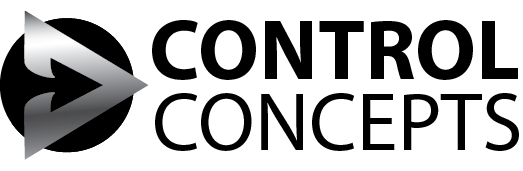
Date: Tuesday, January 23, 2020 

Ethernet/IP Device Profile

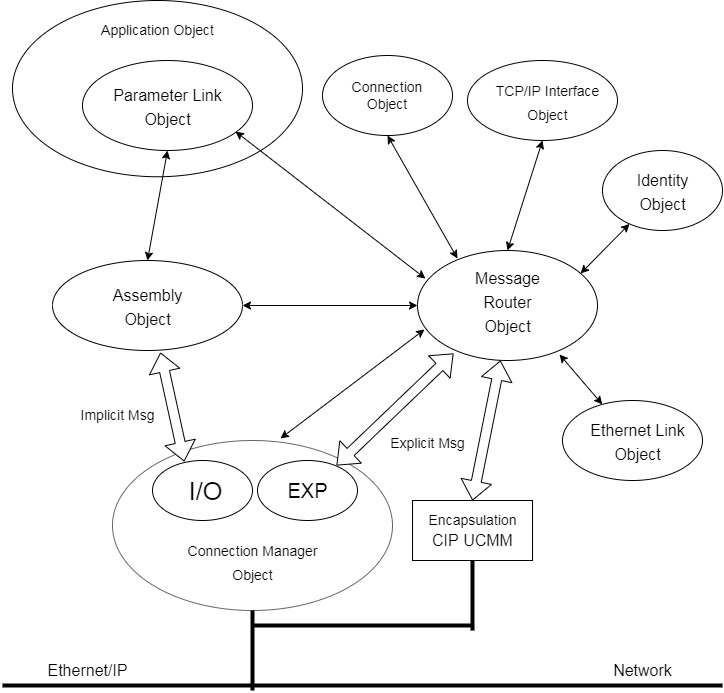
Revision: B.3

Revision Date: Thursday, September 28, 2022

**Overview**

Devices supported by this profile are exclusively confined to Control Concepts Inc. Power Controllers. These devices support specific “IO Assembly Instance” definitions which are used to pass control and status information to and from a device. This profile makes Power Controllers from Control Concepts inter-operable, but not directly interchangeable without performing configuration using the Control Panel interface software provided by Control Concepts Inc.

**Object Model**



**Generic Device**

**Device Type: 2Bh**

**Object Model:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Class Code** | **Object Class** | **Optional/Required** | **# of Instances** |
| 1 | [Identity](#_Identity_Object) | Required | 1 |
| 2 | [Message Router](#_Message_Router_Object) | Required | 1 |
| 246 (0xF6) | [Ethernet Link](#_Ethernet_Link_Object) | Required | 2 |
| 245 (0xF5) | [TCP/IP Interface](#_TCP/IP_Interface_Object) | Required | 1 |
| 244 (0xF4) | [Port](#_Port) | Optional | 1 |
| 6 | [Connection Manager](#_Connection_Manager_Object) | Required | 1 |
| 4 | [Assembly](#_Assembly_Object) | Required | 2 |
| 100 (0x64) | [Parameter Link](#_Parameter_Link_Object) | Required | 30 |
| 265 (0x109) | [LLDP Management](#_LLDP_Management_Object) | Required | 1 |
| 266 (0x10A) | [LLDP Data Table](#_LLDP_Data_Table) | Required | 48 |

**How Objects Affect Behavior**

|  |  |
| --- | --- |
| **Object** | **Effect on Behavior** |
| Identity | Supports the Reset service |
| Message Router | No Effect |
| Ethernet Link | Counters and status of the IEEE 802.3 communications interface |
| TCP/IP Interface | Configuration of the TCP/IP network interface |
| Port | Obtain information about backplane/subnets |
| Connection Manager | Manages the internal resources for I/O and Explicit connections |
| Connection | Contains the number of logical ports into and out of the device |
| Assembly | Defines input/output data format |
| Parameter Link | Provides a public interface to the device data |
| LLDP Management | Provides control for LLDP protocol (2 ports supported) |
| LLDP Data Table | Provides interface for link data on up to 48 neighbors |

**Object Interfaces**

|  |  |
| --- | --- |
| **Object** | **Interface** |
| Identity | Message Router |
| Message Router | UCMM |
| Ethernet Link | Message Router |
| TCP/IP Interface | Message Router |
| Port | Message Router |
| Connection Manager | Message Router |
| Connection | Message Router |
| Assembly | Message Router and/or I/O Connection |
| Parameter Link | Message Router |
| LLDP Management | Message Router |
| LLDP Data Table | Message Router |

**I/O Assembly Instances**

|  |  |  |
| --- | --- | --- |
| **Number** | **Type** | **Name** |
| 1 | Output | Parameter Write, O🡪T |
| 2 | Input | Parameter Read, T🡪O |

**Format of I/O Assembly Data, Attribute 3 – Default**

**Note:** We support configuring the assembly format via a sideband channel. The Input Assembly may have up to 30 members, but defaults to 19.

