cool-Log™

Command Set

Revision 1.0

1 Scope

This is detailed description of the cool-Log™ command set that is required for the IDS smart sensory tag products (SL13A, SL900A). The basic command set is same for all supported devices, with minor differences that are a consequence of the particular functions. For detailed description of the cool-Log™ implementation in sensory tag devices, please refer to the device specific cool-Log™ documentation:

- SL13A: IDS-SL13A-Cool-log.pdf
- SL900A: IDS-SL900A-AN6-Cool-log.pdf

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2 cool-Log Commands

Some commands can be password protected to prevent unauthorized modification of the chip parameters, settings and calibration.

#	COMMAND	COMMAND CODE	PASSWORD PROTECTED	DEFINITION
1	Set Password	0xA0	Write protection	Sets the passwords
2	Set Log Mode	0xA1	Write protection	Sets logging mode
3	Set Log Limits	0xA2	Write protection	Sets the measurement limits for limits logging mode
4	Get measurement setup	0xA3	Read protection	Reads 4 system blocks - Start time, Log limits, Log mode, and Delay time + application area size
5	Set external sensor parameters	0xA4	Write protection	Sets parameters/calibration for external sensors
6	Set Calibration Data	0xA5	Write protection	Sets the calibration data for the temperature sensor and timer
7	End Log	0xA6	Write protection	Stops the log procedure and returns the chip to Standby mode
8	Start Log	0xA7	Write protection	Starts the timer and the selected log procedure
9	Get Log State	0xA8	Read protection	Gets the log state of the chip
10	Get calibration data	0xA9	Read protection	Reads the internal and external calibration data
11	Get Battery level	0xAA	/	Measures the battery voltage
12	Set Shelf Life	0xAB	Write protection	Set the shelf life parameters
13	Initialize	0xAC	Write protection	Initializes the chip and sets the application area size and the logging delay
14	Get Sensor Value	0xAD	/	Measures the specified sensor
15	Open Area	0xAE	/	Opens access to the specified EEPROM area
16	Access FIFO	0xAF	/	Reads or writes the integrated FIFO register (for fast SPI to RFID data transfer or for I^2C master control)

Table 1: cool-Log™ Command Overview

The cool-Log™ command set has been designed in order to support the functionality of the IDS sensory tags. The command set supports data logging, sensor interfacing and password handling.

#	Command	Command Code	SL900A		SL13A	
			Name	Definition	Name	Definition
1	Set Password	0xA0	Set Password	Writes the System, Application or Measurement password to EEPROM	Set Password	Writes the System, User or Measurement password to EEPROM or password RAM
2	Set Log Mode	0xA1	Set Log Mode	Sets the logging mode	Set Log Mode	Sets the logging mode and the Extreme upper limit
3	Set Log Limits	0xA2	Set Log Limits	Sets the 4 logging limits (Extreme upper, Upper, Lower, Extreme Lower)	Set Log Limits	Sets 3 logging limits (Upper, Lower, Extreme lower)
4	Get measurement setup	0xA3	Get measurement setup	Reads the measurement setup (start time, log limits, log mode, delay time, application area size)	Get measurement setup	Reads the measurement setup (start time, log limits, log mode, delay time, user area size)
5	Set external sensor parameters	0xA4	Set SFE parameters	Sets parameters for the external sensor front end (sensor type, gain)	Set external calibration data	Writes 32-bit calibration data that can be used for external calibration (this value is not used internally in the device)
6	Set Calibration Data	0xA5	Set Calibration Data	Sets the calibration data for the temperature sensor, timer and reference voltages	Set internal calibration data	Sets the calibration data for the temperature sensor and timer
7	End Log	0xA6	End Log	Stops the logging procedure and returns the device to stand-by mode	Set passive	Stops the logging procedure and returns the device to stand-by mode
8	Start Log	0xA7	Start Log	Starts the logging procedure, writes the start time and refreshes the volatile calibration registers	Start log	Starts the logging procedure and writes the start time
9	Get Log State	0xA8	Get Log State	Reads the log state – measurement counter, memory pointer, logging flag, replacement counter, limit counters, shelf life parameters	Get Log State	Reads the log state – measurement counter, memory pointer, logging flag, replacement counter, limit counters
10	Get calibration data	0xA9	Get calibration data	Reads the calibration data and SFE parameters	Get calibration data	Reads the internal and external calibration data
11	Get Battery level	0xAA	Get Battery level	Measures the battery voltage, can optionally re-trigger the battery type detection	Get Battery level	Measures the battery voltage
12	Set Shelf Life	0xAB	Set Shelf Life	Sets all required parameters for dynamic shelf life calculation	Verify password	Verifies if the selected memory area is open
13	Initialize	0xAC	Initialize	Sets the application area size and the logging delay	Initialize	Sets the user area size and the logging delay
14	Get Sensor Value	0xAD	Get Sensor Value	Measures the specified sensor	Get temperature	Measures the temperature or external sensor
15	Open Area	0xAE	Open Area	Opens access to the specified EEPROM area	/	Not implemented
16	Access FIFO	0xAF	Access FIFO	Reads or writes the 8-byte FIFO register	/	Not implemented

