BALLUFF

*sensors worldwide*

# BIS CBx fast protokoll

User's Guide

www.balluff.com

# CONTENTS

# REFERENCES

## CONVENTIONS

This manual uses the following conventions:

“User” or “Operator” refers to anyone using the CBx Protocol software to program an RFID device.

“Device” refers to the Balluff processor units.

“You” refers to the System Administrator or Technical Support person using this manual to program, maintain or troubleshoot an RFID device.

BIS M-41_ , BIS M-62_ and BIS U-62_ processor units are referred to as controllers, or just “the controller ”.

| | | |
|---|---|---|
| BIS M-410 | correspond to the old name | C-0405 unit |
| BIS M-411 | correspond to the old name | C-1007 unit |
| BIS M-620-068_ | correspond to the old name | HF-CNTL-232_ unit |
| BIS M-620-067_ | correspond to the old name | HF-CNTL-485_ unit |
| BIS M-622-068_ | correspond to the old name | HF-CNTL-PBS_ unit |
| BIS M-623-071_ | correspond to the old name | HF-CNTL-DNT_ unit |
| BIS M-626-069_ | correspond to the old name | HF-CNTL-IND_ unit |
| BIS M-628-075_ | correspond to the old name | HF-CNTL-PNT_ unit |
| BIS U-620-068_ | correspond to the old name | UHF-CNTL-232_ unit |
| BIS U-620-067_ | correspond to the old name | UHF-CNTL-485_ unit |
| BIS U-626-069_ | correspond to the old name | UHF-CNTL-IND_ unit |
| BIS Z-GW-001-DNT | correspond to the old name | GWY-01-DNT-01 |
| BIS Z-GW-001-IND | correspond to the old name | GWY-01-IND-01 |
| BIS Z-GW-001-PBS | correspond to the old name | GWY-01-PBS-01 |
| BIS Z-GW-001-RS232 | correspond to the old name | GWY-01-232-01 |
| BIS Z-GW-001-TCP | correspond to the old name | GWY-01-TCP-01 |
| BIS Z-HB-004-IND | correspond to the old name | HUB-04-IND-01 |
| BIS Z-HB-004-TCP | correspond to the old name | HUB-04-TCP-01 |

## REFERENCE DOCUMENTATION

The documentation related to the Gateway, Hub, and the BIS M-41_, BIS M-62_ and BIS U-62_ processor units management is available on the website:

www.balluff.com

## SERVICES AND SUPPORT

Balluff provides several services as well as technical support through its website. Log on to **www.balluff.com** and click on the links indicated for further information including:

- **PRODUCTS**
  Search through the links to arrive at your product page which describes specific Info, Features, Applications, Models, Accessories, and Downloads including:
  - **Dashboard™**: a Windows-based utility program, which allows system testing, monitoring, and configuration using a PC. It provides Serial (RS232 or USB) and Ethernet interface configuration.
  - **C-Macro Builder™**: an easy to use GUI-driven utility for Windows. This software tool allows users with minimal programming experience to “build” their own macro programs (which are stored internally on and executed directly by RFID Controllers).

# 1 CBX COMMAND PROTOCOL

## 1.1 COMMAND PROTOCOL MATRIX

Balluff RFID products support three basic command protocols: *CBx, ABx Fast* and *ABx Standard*. To determine which command protocol to utilize, please refer to the table below, which lists the different RFID devices and indicates the command protocol supported by each.

| Product | CBx | ABx Fast | ABx Standard |
|---|---|---|---|
| BIS M-410-068-001_ | | X | X |
| BIS M-411-068-001_ | | X | X |
| BIS M-620-068-A01-00_ | | X | X |
| BIS U-620-068 | | X | X |
| BIS M-622/623/626_ | X | | |
| BIS U-626-069_ | X | | |
| BIS Z-GW-001_ all models | X | | |
| BIS Z-HB-001_ all models | X | | |

**Table 1-1: Command Protocol Matrix**

**NOTE**

*RS485-based RFID controllers are used in conjunction with Subnet16™ Gateway and Subnet16™ Hub interface modules, which use the CBx Command Protocol.*

## 1.2 CBX COMMAND PROTOCOL OVERVIEW

In order to execute RFID commands properly, the RFID device and host computer must be able to communicate using the same language. The language that is used to communicate is referred to as the *Command Protocol*. **The primary command protocol used by TCP/IP and Fieldbus connection-based RFID devices is called "*CBx*"**.

The *CBx Command Protocol* incorporates Balluff Multidrop Subnet16™ networking support, which can be used with Industrial Ethernet applications.

CBx is based on a double-byte oriented packet structure where commands always contain a minimum of six data “words,” even when one or more parameters are not applicable to the command.

CBx does not support the inclusion of a checksum byte, which is supported in the *ABx Fast Command Protocol*.

### 1.2.1 CBx Command Procedure for Gateway/Hub Interface Modules

Commands are initiated by a host computer or Programmable Logic Controller (PLC) and are received by a Subnet16™ Gateway or Subnet16™ Hub Interface Module that is connected to the host, PLC or LAN by standard Ethernet cabling. Commands are delivered from the Gateway/Hub to RFID controllers via ThickNet or ThinNet cabling.

When the Gateway/Hub receives a controller-bound command, it distributes the command to the "*Node ID*" number specified in the command packet. Each 485-based controller connected to the Multidrop Subnet16™ network is assigned an individual Node ID number between 1 and 16.

### 1.2.2 CBx Command Procedure for Controllers

Commands are initiated by a host computer or Programmable Logic Controller (PLC) and are received by a BIS M-41x, BIS M-62x or BIS U-62x- Series Processors that is connected to the host, PLC or LAN by standard Ethernet cabling.
Commands are executed directly by the controller when "*Node ID 01*" is specified in the command packet (for models other than -485, the Node ID will always be 01).

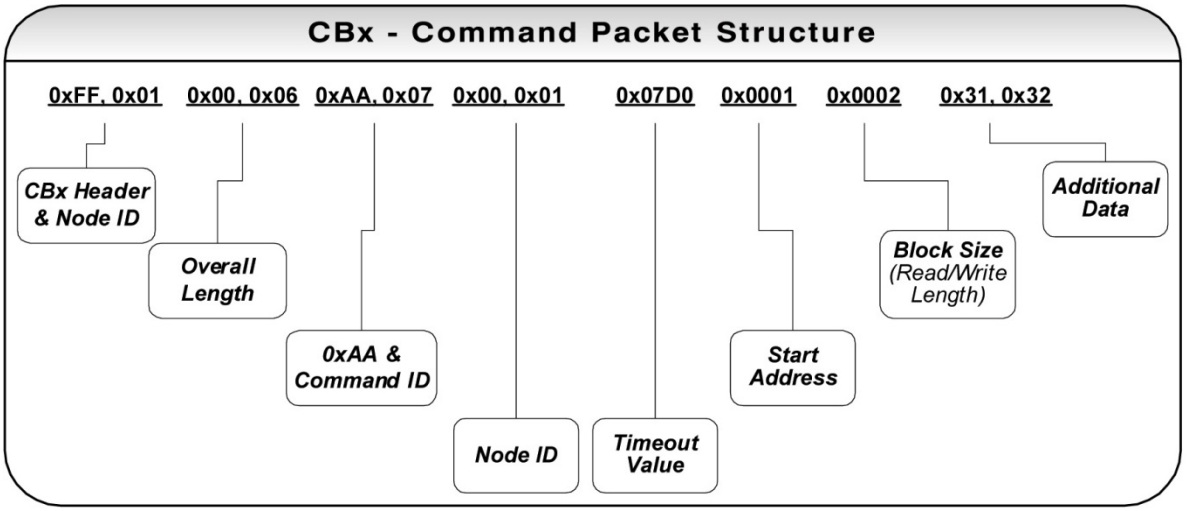
## 1.3 CBX COMMAND PROTOCOL PACKET STRUCTURES

**NOTE**

*The CBx packet structures described herein are protocol independent and can be implemented the same for all Ethernet or Fieldbus protocols (Ethernet/IP, Modbus TCP, DeviceNet, etc.).*

### 1.3.1 CBx Command Packet Structure

As noted, CBx commands contain a minimum of six words (not including the CBx Header and Node ID in the first word). Below is the structure of a standard CBx command packet.



(MSB = Most Significant Byte, LSB = Least Significant Byte)

| Word # | Command Packet Element | MSB | LSB |
|---|---|---|---|
| 00 | **CBx Header** in MSB: *0xFF*<br>**Node ID** in LSB<br>NOTE: These first two bytes are not required for PLC-based RFID applications (Modbus/TCP, Ethernet/IP) | 0xFF | <Node ID> |
| 01 | **Overall Length**: 2-byte integer indicating the number of 16-bit "*words*" in the command packet (not including the previous two bytes: *CBx Header* and *Node ID)*.<br>Note: this value will always be at least 6, as each command has a minimum of 12-bytes (or 6 words). Overall Length will increase when additional data words are used in the command (for fills, writes, etc.). | 0x00 | 0x06 + (number of any additional data words) |
| 02 | **0xAA** in MSB<br>**Command ID**: single-byte value in LSB indicates command to perform | **0xAA** | <Command ID> |
| 03 | **0x00** in MSB<br>**Node ID**: LSB value indicates the Node ID number of the device to which the command is intended. See Note below. | 0x00 | <Node ID> |
| 04 | **Timeout Value**: 2-byte integer representing the length of time allowed for the completion of the command (when applicable). Measured in one-millisecond increments, the *Timeout Value* can have a value of 0x0001 to 0xFFFE (*1 - 65,534 milliseconds*). | <Timeout MSB> | <Timeout LSB> |
| 05 | **Start Address**: 2-byte integer indicating the location of tag memory where a read or write operation will begin (when applicable) | <Start MSB> | <Start LSB> |
| 06 | **Block Size**: 2-byte integer indicating the number of bytes that are to be read from or written to a tag during the operation (when applicable) | <Size MSB> | <Size LSB> |
| 07 | **Additional Data:** (bytes 1 & 2) used to hold 2-bytes of data used for writes and fills (when applicable) | <D1> | <D2> |
| 08 | **Additional Data:** (bytes 3 & 4) used to hold an additional 2-bytes of data for writes (when applicable) | <D3> | <D4> |

**Table 1-2: CBx Command Packet Structure**

**NOTE**

*The Node ID value must be 0x20 (Node ID 32) when the command is directed to a Gateway or Hub, 0x01 to 0x10 (Node ID 01 to 16) for a controller in the Subnet16™. When the command is directed to any other controller (i.e. serial point-to-point or Fieldbus slaves), it must be 0x01 (Node ID 01).*

### 1.3.2 CBx Response Packet Structure

After executing a command, the controller will generate a host-bound response message. The response message will contain EITHER the results of the attempted command or an error code indicating the reason the operation could not be completed successfully. Below is the structure of a standard CBx response packet.

| Word # | Response Packet Element | MSB | LSB |
|---|---|---|---|
| 00 | **CBx Header** in MSB: *0xFF*<br>**Node ID Echo** in LSB<br>NOTE: These first two bytes will not be returned in the response packet for commands executed by Node 01 | 0xFF | <Node ID Echo> |
| 01 | **Overall Length**: 2-byte integer indicating the number of "*words*" in the response packet. This value will always be at least *6 words* and does not include the previous two bytes: *CBx Header* and *Node ID Echo*. | 0x00 | 0x06 + (number of any additional data words retrieved) |
| 02 | **0xAA** in MSB<br>**Command Echo**: single-byte LSB value identifies the command that was performed. | **0xAA** | <Command Echo> |
| 03 | **Instance Counter:** in MSB<br>(*see description on following page*)<br>**Node ID Echo**: Value in LSB identifies the Node ID of the device that performed the command and/or generated the response. | <Instance Counter> | <Node ID Echo> |
| 04 | **Month** and **Day** Timestamp | <Month> | <Day> |
| 05 | **Hour** and **Minute** Timestamp | <Hour> | <Minute> |
| 06 | **Second** Timestamp in MSB<br>**Additional Data Length**: Value in LSB indicates the number of additional bytes retrieved (when applicable) | <Second> | <Additional Data Length> |
| 07 | **Retrieved Data:** (bytes 1 & 2) used to hold 2-bytes of retrieved data (when applicable) | <B1> | <B2> |
| 08 | **Retrieved Data:** (bytes 3 & 4) used to hold an additional 2-bytes of retrieved data (when applicable) | <B3> | <B4> |

**Table 1-3: CBx Response Packet Structure**

## Instance Counter

The Instance Counter is a one-byte value used to track the number of responses generated by each Node ID. *Instance Counter* values are stored in the internal RAM of the Gateway/Hub and are incremented by one following each response. If, for example, the controller at Node 01 has generated 10 responses, the *Instance Counter* value for Node 01 in the Gateway/Hub will read 10 (*0x0A*). When power is cycled to the Gateway/Hub, the *Instance Counter* values for all nodes (and for the Gateway/Hub itself) will be reset to zero (*0x00*).

The same is true for all other controller applications (i.e. serial point-to-point or Fieldbus slaves).

## CBx Command and Response Example

In the example below, *Command 0x05 (Read Data)* is issued to the controller at Node 01, instructing it to read four bytes of data beginning at tag address 0x0020. The *Timeout Value*, measured in milliseconds, has been set to two seconds (*0x07D0 = 2000 x .001 = 2 seconds*) for the completion of this command.

## Command from Host

| Word # | Command Element | MSB | LSB |
|---|---|---|---|
| 00 | **CBx Header** in MSB: *0xFF*<br>**Node ID** in LSB | 0xFF | 0x01 |
| 01 | **Overall Length of Command**: (in words, not including the previous two bytes ) | 0x00 | 0x06 |
| 02 | **0xAA** in MSB<br>**Command ID** in LSB: (0x05: Read Data) | **0xAA** | 0x05 |
| 03 | **0x00** in MSB<br>**Node ID** in LSB | 0x00 | 0x01 |
| 04 | **Timeout Value** | 0x07 | 0xD0 |
| 05 | **Start Address**: (2-byte integer for the starting location of the read operation: 0x0020) | 0x00 | 0x20 |
| 06 | **Block Size**: (2-byte integer for the number of bytes to read: 0x0004) | 0x00 | 0x04 |

## Response from Controller

Below is an example of the response from the controller at Node 01 after successfully executing the *Read Data* command (as issued in the previous example). Because this example was performed by the controller at Node 01, the ensuing response will NOT contain the two-byte CBx Header of *0xFF* and the *Node ID* in the first word, as would be the case for all other Node ID responses.

| Word # | Response Element | MSB | LSB |
|---|---|---|---|
| 01 | **Overall Length of Response**: (in words) | 0x00 | 0x08 |
| 02 | **0xAA** in MSB<br>**Command Echo** in LSB: (0x05: Read Data) | **0xAA** | 0x05 |
| 03 | **Instance Counter** in MSB<br>**Node ID Echo** in LSB | <Instance Counter> | 0x01 |
| 04 | **Month** and **Day** Timestamp:<br>(March 19th) | 0x03 | 0x13 |
| 05 | **Hour** and **Minute** Timestamp:<br>(10:11: AM) | 0x0A | 0x0B |
| 06 | **Seconds** Timestamp in MSB:<br>(:36 seconds)<br>**Additional Data Length** in LSB: (number of bytes retrieved: 0x04) | 0x24 | 0x04 |
| 07 | **Retrieved Data**: (bytes 1 & 2) | 0x01 | 0x02 |
| 08 | **Retrieved Data**: (bytes 3 & 4) | 0x03 | 0x04 |

### 1.3.3 CBx Multi-Tag Command Packet Structure

*CBx Multi-tag Commands* instruct a specified controller to read from or write to several tags at once when multiple tags are simultaneously within RF range. It is also possible to single-out and read from or write to one tag (identified by its unique tag ID number) when multiple tags are present in the RF field simultaneously.

**NOTE**

*Multi-tag commands only support ISO 15693 compliant RFID tags.*

Below is the structure of a basic CBx Multi-tag command packet.

| Word # | Command Packet Element | MSB | LSB |
|---|---|---|---|
| 00 | **CBx Header** in MSB: *0xFF*<br>**Node ID** in LSB | 0xFF | <Node ID> |
| 01 | **Overall Length**: 2-byte integer value indicating the number of "*words*" in the command packet (*not including the previous two bytes*). | 0x00 | 0x08 + (number of any additional data words) |
| 02 | **0xAA** in MSB<br>**Command ID**: LSB value indicates command to perform | **0xAA** | <Command ID> |
| 03 | **0x00** in MSB<br>**Node ID**: LSB value indicates the Node ID number of the controller to which the command is intended. | 0x00 | 0x01 |
| 04 | **Timeout Value**: 2-byte integer represents the maximum length of time allowed for the completion of the command, measured in one-millisecond increments, where *0x0BB8 = 3000 x .001 = 3 seconds.* The *Timeout Value* can have a value of 0x0001 to 0xFFFE (*1 - 65,534 milliseconds*). | 0x0B | 0xB8 |
| 05 | **Start Address**: 2-byte integer indicating the location of tag memory where a read or write operation will begin (when applicable) | <Start MSB> | <Start LSB> |
| 06 | **Block Size**: 2-byte integer indicating the number of bytes that are to be read from or written to a tag during the operation (when applicable) | <Size MSB> | <Size LSB> |
| 07 | **AFI (Application Family Identifier)**: Single-byte MSB value (0x00-0xFF) specifies a subset of tags. 0x00 = all tags in RF range will respond to the command (*see description in par. below*).<br>**Anti-Collision Mode**: Single-byte LSB value allows the user to enable the use of 16 time slots for retrieving data where 0x01 = Multi-Slot, 0x00 = Single-Slot (*see description in par. below*). | 0x00 | 0x01 |
| 08 | **Tag Limit**: Single-byte MSB value for the maximum # of tags expected in RF range, up to 100 (*see description in par. below*).<br>**0x00** in LSB | 0x64 (100 tags max Tag Limit) | 0x00 |
| 09 | **Additional Data:** (bytes 1 & 2) used to hold 2-bytes of data used for writes and fills (when applicable) | <D1> | <D2> |
| 10 | **Additional Data:** (bytes 3 & 4) used to hold an additional 2-bytes of data for writes (when applicable) | <D3> | <D4> |

**Table 1-4: CBx Multi-Tag Command Packet Structure**

## AFI (Application Family Identifier)

The *AFI* parameter is a one-byte value (*0x00 – 0xFF*) that can be used in multi-tag commands to specify a subset of tags when many are identified simultaneously in RF range. The parameter allows the user to filter tags based on a pre-written value stored at a special location on the tag.

For example, if the AFI value is set to one (*0x01*), only those tags with the pre-written AFI value *0x01* will respond to the given command. When an AFI value of zero (*0x00*) is entered for this parameter, all tag families within RF range will respond to the command.

## Anti-Collision Mode

Tag collisions in RFID applications occur when numerous passive RFID tags become simultaneously activated (by the RFID controller) and thus reflect their respective signals back to the reader at the same time, such that the controller cannot differentiate between tags.

Balluff RFID controllers make use of anti-collision algorithms to enable a single reader/antenna to read more than one tag in the reader's field.
The *Anti-collision Mode* parameter controls the tag-reading algorithm used to achieve the fastest reading speed for the number of tags expected in RF range at any given moment. This parameter helps the reader/antenna avoid data collisions when simultaneously reading multiple tags.

