e*

*^RF* Write or Read RFID command.

*a* Specifies the read or write option. The default is W.  
W = write to the tag  
L = write with LOCK  
R = read the tag  
P = read password (Gen 2 tags only; used when c is set to K or A).

*b* Specifies the data format. The default is H.  
A = ASCII  
H = Hex  
E = EPC format.

- c* Specifies the starting block number. The default is 0. Since there are currently only 8–byte or 12–byte blocks, the starting block number can only be 0. Or, specifies which password to read (Gen 2 tags only; used when a is set to P):  
K = kill password  
A = access password
- d* Specifies the number of blocks to read. This option is valid only for the read operation. Since there are currently only 8–byte or 12–byte blocks, the number of blocks to be read can only be 1.
- e* Specifies the memory bank to write to or read from. The default is E.  
E = EPC  
0 = Reserved  
1 = EPC  
2 = TID (only for read)  
3 = USER

### Calibrate Transponder ^HR

**Purpose** This command initiates an RFID transponder calibration for a specific RFID label and returns the results to the host computer.

**Format** ^HR*a,b*

*^HR* Calibrate RFID command.

*a* The start string to appear before the returned result. The default is “start”. The acceptable value is any string less than 65 characters.

*b* The end string to appear after the returned result. The default is “end”. The acceptable value is any string less than 65 characters.

### Define EPC Data Structure ^RB

**Purpose** This command defines the structure of EPC data, which can be read from or written to an RFID transponder.

**Format** ^RB*p0,p1,p2...,p15*

*^RB* EPC Data command.

*n* Total bit size of the field. The default is 96. The acceptable value range is 1 to *n*, where *n* is the total bit size of the tag.

*p1..p15* Specifies each partition size. These must add up to the total bit size. The default is 1. The acceptable value range is 1 to 64 bits for each partition.

### Enable RFID Motion ^RM

**Purpose** This command enables or disables RFID paper motion. By default, labels automatically print at the end of the format. This command allows you to inhibit the label from moving.

**Format** ^RM*a*

- ^RM** Enable RFID Motion command.
- a** The default is Y. The acceptable values are Y (Yes, move the label) or N (No, do not move the label).

## Specify RFID Retries for a Block ^RR

**Purpose** This command specifies the number of times that the printer attempts to read from or write to a particular block of a single RFID tag. The number will reflect in the *RFID > Control > Auto Retry* menu.

**Format** ^RRa

- ^RR** Specify RFID Retries command.
- a** The default is 2. The acceptable value range is 1 to 9.

## RFID Setup ^RS

**Purpose** This command sets up parameters including tag type, read/write position of the transponder, and error handling.

**Format** ^RSa,b,c,d,e,f,g,h

- ^RS** RFID Setup command.
- a** Selects the tag type. The acceptable values range is 0 to 5. (This option is currently not supported.)
- b** Sets the read/write position of the transponder in the vertical (Y axis) in dot rows from the top of the label. Set to 0 if the transponder is already in the effective area without moving the media. The default value is label length minus 1 mm. The acceptable value range is 0 to label length.
- c** Sets the length of the void printout in dot rows. The acceptable value range is 0 to label length. (This option is currently not supported.)
- d** Sets the number of retries that will be attempted in case of read/write failure. The number will reflect in the Label Retry menu.
- e** Error handling. Enter N for no action. Enter P to place the printer in Pause mode. Enter E to place the printer in Error mode. (This option is currently not supported.)
- f** Signals on applicator. Enter S to single signal. Enter D for double signal. (This option is currently not supported.)
- g** Certify tag with a pre-read. (This option is currently not supported.)
- h** Sets the print speed at which "VOID" will be printed across the label. (This option is currently not supported.)

## Tag Password ^RZ

**Purpose** This command defines the password for the tag during writing.

**WARNING:** With Gen 2 tags you can lock a tag's memory bank with an access password, or define

### a kill password that can permanently disable a tag

**Format**    ^RZ*a,b,c*

- ^RZ    Set RFID Tag Password command.
- a*    Sets a password. Gen 2 tags use a 32-bit password and they specify the memory bank and lock style. Other tags use 8 bits and they ignore the memory bank and lock style. To read the password, see section “Write or Read Format ^RF” on page 46. The default is 00. The acceptable value range is 00 to FF (hexadecimal).
- b*    Specifies the memory bank (Gen 2 tags only). There is no default value.
- K = kill password  
        A = access password  
        E = EPC  
        T = tag identifier (TID)  
        U = user
- c*    Specifies the lock style (Gen 2 tags only). There is no default value.
- U or O = unlocked  
        L = locked  
        P = permalocked  
        W = write value (used only when *b* is set to K)

