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1 Firmware Description

The Door Sensor is a battery operated device and to preserve battery life goes to sleep quickly. Door Sensor must be awake when receiving commands to operate as expected.

1.1 INSTEON Commands Supported

1.1.1 Standard length common INSTEON commands:

All direct commands will be ignored if the sender's ID is not in the I2CS device's database with the exceptions below. The Door Sensor will reply with a NAK and 0xFF in cmd2 to indicate that the ID is not in the database.

Assign to ALL-Link Group Command

Description: Sent when holding down the SET Button for 3 seconds on the device. Blinks the LED green for 4 minutes or until linked to another device.

Example (Hex): AA BB CC XX YY ZZ CF 01 DD (where AA.BB.CC is the Door Sensor's ID)

SD Command	Message Direction	From Address (3 bytes)	To Address (3 bytes)	Message type	Cmd1 (1 byte)	Cmd2 (1 byte)	Notes
Assign to ALL-Link Group	From Device	Device's ID	0xxx (DevCat), 0yyy (SubCat), 0zzz (firmware revision)	Broadcast	0x02 (Controller only)	0xDD (hardware revision)	Sent when holding down SET Button for 3 seconds. Group number for Door Sensor is 0x01

Delete from ALL-Link Group Command

Description: Blinks the LED red for 4 minutes or until unlinked from another device.

Example (Hex): AA BB CC XX XX XX CF 02 01 (where AA.BB.CC is the Door Sensor's ID)

Delete from ALL-Link Group	From Device	Device's ID	0xxx (DevCat), 0yyy (SubCat), 0zzz (firmware revision)	Broadcast	0x02	0xDD (hardware revision)	Group number for Door Sensor is 0x01
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INSTEON Engine Version Command

Description: Returns the INSTEON Engine version in the acknowledgement.

INSTEON Engine Version	To device	Sender's ID	Device's ID	Direct	0x0D	0x00	
	Response	Device's ID	Sender's ID	Ack	0x0D	0x02	Indicate i2CS engine version

Ping Command

Description: Returns the exact same message with an acknowledgement.

Ping	To device	Sender's ID	Device's ID	Direct	0x0F	0x00 -> 0xFF (Don't Care Value)	
	Response	Device's ID	Sender's ID	Ack	0x0F	Same as sent	

ID Request Command

Description: Same as holding down the SET Button for 3 seconds on the device, but without going into linking mode

Example (Hex): AA BB CC DD EE FF 0F 0A 01 (where DD.EE.FF is the Sender's ID, AA.BB.CC is the Device's Id)

SD Command	Message Direction	From Address (3 bytes)	To Address (3 bytes)	Message type	Cmd1 (1 byte)	Cmd2 (1 byte)	Notes
ID Request	To device	Sender's ID	Device's ID	Direct	0x10	0x00 -> 0xFF (Don't Care Value)	
	Response	Device's ID	Sender's ID	Ack	0x10	Same as sent	
	Sent from Device	Device's ID	0xXX (DevCat), 0xYY (SubCat), 0xZZ (firmware revision)	Broadcast	0x02 (Controller Only)	0xDD (hardware revision)	Same as holding down SET Button for 3 seconds, but device not in linking mode

Success Report Broadcast

Description: Sent at the end of a group broadcast

Example (Hex): AA BB CC 11 03 01 CF 06 01 (where AA.BB.CC is the Device's ID, cleanup of cmd1 = 0x11, group = 0x01, 1 out of 3 devices failed to cleanup correctly)

SD Command	Message Direction	From Address (3 bytes)	To Address (3 bytes)	Message type	Cmd1 (1 byte)	Cmd2 (1 byte)	Notes
Broadcast cleanup	To device	Sender's ID	Hi byte = cmd1 being Cleaned up Med byte = Number of devices to be cleaned up Lo byte = Group Number	Group Broadcast	0x06	0x00 -> 0xFF (Number of Failed Cleanups)	

SD Command	Message Direction	From Address (3 bytes)	To Address (3 bytes)	Message type	Cmd1 (1 byte)	Cmd2 (1 byte)	Notes
Status Request	To device	Sender's ID	Device's ID	Direct	0x19	Status Request Command	See Read Operating Flags Table
	Response	Device's ID	Sender's ID	Ack	0x19	Same as sent	

Read Operating Flags Table

0	ACK of this command has the status of end button (Open=FF/Closed=00) in Cmd2 and Database Delta in Cmd1
1	ACK of this command has battery level in Cmd2. Measurements showed: 61=1.75V, 54=1.6V, 51=1.5V, 40=1.25V (Low Battery)

1.1.2 Standard length Door Sensor INSTEON commands:

SD Command	Message Direction	From Address (3 bytes)	To Address (3 bytes)	Message type	Cmd1 (1 byte)	Cmd2 (1 byte)	Notes
Door Sensor – Entering Open State	From Device	Device's ID	0x00 0x00 0x01	Broadcast	0x11	0x01	

Door Sensor – Entering Closed State	From Device	Device's ID	0x00 0x00 0x01	Broadcast	0x13	0x01	
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Heartbeat	From Device	Device's ID	0x00 0x00 0x04	Broadcast	0x11 = open; 0x13 = closed	0x04	
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Heartbeat is sent about once every 24 hours by default or sent at whatever interval set to. There must be a link in Group 4 for Hidden Door Sensor to send this message.