The choices for this parameter are one (0x01) for Multi-Slot and zero (0x00) for Single-Slot.

- *ONE*: Setting this parameter to one (0x01), implements a multi-slot system of 16 time slots. To avoid data collisions when the controller encounters multiple tags simultaneously, data requested from each tag is transferred to the controller only during the time slot that matches a specific pattern in the tag ID number.
- *ZERO*: Setting this parameter to zero (0x00) utilizes a single time slot under which the requested data from all tags is transferred to the controller as soon as it becomes available. This setting can result in faster tag read performance when only a few tags are expected in the RF field

The Anti-Collision Mode parameter immediately follows the "*AFI*" parameter in the multi-tag command packet string.

## Tag Limit

The *Tag Limit* parameter holds a one-byte value that indicates the maximum number of tags expected simultaneously in RF range for the given command operation. This parameter allows users to limit the number of attempted read/write operations the controller will make per execution (users do not have to wait for the Timeout to expire).

The *Tag Limit* value should be set in relation to the maximum number of tags that could possibly be present in the reading field at any one time. Setting a high value increases the number of tags that are expected in the antenna's RF field. Setting a low value can speed up multi-tag operations when only a small number of tags could be present at any given moment.

Setting the proper value is therefore a tradeoff between the number of expected tags in the reading field, and the time required to read/write to them. The permitted values range from one to 100 (0x01 – 0x64).

The *Tag Limit* parameter resides directly after the "*Anti-collision Mode*" parameter in the command string (when applicable).

## Timeout Value

Multi-tag commands also contain a two-byte *Timeout Value* parameter that is used to limit the length of time for which the controller will attempt to complete a given operation.
It is important to set a realistic *Timeout Value* that permits enough time for the controller to read/write to all tags specified in the command. Processing multiple-tag operations requires a longer time period than does the execution of single-tag commands.

The value is expressed in one-millisecond increments, with a maximum value of 0xFFFE (65,534 milliseconds) or approximately 60 seconds. It is recommended that users allow at least 100 ms per tag for multi-tag read operations and 150 ms per tag for multi-tag writes.
Using a *Timeout Value* that is too short may cause the controller to inadvertently "time out" before the data has been successfully read from or written to all tags in RF range. For time critical applications, the optimal *Timeout Value* should be obtained through rigorous performance testing.

## Tag ID / Serial Number

There are two multi-tag commands that allow the user to retrieve data from or write data to a single tag (specified by its tag ID number) when numerous tags are concurrently present in the RF field (*CBx Command 0xA5 - Multi-Tag Block Read by ID* and *CBx Command 0xA6 – Multi-Tag Block Write by ID*). The tag ID number is a unique, read-only, 64-bit (eight-byte) number stored in tag memory. Targeted tags can be recognized through a previously issued *Multi-Tag Get Inventory (0x97)* command.

### 1.3.4 CBx Multi-Tag Response Packet Structures

When executing multi-tag commands designed to retrieve information from several tags at once (for example *CBx Command 0x92: Multi-Tag Read ID and Data All)*, the RFID controller will generate separate host-bound response packets for each tag that has been read. Below is the structure of a basic CBx multi-tag response packet generated by the controller at Node 01.

CBx Multi-tag Response Packet Structure (One Packet for Each Tag Read)

| Word # | Response Packet Element | MSB | LSB |
|---|---|---|---|
| 01 | **Overall Length**: 2-byte integer indicates the number of "*words*" in the response packet. | 0x00 | 0x06 + (number of any additional words retrieved) |
| 02 | **0xAA** in MSB<br>**Command Echo**: single-byte value identifies the command that was performed in LSB | **0xAA** | 0x92 |
| 03 | **Instance Counter**: 1-byte MSB value indicates number of responses generated by the Node ID identified in the LSB.<br>**Node ID Echo**: 1-byte value indicates the Node ID of the RFID controller that performed the command. | <IC> | 0x01 |
| 04 | **Month** and **Day** Timestamp | <Month> | <Day> |
| 05 | **Hour** and **Minute** Timestamp | <Hour> | <Minute> |
| 06 | **Second** Timestamp in MSB<br>**Additional Data Length**: single-byte LSB value indicates the number of additional bytes retrieved, includes both *Tag ID* and *Read Data* bytes (when applicable) | <Second> | <N-bytes> |
| 07 | **Tag ID bytes 1 and 2**: holds the first two bytes of the Tag ID number | <ID byte 1> | <ID byte 2> |
| 08 | **Tag ID bytes 3 and 4** | <ID byte 3> | <ID byte 4> |
| 09 | **Tag ID bytes 5 and 6** | <ID byte 5> | <ID byte 6> |
| 10 | **Tag ID bytes 7 and 8** | <ID byte 7> | <ID byte 8> |
| 11 | **Read Data bytes 1 and 2**: holds 2 bytes of retrieved data from tag read operations | <D01> | <D02> |
| … | … | … | … |
| 18 | **Read Data bytes 15 and 16** | <D15> | <D16> |

**Table 1-5: CBx Multi-Tag Response Packet Structure**

## CBx Multi-Tag Response Final Termination Packet Structure

After the RFID controller has issued response packets for each tag identified and/or read, a final termination packet is generated. Below is the structure of a standard CBx multi-tag response final termination packet generated by the controller at Node 01.

| Word # | Final Termination Packet Element | MSB | LSB |
|---|---|---|---|
| 01 | **Overall Length**: 2-byte integer indicates the number of "*words*" in the packet. | 0x00 | 0x07 |
| 02 | **0xAA** in MSB, **0xFF** in LSB | **0xAA** | **0xFF** |
| 03 | **Instance Counter**: 1-byte value indicates the number of responses generated by the Node ID identified in the LSB (this value is not to be confused with the number of tags read during a single operation)<br>**Node ID Echo**: 1-byte value indicates the Node ID of the controller that performed the command. | <IC> | 0x01 |
| 04 | **Month** and **Day** Timestamp | <Month> | <Day> |
| 05 | **Hour** and **Minute** Timestamp | <Hour> | <Minute> |
| 06 | **Second** Timestamp in MSB<br>**Additional Data Length**: Single-byte LSB value indicates the number of additional bytes retrieved (value will usually = 2, for *Number of Tags Read/Written* and *Status*) | <Second> | 0x02 |
| 07 | **Number of Tags Read/Written** in MSB, identifies the number of tags read from or written to during the operation<br>**Status** in LSB (0x00 = operation completed successfully, 0x07 = Read Tag ID failed / Tag Not Found) | <N-tags> | 0x00 |

**Table 1-6: CBx Multi-Tag Response Final Termination Packet Structure**

## 1.4 NOTIFICATION EVENT MESSAGES

Notification Messages are small host-bound informational packets of data that are issued by a Gateway/Hub when a specified *Notification Event* occurs within the Gateway/Hub or on the Subnet16™ network.

The Gateway/Hub stores 9 different Notification Messages internally. The Hub stores an additional 4 Notification Messages relative to its Inputs/Outputs. See the Notification Message Table below.

## Notification Message Table

The following table lists the Notification Messages, their bit mask values and contains a description of the Notification Event that can be set to trigger the notification.

| Bit | Notification Message | Notification Event Description |
|---|---|---|
| 1 | CONTROLLER IS HEALTHY | Sent whenever the status of a controller changes to 'Healthy' |
| 2 | CONTROLLER HAS PROBLEM | Sent whenever a controller is marked 'Has Problem' |
| 3 | CONTROLLER STOPPED RESPONDING | Sent whenever a controller is marked 'Stopped Responding' |
| 4 | CONTROLLER DEACTIVATED | Sent whenever a controller is deactivated (is marked 'Inactive') |
| 5 | CONTROLLER MISSED POLL | Sent whenever a controller misses a poll |
| 6 | CONTROLLER ADDRESS CONFLICT | Sent whenever the Gateway/Hub detects a Node ID conflict |
| 7 | CONTROLLER CONFIGURATION FAILURE | Sent whenever the Gateway/Hub fails to configure a controller |
| 8 | TAG PRESENT AT NODE * | Sent whenever a tag is first recognized in the RF field of the specified node |
| 9 | TAG NOT PRESENT AT NODE * | Sent whenever a tag is no longer recognized within or has exited the RF field of the specified node |
| 10 | INPUT SET (Hub only) | Sent when one of the Hub's four Inputs has been set |
| 11 | INPUT CLEARED (Hub only) | Sent when one of the Hub's four Inputs has been cleared |
| 12 | OUTPUT SET (Hub only) | Sent when one of the Hub's four Outputs has been set |
| 13 | OUTPUT CLEARED (Hub only) | Sent when one of the Hub's four Outputs has been cleared |

**Table 1-7: Notification Message Table**

* - *Tag Presence* must be **enabled** on the RFID controller.

**NOTE**

*The Gateway only supports Notification Messages 1 – 9. Notification Messages 10 – 13 pertain to the status of the Hub's Digital Inputs and Outputs.*

Notification Messages are enabled or disabled by setting or clearing the corresponding bit within the 16-bit Notification Mask (see Command 0x24). If the bit is set, the corresponding Notification Message will be generated when the specified event occurs.

When a Notification Message is enabled and its corresponding Notification Event occurs, the Notification Message will be generated by the Gateway/Hub and will be written to the Node Output Page of the affected Subnet Node (i.e., the Node ID that triggered the notification). See Command Mapping in the appendix for more details.

Triggered Notification Messages are provided immediately to the host.

### Notification Message Packet Structure

| Word # | Notification Message Packet Element | MSB | LSB |
|---|---|---|---|
| 01 | **Overall Length of Notification Message**: 2-byte integer indicates the number of "*words*" in the packet. | 0x00 | 0x06 |
| 02 | **0xFE** in MSB = Notification Message Flag<br>**Notification Event** in LSB | **0xFE** | < Notification Event > |
| 03 | **Instance Counter**: (a Notification Message is considered a response; therefore the Instance Counter is incremented by one)<br>**Node ID Echo** in LSB: value indicates the Node ID of the device to which the Notification Message refers. (*example 0x05*) | <IC> | 0x05 |
| 04 | **Month** and **Day** Timestamp | <Month> | <Day> |
| 05 | **Hour** and **Minute** Timestamp | <Hour> | <Minute> |
| 06 | **Second** Timestamp in MSB<br>**0x00**:in LSB | <Second> | 0x00 |

## 1.5 ERROR MESSAGES

### CBx Error Response Packet Structure

A one-byte **Error Code** will be returned in the MSB of the **seventh** data word of an error response packet (followed by 0x00 in the LSB.

| Word # | Error Response Element | MSB | LSB |
|---|---|---|---|
| 01 | **Overall Length**: 2-byte integer indicating the number of "*words*" in the response packet. This value will always be 7 words (6 + 1 for the error code). | 0x00 | 0x07 |
| 02 | **0xFF** in the MSB = Error Flag (indicates that an error occurred).<br>**Error Information Byte**: 0xFF in the LSB indicates that a controller-based error occurred. Any value other than 0xFF indicates that a Gateway/Hub-based error occurred (and identifies the command that was attempted when the error occurred). | **0xFF** | <Error Info> |
| 03 | **Instance Counter**: this 1-byte value in the MSB tallies the number of responses from a given Node ID.<br>**Node ID Echo**: the 1-byte LSB value indicates the Node ID of the controller for which the command was intended. | <Instance Counter> | <Node ID Echo> |
| 04 | **Month** and **Day** Timestamp | <Month> | <Day> |
| 05 | **Hour** and **Minute** Timestamp | <Hour> | <Minute> |
| 06 | **Second** Timestamp in MSB<br>**Additional Data Length**: in LSB (0x01 for Error Code) | <Second> | 0x01 |
| 07 | **Error Code**: 1-byte Error Code in MSB<br>**0x00** in LSB | <Error Code> | 0x00 |

**Table 1-8: CBx Error Response Packet Structure**

## Error Response Example

Below is an example of a CBx Error Response for **Error Code 0x07** (Tag Not Found).

| Error Response Parameter | MSB | LSB |
|---|---|---|
| **0x00** in MSB<br>**Overall Length of Response** in LSB (*in words*) | 0x00 | 0x07 |
| **Error Flag** in MSB.<br>**Error Information Byte** in LSB | **0xFF** | **0xFF** |
| **Instance Counter** in MSB<br>**Node ID Echo** in LSB | 0x00 | 0x01 |
| **Month** and **Day** Timestamp:(*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*:36 seconds*).<br>**Additional Data Length** in LSB: (*0x01 for Error Code*) | 0x24 | 0x01 |
| **Error Code** in MSB (0x07 = Tag Not Found)<br>**0x00** in LSB | **0x07** | 0x00 |

### 1.5.1 Error Codes

| Error Code | Error | Description |
|---|---|---|
| 0x02 | LOCK TAG BLOCK FAILED | Lock Tag Block Operation Failed |
| 0x04 | FILL TAG FAILED | Fill Operation Failed |
| 0x05 | READ DATA FAILED | Read Data Command Failed |
| 0x06 | WRITE DATA FAILED | Write Data Command Failed |
| 0x07 | READ TAG ID / TAG SEARCH FAILED | Read Tag ID / Tag Search Command Failed (Tag Not Found) |
| 0x21 | INVALID SYNTAX | Command Contained a Syntax Error |
| 0x23 | INVALID TAG TYPE | Invalid or Unsupported Tag Type |
| 0x30 | INTERNAL CONTROLLER ERROR | Generic Internal Controller Error |
| 0x31 | INVALID CONTROLLER TYPE | Invalid Controller Type (when Setting Configuration) |
| 0x32 | INVALID PROGRAMMING ADDRESS | Invalid Tag Programming Address Specified in the Command |
| 0x35 | INVALID RESET | Invalid Hardware Reset |
| 0x36 | SET CONFIGURATION ERROR | Controller Configuration not Written |
| 0x37 | GET CONFIGURATION ERROR | Controller Configuration not Read |
| 0x80 | UNKNOWN GATEWAY/HUB ERROR | Generic Interface Module Error – an error occurred, but the Gateway/Hub could not determine the error code. |
| 0x81 | COMMAND MALFORMED | Generic Command Syntax Error |
| 0x83 | COMMAND INVALID OPCODE | Invalid Command ID Number specified in the command. |
| 0x84 | COMMAND INVALID PARAMETER | A parameter specified in the command was invalid. |

| Error Code | Error | Description |
|---|---|---|
| 0x85 | COMMAND INVALID CONTROLLER ID | An invalid Node ID was specified in the command, or no controller was detected/present at the specified Node. |
| 0x86 | COMMAND INACTIVE CONTROLLER ID | The Node ID specified in the command is currently inactive. |
| 0x87 | SUBNET DEVICE SELECT FAILED | Internal Subnet Error – the specified Subnet device failed. |
| 0x88 | SUBNET DEVICE FAILED TO ACKNOWLEDGE | Internal Subnet Error - the specified Subnet device failed to respond to polling. |
| 0x89 | SUBNET RESPONSE MALFORMED | Internal Subnet Error – a controller returned a malformed response. |
| 0x8A | SUBNET RESPONSE TIMEOUT | Internal Subnet Error – a controller was unable to generate a response before timeout was reached. |
| 0x8B | SUBNET RESPONSE INVALID CHECKSUM | Internal Subnet Error – a controller generated a response that has an invalid checksum. |
| 0x8C | SUBNET DEVICE CONFLICT DETECTED | Internal Subnet Error – a Node ID conflict has been detected |
| 0x8D | BUFFER OVERFLOW | Internal Error – buffer limit was exceeded |
| 0x8E | FLASH FAILURE | Internal Flash Memory Error |
| 0x93 | NODE MISMATCH ERROR | The Node specified in the command did not match the Node to which the command was sent. |
| 0x94 | CRC ERROR | Cyclic Redundancy Check Error |
| 0x95 | PROTOCOL ERROR | Internal Communications Error |

# 2 CBX RFID COMMANDS

## 2.1 CBX RFID COMMAND TABLE

| Command ID | Command Name | Description |
|---|---|---|
| **RFID Tag Commands** | | |
| 0x02 | Lock Memory Block | Write protects a block of tag memory |
| 0x04 | Fill Tag | Writes a specified data byte value to all defined tag addresses |
| 0x05 | Read Data | Reads a specified length of data from a contiguous (sequential) area of tag memory |
| 0x06 | Write Data | Writes a specified number of bytes to a contiguous area of tag memory |
| 0x07 | Read Tag ID | Reads a tag's unique tag ID number |
| 0x08 | Tag Search | Instructs the controller to search for a tag in its RF field |
| 0x0C | Execute Macro | Instructs the controller to execute one of its eight possible macros |
| 0x0D | Start Continuous Read | Instructs the controller to start or stop Continuous Read mode. |
| 0x0E | Read Tag ID and Data | Reads a tag's ID and the requested number of bytes from tag memory |
| 0x0F | Start Continuous Read Tag ID and Data | Places the controller into (or out of) Continuous Read mode and (when evoked) will retrieve a tag's ID. |
| 0xC2 | Read EPC Code | Reads the 12-byte EPC memory area of an EPC Class 1 Gen 2 tag |
| 0xC3 | Write EPC Code | Writes the 12-byte EPC memory area of an EPC Class 1 Gen 2 tag |
| **Controller Commands** | | |
| 0x30 | Get Controller Name | Retrieves the controller's user-defined name |
| 0x33 | Get Controller Configuration | Retrieves the controller's configuration settings |
| 0x38 | Get Controller Info | Retrieves hardware, firmware and serial number information from the controller |
| 0x40 | Set Controller Name | Used to set (create or modify) the user-defined name for the controller |
| 0x43 | Set Controller Configuration | Used to set (configure or modify) the controller's configuration parameters and settings |
| 0x4E | Set Controller Time | Used to set the time for the controller |
| 0x53 | Initialize Controller | Removes all configuration settings stored for the controller |
| 0x54 | Reset Controller | Resets power to the controller |

| Command ID | Command Name | Description |
|---|---|---|
| **Additional UHF-Series Controller Commands** | | |
| 0xC0 | Set UHF Controller Configuration | Used to set (configure or modify) additional UHF controller configuration parameters |
| 0xC1 | Get Controller Configuration | Retrieves the UHF controller's additional configuration parameter settings |
| **I/O Commands** | | |
| 0x1A | Get Digital Inputs | Retrieves the status of the RFID Controller or Hub's digital input(s) |
| 0x1B | Get Digital Outputs | Retrieve the status of the RFID Controller or Hub's digital outputs |
| 0x2A | Set/Clear Digital Outputs | Used to set and/or clear any or all of the RFID Controller or Hub's digital outputs |
| **Gateway/Hub Subnet Commands** | | |
| 0x10 | Get Gateway/Hub Software Version | Retrieves the version number of the firmware code installed on the Gateway/Hub |
| 0x11 | Get Gateway/Hub Name | Retrieves the Gateway/Hub's user-defined ASCII name |
| 0x12 | Get Dipswitch Settings | Retrieves the status of the Gateway/Hub configuration dipswitches |
| 0x13 | Get Node Status List | Retrieves the operational status of the Gateway/Hub Subnet Nodes |
| 0x14 | Get Notification Mask | Retrieves the user-defined 16-bit "*Notification Mask*" that determines for which events the Gateway/Hub notifies the host PC |
| 0x15 | Get Last Gateway/Hub Error | Retrieves information from the Gateway/Hub regarding the last or most recent error that was experienced |
| 0x16 | Get Gateway/Hub Time | Retrieves the current date and time as set internally on the Gateway/Hub |
| 0x1C | Get Subnet Baud Rate | Retrieves the baud rate of the Subnet network |
| 0x21 | Set Gateway/Hub Name | Writes to flash memory, a user-defined "friendly" name for the Gateway/Hub |
| 0x24 | Set Notification Mask | Used to customize or modify the Gateway/Hub's 16-bit Notification Mask |
| 0x26 | Set Gateway/Hub Time | Used to set the Gateway/Hub's internal clock and calendar |
| 0x2C | Set Subnet Baud Rate | Used to modify and store changes to the Subnet network baud rate |
| 0x60 | Initialize Gateway/Hub | Clears all Subnet Node configuration information stored in the Gateway/Hub's flash memory |
| 0x61 | Reset Gateway/Hub | Performs an electrical reset of the Gateway/Hub |

| Command ID | Command Name | Description |
|---|---|---|
| 0x62 | Initialize All Nodes | Removes all stored configuration information for all nodes and reconfigures them to factory defaults |
| 0x63 | Initialize All Node Macros | Removes all stored macros from all nodes |
| 0x70 | Start Subnet | Instructs the Gateway/Hub to begin “polling” the Subnet network |
| 0x71 | Move Controller (Gateway Only) | Used to move all stored configuration data for a particular Node ID to another specified Node ID (Gateway only) |
| 0x79 | Clear Pending Response | Deletes all pending or buffered responses in the Gateway/Hub and resets all Instance Counters to zero |
| **Multi-Tag RFID Commands** | | |
| 0x92 | Multi-Tag Read ID and Data All | Retrieves the tag ID number and a contiguous segment of data from all RFID tags in range |
| 0x95 | Multi-Tag Block Read All | Retrieves a contiguous segment of data from all RFID tags in range |
| 0x96 | Multi-Tag Block Write All | Writes a contiguous segment of data to all RFID tags in range |
| 0x97 | Multi-Tag Get Inventory | Retrieves the tag ID number from all RFID tags found in range |
| 0x98 | Multi-Tag Search All | Checks for the presence of RFID tags in RF range and returns only the number of tags found |
| 0xA5 | Multi-Tag Block Read by ID | Reads a contiguous segment of data from a specific RFID tag identified by its tag ID |
| 0xA6 | Multi-Tag Block Write by ID | Writes a contiguous segment of data to a specific RFID tag identified by its tag ID |
| 0xC4 | Multi-Tag Read EPC Code | Reads the 12-byte EPC memory area of all EPC Class 1 Gen 2 tags found in range |

