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# **User Manual Addendum, Traffic Lights**

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## Overview

The Traffic Light feature allows the creation of traffic lights for use during system operation. Traffic lights are used to control vehicle movement at defined positions in the transport system. Traffic lights are associated with specific motor blocks.

When the traffic light is set to green, vehicles are granted permission to move beyond the position of the traffic light. When the traffic light is set to red, vehicles are not granted permission to move beyond the position of the traffic light.

There is a limit of one traffic light per motor block and 32 traffic lights per path. Commands to create traffic lights on a motor block where a traffic light is already located or create more than 32 traffic lights on a path are rejected.

This document describes the changes to the NCHost TCP Interface Utility, the Host Controller TCP/IP Communication Protocol, the Host Controller EtherNet/IP Communication Protocol, and the Node Controller Configuration File.

## Related Documents

This document references the following manuals:

- Host Controller TCP/IP Communication Protocol User Manual, 990000436.
- Host Controller EtherNet/IP Communication Protocol User Manual, 990000437.
- MagneMover LITE Configurator User Manual, 990000558.
- NCHost TCP Interface Utility User Manual, 990000562.

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## NCHost TCP Interface Utility User Manual Addendum

This section is an addendum to the *NCHost TCP Interface Utility User Manual* and describes additions to the NCHost User Interface for support of traffic lights.

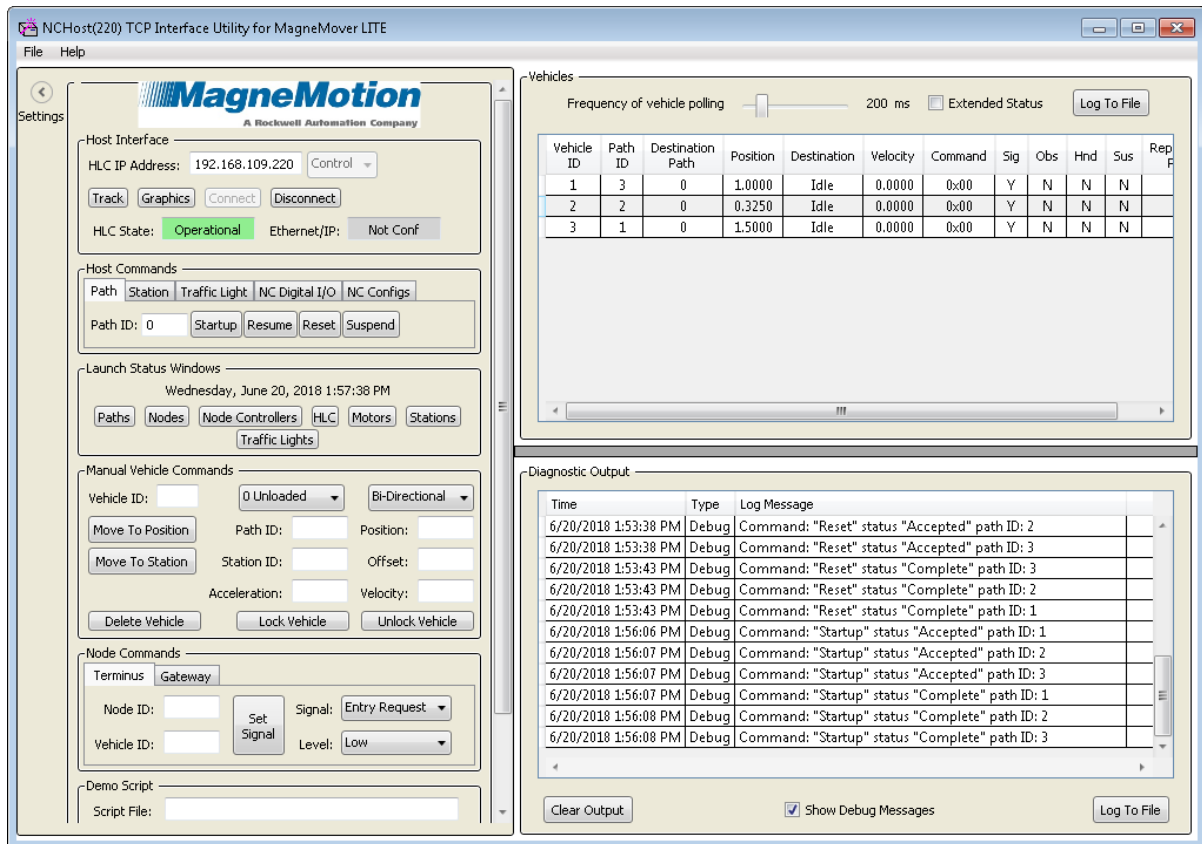


Figure 1: NCHost TCP Interface Utility for MagneMover LITE

### Monitoring Transport System Status

Transport system status is available through the **Launch Status Windows** section. See [Figure 2](#) and the Launch Status Windows section in the *NCHost TCP Interface Utility User Manual* for detailed descriptions of all items).

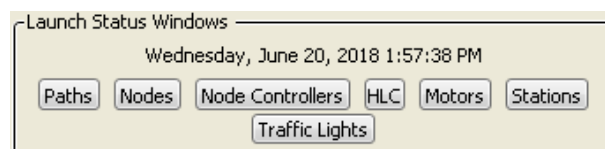


Figure 2: Launch Status Windows Section

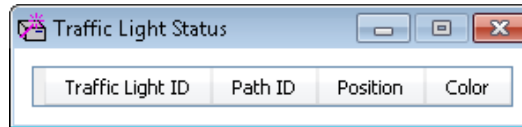
### Traffic Lights Status Window

To monitor the traffic light status:

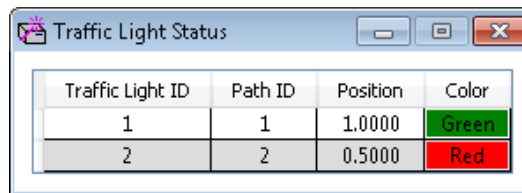
1. In the **Launch Status Windows** section (see [Figure 2](#)), select **Traffic Lights**.

*The **Traffic Light Status** window is displayed as shown in [Figure 3](#).*

Traffic lights can only be created while the system is operational. If no traffic lights have been created, the **Traffic Light Status** window is empty as displayed in the upper figure in [Figure 3](#). If traffic lights have been created, they are displayed in the **Traffic Light Status** window as displayed in the lower figure in [Figure 3](#).



No Traffic Lights Defined



Two Traffic Lights Defined

Figure 3: Traffic Light Status Window

2. Move the status window to a convenient location.
3. When finished using the **Traffic Light Status** window, select the **X** in the upper-right corner to close the window.

## Host Commands

All Host Commands available to be sent from NCHost to the HLC are in the **Host Commands** section (see [Figure 4](#)).

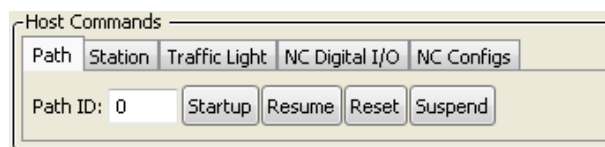


Figure 4: Host Commands Section

## Create a Traffic Light

To create a Traffic Light:

1. Open the **Traffic Light Status** window to view the traffic light status if desired.
2. In the **Host Commands** section, select the **Traffic Light** tab (see [Figure 5](#)).

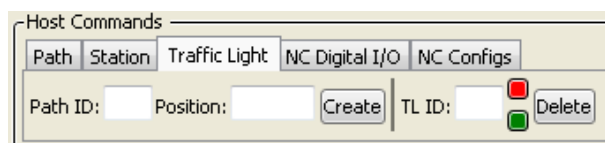
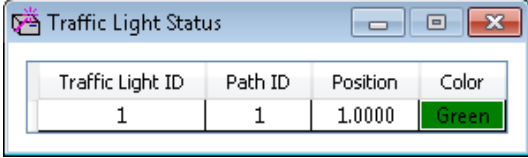


Figure 5: Host Commands Section - Traffic Light Tab

3. Enter the desired **Path ID** and **Position** of the traffic light.
4. Select **Create**.

*The traffic light is created with an initial Color of green as shown in Figure 6.*



Traffic Light ID	Path ID	Position	Color
1	1	1.0000	Green

Figure 6: Traffic Light with Initial Settings

## Set a Traffic Light

To set the traffic light to **Green**:

1. Open the **Traffic Light Status** window to view the traffic light status if desired.
2. In the **Host Commands** section, select the **Traffic Light** tab (see Figure 7).

