



**A Rockwell Automation Company**

**Host Controller TCP/IP Communication Protocol  
User Manual Addendum, System Monitoring**

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MagneMotion  
A Rockwell Automation Company  
139 Barnum Road  
Devens, MA 01434  
USA

Phone: +1 978-757-9100  
Fax: +1 978-757-9200

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

## Contents

Purpose.....	5
Reference Documents .....	5
Definitions.....	5
Theory of Operation.....	7
System Metrics.....	7
Behavior Patterns .....	7
Component Types .....	8
Metric Identifiers .....	8
Metric Instance.....	8
Accessing the System Monitoring Interface.....	8
System Monitoring API .....	8
Subscribe.....	9
Unsubscribe.....	11
Polling.....	12
Communication Protocol .....	13
Host Controller to HLC Communications .....	13
SM Subscription Command (0xBF 0A 01) .....	14
SM Poll Command (0xBF 0A 03) .....	17
HLC to Host Controller Communications .....	19
SM Subscription Response (0xDF 0A 01).....	20
SM Subscription Data Response (0xDF 0A 02).....	22
SM Poll Data Response (0xDF 0A 03).....	25
Component Types .....	28
HLC Component Type.....	28
Node Controller Component Type.....	29
Node Component Type.....	30
Path Component Type.....	31
Vehicle Component Type .....	32
Station Component Type .....	33
Motor Component Type.....	34
HLC Error Status Codes .....	35
Common System Monitoring Intervals.....	37
Example .....	38
Metric Identifiers .....	39
Rockwell Automation Support .....	42

## Figures

Figure 1: Empty Metric Subscription Slots .....	9
Figure 2: Subscribe Sequence Diagram.....	10
Figure 3: Metric Subscription Slot Allocated for Temperature Monitoring.....	10
Figure 4: Unsubscribe Sequence Diagram.....	11
Figure 5: Metric Subscription Slot Freed for Reuse .....	11
Figure 6: Poll Sequence Diagram .....	12

## Tables

Table 1: System Monitoring Terminology .....	5
Table 2: Gauge Pattern Properties .....	7
Table 3: Host Controller to HLC Commands .....	13
Table 4: HLC to Host Controller Responses .....	19
Table 5: Component Types Available for Monitoring .....	28
Table 6: HLC Command Status Codes.....	35
Table 7: Common System Monitoring Intervals .....	37
Table 8: Hardware Metrics .....	39
Table 9: Syntax Types .....	40

## Purpose

This document is an addendum to the *Host Controller TCP/IP Communication Protocol User Manual* and describes the additions to the protocol for communication between the MagneMotion High Level Controller application and a Host Controller using the “ABBA” protocol.

An additional function has been added that provides System Monitoring.

## Reference Documents

- 990000436, Host Controller TCP/IP Communication Protocol User Manual
- Numerical Recipes in C: The Art of Scientific Computing by Press et al.

## Definitions

*Table 1: System Monitoring Terminology*

Term	Definition
Component, Component Type	The main parts that form a MagneMotion transport system. The different component types are defined by their use: High Level Controller, Node Controller, Node, Path, Vehicle, Station, and Motor.
Counter Pattern	Behavioral pattern that represents a non-negative integer value which increases monotonically until it reaches its maximum value, when it wraps around and starts increasing again from zero.
CRC	Cyclic Redundancy Check
CRC-CCITT	CRC method defined by the CCITT
Gauge Pattern	Behavioral pattern that represents a dynamic value which may increase or decrease and contains the following properties: <i>last value</i> , <i>minimum value</i> , <i>maximum value</i> , and <i>average value</i> .
LSB	Least Significant Byte
Metric ID	ID of metric data associated with a component.
Metric Instance	Selects a specific metric instance for metrics that have multiple unique instances.
MSB	Most Significant Byte
Polling	System Monitoring API which permits a Host Controller to request on demand reporting of a component’s metric data.
System Monitoring	Mechanism for retrieving system metrics of various components comprising a MagneMotion transport system.

*Table 1: System Monitoring Terminology*

<b>Term</b>	<b>Definition</b>
Subscribe	System Monitoring API which permits a Host Controller to request the continuous reporting of a component's metric data at a fixed sampling interval.
Unsubscribe	System Monitoring API which permits a Host Controller to unsubscribe one or more subscriptions for metric data.
Variable Pattern	Behavioral pattern that represents a simple value, such as constants, configuration, or other internal parameter information.

## Theory of Operation

The System Monitoring API describes a mechanism for retrieving system metrics that can be used to characterize the health of various components within a MagneMotion transport system.

When collecting system metrics on a larger scale and over longer periods of time, such metrics can be used to discover meaningful patterns for improving system operation and early fault detection. By aggregating such data, system metrics facilitate predictive analytics, factory optimization, and efficiency analysis decisions.

The goal of the System Monitoring API is to provide the user with the information needed to quickly discover, diagnose, and solve installation issues as well as monitor the operation of running systems.

## System Metrics

During normal operation, a Host Controller can survey the health of system components within a MagneMotion transport system. For example, each motor can be directed to continually report key system metrics such as board temperature and propulsion voltage.

System metrics are enumerated using a unique identifier and organized into simple behavior patterns.

