PRINTRONIX®

RFID Labeling Reference Manual

SL5000$^{r\text{™}}$ MP and MP2
RFID Smart Label Printers

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RFID Smart Label Printers

RFID Labeling Reference Manual

PRINTRONIX®

Trademark Acknowledgements

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1 RFID Smart Label Application And Reference Notes

Overview

NOTE: For the latest version of this reference manual, visit the Services & Support page at www.printronix.com.

This manual covers the following products:

- Printronix SL5000r DK Smart Label Developer's Kit
- Printronix SL5000r DK2 Smart Label Developer's Kit
- Printronix SL5000r MP Multi-protocol RFID printer, supporting Class 0/0+, Class 1, Class 1.19 RFID, Class Gen 2, and Class Zuma™ RFID tags and labels
- Printronix SL5000r MP2 Multi-protocol RFID printer, supporting Class 0/0+, Class 1, Class 1.19 RFID, Class Gen 2, and Class Zuma™ RFID tags and labels

Chapter 1 Overview

The Printronix SL5000r DK/DK2 Smart Label Developer's Kit contains:

- SL5000r MP/MP2 multiprotocol RFID printer
- Integrated RFID UHF encoder supporting Class 0/0+, Class 1, Class 1.19, Class Gen 2, and Class Zuma RFID tags and labels
- Software Migration Tools that permit the seamless encoding of smart labels
- Media starter kit (100 4 inch x 6 inch standard labels, 50 m 8500 thermal premium wax resin ribbon, and a printhead cleaning pen)
- 1000 Class 1 RFID smart labels
- One 625 m thermal premium wax ribbon
- Network interface card, which includes Printronix's PrintNet® Enterprise, a remote network printer management software application.
- Programming manuals (CD)
- RFID Labeling Reference Manual (this manual)
- Application and reference notes (this chapter)
- Technical support

The intent of the kit is to provide a complete environment for the printing and encoding of RFID smart labels right out of the box. Printronix has specifically designed this kit to help you fast track your RFID printer application through the use of a suite of Software Migration Tools (SMT).

What To Expect When Running Your 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 Error Handling setting. See “Error Handling” on page 27.

Smart Label Characteristics

IMPORTANT **Purchase additional smart labels directly from Printronix to assure the highest level of performance and reliability. See “How To Order More Smart Labels” on page 16.**

Supported Tag Types

Printronix RFID SL5000 MP and MP2 printers support a number of RFID protocols and coupler configurations.

For a list of Certified RFID Smart Labels available from Printronix, and a complete list of tag types supported by Printronix RFID SL5000 MP and MP2 printers:

1. Go to www.printronix.com and select your Country/Language of choice.
2. Under SOLUTION OFFERINGS, click **RFID Printers**.
3. Under **RFID Smart Labels**, click **View Series**.
    a. For a list of Certified RFID Smart Labels available from Printronix, click **Certified RFID Labels**.
    b. For a complete list of supported RFID tag types, click **Supported RFID Tags**.

These web pages will be updated regularly to include newly supported RFID tag types and newly Certified RFID Smart Labels available from Printronix.

Currently supported smart labels have the following characteristics:

General Tag Type

- UHF 869/915 MHz radio frequency

Technology Tag Class

- EPC Class 0 tags – 64 data bits Read Only
- EPC Class 0 tags – 96 data bits Read Only
- EPC Class 0+ tags – 64 data bits Read/Write
- EPC Class 0+ tags – 96 data bits Read/Write

NOTE: For EPC Class 0+, Class 1.19, and Class Zuma tags, the AWID multi-protocol reader used by Printronix enforces the EPC format in the following manner:

- For 96–bit data, the two most significant bits must be 0.
- For 64–bit data, the two most significant bits must be 1.

- EPC Class 1 tags – 64 data bits Read/Write
- EPC Class 1 tags – 96 data bits Read/Write
- EPC Class 1.19 tags – 96 data bits Read/Write
- EPC Class Gen 2 tags – 96 data bits Read/Write
- Impinj® Zuma tags – 96 data bits Read/Write

Label Size

4 x 2, 4 x 4, 4 x 6, 4 x 8 inch label stock

Transitioning From UCC/GTIN Applications Using Printronix Software Migration Tools (SMT)

It is likely that your software is already set up to create bar codes. You may have also spent a lot of time creating compliance label templates & integrating them into your system. The Smart Label Developer's Kit Software Migration Tools will allow you to effortlessly transition from printing compliance labels to smart labels.

How Printronix Makes It Easy

If you are printing bar codes now, you can print smart labels — no change to your host datastream or existing compliance templates is required.

How It Works

A set of Software Migration Tools has been created to intercept the bar code data in the host datastream and copy the data to a smart label RFID tag according to a set of rules. Each tool has been designed for a specific end-use application. By simply selecting the desired Software Migration Tool from the printer's control panel, you automatically enable the printer to create an RFID smart label from your existing software application even if the software does not have the functionality to program RFID tags. The tools include:

- **GTIN:** Copies the Global Trade Identification Number (GTIN) bar code data for case and pallet labels onto the smart label's RFID tag.
- **EAN-8**, **EAN13**, **UPCA**, and **UCC128:** These tools copy the data from their respective bar code symbologies to a smart label's RFID tag. This enables the achievement of supply-chain efficiencies with RFID-ready trading partners while at the same time remaining compatible with those who are not.

- **EPC:** This tool allows EPC data to be directly encoded into the smart label's RFID tag. Simply have your existing software application write the desired EPC number to a Code 3 of 9 barcode. The printer will then write the EPC data to the RFID tag without printing the bar code.

The existing toolset will meet the needs of many RFID early adopters. If you have a requirement for a Software Migration Tool not included in this kit, feel free to contact Printronix.

To select and use the tools, see "Software Migration Tools (SMT)" on page 65.

Hardware/Infrastructure Considerations

Once your smart labels have been applied to their target container or pallet you will need external readers to track them through your supply chain. Such readers are typically networked devices that are deployed at key points in the warehouse or distribution center to track incoming and outgoing packages. The readers are managed through a server for gathering and filtering all the RFID information. Readers may have multiple couplers to maximize read range and reliability.

The readers you purchase must be compatible with the smart labels programmed by the printer. Specifically, they should be EPC Class 0, Class 0+, Class 1, Class 1.19, Class Gen 2, and Class Zuma compliant. Handheld readers with integrated couplers can be purchased from AWID (www.awid.com).

The data that are gathered by the reader servers must be managed for tracking and archiving purposes. Software applications that perform these tasks are available from companies such as Manhattan Associates® (www.manh.com).

Contact Information

Printronix Professional Services

Printronix can partner with you on your RFID pilot project to make your existing software applications RFID/smart label capable. We specialize in smart label print and apply configuration and integration, RFID pilot implementation, and transition from RFID pilots to full production rollouts.

Call the Printronix Customer Support Center at (714) 368-2686 and ask for Professional Services Support.

How To Order More Smart Labels

Contact the Printronix Supplies Department for genuine Printronix supplies.

Americas	(800) 733-1900
Europe, Middle East, and Africa	(33) 1 46 25 1900
Asia Pacific	(65) 6548 4116 or (65) 6548 4182

http://www.printronix.com/supplies-parts.aspx

Printronix Customer Support Center

IMPORTANT **Please have the following information available prior to calling the Printronix Customer Support Center:**

- Model number
- Serial number (located on the back of the printer)
- Installed options (i.e., interface and host type if applicable to the problem)
- Configuration printout (see “Printing A Configuration” in the *Quick Setup Guide*)
- Is the problem with a new install or an existing printer?

