Chapter 6

RS 485/232 Communication Protocol

6 RS 485/232 Communication Protocol

6.1. RS- 485/232 Communication Protocol: General Description

Communication between the Local Site Controller LSC and the STAR READER is based on the master/slave approach. The LSC is the MASTER unit, the READERS are the SLAVE units.
The LSC and the READERS communicate via a RS-485 multi drop or RS-232 connection. Each READER has its own address, enabling the LSC to approach each reader individually.

6.2. Physical Layer

6.2.1. Down-link

Down-link is the link from the LSC to the READERS. The link is RS-485 or RS-232 half duplex. Data rate can be one of the following: 2400, 4800, 9600, 19200, 38400 BPS. The default rate is set at 9600 BPS.

6.2.2. Up-link

Up-link is the link from the READERS to the LSC. The link is RS-485 or RS-232 half duplex. Data rate can be one of the following: 2400, 4800, 9600, 19200, 38400 BPS. The default rate is set at 9600 BPS.

6.3. **Protocol Flow**.

Communication is initiated by a command sent by the LSC to the READER. The READER executes the command and responds accordingly. In a long command session, the session is concluded when the LSC acknowledges the READER within T_{ACK} = 50 msec.

If the READERS are in sleep mode, the LSC must ensure they are awakened prior to the initialization of the session. In this case, the LSC should wait T_w = 50 msec before sending the main command.

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There are 2 types of commands: **SHORT COMMANDS** and **LONG COMMANDS**.

Short Commands: These are commands that are relevant to internal tasks at the reader level.
Long Commands: These commands involve sessions with seals.

The READER will respond to commands generated by the LSC within T_{RLSC} seconds.
For short commands, response time should be: T_{RLSC} = 50 msec.
For long commands, the LSC should return to retrieve the results after $T_{session}$ with the appropriate **GET RESULTS** command.
$T_{session}$ is a derivative of the type of command executed to the seals.

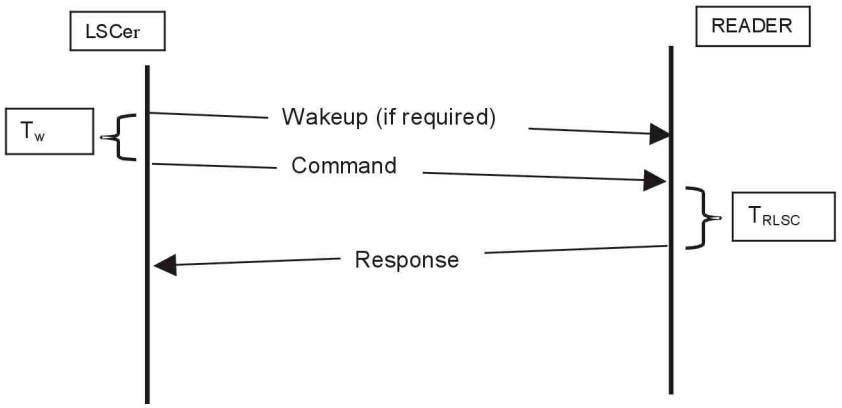
Acknowledge can be positive or negative.
If the LSC detects a problem, Acknowledge will be negative.

The READERS are designed to work in cycles. Following an internal or external trigger, a READER SESSION is generated. This is a full communication cycle going back and forth between a READER and the tags located in the READER's receiving zone.

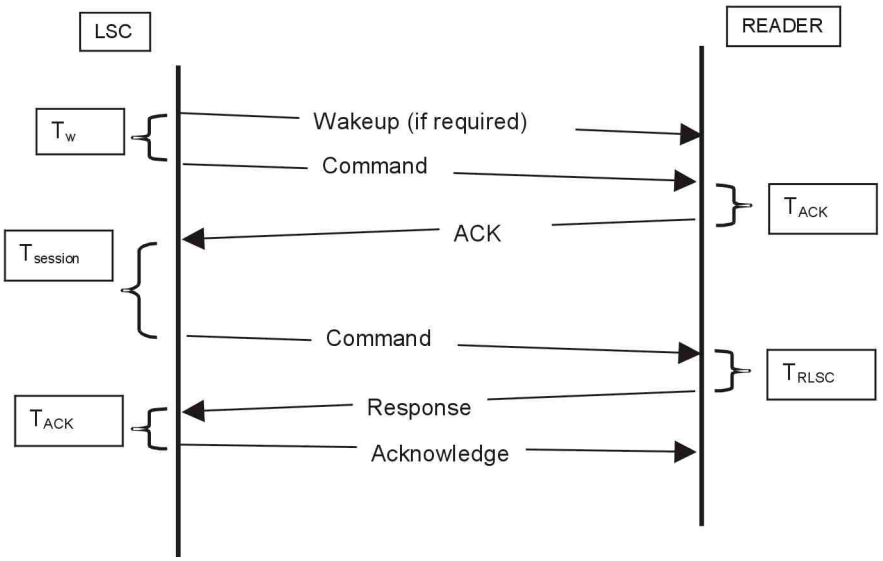
The LSC operates differently The READERs are scanned on a different time line, using the same frequency as that of the READER's cycles or greater.

This protocol supports RS-485 and RS-232 communication fashions. When working with the LSC using RS-232 communication opposite only one device, address fields should be set to **0xFFFF**. When using RS-485 communication in broadcast situations, the address field should be set to **0x0000**.

Short Commands Mode:



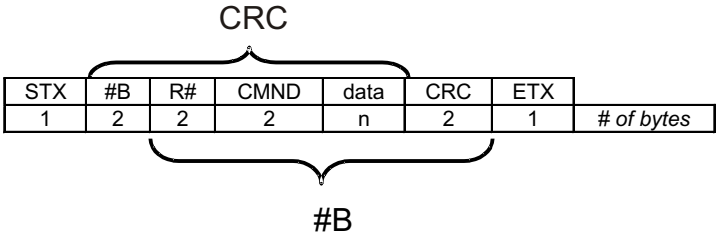
Long Commands Mode:



6.4. String Formats.

6.4.1. LSC to READERS messages.

Commands & Acknowledge strings:



Where:

STX	This is the marker for the beginning of the messages. STX = 02 hex.
#B	String length, the string contains the R#,CMND, the DATA field, and the CRC.
R#	This session's READER address .
CMND	This session's command code .
DATA	The data field contains the data required to execute the command
CRC	This is the cyclic redundancy check for DATA and fields #B, R#, CMND.
ETX	This is the marker for the end of the messages. ETX = 03 hex.

6.4.1.1. CRC Calculation.

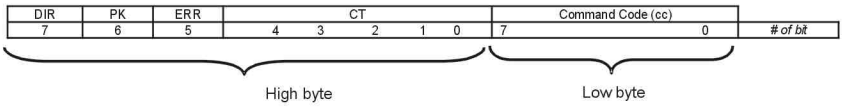
CRC calculations are based on the following CCITT polynomial:

$$X^{16} + X^{12} + X^5 + 1$$

The result is 2 bytes.

