9.2. Message Data Arguments (MDA) Field

The remaining bytes of a UPB Message are known collectively as the Message Data Arguments. A UPB Message can have up to 17 bytes of Message Data Arguments.

10. The UPB Core Command Set

The UPB Core Command Set (Table 9 below) is a group of UPB Command Messages that are common to all UPB devices. This Message Set is identified by the MSID value of 000 and it covers the command MDID range of 0x00 to 0x1F.

MDID (Hex)	Command Name	Description
0x00	Null Command	Performs no action.
0x01	Write Enable Command	Commands the receiving device to disable its global write protection of its Setup Registers.
0x02	Write Protect Command	Commands the receiving device to enable its global write protection of its Setup Registers.
0x03	Start Setup Mode Command	Puts the receiving device(s) into the Setup Mode.
0x04	Stop Setup Mode Command	Takes the receiving device(s) out of the Setup Mode.
0x05	Get Setup Time Command	Requests the value of the Setup Mode Timer of the receiving device to be returned in a Setup Time Report.
0x06	Auto-Address Command	Commands the receiving device to select and set itself to a new random Unit ID (between 1 and 250).
0x07	Get Device Status Command	Requests the value of the Device Status Register of the receiving device to be returned in a Device Status Report.
0x08	Set Device Control Command	Sets the Device Control Register to a given value.
0x09 – 0x0A	Unused	Reserved for future command use.
0x0B	Add Link Command	Changes the first Receive Component's "Unused" (0xFF) Link ID to the specified Link ID.

MDID (Hex)	Command Name	Description
0x0C	Delete Link Command	Changes the Receive Component's specified Link ID to an "Unused" (0xFF) Link ID.
0x0D	Transmit This Message Command	Requests that the receiving device transmit the UPB Message contained in the MDA field.
0x0E	Device Reset Command	Requests the receiving device to reset itself and start running as if power was just applied.
0x0F	Get Device Signature Command	Requests the receiving device to return a Device Signature Report.
0x10	Get Register Value Command	Requests the values of one or more of the receiving device's Setup Registers to be returned in a Register Values Report.
0x11	Set Register Value Command	Sets one or more Setup Registers in the receiving device to a given list of values.
0x12 – 0x1F	Unused	Reserved for future command use.

Table 9: The UPB Core Command Set

10.1. UPB Core Commands

10.1.1. The "Null" Command

The "Null" Command does not perform any action on the receiving device. It can be used to simply get Acknowledgement responses back from an addressed UPB device to know that it exists. The "Null" Command has a Message Data ID of **0x00** and has the following syntax:

MDID
0x00

10.1.2. The "Write Enable" Command

The "Write Enable" Command is used to disable the global write protection of a device's Setup Registers so that they may be written into. For extra security, this message must include the assigned Network Password of the addressed device. The "Write Enable" Command has a Message Data ID of **0x01** and has the following syntax:

MDID	Arg1	Arg2
0x01	PM	PL

Where PM & PL are the 16-bit Network Password (0x0000 – 0xFFFF).

When the addressed UPB device receives this command, and validates the Network Password, it will disable its global write protection. If the Network Password in this message fails to match the assigned Network Password of the receiving device then this message is ignored.

10.1.3. The "Write Protect" Command

The "Write Protect" Command is used to enable global write protection of a device's Setup Registers. The "Write Protect" Command has a Message Data ID of **0x02** and has the following syntax:

MDID
0x02

When the addressed UPB device receives this command it will write protect its Setup Registers (the default state).

10.1.4. The "Start Setup Mode" Command

The "Start Setup Mode" Command is used to put the addressed device into the Setup Mode. For extra security, this message must include the Network Password of the addressed device. The "Start Setup Mode" Command has a Message Data ID of **0x03** and has the following syntax:

MDID	Arg1	Arg2	Arg3	Arg4	Arg5	Arg6
0x03	PM	PL	[MIDH]	[MIDL]	[PIDH]	[PIDL]

Where PM & PL are the assigned 16-bit Network Password (0x0000 – 0xFFFF).

When the addressed UPB device receives this command, and validates the Network Password, it will go into the Setup Mode for the next 5 minutes. If the Network Password in this message fails to match the assigned Network Password of the receiving device then this message is ignored.

Optional arguments Arg3, Arg4, Arg5, and Arg6 (if all included in the command) are used to select a particular group of devices by Manufacturer ID (MID) and Product ID (PID) to go into Setup Mode. If the Manufacturer ID and Product ID in this message fails to match the Manufacturer ID and Product ID of the receiving

device then this message is ignored. Note: this option, termed "Selective Start Setup Mode" is only available on UPB devices that implement Version 002 (and higher) of the UPB Protocol.

10.1.5. The "Stop Setup Mode" Command

The "Stop Setup Mode" Command is used to take the addressed device out of the Setup Mode and return it to the Normal Mode. The "Stop Setup Mode" Command has a Message Data ID of **0x04** and has the following syntax:

MDID
0x04

When the addressed UPB device receives this command it will return to Normal Mode and write protect its Setup Registers.

10.1.6. The "Get Setup Time" Command

The "Get Setup Time" Command is used to retrieve the amount of time the addressed device has before it times out of the Setup Mode. When a device enters the Setup Mode it will automatically time out of it in five minutes. This command is intended primarily for device setup and test operations. The "Get Setup Time" Command has a Message Data ID of **0x05** and has the following syntax:

MDID
0x05

When the addressed UPB device receives this command, it will respond with a Setup Time Report message (0x85) that contains the current value in the device's Setup Mode Timer.