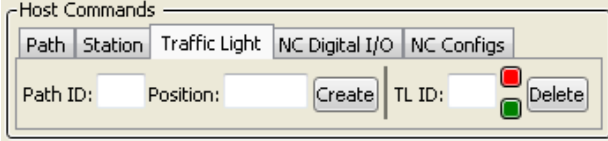


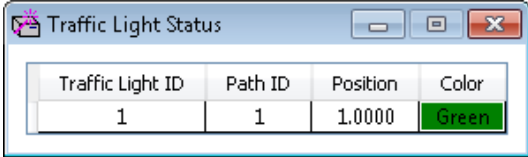
Figure 7: Host Commands Section - Traffic Light Tab

3. Enter the ID of the desired traffic light to set in the **TL ID** field.

**NOTE:** A **TL ID** of 0 cannot be used to set all traffic lights.

4. Select the **Green** button.

*If the traffic light was **Red**, the **Color** turns **Green**. If the traffic light was **Green**, the **Color** remains **Green**.*



Traffic Light ID	Path ID	Position	Color
1	1	1.0000	Green

Figure 8: Green Traffic Light

To set the traffic light to **Red**:

1. Open the **Traffic Light Status** window to view the traffic light status if desired.
2. In the **Host Commands** section, select the **Traffic Light** tab (see Figure 7).

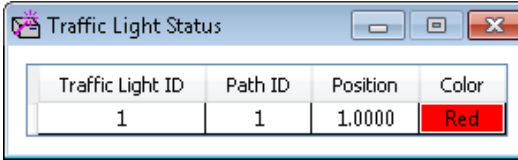
3. Enter the ID of the desired traffic light to set in the **TL ID** field.

**NOTE:** A **TL ID** of 0 cannot be used to set all traffic lights.

4. Select the **Red** button.

*If the traffic light was **Green**, the **Color** turns **Red** as shown in Figure 9. If the traffic light was **Red**, the **Color** remains **Red**.*





Traffic Light ID	Path ID	Position	Color
1	1	1.0000	Red

Figure 9: Red Traffic Light

## Delete a Traffic Light

To delete a traffic light:

1. Open the **Traffic Light Status** window to view the traffic light status if desired.
2. In the **Host Commands** section, select the **Traffic Light** tab (see [Figure 10](#)).

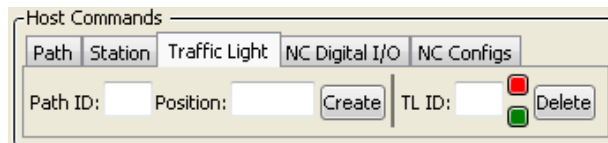


Figure 10: Host Commands Section - Traffic Light Tab

3. Enter the ID of the desired traffic light to be deleted in the **TL ID** field.
4. Select **Delete**.

*The traffic light is deleted from the **Traffic Light Status** window.*

## Host Controller TCP/IP Communication Protocol User Manual Addendum

This section is an addendum to the *Host Controller TCP/IP Communication Protocol User Manual* to support the traffic light feature. The additions to the protocol for communication between the high level controller (HLC) and a host controller that is equipped with a TCP/IP interface are described.

### Host Controller to HLC Communications

This section describes the commands (listed in [Table 1](#)) sent from the host controller to the HLC as asynchronous requests for the transport system to perform an action. These requests are responded to by the HLC by routing the command to the appropriate node controller for completion and sending responses to the host controller (listed in [Table 2](#)).

*Table 1: Host Controller to HLC Commands*

Description and Value	Use	Page
<a href="#">Create Traffic Light (0xBF 02 01)</a>	MM LITE	<a href="#">11</a>
<a href="#">Set Traffic Light (0xBF 02 02)</a>	MM LITE	<a href="#">13</a>
<a href="#">Get Traffic Light Status (0xBF 02 03)</a>	MM LITE	<a href="#">15</a>
<a href="#">Delete Traffic Light (0xBF 02 04)</a>	MM LITE	<a href="#">17</a>

## Create Traffic Light (0xBF 02 01)

### Type

Host Controller → HLC

### Purpose

Creates a traffic light at the specified position on the designated path. When created, a traffic light is set to green to allow vehicles to move beyond the traffic light position.

There is a limit of one traffic light per motor block and 32 traffic lights per path. The HLC rejects commands that attempt to create a traffic light on a motor block where a traffic light is already located or create more than 32 traffic lights on a path.

### Support

This command is supported in the latest software release for the following product lines:

- MagneMover LITE transport systems.

### Format

Offset	Item	Bytes	Range
0	Command Header	1	0xBF
1	Extension Type	1	0x02
2	Extension Subtype	1	0x01
3	Path ID	2	1–65535
5	Position	4	0.0–41.0m (floating-point)
9	Host Command Count	4	0x0–0xFFFFFFFF

### Arguments

**Command Header** – Fixed message type that identifies this message as a Host Extension command.

**Extension Type** – Fixed extension type that identifies this command as a Traffic Light extension command.

**Extension Subtype** – Fixed extension subtype that identifies this command as a Create Traffic Light extension command.

**Path ID** – The ID of the path where a traffic light is to be placed.

**Position** – The position (in meters) relative to the start of the specified path where a traffic light is to be placed. Expressed as a 32-bit single-precision floating-point number.

**Host Command Count** – A unique value that is supplied by the host controller when this message is sent. It aids the host controller in the execution of this command.

The Host Command Count field is always returned in Command Status (0xD0) messages.

## Response

After receiving the command and verifying the command parameters, the HLC sends either a ‘Command Accepted’ or ‘Command Rejected’ response as appropriate (refer to Command Status (0xD0)). If the command is accepted, the HLC handles setting the traffic light to green on the targeted motor block.

On command completion, the HLC sends a ‘Command Complete’ or a ‘Command Failed’ response. For Command Complete messages, the ID of the new traffic light is included in the Command Status (0xD0) message.

## See Also

[Command Status \(0xD0\)](#) on page 20

[Traffic Light Status \(0xDF 02 01\)](#) on page 22

## Set Traffic Light (0xBF 02 02)

### Type

Host Controller → HLC

### Purpose

Set the color for a traffic light to either green or red. Depending on color, a traffic light controls vehicle movement as follows:

- When set to green, vehicles are granted permission to move beyond the position of the traffic light.
- When set to red, vehicles are not granted permission to move into or beyond the motor block at the position of the traffic light. The obstructed status bit for the vehicle is set if the vehicle is stopped at a traffic light. The obstructed status bit is also set if the vehicle is waiting in a queue of vehicles or waiting at a switch.

If a traffic light is commanded to turn red, and a vehicle has not yet reached the commanded traffic light position but has permission to enter or move past the motor block at the position of the traffic light, the vehicle does not stop at the traffic light and continues its commanded move.

### Support

This command is supported in the latest software release for the following product lines:

- MagneMover LITE transport systems.

### Format

Offset	Item	Bytes	Range
0	Command Header	1	0xBF
1	Extension Type	1	0x02
2	Extension Subtype	1	0x02
3	Traffic Light ID	2	1–4096
5	Color	1	Values are: 0 – Green (allows traffic to pass) 1 – Red (stops traffic)
6	Host Command Count	4	0x0–0xFFFFFFFF

### Arguments

**Command Header** – Fixed message type that identifies this message as a Host Extension command.

**Extension Type** – Fixed extension type that identifies this command as a Traffic Light extension command.

**Extension Subtype** – Fixed extension subtype that identifies this command as a Set Traffic Light extension command.

**Traffic Light ID** – The ID of the specified traffic light to change.

**Color** – Color to set for the specified traffic light.

**Host Command Count** – A unique value that is supplied by the host controller when this message is sent. It aids the host controller in the execution of this command.

