DOTR-900

Text Command Interface Protocol

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Document Revision History

Doc Ver.	Release date	Description of change	Writer
1.7	2013.11.14	Added to battery information from trigger message	Eric
1.8	2015-02-25	Modified form	JOO

Table of Contents

1. Introduction

This document defines Text Interface Protocol between host controller and the RFID module which adapt R900 firmware.

2. Command Syntax

A. Commands and responses are ASCII text based.. Every command and response lines are terminated by <0d><0a> or <0d> depending on initializing sequence. Here, <> means one byte hexa-decimal number.

B. A comma(,) is used as separator between command and parameters.

C. Every parameter is separated by comma(,). Each parameter can be omitted to use default value for the parameter. For example, for a command line like “command,p_a,p_b,p_c” can be expressed like as “command,p_a,,p_c” if p_b is same to the default value. Also it could be “command,p_a,,” if p_b and p_c is same to the default value respectively.

D. Numbers for parameters can be decimal number or hexa-decimal number. Decimal number is expressed in an ordinary form, but hexa-decimal number must be one of the forms of x1f, x01f, X1F or X01F.

E. A Command can be capital character string or small character string.

F. A Response to the command has several forms like “ok<n>”, “ok,value” or “err=error_code<n>” where <n> means <0d><0a> or <0d> decided in initialization phase. For unknown command line or bad command with invalid parameters, a carrot mark(^) is prefixed on the command or parameter.

G. A Result of the operation of the command has one of the forms like as “ok<n>” or “end=error_code,command<n>”. If you abort operation by issuing command s(Stop), you receive “end=-1,command<n>”.

H. Prompt “$>” is sent if the reader is ready.

3. Command List

Refer to the following table. There <n> means <0d><0a> or <0d> depending on delimiter mode. C_R means response to the command line, O_R means a result of the operation of the command. HEXA_STRING means hexa-decimal string without X or x.

Function	Syntax	Response or result	Description
Open Interface	<0d><0a><0d><0a><0d><0a><0d><0a>	<0d><0a>$>	= This stream can be issued to try setup connection with <0d><0a> terminator between host and Bluetooth reader just after reset(or power cycle).
	<0d><0d><0d><0d><0d><0d><0d><0d>	<0d>$>	= Auto feed option. This stream can be issued to try setup connection with <0d> terminator between host and Bluetooth reader just after reset(or power cycle).
NULL	<n>	$>	Use to check connectivity. There are no response if this command is issued while the reader is busy for an operation.
Inventory	i,f_s,f_m,to<n>	C_R <RESULT><n> O_R	= Use to inventory tags. F_s(D=0); set to 1 to stop automatically after a tag is inventoried. F_m(D=0); set to 3 to query selected tags by select mask. Set to 2 to query unselected tags by select mask. Set to 0 or 1 to query all tags without select mask. To(D=0); the operation timeout value in msec. 0 means unlimited and issue 's' command to stop the operation. RESULT represents a tag ID expressed in HEXA_STRING. For this command there could be multiple RESULTs depending on conditions.

			Ex)3000123456789ABC,t=1234, s=-30, here 't=' and 's=' are optional informations. Refer to "ireport" for the meanings.
Stop operation	s<n>	End=-1,xx	= Use to stop undergoing operation if any. "end=-1,xx" is issued after the operation is aborted. Here Xx is A ID of the aborted operation.
Get version	ver<n>	C_R <RESULT><n>	= Use to get firmware version. The RESULT is in form of "ok,ver=TEXT_STRING".
Set default parameter	default<n>	C_R	= Use to recall default setting for the changes after reset.
Inventory Parameter	iparam,session,q,m_ab<n>	C_R	= Use to setup parameters for query command. Session(D=0); session value for query command. Q(D=5); q value for query command. M_ab(D=2); target value for query command. Set to 0 for target A. Current setting can be read using "g" command.
Getting parameter	g,<cmd>,p<n>	C_R RESULT<n>	= Get setting value from the reader. <cmd>; one of the command which is used to set operatiom parameters. P; parameter of <cmd>. Ex) you can get current setting in form of ok,session,q,m_ab<n> as a result of issuing "g,iparam".
Select Mask	m,n,bits,mem,b_offset,pattern,tar	C_R	= Setup select mask pattern to

	get,action<n>		be used in query command. N; the index of mask table (0~7). Bits(D=0); Number of bits of the select mask pattern. Use 0 to clear current mask. Mem(D=0); Memory Bank ID of the tag to match for the select mask. 0=RESERVED, 1=EPC, 2=TID, 3=USER. B_offset(D=0); Bit offset of the memory bank of the tag to mach for the select mask. Note that starting bit offset of the PC/EPC is 16. Pattern(D=0); Bit pattern of the memory in the tag to match for the select mask. Must be HEXA_STRING. MSB is the starting bit. Target(D=4): Target flag in the tag will be altered after select command. Default(4) is select flag.. Action(D=1); Flag setting option . Default(1) is “set flag”. If the pattern matches with the tag memory pattern. Otherwise the flag keeps its state. Ex) command to setup PC/EPC as a select mask is “M,0,96,1,16,3000123456789abc ,,”.
Setting Tx power	txp,a<n>	C_R	= Use to change RF transmission power.

