



# **RFID User Guide**



Read this User Guide before and during usage of the above product. Keep this document handy for future reference.

PN: 9001147D

www.satoamerica.com

#### SATO America, Inc.

10350A Nations Ford Road Charlotte, NC 28273

Main Phone: (704) 644.1650 Technical Support: (704) 644.1660 Technical Support Fax: (704) 644.1661 E-Mail: satosales@satoamerica.com techsupport@satoamerica.com www.satoamerica.com Copyright 2008 SATO America, Inc. All rights reserved

# SCOPE

This document is to serve as a guide on how to control the RFID portion of the printer using SATO Barcode Programming Language (SBPL) and Label Gallery Plus/TruePro software. It will include menu selection and all relative command code sequences.

### **OVERVIEW**

The RFID Reader and antenna are integrated into printer among the standard components. A data cable connects the main circuit board to the RFID Reader. The Reader is, in turn, connected to the antenna by its own antenna cable. Through software configuration and hardware installation, the printer is then capable of writing and verifying EPC RFID tags. Tag location and orientation within the label is critical to the performance of the unit.

All "e" series, plug-in interfaces may be used with the RFID print engine, including Ethernet and 802.11b wireless interfaces.

The following process details the steps involved in writing to the EPC tag:





# **RFID HARDWARE CONFIGURATION**

The RFID hardware kit is comprised of the: RFID Module, RFID Antenna w/coaxial cable, RFID Cable Set. The figure below displays configuration:



Figure 2, Hardware Configuration

# **RFID MODE**

The RFID Mode typically appears following the printer's Service Mode. Use the printer's Operator or Service Manual for guidance on the specific menu structure for that printer and how to maneuver to the Service Mode and beyond. The RFID Mode menu will only appear on applicable printer's with the required devices installed.



Figure 3, RFID Mode Flow Chart

RFID MENU SCREEN REFERENCE					
MENU	DESCRIPTION				
RFID LIFE COUNT TOTAL 000000	Displays the total accumulated quantity of RFID writes. The count may be reset by performing a Factory Clear. [Total quantity of successful writes] + [total quantity of write failures] = Total RFID Writes				
RFID LIFE COUNT SUCCESS 000000	Displays the total accumulated quantity of successful RFID writes. The count may be reset by performing a Factory Clear.				
RFID LIFE COUNT FAILURE 000000	Displays the total quantity of accumulated failed RFID writes. The count may be reset by performing a Factory Clear.				
	Displays the total quantity of RFID writes.				
RFID COUNT TOTAL 000000	[Total quantity of successful writes] + [total quantity of write failures] = Total RFID Writes				
RFID COUNT SUCCESS 000000	Displays the total accumulated quantity of successful RFID writes.				
RFID COUNT FAILURE 000000	Displays the total quantity of accumulated failed RFID writes.				
CLEAR RFID COUNT YES NO	Allows the selection of whether or not to counter clear. Use the printer's operator panel to scroll and select the desired option.				
RFID LABEL DATA RELEASE RETRY	Allows the selection of the printer's action following a write failure. The RELEASE option deletes the current job so the printer may advance to next print job. Choosing the RETRY option instructs the printer to continue attempting to write the same data until it succeeds or until an error (MAX ERR CNT) occurs.				
MAX ERR CNT XX	Determines the quantity of error counts allowed before the printer stops. Use the printer's operator panel to scroll and select the desired setting.				
RFID ERR SLASH YES NO	Allows the selection of whether or not a slash will printed diagonally across a label when an RFID error occurs. Use the printer's operator panel to scroll and select the desired option.				

