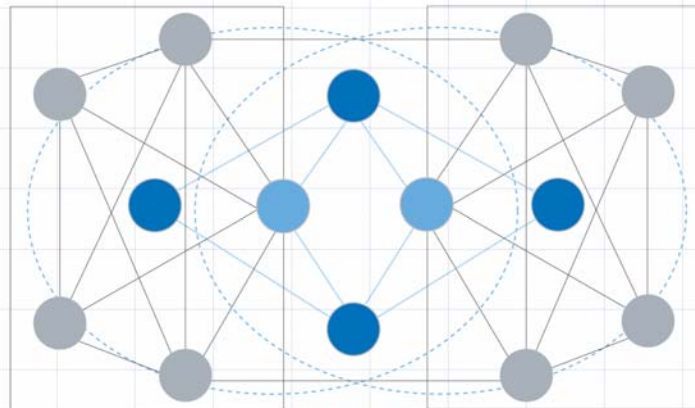




INST E N

Modern Developer's Guide



smartlabs

Table of Contents

- INTRODUCTION..... 1**
- INSTEON Modem Chips..... 1**
- The SmartLabs Powerline Modem (PLM) 2**
- Comparing the Powerline Modem (PLM) to the PowerLinc Controller (PLC) 2**
- Other Documents Included by Reference 4**
 - INSTEON Developer's Guide..... 4*
 - INSTEON Conformance Specification 4*
 - INSTEON Command Tables Document 4
 - INSTEON Device Categories and Product Keys Document..... 4
 - INSTEON Modem Spec Sheets..... 5*
 - IN2680A INSTEON Direct Powerline Modem Interface..... 5
 - IN2682A INSTEON Direct RF Modem Interface 5
- INSTEON MODEM REFERENCE 6**
- Software Reference 6**
 - IM Serial Communication Protocol and Settings..... 7*
 - IM Serial Communication Protocol 8
 - IM RS232 Port Settings..... 8
 - How to Quickly Start Communicating with an IM 9
 - IM Power-up and Reset States..... 10*
 - IM Power-up Behavior 10
 - IM Factory Reset State 10
 - IM Serial Commands..... 11*
 - IM Serial Command Summary Table 12
 - IM Serial Command Charts..... 16
 - INSTEON Message Handling..... 17
 - Send INSTEON Standard or Extended Message 17
 - INSTEON Standard Message Received 20
 - INSTEON Extended Message Received 21
 - Set INSTEON ACK Message Byte..... 23
 - Set INSTEON ACK Message Two Bytes..... 24
 - Set INSTEON NAK Message Byte 25
 - X10 Message Handling 26
 - Send X10 26
 - X10 Received..... 27
 - INSTEON ALL-Link Commands 28
 - Send ALL-Link Command..... 28
 - ALL-Link Cleanup Failure Report 30
 - ALL-Link Cleanup Status Report..... 31
 - ALL-Linking Session Management..... 32
 - Start ALL-Linking..... 32
 - Cancel ALL-Linking 33
 - ALL-Linking Completed..... 34
 - ALL-Link Database Management..... 35
 - Get First ALL-Link Record 35
 - Get Next ALL-Link Record 36
 - Get ALL-Link Record for Sender..... 37

ALL-Link Record Response	38
Manage ALL-Link Record	39
IM Status Management	41
Reset the IM	41
User Reset Detected	42
Get IM Configuration	43
Set IM Configuration	44
Get IM Info	46
Set Host Device Category	47
RF Sleep	48
IM Input/Output	49
Button Event Report	49
LED On	50
LED Off	51
Hardware Reference	52
<i>INSTEON Powerline Modem (PLM) Main Board</i>	<i>53</i>
INSTEON PLM Main Board Schematic	54
INSTEON PLM Main Board Bill of Materials	55
<i>INSTEON PLM Serial (RS232) Daughter Board</i>	<i>57</i>
INSTEON PLM Serial Daughter Board Schematic	58
INSTEON PLM Serial Daughter Board Bill of Materials	59
<i>INSTEON PLM Ethernet (IP) Daughter Board</i>	<i>60</i>
INSTEON PLM Ethernet (IP) Daughter Board Schematic	61
INSTEON PLM Ethernet (IP) Daughter Board Bill of Materials	62

Revision History

Release Date	Author	Description
01-30-07	PVD	Abstracted from INSTEON Developers Guide.
02-12-07	PVD	Added daughter card sections.
02-14-07	PVD	Released for proofreading.
03-01-07	PVD	More information on the PLM, comparison to PLC.
03-27-07	PVD	Fixed bytcount in IM Command 0x62 <i>Send INSTEON Standard or Extended Message</i> .
03-28-07	PVD	Added IM Command 0x58 <i>ALL-Link Cleanup Status Report</i> .
03-29-07	PVD	Updated explanation of IM Command 0x6F <i>Manage ALL-Link Record</i> .
04-02-07	PVD	Updated explanation of IM Commands 0x61 <i>Send ALL-Link Command</i> , 0x56 <i>ALL-Link Cleanup Failure Report</i> , and 0x58 <i>ALL-Link Cleanup Status Report</i> .
04-06-07	PVD	IM Command 0x58 <i>ALL-Link Cleanup Status Report</i> also sent when IM interrupts its own Cleanup sequence.
04-17-07	PVD	Corrected <X10 Flag> value in IM Commands 0x63 <i>Send X10</i> and 0x52 <i>X10 Received</i> .
04-19-07	PVD	Added page number subscripts to links.

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INTRODUCTION



This *INSTEON Modem Developer's Guide* is for users of INSTEON Modem chips, such as the IN2680A Powerline Modem Interface or the IN2682A RF Modem Interface, and also for purchasers of the SmartLabs PowerLine Modem™ (PLM) module.

The information in this document is excerpted from the [INSTEON Developer's Guide](#)⁴, which purchasers of an INSTEON Software Development Kit may download from www.insteon.net.

INSTEON Modem Chips

INSTEON Modems (IMs) are single chips available from SmartLabs that use simple ASCII commands over a serial port to interface to an INSTEON network. The [IN2680A INSTEON Direct Powerline Modem Interface](#)⁵ chip connects to an INSTEON network via the house wiring and the [IN2682A INSTEON Direct RF Modem Interface](#)⁵ connects via radio. A BiPHY™ Modem that interfaces to *both* the powerline and radio is under development.

Developers can create INSTEON applications that run on whatever host device they choose, as long as the host can communicate serially with the IM using the RS232 serial protocol at TTL levels. A microcontroller chip is the most common choice for a host device in standalone INSTEON modules, although virtually any hardware capable of executing applications and communicating serially can use an IM to interface with an INSTEON network.

Perhaps the greatest advantage of using an IM is that you can create applications in a development environment that you are already comfortable with. The ASCII [IM Serial Commands](#)¹¹ are relatively few in number and easy to learn, so development cycles can be short.

As an added bonus, the easiest way to achieve INSTEON conformance for your product is to build it around an INSTEON modem, because an IM automatically handles most of the details of the INSTEON protocol for you. See the [INSTEON Conformance Specification](#)⁴ document for the full conformance requirements.

The main functions of an INSTEON Modem are:

- Interfacing to a host via an RS232 serial port at TTL levels.
- Interfacing to the powerline or an FSK 915 MHz radio.
- Sending and receiving INSTEON messages.
- Sending and receiving X10 messages.
- ALL-Linking to other INSTEON devices and managing an ALL-Link Database.
- Sending ALL-Link Commands and transparently handling ALL-Link Cleanups.
- Managing a SET Button and LED.

The SmartLabs Powerline Modem (PLM)

The SmartLabs Powerline Modem (PLM) is an INSTEON-to-Serial Bridge module that plugs into a power outlet and also has a serial port that you connect to your PC (an Ethernet interface is under development). It uses an IN2680A Powerline Modem chip that offers a simple set of ASCII [IM Serial Commands](#)_{1,1} for interacting with INSTEON devices.

The PLM uses a daughter board to implement serial communications with the host. Daughter boards interface to the PLM's main board via an 8-pin connector using TTL-level serial communications. PLMs with RS232 daughter boards are currently available, with USB and Ethernet versions under development.

You may communicate to an RS232 PLM via USB by using a USB-to-Serial adapter. SmartLabs has found that Keyspan brand adapters, models USA-49WLC and USA-19HS, provide excellent protocol translation and PLM compatibility.

If you wish, you may create a custom daughter board that fits within a PLM module. You can find hardware reference designs for such custom devices in the [Hardware Reference](#)_{5,2} section below. To support custom daughter boards, SmartLabs offers a special version of the PLM with the following features:

- Uses the same case as the current PLM/PLC modules.
- Has no labeling on the front cover or rear UL label.
- Does not have UL approval.
- Does not include a daughter board.
- Includes the plastic insert for a RJ-45 jack or a blank cover.
- Uses PLM firmware with auto EEPROM detection. When no external EEPROM is detected, the PLM is limited to 31 ALL-Links.

Comparing the Powerline Modem (PLM) to the PowerLinc Controller (PLC)

The SmartLabs PowerLinc controller (PLC) module runs a downloadable SALad application that implements an interface between a host device and an INSTEON network on the powerline. SALad is a language developed specially for the PLC and other SALad-enabled INSTEON devices. If desired, the SALad application can be designed to run in standalone mode without any connection to a host.

Unlike the PLC, a PLM cannot operate in standalone mode because it cannot run application programs by itself. External applications designed to work with a PLC, such as SmartLabs Device Manager (SDM), will not work with a PLM.

In summary, these are the main differences between the PLC and the PLM:

- The PLM has a simplified command set compared to the PLC.
- The PLM does not support SmartLabs Device Manager (SDM) running on a host computer.
- The PLC runs a downloadable SALad application, such as the SALad *coreApp* program, but the PLM cannot run applications of any kind. An embedded host on a daughter card or else an always-on external host must be available full time to run applications and manage the PLM.
- The PLM does not have an internal realtime clock.
- If fewer than 32 ALL-Links need to be supported, the PLM can run without external EEPROM. The PLC must have external EEPROM to store a downloadable SALad program.

Other Documents Included by Reference

This *INSTEON Modem Developer's Guide* contains information abstracted from the comprehensive *INSTEON Developer's Guide, 2nd Edition*.

Although the full *INSTEON Developer's Guide* is largely self-contained, there are aspects of INSTEON technology, such as listings of INSTEON Commands, INSTEON Device Categories, and INSTEON Product Keys, that require continuous updating as developers create new INSTEON products. Accordingly, SmartLabs maintains separate documents for that kind of information.

All of the documents listed in this section are available for downloading at www.insteon.net.

INSTEON Developer's Guide

The book-length *INSTEON Developer's Guide, 2nd Edition* is the primary source for the information contained in this (much shorter) *INSTEON Modem Developer's Guide*. Some links in this document refer to information found there. Developers who purchase an INSTEON Software Developer's Kit may download the *INSTEON Developer's Guide* from www.insteon.net.

INSTEON Conformance Specification

The *INSTEON Conformance Specification* identifies those aspects of INSTEON that assure interoperability with other INSTEON products. The Conformance Spec assumes that readers have already gained familiarity with INSTEON technology by reading the *INSTEON Developer's Guide*.

INSTEON Command Tables Document

The current tables of INSTEON Commands are contained in a separate document titled *INSTEON Command Tables*, which is integral to both the *INSTEON Conformance Specification* and the *INSTEON Developer's Guide*.

The filename for that document is *INSTEON Command Tables yyyyymmddx.doc*, where *yyyy* is the year, *mm* is the month, *dd* is the day, and *x* is a daily version letter beginning with *a*. Be sure to refer to the document with the latest date.

INSTEON Device Categories and Product Keys Document

The current table of INSTEON Device Categories (DevCats), Subcategories (SubCats), and INSTEON Product Keys (IPKs) is contained in a separate document titled *INSTEON Device Categories and Product Keys*, which is also integral to both the *INSTEON Conformance Specification* and the *INSTEON Developer's Guide*.

The filename for that document is *INSTEON DevCats and Product Keys yyyyymmddx.doc*, where *yyyy* is the year, *mm* is the month, *dd* is the day, and *x* is a daily version letter beginning with *a*. Be sure to refer to the document with the latest date.

INSTEON Modem Spec Sheets

Developers will find the latest specifications for INSTEON modem ICs at www.insteon.net.

IN2680A INSTEON Direct Powerline Modem Interface

The IN2680A is a one-chip solution that uses the simple ASCII serial interface documented here (see [IM Serial Commands₁₁](#)) to connect a host device or system to an INSTEON network via the powerline.

IN2682A INSTEON Direct RF Modem Interface

The IN2682A is similar to the IN2680A Powerline Modem except that it connects to an INSTEON network via radio.

INSTEON MODEM REFERENCE

Software Reference

INSTEON Modem (IM) chips and the SmartLabs PowerLine Modem™ (PLM) module offer developers a simple, robust interface to an INSTEON network. There are currently two kinds of IM chip, the [IN2680A INSTEON Direct Powerline Modem Interface](#)₅ and the [IN2682A INSTEON Direct RF Modem Interface](#)₅. A BiPHY™ Modem that interfaces to *both* the powerline and radio is under development.

INSTEON Modems provide a simpler interface to many of the low-level *IBIOS Serial Commands* implemented in the SmartLabs PowerLine Controller™ (PLC) described in the [INSTEON Developer's Guide](#)₄, but they also handle ALL-Linking, ALL-Link Database management, ALL-Link Cleanup messages, X10 powerline interfacing, and message acknowledgement. The RS232 serial interface to the host is similar to that of the PLC.

In This Section

[IM Serial Communication Protocol and Settings](#)₇

Describes the serial communication protocol, the port settings for an RS232 link, and a recommended terminal program.