10.1.7. The "Auto-Address" Command

The "Auto-Address" Command is used to change the Unit ID of the addressed device to a random value. This command is intended to be used for detecting Duplicate IDs as described in Section 18.6. Note that the addressed device must first have been placed into the Setup Mode for this command to take effect. The "Auto-Address" Command has a Message Data ID of **0x06** and has the following syntax:

MDID
0x06

When the addressed UPB device receives this command it will set its Unit ID to a random value between 1 and 250.

Note: The addressed device must be in the Setup Mode in order for this command to take effect.

10.1.8. The "Get Device Status" Command

The "Get Device Status" Command is used to retrieve the contents of the 8-bit Device Status Register. The "Get Device Status" Command has a Message Data ID of **0x07** and has the following syntax:

MDID
0x07

When the addressed UPB device receives this command, it will respond with a Device Status Report (0x87) that contains the 1-byte contents of the Device Status Register.

10.1.9. The "Set Device Control" Command

The "Set Device Control" Command is used to set the 8-bit Device Control Register to a specified value. The "Set Device Control" Command has a Message Data ID of **0x08** and has the following syntax:

MDID	Arg1
0x08	VV

Where VV is the value (0x00 – 0xFF) to be written into the Device Control Register.

When the addressed UPB device receives this command, it will set its Device Control Register to the value specified in the 1st argument of the command.

10.1.10. The "Add Link" Command

The "Add Link" Command is used to assign a Link ID to an unused Receive Component of the receiving device. The "Add Link" Command must be sent in a Direct Packet or it will be ignored. For added security, the receiving device must also be in the Setup Mode for this command to be accepted. The "Add Link" Command has a Message Data ID of **0x0B** and has the following syntax:

MDID	Arg1
0x0B	LID

Where LID is the Link ID (1 - 250) to be assigned to the previously unused Receive Component.

When the addressed UPB device receives this command, it will assign the Link ID in the 1st argument of the command to the 1st unused Receive Component. If the addressed UPB device doesn't have any more unused Receive Components then it will ignore the command.

10.1.11. The "Delete Link" Command

The "Delete Link" Command is used to remove a Link ID from the Receive Components of the receiving device. The "Delete Link" Command must be sent in a Direct Packet or it will be ignored. For added security, the receiving device must also be in the Setup Mode for this command to be accepted. The "Delete Link" Command has a Message Data ID of **0x0C** and has the following syntax:

MDID	Arg1
0x0C	LID

Where LID is the Link ID (1 - 250) to be removed from the device's Receive Components.

When the addressed UPB device receives this command, it will remove the Link ID in the 1st argument of the command from the device's Receive Components. If the addressed UPB device doesn't have a Receive Component with the specified Link ID then the command will be ignored.

10.1.12. The "Transmit This Message" Command

The "Transmit This Message" Command is used to request that the receiving device transmit the valid UPB Message that is contained in the Message Data Argument field. The "Transmit This Message" Command has a Message Data ID of **0x0D** and has the following syntax:

MDID	Arg1	Arg2	Arg3	Arg4	Arg5	Arg6	Arg7	Arg8
0x0D	CB1	CB2	NID	DID	SID	VV	[VV]	[VV]
Arg9	Arg10	Arg11	Arg12	Arg13	Arg14	Arg15	Arg16	Arg17
[VV]	[VV]	[VV]	[VV]	[VV]	[VV]	[VV]	[VV]	[VV]

Where CB1, CB2, NID, DID, and SID are the five bytes of the Packet Header and VV is the rest of the UPB Message and Checksum to be transmitted by the receiving device. Note: this command is intended to be used for such things as allowing a test tool to monitor the communication strengths between two UPB devices.

10.1.13. The “Device Reset” Command

The “Device Reset” Command is used to reset a receiving device. For extra security, this message must include the assigned Network Password of the addressed device. The “Device Reset” Command has a Message Data ID of **0x0E** and has the following syntax:

MDID	Arg1	Arg2
0x0E	PM	PL

Where PM & PL are the 16-bit Network Password (0x0000 – 0xFFFF).

When the addressed UPB device receives this command, and validates the Network Password, it will reset itself. If the Network Password in this message fails to match the assigned Network Password of the receiving device then this message is ignored.

10.1.14. The “Get Device Signature” Command

The “Get Device Signature” Command is used to request a “Device Signature Report” from the receiving device. The “Get Device Signature” Command has a Message Data ID of **0x0F** and has the following syntax:

MDID
0x0F

When the addressed UPB device receives this command, it will respond with a Device Signature Report (0x8F) as described in section TBD.

10.1.15. The “Get Register Values” Command

The “Get Register Values” Command is used to retrieve the contents of one or more Setup Registers from the addressed device. This command is intended primarily for device setup and test operations. The “Get Register Values” Command has a Message Data ID of **0x10** and has the following syntax:

MDID	Arg1	Arg2
0x10	RR	NN

Where RR is the starting register number (0x00 – 0xFF) to be retrieved and NN is the number of registers to be retrieved (0x01 – 0x10).

When the addressed UPB device receives this command, it will respond with a Register Values Report message that includes the contents of the specified Setup Register(s) (see Section 0).