The Host Command Count field is always returned in Command Status (0xD0) messages.

## Response

After receiving the command and verifying the command parameters, the HLC sends either a 'Command Accepted' or 'Command Rejected' response as appropriate (refer to Command Status (0xD0)). If the command is accepted, the HLC handles setting the traffic light to the specific color on the targeted motor block.

On completion of the command, the HLC sends a 'Command Complete' or a 'Command Failed' response.

## See Also

[Command Status \(0xD0\)](#) on page 20

[Traffic Light Status \(0xDF 02 01\)](#) on page 22

## Get Traffic Light Status (0xBF 02 03)

### Type

Host Controller → HLC

### Purpose

Requests the status for a specific traffic light or for all traffic lights in a transport system.

### Support

This command is supported in the latest software release for the following product lines:

- MagneMover LITE transport systems.

### Format

Offset	Item	Bytes	Range
0	Command Header	1	0xBF
1	Extension Type	1	0x02
2	Extension Subtype	1	0x03
3	Traffic Light ID	2	Values are: 0 – Get the status for all traffic lights 1–4096 – Get status for a specific traffic light

### Arguments

**Command Header** – Fixed message type that identifies this message as a Host Extension command.

**Extension Type** – Fixed extension type that identifies this command as a Traffic Light extension command.

**Extension Subtype** – Fixed extension subtype that identifies this command as a Get Traffic Light Status extension command.

**Traffic Light ID** – The ID of the traffic light for which status is being requested.

If the Traffic Light ID field is nonzero, the HLC gets status only for the specified traffic light. If the specified traffic light does not exist, a [Traffic Light Status \(0xDF 02 01\)](#) response message is returned with the failing Traffic Light ID and the Command Status field set to indicate that no such traffic light exists in the transport system.

If the Traffic Light ID field is 0, the HLC gets status for all currently defined traffic lights. A [Traffic Light Status \(0xDF 02 01\)](#) response message is returned for each traffic light with its success or failure status. If no traffic lights exist, the HLC accepts the command and a Traffic Light ID of 0 and a Command Status of ‘Command Accepted’ is returned in the [Traffic Light Status \(0xDF 02 01\)](#) response message.

If the HLC rejects a Get Traffic Light Status command, the ID of the traffic light and the command failure status are included in the [Traffic Light Status \(0xDF 02 01\)](#) response message.

## Response

After receiving the command and verifying the command parameters, the HLC sends one or more [Traffic Light Status \(0xDF 02 01\)](#) response messages to the host controller.

## See Also

[Command Status \(0xD0\)](#) on page 20

[Traffic Light Status \(0xDF 02 01\)](#) on page 22



## Delete Traffic Light (0xBF 02 04)

### Type

Host Controller → HLC

### Purpose

Delete the specified traffic light. When a traffic light is deleted, the associated motor block is set to green to allow vehicles to move beyond the traffic light position.

### Support

This command is supported in the latest software release for the following product lines:

- MagneMover LITE transport systems.

### Format

Offset	Item	Bytes	Range
0	Command Header	1	0xBF
1	Extension Type	1	0x02
2	Extension Subtype	1	0x04
3	Traffic Light ID	2	1–4096
5	Host Command Count	4	0x0–0xFFFFFFFF

### Arguments

**Command Header** – Fixed message type that identifies this message as a Host Extension command.

**Extension Type** – Fixed extension type that identifies this command as a Traffic Light extension command.

**Extension Subtype** – Fixed extension subtype that identifies this command as a Delete Traffic Light extension command.

**Traffic Light ID** – The ID of the specified traffic light to delete.

**Host Command Count** – A unique value that is supplied by the host controller when this message is sent. It aids the host controller in the execution of this command.

The Host Command Count field is always returned in Command Status (0xD0) messages.

### Response

After receiving the command and verifying the command parameters, the HLC sends either a ‘Command Accepted’ or ‘Command Rejected’ response as appropriate (refer to Command

Status (0xD0)). If the command is accepted, the HLC handles setting the traffic light to green on the targeted motor block.

On command completion, the HLC sends a ‘Command Complete’ or a ‘Command Failed’ response.

### See Also

[Command Status \(0xD0\)](#) on page 20

[Traffic Light Status \(0xDF 02 01\)](#) on page 22

## HLC to Host Controller Communications

This section describes the responses that are sent from the high level controller (HLC) to the host controller as asynchronous responses from the transport system after performing an action. [Table 2](#) lists the responses that are used with the traffic light functionality.

*Table 2: HLC to Host Controller Responses*

Description and Value	Use	Page
<a href="#">Command Status (0xD0)</a>	MM LITE	<a href="#">20</a>
<a href="#">Traffic Light Status (0xDF 02 01)</a>	MM LITE	<a href="#">22</a>

## Command Status (0xD0)

### Type

HLC → Host Controller

### Purpose

Acknowledges the reception or rejection of a command, signals command execution failure, or signals command completion.

**NOTE:** Receipt of a valid command or the event of a command completion is required.

### Support

This response is supported in the latest software release for the following product lines:

- MagneMover LITE transport systems.

### Format

Offset	Item	Bytes	Range
0	Response Header	1	0xD0
1	Command	1	0xB0–0xBC, 0xBF
2	Command Status	1	0x00–0x80
3	Command Data Detail	Varies	Varies for each command

### Arguments

**Response Header** – Fixed message type that identifies this message as a Command Status response message.

**Command** – Header of the command that this message is acknowledging.

Cmd	Ext	Sub	Command	Valid Command Status Values
0xBF	0x02	0x01	Create Traffic Light	0x00, 0x03, 0x04, 0x09, 0x0A, 0x0C, 0x0D, 0x0E, 0x10, 0x14, 0x41, 0x42, 0x80
0xBF	0x02	0x02	Set Traffic Light	0x00, 0x0B, 0x0C, 0x0E, 0x11, 0x41, 0x42, 0x80
0xBF	0x02	0x04	Delete Traffic Light	0x00, 0x0C, 0x0E, 0x11, 0x41, 0x42, 0x80

**Command Status** – The status of the command that this message is acknowledging, see [HLC Status Codes](#) on page 42.

**Command Data Detail** – Variable amount of data that provides the details of the command that is specified in the Command field.

Cmd	Ext	Sub	Command Description	Command Data
0xBF	0x02	0x01	Create Traffic Light	Extension Type (1 byte) Extension Subtype (1 byte) Path ID (2 bytes) Position (4 bytes) Host Command Count (4 bytes) Traffic Light ID (2 bytes)
0xBF	0x02	0x02	Set Traffic Light	Extension Type (1 byte) Extension Subtype (1 byte) Traffic Light ID (2 bytes) Color (1 byte) Host Command Count (4 bytes)
0xBF	0x02	0x04	Delete Traffic Light	Extension Type (1 byte) Extension Subtype (1 byte) Traffic Light ID (2 bytes) Host Command Count (4 bytes)

### See Also

[Create Traffic Light \(0xBF 02 01\)](#) on page 11

[Set Traffic Light \(0xBF 02 02\)](#) on page 13

[Get Traffic Light Status \(0xBF 02 03\)](#) on page 15

[Delete Traffic Light \(0xBF 02 04\)](#) on page 17

## Traffic Light Status (0xDF 02 01)

### Type

HLC → Host Controller

### Purpose

Reports status for one or more traffic lights that are specified in a [Get Traffic Light Status \(0xBF 02 03\)](#) command message to the host controller.

### Support

This response is supported in the latest software release for the following product lines:

- MagneMover LITE transport systems.

### Format

Offset	Item	Bytes	Range
0	Response Header	1	0xDF
1	Extension Type	1	0x02
2	Extension Subtype	1	0x01
3	Command Status	1	0x00, 0x0C, 0x0E, 0x11
4	Traffic Light ID	2	0–40967
6	Path ID	2	1–65535
8	Position	4	0–41.0m (floating-point)
12	Color	1	Values are: 0 – Green (allows traffic to pass) 1 – Red (stops traffic)

### Arguments

**Response Header** – Fixed message type that identifies this message as a Host Extension message.

**Extension Type** – Fixed extension type that identifies this message as a Traffic Light extension message.

**Extension Subtype** – Fixed extension subtype that identifies this message as a Traffic Light Status extension message.