- Description of the problem (be specific)
- Good and bad samples that clearly show the problem (faxing of these samples may be required)

Americas	(714) 368-2686
Europe, Middle East, and Africa	(31) 24 6489 311
Asia Pacific	(65) 6548 4114

http://www.printronix.com/support.aspx

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Visit the Printronix web site at www.printronix.com

Useful Industry Web Links

Printronix, Inc.
www.printronix.com

Alien Technology® Corporation
www.alientechnology.com

Applied Wireless Identifications Group, Inc.
www.awid.com

EPCglobal, Inc.
www.epcglobalinc.org

RFID Journal
www.rfidjournal.com

Uniform Code Council, Inc.®
www.uc-council.org

2 Smart Label Development

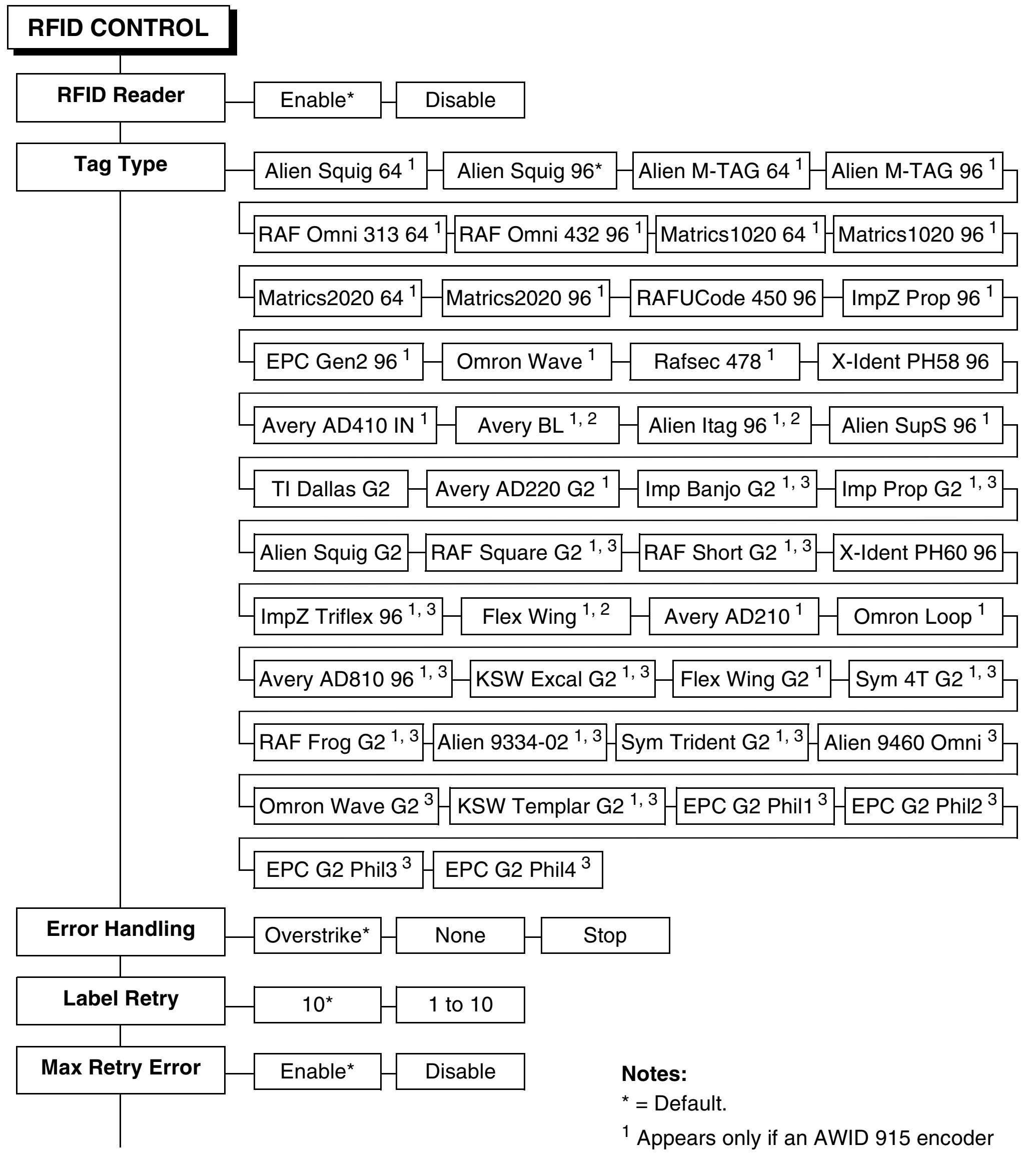
Overview

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.

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

- Use the Software Migration Tools (SMT) to enable the printer to automatically create RFID commands from your existing bar code commands. These tools are described on page 65.
- Incorporate RFID commands into new or existing Printronix PGL® programs. Command details start on page 35.
- Incorporate RFID commands into new or existing ZPL™ programs. By selecting the Printronix PPI/ZGL emulation you can seamlessly upgrade from Zebra™ printers. Command details start on page 55.
- Incorporate RFID commands into new or existing SATO® printer language programs. By selecting the Printronix PPI/STGL emulation you can seamlessly upgrade from SATO printers. Command details start on page 63.

RFID CONTROL Menu



(cont. on next page)

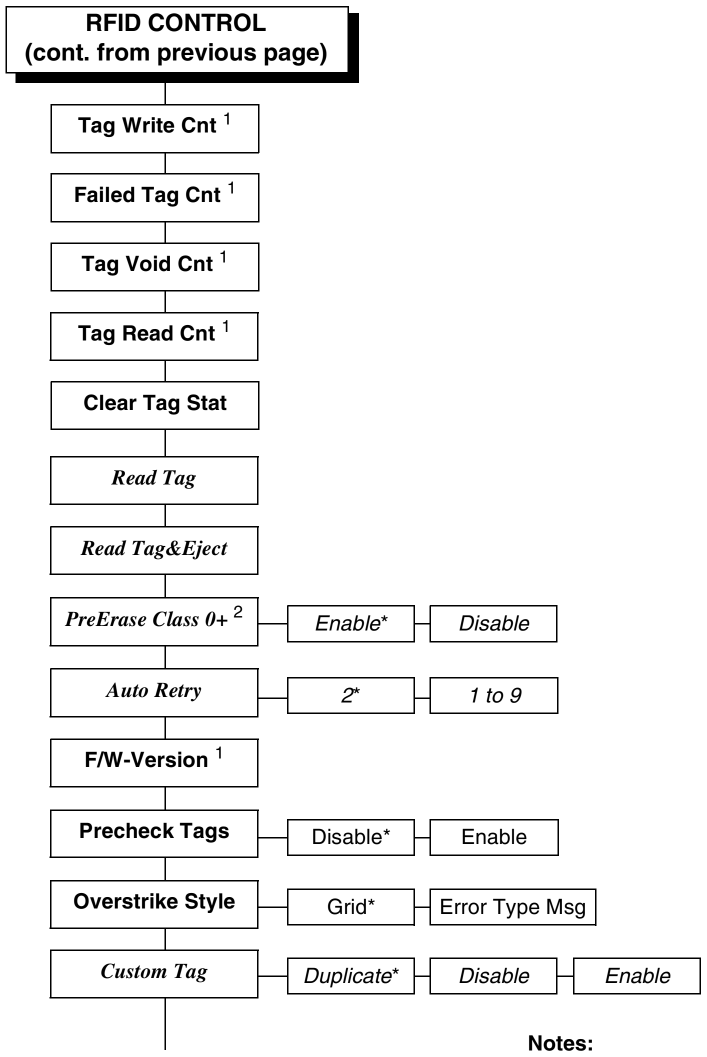
Notes:

* = Default.

[1] Appears only if an AWID 915 encoder (USA/Canada) is installed.

[2] Appears only on six inch printers.

[3] Appears only on MP2 RFID printers.



(cont. on next page)