**Table 2-1: CBx RFID Command Table**

# CBX COMMAND 0X02: LOCK MEMORY BLOCK

## Command 0x02 - Description

The *Lock Memory Block Command* allows the user to write protect or lock a block of tag memory to prevent data from being overwritten.
The *Starting Block* parameter specifies the first block of tag memory addresses to be locked.
The *Number of Blocks* parameter specifies the number of blocks to lock, (*1 ~ N*).
Depending on the architecture of the tag used, a "block" can be either 4-bytes or 8-bytes. Users must know the memory architecture and block size of their tag before using this command.
This command only supports ISO 15693 compliant RFID tags.

**CAUTION**

*Extreme caution should be taken when using this command. Once a block of tag memory is locked, it cannot be unlocked and all data written to the block is permanent.*

## Command 0x02 – CBx Example

This example instructs the controller at Node 01 to lock two blocks of tag memory, beginning at block address 0x00 (the first available block). A *Timeout Value* of two seconds (*0x07D0 = 2000 x one-millisecond increments*) is set for the completion of this command.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB: (0x*02*) | 0xAA | 0x02 |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x01 |
| **Timeout Value** | 0x07 | 0xD0 |
| **Starting Block**: (*MSB always = 0x00*) | 0x00 | 0x00 |
| **Number of Blocks**: (*MSB always = 0x00*) | 0x00 | 0x02 |

## Response from Controller

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command Echo** in LSB (*0x02*) | 0xAA | 0x04 |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*:36 seconds*) **0x00** in LSB | 0x24 | 0x00 |

# CBX COMMAND 0X04: FILL TAG

## Command 0x04 - Description

The *Fill Tag Command* instructs the specified RFID controller to fill multiple contiguous addresses of an RFID tag with a single byte value. This command is commonly used to clear sequential segments of tag memory by writing the one-byte value repeatedly across a specified range of tag addresses.
This command requires one *Data Byte Value*, a *Start Address* and a *Fill Length*. It will then proceed to fill the tag with the *Data Byte Value*, for the specified *Fill Length* (number of consecutive bytes), beginning at the *Start Address.*
When the *Start Address* is set to zero (*0x0000*), the fill will begin at the first available byte of tag memory. When the *Fill Length* is set to zero (*0x0000*), the controller will write fill data from the *Start Address* to the end of the tag's memory. If the *Fill Length* value extends beyond the last byte in the tag, the controller will return an error.

**NOTE**

*The "Fill Length" in this command represents the number of bytes to fill on the tag, not the length of the 'Data Byte Value' provided in the command, which is always one byte.*

## Command 0x04 - CBx Example

This example instructs the controller at Node 01 to fill an entire tag with the ASCII character 'A' (*Data Byte Value 0x41*) starting at the beginning of the tag (*Start Address 0x0000*). A *Timeout Value* of 2 seconds (*0x07D0 = 2000 x one-millisecond increments*) is set for the completion of the command.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x07 |
| **0xAA** in MSB, **Command ID** in LSB: (0x*04*) | 0xAA | 0x04 |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x01 |
| **Timeout Value** | 0x07 | 0xD0 |
| **Start Address** | 0x00 | 0x00 |
| **Fill Length** | 0x00 | 0x00 |
| **Data Byte Value** in MSB (*A = 0x41*), **0x00** in LSB | 0x41 <A> | 0x00 |

## Response from Controller

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command Echo** in LSB (*0x04*) | 0xAA | 0x04 |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*:36 seconds*) **0x00** in LSB | 0x24 | 0x00 |

# CBX COMMAND 0X05: READ DATA

## Command 0x05 - Description

The *Read Data Command* instructs the controller to retrieve a specific number of bytes of data from a contiguous (*sequential*) area of an RFID tag's memory.
When the *Start Address* is set to zero (*0x0000*), the controller will start reading at the beginning (or first accessible byte) of the tag. The minimum *Block Size* is one byte, the maximum *Block Size* for read operations is 1024 bytes or the entire read/write address space of the tag (whichever is less). If the *Block Size* exceeds the last available tag address, the controller will return an error code.

## Command 0x05 - CBx Example

This example instructs the controller at Node 01 to read four bytes of data from a tag starting at address 0x0001. A *Timeout Value* of 2 seconds (*0x07D0 = 2000 x one-millisecond increments*) is set for the completion of the command.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB. **Command ID** in LSB (*0x05*) | 0xAA | 0x05 |
| **0x00** in MSB. **Node ID** in LSB | 0x00 | 0x01 |
| **Timeout Value** | 0x07 | 0xD0 |
| **Start Address** | 0x00 | 0x01 |
| **Block Size** | 0x00 | 0x04 |

## Response from Controller

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x08 |
| **0xAA** in MSB. **Command Echo** in LSB | 0xAA | 0x05 |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp:(*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*:36 seconds*).<br>**Additional Data Length** in LSB: (*0x04*) | 0x24 | 0x04 |
| **Read Data** (*bytes 1 and 2*) | 0x01 | 0x02 |
| **Read Data** (*bytes 3 and 4*) | 0x03 | 0x04 |

# CBX COMMAND 0X06: WRITE DATA

## Command 0x06 - Description

The *Write Data Command* instructs the controller to write specified information to an RFID tag. This command is used to store segments of data in contiguous tag memory locations. It is capable of transferring up to 100 bytes of data from the host to the tag with one command. When the *Start Address* is set to zero (*0x0000*), the controller will begin writing to the first available byte of tag memory. The shortest possible *Block Size* is one byte, the maximum *Block Size* for write operations is 1024 bytes or the entire read/write address space of the tag (whichever is less). If the *Block Size* exceeds the last available tag address, the controller will return an error code.

## Command 0x06 - CBx Example

This example instructs the controller at Node 01 to write the five ASCII characters H, E, L, L, O (*Data Byte Values: 0x48, 0x45, 0x4C, 0x4C and 0x4F*) to a tag starting at address 0x000. A *Timeout Value* of 2 seconds (*0x07D0 = 2000 x one-millisecond increments*) is set for the completion of this command.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x09 |
| **0xAA** in MSB. **Command ID** in LSB (*0x06*) | 0xAA | 0x06 |
| **0x00** in MSB. **Node ID** in LSB | 0x00 | 0x01 |
| **Timeout Value** (*measured in ms*) | 0x07 | 0xD0 |
| **Start Address** | 0x00 | 0x00 |
| **Block Size** (*in bytes*) | 0x00 | 0x05 |
| **Write Data** (*bytes 1 and 2*) | 0x48 <H> | 0x45 <E> |
| **Write Data** (*bytes 3 and 4*) | 0x4C <L> | 0x4C <L> |
| **Write Data** (*byte 5*) in MSB. **0x00** in LSB | 0x4F <O> | 0x00 |

## Response from Controller

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB. **Command Echo** in LSB | 0xAA | 0x06 |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB (*:36 seconds*). **0x00** in LSB | 0x24 | 0x00 |

# CBX COMMAND 0X07: READ TAG ID

## Command 0x07 - Description

The *Read Tag ID Command* instructs the RFID controller to locate a tag in range and retrieve its unique tag identification number. If a tag is not located before the Timeout Value expires, an error will be returned.
RFID tags are assigned a unique tag ID number during the manufacturing process. After a tag ID number has been assigned to a tag, the value cannot be altered and is not considered part of the available read/write memory space of the tag.

- ISO 14443 compliant tags receive a 4-byte tag ID number. By using just four bytes, tag manufacturers can generate over 4.2 billion possible ISO 14443 compliant tag ID numbers.
- ISO 15693 compliant tags are given an 8-byte tag ID number. When using eight bytes, manufacturers can generate over 280 trillion possible tag ID numbers.

## Command 0x07 - CBx Example

This example instructs the controller at Node 01 to retrieve a tag's ID, which, in this example, is the eight-byte value *E0040100002E16AD*. A *Timeout Value* of 2 seconds (*0x07D0 = 2000 x one-millisecond increments*) is set for the completion of the command.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB. **Command ID** in LSB (*0x07*) | 0xAA | 0x07 |
| **0x00** in MSB. **Node ID** in LSB | 0x00 | 0x01 |
| **Timeout Value** | 0x07 | 0xD0 |
| **Not Used** (*0x00, 0x00*)* | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*)* | 0x00 | 0x00 |

**NOTE**

*Even when one or more command parameters are not used in a particular command, the parameter's two bytes must still be accounted for in the Overall Length. Include all "zeroes" for these bytes (0x00, 0x00).*

## Response from Controller (Tag Found)

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x0A |
| **0xAA** in MSB, **Command Echo** in LSB | **0xAA** | 0x07 |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*:36 seconds*).<br>**Additional Data Length** in LSB: (*0x08*) | 0x24 | 0x08 |
| **Tag ID** (*bytes 1 & 2*) | 0xE0 | 0x04 |
| **Tag ID** (*bytes 3 & 4*) | 0x01 | 0x00 |
| **Tag ID** (*bytes 5 & 6*) | 0x00 | 0x2E |
| **Tag ID** (*bytes 7 & 8*) | 0x16 | 0xAD |

## Response from Controller (Tag Not Found)

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x07 |
| **Error Flag** in MSB = 0xFF.<br>**Error Information Byte** in LSB.<br>0xFF in the LSB indicates that a controller-based error occurred. Any value other than 0xFF indicates that a Gateway or Hub-based error occurred (and identifies the command that was attempted when the error occurred). | **0xFF** | 0xFF |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*:36 seconds*).<br>**Additional Data Length** in LSB: (*0x01*) | 0x24 | 0x01 |
| **Error Code** in MSB (*0x07 = "Tag Not Found").* **0x00** in LSB | 0x07 | 0x00 |

# CBX COMMAND 0X08: TAG SEARCH

## Command 0x08 - Description

The *Tag Search Command* instructs the controller to search for the presence of a tag within RF range of the antenna. If the controller finds a tag it will return a *Command Response* to the host. If a tag is not located before the Timeout Value expires, an error will be returned.

## Command 0x08 - CBx Example

This example instructs the controller at Node 01 to search for the presence of a tag within RF range of the antenna. A *Timeout Value* of 2 seconds (*0x07D0 = 2000 x one-millisecond increments*) is set for the completion of the command.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x08*) | 0xAA | 0x08 |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x01 |
| **Timeout Value** | 0x07 | 0xD0 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |

## Response from Controller (Tag Found)

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command Echo** in LSB | **0xAA** | 0x08 |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19$^{th}$*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*:36 seconds*). **0x00** in LSB | 0x24 | 0x00 |

## Response from Controller (Tag Not Found)

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x07 |
| **Error Flag** in MSB: (*0xFF*).<br>**Error Information Byte** in LSB.<br>0xFF in the LSB indicates that a controller-based error occurred. Any value other than 0xFF indicates that a Gateway/Hub-based error occurred (and identifies the command that was attempted when the error occurred). | **0xFF** | 0xFF |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*:36 seconds*).<br>**Additional Data Length** in LSB: (*0x01*) | 0x24 | 0x01 |
| **Error Code** in MSB (*0x07 = "Tag Not Found"*). **0x00** in LSB | 0x07 | 0x00 |

# CBX COMMAND 0X0C: EXECUTE MACRO

## Command 0x0C - Description

The *Execute Macro Command* is used to perform one of the controller's eight possible macros.

To design your own RFID command macros, use the C-Macro™ Builder software tool.

The value 0x00 in the *Macro Number* means stop all macro execution.

## Command 0x0C - CBx Example

This example instructs the controller at Node 01 to execute *Macro #1*.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x0C)* | 0xAA | 0x0C |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x01 |
| **Macro Number** in MSB: (*01 - 08*)<br>**0x00** in LSB | 0x01 | 0x00 |
| **Not Used:** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used:** (*0x00, 0x00*) | 0x00 | 0x00 |

## Response from Controller

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x0C |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19$^{th}$*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*:36 seconds*). **0x00** in LSB | 0x24 | 0x00 |

# CBX COMMAND 0X0D: START CONTINUOUS READ

## Command 0x0D - Description

The *Start Continuous Read Command* instructs the controller to begin (or stop, when evoked) the continual reading of any tag that enters RF range.

When the controller is in *Continuous Read* mode, it will constantly emit RF energy in an attempt to read any tag that comes into range of the antenna. As a tag enters the antenna field, it is immediately read and the data is passed to the host. The controller will continue to read the tag but will not re-send the same data to the host until the tag has moved outside the RF field for a specified time period. This parameter is known as the *Duplicate Read Delay*, which prevents redundant data transmissions when the controller is in Continuous Read mode.

If another RFID command is executed while the controller is in *Continuous Read* mode, the Controller will temporarily stop continuous reading to execute the command, after which the controller will return to *Continuous Read* mode.

The *Continuous Read* command contains three primary components: a *Start Address*, a *Block Size* and a *Duplicate Read Delay* value.

**Start Address**: The *Start Address* is a 2-byte integer indicating the tag address location where the read will begin.

**Block Size**: The *Block Size* is a 2-byte integer that represents the number of tag data bytes to retrieve. By setting this parameter to one (*0x0001*) or higher, *Continuous Read* mode will be switched ON at the completion of the command. Setting the *Block Size* to zero (*0x0000*) will disable or turn *Continuous Read* mode off.

**Duplicate Read Delay**: During *Continuous Read* mode, any tag that comes within range of the antenna will be constantly read and the requested data from the tag will be passed to the host. This single-byte delay parameter indicates the number of seconds that a tag must remain out of RF range before it can be re-read and have its data sent to the host for a second time. It is implemented to enable the operator to limit the volume of information sent by the controller. The *Duplicate Read Delay* parameter can have a value of 0 to 60 seconds. When the *Duplicate Read Delay* value is set to zero, the controller will continuously read AND transmit duplicate tag data to the host.

## Continuous Read at Power-up

By default, *Continuous Read* mode is not restarted if the controller is reset. However, through the use of the *Dashboard™ Utility,* the controller can be configured to enter *Continuous Read* mode automatically after a reset or power-up. For more information regarding the Balluff Dashboard™ Utility, visit the website at *www.balluff.com*.

## Command 0x0D - CBx Example

This example places the controller at Node 01 in *Continuous Read* mode and retrieves 4 bytes of data from the tag starting at address 0x0001. The *Duplicate Read Delay* is set to 2 seconds (*0x02 = 2 x 1 second increments*).

## Command from Host (Starting Continuous Read)

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command**: (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x0D*) | 0xAA | 0x0D |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x01 |
| **0x00** in MSB, **Duplicate Read Delay** in LSB | 0x00 | 0x02 |
| **Start Address** | 0x00 | 0x01 |
| **Block Size** (*in bytes*) | 0x00 | 0x04 |

## Response from Controller (Continuous Read Evoked)

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x08 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x0D |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*:36 seconds*).<br>**Additional Data Length** in LSB: (*0x04*) | 0x24 | 0x04 |
| **Read Data** (*bytes 1 & 2*) | 0x05 | 0xAA |
| **Read Data** (*bytes 3 & 4*) | 0xE7 | 0x0A |

To exit out of Continuous Read mode, re-issue the command with zero (0x0000) for the Block Size.

## Command from Host (Stopping Continuous Read)

| Parameter Field | MSB | LSB |
|---|---|---|
| CBx Header in MSB, Node ID in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB (*0x0D*) | 0xAA | 0x0D |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x01 |
| **0x00** in MSB, **Duplicate Read Delay** in LSB | 0x00 | 0x02 |
| **Start Address** | 0x00 | 0x00 |
| **Block Size** (*in bytes*) | 0x00 | 0x00 |

## Response from Controller (Continuous Read Stopped)

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x0D |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:12: AM*) | 0x0A | 0x0C |
| **Seconds** Timestamp in MSB: (*:36 seconds*). **0x00** in LSB | 0x24 | 0x00 |

## Continuous Read Mode Controller LED Behavior

| LED | Behavior | Description |
|---|---|---|
| READY | ON | Controller is powered and functioning |
| COM | ON | Duplicate Read Delay ≥ 1 and a tag has entered the RF field. COM LED will remain ON while a tag is in the RF field.<br>After the tag has exited the RF field the COM light will remain ON for the duration of the Duplicate Read Delay before turning OFF. |
| COM | BLINKING | Duplicate Read Delay = 0 and a tag is in the RF field |
| RF | ON | Continuous Read mode is enabled |

**Table 2-2: Continuous Read Mode LED Behavior**

# CBX COMMAND 0X0E: READ TAG ID AND DATA

## Command 0x0E - Description

The *Read Tag ID and Data Command* instructs the RFID controller to retrieve a tag's unique identification (*Tag ID*) number followed by the requested data. The minimum *Block Size* for read operations is one byte, the maximum *Block Size* for read operations is 1024 bytes or the entire read/write address space of the tag (minus the number of tag ID bytes), whichever is less.