6.4.1.2. CMND Field Structure.

The command field is divided into several sections:

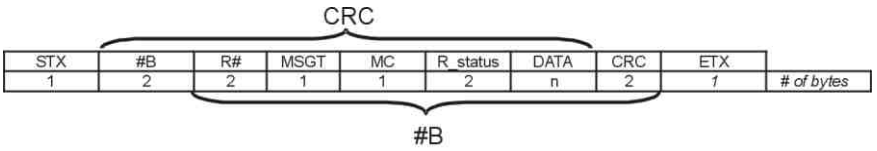


Where:

DIR	Denotes string direction. In case of a command from the LSC to the reader, it is equal to 0.
PK	Denotes whether the command transmitted is composed of packets or not. PK = 0 is for non-packet commands. PK = 1 is for packet commands.
ERR	this flag indicates an error. ERR = 0 no error. ERR = 1 Error. The first byte in the data field is the error code.
CT	Is the scenario command type. It describes the command type, and whether it is in short or long form 00000 designates SHORT commands that stream from the LCR to the Reader for MCU purposes. 00011 is for LONG commands.
CC	This is the command code .

6.4.2. Reader to LSC Message

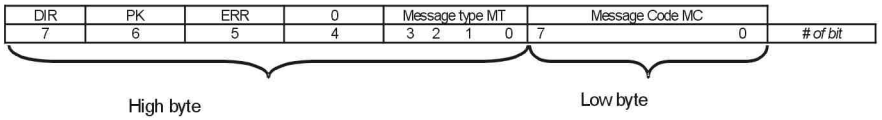
Response & Acknowledge strings:



STX	This is the marker for the beginning of the messages. STX=02 hex.
#B	String length, the string contains the R#, MSGT, MC, R_status, the DATA field and the CRC.
R#	This is the address of the READER for the current session.
MSGT	This is the message type response for the current session. The MSGT corresponds to a specific command (see paragraph 6.4.2.1)
MC	This is the message code (see paragraph 5.2)
R_status	This is the status field of the reader. The field contains bytes A&B (see paragraph 6.4.2.2)
DATA	The data field contains the relevant response data.
CRC	This is the cyclic redundancy check for fields #B, MSGT, R_status and DATA.
ETX	This is the marker for the end of the messages. ETX=03 hex.

6.4.2.1. MSGT Field Structure.

The Message Type field is divided into several sections:



Where:

DIR	Is the string direction.Response will be 1.
PK	Denotes whether the transmitted message is composed of packets. A response of 1 indicates that the message is composed of packets. If the response is 0, the message was transmitted without packets. (If PK=0 there must be 1 reserved data byte).
ERR	This flag indicates an error. ERR = 0 no error. ERR = 1 Error. The first byte in the data field stores the error code.
MT	This code reflects the nature of the response. A regular response to a command has the same value as the CC (See paragraph 6.4.1.2).
MC	This field holds the same value as the Command Code of the related commands. This field makes it possible to link the response to the appropriate command.

6.4.2.2. R_Status Field Structure

The READER's STATUS field is 4 bytes.

Byte A	Byte B	Byte C	Byte D

Byte A represents the status of the main motherboard MCU.
The other bytes represent the RF modems' status.
In a general Reader response the R-Status reply contains bytes A&B only.
In a GET Status command, the reply contains all the R-Status bytes.

Byte A:

7	6	5	4	3	2	1	0
LCK	485	PCR	PER	VCCERR	VBERR	PMC	EDC

Where:

LCK — If the response shows 0, the READER's parameters are locked.
If the response is 1, the READER's parameters are unlocked.
If the response is 0, the READER is using RS-232 mode for communication.

485 — If the response shows 1, the READER is using RS-485 mode for communication.

PCR — If the response shows 0, the parameters in the MCU's E^2ROM are OK.
If the reponse is 1, parameters were corrupted and successfully restored.

PER — If the response is 0, the parameters in the MCU's E^2ROM are OK.
If the answer is 1, parameters are corrupted.

VCCERR — If response is 0, internal power is OK.
If response is 1, internal power is faulty.

VBERR — If response shows 0, internal battery is OK.
If response is1, internal battery is faulty.

PMC — If response is 0, program memory in the MCU is OK.
If response is 1, program memory is corrupted.

EDC — This flag indicates that a delayed command was triggered and is in process.

Byte B:

7	6	5	4	3	2	1	0
Ch1	Ch2	Ch3	Ch4	Ch1err	Ch2err	Ch3err	Ch4err

Where:

Ch1 — if 0 channel1 is not in use.
If 1 channel1 is in use.

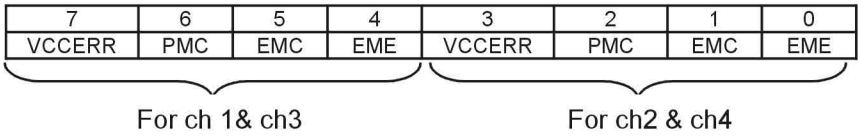
Ch2 — Iif 0 channel2 is not in use.
If 1 channel2 is in use.

Ch3 — If 0 channel3 is not in use.
If 1 channel3 is in use.

Ch4 — If 0 channel4 is not in use.
If 1 channel4 is in use.

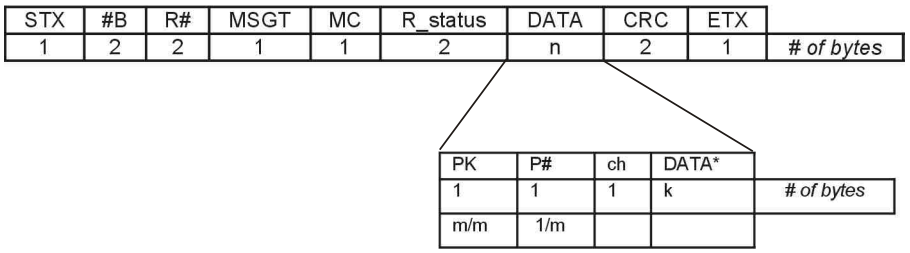
Ch1err	If 0, channel is OK If 1, channel is defective, details are in byte C. If byte C flags are OK, there is a communication failure with this channel.I
Ch2err	If 0, channe2 is OK. If 1, channe2 is defective, details are in byte C. If byte C flags are OK, there is a communication failure with this channel.
Ch3err	If 0, channe3 is OK. If 1, channe3 is defective, details are in byte D. If byte D flags are OK, there is a communication failure with this channel.
Ch4err	If 0, channe4 is OK. If 1, channe4 is defective, details are in byte D. If byte D flags are OK, there is a communication failure with this channel.

Bytes C&D:



VCCERR	If 0, power is OK. If 1, power is not faulty
PMC	If 0, program memory in the module is OK. If 1, program memory is corrupted.
EMC	If 0, E^2ROM is OK. If 1, E^2ROM was corrupted and then restored.
EME	If 0, E^2ROM is OK. If 1, E^2ROM was corrupted.

6.4.2.3. Reader Messages Packed Data Format



Where:

PK	The first byte is the total number of packets in the string.
P#	The second byte is the packet serial number.
Ch	The third byte is the channel number from which the message is received.

Maximum total message length is 128 bytes.
Maximum Data* length is 115 bytes.

6.4.2.3.1. Packed Data from the LSC.

When the packets originate with the LSC, each packet will be transmitted after an appropriate response from the READER. The LSC may retransmit the last packet upon receipt of a response indicating that the last packet was not received satisfactorily.