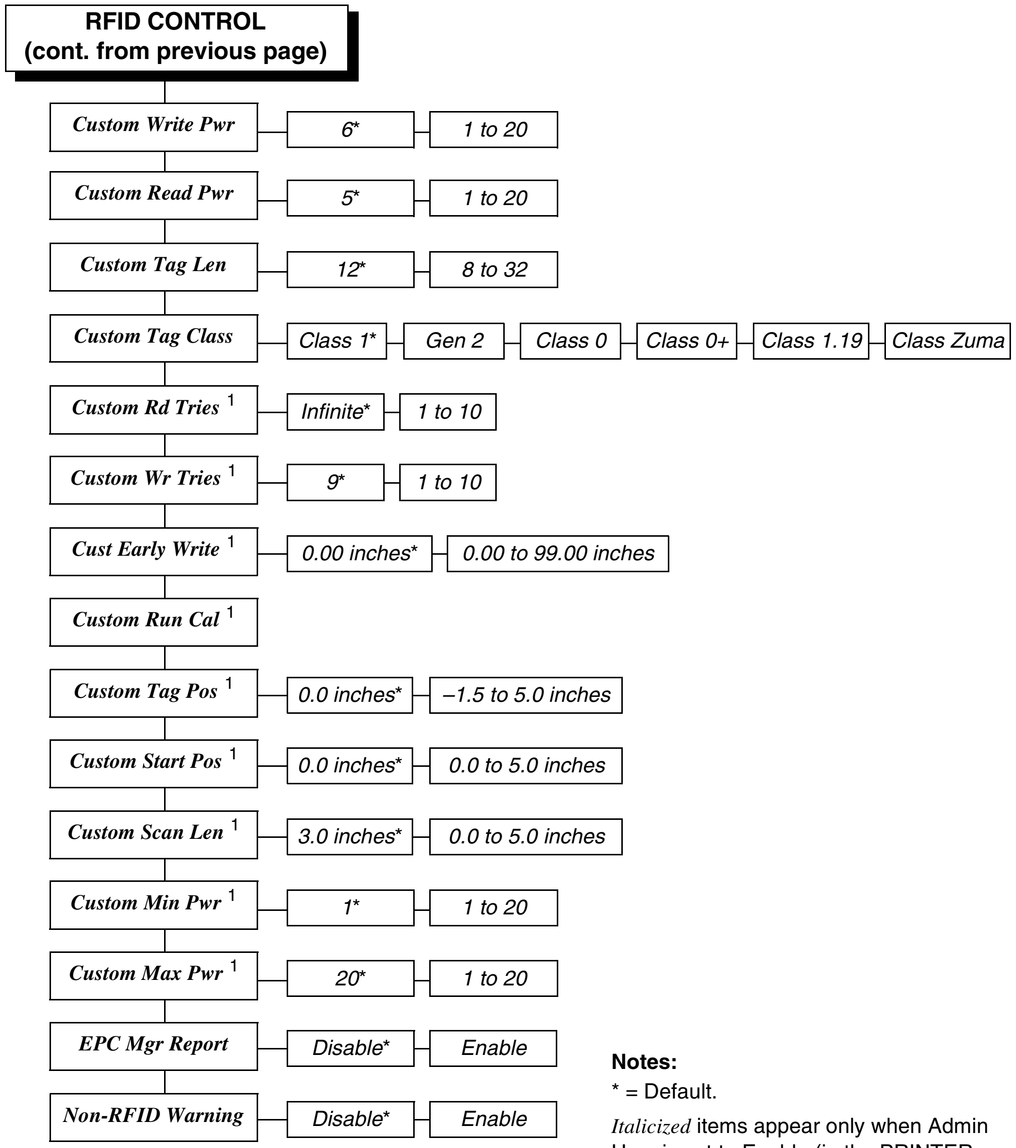
Notes:

* = Default.

Italicized items appear only when Admin User is set to Enable (in the PRINTER CONTROL menu).

[1] Display item only.

[2] Appears only if Tag Type is set to Matrics2020 64 or Matrics2020 96.


RFID CONTROL
(cont. from previous page)
Custom Write Pwr | 6* | 1 to 20
Custom Read Pwr | 5* | 1 to 20
Custom Tag Len | 12* | 8 to 32
Custom Tag Class | Class 1* | Gen 2 | Class 0 | Class 0+ | Class 1.19 | Class Zuma
Custom Rd Tries 1 | Infinite* | 1 to 10
Custom Wr Tries 1 | 9* | 1 to 10
Cust Early Write 1 | 0.00 inches* | 0.00 to 99.00 inches
Custom Run Cal 1
Custom Tag Pos 1 | 0.0 inches* | –1.5 to 5.0 inches
Custom Start Pos 1 | 0.0 inches* | 0.0 to 5.0 inches
Custom Scan Len 1 | 3.0 inches* | 0.0 to 5.0 inches
Custom Min Pwr 1 | 1* | 1 to 20
Custom Max Pwr 1 | 20* | 1 to 20
EPC Mgr Report | Disable* | Enable
Non-RFID Warning | Disable* | Enable

Notes:

* = Default.

Italicized items appear only when Admin User is set to Enable (in the PRINTER CONTROL menu).

[1] Appears only on MP2 RFID printers.

RFID CONTROL Menu Items

RFID Reader

This menu item enables or disables the RFID encoder.
The default is Enable.

Tag Type

This menu item selects the tag type in use. Table 1 lists supported tags types in alphabetical order. Other types may be added in the future.

NOTE: The "RFID CONTROL Menu" on page 20 lists supported tags types in the order they appear in the menu.

Table 1. Supported RFID Tag Types

Tag Name	Bits	Protocol	Custom Tag Class	Menu Selection
Alien® 9334 (2 x 2)	96	Class 1, Gen 1	Class 1	Alien 9334-02
Alien 9460 Omni	96	Class 1, Gen 2	Gen 2	Alien 9460 Omni
Alien Gen 2 Squiggle	96	Class 1, Gen 2	Gen 2	Alien Squig G2
Alien I-Tag	96	Class 1, Gen 1	Class 1	Alien Itag 96
Alien M-Tag	64	Class 1, Gen 1	Class 1	Alien M-TAG 64
Alien M-Tag	96	Class 1, Gen 1	Class 1	Alien M-TAG 96
Alien Squiggle	64	Class 1, Gen 1	Class 1	Alien Squig 64

Table 1. Supported RFID Tag Types

Tag Name	Bits	Protocol	Custom Tag Class	Menu Selection
Alien Squiggle	96	Class 1, Gen 1	Class 1	Alien Squig 96
Alien Squiggle 2 (aka Super Squiggle)	96	Class 1, Gen 1	Class 1	Alien SupS 96
Avery™ AD-210 (aka Strip)	96	Class 1, Gen 1	Class 1	Avery AD210
Avery AD-220 (aka Runway)	96	Class 1, Gen 2	Gen 2	Avery AD220 G2
Avery AD-410 (aka IN)	96	Class 1, Gen 1	Class 1	Avery AD410 IN
Avery AD-610 (aka BL)	96	Class 1, Gen 1	Class 1	Avery BL
Avery AD-620 (aka Triflex)	96	Class Zuma	Class Zuma	ImpZ Triflex 96
Generic Philips (coupler yellow)	96	Class 1, Gen 2	Gen 2	EPC G2 Phil1
Generic Philips (coupler orange)	96	Class 1, Gen 2	Gen 2	EPC G2 Phil2
Generic Philips (coupler red)	96	Class 1, Gen 2	Gen 2	EPC G2 Phil3
Generic Philips (coupler blue)	96	Class 1, Gen 2	Gen 2	EPC G2 Phil4
Impinj Gen 2 Banjo	96	Class 1, Gen 2	Gen 2	Imp Banjo G2
Impinj Propeller	96	Class Zuma	Class Zuma	ImpZ Prop 96
Impinj Gen 2 Propeller	96	Class 1, Gen 2	Gen 2	Imp Prop G2

Table 1. Supported RFID Tag Types

Tag Name	Bits	Protocol	Custom Tag Class	Menu Selection
KSW Gen 2 Excalibur	96	Class 1, Gen 2	Gen 2	KSW Excal G2
KSW Gen 2 Templar	96	Class 1, Gen 2	Gen 2	KSW Templar G2
Omron™ Loop	96	Class 1, Gen 1	Class 1	Omron Loop
Omron Wave	96	Class 1, Gen 1	Class 1	Omron Wave
Omron Gen 2 Wave	96	Class 1, Gen 2	Gen 2	Omron Wave G2
Rafsec® 313	64	Class 1, Gen 1	Class 1	RAF Omni 313 64
Rafsec 432	96	Class 1, Gen 1	Class 1	RAF Omni 432 96
Rafsec 450	96	Class 1.19	Class 1.19	RAFUCode 450 96
Rafsec 478	96	Class 1, Gen 1	Class 1	Rafsec 478
Rafsec Gen 2 Frog (3000790)	96	Class 1, Gen 2	Gen 2	RAF Frog G2
Rafsec Short Dipole (OneTenna)	96	Class 1, Gen 2	Gen 2	RAF Short G2
Rafsec Square Dipole (OneTenna)	96	Class 1, Gen 2	Gen 2	RAF Square G2
RF IDentics Flex Wing	96	Class Zuma	Class Zuma	Flex Wing
RF IDentics Gen 2 Flex Wing	96	Class 1, Gen 2	Gen 2	Flex Wing G2

Table 1. Supported RFID Tag Types

Tag Name	Bits	Protocol	Custom Tag Class	Menu Selection
Symbol® Class 0 Read-Only (aka Matrics® X1020)	64	Class 0	Class 0	Matrics1020 64
Symbol Class 0 Read-Only (aka Matrics X1020)	96	Class 0	Class 0	Matrics1020 96
Symbol Class 0+ (aka Matrics X2020)	64	Class 0+	Class 0+	Matrics2020 64
Symbol Class 0+ 4T Glacier (aka Matrics X2020)	96	Class 0+	Class 0+	Matrics2020 96
Symbol Gen 2 Four T	96	Class 1, Gen 2	Gen 2	Sym 4T G2
Symbol Gen 2 Trident	96	Class 1, Gen 2	Gen 2	Sym Trident G2
TI™ Gen 2 Dallas	96	Class 1, Gen 2	Gen 2	TI Dallas G2
X-ident PH 58	96	Class 1.19	Class 1.19	X-Ident PH58 96
X-ident PH 60	96	Class 1.19	Class 1.19	X-Ident PH60 96

Error Handling

This menu item selects the error handling mode for RFID failures. The default is Overstrike.