**Instance #1 Output Assembly (Parameter Write, O🡪T)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **BYTE** | **Format** | **MAP to Class** | **MAP to Instance** | **MAP to Attribute** |
| 0 | Data Value 1 [LSB] | 100 | 1 | 1 |
| 1 | Data Value 1 [MSB] | 100 | 1 | 1 |
| 2 | Data Value 2 [LSB] | 100 | 2 | 1 |
| 3 | Data Value 2 [MSB] | 100 | 2 | 1 |

**Instance #2 Input Assembly (Parameter Read, T🡪O)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **BYTE** | **Format** | **MAP to Class** | **MAP to Instance** | **MAP to Attribute** |
| 0 | Data Value 1 [LSB] | 100 | 1 | 1 |
| 1 | Data Value 1 [MSB] | 100 | 1 | 1 |
| 2 | Data Value 2 [LSB] | 100 | 2 | 1 |
| 3 | Data Value 2 [MSB] | 100 | 2 | 1 |
| 4 | Data Value 3 [LSB] | 100 | 3 | 1 |
| 5 | Data Value 3 [MSB] | 100 | 3 | 1 |
| 6 | Data Value 4 [LSB] | 100 | 4 | 1 |
| 7 | Data Value 4 [MSB] | 100 | 4 | 1 |
| 8 | Data Value 5 [LSB] | 100 | 5 | 1 |
| 9 | Data Value 5 [MSB] | 100 | 5 | 1 |
| 10 | Data Value 6 [LSB] | 100 | 6 | 1 |
| 11 | Data Value 6 [MSB] | 100 | 6 | 1 |
| 12 | Data Value 7 [LSB] | 100 | 7 | 1 |
| 13 | Data Value 7 [MSB] | 100 | 7 | 1 |
| 14 | Data Value 8 [LSB] | 100 | 8 | 1 |
| 15 | Data Value 8 [MSB] | 100 | 8 | 1 |
| 16 | Data Value 9 [LSB] | 100 | 9 | 1 |
| 17 | Data Value 9 [MSB] | 100 | 9 | 1 |
| 18 | Data Value 10 [LSB] | 100 | 10 | 1 |
| 19 | Data Value 10 [MSB] | 100 | 10 | 1 |
| 20 | Data Value 11 [LSB] | 100 | 11 | 1 |
| 21 | Data Value 11 [MSB] | 100 | 11 | 1 |
| 22 | Data Value 12 [LSB] | 100 | 12 | 1 |
| 23 | Data Value 12 [MSB] | 100 | 12 | 1 |
| 24 | Data Value 13 [LSB] | 100 | 13 | 1 |
| 25 | Data Value 13 [MSB] | 100 | 13 | 1 |
| 26 | Data Value 14 [LSB] | 100 | 14 | 1 |
| 27 | Data Value 14 [MSB] | 100 | 14 | 1 |
| 28 | Data Value 15 [LSB] | 100 | 15 | 1 |
| 29 | Data Value 15 [MSB] | 100 | 15 | 1 |

**Instance #2 Input Assembly (Parameter Read, T🡪O) continued**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **BYTE** | **Format** | **MAP to Class** | **MAP to Instance** | **MAP to Attribute** |
| 30 | Data Value 16 [LSB] | 100 | 16 | 1 |
| 31 | Data Value 16 [MSB] | 100 | 16 | 1 |
| 32 | Data Value 17 [LSB] | 100 | 17 | 1 |
| 33 | Data Value 17 [MSB] | 100 | 17 | 1 |
| 34 | Data Value 18 [LSB] | 100 | 18 | 1 |
| 35 | Data Value 18 [MSB] | 100 | 18 | 1 |
| 36 | Data Value 19 [LSB] | 100 | 19 | 1 |
| 37 | Data Value 19 [MSB] | 100 | 19 | 1 |
| 38 | Data Value 20 [LSB] | 100 | 20 | 1 |
| 39 | Data Value 20 [MSB] | 100 | 20 | 1 |
| 40 | Data Value 21 [LSB] | 100 | 21 | 1 |
| 41 | Data Value 21 [MSB] | 100 | 21 | 1 |
| 42 | Data Value 22 [LSB] | 100 | 22 | 1 |
| 43 | Data Value 22 [MSB] | 100 | 22 | 1 |
| 44 | Data Value 23 [LSB] | 100 | 23 | 1 |
| 45 | Data Value 23 [MSB] | 100 | 23 | 1 |
| 46 | Data Value 24 [LSB] | 100 | 24 | 1 |
| 47 | Data Value 24 [MSB] | 100 | 24 | 1 |
| 48 | Data Value 25 [LSB] | 100 | 25 | 1 |
| 49 | Data Value 25 [MSB] | 100 | 25 | 1 |
| 50 | Data Value 26 [LSB] | 100 | 26 | 1 |
| 51 | Data Value 26 [MSB] | 100 | 26 | 1 |
| 52 | Data Value 27 [LSB] | 100 | 27 | 1 |
| 53 | Data Value 27 [MSB] | 100 | 27 | 1 |
| 54 | Data Value 28 [LSB] | 100 | 28 | 1 |
| 55 | Data Value 28 [MSB] | 100 | 28 | 1 |
| 56 | Data Value 29 [LSB] | 100 | 29 | 1 |
| 57 | Data Value 29 [MSB] | 100 | 29 | 1 |
| 58 | Data Value 30 [LSB] | 100 | 30 | 1 |
| 59 | Data Value 30 [MSB] | 100 | 30 | 1 |

# Identity Object

**Class Code: 01h**

This object provides identification of and general information about the device.