RFID MENU SCREEN REFERENCE					
MENU	DESCRIPTION				
	Determines the command structure used for IP0.				
COMMAND TYPE NEW OLD	will stay with the previous IP0 command structure.				
	Use the printer's operator panel to scroll and select the desired option.				
	Allows the selection of the output pattern of RFID error. Selecting PULSE will result in a single pulsating output and selecting LEVEL will result in a flat output.				
PULSE LEVEL	Use the printer's operator panel to scroll and select the desired option.				
	Allows the determination of the pulse length. The setting range is between 100 and 500 milliseconds.				
100MSEC	Use the printer's operator panel to scroll and select the desired setting.				
	Allows the selection of the desired RFID module. There are two options that will be available for use and each will be represented in place of <i>Module A</i> and <i>Module B</i> .				
Module A Module B	Use the printer's operator panel to scroll and select the desired option.				
PROTOCOL SELECT 0 + 1 GEN2	Displays only when a multi-protocol module has been selected and allows the determination of the EPC tag protocol. Use the printer's operator panel to scroll and select the desired option.				
TAG DATA AREA 64BIT 96BIT	Displays only when EPC class 0 or 1 has been selected and allows the determination of the tag data size to be used. Note that when 96-bit ASCII has been selected, I/O data is 24-digit. Use the printer's operator panel to scroll and select the desired option.				
	Allows the 1/O data form for ID0 and ID1 to be collected				
RFID I/O BASE-X	BIN is binary form and "0" can be described as "00000000", ASCII is text form and "0" can be described as "0". HEX is hexadecimal form and "0" can be described as "00".				
	Use the printer's operator panel to scroll and select the desired option.				
READER VERSION XXXXXXXXX	Displays the Firmware version of the RFID module. Use the printer's operator panel to advance to the next menu screen.				
	Allows the determination of whether or not the EPC data will be viewed in the inlay which is currently in the antenna's read position.				
VIEW EPC DATA YES NO	Use the printer's operator panel to scroll and select the desired option.				
	Displays the EPC data in the inlay which is currently in the antennas read position and				
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	Use the printer's operator panel to scroll and select the desired option.				

RFID MENU SCREEN REFERENCE				
MENU	DESCRIPTION			
NO TAG FOUND RETRY CONTINUE	Is an error display screen and allows the selection of whether or not to retry or continue. Use the printer's operator panel to scroll and select the desired option.			
RFID SETTING YES NO	Allows the enabling of direct communication between the host and the RFID module. When YES has been selected, the module is ready to communicate with the host without the printer's intervention and all data will be processed through the host. This setting will be maintained until the selection has been changed to NO or the next Factory Clear. The setting will then revert to the default. Use the printer's operator panel to scroll and select the desired option.			

# **CALIBRATION MODE**

The Calibration Mode typically appears following the RFID Mode. Use the printer's Operator or Service Manual for guidance on the specific menu structure for that printer and how to maneuver to the Service Mode and beyond. The Configuration Mode menu will only appear on applicable printer's with the required devices installed.

If using RFID labels that are printer specific, RFID transponder calibration is not necessary because the printer will automatically place the labels in the optimal programming position. Contact SATO America Technical Support for inlay + placement specifications as necessary.

Where printer specific RFID labels are not to be used or in cases of new inlay types, RFID calibration may be required to determine the optimal programming position and transmission/reception power conducive to that media.





CALIBRATION MENU SCREEN REFERENCE					
MENU	DESCRIPTION				
CAL.LABEL CON 1 2 3	Allows the selection of the label quantity to be used for calibration. A measurement will occur for each label to create a ratio of variance in determining the nominal. A report will be issued. Use the printer's operator panel to scroll and select the desired option.				
LABEL SIZE XXXMM	Allows the determination of label length to be used for calibration purposes. Use the printer's operator panel to scroll and select the desired setting. The increments are in millimeters.				
MAX. WRITE CNT 010	Allows the determination of the maximum quantity of write attempts at a single position. Use the printer's operator panel to scroll and select the desired attempts.				
CAL. START YES NO	Allows the initialization of calibration. Ensure the printer is loaded with the intended media to be calibrated. Use the printer's operator panel to scroll and select the desired option.				
CALIBRATING P:XXX AP:XX.XDBM	Displays the status of the active calibration. The "P" value represents the location currently being calibrated. The "Ap" value represents the power being applied at the time. The time required to complete calibration may vary depending on label size and protocol type.				
CAL. OVER FINISH PRINT	Displays at the completion of calibration and prompts for option selection. Select PRINT to print a chart of results and FINISH to bypass. Use the printer's operator panel to scroll and select the desired option.				
PRINT AGAIN YES NO	Allows for the printing of an additional label containing the calibration results. Use the printer's operator panel to scroll and select the desired option.				
TAG OFFSET AUTO MANUAL	Allows the selection of the manner of determining the best write position. Selecting AUTO will allow the printer to make the determination. Selecting MANUAL will allow the user to determine. If desirable results are achieved from the default position, select MANUAL to achieve optimal speed performance of printer operation.				
RFID TAG OFFSET XXXMM	Displays only if MANUAL was selected for determining the best write position, allowing for the offset distance to be established. Use the printer's operator panel to scroll and select the desired offset distance. The measurement increments are in millimeters.				
ANTENNA POWER XXXMW	Allows for the determination of the antenna's reception power when calibrating.				