[IM Power-up and Reset States](#)₁₀

Explains what happens when you power up the IM or reset it.

[IM Serial Commands](#)₁₁

Lists the IM Serial Commands and describes what they do, in a single table and individual charts grouped by functionality.

IM Serial Communication Protocol and Settings

In This Section

[IM Serial Communication Protocol](#)₈

Gives the protocol for communicating serially with an INSTEON Modem.

[IM RS232 Port Settings](#)₈

Shows how to set up your PC's COM (RS232) port to talk to an INSTEON Modem.

[How to Quickly Start Communicating with an IM](#)₉

Gives a recommendation for a terminal program for communicating with an INSTEON Modem.

IM Serial Communication Protocol

All INSTEON Modem (IM) Serial Commands start with ASCII 0x02 (STX, Start-of-Text) followed by the Serial Command Number (see [IM Serial Commands₁₁](#)). What data follows the Command depends on the Command syntax (see [IM Serial Command Summary Table₁₂](#) and [IM Serial Command Charts₁₆](#)).

When you send a message to the IM, it will respond with an echo of the 0x02 and the IM Command Number followed by any data that the Command returns (often just an echo of what you sent to it). The last byte it sends back will be ASCII 0x06 (ACK, Acknowledge).

(**S:** and **R:** denote serial data you **Send to** or **Receive from** the IM, respectively.)

S:	0x02 <Command Number> <parameters>
R:	0x02 <Command Number> <any returned data> 0x06 (ACK)

If the IM is not ready, it will respond with an echo of the 0x02 and the IM Command Number followed by ASCII 0x15 (NAK, Negative Acknowledge).

S:	0x02 <Command Number> <parameters>
R:	0x15 (NAK)

If you receive 0x15 (NAK), resend your Serial Command.

IM RS232 Port Settings

To communicate to an RS232 IM, set your PC's COM port as follows:

Setting	Value
Baud Rate	19,200
Data Bits	8
Parity	N
Stop Bits	1
Hardware Flow Control	None
Software Flow Control	IM echoes bytes received from host

The IM buffers IM Commands as it receives them, so you can send a complete IM Command without pause. To maintain compatibility with earlier IM versions, the IM will echo each byte that it receives (earlier versions of the IM used byte echoing for flow control). You can now ignore the byte echos, but in order to avoid overrunning the IM's receive buffer, you must wait for the IM to send its response to your current IM Command before sending a new one.

Note that there is a *maximum* time between IM Command bytes that you send to the IM. If you do not send the next expected byte of an IM Command within 240 milliseconds after sending the previous one, the IM will reset its message parser and you will have to resend the message from the beginning. You can disable this *Deadman* feature by setting a configuration bit (see [Set IM Configuration₄₄](#) below).

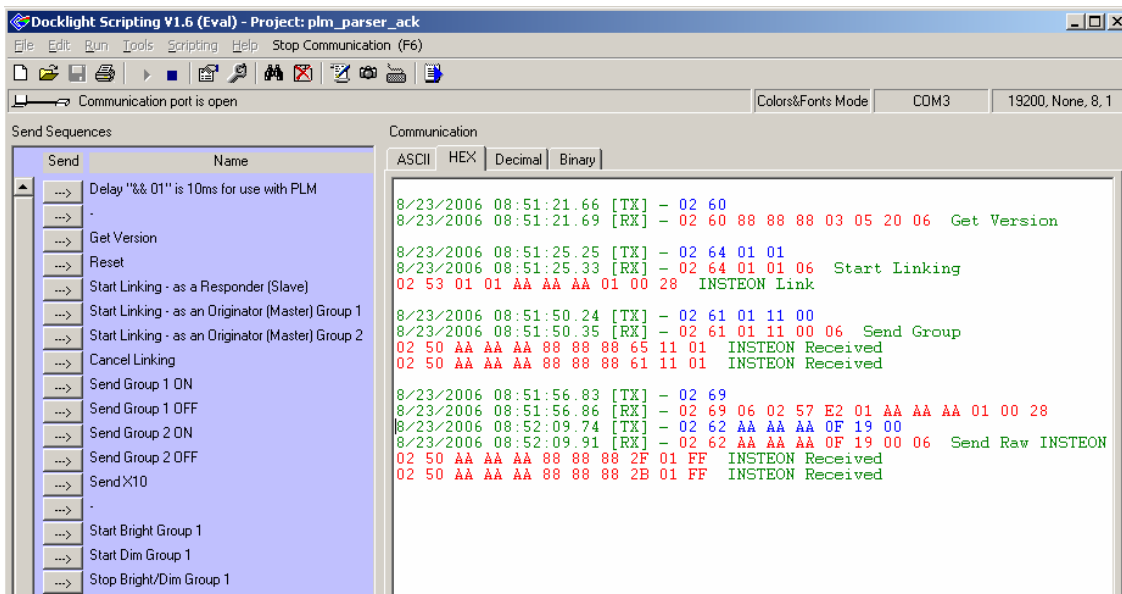
There is no flow control when the IM sends data *to* the host—the IM will transfer data to the host as fast as it can send it.

How to Quickly Start Communicating with an IM

No matter how your application intends to use the IM, it is important to gain a basic understanding of how it operates. SmartLabs suggests that developers use a terminal communications program and a serial connection to an IM to get started.

While there are many terminal programs for computers, SmartLabs has found good results with Docklight Scripting. An evaluation copy may be downloaded from <http://www.docklight.de/>.

Docklight Scripting allows you to set up test macros and label received *IM Serial Commands*₁ for easy identification, as suggested in the following screenshot:



IM Power-up and Reset States

This section describes the [IM Power-up Behavior](#)₁₀ and the [IM Factory Reset State](#)₁₀.

IM Power-up Behavior

The table below shows the state of the IM when it powers up. Holding down the SET Button while powering up will cause a factory reset.

LED Indication	Meaning
LED on steadily	The IM detected an external EEPROM (up to 32 KB) for storage of database links.
LED blinks six times	The IM did not detect an external EEPROM, so it will use the internal EEPROM in the processor chip. A maximum of 31 ALL-Links are permitted. An attempt to add a 32 nd ALL-Link will result in the 31 st being erased.
LED off	The user pressed and held the IM's SET button for 10 seconds while powering up, causing the IM to perform a factory reset and go into the IM Factory Reset State ₁₀ . At the conclusion of the reset, the IM's LED will give one of the two indications above. You will also receive a User Reset Detected ₄₂ message from the IM.

IM Factory Reset State

Resetting the IM to its factory default condition by holding down the SET Button for ten seconds while powering it up or by sending it a [Reset the IM](#)₄₁ Command puts it into the following state:

IM Resource	Factory Reset State
ALL-Link Database	Erased (set to all zeros).
Host Device Category, Device Subcategory, Firmware Version	Set to the original DevCat (0x03), SubCat (0x05), and firmware version hard-coded into the IM's firmware at the factory.
IM Configuration Flags	Cleared (set to all zeros).

IM Serial Commands

The IM Serial Command set is a simple but complete interface between a host application and an INSTEON network. For example, a microcontroller in a thermostat could use an INSTEON Powerline Modem to send and receive messages to other INSTEON or X10 devices on the home's powerline.

In this section, the IM Serial Commands are presented twice, once as a summary table, and again as a series of charts grouped by functionality.

In This Section

[IM Serial Command Summary Table](#)₁₂

Describes all of the IM Serial Commands in table form ordered by Command Number.

[IM Serial Command Charts](#)₁₆

Describes all of the IM Serial Commands using individual charts for each Command, grouped by functionality.

IM Serial Command Summary Table

This table lists all of the Modem Serial Commands supported by INSTEON powerline or RF modem chips.

Code

Gives the hexadecimal number of the IM Serial Command. Note that IM Commands sent by an IM to the host begin at **0x50** and IM Commands sent by the host to an IM begin at **0x60**.

Command

Gives the name of the IM Serial Command as a link to the complete explanation of the Command in the [IM Serial Command Charts](#)₁₆.

Format

Gives the syntax of the IM Serial Command, including any parameters.

S: and **R:** denote serial data you **Send to** or **Receive from** the IM, respectively. See [IM Serial Communication Protocol](#)₈ for more information.

All IM Serial Commands start with ASCII 0x02 (STX, Start-of-Text) followed by the Serial Command Number.

All fields in this table contain only one byte, except as noted.

INSTEON Modem Serial Commands		
Commands Sent from an IM to the Host		
Code	Command	Format
0x50	INSTEON Standard Message Received ₂₀	R: 0x02 0x50 <INSTEON Standard message (9 bytes)>
0x51	INSTEON Extended Message Received ₂₁	R: 0x02 0x51 <INSTEON Extended message (23 bytes)>
0x52	X10 Received ₂₇	R: 0x02 0x52 <Raw X10> <X10 Flag>
0x53	ALL-Linking Completed ₃₄	R: 0x02 0x53 <0x00 (IM is Responder) 0x01 (IM is Controller 0xFF Link Deleted)> <ALL-Link Group> <ID high byte> <ID middle byte> <ID low byte> <Device Category> <Device Subcategory> <0xFF Firmware Revision>
0x54	Button Event Report ₄₉	R: 0x02 0x54 <0x02> IM's SET Button tapped
		R: 0x02 0x54 <0x03> IM's SET Button held
		R: 0x02 0x54 <0x04> IM's SET Button released after hold
		R: 0x02 0x54 <0x12> IM's Button 2 tapped
		R: 0x02 0x54 <0x13> IM's Button 2 held
		R: 0x02 0x54 <0x14> IM's Button 2 released after hold
		R: 0x02 0x54 <0x22> IM's Button 3 tapped

INSTEON Modem Serial Commands		
Commands Sent from an IM to the Host		
Code	Command	Format
		R: 0x02 0x54 <0x23> IM's Button 3 held
		R: 0x02 0x54 <0x24> IM's Button 3 released after hold
0x55	User Reset Detected ₄₂	R: 0x02 0x55 User pushed and held IM's SET Button on power up
0x56	ALL-Link Cleanup Failure Report ₃₀	R: 0x02 0x56 <0x01> <ALL-Link Group> <ID high byte> <ID middle byte> <ID low byte>
0x57	ALL-Link Record Response ₃₈	R: 0x02 0x57 <ALL-Link Record Flags> <ALL-Link Group> <ID high byte> <ID middle byte> <ID low byte> <Link Data 1> <Link Data 2> <Link Data 3>
0x58	ALL-Link Cleanup Status Report ₃₁	R: 0x02 0x58 <0x06> ALL-Link Cleanup sequence completed
		R: 0x02 0x58 <0x15> ALL-Link Cleanup sequence aborted due to INSTEON traffic
Commands Sent from the Host to an IM		
0x60	Get IM Info ₄₆	S: 0x02 0x60
		R: 0x02 0x60 <ID high byte> <ID middle byte> <ID low byte> <Device Category> <Device Subcategory> < Firmware Revision> <0x06>
0x61	Send ALL-Link Command ₂₈	S: 0x02 0x61 <ALL-Link Group> <ALL-Link Command> <0xFF 0x00>
		R: 0x02 0x61 <ALL-Link Group> <ALL-Link Command> <0xFF 0x00> <0x06>
0x62	Send INSTEON Standard or Extended Message ₁₇	S: 0x02 0x62 <INSTEON Standard message (6 bytes, excludes <i>From Address</i>) INSTEON Extended message (20 bytes, excludes <i>From Address</i>)>
		R: 0x02 0x62 <INSTEON Standard message (6 bytes, excludes <i>From Address</i>) INSTEON Extended message (20 bytes, excludes <i>From Address</i>)> <0x06>
0x63	Send X10 ₂₆	S: 0x02 0x63 <Raw X10> <X10 Flag>
		R: 0x02 0x63 <Raw X10> <X10 Flag> <0x06>
0x64	Start ALL-Linking ₃₂	S: 0x02 0x64 <0x00 (IM is Responder) 0x01 (IM is Controller) 0x03 (IM is either) 0xFF (Link Deleted)> <ALL-Link Group>

INSTEON Modem Serial Commands		
Commands Sent from an IM to the Host		
Code	Command	Format
		R: 0x02 0x64 <0x00 (IM is Responder) 0x01 (IM is Controller) 0x03 (IM is either) 0xFF (Link Deleted)> <ALL-Link Group> <0x06>
0x65	Cancel ALL-Linking ₃₃	S: 0x02 0x65 R: 0x02 0x65 <0x06>
0x66	Set Host Device Category ₄₇	S: 0x02 0x66 <Device Category> <Device Subcategory> <0xFF Firmware Revision> R: 0x02 0x66 <Device Category> <Device Subcategory> <0xFF Firmware Revision> <0x06>
0x67	Reset the IM ₄₁	S: 0x02 0x67 R: 0x02 0x67 <0x06>
0x68	Set INSTEON ACK Message Byte ₂₃	S: 0x02 0x68 <Command 2 Data> R: 0x02 0x68 <Command 2 Data> <0x06>
0x69	Get First ALL-Link Record ₃₅	S: 0x02 0x69 R: 0x02 0x69 <0x06>
0x6A	Get Next ALL-Link Record ₃₆	S: 0x02 0x6A R: 0x02 0x6A <0x06>
0x6B	Set IM Configuration ₄₄	S: 0x02 0x6B <IM Configuration Flags> R: 0x02 0x6B <IM Configuration Flags> <0x06>
0x6C	Get ALL-Link Record for Sender ₃₇	S: 0x02 0x6C R: 0x02 0x6C <0x06>
0x6D	LED On ₅₀	S: 0x02 0x6D R: 0x02 0x6D <0x06>
0x6E	LED Off ₅₁	S: 0x02 0x6E R: 0x02 0x6E <0x06>
0x6F	Manage ALL-Link Record ₃₉	S: 0x02 0x6F <Control Flags> <ALL-Link Record Flags> <ALL-Link Group> <ID high byte> <ID middle byte> <ID low byte> <Link Data 1> <Link Data 2> <Link Data 3>

INSTEON Modem Serial Commands		
Commands Sent from an IM to the Host		
Code	Command	Format
		R: 0x02 0x6F <Control Flags> <ALL-Link Record Flags> <ALL-Link Group> <ID high byte> <ID middle byte> <ID low byte> <Link Data 1> <Link Data 2> <Link Data 3> <0x06>
0x70	Set INSTEON NAK Message Byte ₂₅	S: 0x02 0x70 <Command 2 Data>
		R: 0x02 0x70 <Command 2 Data> <0x06>
0x71	Set INSTEON ACK Message Two Bytes ₂₄	S: 0x02 0x71 <Command 1 Data> <Command 2 Data>
		R: 0x02 0x71 <Command 1 Data> <Command 2 Data> <0x06>
0x72	RF Sleep ₄₈	S: 0x02 0x72
		R: 0x02 0x72 <0x06>
0x73	Get IM Configuration ₄₃	S: 0x02 0x73
		R: 0x02 0x73 <IM Configuration Flags> <Spare 1> <Spare 2> <0x06>

IM Serial Command Charts

The following charts describe the IM Commands individually in a chart format, grouped by functionality. These are the same IM Commands as in the [IM Serial Command Summary Table₁₂](#), which is ordered by Command Number.

