

EtherNet/IP Object Module

Object Model Revision: 1.10

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Table of Contents

EtherNet/IP Object Model 3

Identity Object (01HEX - 1 Instance) 4

Assembly Object (04HEX - 3 Instances) 5

Notes 11

Change History 15

## EtherNet/IP Object Model

Table 2‑1 Describes data types used in this Object Model.

Table 2‑1 Data types

|  |  |
| --- | --- |
| **Data Type** | **Description** |
| USINT | Unsigned Short Integer (8-bit) |
| UINT | Unsigned Integer (16-bit) |
| UDINT | Unsigned Double Integer (32-bit) |
| INT | Signed Integer (16-bit) |
| STRING | Character String (1 byte per character) |
| SHORT STRING*nn* | Character String (1st byte is length; up to *nn* characters) |
| BYTE | Bit String (8-bits) |
| WORD | Bit String (16-bits) |
| DWORD | Bit String (32-bits) |
| REAL | IEEE 32-bit Single Precision Floating Point |

### Identity Object (01HEX - 1 Instance)

The following tables contain the attribute, status, and common services information for the Identity Object.

Table 2‑2 Identity Object (01HEX - 1 Instance)

| **Instance** | **Attribute ID** | **Name** | **CIP**  **Data Type** | **Data**  **Value** | **Access Rule** |
| --- | --- | --- | --- | --- | --- |
| Class (Instance 0) | 1 | Revision | UINT | 1 | Get |
| Instance 1 | 1 | Vendor Number | UINT | 486 | Get |
|  | 2 | Device Type | UINT | 43 | Get |
|  | 3 | Product Code Number | UINT | 1 | Get |
|  | 4 | Product Major Revision Product Minor Revision | USINT USINT | 01 01 | Get |
|  | 5 | Status | WORD | See | Get |
|  | 6 | Serial Number | UDINT | Unique 32-Bit value | Get |
|  | 7 | Product Name | SHORT STRING32 | “Miller Access E”  “Miller Electric Continuum” | Get |

Table 2‑3 Identity Object’s common services

| **Service code** | **Implemented for** | | **Service name** |
| --- | --- | --- | --- |
| **Class level** | **Instance level** |
| 05Hex | No | Yes | Reset |
| 0EHex | Yes | Yes | Get\_Attribute\_Single |
| 10Hex | No | Yes | Set\_Attribute\_Single |

### Assembly Object (04HEX - 3 Instances)

The following tables contain the attribute, instance, data mapping, and common services information for the Assembly Object. The values are generally represented as Group Output or Group Input in robots.

Table 2‑4 Assembly Object (04HEX - 2 Instances)

| **Instance** | **Attribute ID** | **Name** | **CIP**  **Data Type** | **Data**  **Value** | **Access Rule** |
| --- | --- | --- | --- | --- | --- |
| Class (Instance 0) | 1 | Revision | UINT | 2 | Get |
|  | 2 | Max instance | UINT | 129 | Get |
| Input  (T->O)  Instance 100  **Welder**  **to**  **Robot**  **Normally this is called an Input in CIP terms.** | 3 | |  |  | | --- | --- | | **Word** | **Value** | | 0 | Input Flags | | 1 | Actual Wire Feed Speed | | 2 | Actual Arc Current | | 3 | Actual Arc Voltage | | 4 | Error Type | | 5 | Heat Input per Length (J/cm) | | 6 | Return Pcode ID | | 7 | Return Pcode Value | | 8 | Job ID Loaded | | 9 | Teach Index n Value (fixed index based on robot type) / Reserved | | … | Teach Index n Value (fixed index based on robot type) / Reserved | | N | Teach Index n Value (fixed index based on robot type) / Reserved | | | | Get |
| Output  (O->T)  Instance 112  **Robot**  **to**  **Welder**  **Normally this is called an Output in CIP terms.** | 3 | |  |  | | --- | --- | | **Word** | **Value** | | 0 | Output Flags | | 1 | Amps / Wire Feed Speed Command (Based on Output Flags) | | 2 | Arc Length/Voltage Command | | 3 | Inductance + Slope (Bytes) / Arc Control Command | | 4 | Weld List Number | | 5 | Part ID and Start/End | | 6 | Weld ID | | 7 | Tool Center Point (Weld) Travel Speed | | 8 | Get Pcode ID | | 9 | Set Pcode ID | | 10 | Set Pcode Value | | 11 | Job ID | | 12 | Teach Index n Value (fixed index based on robot type) / Reserved | | … | Teach Index n Value (fixed index based on robot type) / Reserved | | N | Teach Index n Value (fixed index based on robot type) / Reserved | | | | Get/Set |
| Output  (O->T)  Instance 113  **PLC**  **to**  **Welder**  **Normally this is called an Output in CIP terms.** | 3 | |  |  | | --- | --- | | **Word** | **Value** | | 0 | Output Flags | | 1 | Weld List Number | | 2 | Part ID and Start/End | | 3 | Weld ID | | 4 | Job ID | | | | Get/Set |
| 254 (0xFE) |  | Input Only Heartbeat1 | Heartbeat | 0 | n/a |
| 255 (0xFF) |  | Listen Only Heartbeat2 | Heartbeat | 0 | n/a |
| Unused (n) |  | Configuration3 |  |  |  |