Low Battery	From Device	Device's ID	0x00 0x00 0x03	Broadcast	0x11 = open; 0x13 = closed	0x03	
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Low Battery is sent once every time device wakes up if battery is low. There must be a link in Group 3 for Hidden Door Sensor to send this message.

SD Command	Message Direction	From Address (3 bytes)	To Address (3 bytes)	Message type	Cmd1 (1 byte)	Cmd2 (1 byte)	Notes
Read Operating Flags	To device	Sender's ID	Device's ID	Direct	0x1F	Operating Flags Command	See Read Operating Flags Table
	Response	Device's ID	Sender's ID	Ack	0x1F	Same as sent	

Read Operating Flags Table	
	bit 0 = Do Cleanup Report bit 1 = 2 Groups bit 2 = Repeat Open bit 3 = Repeat Closed bit 4 = Link to FF Group bit 5 = LED Disable bit 6 = N/A bit 7 = Programming Lock
0	bit 7 = Programming Lock
1	Data Base Delta flag....gets incremented with any change in the Database

1.1.3 Extended length Door Sensor INSTEON commands:

Remote Enter Linking Mode Command

Description: Same as holding down the SET Button for 3 seconds on the device. Blinks the LED green for 4 minutes or until linked to another device. Hidden Door Sensor is a Controller only, therefore it must be put into linking mode first.

Extended Command	Message Direction	From Address (3 bytes)	To Address (3 bytes)	Message type	Cmd1 (1 byte)	Cmd2 (1 byte)	Data 1 (1 byte)	Data 2 (1 byte)
Enter Linking Mode	To device	Sender's ID	Device's ID	Extended Direct	0x09	Group Number	0x00	See Extended Enter Linking mode Info
	Response	Device's ID	Sender's ID	Ack	0x09	Same as sent		
	Sent from Device	Device's ID	0xXX (DevCat), 0xYY (SubCat), 0xZZ (firmware revision)	Broadcast	0x02 (Controller Only)	0xDD (hardware revision)	Same as holding down SET Button for 3 seconds	Same as holding down SET Button for 3 seconds

Extended Enter Linking mode Info									
Data 2 (1 byte)	Data 3	Data 4 (1 byte)	Data 5	Data 6	Data 7	Data 8	Data 9	...	Data 14
0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00		Checksum (0xF6, for group 1 in cmd2)

Remote Exit Linking Mode Command

Description: Same as tapping Set Button twice to exit Linking Mode

Example (Hex): DD EE FF AA BB CC 0F 08 01 (where DD.EE.FF is the Sender's ID, AA.BB.CC is the Device's ID)

Extended Command	Message Direction	From Address (3 bytes)	To Address (3 bytes)	Message type	Cmd1 (1 byte)	Cmd2 (1 byte)	Data 1 (1 byte)	Data 2 (1 byte)
Exit Linking Mode	To device	Sender's ID	Device's ID	Extended Direct	0x08	0x00 -> 0xFF (Don't Care Value)	0x00	See Extended Exit Linking mode Info
	Response	Device's ID	Sender's ID	Ack	0x08	Same as sent		

Extended Enter Unlinking mode Info									
Data 2 (1 byte)	Data 3	Data 4 (1 byte)	Data 5	Data 6	Data 7	Data 8	Data 9	...	Data 14
0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00		Checksum (0xF5, for group 1 in cmd2)

Extended Command	Message Direction	From Address (3 bytes)	To Address (3 bytes)	Message type	Cmd1 (1 byte)	Cmd2 (1 byte)	Notes
Set Operating Flags	To device	Sender's ID	Device's ID	Extended Direct	0x20	Operating Flags Command	See Set Operating Flags Table below Data 14 to contain Checksum
	Response	Device's ID	Sender's ID	Ack	0x20	Same as sent	

Set Operating Flags Table	
00	Programming lock On... No P&H Linking
01	Programming lock off
02	LED OFF
03	LED ON
04	Two Groups. Group1 ON Group2 ON
05	One Group
06	Link to ALL (FF in database group). One Link with FF and it's automatically in all groups OPEN/CLOSED/BATTERY LOW/HEARTBEAT
07	Link to one
08	Repeat Closed. Send a closed message every 5 minutes for 50 minutes
09	Don't Repeat Closed