Note that IM Commands sent by an IM to the host begin at **0x50** and IM Commands sent by the host to an IM begin at **0x60**. When the host sends an IM Command to an IM, the IM will respond with a message according to the [IM Serial Communication Protocol₈](#).

In This Section

[INSTEON Message Handling₁₇](#)

Commands for sending and receiving INSTEON messages.

[X10 Message Handling₂₆](#)

Commands for sending and receiving X10 messages.

[INSTEON ALL-Link Commands₂₈](#)

Commands for sending ALL-Link Commands with automatic handling of ALL-Link Cleanup Commands.

[ALL-Linking Session Management₃₂](#)

Commands for creating ALL-Links between an IM and other INSTEON devices.

[ALL-Link Database Management₃₅](#)

Commands for managing ALL-Link Records in the IM's ALL-Link Database.

[IM Status Management₄₁](#)

Commands for resetting and configuring the IM.

[IM Input/Output₄₉](#)

Commands for managing the IM's SET Button and LED.

INSTEON Message Handling

Send INSTEON Standard or Extended Message

This Command lets you send either a Standard-length or an Extended-length INSTEON message, depending only on what kind of INSTEON message you include in the body of the Command.

Send INSTEON Standard-length Message

Send INSTEON Standard-length Message (0x62)		
What it does	Allows you to send a raw Standard-length INSTEON message.	
What you send	8 bytes.	
What you'll get	9 bytes.	
LED indication	None.	
Related Commands	IM 0x50 INSTEON Standard Message Received ₂₀ IM 0x51 INSTEON Extended Message Received ₂₁	
Command Sent from Host to IM		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x62	IM Command Number
3	<To Address high>	The high byte of the INSTEON ID of the message addressee.
4	<To Address middle>	The middle byte of the INSTEON ID of the message addressee.
5	<To Address low>	The low byte of the INSTEON ID of the message addressee.
6	<Message Flags>	The INSTEON message flags indicating message type and hops. Extended Message Flag (bit 4) is 0
7	<Command 1>	INSTEON Command 1 for the addressee to execute
8	<Command 2>	INSTEON Command 2 for the addressee to execute
Message Returned by IM to Host		
Byte	Value	Meaning
1	0x02	Echoed Start of IM Command
2	0x62	Echoed IM Command Number
3	<To Address high>	Echoed <To Address high>
4	<To Address middle>	Echoed <To Address middle>
5	<To Address low>	Echoed <To Address low>
6	<Message Flags>	Echoed <Message Flags> Extended Message Flag (bit 4) is 0
7	<Command 1>	Echoed <Command 1>
8	<Command 2>	Echoed <Command 2>
9	<ACK/NAK>	0x06 (ACK) if the IM executed the Command correctly 0x15 (NAK) if an error occurred
Notes		
The <i>From Address</i> is not required because the IM will automatically insert its own INSTEON ID into the message.		
For more information on INSTEON Commands and the latest Command set, please download the current INSTEON Command Tables Document ₄ from www.insteon.net .		

Send INSTEON Extended-length Message

Send INSTEON Extended-length Message (0x62)		
What it does	Allows you to send a raw Extended-length INSTEON message.	
What you send	22 bytes.	
What you'll get	23 bytes.	
LED indication	None.	
Related Commands	IM 0x50 INSTEON Standard Message Received ₂₀ IM 0x51 INSTEON Extended Message Received ₂₁	
Command Sent from Host to IM		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x62	IM Command Number
3	<To Address high>	The high byte of the INSTEON ID of the message addressee.
4	<To Address middle>	The middle byte of the INSTEON ID of the message addressee.
5	<To Address low>	The low byte of the INSTEON ID of the message addressee.
6	<Message Flags>	The INSTEON message flags indicating message type and hops. Extended Message Flag (bit 4) is 1
7	<Command 1>	INSTEON Command 1 for the addressee to execute
8	<Command 2>	INSTEON Command 2 for the addressee to execute
9	<User Data 1>	Extended message data
10	<User Data 2>	Extended message data
11	<User Data 3>	Extended message data
12	<User Data 4>	Extended message data
13	<User Data 5>	Extended message data
14	<User Data 6>	Extended message data
15	<User Data 7>	Extended message data
16	<User Data 8>	Extended message data
17	<User Data 9>	Extended message data
18	<User Data 10>	Extended message data
19	<User Data 11>	Extended message data
20	<User Data 12>	Extended message data
21	<User Data 13>	Extended message data
22	<User Data 14>	Extended message data
Message Returned by IM to Host		
Byte	Value	Meaning
1	0x02	Echoed Start of IM Command
2	0x62	Echoed IM Command Number
3	<To Address high>	Echoed <To Address high>
4	<To Address middle>	Echoed <To Address middle>
5	<To Address low>	Echoed <To Address low>
6	<Message Flags>	Echoed <Message Flags> Extended Message Flag (bit 4) is 1
7	<Command 1>	Echoed <Command 1>
8	<Command 2>	Echoed <Command 2>
9	<User Data 1>	Echoed Extended message data
10	<User Data 2>	Echoed Extended message data
11	<User Data 3>	Echoed Extended message data
12	<User Data 4>	Echoed Extended message data
13	<User Data 5>	Echoed Extended message data
14	<User Data 6>	Echoed Extended message data

Send INSTEON Extended-length Message (0x62)		
15	<User Data 7>	Echoed Extended message data
16	<User Data 8>	Echoed Extended message data
17	<User Data 9>	Echoed Extended message data
18	<User Data 10>	Echoed Extended message data
19	<User Data 11>	Echoed Extended message data
20	<User Data 12>	Echoed Extended message data
21	<User Data 13>	Echoed Extended message data
22	<User Data 14>	Echoed Extended message data
23	<ACK/NAK>	0x06 (ACK) if the IM executed the Command correctly 0x15 (NAK) if an error occurred
Notes		
The <i>From Address</i> is not required because the IM will automatically insert its own INSTEON ID into the message.		
For more information on INSTEON Commands and the latest Command set, please download the current INSTEON Command Tables Document from www.insteon.net .		

INSTEON Standard Message Received

INSTEON Standard Message Received (0x50)		
What it does	Informs you of an incoming Standard-length INSTEON message.	
When you'll get this	A Standard-length INSTEON message is received from either a Controller or Responder that you are ALL-Linked to.	
What you'll get	11 bytes.	
LED indication	The LED will blink during INSTEON reception.	
Related Commands	IM 0x51 INSTEON Extended Message Received ₂₁ IM 0x52 X10 Received ₂₇	
Message Sent from IM to Host		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x50	IM Command Number
3	<From Address high>	The high byte of the INSTEON ID of the message originator.
4	<From Address middle>	The middle byte of the INSTEON ID of the message originator.
5	<From Address low>	The low byte of the INSTEON ID of the message originator.
6	<To Address high>	The high byte of the INSTEON ID of the message addressee. If the message is an ALL-Link Broadcast (bits 7 and 6 of the <Message Flags> byte are set) then this will be 0.
7	<To Address middle>	The middle byte of the INSTEON ID of the message addressee. If the message is an ALL-Link Broadcast (bits 7 and 6 of the <Message Flags> byte are set) then this will be 0.
8	<To Address low>	The low byte of the INSTEON ID of the message addressee. If the message is an ALL-Link Broadcast (bits 7 and 6 of the <Message Flags> byte are set) then this will indicate the ALL-Link Group Number.
9	<Message Flags>	The INSTEON message flags indicating message type and hops.
10	<Command 1>	INSTEON <i>Command 1</i> field of the message.
11	<Command 2>	INSTEON <i>Command 2</i> field of the message. This byte contains the ALL-Link Group Number of the ALL-Link Broadcast when either bit 6 of the <Message Flags> byte is set (ALL-Link Cleanup) or bits 6 and 5 of the <Message Flags> byte are set (ALL-Link Cleanup ACK).
Notes		
This is the same as IM 0x51 INSTEON Extended Message Received ₂₁ , except that there is no <User Data>.		
Normally, the IM will only send the host INSTEON messages that are explicitly addressed to the IM or that are from devices that the IM is ALL-Linked to. This behavior can be modified—see the About Monitor Mode ₄₅ note in the Set IM Configuration ₄₄ chart for more information.		
For more information on INSTEON Commands and the latest Command set, please download the current INSTEON Command Tables Document ₄ from www.insteon.net .		

INSTEON Extended Message Received

INSTEON Extended Message Received (0x51)		
What it does	Informs you of an incoming Extended-length INSTEON message.	
When you'll get this	An Extended-length INSTEON message is received from either a Controller or Responder that you are ALL-Linked to.	
What you'll get	25 bytes.	
LED indication	The LED will blink during INSTEON reception.	
Related Commands	IM 0x50 INSTEON Standard Message Received ₂₀ IM 0x52 X10 Received ₂₇	
Message Sent from IM to Host		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x51	IM Command Number
3	<From Address high>	The high byte of the INSTEON ID of the message originator.
4	<From Address middle>	The middle byte of the INSTEON ID of the message originator.
5	<From Address low>	The low byte of the INSTEON ID of the message originator.
6	<To Address high>	The high byte of the INSTEON ID of the message addressee. If the message is an ALL-Link Broadcast (bits 7 and 6 of the <Message Flags> byte are set) then this will be 0.
7	<To Address middle>	The middle byte of the INSTEON ID of the message addressee. If the message is an ALL-Link Broadcast (bits 7 and 6 of the <Message Flags> byte are set) then this will be 0.
8	<To Address low>	The low byte of the INSTEON ID of the message addressee. If the message is an ALL-Link Broadcast (bits 7 and 6 of the <Message Flags> byte are set) then this will indicate the ALL-Link Group Number.
9	<Message Flags>	The INSTEON message flags indicating message type and hops.
10	<Command 1>	INSTEON <i>Command 1</i> field of the message.
11	<Command 2>	INSTEON <i>Command 2</i> field of the message. This byte contains the ALL-Link Group Number of the ALL-Link Broadcast when either bit 6 of the <Message Flags> byte is set (ALL-Link Cleanup) or bits 6 and 5 of the <Message Flags> byte are set (ALL-Link Cleanup ACK).
12	<User Data 1>	Extended message data
13	<User Data 2>	Extended message data
14	<User Data 3>	Extended message data
15	<User Data 4>	Extended message data
16	<User Data 5>	Extended message data
17	<User Data 6>	Extended message data
18	<User Data 7>	Extended message data
19	<User Data 8>	Extended message data
20	<User Data 9>	Extended message data
21	<User Data 10>	Extended message data
22	<User Data 11>	Extended message data
23	<User Data 12>	Extended message data
24	<User Data 13>	Extended message data
25	<User Data 14>	Extended message data

INSTEON Extended Message Received (0x51)
Notes
<p>This is the same as IM 0x50 INSTEON Standard Message Received₂₀, except that there are 14 bytes of <User Data>.</p>
<p>Normally, the IM will only send the host INSTEON messages that are explicitly addressed to the IM or that are from devices that the IM is ALL-Linked to. This behavior can be modified—see the About Monitor Mode₄₅ note in the Set IM Configuration₄₄ chart for more information.</p>
<p>For more information on INSTEON Commands and the latest Command set, please download the current INSTEON Command Tables Document₄ from www.insteon.net.</p>

Set INSTEON ACK Message Byte

Set INSTEON ACK Message Byte (0x68)		
What it does	Allows you to put one byte of data into the <i>Command 2</i> field of the INSTEON ACK message that the INSTEON Engine automatically sends after it receives an INSTEON Direct message.	
What you send	3 bytes.	
What you'll get	4 bytes.	
LED indication	None.	
Related Commands	IM 0x50 INSTEON Standard Message Received ₂₀ IM 0x51 INSTEON Extended Message Received ₂₁ IM 0x71 Set INSTEON ACK Message Two Bytes ₂₄ IM 0x70 Set INSTEON NAK Message Byte ₂₅	
Command Sent from Host to IM		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x68	IM Command Number
3	<Command 2 Data>	Data byte to place into the <i>Command 2</i> field of the ACK response.
Message Returned by IM to Host		
Byte	Value	Meaning
1	0x02	Echoed Start of IM Command
2	0x68	Echoed IM Command Number
3	<Command 2 Data>	Echoed <Command 2 Data>
4	<ACK/NAK>	0x06 (ACK) if the IM executed the Command correctly. 0x15 (NAK) if an error occurred.
Notes		
You have only about 15 milliseconds after the receipt of an INSTEON Direct message from the IM to send this Command to the IM. The reason is that the INSTEON Engine in the IM automatically sends Acknowledgement messages in assigned timeslots.		
Use Set INSTEON ACK Message Two Bytes ₂₄ when you need to return two bytes of data in an ACK message.		
Use Set INSTEON NAK Message Byte ₂₅ when you need to return one byte of data in a NAK message.		
Certain INSTEON Direct Commands require returned data in the Acknowledgement message. For more information on INSTEON Commands and the latest Command set, please download the current INSTEON Command Tables Document ₄ from www.insteon.net .		