In Overstrike mode, 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 Max Retry Error setting.

In None mode, no specific action is taken when a tag fails to be programmed.

In Stop mode, when a tag fails to be programmed, 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.

Label Retry

NOTE: Label Retry only applies when the Error Handling mode is set to Overstrike.

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. The default is 10.

Max Retry Error

This menu item enables or disables Max Retry Error. If it is set to Disable, errors are not declared and the print content for the current label is discarded. The default is Enable.

Tag Write Cnt

This menu item displays on the control panel’s LCD the number of tags attempted to be written since the last Clear Tag Stat operation has been initiated. (See “Clear Tag Stat” below.)

Failed Tag Cnt

This menu item displays on the control panel’s LCD the number of failed tag write attempts since the last Clear Tag Stat operation has been initiated. (See “Clear Tag Stat” below.)

Tag Void Cnt

This menu item always displays 0 unless the RFID encoder is used with an attached online data validator. When used with a validator, Tag Void Cnt represents how many valid RFID tags were overstruck due to bad bar code scanning. Refer to the *Online Data Validator User’s Manual*.

Tag Read Cnt

This menu item displays the number of tags read since the last Clear Tag Stat (below).

Clear Tag Stat

This menu item clears the Tag Write Cnt, Failed Tag Cnt, Tag Void Cnt, and Tag Read Cnt menu items.

F/W-Version

This menu item displays on the control panel’s LCD the reader firmware version.

Precheck Tags

NOTE: This menu item applies to Class 1 tags only.

When this menu item is set to Enable, the RFID encoder checks the tags for a pre-programmed quality code. If the code is absent, the tag immediately fails and the selected Error Handling mode is performed (Overstrike, None, or Stop). The default is Disable.

Overstrike Style

This menu item selects the style of the overstrike pattern.
The default is Grid.

When it is set to Grid, a grid pattern prints when it overstrikes. When it is set to Error Type Msg, an error message prints that indicates which error occurred (see Table 2).

IMPORTANT **If you are using a validator, set the RFID Overstrike Style different than the validator Overstrike Style (in the VALIDATOR menu). This will help you differentiate between an RFID error and a validator error.**

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.
Tag Comm Err *x* Check cable	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.
Precheck Fail *x* Check media	This failure occurs only when the Precheck Tags menu item is set to Enable. It indicates that the RFID tag was automatically failed since it did not contain the correct pre-programmed quality code.

NOTE: 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.

Admin User Menu Items

To see these menu items, set Admin User to Enable in the PRINTER CONTROL menu. (Refer to the *User's Manual*.)

IMPORTANT **Admin User menu items should only be used by authorized personnel.**

Read Tag

IMPORTANT **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.**

This menu item 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.

Read Tag&Eject

IMPORTANT **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.**

The menu item works exactly the same as Read Tag (above), except that after the printer reads the tag, it feeds the label to the next top-of-form.

PreErase Class 0+

IMPORTANT **If you set PreErase Class 0+ to Disable, no erase cycle will occur and pre-programmed tags are not guaranteed to program correctly.**

This menu item enables or disables an automatic erase cycle forced on a Class 0+ tag before the tag is programmed. If an error occurs during the initial encoding, the ensuing retries will also include an automatic erase cycle.

If the tags are used and are known to have been previously written to, an erase cycle will be necessary. Many virgin Class 0+ tags are delivered pre-programmed, also requiring an erase cycle.

The default is Enable.

Auto Retry

This menu item selects the number of automatic (internal) retries that the printer will attempt on the same tag before declaring a tag error and performing the Error Handling mode selected (Overstrike, Stop, or None). The default is 2.

Custom Tag

This menu item enables or disables the custom tag menus (all menu items that begin with Custom or Cust). The default is Disable.

The custom tag menus allow the RFID encoder to work with tag types that are not listed in the Tag Type menu item.

NOTE: Printronix cannot guarantee the performance of tag types not certified by Printronix.

When Custom Tag is set to Disable, the settings in the custom tag menus are ignored by the RFID encoder.

When it is set to Enable, the RFID encoder uses the settings in the custom tag menus, which must be set to match the characteristics of the custom tag.

When it is set to Duplicate, the settings of the selected Tag Type menu item are copied into the custom tag menus, but are ignored by the RFID encoder.

Custom Write Pwr

NOTE: To enable this menu item, set Custom Tag to Enable.

This menu item selects the write power level to be used in the RFID encoder. 1 is the lowest power level setting, and 20 is the highest. The default is 6.

Custom Read Pwr

NOTE: To enable this menu item, set Custom Tag to Enable.

This menu item selects the read power level to be used in the RFID encoder. 1 is the lowest power level setting, and 20 is the highest. The default is 5.

Custom Tag Len

NOTE: To enable this menu item, set Custom Tag to Enable.

This menu item selects the number of bytes in the tag.
The default is 12.

Custom Tag Class

NOTE: To enable this menu item, set Custom Tag to Enable.

This menu item selects the class of the custom tag. Class 1, Class 0+, Class 1.19, Class Gen 2, and Class Zuma tags are read/write. Class 0 tags are read only. The default is Class 1.

Custom Rd Tries

NOTE: To enable this menu item, set Custom Tag to Enable.

This menu item selects how many times the RFID encoder will try each read command. The default is infinite, which causes the encoder to try until the operation times out.

Custom Wr Tries

NOTE: To enable this menu item, set Custom Tag to Enable.

This menu item selects how many times the RFID encoder will try each write command. The default is 9.

Cust Early Write

NOTE: To enable this menu item, set Custom Tag to Enable.

This menu item selects how early the RFID encoder will write the next tag before it completes the printing on the current label.

Certain tag types are designed to allow early tag writing for maximum print speed. The default is 0.00 inches.

IMPORTANT **Change this menu item with caution. If the write is performed too early, the wrong tag will be written.**

Custom Run Cal

This menu item causes the printer to run calibration for the current RFID tags installed in the printer. After the calibration is complete, the custom settings are changed to work with the tags installed. These settings do not take effect until Custom Tag is set to Enable.

Custom Tag Pos

This menu item determines how far the RFID tag position of the currently installed custom tags differs from the RFID tag position of the standard Printronix tag. Printronix printers print at maximum speed with RFID labels that have RFID tags in the standard position. The default is 0.0 inches.

Custom Start Pos

This menu item determines where on the label the RFID calibration will begin. By default, the calibration procedure will start at the beginning of the label (0.0 inches). To make the calibration work faster, change this value to force the calibration to begin after the beginning of the label.

Custom Scan Len

The menu item determines how much of the label will be scanned during the RFID calibration procedure. The default is 3.0 inches.

Custom Min Power

The menu item determines the minimum power level that the calibration procedure will use when attempting to find the ideal power level. To make the calibration work faster, increase this value to exclude the lower power levels. The default is 1.

Custom Max Power

The menu item determines the maximum power level that the calibration procedure will use when attempting to find the ideal power level. To make the calibration work faster, decrease this value to exclude the higher power levels. The default is 20.

EPC Mgr Report

This menu item enables EPC and label information to be sent out the network port. This information can be used by an RFID tag data and labels manager program. The default is Disable.

Non-RFID Warning

When this menu item is set to Enable, the printer checks to make sure that non-RFID jobs are not being printed on RFID labels (to prevent RFID labels from being wasted).

If RFID labels are installed in the printer, and a job is printed with at least one form that contains no RFID commands, a fault will be declared and the data for the forms that contain no RFID commands will be absorbed.

The default is Disable.

Requesting An RFID Report

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

1. Press the **PAUSE** key to take the printer offline.
2. If necessary, press ↓ and ↵ at the same time to unlock the ↵ key.
3. Press **TEST PRINT**. Printer Tests displays.
4. Press **+** until ODV/RFID Report displays.
5. Press ↵ to print the report.
6. Press ↓ and ↵ at the same time to lock the ↵ key, then press **PAUSE** to take the printer offline.
7. Press **PAUSE** again to put the printer online.