1. This instance allows clients (PLCs) to monitor input data without providing output data.

2 This instance allows clients (PLCs) to monitor input data without providing output data. To use this connection type, an owning connection must exist from a second client and the configuration of the connection must match exactly.

3 Configuration data is not required, but it must match if supplied. Contents of the configuration instance are yet to be determined.

Table 2‑5 Assembly Object’s common services

| **Service code** | **Implemented for** | | **Service name** |
| --- | --- | --- | --- |
| **Class level** | **Instance level** |
| 0EHex | Yes | Yes | Get\_Attribute\_Single |
| 10Hex | Yes | Yes | Set\_Attribute\_Single |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Output Flags (Command)** | |  | **Input Flags (Status)** | |
| ***Bit*** | ***Names*** |  | ***Bit*** | ***Names*** |
| 15 | Cell State 4 |  | 15 | Synergic Values for Current Process  On (1) / Off (0) |
| 14 | Cell State 3 |  | 14 | Part  Started (1) / Finished (0) |
| 13 | Cell State 2 |  | 13 | Job  Loaded (1) / No Job (0) |
| 12 | Cell State 1 |  | 12 | Reserved (0) |
| 11 | Touch Sense Command |  | 11 | Touch Sense Active |
| 10 | Reserved (0) |  | 10 | Weld State Status |
| 9 | Contactor  On (1) / Off (0) |  | 9 | Contactor Status |
| 8 | Reset Process Errors  Reset (1) / Do Not Reset (0) |  | 8 | Error Active |
| 7 | Advance Sequence (To CenterpointTM) |  | 7 | Error Type Process |
| 6 | Ignore Weld (To CenterpointTM) |  | 6 | Reserved (0) |
| 5 | Command Type  Amps (1) / Wire Feed Speed (0) |  | 5 | Reserved (0) |
| 4 | Weld Disable  Disabled (1) / Enabled (0) |  | 4 | Touched |
| 3 | Gas  On (1) / Off (0) |  | 3 | Gas Status  On (1) / Off (0) |
| 2 | Motor Forward  On (1) / Off (0) |  | 2 | Motor Forward Status  On (1) / Off (0) |
| 1 | Motor Retract  On (1) / Off (0) |  | 1 | Motor Retract Status  On (1) / Off (0) |
| 0 | Reserved (0) |  | 0 | Arc Detect |