10.1.16. The “Set Register Values” Command

The “Set Register Values” Command is used to write a list of (up to 16) values into a block of Setup Registers of the addressed device. This command is intended primarily for device setup and test operations. Note that the addressed device must first have write protection disabled in order for this command to take effect. The “Set Register Values” Command has a Message Data ID of **0x11** and has the following syntax:

MDID	Arg1	Arg2	Arg3	Arg4	Arg5	Arg6	Arg7	Arg8
0x11	RR	VV	[VV]	[VV]	[VV]	[VV]	[VV]	[VV]
Arg9	Arg10	Arg11	Arg12	Arg13	Arg14	Arg15	Arg16	Arg17
[VV]	[VV]	[VV]	[VV]	[VV]	[VV]	[VV]	[VV]	[VV]

Where RR is the starting register number to be written (0x00 – 0xFF), VV is the value to set that register to, and [VV] is an optional list of up to 15 more values (0x00 – 0xFF) to set the next consecutive register(s) to.

When the addressed UPB device receives this command, it will write the values in the given list into its Setup Registers starting at the register specified in the command.

Note: The addressed device must first have global write protection disabled in order for this command to take effect.

11. The Device Control Command Set

The Device Control Command Set (Table 10 below) is a group of UPB Command Messages designed to perform the most common device control functions. This Message Set is identified by the MSID value of 001 and it occupies the MDID range of 0x20 to 0x3F.

MDID (Hex)	Command/Report Name	Command Description
0x20	Activate Link Command	Requests the receiving device(s) to activate their linked Receive Components.
0x21	Deactivate Link Command	Requests the receiving device(s) to deactivate their linked Receive Components.
0x22	Goto Command	Requests the receiving device(s) or channel to go to a specified Level (or state) at a specified Rate.
0x23	Fade Start Command	Requests the receiving dimming-type device(s) or channel to go to a specified Level (or state) at a specified Rate.
0x24	Fade Stop Command	Requests the receiving dimming-type device(s) to stop fading and stay at their current level.
0x25	Blink Command	Requests the receiving device to blink on and off their output at a specified rate.
0x26	Indicate Command	Requests the receiving indicator-type device(s) or channel to go to a specified Level (or State).
0x27	Toggle Command	Requests the receiving device(s) or channel to toggle their output at a specified rate for a specified number of toggles.
0x28 – 0x2F	Unused	Reserved for future use.
0x30	Report State Command	Requests the receiving device to report its current state information in a Device State Report.
0x31	Store State Command	Requests the receiving device(s) to store its current state in the addressed Receive Component.

MDID (Hex)	Command/Report Name	Command Description
0x32 – 0x3F	Unused	Reserved for future use.

Table 10: The Device Control Message Set

11.1. Device Control Commands

11.1.1. The Activate Link Command

The “Activate Link” Command is used to request the receiving device(s) to activate their “linked” Receive Components. The “Activate Link” Command must be packaged in a Link Packet or it will be ignored. The “Activate Link” Command has the Message Data ID of **0x20** and has the following syntax:

MDID
0x20

When the addressed UPB device receives this command, it will “activate” the Receive Component(s) that are associated with the Link ID that was made active by this command.

The term “activate” is a general term that usually means to turn to the ON state but each individual device manufacturer can define it differently for their device. To some devices the term “activate” might mean to turn ON a lighting channel to a preset level (e.g. 50%). To other devices the term “activate” might mean to blink an indicator every second. The parameters in the activated Receive Component Record can be used to configure what to do to the associated physical component when it is “activated”.

11.1.2. The Deactivate Link Command

The “Deactivate Link” Command is used to request the receiving device(s) to “deactivate” their linked Receive Components. The “Deactivate Link” Command must be packaged in a Link Packet or it will be ignored. The “Deactivate Link” Command has the Message Data ID of **0x21** and has the following syntax:

MDID
0x21

When the addressed UPB device receives this command, it will “deactivate” the Receive Component(s) that are associated with the Link ID that was made active by this command.

The term “deactivate” is a general term that usually means to turn to the OFF state but each individual device manufacturer can define it differently for their device. To some devices the term “deactivate” might mean to turn a lighting channel to 0%. To other devices the term “deactivate” might mean to set an indicator to red. The parameters in the deactivated Receive Component Record can be used to configure what to do to the associated physical component when it is “deactivated”.

11.1.3. The Goto Command

The “Goto” Command is used to request a receiving device or a group of “linked” Device Components to go to a specified Level at a specified Rate. The “Goto” Command has the Message Data ID of **0x22** and has two different syntaxes based on how it is packaged. The “Goto” Command can either be packaged in a Link Packet to affect a group of “linked” Device Components or it can be packaged in a Direct Packet to affect an individual device.

The message syntax for the “Goto” Command packaged in a Link Packet is as follows:

MDID	Arg1	Arg2
0x22	LL	[RR]

Where LL is the specified Level (0x00 – 0x64) and [RR] is the optional specified Rate (0x00 – 0xFF). When the addressed UPB devices receive this command, they shall set their “linked” Receive Components to the specified Level at the specified Rate. If the Rate is not specified in the command then each device’s Default Rate shall be used instead.

The message syntax for the “Goto” Command packaged in a Direct Packet is designed to account for multiple-channel devices and is as follows:

MDID	Arg1	Arg2	Arg3
0x22	LL	[RR]	[CC]

Where LL is the specified Level (0x00 – 0x64) and [RR] is the optional specified Rate (0x00 – 0xFF) and [CC] is the optional specified Channel (0x00 – 0xFF). When the addressed UPB device receives this command, it shall set the specified Channel to the specified Level at the specified Rate. If the Channel is not specified in the command then all of the device’s channels shall be affected. If the Rate is not specified in the command then each device’s Default Rate shall be used instead.