RFID PGL Commands

IMPORTANT **For all examples make sure Label Length in the QUICK SETUP menu 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.

Mode CREATE

Format RFWTAG[;LOCKn*[;format]*];*size[;mem bank]*
(*Bit Field*)+
STOP

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

LOCK*n[;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.
	format is 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.
size	A decimal number specifying the overall bit length of the memory bank.
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 (currently not applicable for RFWTAG) **'USR'** – User 32 bytes area **'ACS'** – 4 bytes access code area **'KIL'** – 4 bytes kill code area
Bit Field	A line description of a bit field and must have one of the following syntax formats: 1. For non-incremental data (both static and dynamic) *length*;[**DF***n*;]*format*;(D)*datafield*(D) 2. For incremental fixed data *length*;**I**;*format*;**STEP**[*idir*]*step*;[**RPT***n*;] [**RST***n*;](D)*startdata*(D) 3. For dynamic incremental data *length*;**IDF***n*;*format*;
length	A decimal number specifying the bit length of a field within a tag. The maximum length for each DFn field 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*	Optional parameter to indicate this field has dynamic data. Replace *n* with a number ranging from 1 to 512 to identify the field number of this particular field. If this option is used, *datafield* is ignored, and dynamic data must be entered via the DF command in the EXECUTE mode.
IDF*n*	Enter **IDF** to indicate this field is a bit field with dynamical assignment of increment (or decrement) data. The *step* and *startdata* parameters will be supplied by the IDF command in the EXECUTE mode. Replace *n* with a number ranging from 1 to 512 to identify the field number of this bit field. Dynamically enter the *step* and *startdata* parameters using the IDF command in the EXECUTE mode.

NOTE: 1. The same field number cannot be used in both DFn and IDFn.

2. If a field is defined as IDFn, it must be referenced as IDFn later for consistency. The same applies for DFn.

3. If <IDFn> syntax is used for merging data into AFn or BFn, neither DFn, AFn, or BFn will be incremented. The increment only takes place in the ~DFn command where the STEP is specified.

format	A letter specifying the format of the data field. **B** – binary, **D** – decimal, **H** – 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 (/).
datafield	The static data of this static field. It is a mandatory parameter of bit field with static data.
I	Identifies this field is an incremental bit field.
STEP	Specifies that the incremental data field will use the step method. Enter **STEP;**. The STEP option replaces the STEPMASK option that is used in Alpha and Barcode.

idir	Enter a plus sign (+) or leave the field blank to increment (default). Enter a minus sign (–) to decrement.
step	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.
RPT*n*	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 *n* is 1, which will increment the field value each time it prints. The repeat count can range from 1 to 65535.
RST*n*	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 *n* can range from 1 to 65535.
startdata	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 vaue 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, the dynamic format <DFn> needs to be a different dynamic number for LOCK and UNLOCK since it is designed where a unique dynamic number can be linked to only one object type. In this case, LOCK is linked to RFWTAG object and UNLOCK is linked to RFRTAG option. Although both options use the same passcode, the dynamic format needs to be in a different dynamic number in the same form.

11. The NOMOTION parameter of the CREATE command is used primarily in RFID applications. Refer to “CREATE” in the *IGP/PGL Programmer’s Reference Manual*.

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 = 2d, Filter Value = 5d, EPC Manager Index = 15383d, Object Class = 703710d or 0xABCDE, and the Serial Number = 0123456d.

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*              /Company Prefix
24;D;*7777777*             /Item Reference
```

```
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;*313233343536373839414243444546
4748494A4B4C4D4E4F*
```

```
~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<DF7>;H;96;EPC
96;DF2;H
STOP
RFWTAG;LOCK313233;H;32;KIL
32;DF3;H
STOP
RFRTAG;UNLOCK3224115;32;KIL
32;DF4;H
STOP
RFWTAG;LOCK<DF6>;D;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;*3132333435363738394142 43*
~DF3;*3435363738*
~DF6;*3224115*
~DF7;*3132333*
~AF1;<DF2>
~AF2;<DF6>
~AF3;<DF7>
~AF4;<DF8>
~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.

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 UNLOCKn option is used to unlock any memory bank, which at the same is programmed to read the tag, the operation UNLOCKn will not unlock ACS memory area. 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. *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 of access code area. **‘KIL’** – 4 bytes of kill code area	
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 DFn 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 42, 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

IMPORTANT **This command requires the use of the Return Status port. See "Return Status Port" on page 64.**

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.

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.
format	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 DFn format could be either B, D, or H. Due to the possible conversion the outgoing datastream 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 datastream 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.

(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 preceeding the field data.

ASCIITrailer

Optional parameter to append an ASCII string of characters to the RFID data. You can insert the LF/CR characters \r\n into the string.

NOTE: 1. The DFn 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 DFn field, the DFn 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 AFn or BFn, the original format is S format.

4. 432 in the ~CREATE line specifies a 6 inch label. Use 144 for 2 inch labels and 288 for 4 inch labels.

5. 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 “\\”
                                   (0x5C0x5C) 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.
```

Write Tag

IMPORTANT **This command is still supported but no longer in development. We recommend you develop your application using the RFWTAG command as defined on page 35.**

Purpose To program non-incremental data into an RFID tag (embedded in a smart label).

Mode CREATE

Format

RFWRITE;[HEX;][EPC*m*;][RF*n*;L;][LOCK;]AT*p*;[(D)*datafield*(D)]

RFWRITE;	The RFID Write Tag command.
HEX;	Optional parameter to indicate that the text in *datafield* is in hexadecimal format and that it will be converted to binary format.
EPC*m*;	Optional parameter to indicate that the data in *datafield* should be converted to an EPC number. When this parameter is used, the HEX option is automatically enabled and the data field is limited to a maximum of 14 digits. The AT parameter is ignored. The tag is then programmed as follows: **Bits 0 to 1** are programmed with the EPC value 0 to 3, specified in *m*. **Bits 2 to 57** are programmed with the hexadecimal characters in the data field (14 maximum). If the data field has less than 14 hexadecimal characters, zeros are assumed for the remaining digits. **Bits 58 to 63** are set to zero.
RF*n*;*L*;	Optional parameter to indicate that this field has dynamic data. Replace *n* with a number ranging from 1 to 512 to identify the field number of this RFWRITE field. Replace *L* with the length of the dynamic data string. If this option is used, the *datafield* is ignored, and dynamic data must be entered via the RF command in the EXECUTE mode. The length of the dynamic data must be equal to *L*.
LOCK;	Optional parameter to write-protect the data. Currently not supported.
AT*p*;	*p* specifies the decimal start position where data will be written to the tag. Subsequent bits will be shifted and previous bits are nulled.

(D)	Delimiter designating the start and end of static data for the RFWRITE field. Replace (D) with any printable character, except the SFCC and "/" (the slash character).
datafield	The static data of the RFWRITE field.

NOTE: RFWRITE fields are not expandable in VDUP and/or HDUP sections.

Read Tag

IMPORTANT **This command is still supported but no longer in development. We recommend you develop your application using the RFRTAG command as defined on page 45.**

Read Tag is not a command, but an element of the ALPHA and BARCODE commands. See "Alphanumerics" and "Bar Codes" in the *IGP/PGL Programmer's Reference Manual* for more information.

Purpose Embed RFID data into an ALPHA or BARCODE data field.

Format <RDI>*position,length[,format];*

<RDI>	The RFID Data Indicator character, as defined by the RFREAD parameter in the ALPHA or BARCODE commands. See the ALPHA and/or BARCODE command description for details.
position	The decimal number that specifies the starting position of the data inside the transponder.
length	The decimal number that specifies the length of the data to be read.
format	Replace the optional *format* parameter with any non-zero number to convert the data to hexadecimal format.

RFID PPI/ZGL Commands

IMPORTANT **For all examples make sure Label Length in the QUICK SETUP menu matches the physical length of the installed media.**

Read Tag

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 PPI/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.
length	The number of blocks to be read from the RFID tag. The PPI/ZGL only supports Alien Technology Class 1a tags, which have only one 8–byte or 12–byte block. Therefore, *length* 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 PPI/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. The default is 0.
reserved	This is a reserved flag. The PPI/ZGL absorbs this number.

Comments

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

Write Tag

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 PPI/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 PPI/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 PPI/ZGL absorbs this number.

Write or Read RFID Format

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

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

^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

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.
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.

Calibrate RFID Transponder Position

Purpose This command initiates an RFID 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

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

Purpose This command enables or disables RFID paper motion. Be 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

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 Auto Retry menu.

Format ^RR*a*

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

RFID Setup

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

Format ^RS*a*,*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.)

Set RFID Tag Password

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

Format ^RZ*a*

^RZ	Set RFID Tag Password command.
a	The default is 00. The acceptable value range is 00 to FF (hexadecimal).

Host Verification

IMPORTANT **This command requires the use of the Return Status port. See "Return Status Port" on page 64.**

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

Format ^HV*x*,*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 of Use

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

Example of Response