Set INSTEON ACK Message Two Bytes

Set INSTEON ACK Message Two Bytes (0x71)		
What it does	Allows you to put two bytes of data into the combined <i>Command 1</i> and <i>Command 2</i> fields of the INSTEON ACK message that the INSTEON Engine automatically sends after it receives an INSTEON Direct message.	
What you send	4 bytes.	
What you'll get	5 bytes.	
LED indication	None.	
Related Commands	IM 0x50 INSTEON Standard Message Received ₂₀ IM 0x51 INSTEON Extended Message Received ₂₁ IM 0x68 Set INSTEON ACK Message Byte ₂₃ IM 0x70 Set INSTEON NAK Message Byte ₂₅	
Command Sent from Host to IM		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x71	IM Command Number
3	<Command 1 Data>	Data byte to place into the <i>Command 1</i> field 2 of the ACK response.
4	<Command 2 Data>	Data byte to place into the <i>Command 2</i> field 2 of the ACK response.
Message Returned by IM to Host		
Byte	Value	Meaning
1	0x02	Echoed Start of IM Command
2	0x71	Echoed IM Command Number
3	<Command 1 Data>	Echoed <Command 1 Data>
4	<Command 2 Data>	Echoed <Command 2 Data>
5	<ACK/NAK>	0x06 (ACK) if the IM executed the Command correctly. 0x15 (NAK) if an error occurred.
Notes		
You have only about 15 milliseconds after the receipt of an INSTEON Direct message from the IM to send this Command to the IM. The reason is that the INSTEON Engine in the IM automatically sends Acknowledgement messages in assigned timeslots.		
Use Set INSTEON ACK Message Byte ₂₃ when you only need to return one byte of data in an ACK message.		
Use Set INSTEON NAK Message Byte ₂₅ when you need to return one byte of data in a NAK message.		
Certain INSTEON Direct Commands require returned data in the Acknowledgement message. For more information on INSTEON Commands and the latest Command set, please download the current INSTEON Command Tables Document ₄ from www.insteon.net .		

Set INSTEON NAK Message Byte

Set INSTEON NAK Message Byte (0x70)		
What it does	Allows you to change the INSTEON ACK message that the INSTEON Engine automatically sends after it receives an INSTEON Direct message into a NAK message, and to put one byte of data into the <i>Command 2</i> field of that message.	
What you send	3 bytes.	
What you'll get	4 bytes.	
LED indication	None.	
Related Commands	IM 0x50 INSTEON Standard Message Received ₂₀ IM 0x51 INSTEON Extended Message Received ₂₁ IM 0x68 Set INSTEON ACK Message Byte ₂₃ IM 0x70 Set INSTEON ACK Message Two Bytes ₂₄	
Command Sent from Host to IM		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x70	IM Command Number
3	<Command 2 Data>	Data byte to place into the <i>Command 2</i> field of the ACK response.
Message Returned by IM to Host		
Byte	Value	Meaning
1	0x02	Echoed Start of IM Command
2	0x70	Echoed IM Command Number
3	<Command 2 Data>	Echoed <Command 2 Data>
4	<ACK/NAK>	0x06 (ACK) if the IM executed the Command correctly. 0x15 (NAK) if an error occurred.
Notes		
You have only about 15 milliseconds after the receipt of an INSTEON Direct message from the IM to send this Command to the IM. The reason is that the INSTEON Engine in the IM automatically sends Acknowledgement messages in assigned timeslots.		
Use Set INSTEON ACK Message Byte ₂₃ or Set INSTEON ACK Message Two Bytes ₂₄ when you need to return one or two bytes of data in an ACK message.		
NAK messages report certain error conditions in a receiving device. See <i>NAK Error Codes</i> in the INSTEON Developer's Guide ₄ for more information.		

X10 Message Handling

Send X10

Send X10 (0x63)			
What it does	Allows you to send a raw X10 Address or X10 Command.		
What you send	4 bytes.		
What you'll get	5 bytes.		
LED indication	None.		
Related Commands	IM 0x52 X10 Received ₇		
Command Sent from Host to IM			
Byte	Value	Meaning	
1	0x02	Start of IM Command	
2	0x63	IM Command Number	
3	<Raw X10>	The four most significant bits contain the X10 House Code. The four least significant bits contain the X10 Key Code.	
4	<X10 Flag>	0x00 indicates that the X10 Key Code is an X10 Unit Code. 0x80 indicates that the X10 Key Code is an X10 Command.	
Message Returned by IM to Host			
Byte	Value	Meaning	
1	0x02	Echoed Start of IM Command	
2	0x63	Echoed IM Command Number	
3	<Raw X10>	Echoed <Raw X10>	
4	<X10 Flag>	Echoed <X10 Flag>	
5	<ACK/NAK>	0x06 (ACK) if the IM executed the Command correctly 0x15 (NAK) if an error occurred	
X10 Translation Table			
	4 MSBs of <Raw X10>	4 LSBs of <Raw X10>	
4-bit Code	X10 House Code	X10 Unit Code <X10 Flag> = 0x00	X10 Command <X10 Flag> = 0x80
0x6	A	1	All Lights Off
0xE	B	2	Status = Off
0x2	C	3	On
0xA	D	4	Preset Dim
0x1	E	5	All Lights On
0x9	F	6	Hail Acknowledge
0x5	G	7	Bright
0xD	H	8	Status = On
0x7	I	9	Extended Code
0xF	J	10	Status Request
0x3	K	11	Off
0xB	L	12	Preset Dim
0x0	M	13	All Units Off
0x8	N	14	Hail Request
0x4	O	15	Dim
0xC	P	16	Extended Data (analog)

X10 Received

X10 Received (0x52)			
What it does	Informs you of an X10 byte detected on the powerline.		
When you'll get this	Any X10 traffic is detected on the powerline.		
What you'll get	4 bytes.		
LED indication	The LED will blink during X10 reception.		
Related Commands	IM 0x63 Send X10 ₂₆ IM 0x50 INSTEON Standard Message Received ₂₀ IM 0x51 INSTEON Extended Message Received ₂₁		
Message Sent from IM to Host			
Byte	Value	Meaning	
1	0x02	Start of IM Command	
2	0x52	IM Command Number	
3	<Raw X10>	The four most significant bits contain the X10 House Code. The four least significant bits contain the X10 Key Code.	
4	<X10 Flag>	0x00 indicates that the X10 Key Code is an X10 Unit Code. 0x80 indicates that the X10 Key Code is an X10 Command.	
X10 Translation Table			
	4 MSBs of <Raw X10>		4 LSBs of <Raw X10>
4-bit Code	X10 House Code	X10 Unit Code <X10 Flag> = 0x00	X10 Command <X10 Flag> = 0x80
0x6	A	1	All Lights Off
0xE	B	2	Status = Off
0x2	C	3	On
0xA	D	4	Preset Dim
0x1	E	5	All Lights On
0x9	F	6	Hail Acknowledge
0x5	G	7	Bright
0xD	H	8	Status = On
0x7	I	9	Extended Code
0xF	J	10	Status Request
0x3	K	11	Off
0xB	L	12	Preset Dim
0x0	M	13	All Units Off
0x8	N	14	Hail Request
0x4	O	15	Dim
0xC	P	16	Extended Data (analog)

INSTEON ALL-Link Commands

Send ALL-Link Command

Send ALL-Link Command (0x61)		
What it does	Sends an ALL-Link Command to an ALL-Link Group of one or more Responders that the IM is ALL-Linked to.	
What you send	5 bytes.	
What you'll get	6 bytes for the echo of the Command and then an additional 11 bytes in an INSTEON Standard Message Received ₂₀ message for each device in the group that acknowledges ALL-Link Cleanup, or 7 bytes in an ALL-Link Cleanup Failure Report ₃₀ message for each device in the group that does not acknowledge ALL-Link Cleanup.	
LED indication	None.	
Related Commands	IM 0x50 INSTEON Standard Message Received ₂₀ IM 0x56 ALL-Link Cleanup Failure Report ₃₀ IM 0x58 ALL-Link Cleanup Status Report ₃₁	
Command Sent from Host to IM		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x61	IM Command Number
3	<ALL-Link Group>	ALL-Link Group Number that the ALL-Link Command is sent to
4	<ALL-Link Command>	ALL-Link Command
5	<Broadcast Command 2>	Sent in the <i>Command 2</i> field of the ALL-Link Broadcast message only. <i>Command 2</i> will always contain the ALL-Link Group Number for the ALL-Link Cleanup messages that follow.
Message Returned by IM to Host		
Byte	Value	Meaning
1	0x02	Echoed Start of IM Command
2	0x61	Echoed IM Command Number
3	<ALL-Link Group>	Echoed <ALL-Link Group>
4	<ALL-Link Command>	Echoed <ALL-Link Command>
5	<Broadcast Command 2>	Echoed <Broadcast Command 2>
6	<ACK/NAK>	0x06 (ACK) if the IM executed the Command correctly 0x15 (NAK) if an error occurred or the group does not exist
Notes		
<p>The IM automatically sends ALL-Link Cleanup messages to each member of an ALL-Link Group following an ALL-Link Broadcast message. If the IM detects other INSTEON traffic during this process, it will abort the ALL-Link Cleanup sequence and send you an ALL-Link Cleanup Status Report₃₁ with a <i>Status Byte</i> of 0x15 (NAK). The Cleanup sequence proceeds in the order in which the devices in the ALL-Link Group were added to the ALL-Link Database. If the IM finishes sending <i>all</i> of the Cleanup messages, it will send you an ALL-Link Cleanup Status Report₃₁ with a <i>Status Byte</i> of 0x06 (ACK).</p>		
<p>For <i>each</i> ALL-Link Cleanup message that the IM sends, you will either receive an INSTEON Standard Message Received₂₀ when the Responder answers with a Cleanup acknowledgement message, or else you will receive an ALL-Link Cleanup Failure Report₃₀ if the Responder fails to answer with a Cleanup acknowledgement message. The IM will send you an ALL-Link Cleanup Status Report₃₁ whether or not every ALL-Link Group member acknowledges the Cleanup Command that the IM sends to it.</p>		
<p>You can cause the IM to cancel its own Cleanup sequence by sending it a new Send ALL-Link Command₂₈ or Send INSTEON Standard or Extended Message₁₇ during the time that it is sending a Cleanup sequence (i.e. <i>after</i> it has finished sending an ALL-Link Broadcast message). The IM <i>will</i> send you an ALL-Link Cleanup Status Report₃₁ in those cases.</p>		
<p>The IM first sends an ALL-Link Broadcast message with <i>Max Hops</i> set to 3. When it sends the ensuing ALL-Link Cleanup messages, it sets <i>Max Hops</i> to 1. If the IM's INSTEON Engine needs to retry a Cleanup message, it will automatically increment <i>Max Hops</i> for each retry, up to a maximum of value of 3.</p>		

Send ALL-Link Command (0x61)
<p>The IM sends the ALL-Link Broadcast message immediately if there is no other INSTEON traffic. If there is other INSTEON traffic, the IM will wait for one silent powerline zero crossing following a completed INSTEON message. The IM will send the first ALL-Link Cleanup message after a delay of 7 zero crossings. Subsequent Cleanups will go out with a delay of 2 zero crossings.</p>
<p>Do not use this command to control light levels with the <i>Light Start Manual Change</i> INSTEON Command SA 0x17. Use Send INSTEON Standard-length Message₁₇ to send INSTEON Command SD 0x17 instead.</p>
<p>For more information on INSTEON Commands and the latest Command set, please download the current INSTEON Command Tables Document₄ from www.insteon.net.</p>