**Command Status** – The status of the command that this message is acknowledging, see [HLC Status Codes](#) on page 42.

**Traffic Light ID** – The ID of the traffic light for which status is being requested.

**Path ID** – The ID of the path where the traffic light is located.

**Position** – The position (in meters) relative to the start of the specified path where a traffic light is located. Expressed as a 32-bit single-precision floating-point number.

**Color** – Color of the specified traffic light.

### See Also

[Create Traffic Light \(0xBF 02 01\)](#) on page 11

[Set Traffic Light \(0xBF 02 02\)](#) on page 13

[Get Traffic Light Status \(0xBF 02 03\)](#) on page 15

[Delete Traffic Light \(0xBF 02 04\)](#) on page 17

## Host Controller EtherNet/IP Communication Protocol User Manual Addendum

This section is an addendum to the *Host Controller EtherNet/IP Communication Protocol User Manual* to support the traffic light feature. The additions to the protocol for communication between the high level controller (HLC) and a host controller that is equipped with an EtherNet/IP interface are described.

### Host Controller to HLC Communications

This section describes Explicit Message types and Tag memory formats that traverse TCP connections between the host controller (PLC) and the HLC.

Command (explicit) messages (listed in [Table 3](#)) are sent from the host controller to the HLC to request the HLC to perform an action. These requests are responded to by the HLC by routing the command to the appropriate node controller for completion and updating the corresponding response tags in PLC memory (listed in [Table 4](#) and [Table 5](#)).

*Table 3: PLC to HLC Explicit Message Requests*

Message Name	Message Element	Use	Page
<a href="#">MMI_create_traffic_light_cmd</a>	udt_MMI_create_traffic_light_cmd	MM LITE	<a href="#">25</a>
<a href="#">MMI_set_traffic_light_cmd</a>	udt_MMI_set_traffic_light_cmd	MM LITE	<a href="#">28</a>
<a href="#">MMI_delete_traffic_light_cmd</a>	udt_MMI_delete_traffic_light_cmd	MM LITE	<a href="#">32</a>



## MMI\_create\_traffic\_light\_cmd

### Type

Host Controller → HLC

### Purpose

Contains one or more entries of type `udt_MMI_create_traffic_light_cmd` used to create a traffic light at the specified position on the designated path. When created, a traffic light is set to green to allow vehicles to move beyond the traffic light position.

There is a limit of one traffic light per motor block and 32 traffic lights per path. The HLC rejects commands that attempt to create a traffic light on a motor block where a traffic light is already located or create more than 32 traffic lights on a path.

Each command can be monitored via its corresponding `udt_MMI_traffic_light_cmd_status` entry in the [MMI\\_traffic\\_light\\_cmd\\_status](#) tag.

### Support

This command is supported in the latest software release for the following product lines:

- MagneMover LITE transport systems.

### Message Element Data Type

The UDT type editor that is shown in [Figure 11](#) shows the type of each element comprising the `udt_MMI_create_traffic_light_cmd` type.

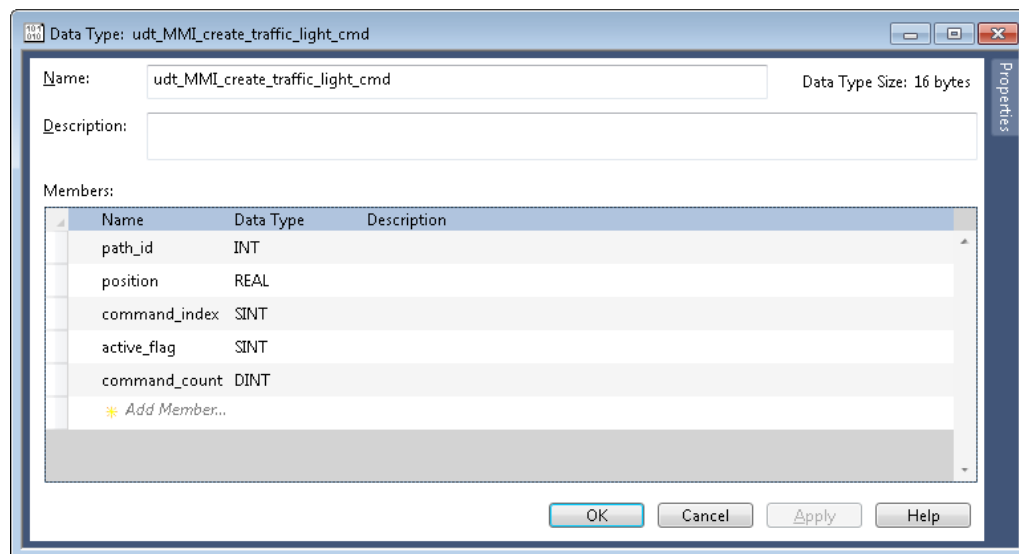


Figure 11: UDT `udt_MMI_create_traffic_light_cmd`

## UDT Field Descriptions

This section describes the format of the UDT used to define Create Traffic Light commands. UDT fields are described in more detail following the table.

Field Name	Data Type	Style	Range
path_id	INT	Decimal	1–65535
position	REAL	Float	0.0–41.0 (m, floating-point)
command_index	SINT	Decimal	0–31
active_flag	SINT	Hex	Values are: 0x00 – HLC skips this entry 0x01 – HLC processes this entry
command_count	DINT	Hex	0x0–0xFFFFFFFF

**path\_id** – The ID of the path where the traffic light is to be placed. The ID must be a nonzero integer that references a path that exists in the configuration.

**position** – The position (in meters), relative to the start of the specified path (expressed as a 32-bit single-precision floating-point number), where a traffic light is to be placed.

**command\_index** – The index of the entry in the [MMI\\_traffic\\_light\\_cmd\\_status](#) tag to update when this `MMI_create_traffic_light_cmd` completes.

**active\_flag** – This flag is used in configurations where a static table of `udt_MMI_create_traffic_light_cmd` entries is used and the same table is sent every time. The HLC only processes those entries with the `active_flag` set.

Value	Description
0x00	The HLC skips the entry for this traffic light.
0x01	The HLC processes the entry for this traffic light.

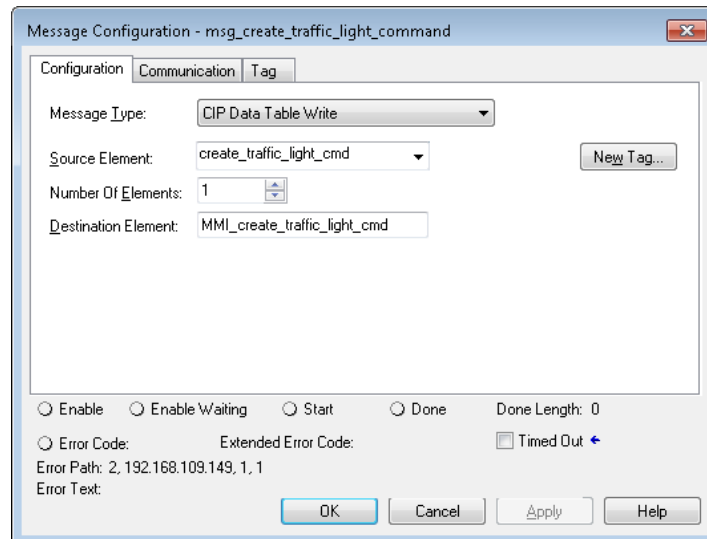
**command\_count** – Host controller derived unique counter, which is used to confirm that the HLC has received the command and to determine command status. This counter provides a convenient handshake mechanism to determine command status by matching the counter with the fields in the [MMI\\_traffic\\_light\\_cmd\\_status](#) array.

Using a scratch DINT tag as a counter is suggested. The scratch DINT tag can be incremented and copied to the `command_count` field each time a new traffic light command is issued so the new command can be tracked against the various count fields that are described in [MMI\\_traffic\\_light\\_cmd\\_status](#).