**IMPORTANT**    Tags that have been permalocked cannot be unlocked or rewritten.

### Example

```
^XA
^RZA1B2C3D4,K,W
    //Write “A1B2C3D4” to the kill memory bank to set the kill password.
^RZ1234ABCD,K,L
    //Use the access password “1234ABCD” to lock (make unreadable) the kill memory bank
^XZ
^XA
^RZ1234ABCD,A,U
    //Unlock the access memory bank.
^RZ1234ABCD,K,U
    //Unlock the kill memory bank.
^FO50,550^A0N,50^FN1^FS
^FN1^RFP,H,K^FS
    //Read from the kill memory bank.
^FO50,650^A0N,50^FN2^FS
^FN2^RFP,H,A^FS
    //Read from the access memory bank.
^HV1,16,KIL=^FS
^HV2,16,ACS=^FS
^XZ
```

## Host Verification ^HV

**IMPORTANT** This command requires setting up the *SYSTEM > Printer Mgmt > Ret. Status Port* menu up correctly. See the *Administrator's Manual* for more details.

**Purpose** This command sends back the data in a ^FN (Field Number) field to the host.

**Format** ^HVx,y,<ASCII>

^HV	Host Verification command.
x	Specified Field Number. The default is 0. The acceptable value range is 0 to 9999.
y	Number of characters to be returned. The default is 64. The acceptable value range is 0 to 256).
<ASCII>	Header (in uppercase ASCII characters). The default is None. The acceptable value range is 0 to 256 characters.

### Example

```
^XA
^WT0^FDHELLOTAG^FS
^RT3,0,1,1^FS
^FO100,100^A0N,60^FN3^FS
^HV3,16,TAGNO = ^FS
^XZ
```

### Response from Printer

```
TAGNO = 48454C4C4F544147
```

## EPC Programming Examples

**IMPORTANT** With all examples make sure *MEDIA > Image > Label Length* matches the physical length of the installed media.

### Example 1

This programming example programs data into an RFID tag and prints that data onto a smart label.

```
^XA
//Begin ZPL form.
^WT0^FH^FD_87_D0_03_45_67_AB_CD_EF^FS
//Write Tag with data = "87D0034567ABCDEF" hex format.
^RT1,0,1,1^FS
//Read Tag into data element 1, 8-byte (16 characters) long (hex format).
^FO100,100^A0N,60^FN1^FS
//Print data in element 1.
^XZ
//End and print label.
```

### Example 2

Same as Example 1, except an alternative ZGL syntax that does not require underscores between the hex characters is used

```
^XA
```

```

//Begin ZPL form.
^WT0,,,,1FDN^FD87D0034567ABCDEF^FS
//Write Tag with data = "87D0034567ABCDEF" (hex format).
^RT1,0,1,1^FS
//Read Tag into data element 1, 8-byte (16 characters) long (hex format).
^FO100,100^A0N,60^FN1^FS
//Print data in element 1.
^XZ
//End and print label.

```

### Example 3

This example uses the ^RF command to write and read the tag.

```

^XA
//Begin ZPL form.
^RFW,H,0^FD31323334^FS
//Write tag data 31323334 in hex.
^FO100,100^A0N,60,60^FN1^FS
//Print tag data in FN1.
^FN1^RFR,H,0^FS
//Read tag data and store into FN1.
^XZ
//End and print label.

```

### Example 4

This example uses the ^RF command to write and read the tag with EPC format.

```

^XA
^RMY
^RB64,16,16,16,16
^RZ01^RR3^RFW,E^FD12594,13108,13622,14136^FS
^FO50,150^A0N,50^FN0^FS
^FN0^RR4^RFR,E^FS
^XZ

```

### Example 5

*On a Gen 2 tag, this example:*

- Writes EPC data "112233445566778899001122" to the tag in hexadecimal format
- Locks the tag's EPC data with the password "1234ABCD"
- Renders the tag's access password unreadable

```

^XA
^RFW,H^FD112233445566778899001122^FS
^RZ1234ABCD,E,L^FS
^RZ1234ABCD,A,L^FS
^XZ

```

*This example:*

- Unlocks EPC data "112233445566778899001122" using the password "1234ABCD"

- Writes EPC data “newdata” to the tag in ASCII format
- Locks the tag’s new EPC data