			a; attenuation from the max power in 1dB. A must be o or negative integer.
Get max power	maxp<n>	C_R Result<n>	= Use to read maximum transmission power level.
Setting Tx cycle	txc,on,off<n>	C_R	= Use to change transmission duty in a channel. On; Transmission interval in msec. Off; Wait interval in msec. ** Must be in legal range.
change channel state	chs,n,f_e<n>	C_R	= Use to change channel usage. N; channel number [1~]. F_e; Set to 1 to use the channel. Or set to 0 not to use. Using “g,chs,0”, you can get entire channel usage. ** Must be legal. Do not change for normal operation.
Setting Country	cc,code	C_R	= Use to change operational region. code; id code for a region to work Using “g,cc”, you can get current working region.
Getting country capability	ccap	C_R <RESULT><n>	= Use to get information of the regional capability. RESULT is bit packed value for its capability. Using “cc,n”, you can select working region. LSB of the result corresponds to code 1.
Reading tag memory	r,w_count,mem,w_offset,ACS_PWD, f_s,f_m,to<n>	C_R <RESULT><n>	= Use to read data from the tag in words. w_count(D=1); number of

		O_R	words(16bits) to read. (1,255) mem; memory bank address to read. 0=RESERVED, 1=EPC, 2=TID, 3=USER. w_offset; word offset of the memory bank to read. ACS_PWD(D=0); access password of the tag. Must match to the value in the tag to read. f_s(D=0); same to “i” command parameter f_s. f_m(D=0); same to “i” command parameter f_m. to(D=0); same to “i” command parameter to.. RESULT is contents of the tag memory and the tag ID(PC/EPC) expressed in HEXA_STRING. RESULT could be multiple. Ex) 12345678ABCD,E=300012345678ABC
Writing Tag memory	w,w_count,mem,w_offset,w_pattern,ACS_PWD,f_s,f_m,to<n>	C_R <RESULT><n> O_R	= Use to write data to the tag memory in words. w_count; number of words(16bits) to write. mem; memory bank address to read. 0=RESERVED, 1=EPC, 2=TID, 3=USER. w_offset; word offset of the memory bank to read. w_pattern; data to write in HEXA_STRING. The string length is w_count *4 digit. ACS_PWD(D=0); access

			password of the tag. Must match to the value in the tag to read. f_s(D=0); same to “i” command parameter f_s. f_m(D=0); same to “i” command parameter f_m. to(D=0); same to “i” command parameter to.. RESULT is result message of the write operation. RESULT could be multiple. Ex) OK,E=300012345678ABC
Killing Tag	kill,KILL_PWD,f_s,f_m,to<n>	C_R <RESULT><n> O_R	= Use to kill tags permanently. KILL_PWD; kill password in the tagto kill. It cannot be 0. f_s(D=0); same to “i” command parameter f_s. f_m(D=0); same to “i” command parameter f_m. to(D=0); same to “i” command parameter to.. RESULT is result message of the kill operation. RESULT could be multiple. Ex) OK,E=300012345678ABC
Locking tag memory	lock,user,tid,epc,,acs_pwd,kill_pwd, ACS_PWD,f_s,f_m,to<n>	C_R <RESULT><n> O_R	= Use to lock the memory bank or password. Each parameter value could be one of the 1(=locked), 0(=unlocked) or omitted(=stay unchanged). Default is “stay unchanged”. user; lock state of the User memory tid; lock state of the TID memory.

			epc; lock state of the PC/EPC memory. acs_pwd; lock state of the access password. kill_pwd; lock state of the kill password. ACS_PWD(D=0); access password of the tag. Must match to the value in the tag to read. f_s(D=0); same to “i” command parameter f_s. f_m(D=0); same to “i” command parameter f_m. to(D=0); same to “i” command parameter to. RESULT is result message of the lock operation. RESULT could be multiple. Ex) OK,E=300012345678ABC
Set Lock tag memory state permanently	lockperm mem_id,f_l,ACS_PWD,f_s,f_m,to<n>	C_R <RESULT><n> O_R	= Use to fix lock state of the memory bank or password permanently. mem_id; ID of the memory bank or password to fix lock state. 0=user memory, 1=tid memory, 2=epc memory, 3=access password, 4=kill password. f_l; lock state to fix. 1 = permanently lock, 0 = permanently unlock. ACS_PWD(D=0); access password of the tag. Must match to the value in the tag to read. f_s(D=0); same to “i” command parameter f_s.