# **COMMAND STRUCTURE**

This chapter provides the command sequences applicable to establishing RFID control through the use of an external host device instead of through the printer's integrated operator panel.

## **EPC CODE WRITE DESIGNATION COMMAND (NEW)**

	· · · · · ·
FUNCTION	Writes EPC code in RFID supply that supports EPC code.
FORMAT	<esc>IP0e:z,d:xxxxxxxxxxxxxxxxxxx;</esc>
PARAMETER	x= EPC data
EXAMPLE	<esc>A</esc>
	<esc>V50<esc>H50<esc>XMTESTTEXT</esc></esc></esc>
	<esc>IP0e:z,d:123456781234567812345678;</esc>
	<esc>Q1</esc>
	<esc>Z</esc>
NOTES	If the EPC code cannot be coded into the tag, an error message will print.

EPC CODE WRITE DESIGNATION COMMAND (OLD)								
FUNCTION	Writes EPC code in RFID supply that supports EPC code.							
FORMAT	<esc>IP0n.nnn</esc>							
PARAMETER	n = Data to be written (16 bytes fixed for 64 bit inlays) or (24 bytes fixed for 96 bit inlays).							
EXAMPLE	To write 64-bit EPC code "8000 0000 4000 0001" for label issuance in RFID supply that supports EPC code:							
	<esc>A</esc>							
	<esc>V50<esc>H50<esc>BD3020654912345678904</esc></esc></esc>							
	<esc>IP0800000040000001</esc>							
	<esc>Q1</esc>							
	<esc>Z</esc>							
NOTES	If data is written to an RFID tag, labels are printed after sent EPC data and encoded EPC data are automatically checked.							
	If EPC code writing could not be carried out (i.e. bad tag), a tag error label is printed.							
	Data other than 0 to 9 and A to F will be considered a command error. If used without print data, this command will not cause a label to feed in the case of a successful tag encode.							

EPC CODE READ DESIGNATION COMMAND					
FUNCTION	Reads information of RFID supply supporting EPC code.				
FORMAT	<esc>IP1</esc>				
RETURN STATUS FORMAT	STX (02H) + ETX (03H)				
<b>RETURN STATUS LIST</b>	STX (02H) = Starting code (1 byte)				
	EPC Code = EPC Code; 16 or 24 bytes fixed (BIN: 256 bytes, ASCII: 32 bytes, HEX: 64 bytes)				
	ETX (03H) = Ending code (1 byte fixed)				
EXAMPLE	<esc>A</esc>				
	<esc>IP1</esc>				
	<esc>Z</esc>				
	If "8000 0000 4000 0001" is recorded in RFID inlay that supports EPC code:				
	02H = Starting code				
	38 30 30 30 30 30 30 30 34 30 30 30 30 30 30 31 EPC				
	03H = Ending code				
	NOTE: In actuality, all data is continuous without spaces.				
NOTES	This command cannot be used in combination with other commands.				
	This command cannot be received during printing - only afterward.				
	Five seconds is required after a command is sent until the status is returned to the host. If the port is closed before all are returned, the tag data will not correctly be received and data other than return status format is returned. The data must then be sorted before operation.				

EPC TRADE MARK PRINT COMMAND								
FUNCTION	Specifies the print of EPC trademark on a tag label.							
FORMAT	<esc>TMx</esc>							
	x = Logo ID number 0 1							
PARAMETER								
EXAMPLE	<esc>A</esc>							
	<esc>V50<esc>H50<esc>TM1</esc></esc></esc>							
	<esc>Q1</esc>							
	<esc>Z</esc>							
NOTES	Rotation <esc>% and Enlargement <esc>L are also available.</esc></esc>							
	Specify the command Enlargement <esc>L right before <esc>TM in case of its usage.</esc></esc>							
	The original print area is of 143W x 101H dots (without the designation of enlargement).							
	When parameter "x" is left blank, logo "1" will be printed.							

# STATUS REQUEST COMMAND

Printer status and response are returned to the host computer as statuses when a request or print command is received. When the status request command is received, the job ID number of the reception data currently being printed, the printer status, the quantity of labels yet to be printed, and the job name are returned to the host computer. When printing is complete or if there isn't reception data, all zeros (hexadecimal 30H) is returned for printing count. If a job Id number has not been designated, a space (hexadecimal 20H) is returned for the job ID number.

NOTE: Do not execute a status enquiry (ENQ) while print data is being sent (STX...ETX) because that status may not be returned or printing not be carried out.