## Behavior Patterns

System Metrics are organized into the following behavioral patterns:

1. The Variable pattern represents a simple value, such as constants, configuration, or other internal parameter information. Variables only return the last updated value when read.
2. The Counter pattern represents a non-negative integer value which increases monotonically until it reaches its maximum value, when it wraps around and starts increasing again from zero. Counters only return the last updated value when read.
3. The Gauge pattern represents a dynamic value which may increase or decrease and contains the following properties: last value, minimum value, maximum value, and average value for the requested sampling interval (refer to [Table 2](#)).

*Table 2: Gauge Pattern Properties*

Gauge Property	Description
Last Value	The last value that updated this metric.
Minimum Value	The lowest value this metric experienced.
Maximum Value	The highest value this metric experienced.

Table 2: Gauge Pattern Properties

Gauge Property	Description
Average Value	The statistical mean calculated by dividing the sum of the updated values by the number of updates for this metric.

When the software updates a Gauge metric, it updates all four properties to maintain statistical consistency. Gauges return all four values when read.

## Component Types

System metrics can be collected from any of the primary components comprising a MagneMotion transport system. Each component is grouped according to its assigned component type.

Available component types are described in [Component Types](#) on page 28.

## Metric Identifiers

Each metric is identified by a unique, 16-bit number called a Metric Identifier (refer to [Table 8](#)). Metric identifiers uniquely identify the behavior and characteristics of the metric it references and are designed to be consistent across system components.

## Metric Instance

Some metrics (e.g., communication counters) have multiple unique instances that are present for each of the communication ports. These kinds of metrics use the instance field to select which port the metric is referencing. For these metrics, the instance field is mandatory, and is used to select the correct occurrence of the value. When a metric consists of a single value and does not require an instance, the instance field value must be zero.

## Accessing the System Monitoring Interface

To access System Monitoring commands, the Host Controller must connect to the High Level Controller using TCP port 801 using industry standard socket communication. Note that this port has been designated only for System Monitoring commands and cannot be used for any other purpose.

## System Monitoring API

The System Monitoring API is a subscription based mechanism that allows Host Controllers to request specific metric data at a custom interval or on demand. The examples provided show monitoring of motors.



The Host Controller can subscribe to a specific system metric to continuously report at the specified interval until stopped with an unsubscribe command. The time interval between samples can range from 1 second to over 18 hours. A command option in the [SM Subscription Command \(0xBF 0A 01\)](#) can be used to instruct the motor to clear the metric data before sampling starts.

To accomplish this, each motor maintains an internal list of active metric subscriptions, up to a maximum of four entries. Each subscription slot, along with tracking data, maintains its own interval time and subscription options.

On reset or power cycle, the motor starts with all subscription slots empty as shown in [Figure 1](#).





	0	-- empty --
	0	-- empty --
	0	-- empty --
	0	-- empty --

Figure 1: Empty Metric Subscription Slots

## Subscribe

The Host Controller subscribes to a system metric for a motor using its Path ID and Motor ID by sending an **SM Subscription Command** message to the HLC, which passes it to the appropriate Node Controller. The subscription command also specifies the metric identifier and metric instance, its sampling interval in seconds, and command options.

Each subscription command consumes a subscription slot in the motor. If a subscription command is received when there are no available subscription slots, the motor responds with an **SM Subscription Response** message with a status of No record available.

When the subscription command is received, the motor stores subscription parameters in one of its available subscription slots. If the subscription command specifies the “Clear Metric Data on Sampling Start” command option, the targeted metric data is cleared at the beginning of each sampling interval.

An **SM Subscription Response** message is sent to the Host Controller to signal command failure or command completion. In addition, metric data updates are continuously reported to the Host Controller using **SM Subscription Data Response** messages as specified.

The sequence diagram in [Figure 2](#) shows a subscription operation to sample motor temperature every 300 seconds (5 minutes). After 300 seconds a metric data update is sent and repeated every 300 seconds thereafter until an unsubscribe command message is sent to stop it.

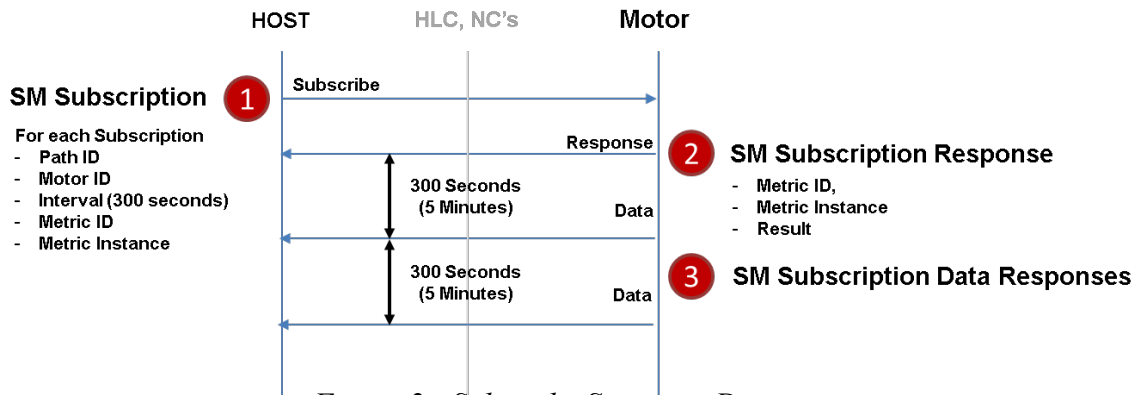


Figure 2: Subscribe Sequence Diagram

When the subscription operation completes, the motor has consumed the first subscription slot to monitor board temperature as shown in [Figure 3](#).

