

# Developer Notes

## SwitchLinc 2-Wire Dimmer (RF Only)

(2474DWH - Dev 0x01 / Sub 0x24)

**Version 003**  
**April 23, 2012**

<b>Revision History</b>
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Rev	Date	Comments
001	1/27/12	Initial Release
002	2/20/12	Added I2CS commands.
002	2/29/12	Added comments to on level and ramp rate
003	4/23/12	Updated property read/write commands

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# 1 Firmware Description

## 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 SwitchLinc 2-Wire Dimmer will reply with a NAK and 0xFF in cmd2 to indicate that the ID is not in the database.

### 1.1.2 Standard length 2 Wire Dimmer INSTEON commands:

#### 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 01 24 XX CF 01 01 (where 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
<b>Assign to ALL-Link Group</b>	From Device	Device's ID	0x01, 0x24, 0xFF (firmware revision)	Broadcast	0x01	0x01	Sent when holding down SET Button for 3 seconds. Group number for 2 Wire Dimmer is 0x01

#### Delete from ALL-Link Group Command

Description: Sent when holding down the SET Button for 3 seconds on the device, then pressing and holding the set button for 3 seconds. Blinks the LED red for 4 minutes or until unlinked from another device.

Example (Hex): AA BB CC 01 24 XX CF 02 01 (where AA.BB.CC is the Device's ID)

<b>Delete from ALL-Link Group</b>	From Device	Device's ID	0x01, 0x24, 0xFF (firmware revision)	Broadcast	0x02	0x01	Group number for 2 Wire Dimmer is 0x01
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#### Ping Command

Description: Same as holding down the SET Button for 3 seconds on the device, then pressing and holding the set button for 3 seconds. Blinks the LED red for 4 minutes or until unlinked from another device.

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

<b>Ping</b>	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, then pressing and holding the set button for 3 seconds. Blinks the LED red for 4 minutes or until unlinked from another device.

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

<b>ID Request</b>	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	0x01 0x24 0xFF (firmware revision)	Broadcast	0x01	0x00	Same as holding down SET Button for 3 seconds, but device not in linking mode

SD Command	Message Direction	From Address (3 bytes)	To Address (3 bytes)	Message type	Cmd1 (1 byte)	Cmd2 (1 byte)	Notes
<b>Status Request</b>	To device	Sender's ID	Device's ID	Direct	0x19	0x00	
	Response	Device's ID	Sender's ID	Ack	Database Delta	Switch On level	

**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
<b>Broadcast cleanup</b>	From device	Device'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)	

Standard length 2 Wire Dimmer INSTEON commands:

SD Command	Message Direction	From Address (3 bytes)	To Address (3 bytes)	Message type	Cmd1 (1 byte)	Cmd2 (1 byte)	Notes
<b>Light ON</b>	To device	Sender's ID	Device's ID	Direct	0x11	0x00 -> 0xFF (on level)	Go to On-Level
	Response	Device's ID	Sender's ID	Ack	0x11	Same as sent	

<b>Light ON Fast</b>	To device	Sender's ID	Device's ID	Direct	0x12	0x00 -> 0xFF (on level)	Go to On-Level instantly
	Response	Device's ID	Sender's ID	Ack	0x12	Same as sent	

<b>Light OFF</b>	To device	Sender's ID	Device's ID	Direct	0x13	0x00 -> 0xFF (on level)	Go to Off at saved Ramp Rate
	Response	Device's ID	Sender's ID	Ack	0x13	Same as sent	

<b>Light OFF Fast</b>	To device	Sender's ID	Device's ID	Direct	0x14	0x00 -> 0xFF (Don't Care Value)	Go to Off instantly
	Response	Device's ID	Sender's ID	Ack	0x14	Same as sent	