```
TAGNO = 48454C4C4F544147
```

PPI/ZGL EPC Programming Examples

IMPORTANT **For all examples make sure Label Length in the QUICK SETUP menu matches the physical length of the installed media.**

Example 1

This programming example programs data into an RFID tag and prints the encodation 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 PPI/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
```

RFID PPI/STGL Commands

<ESC>RK 1,a,b,D16,c.c <ESC>RK 1,a,b,D24,c.c – RFID Write

a	RFID tag Error Ignore. 0 = Disable, 1 = Enabled, 2 to 9 = Auto retry on tag error. This command is ignored for STGL. The error handling for all RFID commands on all supported emulations is set according to the RFID menu 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.
D	Writes data size in number of characters. Valid data size is 16 or 24 characters.
c	EPC data. Valid range is 0 to 9 or A to F only.
Example	<ESC>RK1,0,0,D16,ABCDEF1234567543

Return Status Port

The IGP/PGL VERIFY command (page 48) and PPI/ZGL ^HV command (page 61) require the use of the Return Status port. Set this port using Ret. Status Port in the IGP/PGL SETUP or PPI/ZGL SETUP menu.

NOTE: If you are using the IGP/PGL SETUP menu, you must set Admin User to Enable in the PRINTER CONTROL menu.

If you set Ret. Status Port to Serial, you must set all SERIAL PORT menu settings (i.e., Port Type, Baud Rate, Stop Bits, Parity, etc.) to match the serial port settings in the application.

If you set Ret. Status Port to E-NET Data Port or E-NET Stat Port, you must set the application to connect using TCP/IP. The Host Address must match the IP Address SEG 1 through IP Address SEG 4 settings in the ETHERNET ADDRESS menu. Set the Port Number to 9001 for E-NET Data Port, or 3002 for E-NET Stat Port.

Software Migration Tools (SMT)

There are SMTs for six separate end-use applications supporting both PGL and PPI/ZGL datastreams with 64 and 96 bit tag options for a total of 24 tools. Each tool intercepts bar code data in a host datastream and copies the data to an RFID tag (embedded in a smart label) according to a set of rules as defined below. SMTs assume that only one bar code of the type being processed is present. In the event that there is more than one of a given type of barcode present, only the first is processed.

Bar code information encoded as dynamic data is supported. To avoid ambiguity, where bar code data is provided in the form of dynamic data, the RFID tag will be encoded with only the contents of the first variable bar code field. It is your responsibility to ensure that the first variable bar code is the desired bar code.

NOTE: Dynamic data is variable data entered into specific locations on each form definition. Each time the form prints, a single command enters new data into those locations supplied in the datastream after form definition has been completed.

Tools List

- **GTIN (64 bit) / GTIN_96 (96 bit):** According to Uniform Code Council standards there are two permissible bar codes on standard case labels: UCC-128 and Interleaved Two of Five (ITF14). These are the typical bar code carriers for the GTIN (Global Trade Identification Number). This tool copies data from either an ITF14, or from a UCC-128 barcode with an Application Identifier of 01 (which indicates an SCC-14) to an RFID tag. If barcode checksum data is included in your datastream, it will be encoded onto the tag. If your datastream requests the printer to calculate the bar code checksum, it will not be encoded onto the tag. In the case of the UCC bar code, the (01) application identifier is not written to the tag. Data written to the RFID tag is right justified and zero padded.

- **UCC128 (64 bit) / UCC128_96 (96 bit):** Copies data from a UCC-128 bar code with an application identifier (AI) in the range of 90-99 to an RFID tag. These AI's are reserved for internal applications. The AI is not written to the RFID tag. Data written to the RFID tag is right justified and zero padded. Checksum data calculated by the printer is not encoded onto the tag. Bar code data beyond the 16th digit is truncated without an error message.
- **EAN8 (64 bit) / EAN8_96 (96 bit):** Copies data from an EAN8 bar code to an RFID tag. EAN 8+2 and EAN 8+5 variants are both supported. Data written to the RFID tag is right justified and zero padded. Checksum data calculated by the printer is not encoded onto the RFID tag.
- **EAN13 (64 bit) / EAN13_96 (96 bit):** Copies data from an EAN13 bar code to an RFID tag. EAN 13+2 is also supported but EAN 13+5 variant is not supported. Data written to the RFID tag is right justified and zero padded. Checksum data calculated by the printer is not encoded onto the RFID tag.
- **UPC-A (64 bit) / UPC-A_96 (96 bit):** Copies data from a UPC-A, UPC-A+2 or UPC-A+5 bar code to an RFID tag. Data written to the RFID tag is right justified and zero padded. Checksum data calculated by the printer is not encoded onto the RFID tag.
- **EPC (64 bit) / EPC_96 (96 bit):** This tool allows EPC data carried by a Code 3 of 9 bar code to be encoded onto an RFID tag. Data beyond the 16th digit is not allowable for an EPC and is truncated. Data must be numeric only.
- **zGTIN (64 bit) / zGTIN_96 (96 bit)**, **zEPC (64 bit) / zEPC_96 (96 bit)**, **zUCC128 (64 bit) / zUCC_96 (96 bit)**, **zEAN8 (64 bit) / zEAN8_96 (96 bit)**, **zEAN13 (64 bit) / zEAN13_9 (96 bit)**, and **zUPCA (64 bit) / zUPCA_96 (96 bit):** These are all PPI/ZGL emulation specific tools identical in function to those of their corresponding names above.

NOTE: SMTs are available only for RFID enabled printers. SMTs and CSTs are mutually exclusive: the loading of any CST will cause the SMTs to be ignored. For a description of CSTs, refer to the *Remote Management Software Advanced Tool Kit User's Manual*.

Selecting The Tools

1. Press ⋮☰ until QUICK SETUP displays.
2. If necessary, press ↓ and ↵ at the same time to unlock the ↵ key.
3. Press ↓ until SMT: Sel Toolset displays.
4. Press ↓ until Toolset [1] (PGL emulation 64 bit), Toolset [2] (PPI/ZGL emulation 64 bit), Toolset [3] (PGL emulation 96 bit), or Toolset [4] (PPI/ZGL emulation 96 bit) displays.
5. Press ↵ to select it.
6. Press ↓ until SMT: Select Tool displays.
7. Press ↓ until the desired tool displays.
8. Press ↵ to select it.
9. Press ↓ and ↵ at the same time to lock the ↵ key, then press **PAUSE** to take the printer offline.
10. Press **PAUSE** again to put the printer online.

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 “Error Handling” on page 27) and display the appropriate error message on the control panel’s LCD (see Table 3).

Table 3. Control Panel Error Messages

Error Message	Explanation	Solution
NON-RFID DATA On Rfid Tag	A job was printed that had no RFID commands on at least one form of the job while RFID tags were installed in the printer and the Non-RFID Warning menu item is set to Enable.	Press **PAUSE** to clear the message. Set Non-RFID Warning to Disable, print a job with RFID commands on every form, or install non-RFID labels in the printer.
RFID Comm Err Check Cable	RFID error: communication cannot be established with the RFID encoder. Reader will be set to Disable in the RFID CONTROL menu and the previous port settings restored.	Press **PAUSE** to clear the message. See “Troubleshooting” on page 70.
RFID FW ERR: Version Mismatch	The RFID encoder firmware version is not capable of operating with the printer software.	Press **PAUSE** to clear the message. Redownload the program file to the printer.
RFID LOCK CMD: Not supported!	A lock command was executed on a tag which does not support locking. All Class 1 tags and most Gen 2 tags support locking. Other tag classes such as Class 0+, Class 1.19, and Class Zuma do not support locking.	Press **PAUSE** to clear the message. Remove the lock command from the application.