	<b>300</b>	Temperature
	0	-- empty --
	0	-- empty --
	0	-- empty --

Figure 3: Metric Subscription Slot Allocated for Temperature Monitoring

## Unsubscribe

When a subscription is no longer needed, an **SM Subscription Command** message specifying an unsubscribe operation (Subscription Interval = 0) stops metric data updates and clears the motor’s subscription slot for reuse. When completed, the motor responds with an **SM Subscription Response** message.

The sequence diagram in [Figure 4](#) shows an unsubscribe operation.

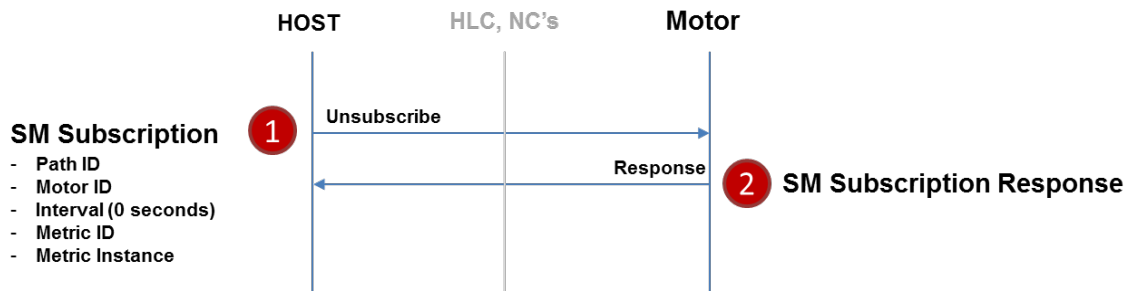


Figure 4: Unsubscribe Sequence Diagram

When the unsubscribe operation completes, the motor frees the specified subscription slot for reuse as shown in [Figure 5](#).

	0	-- empty --
	0	-- empty --
	0	-- empty --
	0	-- empty --

Figure 5: Metric Subscription Slot Freed for Reuse

## Polling

The Host Controller can poll metric data on demand by means of the **SM Poll Command**. Requesting data on demand is useful when the interval desired is longer than the maximum interval supported in the subscription command. This allows for metric polling or arbitrarily long monitoring intervals. The **SM Poll Command** when combined with the “Clear Metric Data on Sampling Start” command option, provides the same statistical consistency as subscription-based monitoring.

Special care should be used when using the “Clear Metric Data on Sampling Start” command option when polling metric data with active subscriptions. Clearing metric data using the **SM Poll Command** affects the consistency of the data being reported in the subscription. When polling, specify that metric data should not be cleared and the subscription-based metric data will remain consistent.

The sequence diagram in [Figure 6](#) shows a poll operation.

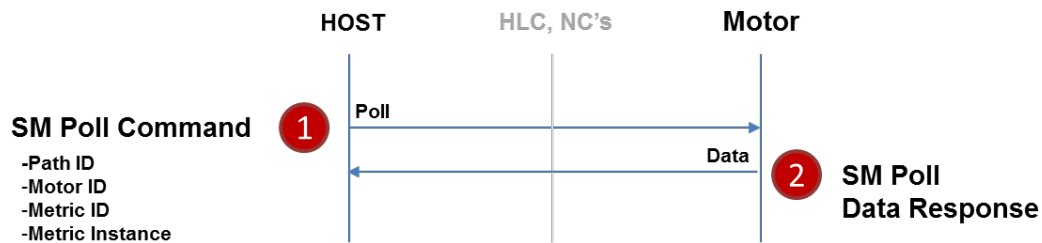


Figure 6: Poll Sequence Diagram

## Communication Protocol

Refer to the Communications Protocol section in the Appendix of the *Host Controller TCP/IP Communication Protocol User Manual* for information on how the TCP/IP protocol is used between the Host Controller and the High Level Controller.

## Host Controller to HLC Communications

This section describes the commands sent from the Host Controller to the High Level Controller (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 4](#)).

[Table 3](#) lists the commands used with the System Monitoring functionality.

*Table 3: Host Controller to HLC Commands*

Description and Value	Use	Page
<a href="#">SM Subscription Command (0xBF 0A 01)</a>	QuickStick 100	<a href="#">14</a>
<a href="#">SM Poll Command (0xBF 0A 03)</a>	QuickStick 100	<a href="#">17</a>

## SM Subscription Command (0xBF 0A 01)

### Type

Host Controller → HLC

### Purpose

The Host Controller sends a “subscribe” **SM Subscription Command** message to the High Level Controller to register for metric data updates on the specified component type. Once registered, metric updates are reported continuously to the Host Controller at the specified interval until stopped with an “unsubscribe” **SM Subscription Command**.

### Support

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

- QuickStick 100 transport systems.

### Format

Offset	Item	Bytes	Range
0	Command Header	1	0xBF (PKT_HOST_EXTENSION)
1	Extension Type	1	0x0A (EXT_PKT_HOST_INFO_SERV)
2	Extension Subtype	1	0x01 (EXT_PKT_HOST_INFO_SERV_SM_SUBSCRIPTION)
3	Component Type	8	Component Type field varies with each type
11	Host Context	2	0x0000 – 0xFFFF
13	Command Options	2	Command Options values are: 0x0000 – None 0x0001 – Clear metric data on sampling start
15	Subscription Interval	2	Subscription Interval values are: 0 – Unsubscribe 1 - 65535 – Subscription interval in seconds
17	Metric ID	2	0x0000 – 0xFFFF
19	Metric Instance	2	0 – 65535

### Command Header

Fixed message type identifying this message as a Host Extension command message.