## Command 0x0E - CBx Example

This example instructs the controller at Node 01 to retrieve the tag ID and two bytes beginning at address 0x0001 from a tag within range of the controller. A *Timeout Value* of 2 seconds (*0x07D0 = 2000 x one-millisecond increments*) is set for the completion of the command. In this example the tag ID number retrieved is *E0040100002E16AD*.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x0E*) | 0xAA | 0x0E |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x01 |
| **Timeout Value** (*measured in ms*) | 0x07 | 0xD0 |
| **Start Address** | 0x00 | 0x01 |
| **Block Size** | 0x00 | 0x02 |

## Response from Controller

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 + number of additional words retrieved |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x0E |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*:36 seconds*).<br>**Additional Data Length** in LSB: (*0x0A*) | 0x24 | 0x0A |
| **Tag ID** (*bytes 1 and 2*) | 0xE0 | 0x04 |
| **Tag ID** (*bytes 3 and 4*) | 0x01 | 0x00 |
| **Tag ID** (*bytes 5 and 6*) | 0x00 | 0x2E |
| **Tag ID** (*bytes 7 and 8*) | 0x16 | 0xAD |
| **Returned Data** (*bytes 1 and 2*) | 0x01 | 0x02 |

# CBX COMMAND 0X0F: START CONTINUOUS READ TAG ID AND DATA

## Command 0x0F - Description

The *Start Continuous Read Tag ID and Data Command* instructs the controller to repeatedly attempt to retrieve the tag ID and a specified number of tag data bytes from any tag that enters RF range. This command is similar to *Command 0x0D*; however, *Command 0x0F* additionally retrieves the tag's ID number.
This command contains four primary parameters: *Start Address*, *Block Size, Start/Stop Flag,* and *Duplicate Read Delay*.

**Start/Stop Flag**: By setting the single-byte *Start/Stop Flag* parameter to one (*0x01*), continuous read mode will be switched ON upon execution of the command. Setting the parameter value back to zero (*0x00*) and re-issuing the command will turn continuous read mode OFF.

**Duplicate Read Delay**: The *Duplicate Read Delay* is a single-byte value representing the number of seconds that a tag must remain OUT of RF range before it can be re-read and have its data sent to the host for a second time. It is used to limit or prevent the volume of redundant information that is transmitted while the controller is performing continuous reads. The parameter can have a value of 00 to 60 seconds (*0x00 – 0x3C*).
For example, when the *Duplicate Read Delay* is set to two (0x02), a tag that has already been read must exit the antenna's RF field for at least two seconds before the controller will recognize it again and re-send its data to the host. When the value is set to zero, the controller will continuously read AND transmit duplicate tag data to the host.

**Start Address**: The *Start Address* is a 2-byte integer indicating the tag address location where the read operation will begin.

**Block Size**: The *Block Size* is a 2-byte integer that represents the number of tag data bytes to retrieve, beginning at the specified *Start Address* location.

## Command 0x0F - CBx Example

This example places the controller at Node 01 into *Continuous Read Tag ID and Data* mode, retrieves the tag ID number and reads four bytes of data starting at address 0x0001 from any tag within range. The *Duplicate Read Delay* is set for 2 seconds (*0x02 = 2 x 1 second increments*).

## Command from Host (Starting Continuous Read)

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x0F*) | 0xAA | 0x0F |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x01 |
| **Start/Stop Flag** in MSB (*0x01 = START, 0x00 = STOP*)<br>**Duplicate Read Delay** in LSB (*measured in seconds*) | **0x01** | 0x02 |
| **Start Address** | 0x00 | 0x01 |
| **Block Size** | 0x00 | 0x04 |

## Response from Controller (Continuous Read Evoked)

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x0C |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x0F |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*:36 seconds*)<br>**Additional Data Length** in LSB: (*12 bytes*) | 0x24 | 0x0C |
| **Tag ID** (*bytes 1 and 2*) | 0xE0 | 0x04 |
| **Tag ID** (*bytes 3 and 4*) | 0x01 | 0x00 |
| **Tag ID** (*bytes 5 and 6*) | 0x00 | 0x10 |
| **Tag ID** (*bytes 7 and 8*) | 0x09 | 0x61 |
| **Returned Data** (*bytes 1 and 2*) | 0x01 | 0x02 |
| **Returned Data** (*bytes 3 and 4*) | 0x03 | 0x04 |

To exit out of Continuous Read Tag ID and Data mode, re-issue the command with zero (0x00) in the *Start/Stop Flag* field.

## Command from Host (Stopping Continuous Read)

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB (*0x0F*) | 0xAA | 0x0F |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x01 |
| **Start/Stop Flag** in MSB (*0x01 = START, 0x00 = STOP*)<br>**Duplicate Read Delay** in LSB | **0x00** | 0x02 |
| **Start Address** | 0x00 | 0x01 |
| **Block Size** (*in bytes*) | 0x00 | 0x00 |

## Response from Controller (Continuous Read Stopped)

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x0F |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19$^{th}$*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*:36 seconds*). **0x00** in LSB | 0x24 | 0x00 |

# CBX COMMAND 0X10: GET GATEWAY/HUB SOFTWARE VERSION

## Command 0x10 - Description

The *Get Gateway/Hub Software Version Command* is used to retrieve the version number of the firmware code installed on the Gateway/Hub.

## Command 0x10 - CBx Example

This example retrieves the software version from an Industrial Hub interface module.
The software version retrieved in this example is the 20-byte string: 48 55 42 2D 30 34 2D 49 4E 44 2D 30 31 20 76 31 2E 31 2E 47, which correspond to the ASCII characters: HUB-04-IND-01 v1.1.G.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x10*) | 0xAA | 0x10 |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x20 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |

## Response from Gateway/Hub

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Response** (*in words*) | 0x00 | 0x10 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x10 |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x20 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*:36 seconds*).<br>**Additional Data Length** in LSB: (*20 bytes*) | 0x24 | 0x14 |
| **Software Version Character**: bytes 1 and 2 | 0x48 <H> | 0x55 <U> |
| **Software Version Character**: bytes 3 and 4 | 0x42 <B> | 0x2D <-> |
| **Software Version Character**: bytes 5 and 6 | 0x30 <0> | 0x34 <4> |
| **Software Version Character**: bytes 7 and 8 | 0x2D <-> | 0x49 <I> |
| **Software Version Character**: bytes 9 and 10 | 0x4E <N> | 0x44 <D> |
| **Software Version Character**: bytes 11 and 12 | 0x2D <-> | 0x30 <0> |
| **Software Version Character**: bytes 13 and 14 | 0x31 <1> | 0x20 <space> |
| **Software Version Character**: bytes 15 and 16 | 0x76 <v> | 0x31 <1> |
| **Software Version Character**: bytes 17 and 18 | 0x2E <.> | 0x31 <1> |
| **Software Version Character**: bytes 19 and 20 | 0x2E <.> | 0x47 <G> |

# CBX COMMAND 0X11: GET GATEWAY/HUB NAME

## Command 0x11 - Description

The *Get Gateway/Hub Name Command* is used to retrieve the Gateway/Hub's user-defined ASCII name.

## Command 0x11 - CBx Example

This example retrieves the user-defined name from an Industrial Hub interface module.
The name retrieved in this example is the 11-byte string: 48 55 42 20 49 4E 44 20 48 55 42, which correspond to the ASCII characters: HUB IND HUB.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x11*) | 0xAA | 0x11 |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x20 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |

## Response from Gateway/Hub

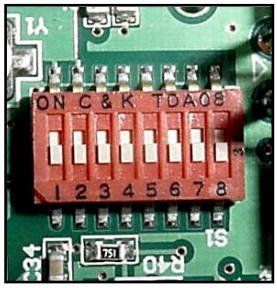
| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Response** (*in words*) | 0x00 | 0x0C |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x11 |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x20 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB (*:36 seconds*).<br>**Additional Data Length** in LSB: (*11 bytes*) | 0x24 | 0x0B |
| **Hub Name Data Bytes**: bytes 1 and 2 | 0x48 <H> | 0x55 <U> |
| **Hub Name Data Bytes**: bytes 3 and 4 | 0x42 <B> | 0x20 <space> |
| **Hub Name Data Bytes**: bytes 5 and 6 | 0x49 <I> | 0x4E <N> |
| **Hub Name Data Bytes**: bytes 7 and 8 | 0x44 <D> | 0x20 <space> |
| **Hub Name Data Bytes**: bytes 9 and 10 | 0x48 <H> | 0x55 <U> |
| **Hub Name Data Byte**: byte 11<br>**0x00** in LSB | 0x42 <B> | 0x00 |

# CBX COMMAND 0X12: GET DIPSWITCH SETTINGS

## Command 0x12 - Description

The *Get Dipswitch Settings Command* is used to retrieve the status of the Gateway/Hub's three main configuration dipswitches.

The resulting response for this command will include a 1-byte value representing the current settings of dipswitches 1-3. Of this one byte, the lowest 3 bits represent the ON/OFF status of dipswitches 1 - 3 (dipswitches 4 - 8 are not applicable and should not be altered).




## Command 0x12 - CBx Example

This example retrieves the dipswitch settings from an Industrial Hub interface module.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x12*) | 0xAA | 0x12 |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x20 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |

## Response from Gateway/Hub

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Response** (*in words*) | 0x00 | 0x07 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x12 |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x20 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*:36 seconds*).<br>**Additional Data Length** in LSB: (*one byte*) | 0x24 | 0x01 |
| **Dipswitch Settings Value** in MSB. **0x00** in LSB | 0x03 | 0x00 |

The dipswitch settings value “0x03” was retrieved in the above example, meaning that dipswitches 1 and 2 are ON.

## Dipswitch Settings Value Definition Table

| Dipswitch Settings Value | Description |
|---|---|
| 0x00 | Dipswitches 1-3 are OFF |
| 0x01 | Dipswitch 1 is ON |
| 0x02 | Dipswitch 2 is ON |
| 0x03 | Dipswitch 1 and 2 are ON |
| 0x04 | Dipswitch 3 is ON |
| 0x05 | Dipswitch 1 and 3 are ON |
| 0x06 | Dipswitch 2 and 3 are ON |
| 0x07 | All 3 Dipswitches are ON |

**Table 2-3: Dipswitch Settings Value Definitions**

# CBX COMMAND 0X13: GET NODE STATUS LIST

## Command 0x13 - Description

The *Get Node Status List Command* is used to retrieve the operational status of the Gateway/Hub's Subnet Nodes. The response will include a list containing a number of individual *Node Status Bytes* (16 for the Gateway, 4 for the Hub), where each byte indicates the status for the corresponding Node ID.

## Command 0x13 – CBx Example

This example retrieves the *Node Status List* from a Gateway interface module.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB. **Command ID** in LSB: (*0x13*) | 0xAA | 0x13 |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x20 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |

## Response from Gateway/Hub

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Response** (*in words*) | 0x00 | 0x0E |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x13 |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | 0x20 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*36 seconds*).<br>**Additional Data Length** in LSB: (*4 bytes*) | 0x24 | 0x04 |
| **Status for Node ID** 1 and 2 | 0x04 | 0x04 |
| **Status for Node ID** 3 and 4 | 0x04 | 0x04 |
| **Status for Node ID** 5 and 6 | 0x04 | 0x04 |
| **Status for Node ID** 7 and 8 | 0x04 | 0x04 |
| **Status for Node ID** 9 and 10 | 0x04 | 0x04 |
| **Status for Node ID** 11 and 12 | 0x04 | 0x04 |
| **Status for Node ID** 13 and 14 | 0x04 | 0x04 |
| **Status for Node ID** 15 and 16 | 0x04 | 0x04 |

In the above example response, all sixteen nodes report "*0x04 – Controller Healthy*."

## Node Status Byte Definition Table

| Node Status Byte | Node Status | Description |
|---|---|---|
| 0x00 | CONTROLLER INACTIVE | No controller has responded to a poll at this Node ID for at least 40 seconds.<br>If a controller does eventually respond at this Node ID, its status will be changed to “0x04 - CONTROLLER HEALTHY” |
| 0x01 | CONTROLLER STOPPED RESPONDING | The controller at this Node ID has not responded to a poll in over 10 seconds.<br>If the controller does not respond to a poll within another 30 seconds, its status will be changed to “0x00 - CONTROLLER INACTIVE”<br>If the controller does respond to a poll, its status will be changed back to “0x04 - CONTROLLER HEALTHY” |
| 0x02 | CONTROLLER HAS PROBLEM | The controller at this Node ID has missed at least 3 consecutive polls.<br>If the controller does not respond to a poll within another 10 seconds, its status will be changed to “0x01 - CONTROLLER STOPPED RESPONDING”<br>If the controller does respond to a poll, its status will be changed back to “0x04 - CONTROLLER HEALTHY” |
| 0x03 | CONTROLLER EXPECTED SOON | This Node Status indicates that a controller is temporarily disconnected or that it is being moved to another Node ID to another.<br>Because a controller is “expected” to appear soon, the Gateway/Hub will poll this Node more frequently than other ‘inactive’ nodes. |
| 0x04 | CONTROLLER HEALTHY | The controller is healthy and responding to polls. However, if the controller misses 3 consecutive polls, its status will be changed to “0x02 - CONTROLLER HAS PROBLEM.” |
| 0x05 | CONTROLLER DOWNLOADING | This status is only applied to a controller that is currently downloading and installing new firmware to its flash memory.<br>To optimize polling and allow for the fastest possible firmware installation, the Hub will temporarily halt the polling of this node until the controller has finished its installation. |

**Table 2-4: Node Status Byte Definitions**

# CBX COMMAND 0X14: GET NOTIFICATION MASK

## Command 0x14 - Description

The *Get Notification Mask Command* is used to retrieve the user-defined 16-bit "*Notification Mask*" that determines for which events the Gateway/Hub notifies the host PC.

The lowest 13 bits of the Notification Mask identify whether a *Notification Message* is enabled (1 = ON) or disabled (0 = OFF) when a particular *Notification Event* occurs.

**NOTE**

*For more information regarding the Notification Mask, see Command 0x24: Set Notification Mask.*

## Command 0x14 - CBx Example

This example retrieves the *Notification Mask* from an Industrial Hub interface module.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x14*) | 0xAA | 0x14 |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x20 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |

## Response from Gateway/Hub

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Response** (*in words*) | 0x00 | 0x07 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x14 |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x20 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB (*:36 seconds*).<br>**Additional Data Length** in LSB: (*2 bytes*) | 0x24 | 0x02 |
| **16-bit Notification Mask** | 0x1F | 0xFF |

In the above example response, the Notification Mask is 0x1FFF, meaning that all 13 Notification Messages are enabled.

## Notification Message Table

The following table lists the 13 Notification Messages, their bit mask values and contains a description of the Notification Event that can be set to trigger the notification.

| Bit | Notification Message | Notification Event Description |
|---|---|---|
| 1 | CONTROLLER IS HEALTHY | Sent whenever the status of a controller changes to 'Healthy' |
| 2 | CONTROLLER HAS PROBLEM | Sent whenever a controller is marked 'Has Problem' |
| 3 | CONTROLLER STOPPED RESPONDING | Sent whenever a controller is marked 'Stopped Responding' |
| 4 | CONTROLLER DEACTIVATED | Sent whenever a controller is deactivated (is marked 'Inactive') |
| 5 | CONTROLLER MISSED POLL | Sent whenever a controller misses a poll |
| 6 | CONTROLLER ADDRESS CONFLICT | Sent whenever the Gateway/Hub detects a Node ID conflict |
| 7 | CONTROLLER CONFIGURATION FAILURE | Sent whenever the Gateway/Hub fails to configure a controller |
| 8 | TAG PRESENT AT NODE * | Sent whenever a tag is first recognized in the RF field of the specified node |
| 9 | TAG NOT PRESENT AT NODE * | Sent whenever a tag is no longer recognized within or has exited the RF field of the specified node |
| 10 | INPUT SET (Hub only) | Sent when one of the Hub's four Inputs has been set |
| 11 | INPUT CLEARED (Hub only) | Sent when one of the Hub's four Inputs has been cleared |
| 12 | OUTPUT SET (Hub only) | Sent when one of the Hub's four Outputs has been set |
| 13 | OUTPUT CLEARED (Hub only) | Sent when one of the Hub's four Outputs has been cleared |

**Table 2-5: Notification Message Table**

* - *Tag Presence* must be **enabled** on the RFID controller.

**NOTE**

*The Gateway only supports Notification Messages 1 – 9. Notification Messages 10 – 13 pertain to the status of the RFID Controller or Hub's Digital Inputs and Outputs.*

# CBX COMMAND 0X15: GET LAST GATEWAY/HUB ERROR

## Command 0x15 - Description

The *Get Last Gateway/Hub Error Command* is used to retrieve information from the Gateway/Hub regarding the last or most recent error that was experienced by the Gateway/Hub or one of its RFID controllers on the Subnet16 network.
The generated response will include 1-byte values for the error code and the Node ID of the device that experienced the error, and may contain an additional text string of further information ("*Error Details*"). When the Gateway/Hub is power cycled, any stored error information will be deleted.

## Command 0x15 - Description

This example retrieves from an Industrial Hub interface module data concerning the most recent error experienced.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x15*) | 0xAA | 0x15 |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x20 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |

## Response from Gateway/Hub

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Response** (*in words*) | 0x00 | 0x12 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x15 |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x20 |
| **Error Code** in MSB.<br>**Error Node** (device that experienced the error) in LSB | 0x8A | 0x04 |
| **Error Hour** and **Minute** Timestamp: (*2:07:PM*) | 0x0E | 0x07 |
| **Error Seconds** Timestamp in MSB: (*:52 seconds*).<br>**Additional Data Length** in LSB: (*23 bytes*) | 0x34 | 0x17 |
| **Error Details Returned Data**: bytes 1 and 2 | 0x53 <S> | 0x75 <u> |
| **Error Details Returned Data**: bytes 3 and 4 | 0x62 <b> | 0x6E <n> |
| **Error Details Returned Data**: bytes 5 and 6 | 0x65 <e> | 0x74 <t> |
| **Error Details Returned Data**: bytes 7 and 8 | 0x20 <space> | 0x52 <R> |
| **Error Details Returned Data**: bytes 9 and 10 | 0x65 <e> | 0x73 <s> |
| **Error Details Returned Data**: bytes 11 and 12 | 0x70 <p> | 0x6F <o> |
| **Error Details Returned Data**: bytes 13 and 14 | 0x6E <n> | 0x73 <s> |
| **Error Details Returned Data**: bytes 15 and 16 | 0x65 <e> | 0x20 <space> |
| **Error Details Returned Data**: bytes 17 and 18 | 0x54 <T> | 0x69 <i> |
| **Error Details Returned Data**: bytes 19 and 20 | 0x6D <m> | 0x65 <e> |
| **Error Details Returned Data**: bytes 21 and 22 | 0x6F <o> | 0x75 <u> |
| **Error Details Returned Data**: byte 23. 0x00 in LSB | 0x74 <t> | 0x00 |

In the above example response, error code 0x8A was reported on Node ID 04 at 2:07:52 P.M. Error Details = "Subnet Response Timeout."