Table 3. Control Panel Error Messages

Error Message	Explanation	Solution
RFID MAX RETRY Check System	Error Handling = Overstrike in the RFID CONTROL menu, and the Label Retry count has been exhausted.	Press **PAUSE** to clear the message. See “Troubleshooting” on page 70.
RFID TAG ERR: Read-Only Tag	A write was attempted on a read-only tag.	Press **PAUSE** to clear the message. Change media to writable tags or remove the write command from the application.
RFID TAG FAILED Check Media	Error Handling = Stop in the RFID CONTROL menu, and the RFID encoder could not read the RFID tag.	Press **PAUSE** to clear the message. See “Troubleshooting” on page 70.
RFID UNLOCK CMD: Not Supported!	An unlock command was executed on a tag which does not support locking.	Press **PAUSE** to clear the message. 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.	Press **PAUSE** to clear the message. Remove references to the 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.	Press **PAUSE** to clear the message. Remove references to the KIL field from the application.

Troubleshooting

If you are having trouble with the RFID encoder, consult Table 4 for a list of symptoms and possible solutions.

Table 4. Troubleshooting the RFID Encoder

Symptom	Solution
No communication between the printer and the reader	1. Make sure Reader = Enable in the RFID CONTROL menu. 2. Use the RFID Test option in the RFID CONTROL menu (Admin User enabled) to read and display the current RFID tag content. Class 1 RFID tags usually contain a valid entry due to the pre-test process. See “Read Tag” on page 30.
Tag failed	1. The label could be misaligned. Perform the Auto Calibrate procedure to ensure the label is at top-of-form. See “Running Auto Calibrate” in the *Quick Setup Guide*. 2. Make sure the media are smart labels with RFID tags located in the correct position. 3. The RFID tag could be defective. Try another tag. 4. Make sure the application does not send too few or too many digits to the RFID tag.
Inconsistent results	Make sure the media is loaded correctly. See “Loading Media And Ribbon” in the *Quick Setup Guide*.
The RFID encoder works, but it does not meet expectations	Make sure that both Error Handling and Label Retry are set to desired values in the RFID CONTROL menu.

3 *MP2 RFID*

New Coupler System

The MP2 RFID has a new coupler design that supports a greater variety of tag types. The new MP2 coupler is moveable laterally via a coupler handle centered under the media guard (next to the gap sensor). See figure on page 72.

The coupler has four positions on a four inch printer and five positions on a six inch printer. These positions are color coded on the front of the media guard. The possible positions moving from inboard (nearest the electronic bay) to outboard (nearest the window) are as follows:

Yellow: 1st Position (furthest inboard)

Orange: 2nd Position

Red: 3rd Position

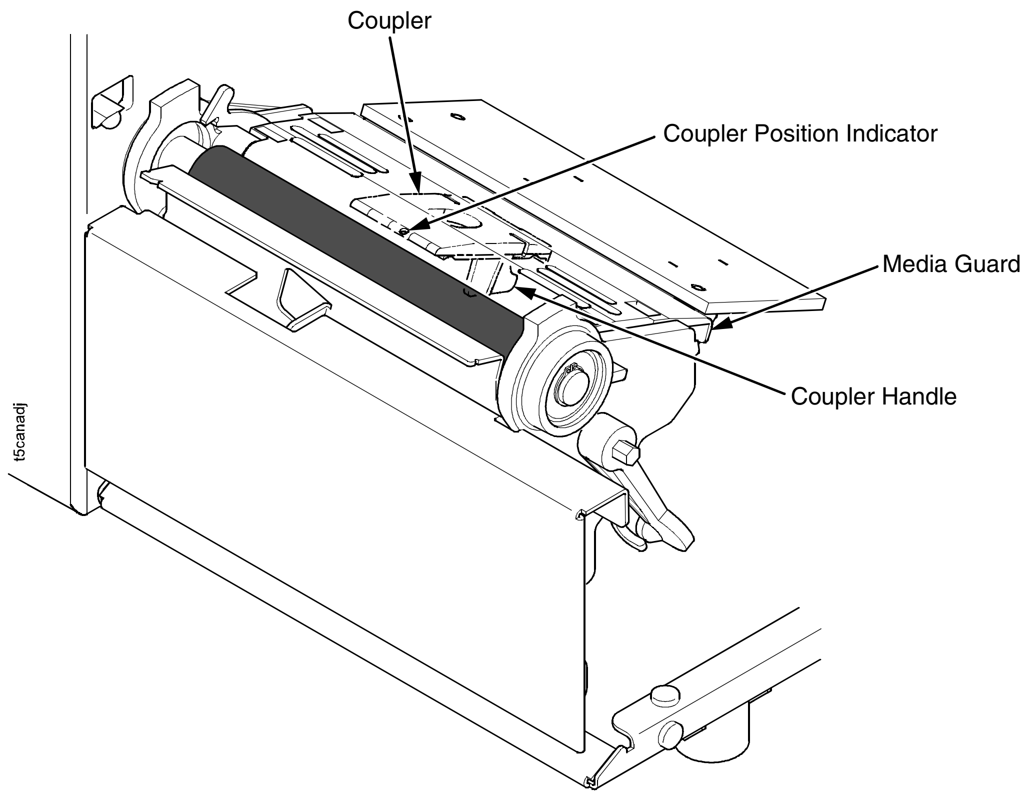
Blue: 4th Position (furthest outboard on a 4 inch printer)

Green: 5th Position (this uses a second coupler position indicator available on six inch printers only)

Once you select a tag type from the front panel, a message will display above the selected tag type:

Ant Pos *x*
where *x* is Yellow, Orange, Red, Blue, or Green.

Adjusting The Coupler Position



Reach under the media guard to grasp the coupler handle. Slide the coupler until the correct color displays in the coupler position indicator.

Four and six inch printers have yellow, orange, red, and blue coupler positions. Six inch printers have an additional coupler position indicator (not shown) to accommodate the green coupler position.

64 Bit And 96 Bit EPC Data Formats

According to the EPC code standard there are two specific data type formats: 64 bit and 96 bit. The type of format is defined by the first two bits of the EPC Header. When the first two bits are set to 00, the EPC format is interpreted as a 96 bit data format. When the first two bits are not 00, the EPC format is interpreted as a 64 bit data format.

Each tag class handles this situation differently.

Class 1 Gen 1

The original Class 1 Gen 1 tag was a 64 bit memory designed prior to the EPC standard. Therefore despite a newer 96 bit tag, the data dependent indication was ignored. This is true today and therefore as long as the data fits into the tag memory no check is made of its format.

Gen 2

The Gen 2 protocol manages data size differently and does not use the data format to identify the data size. The Protocol Control (PC) bits (a separate entry in the tag) manages the data size. Therefore the data format is not restricted to the EPC data format.

Class 0+, Class Zuma, and Class 1.19

These Classes were developed subsequent to the EPC standard and have 96 bit memories for the EPC code. To distinguish between 64 bit data and 96 bit data, they conform to the EPC code format standard.

Three parameters should match for error free operation:

1. EPC Format
2. Selected Tag Data Length
3. Size of Data Request

IMPORTANT **When any of these three parameters are inconsistent then confusion is likely.**

The following tables (Table 5 on page 74 for PGL and Table 6 on page 75 for ZGL) identify the consequences of mismatched criteria.

Table 5. PGL EPC Format Handling

EPC Format (based on header)	Selected Tag Data Length	Size of Data Request (from program)	Result	Comment
64 bit	64 bit	< 64 bit	OK	Pad 0s to left for 64 bit
64 bit	64 bit	= 64 bit	OK	As is
64 bit	64 bit	> 64 bit	Error	Data too long
64 bit	96 bit	< 64 bit	Read 96 bit	Pad 0s to left for 96 bit
64 bit	96 bit	= 64 bit	Read 96 bit	Pad 0s to left for 96 bit
64 bit	96 bit	64 bit <> 96 bit	Read 96 bit	Pad 0s to left for 96 bit
64 bit	96 bit	= 96 bit	Error	EPC incompatible with length
64 bit	96 bit	> 96 bit	Error	Data too long
96 bit	64 bit	< 64 bit	Error	EPC incompatible with length
96 bit	64 bit	= 64 bit	Error	EPC incompatible with length
96 bit	64 bit	> 64 bit	Error	Data too long
96 bit	96 bit	< 96 bit	OK	Pad 0s to left for 96 bit
96 bit	96 bit	= 96 bit	OK	As is
96 bit	96 bit	> 96 bit	Error	Data too long

Table 6. ZGL EPC Format Handling

EPC Format (based on header)	Selected Tag Data Length	Size of Data Request (from program)	Result	Comment
64 bit	64 bit	< 64 bit	OK	Pad 0s on right for 64 bit
64 bit	64 bit	= 64 bit	OK	As is
64 bit	64 bit	> 64 bit	Error	Data too long
64 bit	96 bit	< 64 bit	Read 96 bit	Pad 0s on right for 64 bit
64 bit	96 bit	= 64 bit	Read 96 bit	Pad 0s on right for 64 bit
64 bit	96 bit	64 bit <> 96 bit	Read 96 bit	Pad 0s on right for 64 bit
64 bit	96 bit	= 96 bit	Error	EPC incompatible with length
64 bit	96 bit	> 96 bit	Error	Data too long
96 bit	64 bit	< 64 bit	Error	EPC incompatible with length
96 bit	64 bit	= 64 bit	Error	EPC incompatible with length
96 bit	64 bit	> 64 bit	Error	Data too long
96 bit	96 bit	< 96 bit	OK	Pad 0s on right for 64 bit
96 bit	96 bit	= 96 bit	OK	As is
96 bit	96 bit	> 96 bit	Error	Data too long

Moving From 64 Bit Tags To 96 Bit Tags

When the time comes to upgrade from 64 bit data to 96 bit data the best solution is to select the 96 bit tag type on the menu (which is mandatory) and modify the host datastream to write the full 96 bits.