ALL-Link Cleanup Failure Report

ALL-Link Cleanup Failure Report (0x56)		
What it does	Reports that an ALL-Link Group member did not acknowledge an ALL-Link Cleanup Command.	
When you'll get this	An ALL-Link Group member that you are trying to control did not acknowledge the ALL-Link Cleanup Command sent by the IM.	
What you'll get	7 bytes.	
LED indication	None.	
Related Commands	IM 0x58 ALL-Link Cleanup Status Report ₃₁	
Message Sent from IM to Host		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x56	IM Command Number
3	0x01	Indicates that this ALL-Link Group member did not acknowledge an ALL-Link Cleanup Command.
4	<ALL-Link Group>	Indicates the ALL-Link Group Number that was sent in the ALL-Link Cleanup Command.
5	<ID high byte>	The high byte of the INSTEON ID of the device that did not respond.
6	<ID middle byte>	The middle byte of the INSTEON ID of the device that did not respond.
7	<ID low byte>	The low byte of the INSTEON ID of the device that did not respond.
Notes		
<p>The IM automatically sends ALL-Link Cleanup messages to each member of an ALL-Link Group following an ALL-Link Broadcast message. If the IM detects other INSTEON traffic during this process, it will abort the ALL-Link Cleanup sequence. If the Cleanup sequence is aborted, you will not receive this message nor will you receive a Cleanup acknowledgement message for any subsequent devices in the ALL-Link Group. The Cleanup sequence proceeds in the order in which the devices in the ALL-Link Group were added to the ALL-Link Database.</p>		
<p>For each ALL-Link Cleanup message the IM sends, you will either receive an INSTEON Standard Message Received₂₀ when the Responder sends you an ACK, or you will receive this message. However, it can take awhile before you receive this message. Worst case, if the IM has to wait for a clear line and then retries the Cleanup message for the maximum of five times, the wait will be 2.150 seconds after sending the ALL-Link Broadcast message, or 1.550 seconds after receiving the first Cleanup acknowledgement or this message. If the Cleanup sequence was aborted due to other INSTEON traffic, you will not get this message even then. However, you will receive ALL-Link Cleanup Status Report₃₁ with a <i>Status Byte</i> of 0x15 (NAK) indicating that the Cleanup sequence was aborted.</p>		
<p>It is possible that this ALL-Link Group member did in fact properly receive the ALL-Link Broadcast message that preceded the ALL-Link Cleanup message.</p>		

ALL-Link Cleanup Status Report

ALL-Link Cleanup Status Report (0x58)		
What it does	Notifies you if a Send ALL-Link Command ₂₈ completed with all Cleanup messages sent, or else if Cleanups were interrupted due to other INSTEON traffic.	
When you'll get this	After you issue a Send ALL-Link Command ₂₈ and the IM finishes sending Cleanups to all members of the ALL-Link Group, or else when the Cleanup sequence is aborted due to other INSTEON traffic.	
What you'll get	3 bytes.	
LED indication	None.	
Related Commands	IM 0x61 Send ALL-Link Command ₂₈ IM 0x56 ALL-Link Cleanup Failure Report ₃₀	
Message Sent from IM to Host		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x58	IM Command Number
3	<Status Byte>	<p><0x06> (ASCII ACK) The ALL-Link Command sequence initiated previously using Send ALL-Link Command₂₈ completed. The IM first sent an ALL-Link Broadcast message, followed by ALL-Link Cleanup messages sent to all members of the specified ALL-Link Group. If any member of the ALL-Link Group does not return a Cleanup acknowledgement, you will receive an ALL-Link Cleanup Failure Report₃₀ from that member.</p> <p><0x15> (ASCII NAK) The ALL-Link Command sequence initiated previously using Send ALL-Link Command₂₈ terminated before the IM sent ALL-Link Cleanup messages to all members of the specified ALL-Link Group. This is normal behavior when the IM detects INSTEON traffic from other devices.</p>
Notes		
<p>The IM automatically sends ALL-Link Cleanup messages to each member of an ALL-Link Group following an ALL-Link Broadcast message. If the IM detects other INSTEON traffic during this process, it will abort the ALL-Link Cleanup sequence and send you this message with a <i>Status Byte</i> of 0x15 (NAK). The Cleanup sequence proceeds in the order in which the devices in the ALL-Link Group were added to the ALL-Link Database. If the IM finishes sending <i>all</i> of the Cleanup messages, it will send you this message with a <i>Status Byte</i> of 0x06 (ACK).</p>		
<p>For <i>each</i> ALL-Link Cleanup message that the IM sends, you will either receive an INSTEON Standard Message Received₂₀ when the Responder answers with a Cleanup acknowledgement message, or else you will receive an ALL-Link Cleanup Failure Report₃₀ if the Responder fails to answer with a Cleanup acknowledgement message. The IM will send you <i>this</i> message whether or not every ALL-Link Group member acknowledges the Cleanup Command that the IM sends to it.</p>		
<p>You can cause the IM to cancel its own Cleanup sequence by sending it a new Send ALL-Link Command₂₈ or Send INSTEON Standard or Extended Message₁₇ during the time that it is sending a Cleanup sequence (i.e. <i>after</i> it has finished sending an ALL-Link Broadcast message). The IM <i>will</i> send you this message in those cases.</p>		

ALL-Linking Session Management

Start ALL-Linking

Start ALL-Linking (0x64)		
What it does	Puts the IM into ALL-Linking mode without using the SET Button.	
What you send	4 bytes.	
What you'll get	5 bytes for this Command response and then an additional 10 bytes in an ALL-Linking Completed ₃₄ message once a successful ALL-Link has been established.	
LED indication	The LED will blink continuously at a rate of ½ second on and ½ second off until the ALL-Link is completed or canceled.	
Related Commands	IM 0x53 ALL-Linking Completed ₃₄ IM 0x65 Cancel ALL-Linking ₃₃	
Command Sent from Host to IM		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x64	IM Command Number
3	<Link Code>	The type of ALL-Link to establish.
		0x00 ALL-Links the IM as a Responder (slave).
		0x01 ALL-Links the IM as a Controller (master).
		0x03 ALL-Links the IM as a Controller when the IM initiates ALL-Linking, or as a Responder when another device initiates ALL-Linking.
0xFF	Deletes the ALL-Link.	
4	<ALL-Link Group>	The ALL-Link Group Number to be linked to or deleted.
Message Returned by IM to Host		
Byte	Value	Meaning
1	0x02	Echoed Start of IM Command
2	0x64	Echoed IM Command Number
3	<Code>	Echoed <Code>
4	<ALL-Link Group>	Echoed <ALL-Link Group>
5	<ACK/NAK>	0x06 (ACK) if the IM executed the Command correctly 0x15 (NAK) if an error occurred

Cancel ALL-Linking

Cancel ALL-Linking (0x65)		
What it does	Cancels the ALL-Linking process that was started either by holding down the IM's SET Button or by sending a Start ALL-Linking ₃₂ Command to the IM.	
What you send	2 bytes.	
What you'll get	3 bytes.	
LED indication	The LED will stop blinking.	
Related Commands	IM 0x64 Start ALL-Linking ₃₂ IM 0x54 Button Event Report ₄₉	
Command Sent from Host to IM		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x65	IM Command Number
Message Returned by IM to Host		
Byte	Value	Meaning
1	0x02	Echoed Start of IM Command
2	0x65	Echoed IM Command Number
3	<ACK/NAK>	0x06 (ACK) if the IM executed the Command correctly 0x15 (NAK) if an error occurred

ALL-Linking Completed

ALL-Linking Completed (0x53)		
What it does	Informs you of a successful ALL-Linking procedure.	
When you'll get this	An ALL-Linking procedure has been completed between the IM and either a Controller or Responder.	
What you'll get	10 bytes.	
LED indication	None.	
Related Commands	IM 0x64 Start ALL-Linking ₃₂ IM 0x65 Cancel ALL-Linking ₃₃	
Message Sent from IM to Host		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x53	IM Command Number
3	<Link Code>	Indicates the type of link made. 0x00 means the IM is a Responder (slave) to this device 0x01 means the IM is a Controller (master) of this device 0xFF means the ALL-Link to the device was deleted If done manually (by pushing the SET Button) the Controller / Responder relationship between the IM and the device is determined automatically. You can assign the Controller / Responder relationship unconditionally by using the Start ALL-Linking ₃₂ Command.
4	<ALL-Link Group>	Indicates the ALL-Link Group Number that was assigned to this link. If done manually (by pushing the SET Button) the ALL-Link Group Number is automatically assigned by the IM. You can assign ALL-Link Group Numbers unconditionally by using the Start ALL-Linking ₃₂ Command.
5	<ID high byte>	The high byte of the INSTEON ID of the device that was ALL-Linked.
6	<ID middle byte>	The middle byte of the INSTEON ID of the device that was ALL-Linked.
7	<ID low byte>	The low byte of the INSTEON ID of the device that was ALL-Linked.
8	<Device Category>	The Device Category (DevCat) of the Responder device that was ALL-Linked. (Only valid when the IM is a Controller)
9	<Device Subcategory>	The Device Subcategory (SubCat) of the Responder device that was ALL-Linked. (Only valid when the IM is a Controller)
10	<0xFF Firmware Version>	0xFF for newer devices. For legacy devices this is the firmware version of the Responder device that was ALL-Linked. (Only valid when the IM is a Controller)

ALL-Link Database Management

Get First ALL-Link Record

Get First ALL-Link Record (0x69)		
What it does	Returns the first record in the IM's ALL-Link Database. The data will follow in an ALL-Link Record Response ₃₈ message.	
What you send	2 bytes.	
What you'll get	3 bytes.	
LED indication	None.	
Related Commands	IM 0x57 ALL-Link Record Response ₃₈ IM 0x6A Get Next ALL-Link Record ₃₆ IM 0x6C Get ALL-Link Record for Sender ₃₇	
Command Sent from Host to IM		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x69	IM Command Number
Message Returned by IM to Host		
Byte	Value	Meaning
1	0x02	Echoed Start of IM Command
2	0x69	Echoed IM Command Number
3	<ACK/NAK>	0x06 (ACK) if an ALL-Link Record Response ₃₈ follows 0x15 (NAK) if the database is empty.
Note		
Use this to begin scanning the IM's ALL-Link Database. Follow up with Get Next ALL-Link Record ₃₆ Commands until you receive a NAK.		
In the IM Factory Reset State ₁₀ the ALL-Link Database will be cleared, so you will receive a NAK.		

Get Next ALL-Link Record

Get Next ALL-Link Record (0x6A)		
What it does	Returns the next record in the IM's ALL-Link Database. The data will follow in an ALL-Link Record Response ₃₈ message.	
What you send	2 bytes.	
What you'll get	3 bytes.	
LED indication	None.	
Related Commands	IM 0x57 ALL-Link Record Response ₃₈ IM 0x69 Get First ALL-Link Record ₃₅ IM 0x6C Get ALL-Link Record for Sender ₃₇	
Command Sent from Host to IM		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x6A	IM Command Number
Message Returned by IM to Host		
Byte	Value	Meaning
1	0x02	Echoed Start of IM Command
2	0x6A	Echoed IM Command Number
3	<ACK/NAK>	0x06 (ACK) if an ALL-Link Record Response ₃₈ follows 0x15 (NAK) if there are no more records.
Note		
Use this to continue scanning the IM's ALL-Link Database until you receive a NAK. Begin the scan up with a Get First ALL-Link Record ₃₅ Command.		
In the IM Factory Reset State ₁₀ the ALL-Link Database will be cleared, so you will receive a NAK.		

Get ALL-Link Record for Sender

Get ALL-Link Record for Sender (0x6C)		
What it does	This gets the record from the IM's ALL-Link Database for the last INSTEON message received from an INSTEON device that is in the IM's ALL-Link Database. The data will follow in an ALL-Link Record Response ₃₈ message.	
What you send	2 bytes.	
What you'll get	3 bytes.	
LED indication	None.	
Related Commands	IM 0x57 ALL-Link Record Response ₃₈ IM 0x69 Get First ALL-Link Record ₃₅ IM 0x6A Get Next ALL-Link Record ₃₆	
Command Sent from Host to IM		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x6C	IM Command Number
Message Returned by IM to Host		
Byte	Value	Meaning
1	0x02	Echoed Start of IM Command
2	0x6C	Echoed IM Command Number
3	<ACK/NAK>	0x06 (ACK) if an ALL-Link Record Response ₃₈ follows 0x15 (NAK) if the last INSTEON message received had a <i>From Address</i> not in the IM's ALL-Link Database.
Note		
If you send this after receiving an INSTEON message from an INSTEON device that is not in the IM's ALL-Link Database, you will receive a NAK in response.		
Sending a Get Next ALL-Link Record ₃₆ Command after this will return the ALL-Link Record that follows this one, but your actual position within the ALL-Link Database will be unknown (unless you are at the end).		
In the IM Factory Reset State ₁₀ the ALL-Link Database will be cleared, so you will receive a NAK.		

ALL-Link Record Response

ALL-Link Record Response (0x57)		
What it does	Provides a record from the IM's ALL-Link Database.	
When you'll get this	You get this when you have requested it, in response to a Get First ALL-Link Record ³⁵ a Get Next ALL-Link Record ³⁶ , or a Get ALL-Link Record for Sender ³⁷ Command.	
What you'll get	10 bytes.	
LED indication	None.	
Related Commands	IM 0x69 Get First ALL-Link Record ³⁵ IM 0x6A Get Next ALL-Link Record ³⁶ IM 0x6C Get ALL-Link Record for Sender ³⁷	
Message Sent from IM to Host		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x57	IM Command Number
3	<ALL-Link Record Flags>	ALL-Link Database control flags for this ALL-Link Record
4	<ALL-Link Group>	ALL-Link Group Number for this ALL-Link Record
5	<ID high byte>	INSTEON ID high byte for device ALL-Linked to
6	<ID middle byte>	INSTEON ID middle byte for device ALL-Linked to
7	<ID low byte>	INSTEON ID low byte for device ALL-Linked to
8	<Link Data 1>	Link Information (varies by device ALL-Linked to)
9	<Link Data 2>	Link Information (varies by device ALL-Linked to)
10	<Link Data 3>	Link Information (varies by device ALL-Linked to)
Note		
See the section <i>INSTEON All-Link Database</i> in the INSTEON Developer's Guide ⁴ for details about the contents of an ALL-Link Record.		