# CBX COMMAND 0X16: GET GATEWAY/HUB TIME

## Command 0x16 - Description

The *Get Gateway/Hub Time Command* is used to retrieve the current date and time as set internally on the Gateway/Hub. Date and time are returned in the following format:
Year MSB:LSB (2-byte Integer)
Month (byte), Day of Month (byte)
Hour (byte), Minute (byte)
Seconds (byte)

## Command 0x16 – CBx Example

This example retrieves the date and time from an Industrial Hub interface module.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x16*) | 0xAA | 0x16 |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x20 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |

## Response from Gateway/Hub

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Response** (*in words*) | 0x00 | 0x0A |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x16 |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x20 |
| **Month** and **Day** Timestamp: (*May 23*) | 0x05 | 0x17 |
| **Hour** and **Minute** Timestamp: (*2:08 PM*) | 0x0E | 0x08 |
| **Seconds** Timestamp in MSB: (*:03 seconds*).<br>**Additional Data Length** in LSB: (*7 bytes*) | 0x03 | 0x07 |
| **Year**: (*2007*) | 0x07 | 0xD7 |
| **Month** and **Day**: (*May 23*) | 0x05 | 0x17 |
| **Hours** and **Minutes**: (*2:08 P.M*) | 0x0E | 0x08 |
| **Seconds** in MSB: (*:03 seconds*). **0x00** in LSB | 0x03 | 0x00 |

In the above example response, the date and time retrieved is:

2007, May 23, 14:08:03

# CBX COMMAND 0X1A: GET DIGITAL INPUTS

## Command 0x1A - Description

The *Get Digital Inputs Command* is used to retrieve the 8-bit *Digital Input State* value, which identifies the status of the device's digital input(s). Currently HF and UHF I/O model controllers as well as the Hubs are equipped with one or more Digital Inputs.
See the *Digital Input State Table* on the following page for definitions.

## Command 0x1A – CBx Example

This example retrieves the status of the four Hub Inputs.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x1A*) | 0xAA | 0x1A |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x20 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |

## Response from Device

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Response** (*in words*) | 0x00 | 0x07 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x1A |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x20 |
| **Month** and **Day** Timestamp: (*May 23*) | 0x05 | 0x17 |
| **Hour** and **Minute** Timestamp: (*2:08 PM*) | 0x0E | 0x08 |
| **Seconds** Timestamp in MSB (*:03 seconds*).<br>**Additional Data Length** in LSB: (*2 bytes*) | 0x03 | 0x02 |
| **0x00** in MSB.<br>**Digital Input State** in LSB: (*lowest four bits indicate the state of the Hub's Digital Inputs: 0x0F = all four Hub Inputs are set*). | 0x00 | 0x0F |

## Digital Input State Table

| LSB | BINARY VALUE | | RESULT |
|---|---|---|---|
| | always zero | Inputs<br>**D C B A** | |
| 0x0F | 0 0 0 0 | 1 1 1 1 | all Digital Inputs (hub) = Set |
| … | … | … | … |
| 0x04 | 0 0 0 0 | 0 1 0 0 | only Input C (hub) = Set |
| 0x03 | 0 0 0 0 | 0 0 1 1 | only Input A and B (hub) = Set |
| 0x02 | 0 0 0 0 | 0 0 1 0 | only Input B (hub) = Set |
| 0x01 | 0 0 0 0 | 0 0 0 1 | Digital Input 1 (controller) or Input A (hub) = Set<br>Input B, C, D (hub) = Clear |
| 0x00 | 0 0 0 0 | 0 0 0 0 | Digital Input 1 (controller) = Clear<br>all Digital Inputs (hub) = Clear |

**Table 2-6: Digital Input State**

# CBX COMMAND 0X1B: GET DIGITAL OUTPUTS

## Command 0x1B - Description

The *Get Digital Outputs Command* is used to retrieve the 8-bit *Digital Output State* value, which identifies the status of the device's digital outputs. Currently HF and UHF I/O model controllers as well as the Hubs are equipped with two or more Digital Outputs.
See the *Digital Output State Table* on the following page for definitions.

## Command 0x1B – CBx Example

This example retrieves the status of the four Hub Outputs.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x1B*) | 0xAA | 0x1B |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x20 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |

## Response from Device

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Response** (*in words*) | 0x00 | 0x07 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x1B |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x20 |
| **Month** and **Day** Timestamp: (*May 23*) | 0x05 | 0x17 |
| **Hour** and **Minute** Timestamp: (*2:08 PM*) | 0x0E | 0x08 |
| **Seconds** Timestamp in MSB (*:03 seconds*).<br>**Additional Data Length** in LSB: (*2 bytes*) | 0x03 | 0x02 |
| **0x00** in MSB.<br>**Digital Output State** in LSB: (*lowest four bits indicate the state of the Hub's Digital Outputs: 0x0F = all four Hub Outputs are set*). | 0x00 | 0x0F |

## Digital Output State Table

| LSB | BINARY VALUE | | RESULT |
|---|---|---|---|
| | always zero | Outputs<br>**D C B A** | |
| 0x0F | 0 0 0 0 | 1 1 1 1 | all Digital Outputs (hub) = Set |
| … | … | … | … |
| 0x04 | 0 0 0 0 | 0 1 0 0 | only Output C (hub) = Set |
| 0x03 | 0 0 0 0 | 0 0 1 1 | Digital Output 1 (controller) or Output A (hub) = Set<br>Digital Output 2 (controller) or Output B (hub) = Set<br>Output C, D (hub) = Clear |
| 0x02 | 0 0 0 0 | 0 0 1 0 | Digital Output 1 (controller) or Output A (hub) = Clear<br>Digital Output 2 (controller) or Output B (hub) = Set<br>Output C, D (hub) = Clear |
| 0x01 | 0 0 0 0 | 0 0 0 1 | Digital Output 1 (controller) or Output A (hub) = Set<br>Digital Output 2 (controller) or Output B (hub) = Clear<br>Output C, D (hub) = Clear |
| 0x00 | 0 0 0 0 | 0 0 0 0 | all Digital Outputs (controller) = Clear<br>all Digital Outputs (hub) = Clear |

**Table 2-7: Digital Output State**

# CBX COMMAND 0X1C: GET SUBNET BAUD RATE

## Command 0x1C - Description

The *Get Subnet Baud Rate Command* is used to retrieve the baud rate of the Subnet network. The response will contain a one-byte *Baud Rate Index Value* that indicates the current baud rate of the Subnet. See the *Baud Rate Index Table* of the following page for definitions.

## Command 0x1C – CBx Example

This example retrieves the baud rate of the Subnet network.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x1C*) | 0xAA | 0x1C |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x20 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |

## Response from Gateway/Hub

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Response** (*in words*) | 0x00 | 0x07 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x1C |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x20 |
| **Month** and **Day** Timestamp: (*May 23*) | 0x05 | 0x17 |
| **Hour** and **Minute** Timestamp: (*2:08 PM*) | 0x0E | 0x08 |
| **Seconds** Timestamp in MSB (*:03 seconds*).<br>**Additional Data Length** in LSB: (*one byte*) | 0x03 | 0x01 |
| **Baud Rate Index Value** in MSB: (*0x00 = 9600 baud*). 0x00 in LSB | 0x00 | 0x00 |

## Baud Rate Index Table

| Baud Rate | Index Value |
|---|---|
| 9600 Baud | 0x00 |
| 19200 Baud | 0x01 |
| 38400 Baud | 0x02 |
| 57600 Baud | 0x03 |
| 115200 Baud | 0x04 |

**Table 2-8: Baud Rate Index**

# CBX COMMAND 0X21: SET GATEWAY/HUB NAME

## Command 0x21 - Description

The *Set Gateway/Hub Name Command* is used to write to flash memory, a user-defined "friendly" name for the Gateway/Hub. The Gateway/Hub name can contain up to 64 bytes of data.

## Command 0x21 - CBx Example

This example sets the user-defined Hub name to DLA IND HUB1.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x0C (0x06 + number words in Gateway/Hub name) |
| **0xAA** in MSB, **Command ID** in LSB: (*0x21*) | 0xAA | 0x21 |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x20 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **0x00** in MSB<br>**Hub Name Length** (in bytes) in LSB: (*12 bytes*) | 0x00 | 0x0C |
| **Hub Name Data** (ASCII characters 1 & 2) | 0x44 <D> | 0x4C <L> |
| **Hub Name Data** (ASCII characters 3 & 4) | 0x41 <A> | 0x20 <space> |
| **Hub Name Data** (ASCII characters 5 & 6) | 0x49 <I> | 0x4E <N> |
| **Hub Name Data** (ASCII characters 7 & 8) | 0x44 <D> | 0x20 <space> |
| **Hub Name Data** (ASCII characters 9 & 10) | 0x48 <H> | 0x55 <U> |
| **Hub Name Data** (ASCII characters 11 & 12) | 0x42 <B> | 0x31 <1> |

## Response from Gateway/Hub

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x21 |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x20 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*:36 seconds*). **0x00** in LSB | 0x24 | 0x00 |

# CBX COMMAND 0X24: SET NOTIFICATION MASK

## Command 0x24 - Description

The *Set Notification Mask Command* is used to modify and save changes to the Gateway/Hub's 16-bit Notification Mask. Stored in flash memory, the user-defined Notification Mask determines for which events the Gateway/Hub sends a *Notification Message* to the host.

Notification Messages are small host-bound informational packets of data that are issued by a Gateway/Hub when a specified *Notification Event* occurs within the Gateway/Hub or on the Subnet16™ network.

The Gateway/Hub stores 9 different Notification Messages internally. The Hub stores an additional 4 Notification Messages relative to its Inputs/Outputs. See the Notification Message Table below.

## Notification Message Table

The following table lists the Notification Messages, their bit mask values and contains a description of the Notification Event that can be set to trigger the notification.

| Bit | Notification Message | Notification Event Description |
|---|---|---|
| 1 | CONTROLLER IS HEALTHY | Sent whenever the status of a controller changes to 'Healthy' |
| 2 | CONTROLLER HAS PROBLEM | Sent whenever a controller is marked 'Has Problem' |
| 3 | CONTROLLER STOPPED RESPONDING | Sent whenever a controller is marked 'Stopped Responding' |
| 4 | CONTROLLER DEACTIVATED | Sent whenever a controller is deactivated (is marked 'Inactive') |
| 5 | CONTROLLER MISSED POLL | Sent whenever a controller misses a poll |
| 6 | CONTROLLER ADDRESS CONFLICT | Sent whenever the Gateway/Hub detects a Node ID conflict |
| 7 | CONTROLLER CONFIGURATION FAILURE | Sent whenever the Gateway/Hub fails to configure a controller |
| 8 | TAG PRESENT AT NODE * | Sent whenever a tag is first recognized in the RF field of the specified node |
| 9 | TAG NOT PRESENT AT NODE * | Sent whenever a tag is no longer recognized within or has exited the RF field of the specified node |
| 10 | INPUT SET (Hub only) | Sent when one of the Hub's four Inputs has been set |
| 11 | INPUT CLEARED (Hub only) | Sent when one of the Hub's four Inputs has been cleared |
| 12 | OUTPUT SET (Hub only) | Sent when one of the Hub's four Outputs has been set |
| 13 | OUTPUT CLEARED (Hub only) | Sent when one of the Hub's four Outputs has been cleared |

**Table 2-9: Notification Message Table**

* - *Tag Presence* must be **enabled** on the RFID controller.

**NOTE**

*The Gateway only supports Notification Messages 1 – 9. Notification Messages 10 – 13 pertain to the status of the Hub's Digital Inputs and Outputs.*

Notification Messages are enabled or disabled by setting the corresponding bit within the 16-bit Notification Mask. Bits 01 through 13 each represent one of the Notification Messages. A bit is either set to "1" (ON = enabled) or "0" (OFF = disabled). If a bit is turned ON, the corresponding Notification Message will be generated when the specified event occurs. See par. 1.4 for details on Notification Event Messages.

By default, all Notification Messages are enabled (i.e. the 16-bit Notification Mask is 0x1FFF).

16-bit Notification Mask - Binary Representation - when enabling all 13 Notification Messages:

(0 0 0 1 1 1 1 1) (1 1 1 1 1 1 1 1) = 0x1FFF

[Bit 16 - - Bit 09] [Bit 08 - - Bit 01]

To disable all 13 Notification Messages, set the Notification Mask to 0x0000.

## Command 0x24 - CBx Example

This example sets the user-defined Notification Mask to 0x1FFF, which enables all 13 Notification Messages.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x07 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x24*) | 0xAA | 0x24 |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x20 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **0x00** in MSB. **Notification Mask Length** in LSB: (*2 bytes*) | 0x00 | 0x02 |
| **16-bit Notification Mask** | 0x1F | 0xFF |

## Response from Gateway/Hub

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x24 |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x20 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*:36 seconds*). **0x00** in LSB: | 0x24 | 0x00 |

# CBX COMMAND 0X26: SET GATEWAY/HUB TIME

## Command 0x26 - Description

The *Set Gateway/Hub Time Command* is used to set the Gateway/Hub's internal clock and calendar. Date and time are specified in the following format:
Year MSB:LSB (2-byte Integer)
Month (byte), Day of Month (byte)
Hour (byte), Minute (byte)
Seconds (byte)

## Command 0x26 - CBx Example

This example sets the date and time of the Hub to that of the host PC, which, in this example, is *2007, May 23, 3:19:44 PM*.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x0A |
| **0xAA** in MSB, **Command ID** in LSB: (*0x26*) | 0xAA | 0x26 |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x20 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **0x00** in MSB<br>**Time/Date Data Length** in LSB: (*7 bytes*) | 0x00 | 0x07 |
| **Year**: (*2007*) | 0x07 | 0xD7 |
| **Month** and **Day**: (*May 23*) | 0x05 | 0x17 |
| **Hour** and **Minute**: (*3:19 PM*) | 0x0F | 0x13 |
| **Seconds** in MSB: (*:44 seconds*). **0x00** in LSB | 0x2C | 0x00 |

## Response from Gateway/Hub

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x26 |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x20 |
| **Month** and **Day** Timestamp: (*May 23$^{h}$*) | 0x05 | 0x17 |
| **Hour** and **Minute** Timestamp: (*03:19: P.M.*) | 0x0F | 0x13 |
| **Seconds** Timestamp in MSB: (*:44 seconds*). **0x00** in LSB | 0x2C | 0x07 |

# CBX COMMAND 0X2A: SET/CLEAR DIGITAL OUTPUTS

## Command 0x2A - Description

The *Set/Clear Digital Outputs Command* is used to set or clear any or all of the device's digital outputs.

The 8-bit *Digital Output Mask* is used to select which of the Digital Outputs you wish to affect (i.e., which Digital Outputs will be set or cleared).

The 8-bit *Data State* is used to indicate whether the affected Digital Outputs will either be set (1 = SET) or cleared (0 = CLEAR).

Currently HF and UHF I/O model controllers as well as the Hubs are equipped with two or more Digital Outputs.
For a Hub, only the lowest four bits are used (one bit for each Digital Output, where the lowest bit = Output A, the next highest bit = Output B, etc).
For a controller, only the lowest two bits are used (one bit for each Digital Output, where the lowest bit = Output 1, the next highest bit = Output 2).

## Command 0x2A – CBx Example

This example sets outputs A, B, C and D on an Industrial Hub interface module.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x08 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x2A*) | 0xAA | 0x2A |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x20 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **0x00** in MSB.<br>**Additional Data Length** in LSB (*4 bytes*) | 0x00 | 0x04 |
| **0x00** in MSB.<br>**Digital Output Mask** (indicates which Digital Output states will be affected) in LSB | 0x00 | 0x0F |
| **0x00** in MSB.<br>**Data State** (indicates state to set affected Digital Outputs) in LSB | 0x00 | 0x0F |

## Response from Device

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x2A |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x20 |

| Parameter Field | MSB | LSB |
|---|---|---|
| **Month** and **Day** Timestamp: (*May 23*) | 0x05 | 0x17 |
| **Hour** and **Minute** Timestamp: (*2:08 PM*) | 0x0E | 0x08 |
| **Seconds** Timestamp in MSB (*:03 seconds*). **0x00** in LSB | 0x03 | 0x00 |

## Additional Output Mask / Data State Examples:

### Example 2:
Clear all outputs (hub) A, B, C, D

| LSB HEX VALUE | | BINARY VALUE | | RESULT |
|---|---|---|---|---|
| | | always zero | Outputs **D C B A** | |
| Output Mask | 0x0F | 0 0 0 0 | 1 1 1 1 | Affect all Digital Outputs |
| Data State | 0x00 | 0 0 0 0 | 0 0 0 0 | Clear all Outputs |

### Example 3:
Set outputs A and D, but leave B and C alone

| LSB HEX VALUE | | BINARY VALUE | | RESULT |
|---|---|---|---|---|
| | | always zero | Outputs **D C B A** | |
| Output Mask | 0x09 | 0 0 0 0 | 1 0 0 1 | Affect outputs A and D |
| Data State | 0x09 | 0 0 0 0 | 1 0 0 1 | Set outputs A and D |

### Example 4:
Set outputs A and B, Clear output D, but leave output C alone

| LSB HEX VALUE | | BINARY VALUE | | RESULT |
|---|---|---|---|---|
| | | always zero | Outputs **D C B A** | |
| Output Mask | 0x0B | 0 0 0 0 | 1 0 1 1 | Affect outputs A, B and D |
| Data State | 0x03 | 0 0 0 0 | 0 0 1 1 | Set outputs A and B, clears output D |

### Example 5:
If a bit in the Data State is set, yet the corresponding bit in the Output Mask is not set, it will be ignored, as in the following example.

| LSB HEX VALUE | | BINARY VALUE | | RESULT |
|---|---|---|---|---|
| | | always zero | Outputs **D C B A** | |
| Output Mask | 0x01 | 0 0 0 0 | 0 0 0 1 | Affect output A (hub) or output 1 (controller) |
| Data State | 0x0F | 0 0 0 0 | 1 1 1 1 | Set output A or 1, other bits are ignored |

# CBX COMMAND 0X2C: SET SUBNET BAUD RATE

## Command 0x2C - Description

The *Set Subnet Baud Rate Command* is used to modify and store changes to the Subnet network baud rate. The default Subnet baud rate is 9600.

## Command 0x2C – CBx Example

This example sets the Subnet baud rate to 115200.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x2C*) | 0xAA | 0x2C |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x20 |
| **Baud Rate Index Value** in MSB<br>**0x00** in LSB | 0x04 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |

## Baud Rate Index Table

| Baud Rate | Index Value |
|---|---|
| 9600 Baud | 0x00 |
| 19200 Baud | 0x01 |
| 38400 Baud | 0x02 |
| 57600 Baud | 0x03 |
| 115200 Baud | 0x04 |

## Response from Gateway/Hub

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x2C |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x20 |
| **Month** and **Day** Timestamp: (*May 23*) | 0x05 | 0x17 |
| **Hour** and **Minute** Timestamp: (*2:08 PM*) | 0x0E | 0x08 |
| **Seconds** Timestamp in MSB (*:03 seconds*). **0x00** in LSB | 0x03 | 0x00 |

# CBX COMMAND 0X30: GET CONTROLLER NAME

## Command 0x30 - Description

The *Get Controller Name Command* is used to retrieve the user-defined name from a specified controller.