Since the access password and its lock state are not changed, the access password remains unreadable

```
^XA
^RZ1234ABCD,E,U^FS
^RFW,A^FDnewdata^FS
^RZ1234ABCD,E,L^FS
^XZ
```

### Example 6

This example shows the access of 240 bits EPC and 512 bits USR.

```
^XA
^RZ31323334,K,W
^RZ1234ABCD,K,L
^RFW,H,1,30,1^FD0102030405060708091011121314 15161718192021222324252627282930^FS
^RFR,H,1,30,1^FN0^FS^HV0,128,#EPC240:^FS
^RZ1234ABCD,E,L
^RFW,H,0,64,3^FD010203040506070809101112131415161718192021222324252627282930313233343
53637383940414243444546474849505152535455565758596061626364^FS
^RFR,H,0,64,3^FN1^FS^HV1,128,#USR512:^FS
^RZ1234ABCD,U,L
^XZ
^XA
^RZ1234ABCD,A,U
^RZ1234ABCD,K,U
^RZ1234ABCD,U,U
^RZ1234ABCD,E,U
^FN2^RFP,H,A^FS
^FN3^RFP,H,K^FS
^HV2,16,#ACS=^FS
^HV3,16,#KIL=^FS
^XZ
```

## STGL RFID Commands

### RFID Write

**Purpose** This command specifies data to be written into RFID tags.

**Format** <ESC>RK 1,a,b,D16,c..c

- ^HV Host Verification command.
- a RFID tag Error Ignore. 0 = Disable (default when value is omitted), 1 = Enabled, 2 to 9 = Auto retry on tag error.

**IMPORTANT** This “a” parameter is ignored for STGL. The error handling for all RFID commands on all supported emulations is set according to the menus on the front panel. Using the RFID menu, the user can set the error handling, number of retries, and tag type.

- b Write Protector Designation. Valid range is 0 to 1. 0 = Fixed (default).
- D Write Protector Designation. Valid range is 0 to 1. 0 = Fixed (default).
- 16 or 24 Specification of Writing Data Size. Valid data size is 16 or 24 characters.
- c..c EPC data (fixed at 16 characters). Valid range is 0 to 9 or A to F only.

**Example**

<ESC>RK1,0,0,D16,ABCDEF1234567543

**RFID Write(IP0), RFID Read(IP1)**

Refer to your SATO programmer’s reference manual for a description of the RFID command syntax for IP0 and IP1.

## PTX SETUP Commands

The PTX SETUP commands are a superset of commands which allow the printer to perform several tasks by parsing commands either stored in flash or sent to the printer by the host. Commands range from re-routing debug statements to downloading complete printer configurations. See the *Administrator’s Manual* for a full description of all the commands available. Those specific to RFID are shown in Table 3.

**Concepts to Note**

1. PTX\_SETUP commands are not emulation specific. They work regardless of how *Applications > Control > Active IGP Emul* is setup.
2. The PTX\_SETUP command set is case sensitive; all PTX\_SETUP commands are in uppercase characters only.
3. The white space separating commands may be any number of spaces and tabs. This allows a PTX\_SETUP file to be formatted for easier readability.
4. Any unknown command will terminate the PTX\_SETUP processing. The offending command will be the first line of printed text.

Each emulation has modes in which the PTX\_SETUP commands could get missed. It is highly recommended that all PTX\_SETUP commands be placed between print jobs, rather than attempting to embed them within jobs.

PTX\_SETUP commands have the following format:

```
(SFCC) PTX_SETUP
Command-Sub Command; Value
PTX_END
```

For example, if the SFCC assigned to PTX\_SETUP is the default value of the exclamation mark (!, hex 21), and you want to change the EPC Length for a Higgs-3 RFID tag to 256, use the following command sequence:

!PTX\_SETUP RFID;EPC\_LENGTH;256 PTX\_END

**Table 3 PTX-SETUP Commands for RFID**

Command	Sub-Command	Parameter	Description
RFID	OVERSTRIKE_REPORT	0	When set to 0 (OFF), an RFID overstrike occurs then it is not reported to the host.
		1	When set to 1 (ON), an RFID overstrike occurs then it is reported to the host.
	STATISTICS_REPORT	0	When set to 0 (OFF), RFID statistics are not reported to the host.
		1	When set to 1 (ON) RFID overstrikes are reported to the host when an alert is processed.
	STATISTICS_CLEAR	None	When this command is processed the RFID statistics are cleared.
	EPC_LENGTH	EPC field length	<p>Specifies the EPC Length for RFID tag types that have a variable length EPC field (e.g. higgs-3). EPC field length can be one of (96, 112, 128, 144, 160, 176, 192, 208, 224, 240, 256)</p> <p><b>NOTE:</b> When the EPC length is selected with the command, the USR field is automatically set to the corresponding size as defined by the EPC Global Class-1 Generation -2 UHF RFID Specification.</p> <p>When the EPC length is selected with the command, the PC field must be programmed with the correct value as defined by the EPC Global Class-1 Generation-2 UHF RFID Specification.</p>