6.4.2.3.2. Packed Data from the READER.

When the packets originate with the READER, each packet will be transmitted after an appropriate acknowledgement from the LSC. The READER may retransmit the last packet upon receipt of an acknowledgment indicating that the packet was not received satisfactorily

6 RS 485/232 Communication Protocol

6.5. LSC and Reader Messages.

6.5.1. LSC Commands and Acknowledge Table:

#	Commands Set	Command Code	Comments
1	Wakeup	E0 h	This command wakens READERS ithat were in sleep mode.
2	Execute RF cmnd	20 h	This command generates an appropriate command from the READER to the tags.
3	Get Results	15 h	In a tag-reader session, this command allows the LSC to retrieve the results received by the READER from the tags. .
4	Get Status	16 h	In case of a self-contained command, the READER will return to its current status.
5	Get Burst Message	1C h	This command should be used to retrieve the alert messages retrieved from the seals when using the alert burst mode. These are not available through the regular Get Results.
6	Reset Reader	14 h	This command resets theREADER.
7	Write Parameters	06 h	This command modifies the PARAMETERS of a READER. After issuing a LOCK command, not all the parameters are accessible.
8	Read Parameters	07 h	This command is to read the PARAMETERS of a READER.
9	BIT	09 h	Executes a built in test
10	Sleep	08 h	This command puts the READER into the sleep mode of operation to enable power conservation.
11	Unsync Ack	0A h	Reserved for the unsynchronized response, see table 5.2
12	Get Reader's baud rate	FF h	This command allows the LSC to obtain the reader's baud rate.
13	Set Reader baud rate	FE h	This command allows the LSC to set the READER's baud rate.
14	Set Reader's Address	12 h	This command sets the READER's address for RS-485 usage
15	Acknowledge OK	92 h	This is an acknowledgement of a message coming from a READER.
16	Acknowledge Failed	94 h	This is an acknowledgement of an improper message coming from a READER.
17	Save Command	0F h	This command saves one of the above commands for later execution. It is used to synchronize readers.
18	Execute Saved command	17 h	This command executes the command saved in the READER. When is used in a broadcast fashion, all the READERS execute the command simultaneously.
19	Read Channel Definitions	11 h	This command allows the reading of channel definitions..
20	Write Channel Definitions	10 h	This command allows the writing of channel definitions.

6.5.2. Message Table:

#	Message	Message Code	Comments
1	Wakeup response	-	No response for WAKEUP string
2	Execute RF cmnd response	20 h	
3	Get Results response	15 h	
4	Get Status response	16 h	
5	Get Burst Message response	1C h	
6	Reset Reader response	14 h	
7	Write Parameters response	06 h	
8	Read Parameters response	07 h	
9	BIT response	09 h	
10	Sleep response	08 h	
11	Unsynch Message	0A h	When a READER is in unsynch mode, the READER may send an unsynch message. This occurs after receiving an alert message from a seal.
12	Get Reader's baud rate response	FF h	
13	Set Reader baud rate response	FE h	
14	Set Reader's Address response	12 h	
15	Save Command response	0F h	This command saves one of the above commands for later execution. It is used to synchronize readers.
16	Execute Saved command response	_	This is a broadcast command. There is noresponse to this command.
17	Read Channel Definitions response	11 h	This command allows the reading of channel definitions.
18	Write Channel Definitions response	10 h	This command allows the writing of channel definitions..

6.5.3. Parameters Table:

The following table relates to the Read and Write Parameters Commands:

#	Parameter Name	Parameter Code	Parameter Syntax	Read/Write Access *	Default value [unit]	Unit	Parameter length
1	Version of MCU_firmware	01 h	MVER	R			2 Byte
2	Version of S1_firmware	80 h	SVER1	R			2 Byte
3	Version of S2_firmware	40 h	SVER2	R			2 Byte
4	RSSI ch1	87 h	RSSI1	R			1 Byte
5	RSSI ch2	47 h	RSSI2	R			1 Byte
6	Reader ID	02 h	RID	R / 1	00000000		4 Byte
7	ADI ch1	81 h	ADI1	R/W	00000000		4 Byte
8	ADI ch2	41 h	ADI2	R/W	00000000		4 Byte
9	OrgID*	04 h	OrgID	R / 2	0000		2 Byte
10	Department ch1	82 h	DEP1	R/W			1 Byte
11	Department ch2	42 h	DEP2	R/W			1 Byte
12	Thw ch1	85 h	Thw1	R/W	997	3.072ms	2 Byte
13	Thw ch2	45 h	Thw2	R/W	997	3.072ms	2 Byte
14	Reader Address	03 h	RADD	R/W	0000		2 Byte
15	Transmitter Power ch1	88 h	TRPOR1	R/W	65		1 Byte
16	Transmitter Power ch2	48 h	TRPOR2	R/W	65		1 Byte
17	System ch1	83 h	SYS1	R/W **			1 Byte
18	System ch2	43 h	SYS2	R/W **			1 Byte
19	Mode ch1	84 h	MODE1	R/W	00		1 Byte
20	Mode ch2	44 h	MODE2	R/W	00		1 Byte
21	Hard wakeup ch1	86 h	T_{HP1}	R/W	3256	3.072ms	2 Byte
22	Hard wakeup ch2	46 h	T_{HP1}	R/W	3256	3.072ms	2 Byte

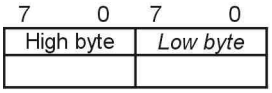
* /1 or /2 defines the LOCK level.

Parameters Format:

6.5.3.1. Reader Master Firmware Version MVER,

MVER is the version of the master firmware. This is a read only parameter.

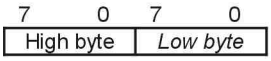
Bits assignment:



6.5.3.2. Reader Slave1 Firmware Version SVER1.

SVER1 is the version of the first slave's firmware.
This is a read only parameter.

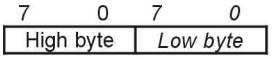
Bits assignment:



6.5.3.3. Reader Slave1 Firmware Version SVER2,

SVER2 is the version of the second slave's firmware.
This is a read only parameter.

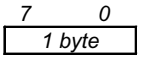
Bits assignment:



6.5.3.4. Reader's receives signal strength RSSI1,

RSSI1 is the amplitude of the received signal from the READER at the first channel. This value indicates the link's properties to the READER and the system.

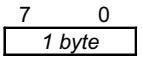
Bits assignment:



Reader's receives signal strength RSSI2,

RSSI2 is the amplitude of the received signal from the READER at the second channel. This value indicates the link's properties to the READER and the system.

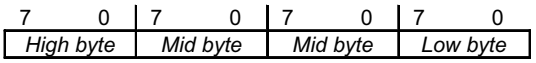
Bits assignment:



6.5.3.5. Reader ID RID,

This is a Reader's ID.

Bits assignment:

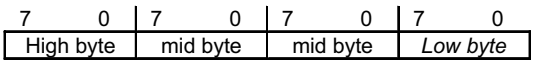


Reader and Seal IDs format are identical. For additional information, see paragraph 5.3.2.

6.5.3.6. Group Access Identifier ADI.

The identifier allows the READER to access groups that conform to this value.

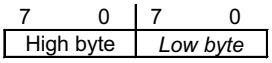
Bits assignment:



6.5.3.7. Organization identifier OrgID*,

This is the end user's identifier. This parameter is used to segregate between companies.