## Command 0x30 - CBx Example

This example retrieves the user-defined name “COBALT” from the controller at Node 01.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x30)* | 0xAA | 0x30 |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x01 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |

## Response from Controller

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x09 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x30 |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19$^{th}$*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*:36 seconds*).<br>**Additional Data Length** in LSB: (*6 bytes*) | 0x24 | 0x06 |
| **Controller Name Data** (ASCII characters 1 & 2) | 0x43 <C> | 0x4F <O> |
| **Controller Name Data** (ASCII characters 3 & 4) | 0x42 <B> | 0x41 <A> |
| **Controller Name Data** (ASCII characters 5 & 6) | 0x4C <L> | 0x54 <T> |

# CBX COMMAND 0X33: GET CONTROLLER CONFIGURATION

## Command 0x33 - Description

The *Get Controller Configuration Command* is used to retrieve the configuration settings stored in the controller's flash memory.

## Command 0x33 - CBx Example

This example retrieves the stored configuration settings from the controller at Node 01.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB. **Command ID** in LSB: (*0x33*) | 0xAA | 0x33 |
| **0x00** in MSB. **Node ID** in LSB | 0x00 | 0x01 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |

## Response from Controller

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x10 |
| **0xAA** in MSB. **Command Echo** in LSB | 0xAA | 0x33 |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds Timestamp** in MSB (*:36 seconds*)<br>**Additional Data Length** (*19 bytes*) | 0x24 | 0x13 |
| **Continuous Read at Power-up - Start Address** (When performing a Continuous Read at power-up or reset, this 2-byte value indicates the starting tag address for the read (0x0000 = begin reading at first available byte). | 0x00 | 0x00 |
| **Continuous Read at Power-up - Block Size** (When performing a Continuous Read at power-up or reset, this 2-byte value indicates the number of continuous bytes to be read. If this value is zero, the controller will not enter Continuous Read mode at power-up or reset. Default is zero 0x0000). | 0x00 | 0x00 |

<table>
<tr><th>Parameter Field</th><th>MSB</th><th>LSB</th></tr>
<tr><td>Continuous Read at Power-up - Duplicate Read Delay in MSB (This single-byte value indicates the number of seconds that a tag must remain out of the RF field before it will be read and have its data sent to the host again. Only used when Continuous Read at power-up is enabled).<br>Node ID in LSB (For -485 models only, this single-byte value indicates the controller’s Node ID number, between 01–16, for all other controllers, the default = one, 0x01)</td><td>0x00</td><td>0x01</td></tr>
<tr><td>Reserved in MSB (0x00). Reserved in LSB (0x00)</td><td>0x00</td><td>0x00</td></tr>
<tr><td>Tag Type in MSB<br>Single-byte value indicates tag IC in use:<br>0x01 = BIS M-1__-03_ (ISO 15693, I-CODE SLI)<br>0x03 = BIS M-1__-07_ (ISO 15693)<br>0x05 = BIS M-1__-10_ (Mifare)<br>0x06 = BIS M-1__-02_ (ISO 15693)<br>(Tag Type is ignored by BIS U-62_.)<br>Reserved in LSB (0x00)</td><td>0x01</td><td>0x00</td></tr>
<tr><td>Communication Mode in MSB (See Communications Mode Table below)<br>Options Byte 1 in LSB (Default = 0x00)<br>Options Byte 1 Table
<table>
<tr><th>BIT</th><th>Description</th></tr>
<tr><td>0</td><td>Tag IDs – LSB First</td></tr>
<tr><td>1</td><td>Reserved</td></tr>
<tr><td>2</td><td>Reserved</td></tr>
<tr><td>3</td><td>Reserved</td></tr>
<tr><td>4</td><td>Reserved</td></tr>
<tr><td>5</td><td>Tag IDs in Continuous Read</td></tr>
<tr><td>6</td><td>Tag Presence ON</td></tr>
<tr><td>7</td><td>Toggle RF</td></tr>
</table></td><td>0xA0</td><td>0x00</td></tr>
<tr><td>Reserved in MSB (Default = 0x00)<br>Options Byte 2 in LSB (Default = 0x00)<br>Options Byte 2 Table
<table>
<tr><th>BIT</th><th>Description</th></tr>
<tr><td>0</td><td>4-Byte Tag IDs (Mifare)</td></tr>
<tr><td>1</td><td>Legacy Error Codes</td></tr>
<tr><td>2</td><td>Reserved</td></tr>
<tr><td>3</td><td>Reserved</td></tr>
<tr><td>4</td><td>Reserved</td></tr>
<tr><td>5</td><td>Reserved</td></tr>
<tr><td>6</td><td>Reserved</td></tr>
<tr><td>7</td><td>Reserved</td></tr>
</table></td><td>0x00</td><td>0x00</td></tr>
<tr><td>Controller Type in MSB (Single-byte value indicates controller type in use)<br>0x02 = BIS M-62_<br>0x03 = BIS M-410_<br>0x04 = BIS M-411_<br>0x0B = BSI U-62_<br>Software Major Release Digit in LSB (first digit in the software version)<br>Example software version: 1.2.A.0<br>Major Release Digit in this example = 1</td><td>0x02</td><td>0x01</td></tr>
</table>

| Parameter Field | MSB | LSB |
|---|---|---|
| **Software Minor Release Digit** in MSB (second digit in the software version)<br>Example software version: *1.2.A.0*<br>Minor Release Digit in this example = 2<br>**Software Correction Release Digit** in LSB (third digit in the software version)<br>Example software version: *1.2.A.0*<br>Correction Release Digit in this example = A | 0x02 | 0x41 |
| **Software Point Release Digit** in MSB (last digit(s) in the software version)<br>Example software version: *1.2.A.0*<br>Point Release Digit in this example = 0<br>**0x00** in LSB | 0x00 | 0x00 |

## Communications Mode Table

| BITS | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0<br>1 | Interface:<br>00 = RS422<br>01 = RS232 / USB<br>10 = RS485<br>11 = Others | | Reserved | | | Baud Rate:<br>000 = 9600<br>001 = 19200<br>010 = 38400<br>011 = 57600<br>100 = 115200 | | |

**Table 2-10: Communications Mode Table**

**NOTE**

*In the above example, the Communications Mode value of 0xA0 = 10100000 in binary, meaning that the controller is an RS485 device that is communicating at 9600 baud.*

# CBX COMMAND 0X38: GET CONTROLLER INFO

## Command 0x38 - Description

The *Get Controller Info Command* is used to retrieve hardware version, serial number and installed firmware identification information from the specified controller.

## Command 0x38 - CBx Example

This example retrieves information from the controller at Node 01.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB. **Command ID** in LSB (*0x38*) | 0xAA | 0x38 |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x01 |
| **Not Used:** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used:** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used:** (*default: 0x00, 0x00*) | 0x00 | 0x00 |

## Response from Controller

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x13 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x38 |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB (*:36 seconds*).<br>**Additional Data Length** in LSB | 0x24 | 0x1A |
| **Controller Type** in MSB<br>Single-byte value indicates controller type:<br>0x02 = BIS M-62_<br>0x03 = BIS M-410_<br>0x04 = BIS M-411_<br>0x0B = BSI U-62_<br>**Software Major Release Digit** in LSB (First digit in the software version)<br>Example software version: *1.2.A.0*<br>Major Release Digit in this example = 1 | 0x02 | 0x01 |

| Parameter Field | MSB | LSB |
|---|---|---|
| **Software Minor Release Digit** in MSB (Second digit in the software version)<br>Example software version: *1.2.A.0*<br>Minor Release Digit in this example = 2<br>**Software Correction Release Digit** in LSB (Third digit in the software version)<br>Example software version: *1.2.A.0*<br>Correction Release Digit in this example = A | 0x02 | 0x41 |
| **Software Point Release Digit** in MSB (Last digit(s) in the software version)<br>Example software version: *1.2.A.0*<br>Point Release Digit in this example = 0<br>**Communications Type** in LSB<br>**0x00** = RS422<br>**0x01** = RS232<br>**0x02** = RS485<br>**0x03** = Ethernet<br>**0x04** = USB<br>**0x05** = DeviceNet | 0x00 | 0x02 |
| **Software CRC** (2-byte value) | 0x7F, 0x36 | |
| **Loader Software Version** (2-byte value) | 0x00, 0x18 | |
| **Processor ID** (5-byte value) | 0x30, 0xFF, 0xFF, 0x0F, 0x04 | |
| **Processor RFU** (3-byte value) | 0x00, 0x00, 0x00 | |
| **Processor Serial Number** (4-byte value) | 0x15, 0x40, 0xA6, 0x3B | |
| **Processor Internal Information** (2-byte value) | 0xB5, 0x68 | |
| **Processor RsMaxP** | 0x5E | |
| **Processor Information CRC** | 0xE4 | |

# CBX COMMAND 0X40: SET CONTROLLER NAME

## Command 0x40 - Description

The *Set Controller Name Command* is used to set a user-defined name for the specified controller. The name will be stored in the flash memory and can contain up to 64 bytes or ASCII characters.

## Command 0x40 - CBx Example

This example writes the name '*COBALT'* to the flash memory of the controller at Node 01.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (*in words*) (0x06 + 0x03 for name length in words) | 0x00 | 0x09 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x40*) | 0xAA | 0x40 |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x01 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **0x00** in MSB, **Name Length** in Bytes in LSB | 0x00 | 0x06 |
| **Name Data** - bytes 1 = C and 2 = O | 0x43 | 0x4F |
| **Name Data** - bytes 3 = B and 4 = A | 0x42 | 0x41 |
| **Name Data** - bytes 5 = L and 6 = T | 0x4C | 0x54 |

## Response from Controller

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x40 |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19$^{th}$*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*:36 seconds*). **0x00** in LSB | 0x24 | 0x00 |

# CBX COMMAND 0X43: SET CONTROLLER CONFIGURATION

## Command 0x43 - Description

The *Set Controller Configuration Command* is used to modify and save changes to the controller's configuration, which will be stored in the unit's flash memory.

**NOTE**

*It is recommended that the user first run the Command 0x33: "Get Controller Configuration" and make note of the current controller configuration values prior to executing this command.*

## Command 0x43 - CBx Example

This example sets the following configuration parameters for the controller at Node 01.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (in words) | 0x00 | 0x10 |
| **0xAA** in MSB. **Command ID** in LSB: (*0x43*) | 0xAA | 0x43 |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x01 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Additional Data Length** (*in bytes*) | 0x00 | 0x13 |
| **Continuous Read at Power-up - Start Address**: (Two-byte integer indicating the tag location where the read operation will begin when performing a continuous read at power-up or reset, *default*: *0x0000* = *begin read at first available byte*) | 0x00 | 0x00 |
| **Continuous Read at Power-up - Block Size**: (Two-byte integer indicating the number of bytes to retrieve when performing a continuous read at power-up or reset. Any value greater than zero instructs the controller to enter continuous read mode the next time it powers-up or is reset. When this value is set to zero, the controller will not enter continuous read mode at power-up or reset, *default* = *0x0000*) | 0x00 | 0x00 |
| **Continuous Read at Power-up - Duplicate Read Delay** in MSB: (Single-byte value indicates the number of seconds that a tag must remain out of RF range before it can be re-read and its data sent to the host again. Only applicable when *Block Size* ≥ one, thereby enabling continuous read at power-up, *default: 0x00*)<br>**Node ID** in LSB (For -485 models only, this single-byte value indicates the controller's Node ID number, between 01–16, for all other controllers, the default = one, 0x01) | 0x00 | 0x01 |
| **Reserved** (default value: 0x00, 0x00) | 0x00 | 0x00 |

<table>
<tr><th>Parameter Field</th><th>MSB</th><th>LSB</th></tr>
<tr><td>Tag Type in MSB: (Single-byte value indicates type of tag integrated circuit to recognize).<br>0x01 = BIS M-1__-03_ (ISO 15693, I-CODE SLI)<br>0x03 = BIS M-1__-07_ (ISO 15693)<br>0x05 = BIS M-1__-10_ (Mifare)<br>0x06 = BIS M-1__-02_ (ISO 15693)<br>(Tag Type is ignored by BIS U-62_.)<br>Reserved in LSB (default: 0x00)</td><td>0x01</td><td>0x00</td></tr>
<tr><td>Communication Mode in MSB (See Communications Mode Table below)<br>Options Byte 1 in LSB<br>Options Byte 1 Table
<table>
<tr><th>BIT</th><th>Description</th></tr>
<tr><td>0</td><td>Tag IDs – LSB First</td></tr>
<tr><td>1</td><td>Reserved</td></tr>
<tr><td>2</td><td>Reserved</td></tr>
<tr><td>3</td><td>Reserved</td></tr>
<tr><td>4</td><td>Reserved</td></tr>
<tr><td>5</td><td>Tag IDs in Continuous Read</td></tr>
<tr><td>6</td><td>Tag Presence ON</td></tr>
<tr><td>7</td><td>Toggle RF</td></tr>
</table></td><td>0xA0</td><td>0x00</td></tr>
<tr><td>Reserved in MSB (default: 0x00)<br>Options Byte 2 in LSB<br>Options Byte 2 Table
<table>
<tr><th>BIT</th><th>Description</th></tr>
<tr><td>0</td><td>4-Byte Tag IDs (Mifare)</td></tr>
<tr><td>1</td><td>Legacy Error Codes</td></tr>
<tr><td>2</td><td>Reserved</td></tr>
<tr><td>3</td><td>Reserved</td></tr>
<tr><td>4</td><td>Reserved</td></tr>
<tr><td>5</td><td>Reserved</td></tr>
<tr><td>6</td><td>Reserved</td></tr>
<tr><td>7</td><td>Reserved</td></tr>
</table></td><td>0x00</td><td>0x00</td></tr>
<tr><td>Controller Type in MSB:<br>Software Major Release Digit in LSB</td><td>0x02</td><td>0x01</td></tr>
<tr><td>Software Minor Release Digit in MSB<br>Correction Release Digit in LSB</td><td>0x02</td><td>0x41</td></tr>
<tr><td>Software Point Release Digit in MSB<br>0x00 in LSB</td><td>0x00</td><td>0x00</td></tr>
</table>

## Communications Mode Table

| BITS | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0<br>1 | Interface:<br>00 = RS422<br>01 = RS232 / USB<br>10 = RS485<br>11 = Others | | Reserved | | | Baud Rate:<br>000 = 9600<br>001 = 19200<br>010 = 38400<br>011 = 57600<br>100 = 115200 | | |

**NOTE**

*In the above example, the Communications Mode value of 0xA0 = 10100000 in binary, meaning that the controller is an RS485 device that is communicating at 9600 baud.*

## Response from Controller

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB. **Command Echo** in LSB | 0xAA | 0x43 |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*36 seconds*) **0x00** in LSB | 0x24 | 0x00 |

# CBX COMMAND 0X4E: SET CONTROLLER TIME

## Command 0x4E - Description

The *Set Controller Time Command* is used to set the controller's internal clock and calendar. Date and Time are specified in the following format:

- Year MSB:LSB (2-byte Integer)
- Month (byte), Day of Month (byte)
- Hour (byte), Minute (byte)
- Seconds (byte), 0x00

## Command 0x4E - CBx Example

This example sets the date and time on the controller to *March 19, 2007 - 9:30 a.m*.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x0A |
| **0xAA** in MSB. **Command ID** in LSB: (*0x4E*) | 0xAA | 0x4E |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x01 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Time/Date Data Length** (*7 bytes*) | 0x00 | 0x07 |
| **Year**: (*2007*) | 0x07 | 0xD7 |
| **Month** and **Day** | 0x03 | 0x13 |
| **Hour** and **Minute** | 0x09 | 0x1E |
| **Seconds** in MSB. **0x00** in LSB | 0x00 | 0x00 |

## Response from Controller

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB. **Command Echo** in LSB | 0xAA | 0x4E |
| **Instance Counter** in MSB. **Node Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19$^{th}$*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*9:30: AM*) | 0x09 | 0x1E |
| **Seconds** Timestamp in MSB: (*03 seconds*) **0x00** in LSB | 0x03 | 0x00 |

# CBX COMMAND 0X53: INITIALIZE CONTROLLER

## Command 0x53 - Description

The *Initialize Controller Command* removes all stored information from the specified controller, including all configuration, macro and trigger data. The controller's Node ID number will be physically reconfigured to factory defaults as well.

## Command 0x53 - CBx Example

This example will remove all stored information from the controller at Node 01.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x53*) | 0xAA | 0x53 |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x01 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |

## Response from Controller

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB. **Command Echo** in LSB | 0xAA | 0x53 |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19$^{th}$*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*36 seconds*). **0x00** in LSB | 0x24 | 0x00 |

# CBX COMMAND 0X54: RESET CONTROLLER

## Command 0x54 - Description

The *Reset Controller Command* is used to reset power to the specified controller without clearing any stored configuration information. However, the controller's configuration can be reset to default values when *Command 0x54* is issued AND a Configuration Tag is placed in the antenna's RF field prior to execution.

## Command 0x54 - CBx Example

This example resets power to the controller at Node 01.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB. **Command ID** in LSB: (*0x54*) | 0xAA | 0x54 |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x01 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |

## Response from Controller

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x54 |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*:36 seconds*). **0x00** in LSB | 0x24 | 0x00 |

# CBX COMMAND 0X60: INITIALIZE GATEWAY/HUB

## Command 0x60 - Description

The *Initialize Gateway/Hub Command* is used to clear all Subnet Node configuration information, user-defined names and Notification Mask settings stored in the Gateway or Hub's flash memory. This command also resets the Subnet baud rate to 9600.

## Command 0x60 - CBx Command Example

This example initializes the Gateway or Hub interface module and removes from the flash memory all configuration information for all Subnet Nodes.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB. **Command ID** in LSB: (*0x60)* | 0xAA | 0x60 |
| **0x00** in MSB. **Node ID** in LSB (Gateway/Hub Node = *0x20*) | 0x00 | 0x20 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |

## Response from Gateway/Hub

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x60 |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | 0x20 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*36 seconds*). **0x00** in LSB | 0x24 | 0x00 |

# CBX COMMAND 0X61: RESET GATEWAY/HUB

## Command 0x61 - Description

The *Reset Gateway/Hub Command* is used to perform a soft (electrical) reset of the Gateway or Hub interface module. The device will behave as if it had just powered up. If dipswitch 1 is ON (its default setting), the unit will automatically begin scanning all Subnet Nodes for attached RFID controllers.

## Command 0x61 - CBx Example

This example resets the Gateway/Hub interface module.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB. **Command ID** in LSB: (*0x60)* | 0xAA | 0x61 |
| **0x00** in MSB.**Node ID** in LSB (Gateway/Hub Node = *0x20*) | 0x00 | 0x20 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |

## Response from Gateway/Hub

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x61 |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | 0x20 |
| **Month** and **Day** Timestamp: (*March 19$^{th}$*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*36 seconds*). **0x00** in LSB | 0x24 | 0x00 |

# CBX COMMAND 0X62: INITIALIZE ALL NODES

## Command 0x62 - Description

The *Initialize All Nodes Commands* removes from the Gateway or Hub interface module all stored configuration information for all Subnet Nodes. Subnet Nodes will be reconfigured to factory defaults.

## Command 0x62 - CBx Example

This example initializes all controllers on the Subnet network, thereby removing all stored configuration information and restoring factory default settings to all controllers.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB. **Command ID** in LSB: (*0x60)* | 0xAA | 0x62 |
| **0x00** in MSB. **Node ID** in LSB (Gateway/Hub Node = *0x20*) | 0x00 | 0x20 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |

## Response from Gateway/Hub

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x62 |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | 0x20 |
| **Month** and **Day** Timestamp: (*March 19$^{th}$*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*36 seconds*). **0x00** in LSB | 0x24 | 0x00 |

# CBX COMMAND 0X63: INITIALIZE ALL NODE MACROS

## Command 0x63 - Description

The *Initialize All Node Macros Command* initializes (removes) from memory all stored macros from all Subnet Nodes.