### Extension Type

Fixed extension type identifying this command as an Info Serv extension command.

### Extension Subtype

Fixed extension subtype identifying this command as an SM Subscription extension command.

### Component Type

The ID of the component targeted for system monitoring. Available component types are described in [Component Types](#) on page 28.

### Host Context

Unique value supplied by the user’s Host Controller when this message is sent. It aids the Host Controller in tracking the execution of this command.

The Host Context is always returned in [SM Subscription Response \(0xDF 0A 01\)](#) and [SM Subscription Data Response \(0xDF 0A 02\)](#) messages for tracking

### Command Options

The Command Options field permits the selection of one or more processing options. The following table describes available command options for the SM Subscription Command:

Option Bitmask	Command Option Description
0x0000	None
0x0001	Clear Metric Data on Sampling Start Instructs the component to clear metric data at the beginning of each sampling interval. Ignored by “unsubscribe” SM Subscription commands.

### Subscription Interval

If the Subscription Interval field is zero, it specifies that the current subscription for the specified metric should be unsubscribed (i.e., stopped).

If the Subscription Interval field is non-zero, it specifies a new subscription for the specified metric and the sampling interval, in seconds, that must elapse before a report of metric data is returned to the Host Controller. The Subscription Interval field allows setting a sampling interval from 1 second to over 18 hours (refer to [Common System Monitoring Intervals](#) on page 37).

## Metric ID

For “subscribe” commands, the unique non-zero ID of a metric to report to the Host Controller (refer to [Table 8](#)).

For “unsubscribe” commands, the ID of one or more metrics to stop reporting to the Host Controller. If the Metric ID field is zero, all subscriptions for the targeted component are unsubscribed. If the Metric ID field is non-zero, only the subscription for the specified metric is unsubscribed.

## Metric Instance

For metrics that have multiple unique instances, the Metric Instance field selects the specific metric instance to report to the Host Controller (refer to [Table 8](#)).

For metrics that have only a single instance, the Metric Instance field should always be zero.

To unsubscribe all instances of a metric, the Metric Instance field should be zero.

## Response

After receiving the command and verifying command parameters, the HLC responds to an SM Subscription Command as follows:

- If a “subscribe” command is accepted, the HLC returns an [SM Subscription Response \(0xDF 0A 01\)](#) message with associated command parameters and success status.

In addition, after processing “subscribe” commands and registering new metric data updates, the HLC forwards data received from the specified component as [SM Subscription Data Response \(0xDF 0A 02\)](#) messages to the Host Controller at the specified interval.

- If an “unsubscribe” command is accepted, the HLC terminates one or more metric updates and returns an [SM Subscription Response \(0xDF 0A 01\)](#) message with associated command parameters and success status.
- If the command is rejected, the HLC returns an [SM Subscription Response \(0xDF 0A 01\)](#) message with associated command parameters and failure status (refer to [Table 6](#)).



## SM Poll Command (0xBF 0A 03)

### Type

Host Controller → HLC

### Purpose

The Host Controller sends an **SM Poll Command** message to the High Level Controller to poll for metric data on the specified component.

### Support

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

- QuickStick 100 transport systems.

### Format

Offset	Item	Bytes	Range
0	Command Header	1	0xBF (PKT_HOST_EXTENSION)
1	Extension Type	1	0x0A (EXT_PKT_HOST_INFO_SERV)
2	Extension Subtype	1	0x03 (EXT_PKT_HOST_INFO_SERV_SM_POLL)
3	Component Type	8	Component Type field varies with each type
11	Host Context	2	0x0000 – 0xFFFF
13	Command Options	2	Command Options values are: 0x0000 – None 0x0001 – Clear metric data on sampling start
15	Reserved	2	Must be zero
17	Metric ID	2	0x0001 – 0xFFFF
19	Metric Instance	2	0 – 65535

### Command Header

Fixed message type identifying this message as a Host Extension command message.

### Extension Type

Fixed extension type identifying this command as an Info Serv extension command.

### Extension Subtype

Fixed extension subtype identifying this command as an SM Poll extension command.

## Component Type

The ID of the component targeted for system monitoring. Available component types are described in [Component Types](#) on page 28.

## Host Context

Unique value supplied by the Host Controller when this message is sent. It aids the Host Controller in tracking the execution of this command.

The Host Context is always returned in [SM Poll Data Response \(0xDF 0A 03\)](#) messages.

## Command Options

The Command Options field permits the selection of one or more processing options. The following table describes available command options for the SM Poll Command:

Option Bitmask	Command Option Description
0x0000	None
0x0001	Clear Metric Data on Sampling Start Instructs the component to clear metric data after returning it to the Host Controller.

## Metric ID

The unique ID of a metric to report to the Host Controller (refer to [Table 8](#)).

## Metric Instance

For metrics that have multiple unique instances, the Metric Instance field selects the specific metric instance to report to the Host Controller (refer to [Table 8](#)).

For metrics that have only a single instance, the Metric Instance field should always be zero.