Bits assignment:

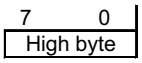


* See paragraph 5.3.3.

6.5.3.8. Department DEP

This is the customer's department identifier. This parameter is used to segregate between departments within a company.

Bits assignment:



* See paragraph 5.3.3.

6.5.3.9. Reader IH length Thw

This is the Reader's IH string length. The values may be modified for a specific application.

Bits assignment:

7 0	7 0
High byte	*Low byte*

6.5.3.10. Reader Address RADD.

This is the Reader's address on the RS-485 link. For RS-232, the value is 0xFFFF

Bits assignment:

7 0	7 0
High byte	*Low byte*

6.5.3.11. Mode MODE.

The MODE parameter determines the operating mode of the Reader. Each bit indicates another feature.

7	6	5	4	3	2	1	0
CRNC	UNSYNC	ABMSG	N.A	N.A	N.A	N.A	N.A

CRNC — Carrier Sense: In some applications, carrier sense must be used before bursting into the air.
The Reader uses this flag to decide whether it is required or not.
CRNC=0 This response determines the regular mode (no carrier sense).
CRNC=1 This response determines that the Reader can sense the carrier. The Reader will execute the RF command only after determining that the air is free.

UNSYNC — In the unsynchronized commands such as Unsynchronized Alert, the Reader's receiver must be ON at all times, waiting for incoming messages from the seals. The mode will be set according to the flag's value:
UNSYNC=0 Synchronized mode only.
UNSYNC=1 Unsynchronized mode in use, receiver should be set to ON.

ABMSG — Burst Messages. This flag indicates whether the alert messages will be sent following Alert GET Results, or whether the Reader will burst independently with Alert Messages.
BRMSG=0 determines the independent messages burst mode.
BRMSG=1 indicates the Alert GET Results mode.

6.5.4. Error Codes

See paragraph 6.4.2

Errors	**Error Code**
Unrecognized Command	01 h
MCU Error	02 h
HF Modem Error	03 h
Result is not ready	05 h
HF Modem is not responding	06 h
MCU I/O Error	07 h
HF Modem BIT Error	08 h
Parameter is locked	09 h
Illegal Parameter Code	0A h

* Error codes appear in the data field

6.5.5. Detailed Commands.

6.5.5.1. Wakeup

6.5.5.1.1. Command Transmission

To wake a READER in sleep mode, a very short string must be sent by the LSC. This will be detected by the hardware and will awaken the READER. As this is a hardware-oriented command, the format is different then all the other commands.

LSC > Reader

CMND(E0h)	
1	*# of bytes*

6.5.5.1.2. Wakeup Response

A WAKEUP string transmission wakens the READER. The READER does not respond to such a string. After the command is issued the READER is ready to receive regular commands.

6.5.5.2. Execute RF Command.

6.5.5.2.1. Command Transmission

This command enables communication sessions with the seals. The LSC inserts the relevant information in the data field allowing the reader to easily compile the final command string.

LSC > Reader

STX	#B	R#	CMND (0320h)	data	CRC	ETX	
1	2	2	2	n	2	1	*# of bytes*

channel	Data*	Time& Date	ADI	
1	m	4	4	*# of bytes*

Where the channel field is one of the following:

Channel	Code
Channel 1	01 h
Channel 2	02 h

Time&Date are the current Time and Date of the LSC.

ADI This parameter allows the User to subgroup seals. If the response indicates 0,the Reader uses its internal value for ADI. If not, this is the value which will be transmitted to the seals.

NOTE: In the Data Field, #B includes the Time & Data and ADI fields.

6.5.5.2.2. Execute RF Command ACK.

This command involves a RF session with either the tags or seals. For that reason, the READER carries a Long Command. The READER responds with an ACK if the command was successfully received.

Reader > LSC

STX	#B	R#	MSGT(XX20h)	R_status	channel	CRC	ETX	
1	2	2	2	2	1	2	*1*	*# of bytes*

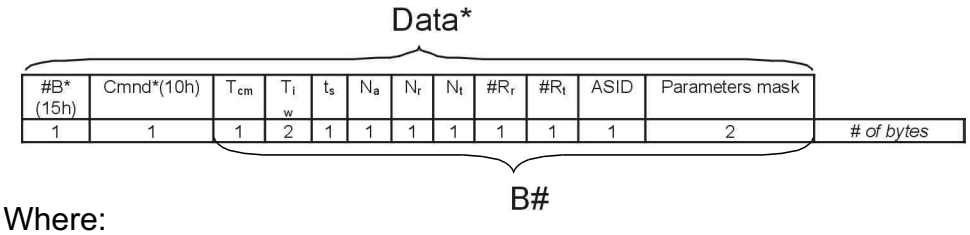
In case of an ACK with an error response:

STX	#B	R#	MSGT(XX20h)	R_status	Err code	CRC	ETX	
1	2	2	2	2	1	2	*1*	*# of bytes*

The final results of this command will be ready later. The LSC should use the GET RESULTS command to retrieve the results. For detailed error codes see para 5.4.

6.5.5.2.3. Verify.

The Verify command is carried through the high frequency modem. The data field in the Execute RF Command will be:



Where:

#B	is the number of bytes in the string from the Cmnd* field up to the ADI field.
Cnmd*	is the opcode of the RF command.
Tcm	The duration of the calibration message window. Resolution is in units of 1024 msec.
Tiw	The duration of the READER interlace window. Resolution is in units of 1024 msec.
Ts	The duration of a slot for receiving responses from a tag or a seal. Resolution is in units of 1024 msec.
Na	The number of slots in the Fixed Assignment Receiving Window.
Nr	The number of slots in the Random Access Receiving Window.
Nt	The number of slots in the Alert Receiving Window.
#Rr	The number of random retransmissions from a tag in the Random Access Receiving Window.
#Rt	The number of random retransmissions from a tag in the Alert Receiving Window.
ASID	Is a random unique ID that is assigned to a specific assignment. For details see Assign commands.
Parameters Mask	Is the parameters bit mask to which the tags and seal respond.

This is the interrogation cycle for reading short messages from tags and seals. Tw wakes the tags in random phase.

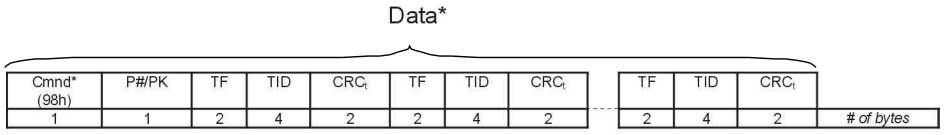
Bit Mask should comply with the following table:

#	Parameter Name	Parameter Code	Parameter Syntax	Read/Write Access	Bit Mask Access order	Parameter Length
1	Seal Status	00hex	TS	R	15	1 Byte
2	Date & Time	01 hex	D&T	R/W	14	4 Bytes
3	Seal Stamp	17 hex	STMP	R	5	2 Byte
4	# of Events	03 hex	#EV	R	12	1 Byte
5	Version of firmware	06 hex	VER	R	9	2 Byte
6	Long Status	07 hex	LTS	R	8	4 bytes
7	Life Counter	04 hex	LFC	R	11	2 Bytes
8	RSSI	08 hex	RSSI	R	7	1 Byte
9	OrgID	12 hex	OrgID	R/W	6	3 Bytes

6.5.5.2.4. Tamper

The Tamper command is intended solely for interrogation of tampered Seals. This command is identical to the Verify command except for the opcode which is 11h.
In accordance to this, only Seals that have detected tamper status will respond. The aim of this command is to provide high priority to tampered Seals in a crowded Seal environment.