**Class Attributes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute ID** | **Access Rule** | **Name** | **Data Type** | **Value** |
| 1 | Get | Revision | UINT | 2 |
| 2 | Get | Max Instance | UINT | 1 |
| 3 | Get | Number of Instances | UINT | 1 |
| 4 | Get | Optional Attribute List | STRUCT of: |  |
| Number of attributes | UINT | 3 |
| Optional attributes | ARRAY of UINT | [19, 21, 22] |
| 6 | Get | Max Number Class Attributes | UINT | 7 |
| 7 | Get | Max Number Instance Attributes | UINT | 22 |

**Class Services**

|  |  |
| --- | --- |
| **Service Code** | **Service Name** |
| 01h | Get\_Attributes\_All |
| 0Eh | Get\_Attribute\_Single |

**Note:** Only one instance of this class is supported

**Instance Attributes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute ID** | **Access Rule** | **Name** | **Data Type** | **Value** |
| 1 | Get | Vendor ID | UINT | 1188 |
| 2 | Get | Device Type | UINT | 43 |
| 3 | Get | Product Code | UINT | 4688 (0x1250) |
| 4 | Get | Revision | STRUCT of: | 1.001 |
| Major Revision | USINT | 1 |
| Minor Revision | USINT | 1 |
| 5 | Get | Status | WORD | SEE Definition below |
| 6 | Get | Serial Number | UDINT | Unique per device |
| 7 | Get | Product Name | SHORT-STRING |  |
| Length | USINT | 4 |
| Contents | STRING[32] | ATOM |
| 19 | Get | Protection Mode |  | 0x0 or 0x1 |
| 21 | Get | Catalog Number | SHORT-STRING |  |
| Length | USINT | 3 |
| Contents | STRING[32] | CCI |
| 22 | Get | Manufacture Date | DATE | Unit-specific |

**Status – Attribute 5, Bit Definitions**

|  |  |  |
| --- | --- | --- |
| **Bit(s)** | **Called** | **Definition** |
| 0 | Owned | 1 = the device has an owner (a connection is established) |
| 1 | Reserved | 0 |
| 2 | Configured | 1 = configured different than “out-of-box” default |
| 3 | Reserved | 0 |
| 4 – 7 | Extended Device Status | SEE Definition below |
| 8 | Minor Recoverable Fault | 1 = recoverable problem has been detected |
| 9 | Minor Unrecoverable Fault | 1 = unrecoverable problem has been detected |
| 10 | Major Recoverable Fault | 1 = recoverable problem has been detected  Device is in “Major Recoverable Fault” state |
| 11 | Major Unrecoverable Fault | 1 = unrecoverable problem has been detected  Device is in “Major Unrecoverable Fault” state |
| 12 – 15 | Extended Device Status 2 | 0 |

**Status, Extended Device Status, Bits 4 – 7 Definition**

|  |  |
| --- | --- |
| **Value** | **Description** |
| 0 | Self Testing or Unknown |
| 1 | Firmware Update in Progress |
| 2 | At least one faulted I/O connection |
| 3 | No I/O connections established |
| 4 | Non-Volatile Configuration bad |
| 5 | Major Fault – either bit 10 or bit 11 of Status (Attribute 5) is true (1) |
| 6 | At least one I/O connection is in run mode |
| 7 | At least one I/O connection established, all in idle mode |
| 8 | 0 |
| 9 | 0 |
| 10 thru 15 | 0 |

**Instance Services**

|  |  |
| --- | --- |
| **Service Code** | **Service Name** |
| 01h | Get\_Attributes\_All |
| 0Eh | Get\_Attribute\_Single |
| 05h | Reset |

**Reset Service (05)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name** | **Data Type** | **Description** | **Value** | **Definition** |
| Type | USINT | Type of Reset | 0 | Emulate a power cycle as closely as possible |
| 1 | Return as closely as possible to factory defaults, and Emulate a power cycle as closely as possible |
| 2 | Return to “out-of-box” configuration with the exception of communication link parameters, and Emulate a power cycle as closely as possible |

**Communication Link Attributes that shall be preserved – Reset Type = 2**

|  |  |  |  |
| --- | --- | --- | --- |
| **Class** | **Instance** | **Attribute** | **Attribute ID** |
| TCP/IP Interface Object (0xF5) | ALL except 0 | Configuration Control | 3 |
| Interface Configuration | 5 |
| Host Name | 6 |

# Message Router Object

**Class Code: 02h**

There is no externally visible interface to the message router object. The message router object supports no class or instance attributes or services.