These are the currently available items for the Pcode values:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Index** | **Description** | **Values** | **Units** | **Comments** |
| 0 |  | 0 |  |  |
| 23 | Run-In Wire Feed Speed | 40 – 255 | Inches/Minute |  |
| 30 | Sequence Index | 0 – 19 | State |  |
| 31 | Enable Sequencer State | 0 = Disable  1 = Enable |  |  |
| 32 | Voltage/Trim | 100 – 440  0 – 99 | Tenth-Volts  Trim |  |
| 33 | Wire Feed Speed Command |  | Inches/Minute | Process Dependent |
| 34 | Motor Ramp Up | 0 = Off  100 – 5000 | Milliseconds |  |
| 35 | Motor Ramp Down | 0 = Off  100 – 5000 | Milliseconds |  |
| 40 | Sequencer Timeout |  |  | Sequencer Index Dependent |
| 66 | Sharp Arc | 0 – 50 |  |  |
| 75 | Inductance / Slope | 0 – 99  0 – 99 | Inductance  Slope | Inductance in Low Byte  Slope in High Byte |
| 100 | Load Default Program | 1 – 7024 |  | Only Values in Available Processes List |
| 101 | Wire Feed Speed Units | 0 = US  1 = Metric |  |  |
| 102 | Control Type |  |  |  |
| 103 | DeviceNet to Robot | 0 = DeviceNet  1 = Analog |  |  |
| 104 | Display Language | 0 = English |  |  |
| 105 | DeviceNet Robot Name |  |  | Deprecated  Use Pcode 136 |
| 106 | User Interface Values | 0 = Actuals  1 = Commands |  |  |
| 107 | Wire Feed Control Module Part # |  |  | Most Significant Word |
| 108 | Wire Feed Control Module Part # |  |  | Least Significant Word |
| 109 | PCM Part # |  |  | Most Significant Word |
| 110 | PCM Part # |  |  | Least Significant Word |
| 111 | AIM Part # |  |  | Most Significant Word |
| 112 | AIM Part # |  |  | Least Significant Word |
| 113 | User Interface Module Part # |  |  | Most Significant Word |
| 114 | User Interface Module Part # |  |  | Least Significant Word |
| 116 | Trigger Hold | 0 = Disable  1 = Enable |  |  |
| 117 | Weld Enable | 0 = Disable  1 = Enable |  |  |
| 118 | Trigger Hold Delay | 1 – 250 | Tenth-Seconds |  |
| 122 | Error Enable |  |  | Bit Mapped |
| 123 | Power Source Type | 0 = 675  1 = 450  2 = 300 |  |  |
| 124 | Dual Program |  |  | Read Only |
| 125 | User Interface Module Command Enable | 0 = Automation |  |  |
| 126 | User Interface Wire Feed Speed |  |  | Process and Power Supply Type Dependent |
| 127 | User Interface Voltage / Trim | 100 – 440  0 – 99 | Tenth-Volts  Trim |  |
| 129 | Last Active Program |  |  | Read Only |
| 131 | Encoder Lock | 0 = Disable  1 = Enable |  |  |
| 136 | Robot Name | 0 = No Robot  1 = Daihen  2 = ABB  3 = Hitachi  4 = Fanuc  5 = Nachi  6 = Motoman / Yaskawa  7 = Comau  8 = Reis  9 = SMIC  10 = IGM  11 = Panasonic  12 = Milacron  13 = Simple  14 = Kuka  15 = Kawasaki |  |  |
| 137 | Robot Detect | 0 = Off  1 = On |  |  |
| 138 | Robot Enable | 0 = Disable  1 = Enable |  |  |
| 139 | Robot Program Select | 0 = Disable  1 = Enable |  |  |
| 146 | 4T | 0 = Of  1 = On |  |  |
| 149 | Total Machine Default | 0 = Default |  |  |
| 155 | Partial Machine Default | 0 = Default |  | Resets Database and Several Other Settings |
| 156 | Dual Schedule | 0 = Off  1 = On |  |  |
| 157 | Trigger Program Select | 0 = Off  1 = On |  |  |
| 158 | Program Locks | 0 = Off  1 = On |  |  |
| 159 | Trigger Dual Schedule | 0 = Off  1 = On |  |  |
| 189 | Automation Upgrade | 0 = Semi-Auto ROI  1 = Auto ROI |  |  |
| 190 | Set Arc Start Time | 1 – 10 | Seconds |  |
| 191 | Set Active Program | 1 – 8 |  | Program # |
| 196 | Auto Calibrate | 0 = Off  1 = On |  | Auto Calibration of the Automation Interface Module |
| 197 | Calibrate 100 IPM |  |  | Read Only  Wire Feed Speed Calibration |
| 198 | Calibrate 1000 IPM |  |  | Read Only  Wire Feed Speed Calibration |
| 199 | Calibrate 10 Volts |  |  | Read Only  Voltage Calibration |
| 200 | Calibrate 44 Volts |  |  | Read Only  Voltage Calibration |
| 201 | Voltage Sense Error Enable | 0 = Disable  1 = Enable |  |  |
| 202 | Motor Overcurrent Error Enable | 0 = Disable  1 = Enable |  |  |
| 203 | Wire Speed Error Enable | 0 = Disable  1 = Enable |  |  |
| 204 | Arc Start Error Enable | 0 = Disable  1 = Enable |  |  |
| 205 | Arc Error Enable | 0 = Disable  1 = Enable |  |  |
| 206 | Gas Flow Error Enable | 0 = Disable  1 = Enable |  |  |
| 207 | Coolant Flow Error Enable | 0 = Disable  1 = Enable |  |  |
| 210 | Wire Stuck Error Enable | 0 = Disable  1 = Enable |  |  |
| 257 | Wire Alloy |  |  | System Dependent |
| 258 | Structure Revision |  |  | Read Only |
| 269 | Dual Feeder | 0 = Single Feeder  1 = Dual Feeder |  |  |
| 390 | Arc Error Time | 0 – 2000 | Milliseconds |  |
| 391 | Arc Error Voltage | 100 – 440 | Tenth-Volts |  |
| 411 | Process Enable Read |  |  | Read Only |
| 412 | Enable Carbon Arc | 0 = Disable  1 = Enable |  |  |
| 413 | Enable Stick Welding | 0 = Disable  1 = Enable |  |  |
| 421 | Weld Time | 0 = Reset |  | Writing “0” Resets Counter  Reading Provides Current Weld Time |
| 614 | Program Bank Number |  |  | System Dependent |
| 615 | Trigger Hold Inactive Time | 0 – 250 | Tenth-Seconds |  |
| 618 | Voltage Sense | 0 = Stud  1 = Sense Lead |  |  |
| 619 | Reset Wire Spool | 0 = Reset |  | Setting to “0” Indicates New Spool is Mounted |
| 620 | Secondary Loop Test Start/Stop | 0 = Stop  1 = Start |  |  |
| 630 | Load Bank Test | 0 = Disable  1 = Enable |  | Enable  (If Not MIG Only) |
| 638 | Dual Schedule Switch as Ignore | 0 = Dual Schedule  1 = CenterpointTM Ignore |  |  |