6.5.5.2.5. Set



Set command is a command used when it is necessary to approach a large number of tags or seals. If the string becomes too large it will be split into packets.

Each packet includes information for up to 8 tags or seals. This is a very critical command, as it uses internal CRC for each tag data.

Where:

P#	The high 4 bits of the first byte are the packet serial number.
PK	The low 4 bits of the first byte are the total number of packets in the BMM string.
CRC_p	Is the CRC of the packet.
CRC_t	Is the CRC of the tag or seal TF & TID

6.5.5.2.6. Suspended set

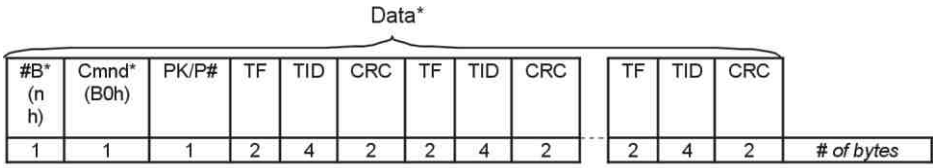
The Suspended Set command is the command used when it is necessary to prepare a large number of Seals. The command functions in the same way as the SET command, the only difference being that the SET command is executed immediately, while the Seal executes the Suspended SET command automatically only after the Seal wire has been plugged into the Seal.

The opcode for this command is 99h. The response is identical to that of the SET response, but with 19h as the message type.

6.5.5.2.7. Soft set

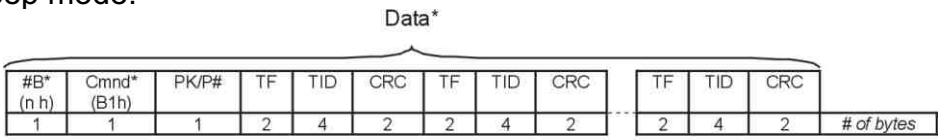
This command has the same structure as the SET command. The difference between the two is at the seal level. The seal marks this command as an event, but doesn't reset the events memory. The opcode for this command is 9Ah. The response is identical to that of the SET response, but with 1Ah as the message type.

6.5.5.2.8. Deep Sleep



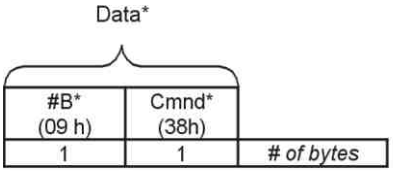
6.5.5.2.9. Hard Wakeup

Hard Wakeup is the command used to wake the seal from deep sleep mode.

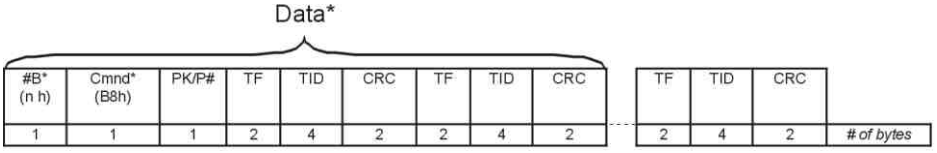


6.5.5.2.10. Start Alert Burst Mode

Starting all seals.

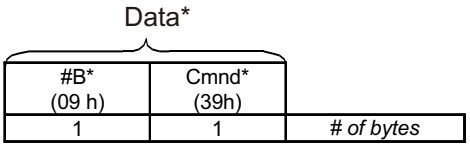


Starting specific tags.

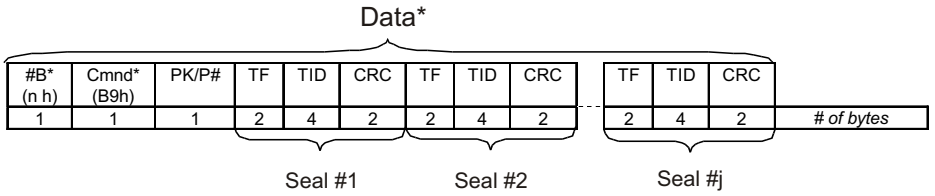


6.5.5.2.11. Stop Alert Burst Mode

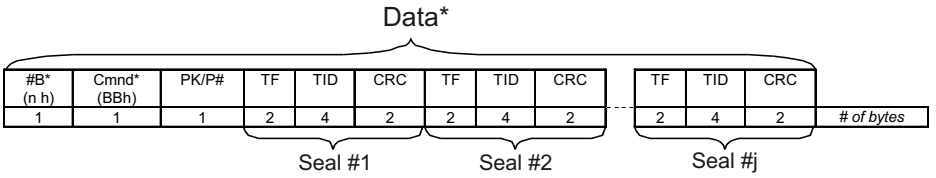
Stopping all tags.



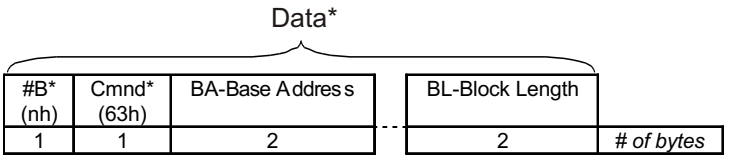
Stopping specific tags



6.5.5.2.12. Acknowledge Alert Burst Mode



6.5.5.2.13. Read Data



Where:

BA This is the base address in the block of data's memory.

BL This is the data block length.

6.5.5.2.14. Write Data

Data*

#B* (n h)	Cmnd* (68h)	TF	TID	PK/P#	BA Base address	Data	
1	1	2	4	1	2	m	*# of bytes*

PK/P# = 11h. At present the packets are fixed.

6.5.5.2.15. Reset Data

Data*

#B* (nh)	Cmnd* (AAh)	PK/P#	TF	TID	CRC_t		TF_8	TID_8	CRC_8	
1	1	1	2	4	2		2	4	2	*# of bytes*
			Seal #1				Seal #8			

Up to 8 seals can be reset in one cycle

6.5.5.2.16. Set/Reset Status.

Data*

#B* (17 h)	Cmnd* (6Bh)	TF	TID	Bit mask	Bit value	
1	1	2	4	4	4	*# of bytes*

Only some of the flags can be set and reset.

Bit mask marks the status bits to be reset.
A value of 0 means “don't modify”.
A value of 1 is to “reset value to zero”.
Each bit corresponds to the appropriate bit in the LTS.

6.5.5.2.17. Write Parameters

Data*

#B* (nh)	Cmnd* (69h)	TF	TID	PK/P#	Par Code	value	Par Code	value		Par Code	value	
1	1	2	4	1	1	i	1	j		1	k	# of bytes

TF&TID=00 is for a broadcast command.
PK/P# = 11h. At present the packets are fixed.

6.5.5.2.18. Read Parameters

Data*

#B* (n h)	Cmnd* (64h)	TF	TID	Par Code	Par Code		Par Code	
1	1	2	4	1	2		j	# of bytes

6.5.5.2.19. Addressed Verify

Data*

#B* (1bh)	Cmnd* (50h)	TF	TID	T_{cm}	T_{iw}	t_s	N_a	N_r	N_t	$\#R_r$	$\#R_t$	ASID	Parameters mask	
1	1	2	4	1	2	1	1	1	1	1	1	1	2	# of bytes

The following parameters are not applicable to this command:
Na, Nt, Rt.