**Class Attributes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute ID** | **Access Rule** | **Name** | **Data Type** | **Value** |
| 1 | Get | Revision | UINT | 1 |
| 2 | Get | Max Instance | UINT | 1 |
| 3 | Get | Number of Instances | UINT | 1 |
| 4 | Get | Optional Attribute List | STRUCT of: |  |
| Number of attributes | UINT | 3 |
| Optional attributes | ARRAY of UINT | [1, 2, 3] |
| 6 | Get | Max Number Class Attributes | UINT | 7 |
| 7 | Get | Max Number Instance Attributes | UINT | 3 |

**Instance Attributes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute ID** | **Access Rule** | **Name** | **Data Type** | **Value** |
| 1 | Get | Object List | STRUCT of: |  |
| Number | UINT | 10 |
| Classes | Array of UINT | Listed [here](#SupportedClasses) |
| 2 | Get | Number Available | UINT | 10 |
| 3 | Get | Number Active | UINT | 0-10 |

**Common Services**

|  |  |
| --- | --- |
| **Service Code** | **Service Name** |
| 01h | Get\_Attributes\_All |
| 0Eh | Get\_Attribute\_Single |

# Port

**Class Code: F4h**

Provides information about the backplane.

**Class Attributes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute ID** | **Access Rule** | **Name** | **Data Type** | **Value** |
| 1 | Get | Revision | UINT | 2 |
| 2 | Get | Max Instance | UINT | 2 |
| 3 | Get | Number of Instances | UINT | 2 |
| 6 | Get | Max Number Class Attributes | UINT | 9 |
| 7 | Get | Max Number Instance Attributes | UINT | 11 |
| 8 | Get | Entry Port | UINT | 1 or 2 |
| 9 | Get | Port Instance Info | ARRAY of STRUCT of: |  |
| Port Type | UINT | Type of port |
| Port Number | UINT | CIP Port Number |

**Class Services**

|  |  |
| --- | --- |
| **Service Code** | **Service Name** |
| 01h | Get\_Attributes\_All |
| 0Eh | Get\_Attribute\_Single |

**Instance Attributes**

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute ID** | **Access Rule** | **Name** | **Data Type** |
| 1 | Get | Port Type | UINT |
| 2 | Get | Port Number | UINT |
| 3 | Get | Logical Link Object | STRUCT OF |
| Path Length | UINT |
| Link Path | Padded EPATH |
| 4 | Get | Port Name | SHORT-STRING |
| 7 | Get | Node Address | Padded EPATH |
| 10 | Get | Port Routing Capabilities | DWORD |
| 11 | Get | Associated Communication Objects | STRUCT of: |
| Number of entries | USINT |
|  | Array of Struct of: |
| Number of 16-bit words in path | USINT |
| Logical path segments that identify communication object instance | Padding EPATH |

**Instance Services**

|  |  |
| --- | --- |
| **Service Code** | **Service Name** |
| 01h | Get\_Attributes\_All |
| 0Eh | Get\_Attribute\_Single |

# Ethernet Link Object

**Class Code: F6h**

The Ethernet Link object maintains link-specific counters and status information for an IEEE 802.3 communications interface

**Class Attributes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute ID** | **Access Rule** | **Name** | **Data Type** | **Value** |
| 1 | Get | Revision | UINT | 4 |
| 2 | Get | Max Instance | UINT | 2 |
| 3 | Get | Number of Instances | UINT | 2 |
| 4 | Get | Optional Attribute List | STRUCT of: |  |
| Number of attributes | UINT | 3 |
| Optional attributes | ARRAY of UINT | [7, 8, 10] |
| 6 | Get | Max Number Class Attributes | UINT | 7 |
| 7 | Get | Max Number Instance Attributes | UINT | 11 |

**Class Services**

|  |  |
| --- | --- |
| **Service Code** | **Service Name** |
| 01h | Get\_Attributes\_All |
| 0Eh | Get\_Attribute\_Single |

**Instance Attributes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute ID** | **Access Rule** | **Name** | **Data Type** | **Value** |
| 1 | Get | Interface Speed | UDINT | Speed in Mbps |
| 2 | Get | Interface Flags | DWORD | SEE Definition below |
| 3 | Get | Physical Address | ARRAY of 6 USINTs | MAC Address:  XX-XX-XX-XX-XX-XX |
| 7 | Get | Interface Control | USINT | 0x02 |
| 8 | Get | Interface State | USINT | 0x01 |
| 10 | Get | Interface Label | SHORT\_STRING | Port #1 & Port #2 |
| 11 | Get | Interface Capability | STRUCT of: |  |
| Capability Bits | DWORD | 6 (SEE Definition below) |
| Speed/Duplex Options | STRUCT of: | Note: Interface Control, Attribute 6, is not supported |
| Array count | USINT | 1 |
|  | ARRAY of STRUCT of: |  |
| Interface speed | UINT | 0 = no selections |
| Interface Duplex Mode | USINT | 0 = no selections |

(Ethernet Link Continued)

**Interface Flags – Attribute 2, Bit Definitions**

|  |  |  |
| --- | --- | --- |
| **Bit(s)** | **Called** | **Definition** |
| 0 | Link Status | 0 = Inactive Link, 1 = Active Link |
| 1 | Half/Full Duplex | 0 = Half Duplex, 1 = Full Duplex |
| 2 – 4 | Negotiation Status | 0 = 000 = Auto-negotiation in progress  1 = 001 = Auto-negotiation and speed detection failed  2 = 010 = Auto-negotiation failed but detected speed  3 = 011 = Successfully negotiated speed & duplex  4 = 100 = Auto-negotiation not attempted |
| 5 | Manual Setting Requires Reset | Value = 0 = automatically applied |
| 6 | Local Hardware Fault | 0 = no fault detected  1 = local hardware fault detected (requires user intervention) |
| 7 – 31 | Reserved | Value = 0 |