## Response

After receiving the command and verifying command parameters, the HLC responds to an SM Poll Command as follows:

- If the command is accepted, the HLC returns an [SM Poll Data Response \(0xDF 0A 03\)](#) message with command parameters, the requested metric data, and success status.
- If the command is rejected, the HLC returns an [SM Poll Data Response \(0xDF 0A 03\)](#) message with command parameters, no metric data, and failure status (refer to [Table 6](#)).

## HLC to Host Controller Communications

This section describes the responses sent from the High Level Controller (HLC) to the Host Controller as asynchronous responses from the transport system after performing an action

[Table 4](#) lists the responses used with the System Monitoring functionality.

*Table 4: HLC to Host Controller Responses*

Description and Value	Use	Page
<a href="#">SM Subscription Response (0xDF 0A 01)</a>	QuickStick 100	<a href="#">20</a>
<a href="#">SM Subscription Data Response (0xDF 0A 02)</a>	QuickStick 100	<a href="#">22</a>
<a href="#">SM Poll Data Response (0xDF 0A 03)</a>	QuickStick 100	<a href="#">24</a>

## SM Subscription Response (0xDF 0A 01)

### Type

HLC → Host Controller

### Purpose

The High Level Controller sends an **SM Subscription Response** message to a Host Controller in response to a previous [SM Subscription Command \(0xBF 0A 01\)](#) to signal command failure or command completion.

### Support

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

- QuickStick 100 transport systems.

### Format

Offset	Item	Bytes	Range
0	Command Header	1	0xDF (PKT_HOST_EXTENSION_RESPONSE)
1	Extension Type	1	0x0A (EXT_PKT_HOST_INFO_SERV)
2	Extension Subtype	1	0x01 (EXT_PKT_HOST_INFO_SERV_SM_SUBS_RESPONSE)
3	Command Status	1	0x00, 0x03, 0x0C, 0x0D, 0x0E, 0x10, 0x26, 0x41
4	Component Type	8	Component Type field varies with each type
12	Host Context	2	0x0000 – 0xFFFF
14	Command Options	2	Command Options values are: 0x0000 – None 0x0001 – Clear metric data on sampling start
16	Subscription Interval	2	Subscription Interval values are: 0 – Unsubscribe 1 - 65535 – Subscription interval in seconds
18	Metric ID	2	0x0000 – 0xFFFF
20	Metric Instance	2	0 – 65535

### Command Header

Fixed message type identifying this message as a Host Extension response message.

---

## Extension Type

Fixed extension type identifying this command as an Info Serv extension command.

## Extension Subtype

Fixed extension subtype identifying this message as an SM Subscription extension response.

## Command Status

Status of the command that this SM Subscription Response message is acknowledging as described in [HLC Error Status Codes](#) on page 35.

## Component Type

The ID of the component targeted for system monitoring. Available component types are described in [Component Types](#) on page 28.

## Host Context

The unique value supplied by the Host Controller when the [SM Subscription Command \(0xBF 0A 01\)](#) message was sent. It aids the Host Controller in tracking the execution of the command.

## Command Options

The **Command Option** specified when the [SM Subscription Command \(0xBF 0A 01\)](#) message was sent.

## Subscription Interval

The **Subscription Interval** specified when the [SM Subscription Command \(0xBF 0A 01\)](#) message was sent.

## Metric ID

The **Metric ID** specified when the [SM Subscription Command \(0xBF 0A 01\)](#) message was sent (refer to [Table 8](#)).

## Metric Instance

The **Metric Instance** specified when the [SM Subscription Command \(0xBF 0A 01\)](#) message was sent.

## SM Subscription Data Response (0xDF 0A 02)

### Type

HLC → Host Controller

### Purpose

Reports metric data requested in an [SM Subscription Command \(0xBF 0A 01\)](#) message to the Host Controller.

### Support

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

- QuickStick 100 transport systems.

### Format

Offset	Item	Bytes	Range
0	Command Header	1	0xDF (PKT_HOST_EXTENSION_RESPONSE)
1	Extension Type	1	0x0A (EXT_PKT_HOST_INFO_SERV)
2	Extension Subtype	1	0x02 (EXT_PKT_HOST_INFO_SERV_SM_SUBS_DATA_RESPONSE)
3	Status	1	0x00, 0x03, 0x0C, 0x0D, 0x0E, 0x10, 0x26, 0x41
4	Component Type	8	Component Type field varies with each type
12	Host Context	2	0x0000 – 0xFFFF
14	Command Options	2	Command Options values are: 0x0000 – None 0x0001 – Clear metric data on sampling start
16	Sequence Number	2	0 – 65535
18	Metric ID	2	0x0001 – 0xFFFF
20	Metric Instance	2	0 – 65535
22	Metric Data Element Size	1	0, 1, 2, 4, 8
23	Metric Data Element Count	1	0, 1, 4
24	Metric Data	varies	Depends on targeted metric data instance

## Command Header

Fixed message type identifying this message as a Host Extension response message.

## Extension Type

Fixed extension type identifying this command as an Info Serv extension command.

## Extension Subtype

Fixed extension subtype identifying this message as an SM Subscription extension response.

## Status

Status for this SM Subscription Data Response message as described in [HLC Error Status Codes](#) on page 35.

## Component Type

The ID of the component targeted for system monitoring. Available component types are described in [Component Types](#) on page 28.