6.5.5.2.20. Read Events

Data*

#B* (n h)	Cmnd* (61h)	PK/P#	TF	TID	EV#	# EV	
1	1	1	2	4	1	1	# of bytes

Where:
EV# is the sequential number of the first Event.
#EV is the number of events to be read from the memory.

6.5.5.3. Get Results

6.5.5.3.1. Command Transmission

This command is used to retrieve the results after an RF communication session.

LSC > Reader

STX	#B	R#	CMND(0015h)	Channel	CRC	ETX	
1	2	2	2	1	2	1	*# of bytes*

Channel indicates the source channel for the results. The value is according to the table in paragraph 5.5.2.1.

6.5.5.3.2. Get Results Command General Response

The following string is the general response

Reader > LSC

STX	#B	R#	MSGT(xx20h)	R_status	DATA	CRC	ETX	
1	2	2	2	2	n	2	*1*	*# of bytes*

channel	PK	P#	Data*	
1	1	1	m	*# of bytes*

Where:

MSGT The high byte of MSGT is according the scenario in use. The low byte is 20 h.

DATA In case the result is not ready, the value of this field is 05 hex error code see paragraph 5.4. If the results are ready, the following applies:

PK	Total number of packets.
P#	Packet number sequence number.
Data*	This string contains the seal records. The field should first be concentrated from all packets before being analyzed.

Seals Records:

Data*1		Data*2		- - - - - - - - - - - - - -				Data*PK-1		Data*PK	
Seal record		Seal record		Seal record		Seal record		Seal record		Seal record	
#B	Data**	#B	Data**	#B	Data**	#B	Data**	#B	Data**	#B	Data**
1	r		r		r		r		r		r

Where:

#B	is the number of bytes for a seal record (including the #B field)
Data**	is the data received after executing the RF command led by TF, TID and Message Type.

Data**				
TF	TID	Message Type	Data Result	
2	4	1		# of bytes

Where:

TF&TID	is the ID of the seal.TF&TID
Message Type	is the transmitted Cmnd*.

In case of a problem the Message Type's MSB will be set to “1”.

If no seal is detected:

Data*1
Seal record
#B=0
1

For the case of an unfinished RF session the complete response is:

Reader > LSC

STX	#B	R#	MSGT(xx15h)	R_status	error	CRC	ETX	
1	2	2	2	2	1	2	*1*	*# of bytes*

6.5.5.3.3. Get Results Command Response for Verify Command.

The response data field is a string of data received from all the seals. Each seal record is marked with the seal's TF&ID. The internal data field is according to the **Parameters mask** transmitted with the Verify command.

Reader > LSC

Data**				
TF	TID	Message Type	Data results according to the bit mask	
2	4	1		# of bytes

Where:
TF&TID is the ID of the seal.
Message Type is 10 h.

If no seal detected:

Data*1
Seal record
#B=0
1

6.5.5.3.4. Get Results Command Response for Tamper Command.

Results are the same as for the Verify command.

6.5.5.3.5. Get Results Command Response for SET Command.

Reader > LSC

Data**					
TF	TID	Message Type	Seal Long Status	Seal Stamp	
2	4	1	4	2	# of bytes

If no seal detected:

Data*1
Seal record
#B=0
1

6.5.5.3.6. Get Results Command Response for Suspended SET Command.

Results are the same as for the SET command.

6.5.5.3.7. Get Results Command Response for Soft SET Command.

Results are the same as for the SET command.

6.5.5.3.8. Get Results Command Response for Read Data Command.

Reader > LSC

Data**						
TF	TID	Message Type	Short Status	PK/P#	Data	
2	4	1	1	1	n	# of bytes

PK/P# = 11h. At present the packets are fixed.

6.5.5.3.9. Get Results Command Response for Write Data Command.

Reader > LSC

Data**				
TF	TID	Message Type	Short seal status	
2	4	1	1	# of bytes

6.5.5.3.10. Get Results Command Response for Deep Sleep.

Reader > LSC

Data**				
TF	TID	Message Type	Short seal status	
2	4	1	1	# of bytes

If no seal detected:

Data*1
Seal record
#B=0
1

6.5.5.3.11. Get Results Command Response for Hard Wakeup Command.

Reader > LSC

Data**				
TF	TID	Message Type	Short seal status	
2	4	1	1	# of bytes

6.5.5.3.12. Get Results Command Response for Reset Data Command.

Reader > LSC

Data**				
TF	TID	Message Type	Short seal status	
2	4	1	1	# of bytes

6.5.5.3.13. Get Results Command Response for Start Alert Burst Mode Command.

Reader > LSC

Data**				
TF	TID	Message Type	Short seal status	
2	4	1	1	# of bytes

6.5.5.3.14. Get Results Command Response for Stop Alert Burst Mode Command.

Reader > LSC

For a group approach:

Data**
Seal record
00 h
1

For a specific seal response:

Data**				
TF	TID	Message Type	Short seal status	
2	4	1	1	# of bytes

6.5.5.3.15. Get Results Command Response for Set/Reset Status Command.

Reader > LSC

For a group approach:

Data**
Seal record
00 h
1

For a specific seal response:

Data**				
TF	TID	Message Type	Short seal status	
2	4	1	1	# of bytes

6.5.5.3.16. Get Results Command Response for Write Parameters Command.

Reader > LSC

Data**				
TF	TID	Message Type	Short seal status	
2	4	1	1	# of bytes

6.5.5.3.17. Get Results Command Response for Read Parameters Command.

Reader > LSC

Data**										
TF	TID	Message Type	Short seal status	PK/P#	Par Code	Par Value		Par Code	Par Value	
2	4	1	1	1	1			1		# of bytes

6.5.5.3.18. Get Results Command Response for Addressed Verify Command.

Reader > LSC

Data**				
TF	TID	Message Type	Data results according to the bit mask	
2	4	1		# of bytes

Where:
If no seal detected:

Data*1
Seal record
#B=0
1

6.5.5.3.19. Get Results Command Response for Read Events Command.

Data**				
TF	TID	Message Type	Events records	
2	4	1		# of bytes

Events Records:

PK/P#	EV#	Event Record	EV#	Event Record		EV#	Event Record
1	1	8 or 16	1	8 or 16		1	8 or 16

PK/P#	EV#	Event Record	EV#	Event Record		EV#	Event Record
1	1	8 or 16	1	8 or 16		1	8 or 16

If no seal detected:

Data*1
Seal record
#B=0
1

8 bytes EVENT message format

FS_{sm}	#B	TF	TID	MT(33)	EV#	Event Code	D&T	STMP	CRC	EM	
	1	2	4	1	1	1	4	2	1		*# of bytes*

Where Event Code is one of the following:

Event	*Event Code*
Wire Tampered	0x02
Low Battery	0x03
Wire Open	0x04
Wire Closed	0x05
RTC Stopped	0x08
DB Corrupted	0x09

16 bytes EVENT message format

FS_{sm}	#B	TF	TID	MT(33)	EV#	Event Code	D&T	STMP	CRC	EM	
	1	2	4	1	1	1	4	2	1		*# of bytes*

FS_{sm}	#B	TF	TID	MT(33)	EV#	Event Code	RID	**	CHKSUM	EM	
	1	2	4	1	1	1	4	2	1		*# of bytes*

Where:
Event Code* is with the value 0x80
** is with one of the following values:

Event	*Event Code*	*MSB*	*LSB*
SET	0x01	Ø	Ø
SOFT SET	0x07	Ø	Ø
READ	0x0A	Ø	Ø
TIME Changed	0x0B	Delta	Ø

Data block is a group of events. Events should not be split. If the event is too long, it should be moved to the next block.