Manage ALL-Link Record

Manage ALL-Link Record (0x6F)		
What it does	Updates the IM's ALL-Link Database with the ALL-Link Record information you send. Use caution with this Command—the IM does not check the validity of the data.	
What you send	11 bytes.	
What you'll get	12 bytes.	
LED indication	None.	
Related Commands	IM 0x57 ALL-Link Record Response ₃₈	
Command Sent from Host to IM		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x6F	IM Command Number
3	<Control Code>	What to do with the ALL-Link Record
	0x00	Does an ALL-Link Record exist for this ID + ALL-Link Group? You will receive an ACK at the end of the returned message if the ALL-Link Record exists, or else a NAK if it doesn't. If the record exists, the IM will return it in an ALL-Link Record Response ₃₈ message.
	0x01	Search for the next ALL-Link Record following the one found using Control Code 0x00 above. This allows you to find both Controller and Responder records for a given ID + ALL-Link Group. Be sure to use the same ID + ALL-Link Group (bytes 5 - 8) as you used for Control Code 0x00. You will receive an ACK at the end of the returned message if the ALL-Link Record exists, or else a NAK if it doesn't. If the record exists, the IM will return it in an ALL-Link Record Response ₃₈ message.
	0x20	Update existing or else add new ALL-Link Record
	0x40	Update existing or else add new Controller (master) ALL-Link Record
	0x41	Update existing or else add new Responder (slave) ALL-Link Record
	0x80	Delete ALL-Link Record
4	<ALL-Link Record Flags>	ALL-Link Database control flags for this ALL-Link Record
5	<ALL-Link Group>	ALL-Link Group Number for this ALL-Link Record
6	<ID high byte>	INSTEON ID high byte for device ALL-Linked to
7	<ID middle byte>	INSTEON ID middle byte for device ALL-Linked to
8	<ID low byte>	INSTEON ID low byte for device ALL-Linked to
9	<Link Data 1>	Link Information: varies by device ALL-Linked to
10	<Link Data 2>	Link Information: varies by device ALL-Linked to
11	<Link Data 3>	Link Information: varies by device ALL-Linked to
Message Returned by IM to Host		
Byte	Value	Meaning
1	0x02	Echoed Start of IM Command
2	0x6F	Echoed IM Command Number
3	<Control Code>	Echoed <Control Code>
4	<ALL-Link Record Flags>	Echoed <ALL-Link Record Flags>
5	<ALL-Link Group>	Echoed <ALL-Link group>
6	<ID high byte>	Echoed <ID high byte>
7	<ID middle byte>	Echoed <ID middle byte>
8	<ID low byte>	Echoed <ID low byte>

Manage ALL-Link Record (0x6F)		
9	<Link Data 1>	Echoed <Link Data 1>
10	<Link Data 2>	Echoed <Link Data 2>
11	<Link Data 3>	Echoed <Link Data 3>
12	<ACK/NAK>	0x06 (ACK) if the IM executed the Command correctly. 0x15 (NAK) if an error occurred or the ALL-Link Record doesn't exist.
Notes		
See the section <i>INSTEON All-Link Database</i> in the INSTEON Developer's Guide , for details about the contents of an ALL-Link Record.		
Please be aware that you can damage the IM's ALL-Link Database if you misuse this Command. For instance, if you zero the <ALL-Link Record Flags> byte in the first ALL-Link Record, the ALL-Link Database will then appear empty.		

IM Status Management

Reset the IM

Reset the IM (0x67)		
What it does	Puts the IM into the IM Factory Reset State ₁₀ , which clears the entire ALL-Link Database.	
What you send	2 bytes.	
What you'll get	3 bytes.	
LED indication	While the reset procedure is being processed, the Status LED will turn off. At the conclusion of the reset procedure, the Status LED will illuminate steadily.	
Related Commands	IM 0x55 User Reset Detected ₄₂	
Command Sent from Host to IM		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x67	IM Command Number
Message Returned by IM to Host		
Byte	Value	Meaning
1	0x02	Echoed Start of IM Command
2	0x67	Echoed IM Command Number
3	<ACK/NAK>	0x06 (ACK) if the IM executed the Command correctly 0x15 (NAK) if an error occurred
Notes		
The IM will send the <ACK/NAK> byte after it erases the EEPROM. ~20 seconds for models with external EEPROM ~2 seconds for models with no external EEPROM		
See the IM Factory Reset State ₁₀ section for complete information on the state of the IM after sending this Command.		

User Reset Detected

User Reset Detected (0x55)		
What it does	Reports that the user manually put the IM into the IM Factory Reset State ₁₀ .	
When you'll get this	The user held down the IM's SET Button for at least 10 seconds when power was first applied.	
What you'll get	2 bytes (not until about 20 seconds after applying power to the IM with the SET Button held down).	
LED indication	The LED will turn off for about 20 seconds. Once the LED turns back on the reset is complete.	
Related Commands	IM 0x67 Reset the IM ₄₁	
Message Sent from IM to Host		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x55	IM Command Number
Notes		
The IM will send this message after it erases the EEPROM. ~20 seconds for models with external EEPROM ~2 seconds for models with no external EEPROM		
See the IM Factory Reset State ₁₀ section for complete information on the state of the IM after receiving this message.		

Get IM Configuration

Get IM Configuration (0x73)		
What it does	Returns the IM's Configuration Flags byte. Also returns two spare bytes of data reserved for future use.	
What you send	2 bytes.	
What you'll get	6 bytes.	
LED indication	None.	
Related Commands	IM 0x6B Set IM Configuration ⁴⁴	
Command Sent from Host to IM		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x73	IM Command Number
Message Returned by IM to Host		
Byte	Value	Meaning
1	0x02	Echoed Start of IM Command
2	0x73	Echoed IM Command Number
3	<IM Configuration Flags>	IM's Configuration Flags. See Set IM Configuration ⁴⁴ for bit definitions.
4	<Spare 1>	0x00, reserved for future use
5	<Spare 2>	0x00, reserved for future use
6	<ACK/NAK>	0x06 (ACK) if the IM executed the Command correctly 0x15 (NAK) if an error occurred
Note		
Because Set IM Configuration ⁴⁴ sets all of the <IM Configuration Flags> at once, to change an individual bit, first use this Command to determine the current state of all of the <IM Configuration Flags>.		

Set IM Configuration

Set IM Configuration (0x6B)		
What it does	Allows you change operating parameters of the IM.	
What you send	3 bytes.	
What you'll get	4 bytes.	
LED indication	None.	
Related Commands	IM 0x73 Get IM Configuration ₄₃ IM 0x54 Button Event Report ₄₉ IM 0x50 INSTEON Standard Message Received ₂₀ IM 0x51 INSTEON Extended Message Received ₂₁ IM 0x6D LED On ₅₀ IM 0x6E LED Off ₅₁	
Command Sent from Host to IM		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x6B	IM Command Number
3	<IM Configuration Flags>	Flag byte containing Configuration Flags that affect IM operation. These all default to 0.
		Bit 7 = 1 Disables automatic linking when the user pushes and holds the SET Button (see Button Event Report ₄₉).
		Bit 6 = 1 Puts the IM into <i>Monitor Mode</i> (see About Monitor Mode ₄₅ in the Notes below).
		Bit 5 = 1 Disables automatic LED operation by the IM. The host must now control the IM's LED using LED On ₅₀ and LED Off ₅₁ .
		Bit 4 = 1 Disable host communications <i>Deadman</i> feature (i.e. allow host to delay more than 240 milliseconds between sending bytes to the IM). See IM RS232 Port Settings ₈ .
	Bits 3 - 0	Reserved for internal use. Set these bits to 0.
Message Returned by IM to Host		
Byte	Value	Meaning
1	0x02	Echoed Start of IM Command
2	0x6B	Echoed IM Command Number
3	<IM Configuration Flags>	Echoed <IM Configuration Flags>
4	<ACK/NAK>	0x06 (ACK) if the IM executed the Command correctly. 0x15 (NAK) if an error occurred.
Notes		
When the IM is in the IM Factory Reset State ₁₀ , the <IM Configuration Flags> will all be set to zero.		
This Command sets all of the <IM Configuration Flags> at once. To change an individual bit, first use Get IM Configuration ₄₃ to determine the current state of all of the <IM Configuration Flags>.		

Set IM Configuration (0x6B)

About Monitor Mode

Normally, the IM will only send the host an [INSTEON Standard Message Received₂₀](#) or [INSTEON Extended Message Received₂₁](#) notification when it receives an INSTEON messages directed specifically to the IM. There are three possibilities:

1. The IM received a Direct message with a *To Address* matching the IM's INSTEON ID,
2. The IM received an ALL-Link Broadcast message sent to an ALL-Link Group that the IM belongs to as a Responder (i.e. the message's *From Address* and ALL-Link Group Number match a Responder entry in the IM's ALL-Link Database), or
3. The IM received an ALL-Link Cleanup message with a *To Address* matching the IM's INSTEON ID and the message's *From Address* and ALL-Link Group Number match a Responder entry in the IM's ALL-Link Database.

In *Monitor Mode*, the IM will also notify the host of received INSTEON messages that contain a *From Address* matching *any* INSTEON ID in the IM's ALL-Link Database, even if the *To Address* does not match the IM's INSTEON ID or the IM does not belong to an ALL-Link Group associated with the message. In other words, if the message originator is in the IM's ALL-Link Database as either a Controller or Responder, the IM will pass the message to the host even if it is not specifically directed to the IM. In this way you can monitor messages between other INSTEON devices as long as the sender is in the IM's ALL-Link Database.

Please be aware that the IM may not always detect this traffic. If the message originator and addressee are close to one another and the IM is farther away, the message originator may not cause the message to hop enough times for the IM to hear it. To know for sure what an INSTEON device's status is, you can usually query it directly using an appropriate INSTEON Direct Command. For more information on INSTEON Commands and the latest Command set, please download the current [INSTEON Command Tables Document](#), from www.insteon.net.

Get IM Info

Get IM Info (0x60)		
What it does	Identifies the IM's 3 byte INSTEON ID, Device Category (DevCat), Device Subcategory (SubCat), and firmware version.	
What you send	2 bytes.	
What you'll get	9 bytes.	
LED indication	None.	
Related Commands	IM 0x66 Set Host Device Category ⁴⁷ IM 0x73 Get IM Configuration ⁴³ IM 0x6B Set IM Configuration ⁴⁴	
Command Sent from Host to IM		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x60	IM Command Number
Message Returned by IM to Host		
Byte	Value	Meaning
1	0x02	Echoed Start of IM Command
2	0x60	Echoed IM Command Number
3	<ID high byte>	IM's INSTEON ID high byte
4	<ID middle byte>	IM's INSTEON ID middle byte
5	<ID low byte>	IM's INSTEON ID low byte
6	<Device Category>	IM's Device Category
7	<Device Subcategory>	IM's Device Subcategory
8	<Firmware Version>	IM's Firmware Version
9	<ACK/NAK>	0x06 (ACK) if the IM executed the Command correctly 0x15 (NAK) if an error occurred
Note		
Using the Set Host Device Category ⁴⁷ Command to change the host's DevCat and SubCat will only affect the data transmitted by the IM to other INSTEON devices during ALL-Linking. When the host sends this Command to the IM, the IM will return the original DevCat, SubCat and firmware version hard-coded into the IM's firmware at the factory.		

Set Host Device Category

Set Host Device Category (0x66)		
What it does	Lets you set the Device Category (DevCat) and Device Subcategory (SubCat) of the host device connected to the IM.	
What you send	5 bytes.	
What you'll get	6 bytes.	
LED indication	None.	
Related Commands	IM 0x60 Get IM Info ₄₆	
Command Sent from Host to IM		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x66	IM Command Number
3	<Device Category>	INSTEON Device Category (DevCat) of the host device connected to the IM.
4	<Device Subcategory>	INSTEON Device Subcategory (SubCat) of the host device connected to the IM.
5	<0xFF Firmware Version>	0xFF In legacy devices this byte represented a BCD-encoded firmware version. The high nibble (4 bits) gave the major revision number and the low nibble gave the minor revision. In current devices use the INSTEON <i>Product Data Request</i> and <i>Product Data Response</i> Commands to retrieve the firmware version as user-defined data.
Message Returned by IM to Host		
Byte	Value	Meaning
1	0x02	Echoed Start of IM Command
2	0x66	Echoed IM Command Number
3	<Device Category>	Echoed <Device Category>
4	<Device Subcategory>	Echoed <Device Subcategory>
5	<0xFF Firmware Version>	Echoed <0xFF> or <Firmware Version>
6	<ACK/NAK>	0x06 (ACK) if the IM executed the Command correctly 0x15 (NAK) if an error occurred
Notes		
For INSTEON compliance, you must obtain an approved DevCat and SubCat assignment for your host product from SmartLabs.		
The IM stores these values in EEPROM so they will not be erased if power is lost.		
When the IM is in the IM Factory Reset State ₁₀ , these values will be set to those hard-coded into the IM's firmware at the factory.		
Using this Command to change the host's DevCat and SubCat will only affect the data transmitted by the IM to other INSTEON devices during ALL-Linking.		
When the host sends a Get IM Info ₄₆ Command to the IM, the IM will return the original DevCat, SubCat and firmware version hard-coded into the IM's firmware at the factory.		
For the latest list of assigned INSTEON DevCats, please download the INSTEON Device Categories and Product Keys Document ₄ from www.insteon.net .		