**Capability Bits – Attribute 11, Bit Definitions**

|  |  |  |
| --- | --- | --- |
| **Bit(s)** | **Called** | **Value, Definition** |
| 0 | Manual Setting Requires Reset | 0 = Interface Control Attribute 6 is not supported |
| 1 | Auto-negotiate | 1 = supports link auto-negotiation |
| 2 | Auto-MDIX | 1 = supports auto MDIX operation |
| 3 | Manual Speed/Duplex | 0 = Interface Control Attribute 6 is not supported |
| 4 – 31 | Reserved | 0 |

**Instance Services**

|  |  |
| --- | --- |
| **Service Code** | **Service Name** |
| 01h | Get\_Attributes\_All |
| 0Eh | Get\_Attribute\_Single |
| 10h | Set\_Attribute\_Single |

# TCP/IP Interface Object

**Class Code: F5h**

The TCP/IP Interface object provides the mechanism to configure the device’s TCP/IP network interface, such as the device’s IP Address, Network Mask, and Gateway Address.

**Class Attributes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute ID** | **Access Rule** | **Name** | **Data Type** | **Value** |
| 1 | Get | Revision | UINT | 4 |
| 2 | Get | Max Instance | UINT | 1 |
| 3 | Get | Number of Instances | UINT | 1 |
| 4 | Get | Optional Attribute List | STRUCT of: |  |
| Number of attributes | UINT | 3 |
| Optional attributes | ARRAY of UINT | [8, 9, 16, 17] |
| 6 | Get | Max Number Class Attributes | UINT | 7 |
| 7 | Get | Max Number Instance Attributes | UINT | 17 |

**Class Services**

|  |  |
| --- | --- |
| **Service Code** | **Service Name** |
| 01h | Get\_Attributes\_All |
| 0Eh | Get\_Attribute\_Single |

**Instance Attributes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute ID** | **Access Rule** | **Name** | **Data Type** | **Value** |
| 1 | Get | Status | DWORD | SEE Definition below |
| 2 | Get | Configuration Capability | DWORD | 148 = 94h  SEE Definition below |
| 3 | Get/Set | Configuration Control | DWORD | SEE Definition below |
| 4 | Get | Physical Link Object | STRUCT of: | Path to Ethernet link object |
| Path Size | UINT | 4 |
| Path | Padded EPATH | [20][F6][24][01] |
| 5 | Get | Interface Configuration | STRUCT of: | TCP/IP network interface configuration |
| IP Address | UDINT | 0 = not configured (Note 1) |
| Network Mask | UDINT | 0 = not configured (Note 1) |
| Gateway Address | UDINT | 0 = not configured (Note 1) |
| Name Server | UDINT | 0 = not configured |
| Name Server 2 | UDINT | 0 = not configured |
| Domain Name | STRING | 48 char max |
| 6 | Get | Host Name | STRING | 64 char max |
| 8 | Get | TTL Value | USINT | 1 |
| 9 | Get | Mcast Config | STRUCT of: |  |
| Alloc Control | USINT | 0 |
| Reserved | USINT | 0 |
| Num Mcast | UINT | 32 |
| Mcast Start Addr | UDINT | 0xefc00100 |
| 13 | Get/Set | Encap Inactivity Timeout | UINT | 120 |
| 16 | Get | Active TCP Connections | UINT | 0-10 |
| 17 | Get | Non-CIP Encap Messages/sec | UDINT | Message count |
| 10 | Set | SelectAcd | BOOL | 0 = Disable ACD  1 = Enable ACD (default) |

Note 1: When configured, set to a valid Class A, B, or C address

**Instance Attributes (continued)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute ID** | **Access Rule** | **Name** | **Data Type** | **Value** |
| 11 | Get/Set | LastConflictDetected | STRUCT of: | ACD Diagnostic parameters |
| AcdActivity | USINT | ACD Activity (default = 0) |
| RemoteMAC | Array of 6 USINT | MAC from Ethernet packet header (default = 0) |
| ArpPdu | Array of 28 USINT | ARP PDU  (default = 0) |
| 13 | Set | Encapsulation Inactivity Timeout | UINT | 0 = Disable  1 to 3600 = timeout in seconds  Default = 120 sec |

**Status – Attribute 1, Bit Definitions**

|  |  |  |
| --- | --- | --- |
| **Bit(s)** | **Called** | **Definition** |
| 0 – 3 | Interface Configuration Status | Indicates the status of the Interface Configuration attribute (5)  0 = not configured  1 = configuration obtained from BOOTP, DHCP, or non-volatile storage |
| 4 | Mcast Pending | 1 = a pending configuration change to the TTL Value and/or the Mcast Config attributes |
| 5 | Interface Configuration Pending | 1 = a pending configuration change in the Interface Configuration attribute |
| 6 | AcdStatus | 1 = IP Address conflict has been detected |
| 7 | AcdFault | 1 = IP Address conflict has been detected or the defense failed, and the current Interface Configuration cannot be used |
| 8 | IANA Port Admin Change Pending | 1 = a pending configuration change in the IANA Port Admin attribute |
| 9 | IANA Protocol Admin Change Pending | 1 = a pending configuration change in the IANA Protocol Admin attribute |
| 10 – 31 | Reserved | 0 |