### Notes

**Input Flags**

**Arc Detect**: Arc has been detected. This is a combination of arc voltage and current.

**Motor Retract Status**: Electrode wire is retracting.

**Motor Forward Status**: Electrode wire is feeding.

**Gas Status**: Shielding gas valve is open.

**Touched**: Touch sense circuit has been closed. Usually, this means the electrode is touching the weldment.

**Error Active:** An operational error has been detected in the arc or welding machine. See the Error Type for details.

**Error Type Process:** The Error Active is an Insight Process error.

**Contactor Status:** The welding output power is active.

**Weld State:** An arc is established and the welder is maintaining the weld.

**Touch Sense Active:** Touch sense voltage is on the welding secondary circuit.

**Job Loaded:** A Job has been loaded into CenterpointTM and is ready to start.

**Part Started:** Acknowledgement of Part Start, stays on until Part End

**Synergic Values:** The Weld List program selected uses Synergic input values rather than MIG values.

**Input Assembly**

**Actual Wire Feed Speed**: Electrode wire speed in Inches/Minute.

**Actual Arc Current**: Arc Current in Amperes.

**Actual Arc Voltage**: Arc Voltage in tenths of volts; 500 is 50.0 volts.

**Error Value**: Zero unless there is an error; otherwise refer to error table.

**Return Pcode ID**: The Pcode requested by the robot.

**Return Pcode Value**: The value of the Pcode requested by the robot.

**Heat Input per cm**: When a **Travel Speed** is supplied, this value is valid.

**Output Flags**

**Motor Retract**: Cause the electrode wire to retract.

**Motor Forward**: Cause the electrode wire to feed normally.

**Gas On**: Cause the shielding gas valve to open.

**Contactor**: Weld Start signal; Cause a weld to begin.

**Touch Sense Command**: Cause the welder to go into touch sense mode and energize the electrode with touch sensing voltage.

**Ignore Weld**: Cause CenterpointTM to not monitor the next weld(s), still counted.

**Advance Sequence**: Cause CenterpointTM to step to the next screen in Job mode.

**Weld Disable**: Cause the welder to ignore trigger or contactor input until released.

**Cell State**: 4-bit value passed to CenterpointTM for OEE logging and enhancement. User defined.

**Output Assembly**

**Wire Feed Speed:** Desired electrode wire speed in Inches/Minute.

**Voltage / Arc Length:** For MIG processes, desired Voltage in tenths of a volt; 200 is 20.0 volts. For Synergic processes, desired unit-less Arc Length; range is 1-99, 50 is nominal. . A value of zero will be replaced with the nominal (50 Arc Length or 25.0 volts).

**Inductance + Slope / Sharp Arc:** For MIG processes, the Inductance is in the lower byte, 0-99, nominally 30, and the Slope is in the upper byte, 1-99, nominally 50. For Synergic processes, Sharp Arc is in the lower byte, 1-50, nominally 25, and the upper byte is ignored. A value of zero will be replaced with the nominal for each.

**Weld List Number:** The number which shows in the Program window on the front of the welder. Factory settings allow 1-8, though future enhancements allow 1-98 in this window and may allow a much larger range. A zero in this field will leave whatever Weld List Number was last used and allow front panel control.