When 64 Bit Data Is Sent To A 96 Bit Tag: PGL

Both the old (RFWRITE) and the new (RFWTAG) commands will pad zeroes to the right on the physical tag. When the tag is read back, both the old (RFREAD) and the new (RFRTAG) commands will recover the correct 64 bits of data. This will then be printed or verified (sent back to host) correctly.

Example 1

```
~NORMAL
~CREATE;test1;216
RFWRITE;HEX;RF3;16;AT1;
FONT;FACE 93952;SLANT 0;BOLD 1
ALPHA
RFREAD@;AF1;25;2;2;0;0
STOP
END
~EXECUTE;test1
~RF3;"68656C6C6F746167"
~AF1;*DATA = @1,16,1;*
~NORMAL
```

Result: printed 68656C6C6F746167

Example 2

```
~NORMAL
~CREATE;TEST1;216
RFWTAG;64
64;H;*3246494454414744*
STOP
RFRTAG;64
64;DF1;H
STOP
VERIFY;DF1;H;*DF1 = *
END
~EXECUTE;TEST1
~NORMAL
```

Result: returned DF1 = 3246494454414744

When 64 Bit Data Is Sent To A 96 Bit Tag: ZGL

The data will be written with zeroes padded to the right. However, when you use the ^HV command to send the data back to the host, only 16 characters should be sent.

Example

```
^XA
^WT0,,1^FH^FD_40_3E_3D_3C_3B_00_00_11^FS
^RT0,,,1^FS
^HV0,16,EPC DATA11=
^XZ
```

Result: returned DATA11=403E3D3C3B000011

PGL

Multiple Read/Write Commands On One Label

When using RFID commands in PGL, it is only possible to use one read and one write command in a single form at a time. To access a single label with multiple reads or writes, split the job into multiple forms where all but the last form has the NOMOTION flag set. This will then apply each form to the same label.

Example

```
~NORMAL
~CREATE;TEST1;NOMOTION
RFRTAG;64
64;DF1;H
STOP
VERIFY;DF1;H;*TagBefore=*
END

~EXECUTE;TEST1
~NORMAL
~CREATE;TEST1
RFWTAG;64
10;B;*101010*
10;D;*255*
10;H;*FF*
10;D;*12*
24;H;*445654*
STOP

RFRTAG;64
64;DF1;H
STOP

VERIFY;DF1;H;*TagAfter=*
END

~EXECUTE;TEST1
~NORMAL
```

The VERIFY Command is not RFID Specific

Although the VERIFY command was added to PGL to enable the sending of RFID data back to a host, it is not actually an RFID command, since:

1. It does not cause any RFID activity
2. It is not restricted to RFID data.

The VERIFY command can be used to send any data expressed in a variable (such as bar code data) back to a host.

Splitting the EPC

Customer Scenario

The customer intended to write 362501031109 to the tag as a decimal number, but when they read the tag back they received 155693006861632597 (not what they expected).

Here Is What They Did

```
RFWTAG;96
64;D;*36250103*
32;D;*1109*
STOP
```

The problem is the way in which the decimal number was divided up. Position matters in arithmetic. One cannot ignore the implied leading zeros in the 32bit quantity as they are significant when the 64 bit value is non zero.

For example, 002000 is the same value as 2000, since the leading two zeroes are insignificant. However, 2002 is not the same as 22, since the zeroes are significant.

So when the customer chose 1109 as the LSB 32 bits, the leading zeros were padded to the left until 32 bits were filled, resulting in 00001109. This converted to hex so that 00000455 was written into those bits.

When the customer chose 36250103 as the MSB 64 bits, the leading zeros were padded to the left until 64 bits were filled, resulting in 0000000036250103. This converted to hex so that 00000000022921F7 was written into those bits.

This means the full number (minus the insignificant leading zeros) was hex 22921F700000455 (decimal 155693006861632597), which is not the number the customer meant.

Simplest Solution

Use the 32 bits first, let it hold the leading zeros, then set the 64 bit to the desired decimal number.

NOTE: This will only work for numbers less then decimal 18446744073709551615 (hex FFFFFFFFFFFFFFFF).

Example

```
RFWTAG;96
32;D;*0 *
64;D;*362501031109*
STOP
```

For numbers greater than this, care must be taken to split the number in the correct fashion. The easiest method is to use hex (or at least convert to hex and then back again into decimal).

Using The Advanced RFID Calibration

Tag Profiler

The Tag Profiler maps the tag position with optimized read and write power settings.

Before running the Tag Profiler, it is important that the proper Gap Sensing procedure has been followed. (Refer to “Calibrating The Printer” in the *Quick Setup Guide*.)

To use the Tag Profiler, first ensure that the tag type that you have selected from the Tag Type menu (see “Tag Type” on page 23 for a list of supported tag types) either matches the tag type you are about to calibrate or is at least of the same Class and data length (i.e. 64 or 96 bits). Next, check that Custom Tag is set to Duplicate. The correct defaults will then be set for Custom Tag Class and Custom Tag Len (length).

Prior to initiating the calibration cycle, the Tag Profiler can be optimized by setting appropriate limits on the following four custom entries:

- **Custom Start Pos.** Identifies the starting position of the calibration scan. The default will start at the Top Of Form (TOF). To avoid inefficient scanning at points far away from the target tag, set the Custom Start Pos. within one inch of the center of the physical tag. E.g., if the center of the tag is physically three inches from the TOF, set Custom Start Pos. to 2 inches (one inch before the center of the tag).
- **Custom Scan Len.** The distance the Tag Profiler will scan to determine the optimum tag position. For improved performance, set Custom Scan Len. to 2 inches or less. This will prevent the printer from looking for a tag far beyond its actual location.
- **Custom Min. Power.** Sets the lower level that will be tested during calibration. To speed up calibration, set Custom Min. Power to two points lower than the Custom Read Pwr. that was set prior to initiating calibration.

- **Custom Max. Power.** Sets the upper level that will be tested during calibration. To speed up calibration, set Custom Max. Power to two points higher than the Custom Write Pwr. that was set prior to initiating calibration.

Once the four custom entries have been set, initiate the calibration cycle: access the Custom Run Cal menu and press ↵ (Enter). The calibration will proceed using the first three good tags. A calibration progress indicator will update on the display. At the end of the calibration cycle, the Tag Profiler will update Custom Write Pwr., Custom Read Pwr., and Custom Tag Pos.

Custom Tag Configurator

When Custom Tag is set to Duplicate, you can manually edit all the custom entries. This allows you to overwrite the values discovered by the calibration in case you want to experiment further. It is generally best to accept the calibration values as is unless you are intimately familiar with the printer and its RFID processes.

Before you leave the Custom Tag Configurator, record the result from Custom Tag Pos. This will be useful when deriving the optimum position for your tag with your converter. Tell the converter to move the tag from the current position by the amount in Custom Tag Pos. A positive value means move toward TOF, a negative value means move away from TOF.

Auto Inlay Locater

After you have run the Tag Profiler (using Custom Run Cal) and recorded the Custom Tag Pos. (offset from optimum position), you may now set Custom Tag to Enable in preparation to use the media with the Auto Inlay Locator.

When Custom Tag is set to Enable, the Auto Inlay Locator uses the results of the Tag Profiler calibration cycle to automatically advance the label to the correct encoding position, encode the tag with the correct write/read power, back-feed the label to the TOF, and proceed normally to print the full label without interruption.

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