Note: The Channel argument (Arg3), if specified, shall follow the following rules:

1. If Arg3 = 0 then all channels of the device shall act on the command.
2. If Arg3 contains a Channel number that the device does not have then the device shall ignore the command.
3. If Arg3 = 1 then the command shall act on Channel #1.
4. If Arg3 = 2 then the command shall act on Channel #2, etc.

11.1.4. The Fade Start Command

The “Fade Start” Command is used to request the receiving dimming-type device or a group of “linked” Device Components on dimming-type devices to fade to a specified Level at a specified Rate. Non-dimming type devices shall ignore the “Fade Start” Command. The “Fade Start” Command has the Message Data ID of **0x23** and has two different syntaxes based on how it is packaged. The “Fade Start” Command can either be packaged in a Link Packet to affect a group of “linked” Device Components or it can be packaged in a Direct Packet to affect an individual device.

The message syntax for the “Fade Start” Command packaged in a Link Packet is as follows:

MDID	Arg1	Arg2
0x23	LL	[RR]

Where LL is the specified Level (0x00 – 0x64) and [RR] is the optional specified Rate (0x00 – 0xFF). When the addressed UPB devices receive this command, they shall set their “linked” Receive Components to the specified Level at the specified Rate. If the Rate is not specified in the command then each device’s Default Rate shall be used instead.

The message syntax for the “Fade Start” Command packaged in a Direct Packet is designed to account for multiple-channel devices and is as follows:

MDID	Arg1	Arg2	Arg3
0x23	LL	[RR]	[CC]

Where LL is the specified Level (0x00 – 0x64) and [RR] is the optional specified Rate (0x00 – 0xFF) and [CC] is the optional specified Channel (0x00 – 0xFF). When the addressed UPB device receives this command, it shall set the specified Channel to the specified Level at the specified Rate. If the Channel is not specified in the command then all of the device’s channels shall be affected. If the Rate is not specified in the command then each device’s Default Rate shall be used instead.

Note: The only difference between the Fade Start Command and the Goto Command is that non-dimming type devices shall ignore the Fade Start Command.

11.1.5. The Fade Stop Command

The “Fade Stop” Command is used to request the receiving dimming-type device or a group of “linked” Device Components on dimming-type devices to stop fading and stay at their current Level. The “Fade Stop” Command can either be packaged in a Link Packet to affect a group of “linked” Device Components or it can be packaged in a Direct Packet to affect an individual device. The “Fade Stop” Command has the Message Data ID of **0x24** and has the following syntax:

MDID
0x24

When the addressed UPB device receives this command, it shall stop any fading operation that is currently going on.

11.1.6. The Blink Command

The “Blink” Command is used to request the receiving device or a group of “linked” Device Components to blink on and off their output at a specified rate. The “Blink” Command has the Message Data ID of **0x25** and has two different syntaxes based on how it is packaged. The “Blink” Command can either be packaged in a Link Packet to affect a group of “linked” Device Components or it can be packaged in a Direct Packet to affect an individual device.

The message syntax for the “Blink” Command packaged in a Link Packet is as follows:

MDID	Arg1
0x25	RR

Where RR is the specified Blink Rate (0x00 – 0xFF). When the addressed UPB devices receive this command, they shall blink their “linked” Receive Components at the specified Rate.

The message syntax for the “Blink” Command packaged in a Direct Packet is designed to account for multiple-channel devices and is as follows:

MDID	Arg1	Arg2
0x25	RR	[CC]

Where RR is the specified Blink Rate (0x00 – 0xFF) and [CC] is the optional specified Channel (0x00 – 0xFF). When the addressed UPB device receives this command, it shall blink the specified Channel at the specified Rate. If the Channel is not specified in the command then all of the device's channels shall be affected.

11.1.7. The Indicate Command

The "Indicate" Command is used to request the receiving indicator-type device or a group of "linked" Device Components on indicator-type devices to go to a specified Level or State. Indicator-type devices or components are those devices (like LEDs) that provide some type of visual or audio feedback to the user that an event has occurred. Non-indicator type devices shall ignore this command. The "Indicate" Command has the Message Data ID of **0x26** and has two different syntaxes based on how it is packaged. The "Indicate" Command can either be packaged in a Link Packet to affect a group of "linked" Device Components or it can be packaged in a Direct Packet to affect an individual device.

The message syntax for the "Indicate" Command packaged in a Link Packet is as follows:

MDID	Arg1	Arg2
0x26	LL	[RR]

Where LL is the specified Level or State (0x00 – 0x64) and [RR] is the optional specified Rate (0x00 – 0xFF). When the addressed indicator-type UPB devices receive this command, they shall set their "linked" Receive Components to the specified Level at the specified Rate. If the Rate is not specified in the command then each device's Default Rate shall be used instead.

The message syntax for the "Indicate" Command packaged in a Direct Packet is designed to account for multiple-channel devices and is as follows:

MDID	Arg1	Arg2	Arg3
0x26	LL	[RR]	[CC]

Where LL is the specified Level (0x00 – 0x64) and [RR] is the optional specified Rate (0x00 – 0xFF) and [CC] is the optional specified Channel (0x00 – 0xFF). When the addressed indicator-type UPB device receives this command, it shall set the specified Channel to the specified Level at the specified Rate. If the Channel is not specified in the command then all of the device's channels shall be affected. If the Rate is not specified in the command then each device's Default Rate shall be used instead.

Note: The only difference between the “Indicate” Command and the “Goto” Command is that non-dimming type devices shall ignore the “Indicate” Command.