## Command 0x63 - CBx Example

This example removes all macros from the Gateway/Hub's internal memory as well as from any connected controllers on the Subnet network.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x60)* | 0xAA | 0x63 |
| **0x00** in MSB, **Node ID** in LSB (Gateway/Hub Node = *0x20*) | 0x00 | 0x20 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |

## Response from Gateway/Hub

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x63 |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x20 |
| **Month** and **Day** Timestamp: (*March 19$^{th}$*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*36 seconds*). **0x00** in LSB | 0x24 | 0x00 |

# CBX COMMAND 0X70: START SUBNET

## Command 0x70 - Description

The *Start Subnet Command* instructs the Gateway/Hub to begin "*polling*" the Subnet network. Initiating this command is only required when dipswitch 1 on the Gateway/Hub is set to OFF. With dipswitch 1 in the OFF position, the Gateway/Hub will not automatically begin polling Subnet Nodes upon power-up.
Setting dipswitch 1 to OFF is a means of forcing the Gateway/Hub to wait until a connection with the host has been established. This is useful when it is desired that the Gateway/Hub NOT poll controllers until a host-initiated connection exists.

## Command 0x70 - CBx Example

This example starts the Subnet, which instructs the Gateway/Hub to begin "polling" all connected controllers on the Subnet network.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x60)* | 0xAA | 0x70 |
| **0x00** in MSB, **Node ID** in LSB (Gateway/Hub Node = *0x20*) | 0x00 | 0x20 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |

## Response from Gateway/Hub

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x70 |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x20 |
| **Month** and **Day** Timestamp: (*March 19$^{th}$*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp:(*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB (*36 seconds*), **0x00** in LSB | 0x24 | 0x00 |

# CBX COMMAND 0X71: MOVE CONTROLLER (GATEWAY ONLY)

## Command 0x71 - Description

The *Move Controller Command*, for Gateway interface modules only, is used to move all of the stored configuration data for a particular Node ID to another specified Node ID. When issuing this command, the Gateway will copy the stored configuration information from the source Node ID to the destination Node ID. If there is a controller attached at the original Node ID, it will be reassigned the new (destination) Node ID as well. After the information is moved, the configuration for the original Node ID will be reinitialized to factory defaults.

## Command 0x71 - CBx Example

This example moves the Gateway's stored controller configuration for Node ID 04 to Node ID 08.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB: (*0x60)* | 0xAA | 0x71 |
| **0x00** in MSB, **Node ID** in LSB (Gateway Node = *0x20*) | 0x00 | 0x20 |
| **0x00** in MSB, **Node ID** of Controller to Move in LSB | 0x00 | 0x04 |
| **0x00** in MSB, **Destination Node ID** in LSB | 0x00 | 0x08 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |

## Response from Gateway/Hub

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x71 |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x20 |
| **Month** and **Day** Timestamp: (*March 19$^{th}$*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*36 seconds*) **0x00** in LSB | 0x24 | 0x00 |

# CBX COMMAND 0X79: CLEAR PENDING RESPONSES

## Command 0x79 - Description

The *Clear Pending Response Command* deletes all pending or buffered responses in the Gateway/Hub and resets all Instance Counters for all nodes, including the Gateway/Hub, to zero (0x00).

## Command 0x79 - CBx Example

This example removes any pending response data from the Gateway/Hub and resets the Instance Counter values for all nodes (including the Gateway/Hub) to zero.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB. **Command ID** in LSB: (*0x60)* | 0xAA | 0x79 |
| **0x00** in MSB. **Node ID** in LSB (Gateway/Hub Node = *0x20*) | 0x00 | 0x20 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |

## Response from Gateway/Hub

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x20 |
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x79 |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x20 |
| **Month** and **Day** Timestamp: (*March 19$^{th}$*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*36 seconds*). **0x00** in LSB | 0x24 | 0x00 |

# CBX COMMAND 0X92: MULTI-TAG READ ID AND DATA ALL

## Command 0x92 - Description

The *Multi-Tag Read ID and Data All Command* is used to retrieve the tag ID and a contiguous segment of data from all RFID tags in range (or those with the specified *AFI*).

The controller will generate separate responses containing the tag ID and the requested data for each responding tag. Each response packet will be sent to the host as soon as it is available. The returned tag IDs can be used to read from/write to a single tag (via the *Multi-Tag Block Read/Write by ID* commands) when multiple tags are identified simultaneously.

A final termination packet is sent when the *Timeout Value* expires.

When the *Start Address* is set to zero (*0x0000*), the controller will start reading at the beginning (or first accessible byte) of the tag.

If the *Block Size* exceeds the last tag address, the controller will return an error message.

## Command 0x92 - CBx Example

This example instructs the controller at Node 01 to read the tag ID and 16 bytes of data from each tag in range starting at address 0x0001. A *Timeout Value* of 3 seconds (*0x0BB8 = 3000 x 1msec increments*) is set for the completion of the command. The *AFI* byte is set to zero so that all tags in range will respond.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** *(in words)* | 0x00 | 0x08 |
| **0xAA** in MSB, **Command ID** in LSB | 0xAA | 0x92 |
| **0x00** in MSB . **Node ID** in LSB | 0x00 | 0x01 |
| **Timeout Value** | 0x0B | 0xB8 |
| **Start Address** | 0x00 | 0x01 |
| **Block Size** | 0x00 | 0x10 |
| **AFI** in MSB. **Anti-Collision Mode** in LSB | 0x00 | 0x01 |
| **Tag Limit** in MSB. **0x00** in LSB | 0x64 | 0x00 |

## Response from Controller (for Each Tag Found)

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** *(in words)* | 0x00 | 0x06 + number of words retrieved |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x92 |
| **Instance Counter** in MSB<br>**Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp | <Month> | <Day> |
| **Hour** and **Minute** Timestamp | <Hour> | <Min> |
| **Seconds** Timestamp<br>**Additional Data Length** (*24 additional bytes returned, includes both ID and Data*) | <Sec> | 0x18 |
| **Tag ID** (*bytes 1 and 2*) | <Tag ID B1> | <Tag ID B2> |
| **Tag ID** (*bytes 3 and 4*) | <Tag ID B3> | <Tag ID B4> |
| **Tag ID** (*bytes 5 and 6*) | <Tag ID B5> | <Tag ID B6> |
| **Tag ID** (*bytes 7 and 8*) | <Tag ID B7> | <Tag ID B8> |
| **Returned Data** (*bytes 1 and 2*) | <D1> | <D2> |
| **Returned Data** (*bytes 3 and 4*) | <D3> | <D4> |
| … | … | … |
| **Returned Data** (*bytes 15 and 16*) | <D15> | <D16> |

## Final Response Packet

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** *(in words)* | 0x00 | 0x07 |
| **0xAA** in MSB, **0xFF** in LSB | 0xAA | 0xFF |
| **Instance Counter** in MSB<br>**Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp | <Month> | <Day> |
| **Hour** and **Minute** Timestamp | <Hour> | <Min> |
| **Seconds** Timestamp<br>**Additional Data Length** (*2 bytes:* "*Number of Tags*" *and* "*Status*") | <Sec> | 0x02 |
| **Number of Tags Read** in MSB<br>**Status** in LSB: 0x00 = operation completed successfully, 0x07 = Read Tag ID failed / Tag Not Found | <# of tags read> | 0x00 |

# CBX COMMAND 0X95: MULTI-TAG BLOCK READ ALL

## Command 0x95 - Description

The *Multi-Tag Block Read All Command* is used to retrieve a contiguous segment of data from all RFID tags within RF range (or those with the specified *AFI*).

The controller will generate separate responses containing the requested data for each responding tag. Each response packet will be sent to the host as soon as it is available.

A final termination packet is sent when the *Timeout Value* expires.

When the *Start Address* is set to zero (*0x0000*), the controller will start reading at the beginning (or first accessible byte) of the tag.

If the *Block Size* exceeds the last tag address, the controller will return an error message.

## Command 0x95 - CBx Example

This example instructs the controller to read 16 bytes of data from each tag in range starting at address 0x0001. A *Timeout Value* of 3 seconds (*0x0BB8 = 3000 x 1msec increments*) is set for the completion of the command. The *AFI* byte is set to zero so all tags in range will respond.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** *(in words)* | 0x00 | 0x08 |
| **0xAA** in MSB, **Command ID** in LSB | 0xAA | 0x95 |
| **0x00** in MSB. **Node ID** in LSB | 0x00 | 0x01 |
| **Timeout Value** | 0x0B | 0xB8 |
| **Start Address** | 0x00 | 0x01 |
| **Block Size** | 0x00 | 0x10 |
| **AFI** in MSB. **Anti-Collision Mode** in LSB | 0x00 | 0x01 |
| **Tag Limit** in MSB. **0x00** in LSB | 0x64 | 0x00 |

## Response from Controller (for Each Tag Found)

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** *(in words)* | 0x00 | 0x06 + number of words retrieved |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x95 |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp | <Month> | <Day> |
| **Hour** and **Minute** Timestamp | <Hour> | <Min> |
| **Seconds** Timestamp.<br>**Additional Data Length** (*16 additional bytes returned*) | <Sec> | 0x10 |
| **Returned Data** (*bytes 1 and 2*) | <D1> | <D2> |
| **Returned Data** (*bytes 3 and 4*) | <D3> | <D4> |
| … | … | … |
| **Returned Data** (*bytes 15 and 16*) | <D15> | <D16> |

## Final Response Packet

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** *(in words)* | 0x00 | 0x07 |
| **0xAA** in MSB, **0xFF** in LSB | 0xAA | 0xFF |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | <Node ID> |
| **Month** and **Day** Timestamp | <Month> | <Day> |
| **Hour** and **Minute** Timestamp | <Hour> | <Min> |
| **Seconds** Timestamp.<br>**Additional Data Length** (*2 bytes:* "*Number of Tags*" *and* "*Status*") | <Sec> | 0x02 |
| **Number of Tags Read** in MSB<br>**Status** in LSB: 0x00 = operation completed successfully, 0x07 = Read Tag ID failed / Tag Not Found | <# of tags read> | 0x00 |

# CBX COMMAND 0X96: MULTI-TAG BLOCK WRITE ALL

## Command 0x96 - Description

The *Multi-Tag Block Write All Command* is used to write a contiguous segment of data to all RFID tags in range (or those with the specified *AFI*).

When the *Start Address* is set to zero (*0x0000*), the specified controller will start writing at the beginning (or first accessible byte) of the tag.

If the *Block Size* exceeds the last tag address, the controller will return an error message.

## Command 0x96 - CBx Example

This example instructs the controller to write 16 bytes of data to each RFID tag in range starting at address 0x0001. A *Timeout Value* of 3 seconds (*0x0BB8 = 3000 x 1msec increments*) is set for the completion of the command. The *AFI* byte is set to zero so that data will be written to all tags.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** *(in words)* | 0x00 | 0x07 + number of *Data Byte* words |
| **0xAA** in MSB, **Command ID** in LSB | 0xAA | 0x96 |
| **0x00** in MSB<br>**Node ID** in LSB | 0x00 | 0x01 |
| **Timeout Value** | 0x0B | 0xB8 |
| **Start Address** | 0x00 | 0x01 |
| **Block Size** | 0x00 | 0x10 |
| **AFI** in MSB, **0x00** in LSB | 0x00 | 0x00 |
| **Data** (*bytes 1 and 2*) | <D1> | <D2> |
| **Data** (*bytes 3 and 4*) | <D3> | <D4> |
| … | … | … |
| **Data** (*bytes 15 and 16*) | <D15> | <D16> |

## Response from Controller

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** *(in words)* | 0x00 | 0x07 |
| **0xAA** in MSB, **0xFF** in LSB | 0xAA | 0xFF |
| **Instance Counter** in MSB<br>**Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp | <Month> | <Day> |
| **Hour** and **Minute** Timestamp | <Hour> | <Min> |
| **Seconds** Timestamp<br>**Additional Data Length** (*2 bytes:* "*Number of Tags*" *and* "*Status*") | <Sec> | 0x02 |
| **Number of Tags Written** in MSB<br>**Status** in LSB: 0x00 = operation completed successfully, 0x07 = Read Tag ID failed / Tag Not Found | <# of tags written> | 0x00 |

# CBX COMMAND 0X97: MULTI-TAG GET INVENTORY

## Command 0x97 - Description

The *Multi-Tag Get Inventory Command* is used to retrieve the tag ID from all RFID tags in range (or those with the specified *AFI*). Each tag has a unique Tag ID or Serial Number. This number cannot be changed and is not considered part of the tag's available memory.

The controller will generate separate responses containing the tag ID for each responding tag. Each response packet will be sent to the host as soon as it is available. The returned tag IDs can be used to read from/write to a single tag (via the *Multi-Tag Block Read/Write by ID* commands) when multiple tags are identified simultaneously.

A final termination packet is sent when the *Timeout Value* expires.

## Command 0x97 - CBx Example

This example instructs the controller to read the tag ID from each tag in range. A *Timeout Value* of 3 seconds (*0x0BB8 = 3000 x 1msec increments*) is set for the completion of the command. The *AFI* byte is set to zero so all tags in range will respond.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** *(in words)* | 0x00 | 0x08 |
| **0xAA** in MSB, **Command ID** in LSB | 0xAA | 0x97 |
| **0x00** in MSB. **Node ID** in LSB | 0x00 | 0x01 |
| **Timeout Value** | 0x0B | 0xB8 |
| **Start Address** | 0x00 | 0x00 |
| **Block Size** | 0x00 | 0x00 |
| **AFI** in MSB. **Anti-Collision Mode** in LSB | 0x00 | 0x01 |
| **Tag Limit** in MSB, **0x00** in LSB | 0x64 | 0x00 |

## Response from Controller (for Each Tag Found)

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** *(in words)* | 0x00 | 0x0A |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x97 |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp | <Month> | <Day> |
| **Hour** and **Minute** Timestamp | <Hour> | <Min> |
| **Seconds** Timestamp in MSB.<br>**Additional Data Length** in LSB (*8 additional bytes returned*) | <Sec> | 0x08 |
| **Tag ID** (*bytes 1 and 2*) | <ID1> | <ID2> |
| **Tag ID** (*bytes 3 and 4*) | <ID3> | <ID4> |
| **Tag ID** (*bytes 5 and 6*) | <ID5> | <ID6> |
| **Tag ID** (*bytes 7 and 8*) | <ID7> | <ID8> |

## Final Response Packet

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** *(in words)* | 0x00 | 0x07 |
| **0xAA** in MSB, **0xFF** in LSB | 0xAA | 0xFF |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp | <Month> | <Day> |
| **Hour** and **Minute** Timestamp | <Hour> | <Min> |
| **Seconds** Timestamp in MSB.<br>**Additional Data Length** in LSB (*2 bytes:* "*Number of Tags*" *and* "*Status*") | <Sec> | 0x02 |
| **Number of Tags Found** in MSB<br>**Status** in LSB: 0x00 = operation completed successfully, 0x07 = Read Tag ID failed / Tag Not Found | <# of tags found> | 0x00 |

# CBX COMMAND 0X98: MULTI-TAG SEARCH ALL

## Command 0x98 - Description

The *Multi-Tag Search All Command* is used to check for the presence of RFID tags in the antenna field.

As soon as the controller finds a tag, it will return a response to the host. If no tags are present, and the *Timeout Value* has expired, the controller will return an error.

## Command 0x98 - CBx Example

This example instructs the controller to search for the presence of any RFID tag in range. A *Timeout Value* of 3 seconds (*0x0BB8 = 3000 x 1msec increments*) is set for the completion of the command. The *AFI* byte is set to zero so all tags in range will respond.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** *(in words)* | 0x00 | 0x08 |
| **0xAA** in MSB, **Command ID** in LSB | 0xAA | 0x98 |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x01 |
| **Timeout Value** | 0x0B | 0xB8 |
| **Start Address** | 0x00 | 0x00 |
| **Block Size** | 0x00 | 0x00 |
| **AFI** in MSB. **Anti-Collision Mode** in LSB | 0x00 | 0x01 |
| **Tag Limit** in MSB, **0x00** in LSB | 0x64 | 0x00 |

## Response from Controller

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** *(in words)* | 0x00 | 0x07 |
| **0xAA** in MSB, **0xFF** in LSB | 0xAA | 0xFF |
| **Instance Counter** in MSB<br>**Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp | <Month> | <Day> |
| **Hour** and **Minute** Timestamp | <Hour> | <Min> |
| **Seconds** Timestamp in MSB<br>**Additional Data Length** in LSB (*2 bytes:* "*Number of Tags*" *and* "*Status*") | <Sec> | 0x02 |
| **Number of Tags Found** in MSB<br>**Status** in LSB: 0x00 = operation successful,<br>0x07 = Tag Not Found | <# of tags found> | 0x00 |

# CBX COMMAND 0XA5: MULTI-TAG BLOCK READ BY ID

## Command 0xA5 - Description

The *Multi-Tag Block Read by ID Command* is used to read a contiguous segment of data from a specific RFID tag identified by its tag ID.

An error packet is sent if the specific tag is not present and the *Timeout Value* expires.

When the *Start Address* is set to zero (*0x0000*), the controller will start reading at the beginning (or first accessible byte) of the tag.

If the *Block Size* exceeds the last tag address, the controller will return an error message.

## Command 0xA5 - CBx Example

This example instructs the controller to read 16 bytes of data from the tag containing the specified tag ID, beginning at tag address 0x0001. A *Timeout Value* of 3 seconds (*0x0BB8 = 3000 x 1msec increments*) is set for the completion of the command.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** *(in words)* | 0x00 | 0x0B |
| **0xAA** in MSB, **Command ID** in LSB | 0xAA | 0xA5 |
| **0x00** in MSB. **Node ID** in LSB | 0x00 | 0x01 |
| **Timeout Value** | 0x0B | 0xB8 |
| **Start Address** | 0x00 | 0x01 |
| **Block Size** | 0x00 | 0x10 |
| **AFI** in MSB, **0x00** in LSB | 0x00 | 0x00 |
| **Tag ID** (*bytes 1 and 2*) | <ID1> | <ID2> |
| **Tag ID** (*bytes 3 and 4*) | <ID3> | <ID4> |
| **Tag ID** (*bytes 5 and 6*) | <ID5> | <ID6> |
| **Tag ID** (*bytes 7 and 8*) | <ID7> | <ID8> |

## Response from Controller

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** *(in words)* | 0x00 | 0x06 + number of returned words |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0x95 |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp | <Month> | <Day> |
| **Hour** and **Minute** Timestamp | <Hour> | <Min> |
| **Seconds** Timestamp in MSB.<br>**Additional Data Length** (*16 additional bytes returned*) in LSB | <Sec> | 0x10 |
| **Returned Data** (*bytes 1 and 2*) | <D1> | <D2> |
| **Returned Data** (*bytes 3 and 4*) | <D3> | <D4> |
| … | … | … |
| **Returned Data** (*bytes 15 and 16*) | <D15> | <D16> |

# CBX COMMAND 0XA6: MULTI-TAG BLOCK WRITE BY ID

## Command 0xA6 - Description

The *Multi-Tag Block Write by ID Command* is used to write a contiguous segment of data to a specific RFID tag identified by its tag ID.