0A	Repeat Open Send a closed message every 5 minutes for 50 minutes
0B	Don't Repeat Open
16	Cleanup Report OFF
17	Cleanup Report ON
18	Stay awake On (Uses FF for the awake interval)
19	Stay awake Off

Extended Command	Message Direction	From Address (3 bytes)	To Address (3 bytes)	Message type	Cmd1 (1 byte)	Cmd2 (1 byte)	Data 1 (1 byte)	Data 2 (1 byte)
Get for Group/Button	To device	Sender's ID	Device's ID	Extended Direct	0x2E	0x00	0x00-> 0xFF Group/Button#	
	Response	Device's ID	Sender's ID	Ack	0x2E	Same as sent	Same as sent	
	Sent from Device	Device's ID	0x01 0xXX 0xXX (firmware revision)	Broadcast	0x01 (Group # for Door Sensor)	0x00	Same as sent	See Get for Group/Button Info

Get for Group/Button Info					
Data 2	Data 3	Data 4 (1 byte)	Data 5 (1 byte)	Data 6 (1 byte)	Data 7 (1 byte)
0x01	Operating Flag Byte	0x61 -> 0x27 (Battery Level to indicate low voltage. Some examples: [61=~1.75v 54=~1.6 51=~1.5 40=~1.25(default low battery)] All voltage levels are approximate values.)	Sensor Status (FF=Closed, 00= Open)	Heart Beat Interval	Battery Low Level

Extended Command	Message Direction	From Address (3 bytes)	To Address (3 bytes)	Message type	Cmd1 (1 byte)	Cmd2 (1 byte)	Data 1 (1 byte)	Data 2 (1 byte)
Set Heartbeat Interval	To device	Sender's ID	Device's ID	Extended Direct	0x2E	0x00	0x00 -> 0xFF (Group/Button)	See Set Heartbeat Interval Info
	Response	Device's ID	Sender's ID	Standard Ack	0x2E	0x00	N/A	N/A

Set Heartbeat Interval Info

Data 2 (1 byte)	Data 3	Data 4	Data 5	Data 6	Data 7	Data 8	Data 9	...	Data 14
0x02	0x00 -> 0xFF (5 minute intervals for Heartbeat; 1 would be Heartbeat every 5 minutes; FF would be 255 x 5 min.; 0x00 = 24 Hr.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Checksum

Extended Command	Message Direction	From Address (3 bytes)	To Address (3 bytes)	Message type	Cmd1 (1 byte)	Cmd2 (1 byte)	Data 1 (1 byte)	Data 2 (1 byte)
Set Low Battery Level	To device	Sender's ID	Device's ID	Extended Direct	0x2E	0x00	0x00 -> 0xFF (Group/Button)	See Set Low Battery Level Info
	Response	Device's ID	Sender's ID	Standard Ack	0x2E	0x00	N/A	N/A

Set Low Battery Level Info

Data 2 (1 byte)	Data 3	Data 4	Data 5	Data 6	Data 7	Data 8	Data 9	...	Data 14
0x03	Low Battery Level (Default is 0x40=1.25V. All voltage levels for Low Battery are approximate values.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Checksum

Extended Command	Message Direction	From Address (3 bytes)	To Address (3 bytes)	Message type	Cmd1 (1 byte)	Cmd2 (1 byte)	Data 1 (1 byte)	Data 2 (1 byte)
Get Database	To device	Sender's ID	Device's ID	Extended Direct	0x2F	0x00	0x00 -> 0xFF (Don't Care Value)	See Get Database Info
	Response	Device's ID	Sender's ID	Standard Ack	0x2F	0x00	N/A	N/A
	From device	Device's ID	Sender's ID	Extended Direct	0x2F	0x00	Same as sent	See Returned Extended Get Database

									Info
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Get Database Info									
Data 2 (1 byte)	Data 3	Data 4	Data 5	Data 6	Data 7	Data 8	Data 9	Data 10	Data 11
0x00	0x00 -> 0xFF (Hi Byte Address)	0x00 -> 0xFF (Lo Byte Address)	0x00 -> 0xFF (# of Records, 0x00 dumps all records)	N/A	N/A	N/A	N/A	N/A	N/A

Returned Extended Get Database Info (will continue to be sent until # of records is sent or until the first never been used record is sent)									
Data 2 (1 byte)	Data 3	Data 4 (1 byte)	Data 5	Data 6	Data 7	Data 8	Data 9	...	Data 13
0x01	0x00 -> 0xFF (Hi Byte Address)	0x00 -> 0xFF (Lo Byte Address)	0x00	Byte 1 of record	Byte 2 of record	Byte 3 of record	Byte 4 of record		Byte 8 of record

