Developer Notes

In-Line 0-10VDC Dimmer or Dual-Switch, Dual-Band

(2475DA2 - Dev 0x01 / Sub 0x25)

Version 007

October 18, 2013

Revision History		

Rev	Date	Comments
001	1/27/12	Initial Release
002	2/10/12	Added I2CS commands.
003	7/03/12	Updated command list
004	4/18/13	Updated Commands
005	6/19/13	Updated Commands
006	7/15/13	Updated Commands
007	10/18/13	Updated Commands (Light On-Relay Direct Control Mode, Light Off-Relay Direct Control Mode, Set Operating Flags, Get for Group/Button 1). Added Get for Group/Button 2 Command. Added Set Engine Level Max Retries Command. Added Ballast Dimmer Voltage by Dim Level Table. Updated AL/L Record Format

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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 0-10VDC Dimmer 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 Device'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), 0xYY (SubCat), 0xZZ (firmware revision)	Broadcast	0x01	0xDD (hardware revision)	Sent when holding down SET Button for 3 seconds. Group number for 277V 0-10VDC Dimmer load 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 YY ZZ CF 02 DD (where AA.BB.CC is the Device's ID)

Delete from ALL-Link Group	From Device	Device's ID	0xXX (DevCat), 0xYY (SubCat), 0xZZ (firmware revision)	Broadcast	0x02	0xDD (hardware revision)	Group number for 277V 0-10VDC Dimmer load is 0x01

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)

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, 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)

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	0x01	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)	

Standard length 277V 0-10VDC Dimmer INSTEON commands:

SD Command	Message Direction	From Address (3 bytes)	To Address (3 bytes)	Message type	Cmd1 (1 byte)	Cmd2 (1 byte)	Notes
Light ON (Relay Direct Control mode)	To device	Sender's ID	Device's ID	Direct	0x11	0xXXX (where if bit 0 is set, relay1 goes On and if bit 1 is set, relay2 goes On	
	Response	Device's ID	Sender's ID	Ack	0x11	Same as sent	

Light ON (Dimmer mode)	To device	Sender's ID	Device's ID	Direct	0x11	0x00->0xFF = On-Level	Go to On-Level at saved Ramp Rate
	Response	Device's ID	Sender's ID	Ack	0x11	Same as sent	

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

Light OFF (Relay Direct Control Mode)	To device	Sender's ID	Device's ID	Direct	0x13	0xXX (where if bit 0 is set, relay1 goes Off and if bit 1 is set, relay2 goes Off	Go to Off at saved Ramp Rate (Dimmer Only)
	Response	Device's ID	Sender's ID	Ack	0x13	Same as sent	

Light OFF (Dimmer Mode)	To device	Sender's ID	Device's ID	Direct	0x13	0x00 -> 0xFF (Don't Care Value)	Go to Off at saved Ramp Rate
	Response	Device's ID	Sender's ID	Ack	0x13	Same as sent	

Light OFF Fast	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	

Bright	To device	Sender's ID	Device's ID	Direct	0x15	0x00 -> 0xFF	Brighten one step. 16 steps total
	Response	Device's ID	Sender's ID	Ack	0x15	Same as sent	

Dim	To device	Sender's ID	Device's ID	Direct	0x16	0x00 -> 0xFF	Dim one step. 16 steps total
	Response	Device's ID	Sender's ID	Ack	0x16	Same as sent	

Start Manual Change	To device	Sender's ID	Device's ID	Direct	0x17	0x00 = Down 0x01 = Up	Start bright or dim
	Response	Device's ID	Sender's ID	Ack	0x17	Same as sent	

Stop Manual Change	To device	Sender's ID	Device's ID	Direct	0x18	0x00 -> 0xFF	
	Response	Device's ID	Sender's ID	Ack	0x18	Same as sent	

SD Command	Message Direction	From Address (3 bytes)	To Address (3 bytes)	Message type	Cmd1 (1 byte)	Cmd2 (1 byte)	Notes
Beep	From device	Device's ID		Direct	0x30	0x00 -> 0xFF (Don't Care Value)	Beep once, same as the press button beep sound
	Response	Device's ID	Sender's ID	Ack	0x30	Same as sent	

1.1.2 Extended length 277V 0-10VDC Dimmer INSTEON commands:

Enter Linking Mode Command

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

Enter Linking Mode	To device	Sender's ID	Device's ID	Extended	0x09	0x00 -> 0xFF (Group Number)	Data14 contains Checksum
	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	0x01	0xDD (hardware revision)	Same as holding down SET Button for 3 seconds

Enter Unlinking Mode Command

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

Enter Unlinking Mode	To device	Sender's ID	Device's ID	Extended	0x0A	0x00 -> 0xFF (Don't Care Value)	Data14 contains Checksum
	Response	Device's ID	Sender's ID	Ack	0x0A	Same as sent	
	Sent from Device	Device's ID	0xXX (DevCat), 0xYY (SubCat), 0xZZ (firmware revision)	Broadcast	0x01	0xDD (hardware revision)	Same as holding down SET Button for 3 seconds and then holding down the SET Button for 3 seconds again.