RF Sleep

RF Sleep (0x72)		
What it does	Directs an RF IM to go into power saving sleep mode. To wake up the RF IM, send it one byte of serial data.	
What you send	2 bytes.	
What you'll get	3 bytes.	
LED indication	None.	
Related Commands	None.	
Command Sent from Host to IM		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x71	IM Command Number
3	<Command 1 Data>	Data byte to place into the <i>Command 1</i> field 2 of the ACK response.
4	<Command 2 Data>	Data byte to place into the <i>Command 2</i> field 2 of the ACK response.
Message Returned by IM to Host		
Byte	Value	Meaning
1	0x02	Echoed Start of IM Command
2	0x71	Echoed IM Command Number
3	<Command 1 Data>	Echoed <Command 1 Data>
4	<Command 2 Data>	Echoed <Command 2 Data>
5	<ACK/NAK>	0x06 (ACK) if the IM executed the Command correctly. 0x15 (NAK) if an error occurred.
Notes		
It does not matter what byte you send serially to wake up the RF IM.		
When the RF IM wakes up, it will reinitialize, but memory will not be altered as it would be in the IM Factory Reset State ₁₀ . Wait a minimum of 40 milliseconds before sending any further IM Serial Commands.		

IM Input/Output

Button Event Report

Button Event Report (0x54)		
What it does	Reports user SET Button events.	
When you'll get this	The user operates the SET Button, or if they exist, Button 2 or Button 3.	
What you'll get	3 bytes.	
LED indication	If the event is <i>SET Button Press and Hold</i> the IM will automatically go into ALL-Linking mode which will cause the LED to blink continuously at a rate of 1/2 second on and 1/2 second off. Automatic linking may be turned off by setting <i>IM Configuration Flags</i> bit 7 (see Set IM Configuration₄₄).	
Related Commands	IM 0x53 ALL-Linking Completed₃₄ IM 0x64 Start ALL-Linking₃₂ IM 0x65 Cancel ALL-Linking₃₃	
Message Sent from IM to Host		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x54	IM Command Number
3	<Button Event>	Indicates the type of SET Button event that occurred.
		0x02 The SET Button was <i>Tapped</i>
		0x03 There was a SET Button <i>Press and Hold</i> for more than three seconds. This automatically puts the IM into ALL-Linking mode unless <i>IM Configuration Flags</i> bit 7 is set.
		0x04 The SET Button was released after a SET Button <i>Press and Hold</i> event was recorded.
		0x12 Button 2 was <i>Tapped</i>
		0x13 There was a Button 2 <i>Press and Hold</i> for more than three seconds.
		0x14 Button 2 was released after a Button 2 <i>Press and Hold</i> event was recorded.
		0x22 Button 3 was <i>Tapped</i>
		0x23 There was a Button 3 <i>Press and Hold</i> for more than three seconds.
		0x24 Button 3 was released after a Button 3 <i>Press and Hold</i> event was recorded.

LED On

LED On (0x6D)		
What it does	Turns on the IM's LED if <i>IM Configuration Flags</i> bit 5 = 1.	
What you send	2 bytes.	
What you'll get	3 bytes.	
LED indication	The LED will go on.	
Related Commands	IM 0x6B Set IM Configuration ₄₄ IM 0x6E LED Off ₅₁	
Command Sent from Host to IM		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x6D	IM Command Number
Message Returned by IM to Host		
Byte	Value	Meaning
1	0x02	Echoed Start of IM Command
2	0x6D	Echoed IM Command Number
3	<ACK/NAK>	0x06 (ACK) if the IM executed the Command correctly. 0x15 (NAK) if an error occurred or <i>IM Configuration Flags</i> bit 5 = 0.

LED Off

LED Off (0x6E)		
What it does	Turns off the IM's LED if <i>IM Configuration Flags</i> bit 5 = 1.	
What you send	2 bytes.	
What you'll get	3 bytes.	
LED indication	The LED will go off.	
Related Commands	IM 0x6B Set IM Configuration ₄₄ IM 0x6D LED On ₅₀	
Command Sent from Host to IM		
Byte	Value	Meaning
1	0x02	Start of IM Command
2	0x6E	IM Command Number
Message Returned by IM to Host		
Byte	Value	Meaning
1	0x02	Echoed Start of IM Command
2	0x6E	Echoed IM Command Number
3	<ACK/NAK>	0x06 (ACK) if the IM executed the Command correctly. 0x15 (NAK) if an error occurred or <i>IM Configuration Flags</i> bit 5 = 0.

Hardware Reference

This section gives a reference design for using the IN2680A Powerline Modem chip in a module connected both to the powerline and to a host device. The design uses a main board for the modem chip, power supply, INSTEON powerline interface, and TTL-level serial communications, and a daughter board for interfacing to a host.

Two different daughter board designs are included. One is for an RS232 interface, and the other is for an IP (Ethernet) interface. A USB interface is under development. Developers may create their own daughter cards to implement custom interfaces.

The reference design presented here is the same one that SmartLabs uses for its Powerline Modem (PLM) module.

In This Section

[INSTEON Powerline Modem \(PLM\) Main Board](#)₅₃

Gives the schematic and bill of materials for the PLM Main Board.

[INSTEON PLM Serial \(RS232\) Daughter Board](#)₅₇

Gives the schematic and bill of materials for the Serial (RS232) Daughter Board.

[INSTEON PLM Ethernet \(IP\) Daughter Board](#)₆₀

Gives the schematic and bill of materials for the Ethernet (IP) Daughter Board.

INSTEON Powerline Modem (PLM) Main Board

The Powerline Modem (PLM) main board includes the IN2680A Powerline Modem chip, a transformer-isolated power supply with a 30-volt charge pump booster, a transformer-coupled powerline signal transponder, an optically-isolated zero crossing detector, and an 8-pin daughter board connector for TTL-level host communications.

In This Section

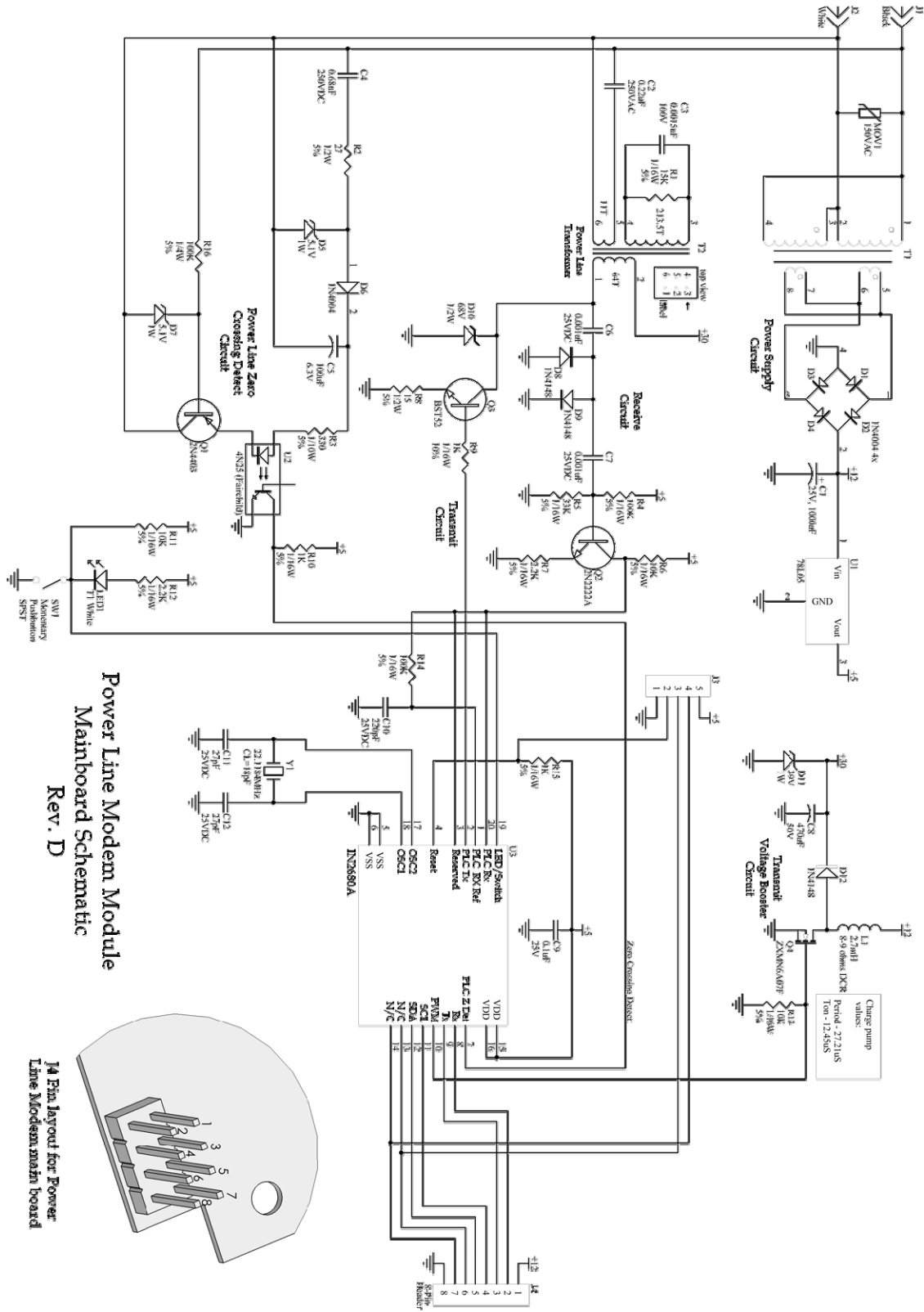
[INSTEON PLM Main Board Schematic](#)₅₄

Gives the schematic and bill of materials for the PLM main board.

[INSTEON PLM Main Board Bill of Materials](#)₅₅

Specifies the parts used in the main board.

INSTEON PLM Main Board Schematic



INSTEON PLM Main Board Bill of Materials

Description	Part Type	Designator	Footprint	Remark
Capacitor	Electrolytic, 1000uF, 25V	C1	Through-hole, 0.2"	
Capacitor	Metal Polyester, 0.22uF, 250VDC	C2	Through-hole, 0.3"	
Capacitor	Ceramic, 0.0015uF, 100V	C3	SMT, 0805	
Capacitor	Metal Polyester, 0.68uF, 250VDC	C4	Through-hole, 0.4"	
Capacitor	Electrolytic, 100uF, 6.3V	C5	Through-hole, 0.1"	
Capacitor	Ceramic, 0.001uF, 25V	C6	SMT, 0603	
Capacitor	Ceramic, 0.001uF, 25V	C7	SMT, 0603	
Capacitor	Electrolytic, 470uF, 50V	C8	Through-hole, 0.2"	
Capacitor	Ceramic, 0.1uF, 25V	C9	SMT, 0603	
Capacitor	Ceramic, 220pF, 25V	C10	SMT, 0603	
Capacitor	Ceramic, 27pF, 25V	C11	SMT, 0603	
Capacitor	Ceramic, 27pF, 25V	C12	SMT, 0603	
Crystal	22.1184MHz, 18pF Load	Y1	Through-hole	Recommended: Citizen model CMR309T22.1184MABJTR
Diode	DL4004	D1	SMT, MELF	
Diode	DL4004	D2	SMT, MELF	
Diode	DL4004	D3	SMT, MELF	
Diode	DL4004	D4	SMT, MELF	
Diode	Zener, 5.1V, 1W	D5	SMT, MELF	
Diode	DL4004	D6	SMT, MELF	
Diode	Zener, 5.1V, 1W	D7	SMT, MELF	
Diode	1N4148	D8	SMT, Mini-MELF	
Diode	1N4148	D9	SMT, Mini-MELF	
Diode	Zener, 68V, 1/2W	D10	SMT, Mini-MELF	
Diode	Zener, 39V, 1W	D11	SMT, MELF	
Diode	1N4148	D12	SMT, Mini-MELF	
Header	5-Pin male	J3	Through-hole, 0.1" ctr	For in-circuit programming
Header	2X4 male	J4	Through-hole, 0.1" ctr	Used to connect to daughter boards
Inductor	2.7mH, 8-9 ohms DCR, 100mA DCI	L1	Through-hole, 0.2"	
LED	Any single color is acceptable	LED1	Through-hole, T1	
MCU	INSTEON IN2680A	U3	SMT, SSOP20	
MOSFET	N-Channel, Zetex ZXMN6A07F	Q4	SMT, SOT-23	
Optocoupler	Fairchild 4N25SM or 4N25S	U2	SMT	100% Transfer ration @ 8mA If and 5mA Ic
Regulator	78L05 Positive 5V regulator	U1	Through-hole, TO-92	
Resistor	15KW, 1/16W, 5%	R1	SMT, 0603	
Resistor	27W, 1/2W, 5%	R2	SMT, 1210	Recommended: Panasonic ERJ-P14J270U Anti-Surge
Resistor	330W, 1/10W, 5%	R3	SMT, 0805	

Description	Part Type	Designator	Footprint	Remark
Resistor	100KW, 1/16W, 5%	R4	SMT, 0603	
Resistor	33KW, 1/16W, 5%	R5	SMT, 0603	
Resistor	10KW, 1/16W, 5%	R6	SMT, 0603	
Resistor	2.2KW, 1/16W, 5%	R7	SMT, 0603	
Resistor	15W, 1/2W, 5%	R8	SMT, 2010	
Resistor	1KW, 1/16W, 5%	R9	SMT, 0603	
Resistor	1K, 1/16W, 5%	R10	SMT, 0603	
Resistor	10KW, 1/16W, 5%	R11	SMT, 0603	
Resistor	2.2KW, 1/16W, 5%	R12	SMT, 0603	May be changed to control LED brightness
Resistor	10KW, 1/16W, 5%	R13	SMT, 0603	
Resistor	100KW, 1/16W, 5%	R14	SMT, 0603	
Resistor	1KW, 1/16W, 5%	R15	SMT, 0603	
Resistor	100KW, 1/4W, 5%	R16	SMT, 1206	
Switch	Tact Switch	SW1	Through-hole	
Transformer	Power Transformer, model 710-2000512	T1	Through-hole	Custom made, available from SmartLabs
Transformer	Power line transformer coil	T2	Through-hole	Abracon AIRV-111 PLC
Transistor	2N4403 PNP	Q1	SMT, SOT-23	
Transistor	2N2222A NPN	Q2	SMT, SOT-23	
Transistor	BST-52 Darlington NPN	Q3	SMT, SOT-89	Recommended brand: Zetex
Varistor	150VAC Metal Oxide Varistor	MOV1	Through-hole, 0.2"	
Wire	Hot wire, black, 16AWG, 300V, 105°C, VW-1	J1	Through-hole	In from power prong
Wire	Neutral wire, white, 16AWG, 300V, 105°C, VW-1	J2	Through-hole	In from power prong

INSTEON PLM Serial (RS232) Daughter Board

The Serial Daughter Board attaches to the Powerline Modem (PLM) Main Board using an 8-pin connector, and to a host device using an RJ-45 jack. Host communications uses the RS232 protocol at TTL signal levels.