## Host Context

The unique value supplied by the Host Controller when the [SM Subscription Command \(0xBF 0A 01\)](#) message was sent. It aids the Host Controller in tracking the execution of this command.

## Command Options

The **Command Options** specified when the [SM Subscription Command \(0xBF 0A 01\)](#) message was sent.

## Sequence Number

A sequence number, unique to each subscription, incremented by the targeted component whenever new metric data is reported to the HLC.

It is initialized to zero when a subscription for a metric is established, is incremented for each new metric update, and continues from zero when it rolls over.

The `sequence_number` field is always zero for metric data updates resulting from SM Poll commands.

## Metric ID

The **Metric ID** specified when the [SM Subscription Command \(0xBF 0A 01\)](#) message was sent (refer to [Table 8](#)).

## Metric Instance

The Metric Instance specified when the [SM Subscription Command \(0xBF 0A 01\)](#) message was sent.

## Metric Data Element Size

Size of data elements in metric instance data reported by the targeted component.

## Metric Data Element Count

Count of data elements in metric instance data reported by the targeted component.

## Metric Data

Metric instance data reported from the specified component (refer to [Table 8](#)).



## SM Poll Data Response (0xDF 0A 03)

### Type

HLC → Host Controller

### Purpose

Reports metric data requested in an [SM Poll Command \(0xBF 0A 03\)](#) message to the Host Controller.

### Support

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

- QuickStick 100 transport systems.

### Format

Offset	Item	Bytes	Range
0	Command Header	1	0xDF (PKT_HOST_EXTENSION_RESPONSE)
1	Extension Type	1	0x0A (EXT_PKT_HOST_INFO_SERV)
2	Extension Subtype	1	0x03 (EXT_PKT_HOST_INFO_SERV_SM_POLL_DATA_RESPONSE)
3	Command Status	1	0x00, 0x03, 0x0C, 0x0D, 0x0E, 0x10, 0x26, 0x41
4	Component Type	8	<i>Component Type</i> field varies with each type
12	Host Context	2	0x0001 – 0xFFFF
14	Command Options	2	<i>Command Options</i> values are: 0x0000 – None 0x0001 – Clear metric data on sampling start
16	Reserved	2	Must be zero
18	Metric ID	2	0x0001 – 0xFFFF
20	Metric Instance	2	0 – 65535
22	Metric Data Element Size	1	0, 1, 2, 4, 8
23	Metric Data Element Count	1	0, 1, 4
24	Metric Data	varies	Depends on targeted metric data instance

---

## Command Header

Fixed message type identifying this message as a Host Extension Response message.

## Extension Type

Fixed extension type identifying this message as an Info Serv extension response.

## Extension Subtype

Fixed extension subtype identifying this message as an SM Poll Data extension response.

## Command Status

Status for this SM Poll Data Response message as described in [HLC Error Status Codes](#) on page 35.

## Component Type

The ID of the component targeted for system monitoring. Available component types are described in [Component Types](#) on page 28.

## Host Context

The unique value supplied by the Host Controller when the [SM Poll Command \(0xBF 0A 03\)](#) message was sent. It aids the Host Controller in tracking the execution of this command.

## Command Options

The **Command Options** specified when the [SM Poll Command \(0xBF 0A 03\)](#) message was sent.

## Metric ID

The **Metric ID** specified when the [SM Poll Command \(0xBF 0A 03\)](#) message was sent (refer to [Table 8](#)).

## Metric Instance

The **Metric Instance** specified when the [SM Poll Command \(0xBF 0A 03\)](#) message was sent.

## Metric Data Element Size

Size of data elements in metric instance data reported by the targeted component.

### **Metric Data Element Count**

Count of data elements in metric instance data reported by the targeted component.

### **Metric Data**

Metric instance data reported from the specified component (refer to [Table 8](#)).

## Component Types

This section describes available component types that can be specified in System Monitoring API command and response messages.

*Table 5: Component Types Available for Monitoring*

ID	Component Type	Page
1	<a href="#">HLC Component Type</a>	<a href="#">28</a>
2	<a href="#">Node Controller Component Type</a>	<a href="#">29</a>
3	<a href="#">Node Component Type</a>	<a href="#">30</a>
4	<a href="#">Path Component Type</a>	<a href="#">31</a>
5	<a href="#">Vehicle Component Type</a>	<a href="#">32</a>
6	<a href="#">Station Component Type</a>	<a href="#">33</a>
7	<a href="#">Motor Component Type</a>	<a href="#">34</a>

## HLC Component Type

### Purpose

Selects collecting system metrics associated with the High Level Controller.

**NOTE:** High Level Controller component monitoring is currently not supported.

### Format

Offset	Item	Bytes	Range
0	Component Type	1	1 – High Level Controller
1	Reserved	7	Must be zero

### Component Type

Fixed component type selecting the High Level Controller.

## Node Controller Component Type

### Purpose

Selects collecting system metrics associated with a Node Controller.

**NOTE:** Node Controller component monitoring is currently not supported.

### Format

Offset	Item	Bytes	Range
0	Component Type	1	2 – Node Controller
1	Reserved	1	Must be zero
2	Node Controller ID	2	1 – 128
4	Reserved	4	Must be zero

### Component Type

Fixed component type selecting a Node Controller.

### Node Controller ID

The ID of the Node Controller targeted for system monitoring or polling. The ID must be a non-zero 16-bit integer that exists in the configuration. Zero is not a valid Node Controller ID for this command.