6.5.5.4. Get Status.

6.5.5.4.1. Command Transmission

This command is to retrieve the READER status.

Reader > LSC

STX	#B	R#	CMND(0016h)	CRC	ETX	
1	2	2	2	2	1	*# of bytes*

6.5.5.4.2. Get Status Command Response

The following string is the general response.

Reader > LSC

STX	#B	R#	MSGT(xx16h)	R_status	CRC	ETX	
1	2	2	2	4	2	*1*	*# of bytes*

6.5.5.5. Get Burst Message

6.5.5.5.1. Command Transmission

This command is used to retrieve the alert messages transmitted asynchronously by seals that are in alert burst mode.

Reader > LSC

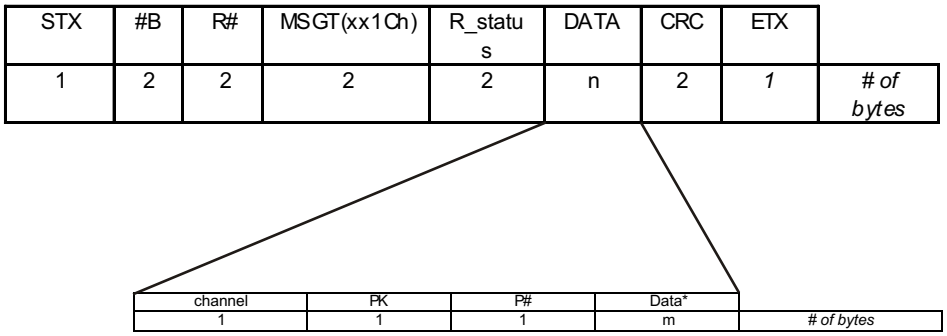
STX	#B	R#	CMND(001Ch)	Channel	CRC	ETX	
1	2	2	2	1	2	1	*# of bytes*

Channel indicates the source channel for the results. The value is according to the table in paragraph 5.5.2.1.

6.5.5.5.2. Get Burst Message Command General Response.

The following string is the general response.

Reader > LSC



Where:

MSGT	high byte of MSGT is according the scenario in use. The low byte is 1C h.
DATA	If the result is not ready, the value of this field is 05 hex error code see Paragraph 5.4. If the result is ready the following applies:
PK	Total number of packets.
P#	Packet number sequence number.
Data*	This string ccontains the seal records. The field should first be concentrated from all packets before analyzing.

Seals Records:

Data*1		Data*2		- - - - - - - - - - - - - -				Data*PK-1		Data*PK	
Seal record		Seal record		Seal record		Seal record		Seal record		Seal record	
#B	Data**	#B	Data**	#B	Data**	#B	Data**	#B	Data**	#B	Data**
1	r		r		r		r		R		r

Where:

#B	is the number of bytes for a seal record (including the #B fiels).
DATA**	is the data received after executing the RF command led by TF, TID and Message Type

Data**				
TF	TID	Message Type	Data Results	
2	4	1		# of bytes

If no seal detected:

Data*1
Seal record
#B=0
1

6.5.5.6. Reset Reader.

6.5.5.6.1. Command Transmission

This command performs a general reset to all readers at one time. In this command, the LSC does not prompt.

LSC > Reader

STX	#B	R#	CMND(0014h)	CRC	ETX	
1	2	2	2	2	1	*# of bytes*

6.5.5.6.2. Reset Reader Command Response

The following string is the response.

Reader > LSC

STX	#B	R#	MSGT(xx14h)	R_status	CRC	ETX	
1	2	2	2	2	2	*1*	*# of bytes*

6.5.5.7. Write Parameters

6.5.5.7.1. Command Transmission

This command enables modification of the parameter's value in the reader. Not all the parameters are available for modification. Please see Table 5.3 .

LSC > Reader

STX	#B	R#	CMND(0006h)	Data	CRC	ETX	
1	2	2	2	n	2	1	*# of bytes*

PAR1code	value	PAR2 code	value		PARm code	value	
1	i	1	k		1	l	*# of bytes*

6.5.5.7.2. Write Parameters Command Response

The following string is the response.

Reader > LSC

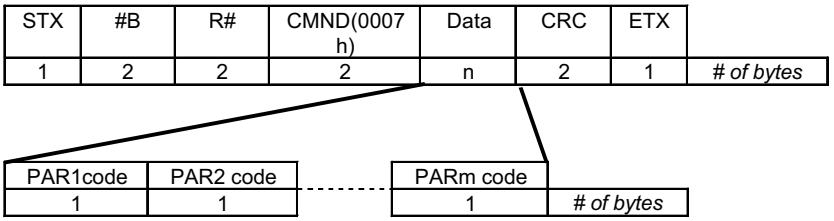
STX	#B	R#	MSGT(xx06h)	R_status	CRC	ETX	
1	2	2	2	2	2	*1*	*# of bytes*

6.5.5.8. Read Parameters.

6.5.5.8.1. Command Transmission

This command enables the reading of the parameter's value from the reader.

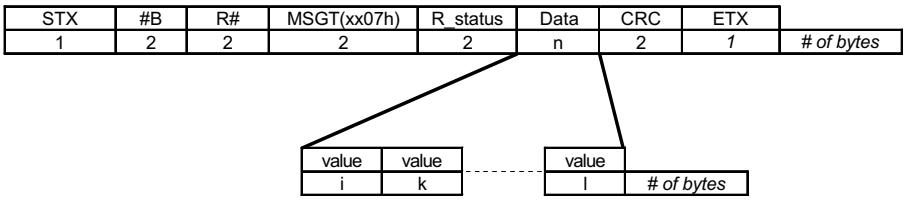
LSC > Reader



6.5.5.8.2. Read Parameters Command Response

The following string is the response.

Reader > LSC



6.5.5.9. BIT

6.5.5.9.1. Command Transmission.

This command generates a set of built-in test procedures.

LSC > Reader

STX	#B	R#	CMND(0009h)	CRC	ETX	
1	2	2	2	2	1	*# of bytes*

6.5.5.9.2. BIT Command Response.

The following string is the response.

Reader > LSC

STX	#B	R#	MSGT(xx09 h)	R_status	CRC	ETX	
1	2	2	2	4	2	*1*	*# of bytes*

6.5.5.10. Sleep.

6.5.5.10.1. Command Transmission

This command places the Reader in sleep mode of operation to save energy. The Wakeup command wakes the Reader from this mode.