SD Command	Message Direction	From Address (3 bytes)	To Address (3 bytes)	Message type	Cmd1 (1 byte)	Cmd2 (1 byte)	Notes
<b>Read Operating Flags</b>	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	
0	bit 0 = Plock bit 1 = LED on TX bit 2 = Resume Dim bit 3 = N/A bit 4 = LED OFF bit 5 = LoadSense
1	Data Base Delta flag...gets incremented with any change in the Database
2	N/A
3	N/A
4	N/A
5	bit 0 = TenD bit 1 = NX10Flag bit 2 = blinkonError bit 3 = CleanupReport On bit 4 = CS on Database/Property writes bit 5 = BigHoldOff bit 6 = IA start hops

SD Command	Message Direction	From Address (3 bytes)	To Address (3 bytes)	Message type	Cmd1 (1 byte)	Cmd2 (1 byte)	Notes
<b>Instant On/Off</b>	To device	Sender's ID	Device's ID	Direct	0x21	0x00 -> 0xFF (on level)	Uses instant Ramp Rate
	Response	Device's ID	Sender's ID	Ack	0x21	Same as sent	
<b>Remote Tap of Set Button</b>	To device	Sender's ID	Device's ID	Direct	0x25	0x00 = Set On Level, 0x02 = Set RR	Load must first be set to corresponding On Level (0x11)
	Response	Device's ID	Sender's ID	Ack	0x25	Same as sent	
<b>RR On</b>	To device	Sender's ID	Device's ID	Direct	0x2E	On level = 16*On + 0F RR = 2*RR+1	
	Response	Device's ID	Sender's ID	Ack	0x2E	Same as sent	
<b>RR Off</b>	To device	Sender's ID	Device's ID	Direct	0x2F	On level = 00 RR = 2*RR+1	
	Response	Device's ID	Sender's ID	Ack	0x2F	Same as sent	
<b>Beep</b>	To device	Sender's ID	Device's ID	Direct	0x30	0x00 -> 0xFF (Don't care value)	Beeps for standard duration (same as Set Button Pressed)
	Response	Device's ID	Sender's ID	Ack	0x30	Same as sent	

### 1.1.3 Extended length 2 Wire Dimmer INSTEON commands:

#### Remote Enter Linking Mode Command

Description: Same as holding down the SET Button for 3 seconds on the device. Blinks the LED red for 4 minutes or until unlinked from another device.

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	0x00 -> 0xFF (Don't Care Value; Always enter group 0x01 linking)	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	0x02 0x2A 0xXX (firmware revision)	Broadcast	0x01	0x00	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 Enter Unlinking Mode Command**

Description: Same as holding down the SET Button for 3 seconds on the device, then pressing and holding the set button for 3 seconds. Blinks the LED red for 4 minutes or until unlinked from another device.

Example (Hex): DD EE FF AA BB CC 0F 0A 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)
<b>Enter Unlinking Mode</b>	To device	Sender's ID	Device's ID	Extended Direct	0x0A	0x00 -> 0xFF (Don't Care Value; Always enter group 0x01 linking)	0x00	See Extended Enter Unlinking mode Info
	Response	Device's ID	Sender's ID	Ack	0x0A	Same as sent		
	Sent from Device	Device's ID	0x02 0x2A 0xXX (firmware revision)	Broadcast	0x01	0x00	Same as holding down SET Button for 3 seconds	Same as holding down SET Button for 3 seconds

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
<b>Set Operating Flags</b>	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	
0	Programming lock On
1	<b>Programming lock off</b>
2	LED on with Insteon TX
3	LED off with Insteon TX
4	Resume Dim On
5	<b>Resume Dim Off</b>
6	N/A
7	N/A
8	Led Off
9	<b>Led On</b>
0A	KeyBeep On
0B	<b>KeyBeep Off</b>
0C	LED on with Insteon TX
0D	LED off with Insteon TX
0E	Resume Dim On
0F	<b>Resume Dim Off</b>
10	N/A
11	N/A
12	Disable X10
13	<b>Enable X10</b>
14	<b>Error Blink off</b>
15	Error Blink on
16	<b>Cleanup Report is off</b>
17	Cleanup Report is on
18	N/A
19	N/A
1A	N/A
1B	N/A
1C	N/A
1D	N/A