11.1.8. The Toggle Command

The “Toggle” Command is used to request a receiving device or a group of “linked” Device Components to toggle their output(s) between their current state and the opposite state one or more times at a specified rate. The “Toggle” Command has the Message Data ID of **0x27** and has two different syntaxes based on how it is packaged. The “Toggle” Command can either be packaged in a Link Packet to affect a group of “linked” Device Components or it can be packaged in a Direct Packet to affect an individual device.

The message syntax for the “Toggle” Command packaged in a Link Packet is as follows:

MDID	Arg1	Arg2
0x27	NN	[RR]

Where NN is the specified Number of toggles (0x00 – 0xFF) and RR is the optional toggle Rate (0x00 – 0xFF). When the addressed UPB devices receive this command, they shall toggle their “linked” Receive Component’s outputs to the opposite state and back to the current state at the specified rate and repeat this for the specified number of times. If the Rate is not specified in the command then a 0.5 second toggle rate shall be applied instead.

The message syntax for the “Toggle” Command packaged in a Direct Packet is designed to account for multiple-channel devices and is as follows:

MDID	Arg1	Arg2	Arg3
0x27	NN	[RR]	[CC]

Where NN is the specified Number of toggles (0x00 – 0xFF) and RR is the optional toggle Rate (0x00 – 0xFF) and [CC] is the optional specified Channel (0x00 – 0xFF). When the addressed UPB device receives this command, it shall toggle the specified Channel to the opposite state and back to the current state at the specified rate and repeat this for the specified number of times. If the Rate is not specified in the command then a 0.5 second toggle rate shall be applied instead.

11.1.9. The Report State Command

The “Report State” Command is used to request the receiving device to report its current state information in a Device State Report. The “Report State” Command

must be packaged in a Direct Packet for it to have any meaning. The “Report State” Command has the Message Data ID of **0x30** and has the following syntax:

MDID
0x30

When the addressed UPB device receives this command, it shall report its current state information in a Device State Report.

11.1.10. The Store State Command

The “Store State” Command is used to request the receiving device(s) to save the current state of its linked components. The “Store State” Command must be packaged in a Link Packet for it to have any meaning.

The “Store State” Command has the Message Data ID of **0x31** and has the following syntax:

MDID
0x31

When the addressed UPB devices receive this command, they shall store the current state of their “linked” Receive Components. Note: This command was intended for lighting control devices to be able to capture their current light levels into Receive Components and then later have those Receive Components “activated” to produce a lighting “Scene”.

12. The Reserved Command Set #1

The Reserved Command Set #1 is just that: reserved (for future use). There is currently no command messages defined for this Message Set, it is simply a placeholder for the future. This Message Set occupies the MDID range of 0x40 to 0x5F.

13. The Reserved Command Set #2

The Reserved Command Set #2 is just that: reserved (for future use). There is currently no command messages defined for this Message Set, it is simply a placeholder for the future. This Message Set occupies the MDID range of 0x60 to 0x7F.

14. The UPB Core Report Set

The UPB Core Report Set (Table 11) is a group of UPB Report Messages that are common to all UPB devices. This Message Set is identified by the MSID value of 100 and it covers the MDID range of 0x80 to 0x9F.

MDID (Hex)	Report Name	Description
0x80	Acknowledgement Response	Reports that the previous UPB Communication Packet was accepted.
0x81 – 0x84	Unused	Reserved for future use.
0x85	Setup Time Report	Returns the current value that is in the device's Setup Mode timer.
0x86	Device State Report	Returns the current state of the device.
0x87	Device Status Report	Returns the current value that is in the device's Device Status Register.
0x88 – 0x8E	Unused	Reserved for future use.
0x8F	Device Signature Report	Returns the device's signature which includes its signal strength, noise level, and checksum information.
0x90	Register Values Report	Returns the values of one or more of the device's Setup Registers (EEPROM).
0x91	RAM Values Report	Returns the values of one or more of the device's SRAM Registers
0x92	Raw Data Report	Reports from 1 to 16 raw data values.

MDID (Hex)	Report Name	Description
0x93	Heartbeat Report	Reports no data. It just lets the network know that the device is alive.
0x94 – 0x9F	Unused	Reserved for future report use.

Table 11: The UPB Core Report Set

14.1. UPB Core Reports

14.1.1. The Acknowledgment Response

UPB devices use the "Acknowledgment" Response to inform the system that it properly received and accepted a UPB Communication Packet with the MSG-bit set to 1. The "Acknowledgment" Response has a Message Data ID of **0x80** and has the following syntax:

MDID	Arg1
0x80	MM

Where MM is the Message Data ID (MDID) of the received Communication Packet (0 – 255).

14.1.2. The Setup Time Report

The "Setup Time" Report is used to return the current value of the device's Setup Mode Timer that indicates the number of ticks that are left before timing out of the Setup Mode. The "Setup Time" Report has a Message Data ID of **0x85** and has the following syntax:

MDID	Arg1	Arg2
0x85	RR	TT

Where RR is the RAM Register Number of the Setup Mode Timer (this will vary from device to device) and TT is the number of ticks that are left before timing out of the Setup Mode. Note: the Setup Mode Timer decrements in ticks of 256 AC half-cycles (2.560 seconds at 50Hz or 2.133 seconds at 60Hz).

14.1.3. The Device State Report

The "Device State" Report is used to return the current state information about the receiving device. The "Device State" Report has a Message Data ID of **0x86** and has the following syntax:

MDID	Arg1	Arg2	Arg3	Arg4	Arg5	Arg6	Arg7	Arg8
0x86	VV	[VV]	[VV]	[VV]	[VV]	[VV]	[VV]	[VV]
Arg9	Arg10	Arg11	Arg12	Arg13	Arg14	Arg15	Arg16	Arg17
[VV]	[VV]	[VV]	[VV]	[VV]	[VV]	[VV]	[VV]	[VV]

Where VV is a list of up to 17 retrieved state information values (0x00 – 0xFF).