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 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

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	
0	bit 0 = Plock bit 1 = LED Blink on TX bit 2 = N/A bit 3 = N/A bit 4 = LED On/Off bit 5 = KeyBeep bit 6 = RF Disable bit 7 = Powerline Disable
1	Data Base Delta flag....gets incremented with any change in the Database
2	CRC Error Count
3	S/N Failure Count
4	N/A
5	bit 0 = TenD bit 1 = No X10 Flag bit 2 = N/A bit 3 = Cleanup Report bit 4 = N/A bit 5 = N/A bit 6 = Smart Hops bit 7 = Dimmer or Relay Mode

SD 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	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
01	**Programming lock off**
02	LED on with Insteon TX
03	**LED off with Insteon TX**
…	
08	LED Off
09	**LED On**
0A	KeyBeep On
0B	**KeyBeep Off**
0C	RF Off (as an originator, will still hop messages)
0D	**RF On**
0E	Powerline Off
0F	**Powerline On**
10	TenDflag On (turns on App retries, read out of database, and cleanup error report)
11	**TenDflag Off**
12	X10 Offflag On Disables all X10 rx and tx
13	**X10 Offflag Off**
16	**Cleanup Report Off**
17	Cleanup Report On
…	
1C	**Start Hops of last RX ACK (SmartHops)**
1D	Start Hops of 1
1E	**10V Dimmer in Dimmer Mode**
1F	10V Dimmer in Relay Mode

Line Information

RJ-10 Mini-modular jack pin-outs:

Pin 4 (Left side)	Pin 3	Pin 2	Pin 1	Group 1: triggers when switch between pin 3 & 4 is closed
				Group 2: triggers when switch between pin 3 & 4 is opened
Ground	Group 1-2	Group 3-4	12-15 VDC	Group 3: triggers when switch between pin 2 & 4 is closed
				Group 4: triggers when switch between pin 2 & 4 is opened

Line1 is default Hi, when it changes form High to Low, group1 is triggered On
When Line1 changes from Low to High, group2 is triggered On
Line2 is default Hi, when it changes form High to Low, group3 is triggered On
When Line2 changes from Low to High, group4 is triggered On

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 1	To device	Sender's ID	Device's ID	Extended Direct	0x2E	0x00	0x00 = N/A; 0x02 = Line 1, Group 1; 0x03 = Line 1, Group 2; 0x04 = Line 2, Group 3; 0x05 = Line 2, Group 4;	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 10-13	Data 14
0x01	On Mask	N/A	X10 House Code	X10 Unit Code	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)	Data 3 (1 byte)
Get for Group 2	To device	Sender's ID	Device's ID	Extended Direct	0x2E	0x00	0x00 = N/A; 0x02 = Line 1, Group 1; 0x03 = Line 1, Group 2; 0x04 = Line 2, Group 3; 0x05 = Line 2, Group 4;	0x00	0x04
	Response	Device's ID	Sender's ID	Standard Ack	0x2E	0x00	N/A	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 10-13	Data 14
0x01	Max Retries	Min Voltage	Max Voltage	N/A	N/A	N/A	N/A	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 OnMask	To device	Sender's ID	Device's ID	Extended Direct	0x2E	0x00	0x00 = N/A; 0x02 = Line 1, Group 1; 0x03 = Line 1, Group 2;	See Set Ramp Rate Info

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)
							0x04 = Line 2, Group 3; 0x05 = Line 2, Group 4;	
	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 10-13	Data 14
0x02	0x00 -> 0xFF (Bit Mask) 00 = disabled, 01 = enabled	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 Ramp Rate	To device	Sender's ID	Device's ID	Extended Direct	0x2E	0x00	0x00 = N/A; 0x02 = Line 1, Group 1; 0x03 = Line 1, Group 2; 0x04 = Line 2, Group 3; 0x05 = Line 2, Group 4;	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 10-13	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	0x00 = N/A; 0x02 = Line 1, Group 1; 0x03 = Line 1, Group 2; 0x04 = Line 2, Group 3;	See Set On Level Info

| | Response | Device's ID | Sender's ID | Standard Ack | 0x2E | 0x00 | N/A | N/A |
| | | | | | | | 0x05 = Line 2, Group 4; | |

Set On Level Info

Data 2 (1 byte)	Data 3	Data 4	Data 5	Data 6	Data 7	Data 8	Data 9	Data 10-13	Data 14
0x06	0x00 -> 0xFF (On Level)	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 LED Brightness	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

Set LED Brightness Info									
Data 2 (1 byte)	Data 3	Data 4	Data 5	Data 6	Data 7	Data 8	Data 9	Data 10-13	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)
Set Min/Max DAC Table	To device	Sender's ID	Device's ID	Extended Direct	0x2E	0x00	0x00 = N/A; 0x02 = Line 1, Group 1; 0x03 = Line 1, Group 2; 0x04 = Line 2, Group 3; 0x05 = Line 2, Group 4;	See Set Min/Max DAC Table Info
	Response	Device's ID	Sender's ID	Standard Ack	0x2E	0x00	N/A	N/A