**Configuration Capability – Attribute 2, Bit Definitions (Value = 94h)**

|  |  |  |
| --- | --- | --- |
| **Bit(s)** | **Called** | **Value Definition** |
| 0 | BOOTP Client | 0 = doesn’t support BOOTP |
| 1 | DNS Client | 0 = doesn’t support DNS |
| 2 | DHCP Client | 1 = supports DHCP for obtaining network configuration |
| 3 | DHCP-DNS Update | 0 = Always zero |
| 4 | Configuration Settable | 1 = Interface Configuration attribute is settable |
| 5 | Hardware Configurable | 0 = IP Address is not hardware configurable |
| 6 | Interface Configuration Change Requires Reset | 0 = a change to the Interface Configuration attribute will take effect immediately |
| 7 | Acd Capable | 1 = this device is ACD capable |
| 8 – 31 | Reserved | 0 |

**Configuration Control – Attribute 3, Bit Definitions**

|  |  |  |
| --- | --- | --- |
| **Bit(s)** | **Called** | **Definition** |
| 0 – 3 | Configuration Method | 0 = use statically-assigned IP configuration values  1 = obtain interface configuration via BOOTP  2 = obtain interface configuration via DHCP |
| 4 | DNS Enable | 1 = resolve host names by querying a DNS server |
| 5 – 31 | Reserved | 0 |

**Instance Services**

|  |  |
| --- | --- |
| **Service Code** | **Service Name** |
| 01h | Get\_Attributes\_All |
| 0Eh | Get\_Attribute\_Single |
| 10h | Set\_Attribute\_Single |

# Connection Manager Object

**Class Code: 06h**

The Connection Manager object allocates and manages the internal resources associated with both I/O and Explicit Messaging connections. The specific instance generated by the Connection Manager Class is referred to as a Connection Instance or a Connection Object.

There is only 1 instance of the Connection Manager object

**Class Attributes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute ID** | **Access Rule** | **Name** | **Data Type** | **Value** |
| 1 | Get | Revision | UINT | 1 |
| 2 | Get | Max Instance | UINT | 1 |
| 3 | Get | Number of Instances | UINT | 1 |
| 4 | Get | Optional Attribute List | STRUCT of: |  |
| Number of attributes | UINT | 8 |
| Optional attributes | ARRAY of UINT | [1, 2, 3, 4, 5, 6, 7, 8] |
| 6 | Get | Max Number Class Attributes | UINT | 7 |
| 7 | Get | Max Number Instance Attributes | UINT | 8 |

**Class Services**

|  |  |
| --- | --- |
| **Service Code** | **Service Name** |
| 01h | Get\_Attributes\_All |
| 0Eh | Get\_Attribute\_Single |

**Instance Attributes**

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute ID** | **Access Rule** | **Name** | **Data Type** |
| 1 | Get/Set | Open Requests | UINT |
| 2 | Get/Set | Open Format Rejects | UINT |
| 3 | Get/Set | Open Resource Rejects | UINT |
| 4 | Get/Set | Open Other Rejects | UINT |
| 5 | Get/Set | Close Requests | UINT |
| 6 | Get/Set | Close Format Requests | UINT |
| 7 | Get/Set | Close Other Requests | UINT |
| 8 | Get/Set | Connection Timeouts | UINT |

**Instance Services**

|  |  |
| --- | --- |
| **Service Code** | **Service Name** |
| 01h | Get\_Attributes\_All |
| 02h | Set\_Attributes\_All |
| 0Eh | Get\_Attribute\_Single |
| 10h | Set\_Attribute\_Single |
| 4Eh | Forward\_Close |
| 52h | Unconnected\_Send |
| 54h | Forward\_Open |
| 5Ah | Get\_Connection\_Owner |
| 5Bh | Large\_Forward\_Open |

**I/O Messaging**

|  |  |  |
| --- | --- | --- |
| **Name** | **Data Type** | **Value** |
| Produced Connection Path | Packed EPATH | [20][04][24][66][30][03] |
| Consumed Connection path | Packed EPATH | [20][04][24][65][30][03] |

**Forward Open, I/O Connection, Application Path**

|  |  |
| --- | --- |
| **Packed EPATH** | **Description** |
| [20][04][2C][65][2C][66] | Assembly Object (04), Output Instance (01), Input Instance (02)  Attribute 3, Member Data, is assumed for both |

# Assembly Object

**Class Code: 04h**

The Assembly Object binds attributes of multiple Parameter Link Objects, which allows data to or from each object to be sent and/or received over a single connection.