			f_m(D=0); same to “i” command parameter f_m. to(D=0); same to “i” command parameter to. RESULT is result message of the lock operation. RESULT could be multiple. Ex) OK,E=300012345678ABC
Pause Tx	pause<n>	none	= Use to pause transmission of the result from the reader. Issue Null line or s(stop) command to cacel th e pause state.
Heart beat	online,value<n>	C_R	= Use to start or stop heart beat handshake. Heart beat can be used for connection monitoring. value; set to 0 to stop heart beat handshake or set to the interval of the heart beat transmission in msec. Note that heart beat transmission is postponed whenever a message is transmitted. “$time=xxx” is transmitted as a heart beat message in idle state. Host need to issue command or Null line not to restart reader earlier than heart beat interval. Initial setting is 0.
Status reporting	alert,f_link<n>	C_R	= Use to setup link state change alert. f_link(D=0); set to 1 to make reader report when link state changes.

			Ex) $online=1<n>. Initial setting is 1.
Inventory reporting format	ireport,f_time,f_rssi <n>	C_R	= Use to setup inventoried information report format. f_time(D=1); set to 1 to get inventoried time. f_rssi(D=0); set to 1 to get rssi of the tag response. Initial setting is f_time=1, f_rssi = 0.
System time	time,val<n>	C_R	= Setup reader elapsed time in msec. val; current time to set. Could be elapsed time in msec since 1970.1.1.
Dislink	bye<n>	C_R	= close connection between host and the reader. The reader stays in powered state.
R900 controls			
Uploading tag data	br.upl, index,count<n>	C_R <RESULT><n> O_R	= Use to upload stored inventoried data while in local operation mode. index; first data to upload (0~). count; number of tag information to upload. RESULT is information line. It could be multiple. Ex) :3000123456789ABC,C=21,F=2010310,L=2010340 where C=total count, F=first detected time, L=last detected time.
Clearing tag data	br.clrlist<n>	C_R	= Clear all stored inventoried tag data permanently.
Alert reader	br.alert,f_link,f_trigger,f_lowbat,f	C_R	= Use to setup alert options.

status	_autooff,f_pwr<n>		f_link; Set to 1 to be alerted when link state changed. Report format is “$online=s<n>”. f_trigger; set to 1 to be alerted when trigger state changed. Report format is “$trigger=s<n>”. f_lowbat; set to 1 to be alerted when battery level is low. Report format is “$lowbat=s<n>”. f_autooff; set to 1 to be alerted when reader is going to be off. Report format is “$autooff=1<n>”. f_pwr; set to 1 to be alerted when reader is going to be off. Report format is “$pwr=0<n>”.
Getting Status word	br.sta<n>	C_R <RESULT><n>	= Use to get reader status. RESULT is status value. This is for engineering purpose.
Setting buzzer volume	br.vol,volume,f_nv<n>	C_R	= Use to change buzzer volume in the reader. volume; Volume to set. (0~2). f_nv; set to 1 to keep change after power cycle. Using “g,bt.vol”, you can get current setting.
Beep	br.beep,f_on<n>	C_R	= Use to turn buzzer sound on or off. f_on; set to 1 to start buzzing or set to 0 to stop buzzing.
Setting automatic power off delay	br.autooff,delay,f_nv<n>	C_R	= Use to change auto off delay interval. delay; delay interval in sec. f_nv; set to 1 to keep change

			after power cycle. Using “g,bt.autooff”, to you can read current setting”.
Getting battery level	br.batt,f_ext<n>	C_R <RESULT><n>	= Use to get current battery level. f_ext(D=0); set to 1 to get extended information. This is for engineering purpose. RESULT는 is left quantity in %. Ex)43,X=257
Reporting battery state	br.reportbatt,f_report<n>	C_R	= Use to setup battery status change report. f_report; set to 1 to be reported when state changed. Report format is “$bat=0xaaaaaaaa”. This is for engineering purpose.
Turning reader off	br.off<n>	C_R	= Use to turn the reader off.
Setting bluetooth configuration	Br.bt.config,mode,key,name<n>	C_R	= use to change the bt operation mode. mode : set to 2 to be BT mode 2. Set to 3 to be BT mode 3. Default is 3. key : set to PIN code. Default is “1234”. name : set to name of bluetooth. Default is “HQ_UHF_READER”. Ex)Br.bt.config,2,1234,HQ_UHF_READER.
Getting Bluetooth mac address	Br.bt.mac<n>	C_R	= use to get Bluetooth mac address. Ex) $btmac,001122334455

4. Select Mask Usage

Select mask is a command to designate the pattern in order to receive a tag which only corresponds to certain conditions when querying tag.