Extended Command	Message Direction	From Address (3 bytes)	To Address (3 bytes)	Message type	Cmd1 (1 byte)	Cmd2 (1 byte)	Data 1 (1 byte)	Data 2 (1 byte)
Set Database	To device	Sender's ID	Device's ID	Extended Direct	0x2F	0x00	0x00 -> 0xFF (Don't Care Value)	See Set Database Info
	Response	Device's ID	Sender's ID	Standard Ack	0x2F	0x00	N/A	N/A

Set Database Info									
Data 2 (1 byte)	Data 3	Data 4 (1 byte)	Data 5	Data 6	Data 7	Data 8	Data 9	Data 13	Data 14
0x02	0x00 -> 0xFF (Hi Byte Address)	0x00 -> 0xFF (Lo Byte Address)	0x01 -> 0x08 (# of bytes to write, over 0x08 is an error and ignored)	Byte 1 of data	Byte 2 of data	Byte 3 of data	Byte 4 of data	Byte 8 of data	Checksum

Checksum Information

For Set Database, Set Properties and 0x20, Data14 will contain a 2s compliment of cmd1 through 2nd to last data record in the last data record.

Example of Checksum:

01 02 03 04 05 06 1F 2F 00 01 02 0F FF 08 E2 01 08 B6 EA 00 1B 01 11
From 01.02.03 to 04.05.06
a record at 0FFF (A valid boundary)
08 bytes a record that 04.05.06 will control
Group 1 the responder is 08.B6.EA (00 1B 01 DNC)
11 is the check sum

Int	Hex	
47	2F	
0	00	
1	01	
2	02	
15	0F	
255	FF	
8	08	
226	E2	
1	01	
8	08	
182	B6	
234	EA	
0	00	
27	1B	
1	01	
1007	3EF	Sum
	10	Compliment (Last byte)
	11	Add 1

Memory Map

All-Link Database (AL /L) Overview

The AL /L starts at the top of external (serial) EEPROM and grows downward. In the Micro Module Shutter, top of memory is 0x0FFF. Each AL /L Record is 8 bytes long, so the first record starts at 0x0FF8, the second record starts at 0x0FF0, and so on down to 0x0300 for a total of 416 links. In what follows, the 3-byte INSTEON Address contained in a record is called the *Device ID* or sometimes just the *ID*. The high byte (MSB) of the Device ID is *ID2*, the middle byte is *ID1*, and the low byte (LSB) is *ID0*.

Micro Module Shutter External EEPROM Structure Overview

Location		Comments
0x0FF8	0xA2 01 AA BB CC FF FE 00	All-Link Database Record
0x0FF0		
0x0FD8		
.....		
0x0300		Last Record, 416 total links allowed
0x02XX	N/A	Addressing below 0x0300 is ignored by database

AL /L Record Format

Micro Module Shutter AL Record Format

Database entries with Record Control Bit 6: 0 = Responder and Group 1 will control the local load.

Linear ALL-Link Database (AL /L) Record Format		
Field	Length (bytes)	Description
Record Control	1	Record Control Flag Bits: Bit 7: 1 = Record is in use, 0 = Record is available Bit 6: 1 = Controller (Master) of Device ID, 0 = Responder to (Slave of) Device ID Bit 5: Not used Bit 4: Not used Bit 3: Not used Bit 2: Not used Bit 1: 1 = Record has been used before, 0 = 'High-water Mark' Bit 0: Not used
Group	1	ALL-Link Group Number this Device ID belongs to
ID	3	Device ID (ID2, ID1, ID0 in that order)
Data 1	1	Not used
Data 2	1	Not used
Data 3	1	Not used

To add a record to an AL /L, you search for an existing record that is marked available. (Available means the same as empty, unused or deleted.) If none is available, you create a new record at the end of the AL /L.

An unused record will have bit 7 of the *Record Control* byte set to zero. The last record in an AL /L will have bit 1 of the *Record Control* byte set to zero.

Overwriting an Empty AL /L Record

If you found an empty record, you simply overwrite it with your new record data.

Change bit 7 of the *Record Control* byte from zero to one to show that the record is now in use.

Set bit 6 of the *Record Control* byte to one if the device containing the AL /L is an INSTEON Controller of the INSTEON Responder Device whose *ID* is in the record. If instead the device containing the AL /L is an INSTEON Responder to the INSTEON Controller Device whose *ID* is in the record, then clear bit 6 of the *Record Control* byte to zero. In other words, within an AL /L, setting bit 6 means "I'm a Controller," and clearing bit 6 means "I'm a Responder."

Put the ALL-Link Group number in the *Group* field, and put the *Device ID* in the *ID* field. Finally, set the *Data 1*, *Data 2*, and *Data 3* fields appropriately for the *Record Class* you are storing.

Creating a New AL /L Record

To create a new record at the end of the AL /T, find the record with bit 1 of the *Record Control* byte set to zero, indicating that it is the last record in the AL /L. Flip that bit to one.