14.1.4. The Device Status Report

The “Device Status” Report is used to return the current value in the Device Status Register. The “Device Status” Report has a Message Data ID of **0x87** and has the following syntax:

MDID	Arg1	Arg2
0x87	RR	VV

Where RR is the RAM Register address of the Device Status Register (this will vary from device to device) and VV is the 8-bit value of the Device Status Register.

14.1.5. The Device Signature Report

The “Device Signature” Report is used to report special signature information about the reporting device. Among this information are some checksums of the Setup Register contents to help setup tools quickly discover if any changes have been made. Also included in this report are Signal Strength and Noise Level information. This message is usually generated in response to a “Get Device Signature” Command. The “Device Signature” Report has a Message Data ID of **0x8F** and has the following syntax:

MDID	Arg1	Arg2	Arg3	Arg4	Arg5	Arg6	Arg7	Arg8
0x8F	PRH	PRL	SS	NL	CS1H	CS1L	CS2H	CS2L
Arg9	Arg10	Arg11	Arg12	Arg13	Arg14	Arg15	Arg16	Arg17
NSR	DI1	DI2	DI3	DI4	DI5	DI6	DI7	DI8

Where:

- PRH/PRL is a 16-bit Pseudo-Random Number.
- SS is the Signal Strength that the “Get Device Signature” command was received at.
- NL is the Noise Level (0-5) that the reporting device is at.
- CS1H/CS1L is the 16-bit checksum of the reporting device’s UPBID.

- CS2H/CS2L is the 16-bit checksum of all Setup Registers of the reporting device.
- NSR is the number of Setup Registers that exist on the reporting device.
- DI1 – DI8 is 8 bytes of Diagnostic Information that is TBD at this time.

14.1.6. The "Register Values" Report

The "Register Values" Report is used to return the value(s) of one or more Setup Registers. This message is usually generated in response to a "Get Register Values" Command. The "Register Values" Report has a Message Data ID of **0x90** and has the following syntax:

MDID	Arg1	Arg2	Arg3	Arg4	Arg5	Arg6	Arg7	Arg8
0x90	RR	VV	[VV]	[VV]	[VV]	[VV]	[VV]	[VV]
Arg9	Arg10	Arg11	Arg12	Arg13	Arg14	Arg15	Arg16	Arg17
[VV]	[VV]	[VV]	[VV]	[VV]	[VV]	[VV]	[VV]	[VV]

Where RR is the starting Setup Register number (0x00 – 0xFF) that is reported and VV is a list of up to 16 retrieved values (0x00 – 0xFF).

14.1.7. The "RAM Values" Report

The "RAM Values" Report is used to return the value(s) of one or more SRAM Registers. The "RAM Values" Report has a Message Data ID of **0x91** and has the following syntax:

MDID	Arg1	Arg2	Arg3	Arg4	Arg5	Arg6	Arg7	Arg8
0x91	RR	VV	[VV]	[VV]	[VV]	[VV]	[VV]	[VV]
Arg9	Arg10	Arg11	Arg12	Arg13	Arg14	Arg15	Arg16	Arg17
[VV]	[VV]	[VV]	[VV]	[VV]	[VV]	[VV]	[VV]	[VV]

Where RR is the starting RAM register number (0x00 – 0xFF) that is reported and VV is a list of up to 16 retrieved values (0x00 – 0xFF).

14.1.8. The "Raw Data" Report

The "Raw Data" Report is used to report from 1 to 16 bytes of raw data from one UPB device to another. The "Raw Data" Report has a Message Data ID of **0x92** and has the following syntax:

ESID	Assigned To	Message Set Purpose
30	Available to be assigned	For future use.
31	Available to be assigned	For future use.

Table 12: Currently Assigned Extended Set ID (ESID) Values

18. Bringing It All Together

Now you have read this whole document and you still don't quite understand how to use UPB communications to do something as simple as turn a UPB Dimming Wall Switch ON and OFF. Well this is the place to look because here we will bring it all together with explanations and examples.

18.1. Learning A UPB Device's Network Password

Before you can ever configure the Setup Registers of a new UPB Device you must first know its assigned Network Password so you can disable Setup Register Write Protection. Issuing the device either a "Write Enable" command or a "Start Setup Mode" command can do this. However, both of these commands require (for security purposes) that you already know and supply the device's assigned Network Password. Furthermore, the UPB System Model prevents you (for security purposes) from reading a device's assigned Network Password unless it is in the Setup Mode.

In summary, you can't read the assigned Network Password unless the device is in Setup Mode and you can't issue a "Start Setup Mode" command without knowing (supplying) the assigned Network Password. This whole "catch-22" situation was purposely designed into the UPB System Model to prevent unauthorized users from easily modifying a device's Setup Registers.

To get around this security protocol the UPB System Model specifies that each UPB device have at least one method to physically get the device into the Setup Mode. This physical method is usually done with some sort of pushbutton press sequence but varies from device type to device type. It is up to device manufacturers to design a method to physically get their UPB device into Setup Mode.