In This Section

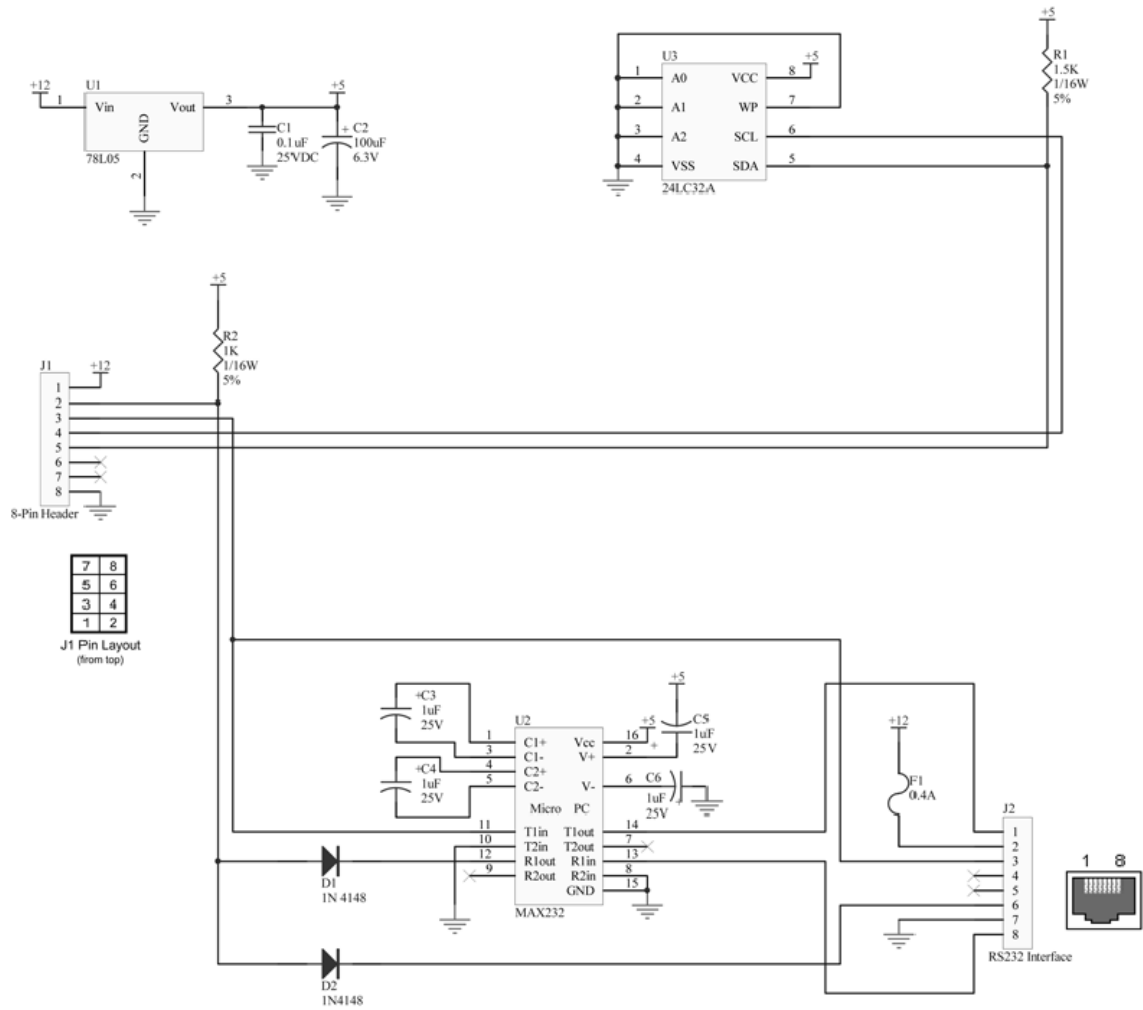
[INSTEON PLM Serial Daughter Board Schematic](#)₅₈

Gives the schematic and bill of materials for the serial (RS232) Daughter Board.

[INSTEON PLM Serial Daughter Board Bill of Materials](#)₅₉

Specifies the parts used in the Serial Daughter Board.

INSTEON PLM Serial Daughter Board Schematic



Serial & TTL Daughter Card Schematic
Rev. A

INSTEON PLM Serial Daughter Board Bill of Materials

Description	Part Type	Designator	Footprint	Remark
Capacitor	Ceramic, 0.1uF, 25V	C1	SMT, 0603	
Capacitor	Electrolytic, 100uF, 6.3V	C2	Through-hole	
Capacitor	Electrolytic, 1uF, 25V	C3	Through-hole	
Capacitor	Electrolytic, 1uF, 25V	C4	Through-hole	
Capacitor	Electrolytic, 1uF, 25V	C5	Through-hole	
Capacitor	Electrolytic, 1uF, 25V	C6	Through-hole	
Diode	1N4148	D1	SMT, Mini-MELF	
Diode	1N4148	D2	SMT, Mini-MELF	
Driver / Receiver	MAX232 Multichannel RS-232 ST232BDR	U2	SMT, SOIC16	
EEPROM	24LC32A	U3	SMT, SOIC8	
Fuse	250V, 0.4A	F1	Through-hole	
Header	Female 2x4, 2x4PIN, 2.54mm, 2185-20	J1	Through-hole, 0.1" ctr	
Jack	Female RJ45	J2	SMT	
Resistor	1.5K Ω , 1/16W, 5%	R1	SMT, 0603	
Resistor	1K Ω , 1/16W, 5%	R2	SMT, 0603	
Voltage Regulator	5V Zetex ZSR500G	U1	SMT, SOT223	

INSTEON PLM Ethernet (IP) Daughter Board

The IP (Ethernet) Daughter Board attaches to the Powerline Modem (PLM) Main Board using an 8-pin connector, and to an Ethernet LAN using an RJ-45 jack.

In This Section

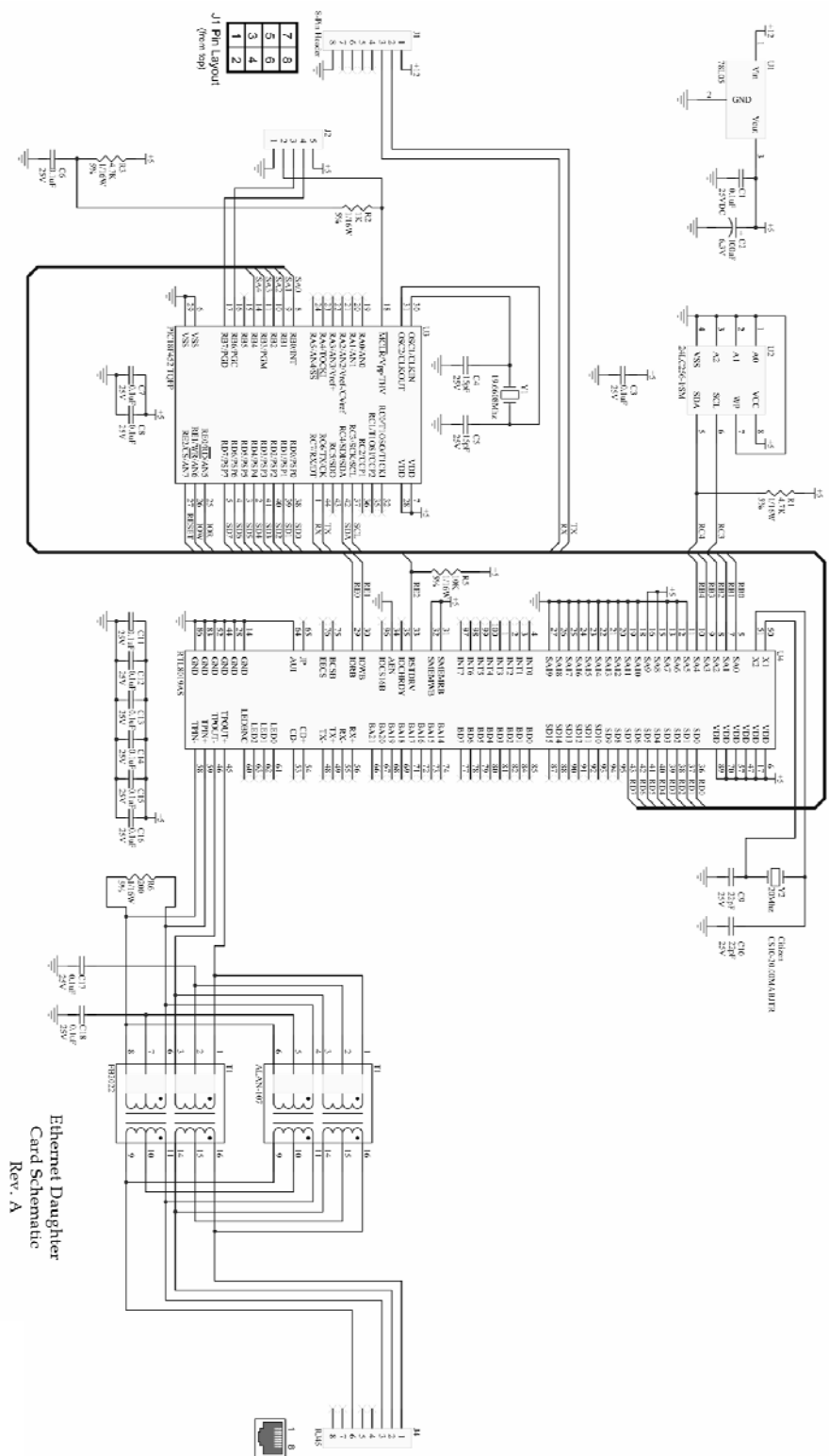
[INSTEON PLM Ethernet \(IP\) Daughter Board Schematic](#)₆₁

Gives the schematic and bill of materials for the IP (Ethernet) Daughter Board.

[INSTEON PLM Ethernet \(IP\) Daughter Board Bill of Materials](#)₆₂

Specifies the parts used in the IP Daughter Board.

INSTEON PLM Ethernet (IP) Daughter Board Schematic



INSTEON PLM Ethernet (IP) Daughter Board Bill of Materials

Description	Part Type	Designator	Footprint	Remark
Capacitor	Ceramic, 0.1uF, 25V	C1	SMT, 0603	
Capacitor	Electrolytic, 100uF, 6.3V	C2	Through-hole, 0.1"	
Capacitor	Ceramic, 0.1uF, 25V	C3	SMT, 0603	
Capacitor	Ceramic, 15pF, 25V	C4	SMT, 0603	
Capacitor	Ceramic, 15pF, 25V	C5	SMT, 0603	
Capacitor	Ceramic, 0.1uF, 25V	C6	SMT, 0603	
Capacitor	Ceramic, 0.1uF, 25V	C7	SMT, 0603	
Capacitor	Ceramic, 0.1uF, 25V	C8	SMT, 0603	
Capacitor	Ceramic, 22pF, 25V	C9	SMT, 0603	
Capacitor	Ceramic, 22pF, 25V	C10	SMT, 0603	
Capacitor	Ceramic, 0.1uF, 25V	C11	SMT, 0603	
Capacitor	Ceramic, 0.1uF, 25V	C12	SMT, 0603	
Capacitor	Ceramic, 0.1uF, 25V	C13	SMT, 0603	
Capacitor	Ceramic, 0.1uF, 25V	C14	SMT, 0603	
Capacitor	Ceramic, 0.1uF, 25V	C15	SMT, 0603	
Capacitor	Ceramic, 0.1uF, 25V	C16	SMT, 0603	
Capacitor	Ceramic, 0.1uF, 25V	C17	SMT, 0603	
Capacitor	Ceramic, 0.1uF, 25V	C18	SMT, 0603	
Controller	Ethernet controller, Realtek RTL8019AS	U4	SMT, QFP-100	
Crystal	19.6608MHz Crystal, 18pF Load	Y1	Through-hole	
Crystal	20MHz Crystal, 18pF Load	Y2	SMT	
Header	5-Pin Male	J2	Through-hole, 0.1" ctr	For in-circuit programming
Jack	RJ45 Female jack	J4	SMT	
MCU	PIC18F452-I/PT	U3	SMT, TQFP-44	
Memory	24LC256-I/SN	U2	SMT, SOP-8	
Regulator	78L05 5V Voltage regulator	U1	SMT, SOT-223	
Resistor	4.7KW, 1/16W, 5%	R1	SMT, 0603	
Resistor	1KW, 1/16W, 5%	R2	SMT, 0603	
Resistor	4.7KW, 1/16W, 5%	R3	SMT, 0603	
Resistor	10KW, 1/16W, 5%	R5	SMT, 0603	
Resistor	200W, 1/16W, 5%	R6	SMT, 0603	
Transformer	Ethernet transformer, Abracon ALAN-107	T1	SMT	