COMMANDS				
RETURN STATUS	DESCRIPTION			
CAN (Hexadecimal 18H)	Cancel Request Command. When the cancel command is received, printing is terminated and all contents are cleared from the receive buffer. As for the status, printer status is returned once the processing is complete.			
	Once the cancel request command is sent, the next data should be sent after 100ms or more has elapsed.			
DLE (Hexadecimal 10H)	Print Stop Request Command. Printing is stopped when the printing stop request command is received. As for the status, printer status after signal reception processing is returned.			
DC1 (Hexadecimal 11H)	Print Start Request Command. The printing stop request command is canceled and printing commences when the printing start request command is received. As for the status, printer status after signal reception processing is returned.			
ACK (Hexadecimal 06H)	Indicates that an error has not occurred on the printer.			
NAK (Hexadecimal 15H)	Indicates that an error has occurred on the printer.			





RETURN STATUS LIST						
	ASCII	HEX				
	No error	0	30			
	Ribbon near end	1	31			
OFFLINE STATUS	Buffer near full		2	32		
	Ribbon near end & bi	3	33			
	Printing stopped (no	error)	4	34		
	Reception Standby	No error	Α	41		
		Ribbon near end	В	42		
		Buffer near full	С	43		
		Ribbon near end & buffer near full	D	44		
		Printing stopped (no error)	E	45		
	Printing	No error	G	47		
		Ribbon near end	Н	48		
		Buffer near full	I	49		
		Ribbon near end & buffer near full	J	4A		
		Printing stopped (no error)	K	4B		
UNLINE STATUS	Standby	No error	М	4D		
		Ribbon near end	N	4E		
		Buffer near full	0	4F		
		Ribbon near end & buffer near full	Р	50		
		Printing stopped (no error)	Q	51		
	Analysis/Editing	No error	S	53		
		Ribbon near end	Т	54		
		Buffer near full	U	55		
		Ribbon near end & buffer near full	V	56		
		Printing stopped (no error)	W	57		
	Head open	b	62			
	Paper end	С	63			
	Ribbon end	d	64			
	Media error	е	65			
	Sensor error		f	66		
ERROR DETECTION	Head error	g	67			
	Cover open		h	68		
	Card error	i	69			
	Cutter error (CL4e or	j	6A			
	Other errors	k	6B			
	Cutter sensor error (C	I	6C			
	Stacker or rewinder for	ull (CL4e only)	m	6D		
RFID STATUS	Successful write		n	6E		
	Failed write	0	6F			

# **EXT CONNECTOR**

The EXT Port pin-out information for the RFID has changed to accommodate the addition of a "tag error" output.

PIN ASSIGNMENTS					
PIN	DESCRIPTION	DIRECTION			
1	Media Out - Pin goes low (0V) when label or ribbon is out.	Output			
2	Signal Ground	Reference			
3	RFID Tag Error - Pin goes low (0V) when a bad RFID tag is identified.	Output			
4	Printer Error - Pin goes low (0V) when the printer detects an error condition such as head open, receiving buffer full or when the user specified number of RFID errors has been reached.	Output			
5	Print Start - The printer will print one label when this pin is pulled to ground.	Input			
6	End Print - Used to drive external devices requiring synchronization with the print cycle.	Output			
7	Reprint - Prints a duplicate of the last label when this signal is received.	Input			
8	Reserved.	Input			
9	Offline - Pin goes low (0V) when the printer is offline.	Output			
10	Ribbon Near End - Pin goes high when the amount of ribbon on the unwind shaft is approximately 46 feet (14 m). The output will be low when the ribbon is gone.	Output			
11	Reserved	Output			
12	+24 +/- 10% @ 2A - Power for external devices.	Output			
13	Vcc - +5V	Output			
14	Frame Ground	Reference			



Figure 7, EXT Connector



# **ERROR & RESET TIMING**

RFID tag and machine error signals are output concurrently when reaching the specified value of the reprint counter. The machine error is a constantly level output. When an ignore command of the RFID tag error is specified, reprint is automatically performed.