Once the new UPB device has been physically put in the Setup Mode, the assigned 2-byte Network Password can be read by issuing the "Get Register Values" command to the Global NID (0x00) and the Setup Mode DID (0xFE) as follows:

CTL		NID	DID	SID	MDID	Arg1	Arg2	CHK
0x09	0x00	0x00	0xFE	0xFF	0x10	0x02	0x02	0xE6

When the new UPB device that is in Setup Mode receives this command it will respond with a "Register Values" Report message that includes the contents of the 2-byte Network Password (e.g. 0x1234) as follows:

CTL		NID	DID	SID	MDID	Arg1	Arg2	Arg3	CHK
0x0A	0x00	0xFF	0xFF	0x01	0x90	0x02	0x12	0x34	0x75

Note that from this “Register Values” Report message we can see that the device’s Network Password is 0x1234 and also that its NID is 0xFF and its Unit ID is 0x01.

18.2. Reading A UPB Device’s Setup Registers

Assuming you now know the assigned Network ID (e.g. 0xFF) and Unit ID (e.g. 0x01) of your UPB device, you can read any of its Setup Registers (except the Network Password registers) by issuing a “Get Register Values” command to the device’s Network ID and Unit ID as follows:

CTL		NID	DID	SID	MDID	Arg1	Arg2	CHK
0x09	0x00	0xFF	0x01	0xFF	0x10	0x00	0x10	0xE8

When the addressed UPB device receives this command it will respond with a “Register Values” Report message that includes the contents of the specified Setup Registers (e.g. 0x00 – 0x0F) as follows:

CTL		NID	DID	SID	MDID	Arg1	Arg2
0x0A	0x00	0xFF	0xFF	0x01	0x90	0x00	0xFF
Arg3	Arg4	Arg5	Arg6	Arg7	Arg8	Arg9	Arg10
0x01	0x00	0x00	0x00	0x00	0x00	0x01	0x00
Arg11	Arg12	Arg13	Arg14	Arg15	Arg16	Arg17	CHK
0x22	0x00	0x01	0x00	0x00	0x00	0x01	0xFF

Note that the Network Password (Arg4 & Arg5) is protected and always reads as the value 0x0000 unless the device is in the Setup Mode.

18.3. Commanding A UPB Device into the Setup Mode

Assuming you know the assigned Network ID (e.g. 0xFF), Unit ID (e.g. 0x01) and Network Password (e.g. 0x1234) of your UPB device, you can command that device into the Setup Mode by issuing it a “Start Setup Mode” command as follows:

CTL		NID	DID	SID	MDID	Arg1	Arg2	CHK
0x09	0x00	0xFF	0x01	0xFF	0x03	0x12	0x34	0xAF

When the addressed UPB device receives this command it will enter the Setup Mode for the next five minutes. Re-issuing this command will start the five-minute time-out all over again. You can always check on how much time is left in Setup Mode by issuing the device a “Get Setup Time” command as follows:

CTL		NID	DID	SID	MDID	CHK
0x07	0x00	0xFF	0x01	0xFF	0x05	0xAF

When the addressed UPB device receives this command, it will respond with a “RAM Values” Report message that includes the number of ?? millisecond ticks that are left before timing out of Setup Mode:

CTL		NID	DID	SID	MDID	Arg1	Arg2	CHK
0x09	0x00	0xFF	0xFF	0x01	0x91	0x5A	0x54	0xB9

Note that this device currently has 84 (0x54) ticks before it will time out of Setup Mode. The Setup Mode Timer for this device (Arg1) happens to be at RAM address 0x5A.

18.4. Assigning A UPB Device’s Network ID & Unit ID

Assuming your UPB device is in the Setup Mode, you can assign it a new Network ID (e.g. 0x44) and Unit ID (e.g. 0x66) by issuing a “Set Register Values” command as follows:

CTL		NID	DID	SID	MDID	Arg1	Arg2	Agr3	CHK
0x0A	0x00	0xFF	0x01	0xFF	0x11	0x00	0x44	0x66	0xAF

When the addressed UPB device (that is in Setup Mode) receives this command it will write the values 0x44 (Arg2) and 0x66 (Arg3) into its Setup Registers 0x00 (Arg1) and 0x01 respectively.

18.5. Controlling A UPB Dimming Wall Switch

Assuming you know the assigned Network ID (NID) and Unit ID (UID) of your UPB Dimming Wall Switch, you can easily control its Light Level using UPB Messages from the Device Control Command Set. In the examples to follow we will assume the UPB Dimming Wall Switch is assigned NID = 0x44 and UID = 0x66.

18.5.1. Example: Turning A UPB Dimming Wall Switch ON

To turn a UPB Dimming Wall Switch ON to 100% simply send it a “Start Fade” command with a Light Level of 100 (0x64) and a Fade Rate of 0 (Snap) as follows:

CTL		NID	DID	SID	MDID	Arg1	Arg2	CHK
0x09	0x00	0x44	0x66	0xFF	0x23	0x64	0x00	0xC7

When the UPB Dimming Wall Switch receives this UPB Message it will immediately “snap” its Light Level to 100%.

18.5.2. Example: Turning A UPB Dimming Wall Switch OFF

To turn a UPB Dimming Wall Switch OFF simply send it a “Start Fade” command with a Light Level of 0 (OFF) and a Fade Rate of 0 (snap) as follows:

CTL		NID	DID	SID	MDID	Arg1	Arg2	CHK
0x09	0x00	0x44	0x66	0xFF	0x23	0x00	0x00	0x2B

When the UPB Dimming Wall Switch receives this UPB Message it will immediately “snap” its Light Level to 0% (OFF).