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)	0x00
	Response	Device's ID	Sender's ID	Standard Ack	0x2E	0x00	N/A	N/A
	From device	Device's ID	Sender's ID	Extended Direct	0x2E	0x00	Same as sent	See Returned Extended Get Message Info

Returned Extended Get Message Info									
Data 2 (1 byte)	Data 3	Data 4	Data 5	Data 6	Data 7	Data 8	Data 9	Data 10	Data 14
0x01	N/A	N/A	N/A	N/A	Ramp Rate	On-Level	LED brightness	N/A	N/A

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 for Ramp Rate	To device	Sender's ID	Device's ID	Extended Direct	0x2E	0x00	<b>0x00 (other values are ignored)</b>	See Set Ramp Rate Info
	Response	Device's ID	Sender's ID	Standard Ack	0x2E	0x00	N/A	N/A

Set Ramp Rate Info									
Data 2 (1 byte)	Data 3	Data 4	Data 5	Data 6	Data 7	Data 8	Data 9	Data 10	Data 14
0x05	0x00 -> 0x1F (Ramp Rate)	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 for On Level	To device	Sender's ID	Device's ID	Extended Direct	0x2E	0x00	<b>0x00 (other values are ignored)</b>	See Set On Level Info
	Response	Device's ID	Sender's ID	Standard Ack	0x2E	0x00	N/A	N/A

Set On Level Info									
Data 2 (1 byte)	Data 3	Data 4	Data 5	Data 6	Data 7	Data 8	Data 9	Data 10	Data 14
0x06	0x00 -> 0xFF	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Checksum

	(On Level)								
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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)
<b>Set for LED Brightness</b>	To device	Sender's ID	Device's ID	Extended Direct	0x2E	0x00	0x00	See Set LED Brightness Info
	Response	Device's ID	Sender's ID	Standard Ack	0x2E	0x00	N/A	N/A

<b>Set LED Brightness Info</b>									
Data 2 (1 byte)	Data 3	Data 4	Data 5	Data 6	Data 7	Data 8	Data 9	Data 10	Data 14
0x07	0x11 -> 0x7F  (LED brightness,  0x11 = least bright,  0x7F = most bright)	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

Get Database Info									
Data 2 (1 byte)	Data 3	Data 4	Data 5	Data 6	Data 7	Data 8	Data 9	Data 10	Data 14
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 14
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

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)
Trigger Group	To device	Sender's ID	Device's ID	Extended Direct	0x30	0x00	0x00 -> 0xFF (Group/Button)	See Trigger Group Info
	Response	Device's ID	Sender's ID	Standard Ack	0x30	0x00	N/A	N/A

Trigger Group Info									
Data 2 (1 byte)	Data 3	Data 4 (1 byte)	Data 5	Data 6	Data 7	Data 8	Data 9	...	Data 13
0x00 = use local On-Level, 0x01 = use Data 3 Level (Note: The Command to the group is not parsed, so if you want the local load to go off, you must set data2 to 1 and data3 to 0)	0x00 -> 0xFF (On-Level if data2 = 0x01)	Cmd1	Cmd2	0x00 = local Ramp Rate, 0x01 = instant Ramp Rate	N/A	N/A	N/A		N/A

### 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

## 1.2 Memory Map

### 1.2.1 All-Link Database (AL /L) Overview

The AL /L starts at the top of external (serial) EEPROM and grows downward. In the SwitchLinc 2-Wire Dimmer, 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*.

### 1.2.2 SwitchLinc 2-Wire Dimmer 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

### 1.2.3 AL /L Record Format

SwitchLinc 2-Wire Dimmer 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.

#### **1.2.4 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.

#### **1.2.5 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.