**Part ID and Start:** The Part ID is used by Insight and communicated to CenterpointTM for arc data monitoring. The value is 1-9999, and a value of 10,000 is added to the Part ID to indicate the Start of a part. A value of zero is ignored. Alternatively, the most-significant bit may be used as the start flag.

**Weld ID:** The Weld ID is used by Insight and communicated to CenterpointTM for arc data monitoring. A value of zero causes Insight to use counted weld numbers for IDs.

**Travel Speed:** cm/sec from the robot, used to calculate the **Heat Input** per cm if supplied.

**Get Pcode ID:** The Pcode desired in the next Input Assembly. 0 if no Pcode response is desired.

**Set Pcode ID:** The Pcode which the robot desires to change value of in the welder. Zero if nothing to set.

**Set Pcode Value:** The value to be set into the Pcode designated above. Ignored for zero ID.

**Job ID:** Signal to CenterpointTM to load a Job from the source and prepare sequencing for Job mode. Ignored if zero, but acknowledged by **Job Loaded** bit.

**Error Table for Machine Errors (Numeric by Priority)**

**Error Active = 1, Error Type Process = 0**

|  |  |
| --- | --- |
| Number | Description |
| 0 | No Error |
| 1 | Weld Cycle Wait |
| 2 | Thermal Over Temperature |
| 3 | Emergency Stop |
| 4 | Overcurrent |
| 5 | RMD Demo Timeout |
| 6 | Cycle Power |
| 7 | Over Power |
| 64 | Motor Overrun |
| 65 | No Voltage Sense |
| 66 | No Tach Index Pulse |
| 67 | Incorrect Tach Pulse Count |
| 68 | No Tach A |
| 69 | No Tach B |
| 70 | No Tach Signal Sensed |
| 71 | Wire Speed Error |
| 72 | Could Not Initiate Arc |
| 73 | Could Not Stop Arc |
| 74 | Gas Flow Error |
| 75 | Coolant Flow Error |
| 76 | File Transfer Error |
| 77 | Ground Current Detected |
| 78 | Check Tip, Wire Stuck |
| 79 | Primary Power Error |
| 80 | Line Error |
| 81 | Motor Communications Error |
| 82 | Robot Communications Error |
| 83 | Low Wire Feed Speed Command |
| 84 | PCM Bus Off |
| 85 | Motor Over Current |
| 86 | Arc Error |
| 87 | User Interface Communications |
| 88 | Polarity Error |
| 89 | RIO Bus Warning |
| 90 | WFM Bus Warning |
| 91 | UIM Bus Warning |
| 92 | PCM Bus Warning |
| 93 | Over Average Current |
| 94 | Force AIM offline for DI |
| 95 | Release Trigger |
| 96 | Trigger Stuck |
| 97 | Software Incompatibility |
| 98 | Wire Spool Low |
| 99 | Check Web |
| 100 | Check System |
| 101 | Trigger Disabled via Insight |
| 102 | Auto Calibration Error |
| 103 | Missed Weld Error |
| 200 | Clock Value Error |

**Error Table Part Error (Bit Mapped)**

**Error Type Process = 1, Part Started = 0**

|  |  |
| --- | --- |
| **Description** | **Bit Value** |
| Missing Welds | 0x01 |
| Process Fault | 0x02 |
| Duration Fault | 0x04 |
| Extra Weld Fault | 0x08 |
| Clamp Time Low | 0x10 |
| Clamp Time High | 0x20 |
| Arc Time Low | 0x40 |
| Arc Time High | 0x80 |

**Error Table Weld Error (Bit Mapped)**

**Error Type Process = 1, Part Started = 1**

|  |  |
| --- | --- |
| **Description** | **Bit Value** |
| Over Voltage | 0x01 |
| Under Voltage | 0x02 |
| Over Current | 0x04 |
| Under Current | 0x08 |
| Over Gas | 0x10 |
| Under Gas | 0x20 |
| Over Wire | 0x40 |
| Under Wire | 0x80 |
| Over Duration | 0x100 |
| Under Duration | 0x200 |

## Change History

| Date | Author | Summary |
| --- | --- | --- |
| 2010-09-29 | Jamin D. Wendrof | Original |
| 2015-03-17 | BaC | Added PLC Support (Instance 113) |
| 2016-04-22 | DJS | Output Flags Bit #5 – Changed from Reserved to Amperage / Wire Feed Speed Command Selection  Updated Pcode Table with Descriptions, Values, and Units.  Part Errors and Weld Errors, when using CenterpointTM, are no longer tied with Error Active, only Error Process.  Added Reset for Error Process |