## Message Configuration

Source Element Type	Number of Elements	Destination Element
<code>udt_MMI_create_traffic_light_cmd</code>	Min: 1 Max: 32	<code>MMI_create_traffic_light_cmd</code>

The source element `create_traffic_light_cmd` shown in [Figure 12](#) is an array of type `udt_MMI_create_traffic_light_cmd`. It can be a single tag with the Number of Elements set to 1, or it can be an array with the Number of Elements set to the maximum of 32.



*Figure 12: Example Create Traffic Light Command Explicit Message Configuration*

## Response

After receiving the command, the HLC verifies the command parameters and updates [MMI\\_traffic\\_light\\_cmd\\_status](#) as appropriate. If the command is accepted, the HLC handles creating the traffic light on the targeted motor block and setting it to green. Once the command completes, the HLC updates [MMI\\_traffic\\_light\\_cmd\\_status](#) to indicate completion.

Additionally, the HLC updates the corresponding traffic light status entry in [MMI\\_traffic\\_light\\_status](#) to reflect the status of the new traffic light. The ID of the new traffic light is returned in the `last_command_accepted_traffic_light_id` field of the [MMI\\_traffic\\_light\\_cmd\\_status](#) tag.

## See Also

[MMI\\_traffic\\_light\\_status](#) on page 36

[MMI\\_traffic\\_light\\_cmd\\_status](#) on page 39

## MMI\_set\_traffic\_light\_cmd

### Type

Host Controller → HLC

### Purpose

Contains one or more entries of type `udt_MMI_set_traffic_light_cmd` use to set the color of a traffic light to either green or red. Depending on color, a traffic light controls vehicle movement as follows:

- When set to green, vehicles are granted permission to move beyond the position of the traffic light.
- When set to red, vehicles are not granted permission to move into or beyond the motor block at the position of the traffic light. The obstructed status bit for the vehicle is set if the vehicle is stopped at a traffic light. The obstructed status bit is also set if the vehicle is waiting in a queue of vehicles or waiting at a switch.

If a traffic light is commanded to turn red, and a vehicle has not yet reached the commanded traffic light position but has permission to enter or move past the motor block at the position of the traffic light, the vehicle does not stop at the traffic light and continues its commanded move.

Each command can be monitored via its corresponding `udt_MMI_traffic_light_cmd_status` entry in the [MMI\\_traffic\\_light\\_cmd\\_status](#) tag.

### Support

This command is supported in the latest software release for the following product lines:

- MagneMover LITE transport systems.

### Message Element Data Type

The UDT type editor that is shown in [Figure 13](#) shows the type of each element comprising the `udt_MMI_set_traffic_light_cmd` type.

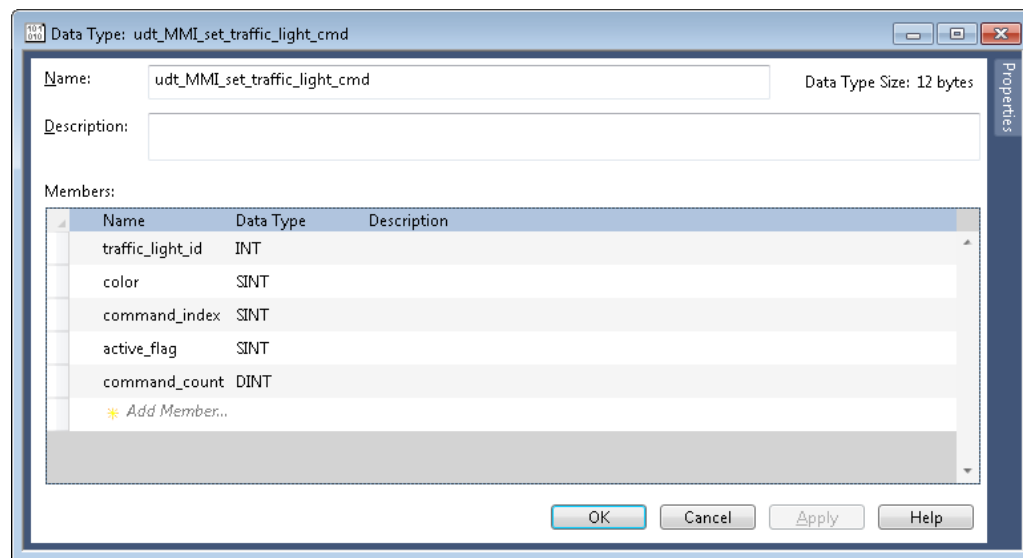


Figure 13: UDT `udt_MMI_set_traffic_light_cmd`

### UDT Field Descriptions

This section describes the format of the UDT used to define Set Traffic Light commands. UDT fields are described in more detail following the table.

Field Name	Data Type	Style	Range
<code>traffic_light_id</code>	INT	Decimal	1–4096
<code>color</code>	SINT	Decimal	Values are: 0 – Green (allows traffic to pass) 1 – Red (stops traffic)
<code>command_index</code>	SINT	Decimal	0–31
<code>active_flag</code>	SINT	Hex	Values are: 0x00 – HLC skips this entry 0x01 – HLC processes this entry
<code>command_count</code>	DINT	Hex	0x0–0xFFFFFFFF

**traffic\_light\_id** – The ID of the specified traffic light to change. The ID must be a nonzero integer that references a traffic light that exists in the configuration.

**color** – Color to set for the specified traffic light.

**command\_index** – The index of the entry in the [MMI\\_traffic\\_light\\_cmd\\_status](#) tag to update when this `MMI_set_traffic_light_cmd` completes.

**active\_flag** – This flag is used in configurations where a static table of `udt_MMI_set_traffic_light_cmd` entries is used and the same table is sent every time. The HLC only processes those entries with the `active_flag` set.

Value	Description
0x00	The HLC skips the entry for this traffic light.
0x01	The HLC processes the entry for this traffic light.

**command\_count** – Host controller derived unique counter, which is used to confirm that the HLC has received the command and to determine command status. This counter provides a convenient handshake mechanism to determine command status by matching the counter with the fields in the [MMI\\_traffic\\_light\\_cmd\\_status](#) array.

Using a scratch DINT tag as a counter is suggested. The scratch DINT tag can be incremented and copied to the **command\_count** field each time a new traffic light command is issued so the new command can be tracked against the various count fields that are described in [MMI\\_traffic\\_light\\_cmd\\_status](#).

### Message Configuration

Source Element Type	Number of Elements	Destination Element
udt_MMI_set_traffic_light_cmd	Min: 1 Max: 32	MMI_set_traffic_light_cmd

The source element `set_traffic_light_cmd` shown in [Figure 14](#) is an array of type `udt_MMI_set_traffic_light_cmd`. It can be a single tag with the Number of Elements set to 1, or it can be an array with the Number of Elements set to the maximum of 32.

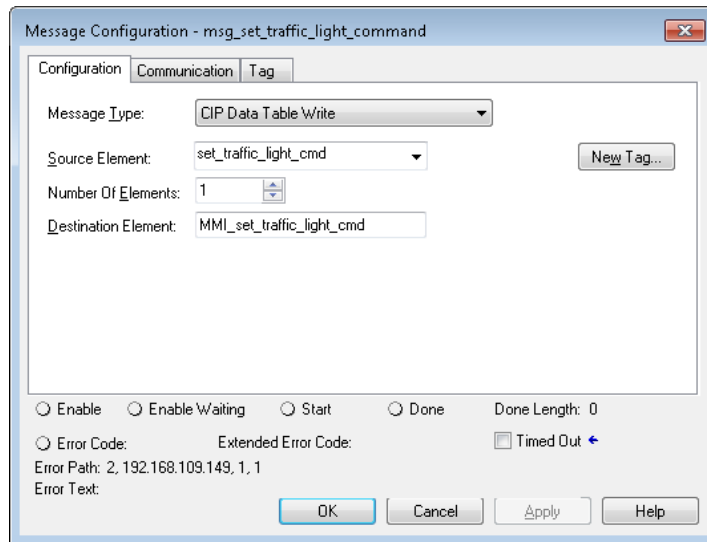


Figure 14: Example Set Traffic Light Command Explicit Message Configuration

### Response

After receiving the command, the HLC verifies the command parameters and updates the [MMI\\_traffic\\_light\\_cmd\\_status](#) as appropriate. If the command is accepted, the HLC handles setting the specified traffic light to the specified color. Once the command completes, the HLC updates [MMI\\_traffic\\_light\\_cmd\\_status](#) to indicate completion.