# 7 *RFID Inlay Pitch*

This printer specifically encodes inlays for item level applications and supports RFID labels that Printronix defines as Short-Pitch and On-Pitch.

## **RFID Inlay Pitch**

Pitch is defined as the distance from one point on an inlay to the same point on the next inlay. The reference point can be any point on the inlay: leading (or trailing) edge of the antenna (often described as the foil), leading (or trailing) edge of the antenna substrate, or the distance between ICs. Use the RFID Inlay Reference Figure 6 for a clearer understanding of the various points that can be used to determine pitch. The T6 RFID printer supports Short-Pitch and On-Pitch RFID Inlays.

**Example:** In the RFID menu under Tag Type, if you want to select an Alien 9730 tag you will have a choice of selecting:

**Aln9730 ShortPitch** or

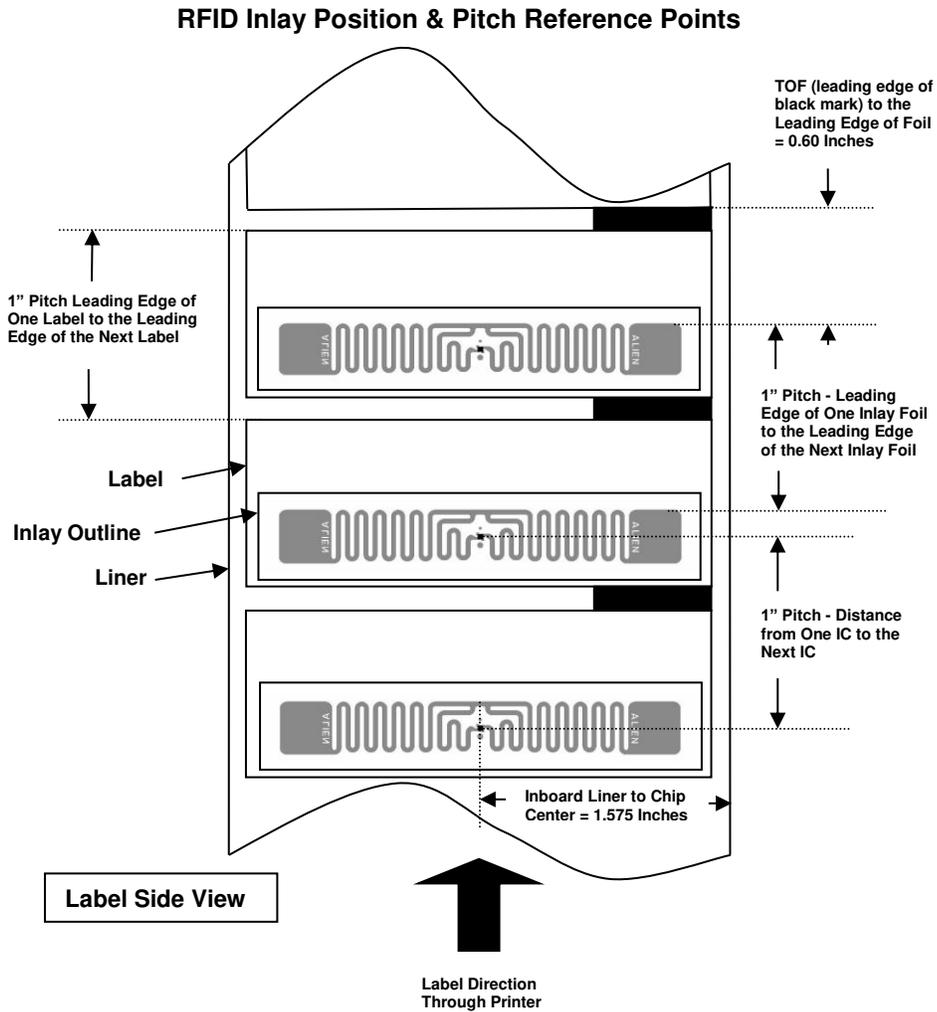
**Aln9730 OnPitch**

The correct choice will be based on the difference in pitch described and illustrated in the Short-Pitch and On-Pitch sections below.