LSC > Reader

STX	#B	R#	CMND(0008h)	CRC	ETX	
1	2	2	2	2	1	*# of bytes*

6.5.5.10.2. Sleep Command Response.

The following string is the response:

Reader > LSC

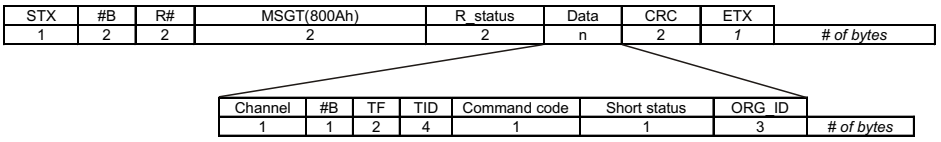
STX	#B	R#	MSGT(xx08h)	R_status	CRC	ETX	
1	2	2	2	2	2	*1*	*# of bytes*

6.5.5.11. Unsynchronized Reader Message.

6.5.5.11.1. Message Transmission

When in unsynchronized mode of operation the Reader may burst with a message. The following string will be received for each seal.

Reader > LSC



STX	#B	R#	MSGT(800Ah)	R_status	Data	CRC	ETX	
1	2	2	2	2	n	2	*1*	*# of bytes*

Channel	#B	TF	TID	Command code	Short status	ORG_ID	
1	1	2	4	1	1	3	*# of bytes*

ORG_ID is an option in the response. It depends on the seal's configuration.

6.5.5.11.2. Message Command Ack.

The following string is the response:

LSC > Reader

STX	#B	R#	CMND(000Ah)	CRC	ETX	
1	2	2	2	2	1	*# of bytes*

6.5.5.12. Get Reader's Baud Rate.

6.5.5.12.1. Command Transmision

This command places the Reader in a sleep mode of operation to save energy. The Reader will wakeup from this mode by receiving a Wakeup command.

LSC > Reader

STX	#B	R# (0000)	CMND (00ff h)	R_ID	CRC	ETX	
1	2	2	2	4	2	1	*# of bytes*

6.5.5.12.2. Get Reader's Baudrate Response.

The following string is the response:

Reader > LSC

STX	#B	R#	MSGT(80ff h)	R_ID	baudrate	CRC	ETX	
1	2	2	2	4	4	2	*1*	*# of bytes*

Baudrate: 2400, 4800, 9600, 19200, 38400

6.5.5.13 Set Reader's Baud Rate.

The baud rate is interpreted as a decimal number translated into a 32 bit binary number or vise-versa.

6.5.5.13.1. Command Transmission

This command puts the Reader in a sleep mode of operation to save energy. The Wakeup command wakes the Reader from this mode. The baudrate is updated after the completion of this command and receipt of the response.

LSC > Reader

STX	#B	R# (0000)	CMND (00fe h)	R_ID	baudrate	CRC	ETX	
1	2	2	2	4	4	2	1	*# of bytes*

6.5.5.13.2. Set Reader's Baud Rate Response.

The following string is the response:

Reader > LSC

STX	#B	R#	MSGT(80feh)	R_ID	baudrate	CRC	ETX	
1	2	2	2	4	4	2	*1*	*# of bytes*

6.5.5.14. Set Reader's Address

6.5.5.14.1. Command Transmission

This command sets the Reader's address for RS-485 communication purposes.

LSC > Reader

STX	#B	R#(0000)	CMND(0012h)	R_ID	New add	CRC	ETX	
1	2	2	2	4	2	2	1	*# of bytes*

* To modify an old address, the above command can be used with a specific Reader by specifying R# with the old address.

6.5.5.14.2. Set Reader's Address Response.

If the above command is a broadcast, there will be no response.

The following string is the response for a command transmission to a specific Reader.

Reader > LSC

STX	#B	R#	MSGT(xx12h)	R_status	CRC	ETX	
1	2	2	2	2	2	*1*	*# of bytes*

The R# is with the new address.

6.5.5.15 Acknowledge OK.

LSC > Reader

This string is a one-way string that acknowledges a positive message received from the READER.

LSC > Reader

STX	#B	R#	CMND(0092h)	CRC	ETX	
1	2	2	2	2	1	*# of bytes*

6.5.5.16. Acknowledge Failed.

LSC > Reader

This string is a one-way string that acknowledges a message indicating a problem coming from the READER.

LSC > Reader

STX	#B	R#	CMND (0094h)	CRC	ETX	
1	2	2	2	2	1	*# of bytes*

6.5.5.17. Save Command

6.5.5.17.1. Command Transmission

This command sends a command to the Reader for later execution by using the “Execute Saved Command”.

LSC > Reader

STX	#B	R#	CMND(000Fh)	data	CRC	ETX	
1	2	2	2		2	1	*# of bytes*

phase	CMND*	Data*	
1	2		*# of bytes*

Where:

Phase	is the duration from the end of the “Execute Saved Command” and the time required to execute the saved command. The phase is in units of 1.024 msec.
CMND*	is the command code of the saved command for delayed execution.
Data*	is the relevant data field for the CMND*

If data=0 this command will clear the saved command.

6.5.5.17.2. Save Command Response.

The following string is the response:

Reader > LSC

STX	#B	R#	MSGT(XX0Fh)	R_status	CRC	ETX	
1	2	2	2	2	2	*1*	*# of bytes*

6.5.5.18. Execute Saved Command

6.5.5.18.1. Command Transmission

This command executes the saved command.
This is a broadcast command sent to all readers.
There will be no response from any reader to this command.

LSC > Reader

STX	#B	R#	CMND(00017h)	data	CRC	ETX	
1	2	2	2	4*k	2	1	*# of bytes*

Reader ID [1]	Reader ID [2]	. . . . .	Reader ID [k]	
4	4		4	*# of bytes*

The data field details the readers by their IDs.

6.5.5.18.2. Execute Saved Command Response

There is no response for this command.

6.5.5.19. Read Channel Definitions Command

6.5.5.19.1. Command Transmission

This command allows the reading of the definitions for a device.

LSC > Reader

STX	#B	R#	CMND(0011h)	channel	CRC	ETX	
1	2	2	2	1	2	1	*# of bytes*

Where:

Channel is the channel number that the device is connected to. Channel can be 0 to indicate the MCU, or 1,2 etc for the other channels.

6.5.5.19.2. Read Channel Definitions Response.

The following string is the response:

Reader > LSC

STX	#B	R#	MSGT(XX11h)	file	CRC	ETX	
1	2	2	2	82	2	*1*	*# of bytes*

Where:

File is the data file that defines the device.
File structure is:

	Name	Size *[bytes]*
1	Part number	16
2	Serial number	16
3	Hardware Version	4
4	Production date	10
5	Production Batch number	4
5	Description	32
6	Reserved	45

The format is ASCII

6.5.5.20. Write Channel Definitions Command

6.5.5.20.1. Command Transmission

This command enables the writing of definitions of a device.

LSC > Reader

STX	#B	R#	CMND(0010h)	data	CRC	ETX	
1	2	2	2		2	1	*# of bytes*

channel	file	
1	82	*# of bytes*

Where:

Channel is the channel number that the device is connected to. Channel can be 0 to indicate the MCU, or 1,2 etc for the other channels.

File is the data file that defines the device.

6.5.5.20.2. Write Channel Definition Response

The following string is the response:

Reader > LSC

STX	#B	R#	MSGT(XX10h)	R_status	CRC	ETX	
1	2	2	2	2	2	*1*	*# of bytes*

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