An error packet is sent if the specific tag is not present and the *Timeout Value* expires.

When the *Start Address* is set to zero (*0x0000*), the controller will start writing at the beginning (or first accessible byte) of the tag.

If the *Block Size* exceeds the last tag address, the controller will return an error message.

## Command 0xA6 - CBx Example

This example instructs the controller at Node 01 to write 16 bytes of data to the tag containing the specified tag ID, beginning at tag address 0x0001. A *Timeout Value* of 3 seconds (*0x0BB8 = 3000 x 1msec increments*) is set for the completion of the command.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** *(in words)* | 0x00 | 0x0B + number of words in *Block Size* |
| **0xAA** in MSB, **Command ID** in LSB | 0xAA | 0xA6 |
| **0x00** in MSB. **Node ID** in LSB | 0x00 | 0x01 |
| **Timeout Value** | 0x0B | 0xB8 |
| **Start Address** | 0x00 | 0x01 |
| **Block Size** | 0x00 | 0x10 |
| **AFI** in MSB, **0x00** in LSB | 0x00 | 0x00 |
| **Tag ID** (*bytes 1 and 2*) | <ID1> | <ID2> |
| **Tag ID** (*bytes 3 and 4*) | <ID3> | <ID4> |
| **Tag ID** (*bytes 5 and 6*) | <ID5> | <ID6> |
| **Tag ID** (*bytes 7 and 8*) | <ID7> | <ID8> |
| **Data** (*bytes 1 and 2*) | <D1> | <D2> |
| **Data** (*bytes 3 and 4*) | <D3> | <D4> |
| … | … | … |
| **Data** (*bytes 15 and 16*) | <D15> | <D16> |

## Response from Controller

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** *(in words)* | 0x00 | 0x06 |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0xA6 |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp | <Month> | <Day> |
| **Hour** and **Minute** Timestamp | <Hour> | <Min> |
| **Seconds** Timestamp in MSB. **0x00** in LSB | <Sec> | 0x00 |

# CBX COMMAND 0XC0: SET UHF CONTROLLER CONFIGURATION

## Command 0xC0 - Description

The *Set UHF Controller Configuration Command* is used to modify and save changes to the UHF-Series controller's configuration, which will be stored in the unit's flash memory.

**NOTE**

*It is recommended that the user first run the Command 0xC1: "Get UHF Controller Configuration" and make note of the current controller configuration values prior to executing this command.*

## Command 0xC0 - CBx Example

This example permits the user to modify or write the indicated configuration parameters to the flash memory of the UHF controller at Node 01. The total number of bytes available for this purpose is **nine**.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (in words) | 0x00 | 0x08 |
| **0xAA** in MSB. **Command ID** in LSB: (*0x43*) | 0xAA | 0xC0 |
| **0x00** in MSB, **Node ID** in LSB | 0x00 | 0x01 |
| **UHF Configuration Byte 1** in MSB<br>**UHF Configuration Byte 2** in LSB<br>These two bytes represent the **Reader Output Power** (value from 0 to 500 mW). | <Byte 1> | <Byte 2> |
| **UHF Configuration Byte 3** in MSB<br>**UHF Configuration Byte 4** in LSB | <Reserved>* | <Reserved>* |
| **UHF Configuration Byte 5** in MSB<br>**UHF Configuration Byte 6** in LSB | <Reserved>* | <Reserved>* |
| **UHF Configuration Byte 7** in MSB<br>**UHF Configuration Byte 8** in LSB<br>Byte 8 is partially reserved according to the table below. This byte permits the user to select the specific **UHF Channel** through which commands are transmitted. The user can write one of the following values: **0**, **3**, **6**, or **9** in bits 4 to 7.<br>This parameter is ignored by BIS U-62_-xxx-111_ US models. | <Reserved>* | <Partially Reserved> |

| BIT | Description |
|---|---|
| 0 | Reserved* |
| 1 | Reserved* |
| 2 | Reserved* |
| 3 | Reserved* |
| 4 | <Channel ID value> |
| 5 | <Channel ID value> |
| 6 | <Channel ID value> |
| 7 | <Channel ID value> |

<table>
<tr><th>Parameter Field</th><th>MSB</th><th>LSB</th></tr>
<tr><td>UHF Configuration Byte 9 in MSB<br>0x00 in LSB<br>Byte 9 is partially reserved according to the table below. This byte permits the user to enable/disable the Choose Nearest One property.<br>If the Choose Nearest One property is disabled (bit = 0), an error response is generated whenever a single-tag read/write command is executed in a multi-tag environment.<br>If the Choose Nearest One property is enabled (bit = 1), the read/write command is executed on the tag with the strongest signal.
<table>
<tr><th>BIT</th><th>Description</th></tr>
<tr><td>0</td><td>Reserved*</td></tr>
<tr><td>1</td><td><Choose Nearest One></td></tr>
<tr><td>2</td><td>Reserved*</td></tr>
<tr><td>3</td><td>Reserved*</td></tr>
<tr><td>4</td><td>Reserved*</td></tr>
<tr><td>5</td><td>Reserved*</td></tr>
<tr><td>6</td><td>Reserved*</td></tr>
<tr><td>7</td><td>Reserved*</td></tr>
</table>
</td><td><Partially Reserved></td><td>0x00</td></tr>
</table>

**NOTE**

** Leave the default value retrieved through the 0xC1 "Get UHF Controller Configuration" command.*

## Response from Controller

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB. **Command Echo** in LSB | 0xAA | 0xC0 |
| **Instance Counter** in MSB, **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*36 seconds*) **0x00** in LSB | 0x24 | 0x00 |

# CBX COMMAND 0XC1: GET UHF CONTROLLER CONFIGURATION

## Command 0xC1 - Description

The *Get UHF Controller Configuration Command* is used to retrieve the configuration settings stored in the UHF-Series controller's flash memory. These are the same values that are set with the *Set UHF Controller Configuration Command*.

## Command 0xC1 - CBx Example

This example retrieves the stored configuration settings from the flash memory of the UHF controller at Node 01.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB. **Command ID** in LSB: (*0x33*) | 0xAA | 0xC1 |
| **0x00** in MSB. **Node ID** in LSB | 0x00 | 0x01 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*default: 0x00, 0x00*) | 0x00 | 0x00 |

## Response from Controller

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x0B |
| **0xAA** in MSB. **Command Echo** in LSB | 0xAA | 0xC1 |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds Timestamp** in MSB (*:36 seconds*)<br>**Additional Data Length** in LSB (*in bytes 0x0A*) | 0x24 | 0x0A |
| **UHF Configuration Byte 1** in MSB<br>**UHF Configuration Byte 2** in LSB<br>These two bytes represent the **Reader Output Power** (value from 0 to 500 mW). | <Byte 1> | <Byte 2> |
| **UHF Configuration Byte 3** in MSB<br>**UHF Configuration Byte 4** in LSB | <Byte 3> | <Byte 4> |
| **UHF Configuration Byte 5** in MSB<br>**UHF Configuration Byte 6** in LSB | <Byte 5> | <Byte 6> |
| **UHF Configuration Byte 7** in MSB<br>**UHF Configuration Byte 8** in LSB | <Byte 7> | <Byte 8> |
| **UHF Configuration Byte 9** in MSB<br>**0x00** in LSB | <Byte 9> | 0x00 |

# CBX COMMAND 0XC2: READ EPC CODE

## Command 0xC2 - Description

The *Read EPC Code Command* instructs the controller to retrieve the EPC memory area of a single UHF Class 1 Gen 2 RFID tag memory.

## Command 0xC2 - CBx Example

This example instructs the controller at Node 01 to read the EPC memory from a tag. A *Timeout Value* of 2 seconds (*0x07D0 = 2000 x one-millisecond increments*) is set for the completion of the command.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB. **Command ID** in LSB (*0xC2*) | 0xAA | 0xC2 |
| **0x00** in MSB. **Node ID** in LSB | 0x00 | 0x01 |
| **Timeout Value** | 0x07 | 0xD0 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |

## Response from Controller (Tag Found)

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x0C |
| **0xAA** in MSB. **Command Echo** in LSB | **0xAA** | 0xC2 |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp:(*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*:36 seconds*).<br>**Additional Data Length** in LSB: (*in bytes 0x0C*) | 0x24 | 0x0C |
| **EPC** (*bytes 1 and 2*) | 0xE0 | 0x04 |
| **EPC** (*bytes 3 and 4*) | 0x01 | 0x00 |
| **EPC** (*bytes 5 and 6*) | 0x00 | 0x2E |
| **EPC** (*bytes 7 and 8*) | 0xEB | 0x34 |
| **EPC** (*bytes 9 and 10*) | 0x11 | 0x35 |
| **EPC** (*bytes 11 and 12*) | 0x16 | 0xAD |

See par. EPC Class 1 Gen 2 Tag Memory Structure in Appendix for details.

## Response from Controller (Tag Not Found)

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** in LSB (*in words*) | 0x00 | 0x07 |
| **Error Flag** in MSB = 0xFF.<br>**Error Information Byte** in LSB<br>0xFF in the LSB indicates that a controller-based error occurred. Any other value other than 0xFF indicates that a Gateway/Hub-based error occurred (and identifies the command that was attempted when the error occurred). | **0xFF** | 0xFF |
| **Instance Counter** in MSB<br>**Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp:(*March 19th*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB: (*:36 seconds*).<br>**Additional Data Length** in LSB: (*0x01 for Error Code*) | 0x24 | 0x01 |
| **Error Code** in MSB (*0x07 = Tag Not Found*)<br>**0x00** in LSB | 0x07 | 0x00 |

# CBX COMMAND 0XC3: WRITE EPC CODE

## Command 0xC3 - Description

The *Write EPC Code Command* instructs the controller to write the EPC memory area of a single UHF Class 1 Gen 2 RFID tag memory.

## Command 0xC3 - CBx Example

This example instructs the controller at Node 01 to write the specified bytes in the EPC memory of a tag. A *Timeout Value* of 2 seconds (*0x07D0 = 2000 x one-millisecond increments*) is set for the completion of this command.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** (*in words*) | 0x00 | 0x0A |
| **0xAA** in MSB. **Command ID** in LSB (*0xC3*) | 0xAA | 0xC3 |
| **0x00** in MSB. **Node ID** in LSB | 0x00 | 0x01 |
| **Timeout Value** (*measured in ms*) | 0x07 | 0xD0 |
| **EPC Write Data** (*bytes 1 and 2*) | 0x48 | 0x45 |
| **EPC Write Data** (*bytes 3 and 4*) | 0x4C | 0x4C |
| **EPC Write Data** (*bytes 5 and 6*) | 0x58 | 0x45 |
| **EPC Write Data** (*bytes 7 and 8*) | 0xAB | 0x6F |
| **EPC Write Data** (*byte 9 and 10*) | 0x4E | 0x45 |
| **EPC Write Data** (*byte 11 and 12*) | 0x4F | 0x00 |

## Response from Controller

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** (*in words*) | 0x00 | 0x06 |
| **0xAA** in MSB. **Command Echo** in LSB | 0xAA | 0xC3 |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp: (*March 19$^{th}$*) | 0x03 | 0x13 |
| **Hour** and **Minute** Timestamp: (*10:11: AM*) | 0x0A | 0x0B |
| **Seconds** Timestamp in MSB (*:36 seconds*). **0x00** in LSB | 0x24 | 0x00 |

See par. EPC Class 1 Gen 2 Tag Memory Structure in Appendix for details.

# CBX COMMAND 0XC4: MULTI-TAG READ EPC CODE

## Command 0xC4 - Description

The *Multi-Tag Read EPC Code Command* is used to retrieve the EPC data from all tags within RF range. A final termination packet is sent when the *Timeout Value* expires.

## Command 0xC4 - CBx Example

This example instructs the controller at Node 01 to read the EPC data from each tag in range. A *Timeout Value* of 3 seconds (*0x0BB8 = 3000 x 1msec increments*) is set for the completion of the command.

## Command from Host

| Parameter Field | MSB | LSB |
|---|---|---|
| **CBx Header** in MSB, **Node ID** in LSB | 0xFF | 0x01 |
| **Overall Length of Command** *(in words)* | 0x00 | 0x06 |
| **0xAA** in MSB, **Command ID** in LSB | 0xAA | 0xC4 |
| **0x00** in MSB . **Node ID** in LSB | 0x00 | 0x01 |
| **Timeout Value** | 0x0B | 0xB8 |
| **Tag Limit** in MSB, 0x00 in LSB | 0x64 | 0x00 |
| **Not Used** (*0x00, 0x00*) | 0x00 | 0x00 |

## Response from Controller (for Each Tag Found)

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** *(in words)* | 0x00 | 0x0C |
| **0xAA** in MSB, **Command Echo** in LSB | 0xAA | 0xC4 |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp | <Month> | <Day> |
| **Hour** and **Minute** Timestamp | <Hour> | <Min> |
| **Seconds** Timestamp<br>**Additional Data Length** (*12 additional bytes returned)* | <Sec> | 0x0C |
| **EPC** (*bytes 1 and 2*) | <D1> | <D2> |
| **EPC** (*bytes 3 and 4*) | <D3> | <D4> |
| **EPC** (*bytes 5 and 6*) | <D5> | <D6> |
| **EPC** (*bytes 7 and 8*) | <D7> | <D8> |
| **EPC** (*bytes 9 and 10*) | <D9> | <D10> |
| **EPC** (*bytes 11 and 12*) | <D11> | <D12> |

## Final Response Packet

| Parameter Field | MSB | LSB |
|---|---|---|
| **Overall Length of Response** *(in words)* | 0x00 | 0x07 |
| **0xAA** in MSB, **0xFF** in LSB | 0xAA | 0xFF |
| **Instance Counter** in MSB. **Node ID Echo** in LSB | <IC> | 0x01 |
| **Month** and **Day** Timestamp | <Month> | <Day> |
| **Hour** and **Minute** Timestamp | <Hour> | <Min> |
| **Seconds** Timestamp<br>**Additional Data Length** (*2 bytes:* "*Number of Tags*" *and* "*Status*") | <Sec> | 0x02 |
| **Number of Tags Found** in MSB<br>**Status** in LSB. 0x00 = operation completed successfully, 0x07 = Read Tag ID failed / Tag Not Found. | <# of tags found> | <0x00 |

See par. EPC Class 1 Gen 2 Tag Memory Structure in Appendix for details.

# A REFERENCES

## EPC CLASS 1 GEN 2 TAG MEMORY STRUCTURE

The memory in Balluff's EPC Class 1 Gen 2 tag *UHF-G2-525xx* is organized in **three** areas:

| Name | Description | Size |
|---|---|---|
| **EPC** | EPC memory according to the EPCglobal Standard | 96-bit (12 bytes) |
| **TID** | Read Only Unique identifier | 64-bits (8 bytes) |
| **USER** | User memory | 512-bit (64 bytes) |

### EPC

EPC is a numbering scheme that allows assignment of a unique identifier to any physical object. It can be regarded as the next generation of Universal Product Code (UPC), which is used on most products today.

EPC enables the means to assign a unique identifier to each item, thus allowing every item to be uniquely identified.

To have more details on the structure of the EPC memory area please consult:

- *EPC Radio-Frequency Identity Protocols Class-1 Generation-2 UHF RFID Protocol for Communications at 860 Mhz – 960 Mhz, Version 1.1.0 (December 17, 2005)*

In our UHF-G2-525xx tag this memory area is pre-programmed with the TID unique identifier and padded with zeroes. The user can change that but it's important to note that only tags with **different** EPC codes will be discriminated in a multi-tag reading environment.

### TID

This is a read-only area that holds a unique tag identifier number. This area can be accessed using the common CBx Read ID commands.

### USER

This is the normal data area that can be accessed using the common CBx Read and Write commands.

**NOTE**

*The fastest access memory is the EPC area. For applications where speed is important the use of this memory is recommended.*

## COMMAND MAPPING

A command is initiated by a host PC or *Programmable Logic Controller* (PLC) and is distributed to the Gateway/Hub over an Ethernet connection. Once issued, the command is then executed directly by the Gateway/Hub or is otherwise routed to the appropriate RFID controller (specified by its numerical "*Node ID*" value, for which there are up to16).

In general, there are two types of commands that can be issued:

- **Controller Commands** - commands intended for one of the attached RFID controllers. "*Read Data*" and "*Write Data*" are two common controller commands.
- **Gateway/Hub Commands** - commands intended for the Gateway/Hub itself. These commands query the Gateway/Hub for information or instruct the it to perform a task. The commands "*Get Node Status List*" and "*Set Notification Mask*" are examples of Gateway/Hub commands

### Mapping Commands & Response Data

In order to properly distribute RFID commands to the intended RFID controller (and to correctly return the controller's response to the host), the Gateway separates input data (*Commands*) from output data (*Responses*) by assigning each controller a *Node Input Page* and a *Node Output Page*. Each "*page*" is actually a small block of memory used to temporarily hold command or response data.

### Node Input Pages

The Gateway/Hub assigns each controller a ***Node Input Page*** that corresponds numerically to its assigned Node ID value. Thus, commands directed to the controller at Node 01, for example, will be written to Node Input Page 01. Node Input Pages hold Gateway and controller-bound command data generated by the host.

Nodes 01 thru 16 are assigned Node Input Pages 01 thru 16 respectively. The Gateway/Hub, itself, is assigned Node Input Page 32.

### Node Output Pages

The Gateway/Hub also assigns each controller a ***Node Output Page*** used to hold host-bound response data generated by the Gateway or one of the RFID controllers after executing a command.

A controller's numeric Node Output Page value is always ***32*** page values greater than its corresponding Node Input Page value. Therefore, response data from the controller at Node 01, for example, will be written to Node Output Page 33 (as Node Output Page 33 is 32 page values greater than its corresponding Node Input Page of 01).

Nodes 01 thru 16 are assigned Node Output Pages 33 thru 48 respectively. The Gateway/Hub is assigned Node Output Page 64.

| Product | Node ID | Node Input Page | Node Output Page |
|---|---|---|---|
| -485 Subnet16™ Controllers | Node 01 | Node Input Page 01 | Node Output Page 33 |
| | Node 02 | Node Input Page 02 | Node Output Page 34 |
| | Node 03 | Node Input Page 03 | Node Output Page 35 |
| | Node 04 | Node Input Page 04 | Node Output Page 36 |
| | Node 05 | Node Input Page 05 | Node Output Page 37 |
| | Node 06 | Node Input Page 06 | Node Output Page 38 |
| | Node 07 | Node Input Page 07 | Node Output Page 39 |
| | Node 08 | Node Input Page 08 | Node Output Page 40 |
| | Node 09 | Node Input Page 09 | Node Output Page 41 |
| | Node 10 | Node Input Page 10 | Node Output Page 42 |
| | Node 11 | Node Input Page 11 | Node Output Page 43 |
| | Node 12 | Node Input Page 12 | Node Output Page 44 |
| | Node 13 | Node Input Page 13 | Node Output Page 45 |
| | Node 14 | Node Input Page 14 | Node Output Page 46 |
| | Node 15 | Node Input Page 15 | Node Output Page 47 |
| | Node 16 | Node Input Page 16 | Node Output Page 48 |
| Gateway/Hub | Node 32 | Node Input Page 32 | Node Output Page 64 |

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