## Node Component Type

### Purpose

Selects collecting system metrics associated with a Node.

**NOTE:** Node component monitoring is currently not supported.

### Format

Offset	Item	Bytes	Range
0	Component Type	1	3 – Node
1	Reserved	1	Must be zero
2	Node ID	2	1 – 256
4	Reserved	4	Must be zero

### Component Type

Fixed component type selecting a Node.

### Node ID

The ID of the Node targeted for system monitoring or polling. The ID must be a non-zero 16-bit integer that exists in the configuration. Zero is not a valid Node ID for this command.

## Path Component Type

### Purpose

Selects collecting system metrics associated with a path.

**NOTE:** Path component monitoring is currently not supported.

### Format

Offset	Item	Bytes	Range
0	Component Type	1	4 – Path
1	Reserved	1	Must be zero
2	Path ID	2	1 – 65535
4	Reserved	4	Must be zero

### Component Type

Fixed component type selecting a path.

### Path ID

The ID of the Path targeted for system monitoring or polling. The ID must be a non-zero 16-bit integer that exists in the configuration. Zero is not a valid Path ID for this command.

## Vehicle Component Type

### Purpose

Selects collecting system metrics associated with a vehicle.

**NOTE:** Vehicle component monitoring is currently not supported.

### Format

Offset	Item	Bytes	Range
0	Component Type	1	5 – Vehicle
1	Reserved	1	Must be zero
2	Vehicle ID	2	1 – 65535
4	Reserved	4	Must be zero

### Component Type

Fixed component type selecting a vehicle.

### Vehicle ID

The ID of the vehicle targeted for system monitoring or polling. The ID must be a non-zero 16-bit integer that exists in the configuration. Zero is not a valid Vehicle ID for this command.



## Station Component Type

### Purpose

Selects collecting system metrics associated with a station.

**NOTE:** Station component monitoring is currently not supported.

### Format

Offset	Item	Bytes	Range
0	Component Type	1	6 – Station
1	Reserved	1	Must be zero
2	Station ID	2	1 – 255
4	Reserved	4	Must be zero

### Component Type

Fixed component type selecting a station.

### Station ID

The ID of the station targeted for system monitoring or polling. The ID must be a non-zero 16-bit integer that exists in the configuration. Zero is not a valid Station ID for this command.

## Motor Component Type

### Purpose

Selects collecting system metrics associated with a motor.

### Format

Offset	Item	Bytes	Range
0	Component Type	1	7 – Motor
1	Reserved	1	Must be zero
2	Path ID	2	1 – 65535
4	Motor ID	2	1 – 65535
6	Slave ID	2	Reserved (must be 0xFFFF)

### Component Type

Fixed component type selecting a motor.

### Path ID

The ID of the path where the specified motor is connected.

### Motor ID

The ID of the motor targeted for system monitoring or polling. The ID must be a non-zero 16-bit integer that exists in the configuration. Zero is not a valid Motor ID for this command.

### Slave ID

The ID of a motor's slave controller targeted for system monitoring or polling.

**NOTE:** Slave controller monitoring is currently not supported and the Slave ID field must be specified as all ones.

## HLC Error Status Codes

This section lists error status codes returned by the HLC when it accepts, rejects, or completes System Monitoring commands.

*Table 6: HLC Command Status Codes*

<b>Status Value</b>	<b>Status Description</b>
0x00	Command Accepted
0x01	Command Rejected – Invalid vehicle ID
0x02	Command Rejected – Invalid station ID
0x03	Command Rejected – Invalid Path ID
0x04	Command Rejected – Invalid position (off Path)
0x05	Command Rejected – E-Stop signal active
0x06	Command Rejected – Interlock signal active
0x07	Command Rejected – Movement suspended
0x08	Command Rejected – Startup sequence already complete
0x09	Command Rejected – Startup sequence already started
0x0A	Command Rejected – Startup sequence not initiated/complete
0x0B	Command Rejected – Invalid parameter (acceleration, velocity, or direction)
0x0C	Command Rejected – Initialization not complete
0x0D	Command Rejected – Reset active
0x0E	Command Rejected – No record available
0x0F	Command Rejected – Terminus Node busy
0x10	Command Rejected – Programming active
0x11	Command Rejected – Invalid traffic light ID
0x12	Command Rejected – Unrecognized command
0x13	Command Rejected – Vehicle lock active
0x14	Command Rejected – Duplicate record
0x15	Command Rejected – Station in use
0x16	Command Rejected – Invalid motor index
0x17	Command Rejected – Motor busy
0x18	Command Rejected – Invalid coil board index
0x19	Command Rejected – Invalid Node ID
0x20	Command Rejected – Invalid Node type
0x21	Command Rejected – Invalid item type

*Table 6: HLC Command Status Codes*

<b>Status Value</b>	<b>Status Description</b>
0x22	Command Rejected – Invalid item index
0x23	Command Rejected – Invalid motor type
0x24	Command Rejected – FastStop active
0x25	Command Rejected – Invalid Node Controller ID
0x26	Command Rejected – Invalid Metric ID
0x27	Command Rejected – Item in use
0x40	Command Failed – Unable to acquire status from motor
0x41	Command Failed – Unable to complete
0x42	Command Failed – Timed out
0x43	Command Failed – Soft Start active
0x44	Command Failed – FastStop active
0x80	Command Completed Successfully

## Common System Monitoring Intervals

[Table 7](#) lists time durations for common system monitoring intervals.