Select mask designates to 8 and this designated mask sends tag when the command of inventory or access is running.

ISO 18000-6C/EPC global C1G2 has a tag with 5 flag related to the action of query.

ISO 18000-6C/EPC global C1G2 has each Inventoried flag to 4 sessions and 1 Select Flag.

This flag keeps the state for a period time and then inventoried flag reset the state of A after some time passes.

S0 inventoried flag keeps the state when tag is receiving radio wave from a reader after changing the state, if the radio wave is cut off, S0 inventoried flag resets.

S1 inventoried flag is reset between 0.5 and 5 seconds regardless of radio wave after changing the state of flag. S2 inventoried flag, S3 inventoried flag, and Select flag keep their states after changing their states while tag is receiving radio wave from a reader. Even if the wave is cut, their states keep for over 2 seconds.

The following is Mask command target code

Code	flag
0	Session 0 Inventoried flag
1	Session 1 Inventoried flag
2	Session 2 Inventoried flag
3	Session 3 Inventoried flag
4	Select flag

The following is action code of Mask command.

Code	Select flag		Inventoried flag	
	Matching tag	Non-matching tag	Matching tag	Non-matching tag
0	SET	RESET	Inventoried -> A	Inventoried -> B
1	SET	No Changing	Inventoried -> A	No Changing
2	No Changing	RESET	No Changing	Inventoried -> B
3	Reversal of State	No Changing	A->B, B->A	No Changing

4	RESET	SET	Inventoried -> B	Inventoried -> A
5	RESET	No Changing	Inventoried -> B	No Changing
6	No Changing	SET	No Changing	Inventoried -> A
7	No Changing	Reversal of State	No Changing	A->B, B->A

The following is the method of using Select flag.

When designating one type of tag	Set the value of Action "0"
When excluding one type of tag	Set the value of Action "4"
When designating several types of tag	Set the value of Action "1"

*** First of all, flag should be reset when Inventory or access is running consecutively because the flag of tag can keep the state of it for a period time.

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*** Do not use mask setting which changes Inventory flag. It needs additional condition.

5. Query Parameters

session : session value of query command. There are 4 sessions each in a tag. The readers can use any of session independently. The tag acts differently during query operation related to the tag response. Session values are ranges of 0~3.

q : tag population quotient of the query command. It ranges 0~15. In case of large tag population, you need to large q value to avoid response collision. Most cases, you don't need to change it.

M_ab : target flag of the query command. Each Tag has inventoried flag to keep its response state to avoid repetitive response. Each state is state "A" and state "B". If you set m_ab to 0, only tags with inventoried flag state "A" respond on query command. If you set m_ab to 1, only tags with inventoried flag state "A" respond on query command. But you must care what session you are using because session 0 inventoried flag has state "A" whenever reader start to transmit rf. If you set m_ab to 2, the reader queries tags using target "A" and target "B" alternatively.

6. EPC Global Class 1 Gen 2 (ISO 18000-6C) Tag Error Codes

These error codes are the tag error codes same to the value of err_tag=xx.

code	Meaning
00h	general error (catch-all for errors not covered by codes)

03h	specified memory location does not exist or the PC value is not supported by the tag
04h	specified memory location is locked and/or permalocked and is not writeable
0Bh	tag has insufficient power to perform the memory write
0Fh	tag does not support error-specific codes
Others	Unknown error

7. Module Internal Error Codes

These errors are module internal error same to the value of err_op=xx.

Code	Meaning
01h	Read after write verify failed.
02h	Problem transmitting tag command.
03h	CRC error on tag response to a write.
04h	CRC error on the read packet when verifying the write.
05h	Maximum retry's on the write exceeded.
06h	Failed waiting for read data from tag, possible timeout.
07h	Failure requesting a new tag handle.
0Ah	Error waiting for tag response, possible timeout.
0Bh	CRC error on tag response to a kill.
0Ch	Problem transmitting 2nd half of tag kill.
0Dh	Tag responded with an invalid handle on first kill command.
0Fh	Bad Access Password
Others	Internal Use