**Class Attributes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute ID** | **Access Rule** | **Name** | **Data Type** | **Value** |
| 1 | Get | Revision | UINT | 3 |
| 2 | Get | Max Instance | UINT | 2 |
| 3 | Get | Number of Instances | UINT | 2 |
| 4 | Get | Optional Attribute List | STRUCT of: |  |
| Number of attributes | UINT | 1 |
| Optional attributes | ARRAY of UINT | [4] |
| 6 | Get | Max Number Class Attributes | UINT | 7 |
| 7 | Get | Max Number Instance Attributes | UINT | 4 |

**Class Services**

|  |  |
| --- | --- |
| **Service Code** | **Service Name** |
| 0E | Get\_Attribute\_Single |

**Instance Attributes**

**Output Assembly (Instance #1)** Write Data (O🡪T)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute ID** | **Access Rule** | **Name** | **Data Type** | **Value** |
| 1 | Get | Number of Members | UINT | Range 0 to 2 = Number of Parameter Link Object instances included |
| 2 | Get | Member List | ARRAY of STRUCT: | Array of CIP paths to Parameter Link Objects |
| Member Size | UINT | 2 = Number of bytes for the member |
| Member Path Size | UINT | 6 = Number of bytes in the member path |
| Member Path | Packed EPATH | [20][65][24][nn][30][01]  nn = Instance ID of Parameter Link Object |
| 3 | Get/Set | Member Data | ARRAY of UINT | Values of Parameter Link object instances attribute 1 |
| 4 | Get | Size | UINT | Number of bytes in Attribute 3 |
| 100 | Get | Parameter Code List | ARRAY of UINT | Values of Parameter Link object instances attribute 3 |

**Input Assembly (Instance #2)** Read Data (T🡪O)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute ID** | **Access Rule** | **Name** | **Data Type** | **Value** |
| 1 | Get | Number of Members | UINT | Range 0 to 30 = Number of Parameter Link Object instances included |
| 2 | Get | Member List | ARRAY of STRUCT: | Array of CIP paths to Parameter Link Objects |
| Member Size | UINT | 2 = Number of bytes for the member |
| Member Path Size | UINT | 6 = Number of bytes in the member path |
| Member Path | Packed EPATH | [20][66][24][nn][30][01]  nn = Instance ID of Parameter Link Object |
| 3 | Get | Member Data | ARRAY of UINT | Values of Parameter Link object instances attribute 1 |
| 4 | Get | Size | UINT | Number of bytes in Attribute 3 |
| 100 | Get | Parameter Code List | ARRAY of UINT | Values of Parameter Link object instances attribute 3 |

**Instance Services**

|  |  |
| --- | --- |
| **Service Code** | **Service Name** |
| 0E | Get\_Attribute\_Single |
| 10 | Set\_Attribute\_Single |
| 18 | Get\_Member |
| 19 | Set\_Member |

# Parameter Link Object

**Class Code: 64h** (Vendor Specific)

The Parameter Link Object provides public access to parameters in the Control Concepts power controller device.

**Class Attributes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute ID** | **Access Rule** | **Name** | **Data Type** | **Value** |
| 1 | Get | Revision | UINT | 1 |
| 2 | Get | Max. instance | UINT | 30 |
| 3 | Get | Number of Instances | UINT | 30 |

**Class Services**

|  |  |
| --- | --- |
| **Service Code** | **Service Name** |
| 01h | Get\_Attributes\_All |
| 0Eh | Get\_Attribute\_Single |

**Instance Attributes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute ID** | **Access Rule** | **Name** | **Data Type** | **Value** |
| 1 | Get/Set | Value | Note 1 | Value of the parameter |
| 2 | Get | Status | USINT | Error Code (SEE Definition below) |
| 3 | Get/Set | Parameter Code | UINT | Product specific parameter code number  Range: 1 thru 389 |
| 4 | Get | Descriptor | USINT | SEE Definition below |
| 5 | Get | Data Type | USINT | SEE Definition below |
| 6 | Get | Data Size | USINT | 2 = size of data value in bytes |

Note 1: The data type is defined by the values of Attributes 4, 5, & 6

**Status – Attribute 2, Error Code**

|  |  |
| --- | --- |
| Value | Description |
| 0 | No Error = OK |
| 1 | Data Value is greater than the maximum allowed |
| 2 | Data Value is less than the minimum allowed |
| 3 | Parameter is locked, Value write is not allowed |
| 4 – 7 | Reserved |
| 8 | Invalid Parameter Code number, Access denied |
| 9 | Invalid Parameter Code number, parameter is not defined |
| 10 | Parameter Code number/data is out of range |

**Descriptor – Attribute 4, Bit Definition**

|  |  |  |
| --- | --- | --- |
| **Bit(s)** | **Called** | **Definition** |
| 0 | Reserved | Always = 0 |
| 1 | Settable Parameter | Value can be read and written |
| 2 | Read Only Parameter | Value is read only |
| 3 | Monitor Parameter | Value is updated at regular intervals |
| 4 | Non-Volatile storage | Value can be saved in non-volatile memory |
| 5 – 7 | Reserved | Always = 0 |

**Data Type – Attribute 5**

|  |  |  |
| --- | --- | --- |
| **Value** | **Type** | **Definition** |
| 1 | WORD | 16-bit, Bit Mapped value |
| 2 | UINT | 16-bit Unsigned Integer |
| 3 | INT | 16-bit Signed Integer |

**Instance Services**

|  |  |
| --- | --- |
| **Service Code** | **Service Name** |
| 0E | Get\_Attribute\_Single |
| 10 | Set\_Attribute\_Single |
| 15 | Restore (Note 2) |
| 16 | Save (Note 2) |

Note 2: Restore and Save Services apply to Attribute 1 “Value” only when bit 4 of the descriptor is set (1). The “Save” service should be used sparingly in order to prevent damage to the non-volatile memory caused by too many write operations.