*Table 7: Common System Monitoring Intervals*

<b>Time Interval (in seconds)</b>	<b>Time Duration</b>
1	1 second
30	30 seconds
60	1 minute
300	5 minutes
900	15 minutes
1800	30 minutes
3600	1 hour
14400	4 hours
28800	8 hours
43200	12 hours
64800	18 hours
65535	18 hours, 12 minutes, 15 seconds (maximum interval)

## Example

The following example shows how to parse the data returned through [SM Subscription Data Response \(0xDF 0A 02\)](#) and [SM Poll Data Response \(0xDF 0A 03\)](#) based on Element Size and Element Count.

```
Index = 0
for(Count = 0; Count < Element_Count; Count++)
{
    Temp32 = 0;

    for(Size = 0; Size < Element_Size; Size++)
    {
        Temp32 <<= 8;
        Temp32 |= Data[Index++];
    }

    Values[Count] = Temp32;
    Values[Count] *= Scale;
    Values[Count] += Offset;
}
```

## Metric Identifiers

Table 8: Hardware Metrics

Name	ID	Instance	Syntax	Units	Conversion	Min	Max	Description
Propulsion Voltage Soft Start Input	0x1015	0	Gauge16	Volts	$\frac{\text{Value} * 128}{65535}$	0 V	+128 V	The propulsion voltage present at the input connector after the input fuse.
Propulsion Soft Start Output Voltage	0x1016	0	Gauge16	Volts	$\frac{\text{Value} * 128}{65535}$	0 V	+128 V	Propulsion Voltage at input of inverters.
External Board Temperature	0x1021	0	Gauge16	°C	$\frac{\text{Value} * 120}{65535}$	0 °C	120 °C	The external hardware board temperature in degrees C. The value is represented as an unsigned 16 bit number as temperature ranging from 0 °C to 120 °C.
Commanded Inverter Currents	0x1030	0	Gauge16	Amps RMS	$\frac{\text{Value} * 30}{65535}$	0 A	QS 100 - 5 A	A single RMS value of the commanded current to all inverters. This gives a measure of power dissipated in the motor. This metric provides a numeric range of 0 to 10 A. Actual maximum achievable value depends on the specific product maximum amperage capability.

Table 9: Syntax Types

Syntax	Description
Integer16	Single signed 16-bit integer. Values range between -32768 and 32767. Returns only the last updated value when read.
Integer32	Single signed 32-bit integer with values range between -2147483648 and 2147483647. Returns only the last updated value when read.
Unsigned16	Single unsigned 16-bit integer with values ranging between 0 and 65535. Returns only the last updated value when read.
Unsigned32	Single unsigned 32-bit integer with values ranging between 0 and 4294967295. Returns only the last updated value when read.
Counter16	Single unsigned 16-bit integer which monotonically increases until it reaches its maximum value, when it wraps around and starts increasing again from zero. Counters only return the last updated value when read.
Counter32	Single unsigned 32-bit integer which monotonically increases until it reaches its maximum value, when it wraps around and starts increasing again from zero. Counters only return the last updated value when read.
Counter64	Single unsigned 64-bit integer which monotonically increases until it reaches its maximum value, when it wraps around and starts increasing again from zero. Counters only return the last updated value when read.
Gauge16	Four signed 16-bit values which may increase or decrease. This returns the following properties (in order): last value, minimum value, maximum value, and average value. When the internal software updates a Gauge metric, it updates all four properties to maintain statistical consistency. When this pattern is read, all four values are returned.
GaugeU16	Four unsigned 16-bit values which may increase or decrease. This returns the following properties (in order): last value, minimum value, maximum value, and average value. When the internal software updates a Gauge metric, it updates all four properties to maintain statistical consistency. When this pattern is read, all four values are returned.



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## More Information

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

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

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## Revision History

Rev.	Change Description
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- |   |   |
|---|---|
| A | Initial release   |
| B | Added Element Size and Element Count fields, changed syntax from GaugeU16 to Gauge16, changed syntax from IntegerU16 to Unsigned16, changed syntax from IntegerU32 to Unsigned32, added Counter64. Update to Rockwell Automation copyright. |
| C | Added error code 0x27. Updated SM Subscription Data Response and SM Poll Data Response to include Metric Data Element Size and Metric Data Element Count fields   |

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<b>Technical Support Center</b>	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	<a href="https://rockwellautomation.custhelp.com/">https://rockwellautomation.custhelp.com/</a>
<b>Local Technical Support Phone Numbers</b>	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>
<b>Direct Dial Codes</b>	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>
<b>Literature Library</b>	Installation Instructions, Manuals, Brochures, and Technical Data.	<a href="http://www.rockwellautomation.com/global/literature-library/overview.page">http://www.rockwellautomation.com/global/literature-library/overview.page</a>
<b>Product Compatibility and Download Center (PCDC)</b>	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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Rockwell Otomasyon Ticaret A.Ş., Kar Plaza İş Merkezi E Blok Kat:6 34752 İçerenköy, İstanbul, Tel: +90 (216) 5698400

### Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444

Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640

Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

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139 Barnum Road, Devens, MA 01434, USA

+1 978-757-9100

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[www.rockwellautomation.com](http://www.rockwellautomation.com)