18.5.3. Example: Fading A UPB Dimming Wall Switch To 50%

To slowly fade a UPB Dimming Wall Switch ON to 50% simply send it a “Start Fade” command with a Light Level of 50 (0x32) and a Fade Rate of 4 (or any other Fade Rate desired) as follows:

CTL		NID	DID	SID	MDID	Arg1	Arg2	CHK
0x09	0x00	0x44	0x66	0xFF	0x23	0x32	0x04	0xF5

When the UPB Dimming Wall Switch receives this UPB Message it will slowly “fade” its Light Level to 50%. Note: the Fade Rate value can range from 0x00 to 0xFF and it is left up to the application designer to assign the exact meaning of each Fade Rate value for their device.

18.6. Activating A Link

TBD

18.7. Duplicate IDs

There is always the possibility that two or more UPB devices share the same Network ID and the same Unit ID. This condition can obviously cause a great deal of confusion if not detected and remedied. Fortunately, the UPB system has facilities built in to allow for the detection and elimination of Duplicate IDs.

18.7.1. Example: Duplicate ID Detection

Duplicate ID Detection can be performed as follows:

1) Perform Network Enumeration to find an unoccupied Network ID.
2) Put the NID/UID under test into Setup Mode.
   a. One or more devices will go into Setup Mode and disable write protection.
3) Move that Unit ID to the unoccupied Network ID.
   a. This is done by writing the unoccupied Network ID value to the Network ID Setup Register of the Unit ID under test.
   b. One or more devices will now be assigned to the unoccupied Network ID.
4) Broadcast the “Auto Address” command to the unoccupied Network ID.
   a. This will command all devices in that network to pick a new random Unit ID.
5) Perform Device Enumeration on the unoccupied NID to determine all of the occupied Unit IDs on that UPB network.
   a. If only one Unit ID is occupied then there were no duplicates.
      i. Move the single device back to the original NID giving it an unoccupied Unit ID.
   b. If more than one Unit ID is occupied then there were duplicates.
      i. Move each device back to the original NID giving them unoccupied Unit IDs.

18.8. Auto-Addressing

TBD

19. Glossary Of UPB Abbreviations and Terms

ACK-bit	Bit #4 of the Control Word (CTL) that is used to request an ACK Pulse to be generated.
ACK Pulse	A single UPB Pulse generated by a UPB receiving device that is used to inform the transmitting device that the UPB Communication Packet was accepted.
ACK Message	TBD
Broadcast DID	A Destination ID (DID) value of 0x00 that all UPB devices on a network will accept.
Configuration Registers	Any additional Setup Register(s) not used by the UPBID.
CTL	Packet Control Word. The first two-bytes of a UPB Packet Header that contains bit fields that are used to indicate such information as: how the UPB Communications Packet should be received and how it should be responded to, as well as its length and sequence information.
Device Components	Logical objects (records) that the UPB device has, usually associated with physical entities on the device (such as pushbuttons, switches, indicators, input channels, output channels, etc.), that are intended to either receive or transmit UPB Link Packets for control purposes.
Device Enumeration	A method available for transmitting devices to quickly determine the Unit IDs of all receiving devices that exist on a particular UPB network.
DID	Destination ID. The 3rd byte of a UPB Communication Packet that indicates who it is intended for.
Direct Packet	A UPB Communication Packet that uses the DID field for a Unit ID. Direct Packets are usually used for communicating to a single device.
ESID	Extended Set ID.
Frame	TBD
Global NID	A Network ID (NID) value of 0x00 that all UPB devices accept.
ID-bit	Bit #5 of the Control Word (CTL) that is used to request an ID Pulse generation.

ID Pulse	A single UPB Pulse that is generated in Position #3 of the UPB Frame (immediately following the end of a UPB Message) that corresponds to the receiving device's Unit ID
Link Packet	A UPB Communication Packet that uses the DID field for a Link ID. Link Packets are usually used for communicating to a group of device components.
LNK-bit	Bit #15 of the Control Word (CTL) that is used to indicate that the UPB Communication Packet is a Link Packet.
MDA	Message Data Arguments. The bytes in a UPB Message that follow the MDID.
MDID	Message Data ID. A unique identifier byte for a UPB Message.
MID	Message ID or Manufacturer ID. The Message ID is a unique 5-bit identifier for the particular command or report in a specified Message Set. The Manufacturer ID is a unique 16-bit code assigned to each UPB device manufacturer.
MSG-bit	Bit #6 of the Control Word (CTL) that is used to request an Acknowledge Message generation.
MSID	Message Set ID. A 3-bit field of the MDID that breaks the UPB Messages into eight Message Sets.
Network Enumeration	A method available for transmitting devices to quickly determine which Network ID's are occupied (by UPB devices).
Network Password	A special 16-bit code (0 – 65,536) that is assigned to a UPB device that must be supplied when trying to do such things as put the device into Setup Mode and disable its write protection.
Normal Mode	A UPB device's normal (or standard) mode of operation.
Normal Packet	A UPB Communication Packet that has the REPRQ field set to zero indicating it is not to be repeated. A Powerline Repeater device does not accept these packets.
NID	Network ID. A unique 8-bit identifier assigned to each UPB device that allow it to communicate with other UPB devices with the same NID but not with devices with another NID.

UPB Pulse Position	The relative position value of a UPB Pulse. There are four possible Pulse Positions (0, 1, 2, or 3) in each UPB Frame.
UPB Repeater	Same as Powerline Repeater.
Zero-Crossing	The point in time where the AC powerline voltage is at zero volts. This occurs roughly every 8.333mS on a 60Hz powerline and 10.0mS on a 50Hz powerline.