Additionally, the HLC updates the corresponding traffic light status entry in [MMI\\_traffic\\_light\\_status](#) to reflect the new status of the traffic light.

---

**See Also**

[MMI\\_traffic\\_light\\_status](#) on page 36

[MMI\\_traffic\\_light\\_cmd\\_status](#) on page 39

## MMI\_delete\_traffic\_light\_cmd

### Type

Host Controller → HLC

### Purpose

Contains one or more entries of type `udt_MMI_delete_traffic_light_cmd` used to delete the specified traffic light. When a traffic light is deleted, the associated motor block is set to green to allow vehicles to move beyond the traffic light position.

Each command can be monitored via its corresponding `udt_MMI_traffic_light_cmd_status` entry in the [MMI\\_traffic\\_light\\_cmd\\_status](#) tag.

### Support

This command is supported in the latest software release for the following product lines:

- MagneMover LITE transport systems.

### Message Element Data Type

The UDT type editor that is shown in [Figure 15](#) shows the type of each element comprising the `udt_MMI_delete_traffic_light_cmd` type.

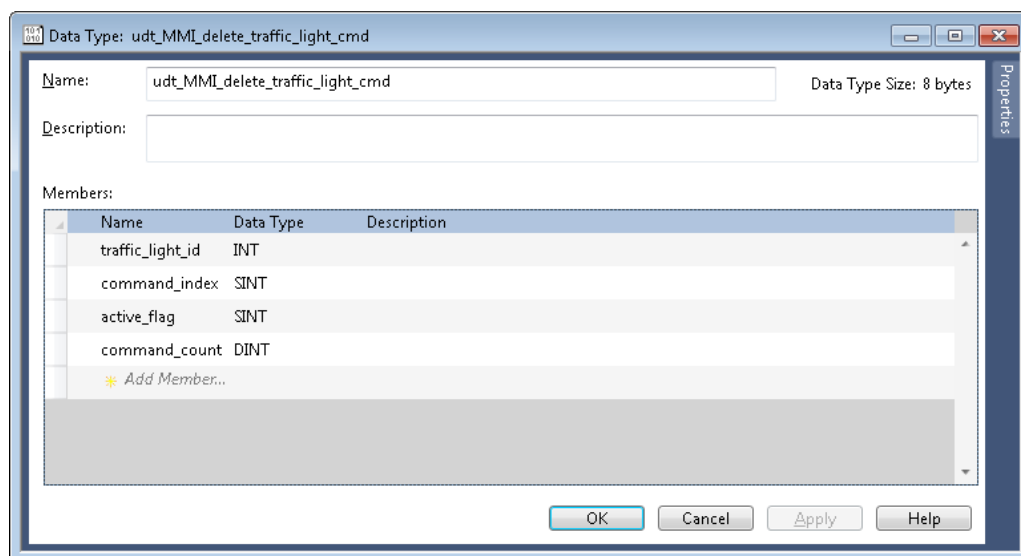


Figure 15: UDT `MMI_delete_traffic_light_cmd`

### UDT Field Descriptions

This section describes the format of the UDT used to define Delete Traffic Light commands. UDT fields are described in more detail following the table.



Field Name	Data Type	Style	Range
traffic_light_id	INT	Decimal	1–4096
command_index	SINT	Decimal	0–31
active_flag	SINT	Hex	Values are: 0x00 – HLC skips this entry 0x01 – HLC processes this entry
command_count	DINT	Hex	0x0–0xFFFFFFFF

**traffic\_light\_id** – The ID of the specified traffic light to delete. The ID must be a nonzero integer that references a traffic light that exists in the configuration.

**command\_index** – The index of the entry in the [MMI\\_traffic\\_light\\_cmd\\_status](#) tag to update when this `MMI_delete_traffic_light_cmd` completes.

**active\_flag** – This flag is used in configurations where a static table of `udt_MMI_delete_traffic_light_cmd` entries is used and the same table is sent every time. The HLC only processes those entries with the `active_flag` set.

Value	Description
0x00	The HLC skips the entry for this traffic light.
0x01	The HLC processes the entry for this traffic light.

**command\_count** – Host controller derived unique counter, which is used to confirm that the HLC has received the command and to determine command status. This counter provides a convenient handshake mechanism to determine command status by matching the counter with the fields in the [MMI\\_traffic\\_light\\_cmd\\_status](#) array.

Using a scratch DINT tag as a counter is suggested. The scratch DINT tag can be incremented and copied to the `command_count` field each time a new traffic light command is issued so the new command can be tracked against the various count fields that are described in [MMI\\_traffic\\_light\\_cmd\\_status](#).

### Message Configuration

Source Element Type	Number of Elements	Destination Element
<code>udt_MMI_delete_traffic_light_cmd</code>	Min: 1 Max: 32	<code>MMI_delete_traffic_light_cmd</code>

The source element `delete_traffic_light_cmd` shown in [Figure 16](#) is an array of type `udt_MMI_delete_traffic_light_cmd`. It can be a single tag with the Number of Elements set to 1, or it can be an array with the Number of Elements set to the maximum of 32.

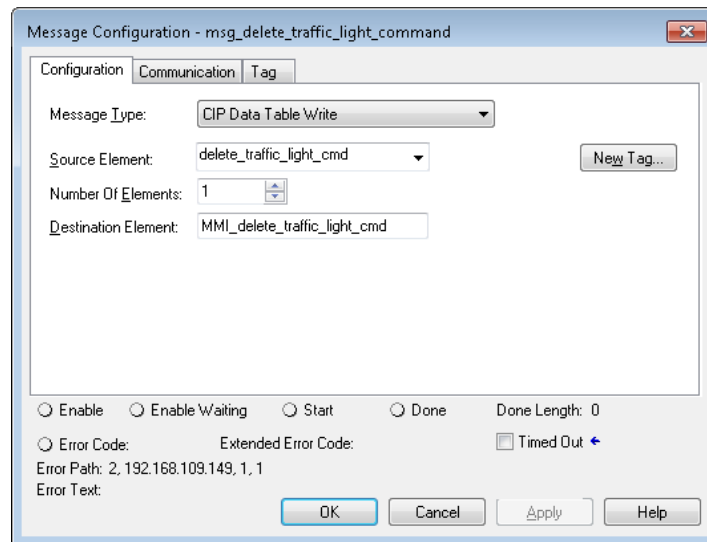


Figure 16: Example Delete Traffic Light Command Explicit Message Configuration

## Response

After receiving the command, the HLC verifies the command parameters and updates the [MMI\\_traffic\\_light\\_cmd\\_status](#) as appropriate. If the command is accepted, the HLC handles deleting the specified traffic light. Once the command completes, the HLC updates [MMI\\_traffic\\_light\\_cmd\\_status](#) to indicate completion.

Additionally, the HLC updates the corresponding traffic light status entry in [MMI\\_traffic\\_light\\_status](#) to reflect the deletion of the traffic light.

## See Also

[MMI\\_traffic\\_light\\_status](#) on page 36

[MMI\\_traffic\\_light\\_cmd\\_status](#) on page 39

## HLC to Host Controller Communications

This section describes the Status and Response Memory Tags that the HLC updates to interoperate with the PLC.

The HLC updates the Status Tags (listed in [Table 4](#)) on state change or when the EtherNet/IP link between the HLC and the PLC has been re-established after going down. Status Tags are informational for the PLC for disseminating status about the traffic light functions. The HLC updates the Response Tags (listed in [Table 5](#)) only in response to specific commands from the PLC issued via explicit messages.