# **PULSE TIMING**



# LEVEL TIMING



#### +

(i) S/	TO Label Gallery I	Plus - [Labe	1]						
<u>F</u> ile	<u>E</u> dit <u>V</u> iew <u>O</u> bject	t <u>D</u> ata <u>T</u> r	ansformations	Tools <u>W</u> indov	w <u>H</u> elp				
E 🗋 (	🔁 🔒   🐒 🖻 盾	3 🔁 🖸	😓 Print 🔹 🏓	Zoom 🔻 View 🝷	👌 Variables 🔹	🛛 😑 Database 🔻	🧭 📮		
Tr A	ial 🔹	10	• A • I	370 =			• 🏷 •	) V 🖫 🔊	🚮 Functions 🝷 🖕
1	- 🎾 🎙	9 6 6.							
	in 10		1 1 1 1		2		3		4
A -									
rtf -									
•									
2									
0									
••									
<b>\$</b>									
-									
•									
- <u>-</u>									
									1
(IIII) ¥	2			<b>E</b> !	0.0	4			

Open Label Gallery Plus. The following main menu screen will appear.

Figure 12, Screen 1

Click inside the label displayed on the screen and Screen 2 will appear. Select the appropriate RFID Printer Driver and any other options needed relative to the labels used (i.e.: dimensions, batch printing, cutter settings, etc.).



Figure 13, Screen 2

Click on OBJECT of the upper task bar and then select the RA DATA option. The following RFID tag (Screen 3) will appear.

RFID Tag									
Write data to RFID tag       Iype:       EPC (Gen 2) - 96	vit Tag Settings Read and Store RFID Tag Data								
Data Fields EPC User Data TID Access code Kill code	Data Block Use EPC encoding Data type: HEX encoded string Data source: Data source: Data size: Data								
	OK Cancel <u>H</u> elp								
Figure 14 Screen 3									

Figure 14, Screen 3

Click on the scroll-down arrow for "Type" and select the EPC (class 2) 94 bit menu option or type of inlay desired. Click on the scroll-down arrow for "Data Type" and select either the ASCII or the Hex Encoded String option.

> NOTE: The ASCII option allows the data to be entered as full ASCII table and the software changes over to HEX when sending it to the printer. For a 64-bit tag selection, eight (8) digits must be used and for a 96-bit selection, twelve (12) digits must be used. HEX allows the data to be entered using 0 through 9 and A through F. The exact data

is sent to the printer's chip. For a 64-bit tag selection, sixteen (16) digits must be used and a 96-bit selection, twenty-four (24) digits must be used.

This data may also be substituted with a variable previously created in Label Gallery by selecting the "Variable" option for the Data Source ratio.

EPC encoding translators may also be used by selecting that relative box on the screen. When checked, select the type of EPC encoding to be used and then fill in the data values which show up as shown on Screen 4.

RFID Tag				
✓ Write data to RFID tag				
<u>Type:</u> EPC (Gen 2) - 96	bit	Tag Settings	<u>R</u> ead and	Store RFID Tag Data
Data Fields EPC	Data Block			
	Encoding type:	SGTIN-96		
Access code		·	Variable:	Data size:
Kill code	Filter value:	Retail Consumer Trade Ite 💌		1/1
	Partition:	4		1/1
	Company Prefix:	32432432		8/8
	Item Reference:	12321		5/5
	Serial Number:	55645736545		11/12
	Block locked			
			ок	Cancel <u>H</u> elp

Figure 15, Screen 4

Click on the OK button when complete and the label will display on the next screen with the RFID inlay outlined around the label. Refer to Screen 5.



Figure 16, Screen 5

Populate the label fields as displayed in Screen 6. Refer to the Label Gallery Manual's for assistance as required.

	SATO L	abel Gallery Pl	us - [La	bel1]	
Eile	<u>E</u> dit	<u>V</u> iew <u>O</u> bject	<u>D</u> ata	Iransformations Tools Window Help	
	👌 l	% 🖻 🔒	5	🛿   😓 Print 🔻 🔎 Zoom 🔹 View 🔹 餋 Variables 🍷 😑 Database 🍷 🕜 🖕	
Ŧ	Arial	- 3	1 🛃 1	0 • A* A*   B 🛛 🙂 🗏 😑 🥊 📜 🔹 🥠 • 🦄 🖋 😘	🔜 🛛 📷 Functions 👻 🖕
		- 🎾 🍋	r B		
	in	0	]	<sup>1</sup>	
<u> </u>		r			
rtf ·	·				
				Sample Text	
•	·    -			Sample Text	
	1				
	-				
-	-				
- E				Test 1234	
<u></u> -	-			·	
iiiii -					
	2 -				

Figure 17, Screen 6

Click on the OK button when complete and the label will show up on the next screen with the RFID inlay outlined around the label. Refer to Screen 7.



Figure 18, Screen 7

This page left blank intentionally.