# Short-Pitch RFID Labels

Printronix defines Short-Pitch labels as those with RFID inlays that have a pitch from 1.0 to 2.0 inches. The RFID inlay is short in length, and is constructed into an item level label that permits inlay encoding and provides the required but limited space to print text, graphics, barcodes or logos.

**NOTE:** Figure 6 shows a section from a roll of Short-Pitch labels and the variety of reference points that can be used to determine the pitch (in this case one-inch pitch).



Short-Pitch Label Configuration Using Alien 9730 Squiglette Inlay

Figure 6 Sample Short-Pitch Label Section

# On-Pitch RFID Labels

Printronix defines On-Pitch labels as those with RFID inlays that have a pitch from 0.5 to 0.625 inches. The RFID inlay is short in length, and is constructed into an item level label that permits inlay encoding and provides the required but limited space to print text, graphics, barcodes or logos.

**NOTE:** Figure 7 shows a section from a roll of On-Pitch labels and the variety of reference points that can be used to determine the pitch (in this case 0.625-inch pitch).

## RFID Inlay Position and Pitch Reference Points

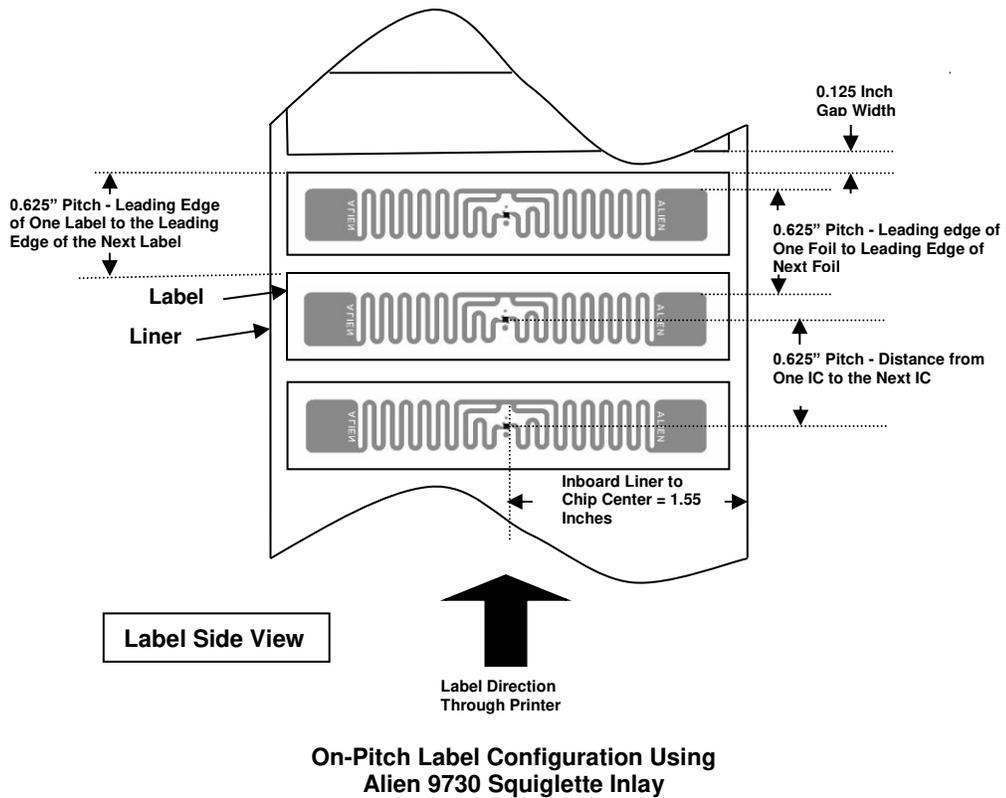


Figure 7 Sample On-Pitch Label Section



# A *Errors and Troubleshooting*

## Error Messages

The RFID encoder can detect a number of errors. When one of these errors occurs, the RFID encoder alerts the printer to perform the currently selected error action (see section Error Handling on page 19) and display the appropriate error message on the control panel's LCD (see Table 4).