*Table 4: HLC to PLC Status Memory Tags*

Message Name	Message Element	Use	Page
<a href="#">MMI_traffic_light_status</a>	udt_MMI_traffic_light_status	MM LITE	<a href="#">36</a>

*Table 5: HLC to PLC Response Memory Tags*

Message Name	Message Element	Use	Page
<a href="#">MMI_traffic_light_cmd_status</a>	udt_MMI_traffic_light_cmd_status	MM LITE	<a href="#">39</a>

## MMI\_traffic\_light\_status

### Type

HLC → Host Controller

### Purpose

Reports the status of all traffic lights in the transport system. This tag is a one-dimensional array of type `udt_MMI_traffic_light_status` indexed by Traffic Light ID. Index 0 is not used since a Traffic Light ID of 0 in the transport system is invalid. An entry is in use when the `traffic_light_id` field in the entry is nonzero. If the `traffic_light_id` field is zero, the entry is not in use, that is, no such traffic light at the index corresponding to the Traffic Light ID exists.

This array must be sized to the maximum Traffic Light ID configured in the transport system plus 1. Use the `PLC_max_traffic_light_id` parameter (see [PLC\\_max\\_traffic\\_light\\_id](#) on page 45) to establish the size of the `MMI_traffic_light_status` tag in PLC memory. When sizing this tag, make sure that the number of traffic lights does not exceed the number of entries in the `MMI_traffic_light_status` tag.

The HLC updates the `MMI_traffic_light_status` array whenever the link between the HLC and the PLC is re-established and on content change.

### Support

This command is supported in the latest software release for the following product lines:

- MagneMover LITE transport systems.

### Tag Format

Tag Name	MMI_traffic_light_status
Type	<code>udt_MMI_traffic_light_status[Traffic Lights+1]</code>
Array	Yes
Array Dimension Limits	Minimum array size: 2 Maximum array size: max <i>Traffic Lights</i> + 1 Array index corresponds to HLC Traffic Light ID. Since Traffic Light ID 0 is invalid, array element [0] is not used.

The UDT type editor that is shown in [Figure 17](#) shows the type of each element in the `MMI_traffic_light_status` array. This type must be created with the type editor first. Then a tag of name `MMI_traffic_light_status` must be created as an array of the UDT dimensioned to at most the maximum number of traffic lights plus 1.

If the transport system has a known maximum number of traffic lights that will not be exceeded that is less than the maximum, the array can be dimensioned to the smaller value to save on tag memory space, but it must not be fewer than 2 entries.

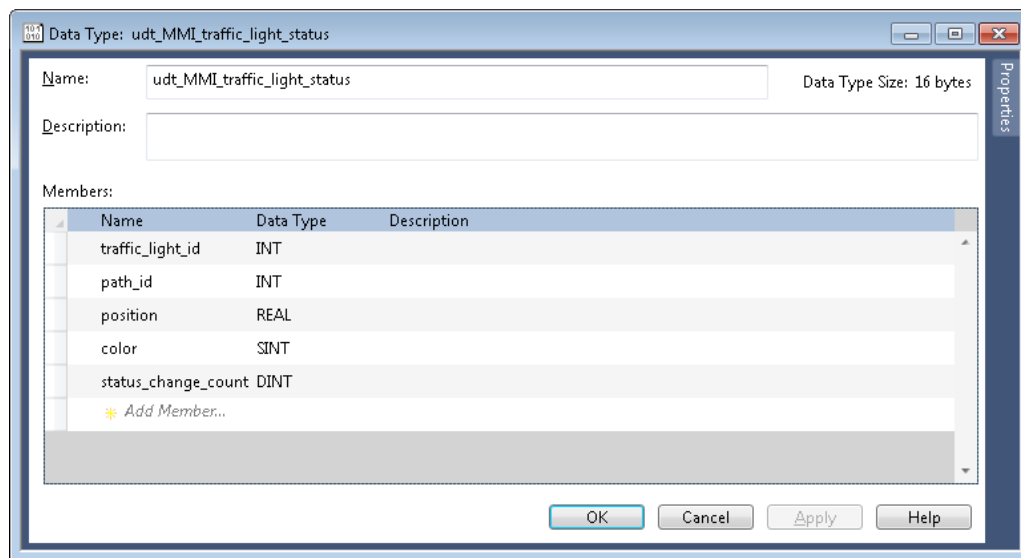


Figure 17: UDT `udt_MMI_traffic_light_status`

## UDT Field Descriptions

This section describes the format of the UDT used to report status for all traffic lights in a transport system. UDT fields are described in more detail following the table.

Field Name	Data Type	Style	Range
<code>traffic_light_id</code>	INT	Decimal	0–4096
<code>path_id</code>	INT	Decimal	1–65535
<code>position</code>	REAL	Float	0.0–41.0 (m, floating-point)
<code>color</code>	SINT	Decimal	Values are: 0 – Green (allows traffic to pass) 1 – Red (stops traffic)
<code>status_change_count</code>	DINT	Hex	0x0–0xFFFFFFFF

**traffic\_light\_id** – The ID of the traffic light that is associated with this traffic light status entry. This field is zero if the traffic light at this index in the `MMI_traffic_light_status` tag is not in use.

**path\_id** – The ID of the path where the traffic light is located.

**position** – The position (in meters), relative to the start of the specified path, where this traffic light is located (expressed as a 32-bit single-precision floating-point number).

**color** – Color of the specified traffic light.

**status\_change\_count** – A sequence count, unique to the targeted traffic light, which the HLC increments whenever status for the traffic light is updated.

The HLC maintains the `status_change_count` for each traffic light metric. It is initialized to 0 when the HLC restarts.

### See Also

[MMI\\_create\\_traffic\\_light\\_cmd](#) on page 25

[MMI\\_set\\_traffic\\_light\\_cmd](#) on page 28

[MMI\\_delete\\_traffic\\_light\\_cmd](#) on page 32

## MMI\_traffic\_light\_cmd\_status

### Type

HLC → Host Controller

### Purpose

Reports the status of traffic light commands in the transport system. This tag is an array of type `udt_MMI_traffic_light_cmd_status` indexed by its associated command index. The `MMI_traffic_light_cmd_status` array is updated only in response to a Create Traffic Light, Set Traffic Light, or Delete Traffic Light command sent from the PLC to the HLC.

This tag array is used to handshake traffic light commands so the PLC logic can know that the HLC received a command, and either accepted it for processing, or rejected it with an appropriate error code. The tag array can be consulted to determine if a command completed and whether it completed successfully or an error occurred.

### Support

This command is supported in the latest software release for the following product lines:

- MagneMover LITE transport systems.

### Tag Format

Tag Name	MMI_traffic_light_cmd_status
Type	<code>udt_MMI_traffic_light_cmd_status[<i>command-index</i>]</code>
Array	Yes
Array Dimension Limits	Minimum array size: 1 Maximum array size: max 32 Array index corresponds to command index.

The UDT type editor that is shown in [Figure 18](#) shows the type of each element in the `MMI_traffic_light_cmd_status` array. This type must be created with the type editor first. Then a tag of name `MMI_traffic_light_cmd_status` must be created as a one-dimensional array of the UDT with a maximum size of 32.

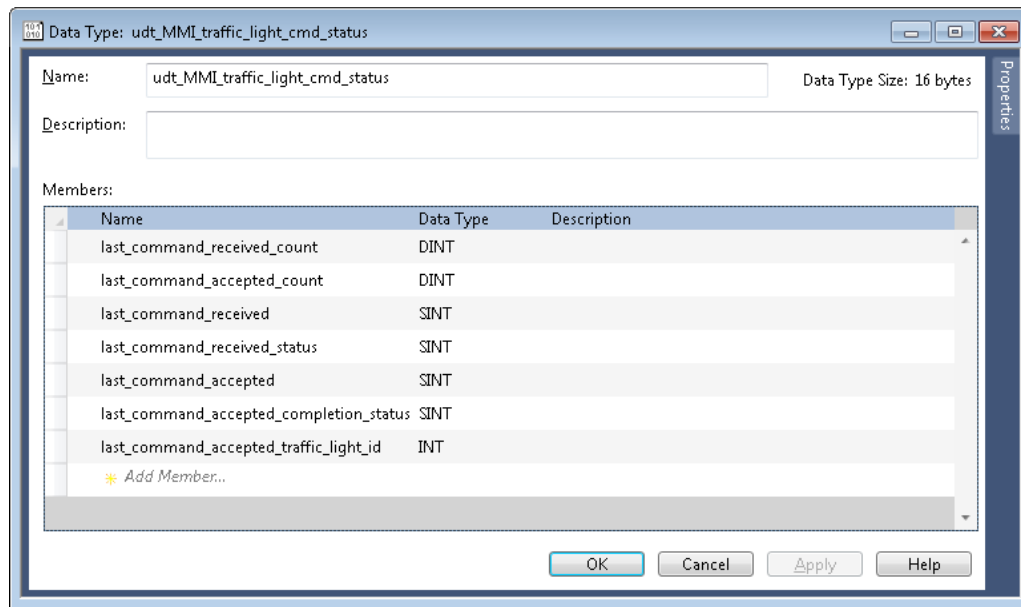


Figure 18: UDT udt\_MMI\_traffic\_light\_cmd\_status

### UDT Field Descriptions

This section describes the format of the UDT used to report the status of traffic light commands. UDT fields are described in more detail following the table.