# LLDP Management Object

**Class Code: 109h**

The LLDP Management Object provides control over the LLDP protocol implemented by the device.

**Class Attributes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute ID** | **Access Rule** | **Name** | **Data Type** | **Value** |
| 1 | Get | Revision | UINT | 1 |
| 2 | Get | Max Instance | UINT | 1 |
| 3 | Get | Number of Instances | UINT | 1 |
| 4 | Get | Optional Attribute List | STRUCT of: |  |
| Number of attributes | UINT | 0 |
| Optional attributes | ARRAY of UINT | [] |
| 6 | Get | Max Number Class Attributes | UINT | 7 |
| 7 | Get | Max Number Instance Attributes | UINT | 5 |

**Class Services**

|  |  |
| --- | --- |
| **Service Code** | **Service Name** |
| 01h | Get\_Attributes\_All |
| 0Eh | Get\_Attribute\_Single |

**Instance Attributes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute ID** | **Access Rule** | **Name** | **Data Type** | **Value** |
| 1 | Get/Set | LLDP Enable | STRUCT of: |  |
| Array Length | UINT: | 3 |
| Enable Array | Array of BYTE: | [0, = port 2 TX enable 0, = port 1 TX enable 0 = global enabled] |
| 2 | Get/Set | Msg TX Interval | UINT | 1-3600 |
| 3 | Get/Set | Msg TX Hold | USINT | 1-100 |
| 4 | Get | LLDP Datastore | WORD | 0x0 |
| 5 | Get | LastChange | UDINT | Time in 100ths of a second of last change |

**Instance Services**

|  |  |
| --- | --- |
| **Service Code** | **Service Name** |
| 10h | Set\_Attribute\_Single |
| 0Eh | Get\_Attribute\_Single |

# LLDP Data Table Object

**Class Code: 10Ah**

The LLDP Data Table object provides information about neighbor links discovered by LLDP.

**Class Attributes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute ID** | **Access Rule** | **Name** | **Data Type** | **Value** |
| 1 | Get | Revision | UINT | 1 |
| 2 | Get | Max Instance | UINT | 48 |
| 3 | Get | Number of Instances | UINT | 0-48 |
| 4 | Get | Optional Attribute List | STRUCT of: |  |
| Number of attributes | UINT | 0 |
| Optional attributes | ARRAY of UINT | [] |
| 6 | Get | Max Number Class Attributes | UINT | 7 |
| 7 | Get | Max Number Instance Attributes | UINT | 9 |

**Class Services**

|  |  |
| --- | --- |
| **Service Code** | **Service Name** |
| 01h | Get\_Attributes\_All |
| 0Eh | Get\_Attribute\_Single |

**Instance Attributes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute ID** | **Access Rule** | **Name** | **Data Type** | **Value** |
| 1 | Get | Ethernet Link Instance Number | UINT | The port this neighbor was discovered on |
| 2 | Get | MAC Address | MAC ADDR | The mac address of the neighbor |
| 3 | Get | Interface Label | SHORT-STRING | Neighboring interface label |
| 4 | Get | Time to Live | UINT | Time until the entry expires |
| 5 | Get | System Capabilities TLV | STRUCT OF | Neighboring system capability TLV |
| System Capabilities | WORD | The neighbor’s capabilities |
| Enabled Capabilities | WORD | The neighbor’s enabled capabilities |
| 6 | Get | IPv4 Management Addresses | STRUCT of: | IPv4 Management Address of neighbor |
| Management Address Count | USINT | Count of neighbor management addresses |
| Management Address | ARRAY of UDINT | A list of 32-bit IPv4 management addresses of the neighbor |
| 7 | Get | CIP Identification | STRUCT of: | CIP Identification TLV type 127 |
| Vendor ID | UINT | CIP Vendor ID |
| Device Type | UINT | CIP Device Type |
| Product Code | UINT | CIP Product Code |
| Major Revision | BYTE | CIP Major Revision |
| Minor Revision | USINT | CIP Minor Revision |
| CIP Serial Number | UDINT | CIP Serial Number |
| 8 | Get | Additional Ethernet Capabilities | STRUCT of: | IEEE 802.3-2018 79.3 |
| Preemption Support | BOOL | 0 = Not supported, 1 = Supported |
| Preemption Status | BOOL | 0 = Not Enabled, 1 = Enabled |
| Preemption Active | BOOL | 0 = Not active, 1 = Active |
| Additional Fragment Size | USINT | Number of frames before preemption |
| 9 | Get | Last Change | UDINT | Value of sysup last time this neighbor’s attribute(s) changed |

**Instance Services**

|  |  |
| --- | --- |
| **Service Code** | **Service Name** |
| 0Eh | Get\_Attribute\_Single |