Set Min/Max DAC Table Info

Data 2 (1 byte)	Data 3	Data 4	Data 5	Data 6	Data 7	Data 8	Data 9	Data 10-13	Data 14
0x0D	0x00 -> 0xFF (Min Level)	0x00 -> 0xFF (Max Level)	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 Engine Level Max Retries	To device	Sender's ID	Device's ID	Extended Direct	0x2E	0x00	0x00 = N/A; 0x02 = Line 1, Group 1; 0x03 = Line 1, Group 2; 0x04 = Line 2, Group 3; 0x05 = Line 2, Group 4;	See Engine Level Max Retries Info
	Response	Device's ID	Sender's ID	Standard Ack	0x2E	0x00	N/A	N/A

Set Engine Level Max Retries Info									
Data 2 (1 byte)	Data 3	Data 4	Data 5	Data 6	Data 7	Data 8	Data 9	Data 10-13	Data 14
0x0F	0x01 -> 0xFF (1-255); 0x00 is default of 5.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Checksum

Checksum Information

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 In-Line 0-10VDC 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 In-Line 0-10VDC 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

In-Line 0-10VDC 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)
On Level	1	where if bit 0 is set, relay 1 goes On or if bit 0 is clear relay1 goes off and where if bit 1 is set, relay2 goes On or if bit 1 is clear relay2 goes off
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.

1.2.6   Ballast Dimmer Voltage by Dim Level

	1 GE ballast connected		2 GE ballast connected		3 GE ballast connected	
	Voltage	Brightness	Voltage	Brightness	Voltage	Brightness
Full Bright	10.6	100%	10.6	100%	10.6	100%
Dimming steps -1	9.2	got dimmer	9.2	got dimmer	9.2	got dimmer
Dimming steps -2	8.1	got dimmer	8.1	got dimmer	8.1	got dimmer
Dimming steps -3	7.4	got dimmer	7.4	got dimmer	7.4	got dimmer
Dimming steps -4	6.7	got dimmer	6.7	got dimmer	6.7	got dimmer
Dimming steps -5	6.2	got dimmer	6.2	got dimmer	6.2	got dimmer
Dimming steps -6	5.7	got dimmer	5.7	got dimmer	5.7	got dimmer
Dimming steps -7	5.2	got dimmer	5.3	got dimmer	5.3	got dimmer
Dimming steps -8	4.8	got dimmer	4.8	got dimmer	4.8	got dimmer
Dimming steps -9	4.4	got dimmer	4.4	got dimmer	4.4	got dimmer
Dimming steps -10	4.1	got dimmer	4.1	got dimmer	4.1	got dimmer
Dimming steps -11	3.7	got dimmer	3.7	got dimmer	3.7	got dimmer
Dimming steps -12	3.4	got dimmer	3.4	got dimmer	3.4	got dimmer
Dimming steps -13	3.1	got dimmer	3.1	got dimmer	3.1	got dimmer
Dimming steps -14	2.9	got dimmer	2.9	got dimmer	2.9	got dimmer
Dimming steps -15	2.6	got dimmer	2.6	got dimmer	2.6	got dimmer
Dimming steps -16	2.3	got dimmer	2.3	got dimmer	2.4	got dimmer
Dimming steps -17	2.1	got dimmer	2.1	got dimmer	2.1	got dimmer
Dimming steps -18	1.8	got dimmer	1.8	got dimmer	1.8	got dimmer

Dimming steps -19	1.6	got dimmer	1.6	got dimmer	1.7	got dimmer
Dimming steps -20	1.5	got dimmer	1.5	got dimmer	1.5	got dimmer
Dimming steps -21	1.3	got dimmer	1.3	got dimmer	1.3	got dimmer
Dimming steps -22	1.1	got dimmer	1.1	got dimmer	1.2	got dimmer
Dimming steps -23	1.0	got dimmer	1.0	got dimmer	1.0	got dimmer
Dimming steps -24	0.9	got dimmer	0.9	got dimmer	1.0	got dimmer
Dimming steps -25	0.8	got dimmer	0.8	got dimmer	0.9	got dimmer
Dimming steps -26	0.7	got dimmer	0.7	got dimmer	0.9	no change
Dimming steps -27	0.6	got dimmer	0.7	got dimmer	0.9	no change
Dimming steps -28	0.5	got dimmer	0.6	no change	0.9	no change
Dimming steps -29	0.5	got dimmer	0.6	no change	0.9	no change
Dimming steps -30	0.4	got dimmer	0.6	no change	0.9	no change
Dimming steps -31	0.3	got dimmer	0.6	no change	0.9	no change
Dimming steps -32	OFF		OFF		OFF	