Field Name	Data Type	Style	Range
last_command_received_count	DINT	Hex	0x0–0xFFFFFFFF
last_command_accepted_count	DINT	Hex	0x0–0xFFFFFFFF
last_command_received	SINT	Hex	Values are: 0x01 – Create Traffic Light command 0x02 – Set Traffic Light command 0x04 – Delete Traffic Light command
last_command_received_status	SINT	Hex	0x00, 0x03, 0x04, 0x09, 0x0A, 0x0B, 0x0C, 0x0D, 0x0E, 0x10, 0x11, 0x14, 0x41
last_command_accepted	SINT	Hex	Values are: 0x01 – Create Traffic Light command 0x02 – Set Traffic Light command 0x04 – Delete Traffic Light command
last_command_accepted_completion_status	SINT	Hex	0x00, 0x41, 0x42, 0x80
last_command_accepted_traffic_light_id	INT	Decimal	0–4096

**last\_command\_received\_count** – The HLC writes the command\_count field of the most recently received traffic light command to this field. PLC logic can use this field to determine if a traffic light command was received by the HLC.



**last\_command\_accepted\_count** – The HLC writes the `command_count` field of the most recently accepted traffic light command to this field when a command has been accepted by the HLC. PLC logic can use this field to determine whether a traffic light command received by the HLC has been accepted or not.

**last\_command\_received** – The HLC writes the command type of the most recently received traffic light command to this field.

**last\_command\_received\_status** – The HLC writes an acceptance or rejection status to this field upon receiving a new traffic light command from the PLC. See [HLC Status Codes](#) on page 42 for the meaning of the status codes.

**last\_command\_accepted** – The HLC writes the command type of the most recently accepted traffic light command to this field. Note that this field is not updated when a received command is rejected.

**last\_command\_accepted\_completion\_status** – The HLC writes the completion status of the `last_command_accepted` to this field when a traffic light command actually completes or fails. See [HLC Status Codes](#) on page 42 for the meaning of the status codes.

**last\_command\_accepted\_traffic\_light\_id** – The HLC writes the traffic light id of the `last_command_accepted` to this field when a traffic light command actually completes or fails.

## See Also

[MMI\\_create\\_traffic\\_light\\_cmd](#) on page 25

[MMI\\_set\\_traffic\\_light\\_cmd](#) on page 28

[MMI\\_delete\\_traffic\\_light\\_cmd](#) on page 32

## HLC Status Codes

Table 6 lists the status codes that the HLC returns when it accepts, rejects, or completes Traffic Light commands.

*Table 6: HLC Status Codes*

<b>Status Value</b>	<b>Status Description</b>
0x00	Command Accepted
0x03	Command Rejected – Invalid path ID
0x04	Command Rejected – Invalid position
0x09	Command Rejected – Startup sequence already started
0x0A	Command Rejected – Startup sequence not initiated/not complete
0x0B	Command Rejected – Invalid parameter
0x0C	Command Rejected – Initialization has not completed
0x0D	Command Rejected – Reset active
0x0E	Command Rejected – No record available
0x10	Command Rejected – Programming active
0x11	Command Rejected – Invalid traffic light ID
0x14	Command Rejected – Duplicate record
0x41	Command Failed – Unable to complete
0x42	Command Failed – Timed out
0x80	Command Completed Successfully

## Traffic Light Configuration

See the *MagneMover LITE Configurator User Manual* for information on the Node Controller Configuration File.

### Node Controller Configuration File XML Reference

This section describes the additional XML elements that are used to enable traffic lights and tailor the reporting of traffic light status to a PLC, shown in [Table 7](#). These elements must be used in the EtherNet/IP section of the Node Controller Configuration File.

*Table 7: Traffic Light Configuration XML Elements*

Element	Description	Use	Page
<a href="#">PLC_traffic_light_enable</a>	Enables use of the traffic light commands	MM LITE	<a href="#">44</a>
<a href="#">PLC_max_traffic_light_id</a>	Defines the maximum number of traffic lights	MM LITE	<a href="#">45</a>

## PLC\_traffic\_light\_enable

### Purpose

Controls whether the HLC pushes traffic light status and response memory tags to PLC memory. If this element is not included in the Node Controller Configuration File, the default value of False is used.

### Syntax

```
<PLC_traffic_light_enable>Enable</PLC_traffic_light_enable>
```

### Contents

**Enable:** **True** – Push traffic light tags to the PLC memory.

**False** – Do not push traffic light tags to the PLC memory.

### Example

The following example enables the high level controller to report Traffic Light Status and Response Memory Tags to a PLC.

```
<PLC_traffic_light_enable>True</PLC_traffic_light_enable>
```

## PLC\_max\_traffic\_light\_id

### Purpose

This element defines the maximum number of traffic lights to accommodate in PLC memory. The default value for this element is 128 traffic lights.

### Syntax

<PLC\_max\_traffic\_light\_id>ID</PLC\_max\_traffic\_light\_id>

### Contents

<b>ID:</b>	Minimum	1
	Maximum:	4096

### Example

The following example sets the maximum number of traffic lights to accommodate in PLC memory to 24.

<PLC\_max\_traffic\_light\_id>24</PLC\_max\_traffic\_light\_id>

## Node Controller Configuration File Example

Figure 19 is an example of the EtherNet/IP configuration section from a Node Controller Configuration File that shows the configuration to report traffic light status and memory tags to a PLC.

```
<Ethernet_IP>
  <PLC_IP_address>192.168.110.72</PLC_IP_address>
  <PLC_CPU_slot>0</PLC_CPU_slot>
  <PLC_max_vehicle_ID>64</PLC_max_vehicle_ID>
  <PLC_send_vehicle_status_period>100</PLC_send_vehicle_status_period>
  <PLC_tag_request_retry_timeout>250</PLC_tag_request_retry_timeout>
  <PLC_traffic_light_enable>True</PLC_traffic_light_enable>
  <PLC_max_traffic_light_id>40</PLC_max_traffic_light_id>
</Ethernet_IP>
```

*Figure 19: Example Traffic Light Node Controller EtherNet/IP Configuration*

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## More Information

MagneMotion website: [www.magnemotion.com](http://www.magnemotion.com)

Questions and Comments: [www.magnemotion.com/about-magnemotion/contact.cfm](http://www.magnemotion.com/about-magnemotion/contact.cfm)

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## Revision History

Ver.	Change Description
A	Initial release
01	Added EtherNet/IP Communication Protocol and Node Controller Configuration File XML Reference

## Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	<a href="https://rockwellautomation.custhelp.com/">https://rockwellautomation.custhelp.com/</a>
Local Technical Support Phone Numbers	Locate the phone number for your country.	<a href="http://www.rockwellautomation.com/global/support/get-support-now.page">http://www.rockwellautomation.com/global/support/get-support-now.page</a>
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	<a href="http://www.rockwellautomation.com/global/support/direct-dial.page">http://www.rockwellautomation.com/global/support/direct-dial.page</a>
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	<a href="http://www.rockwellautomation.com/global/support/direct-dial.page">http://www.rockwellautomation.com/global/support/direct-dial.page</a>
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	<a href="http://www.rockwellautomation.com/global/support/pcdc.page">http://www.rockwellautomation.com/global/support/pcdc.page</a>

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