Table 2: cool-Log™ implementation in the SL900A and SL13A devices

3 Password Policy

Passwords in cool-Log™ systems are stored in the system EEPROM memory. The password locations are write-only from the RFID interface, and read/write from the serial interface (SPI, I^2C, or whatever is implemented in the device).

Password protection is activated immediately after a non-zero password is written to the password memory. Access to the specified memory area is granted only after the RFID reader writes the correct password to the password RAM. Each time a command accesses data in a password protected memory area, the device performs a comparison between the password stored in the EEPROM and the content of the password RAM. Access is granted if the passwords match. The password RAM is a volatile memory that is cleared each time the chip leaves the RF field.

4 Command Description

4.1 Set password

The **SET PASSWORD** command sets the password for the specified memory area. The number of passwords and read or write protection depends on the specific implementation.

4.2 Set log mode

The **SET LOG MODE** command sets various parameters for the logging procedure: log interval, log form, sensor enable and storage rule.

4.3 Set log limits

The **SET LOG LIMITS** command write the 4 limits that are going to be used for logging measurement data. The limits are: Extreme upper limit, Upper limit, Lower limit and Extreme lower limit.

4.4 Get measurement setup

The **GET MEASUREMENT SETUP** command reads 4 system blocks - Start time, Log limits, Log mode, Delay time and Application data.

4.5 Set external sensor parameters

The **SET SFE PARAMETERS** command sets the parameters for the External sensor front end.

4.6 Set calibration cata

The **SET CALIBRATION DATA** command sets the calibration values for the internal temperature sensor, internal voltage references, timer oscillator and low voltage detection level.

WARNING – the factory preset calibration data can be overwritten. It is advised to read the calibration data, change only the required bits and write back with the **SET CALIBRATION DATA** command.

4.7 End log

The **END LOG** command stops the logging procedure and returns the chip to stand-by mode. It also stops the timer.

4.8 Start log

The **START LOG** command starts the logging procedure and sets the Start time in UTC format. In logging state the chips automatically performs the measurements and data logging in the specified time intervals. Supported is also a delayed start, which means that the chip will start with the logging procedure with a specified delay after it receives the **START LOG** command. This command also starts the Interrupt mode of operation where the measurements and data-logging are driven from external events.

4.9 Get log state

The **GET LOG STATE** command gets the log state of following parameters: measurement status and out of limits counter. This gives the ability to quickly check the state of the package without the need to read the whole temperature data log. It also optionally reads the shelf life parameters and the remaining shelf life.

4.10 Get calibration data

The **GET CALIBRATION DATA** command reads the calibration data for the internal and external sensors.

4.11 Get battery level

The **GET BATTERY LEVEL** command measures and reads the voltage level of the battery. It also optionally re-triggers the battery type detection (1.5V or 3V battery).

4.12 Set shelf life

The **SET SHELF LIFE** command writes the shelf life algorithm parameters and enables the dynamic shelf life calculation.

4.13 Initialize

The **INITIALIZE** command sets the size of the application data area, sets the delay time and the delay mode (timer or external switch). The command clears the measurement status and limits counter blocks.

4.14 Get sensor value

The **GET SENSOR VALUE** command measures and backscatters the value of the specified sensor – internal, external 1 or external 2.

4.15 Open area

The **OPEN AREA** command opens the specified area of the memory (System, Application, and Measurement). The password is stored in a RAM location and compared with the password in EEPROM. When the tag leaves the RF field this RAM location is cleared.

4.16 Access FIFO

The **ACCESS FIFO** command can read or write the 8-byte FIFO. The FIFO can also be accessed from the SPI so this command can be used for fast data transfer between a microcontroller connected to the SPI and an RFID reader.

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