**Table 4 RFID Error Messages**

<b>Displayed Message</b>	<b>Solution/Explanation</b>
RFID Comm Err Check Cable	RFID error: communication cannot be established between the printer and the RFID encoder.  <ol style="list-style-type: none"><li>1. Press <b>PAUSE</b> to clear the message.</li><li>2. Disable the <i>Control &gt; RFID Active</i> menu.</li><li>3. See "Troubleshooting" on page 60.</li></ol>
RFID FW ERR: Version Mismatch	The RFID encoder firmware version is not capable of operating with the printer software.  <ol style="list-style-type: none"><li>1. Press <b>PAUSE</b> to clear the message.</li><li>2. Download the program file to the printer again.</li></ol>
RFID LOCK CMD: Not supported!	A lock command was executed on a tag which does not support locking. Most Gen 2 tags support locking.  <ol style="list-style-type: none"><li>1. Press <b>PAUSE</b> to clear the message.</li><li>2. Remove the lock command from the application.</li></ol>
RFID MAX RETRY Check System	The menu <i>Control &gt; Error Handling</i> is set to <i>Overstrike</i> , and the Label Retry count has been exhausted.  <ol style="list-style-type: none"><li>1. Press <b>PAUSE</b> to clear the message.</li><li>2. See "Troubleshooting" on page 60.</li></ol>

Displayed Message	Solution/Explanation
RFID TAG ERR: Read-Only Tag	A write was attempted on a read-only tag.  1. Press <b>PAUSE</b> to clear the message. 2. See “Troubleshooting” on page 60.
ODV COMM ERR See Manual	Communication error between printer and online data validator (ODV).  1. Cycle power. 2. If the problem persists, contact your authorized customer service representative.
RFID TAG FAILED Check Media	The menu <i>Control &gt; Error Handling</i> is set to <i>Stop</i> , and the RFID encoder could not read the RFID tag.  1. Press <b>PAUSE</b> to clear the message. 2. See “Troubleshooting” on page 60.
RFID UNLOCK CMD: Not Supported!	An unlock command was executed on a tag which does not support locking.  1. Press <b>PAUSE</b> to clear the message. 2. Remove the unlock command from the application.
RFID ACS FIELD: Not Supported!	The ACS field was accessed on a tag which does not support the ACS field.  1. Press <b>PAUSE</b> to clear the message. 2. Remove references to ACS field from the application.
RFID KIL FIELD: Not Supported!	The KIL field was accessed on a tag which does not support the KIL field.  1. Press <b>PAUSE</b> to clear the message. 2. Remove references to KIL field from the application.
RFID PC FIELD: Not Supported!	The PC field was accessed on a tag which does not support the PC field.  1. Press <b>PAUSE</b> to clear the message. 2. Remove references to PC field from the application.

## Troubleshooting

If you are having problems with the RFID system, consult Table 5 for a list of symptoms and possible solutions.

**Table 5 Troubleshooting the RFID System**

Symptom	Solution
No communication between the printer and the RFID encoder	<ol style="list-style-type: none"> <li>1. Make sure the reader is enabled via <i>Control &gt; RFID Active</i> menu (page 19).</li> <li>2. Use the <i>Diagnostics &gt; Read Tag</i> feature (page 28) to read and display the current RFID tag content.</li> <li>3. If the problem persists, your RFID encoder may be disconnected or defective. Contact your authorized service representative.</li> </ol>
Tag failed	<ol style="list-style-type: none"> <li>1. The label could be misaligned. Perform the <i>Sensors &gt; Control &gt; Auto Calibrate</i> procedure to ensure the label is at top-of-form. For more information, refer to the Administrator's Manual.</li> <li>2. Make sure the media are smart labels with RFID tags located in the correct position.</li> <li>3. The RFID tag could be defective. Try another tag.</li> <li>4. Make sure the application does not send too few or too many digits to the RFID tag.</li> </ol>
Inconsistent results	Make sure the media is loaded correctly. For more information, refer to the Administrator's Manual.
The RFID encoder works, but it does not meet expectations	Make sure that both <i>Control &gt; Error Handling</i> and <i>Control &gt; Label Retry</i> are set to desired values.
<p>The RFID icon is greyed out in the Settings section:</p> 	The printer did not detect the RFID encoder at power-up. Your RFID encoder may be disconnected or defective. Contact your authorized service representative.

# **B** *Contact Information*

## **Printronix Customer Support**

### **The Printer Place**

Tel.: +1 800 243 3338  
[www.theprinterplace.com](http://www.theprinterplace.com)



P220002-001 F