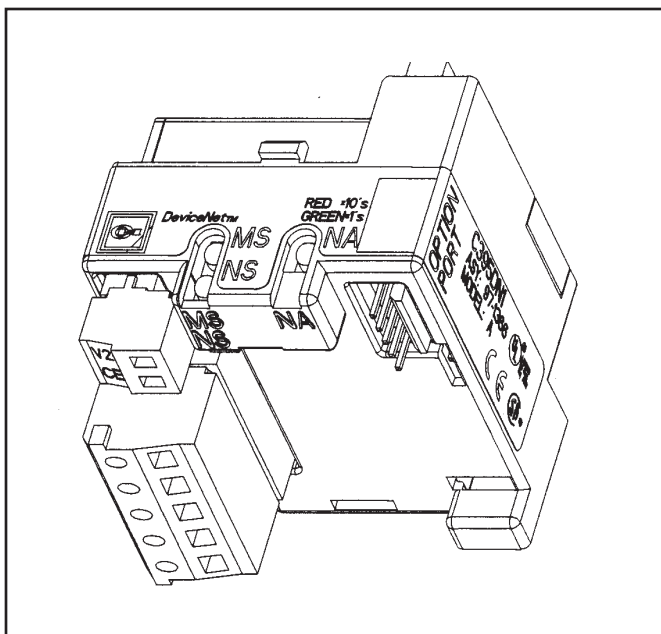




## Instruction Leaflet for the C395DNA



*C395DNA Module*

### DESCRIPTION

The C395DNA is the DeviceNet connection to the C395 Overload Controller system. The DNA module is designed to plug directly onto any C395 overload without additional cables. The module provides DeviceNet users with the ability to control and monitor the functions of the overload system at 125, 250, and 500K baud. A separable connector is provided so that a hand/off/auto hard contact may be used to selectively enable or disable the output of the control functions from the module without affecting its ability to monitor.

### INSTALLATION



### WARNING

**DO NOT INSTALL OR PERFORM MAINTENANCE ON THIS DEVICE WHILE EQUIPMENT IS ENERGIZED. DEATH OR SEVERE PERSONAL INJURY CAN RESULT FROM CONTACT WITH ENERGIZED EQUIPMENT. VERIFY THAT NO VOLTAGE IS PRESENT BEFORE PROCEEDING WITH INSTALLATION OR MAINTENANCE.**

Only qualified persons, as defined in the National Electric Code, who are familiar with the installation, maintenance, and operation of this device and the equipment onto which it is to be installed, as well as applicable local, state, and national regulations and industry standards and accepted practices regarding safety of personnel and the equipment safety should be permitted to install, maintain, or operate this device.

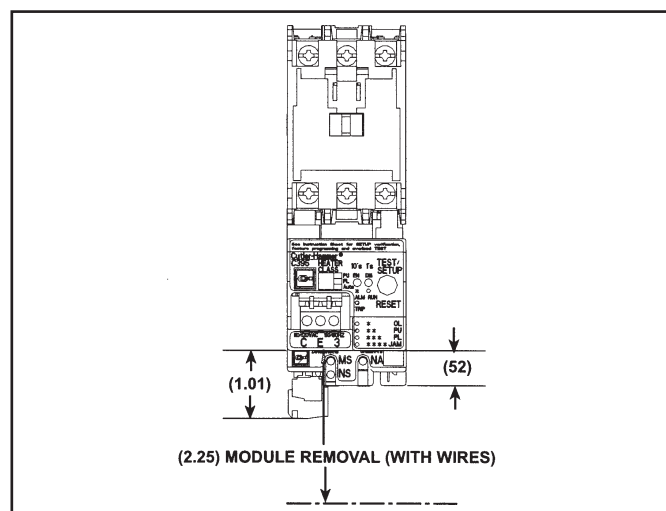
These instructions are provided only as a general guide to such qualified persons and are not all-inclusive. They do not cover every application or circumstance which may arise in the installation, maintenance, or operation of this equipment. Users are advised to comply with all local, state, and national regulations and industry standards and accepted practices regarding safety of personnel and equipment safety.



### CAUTION

**REMOVE ALL POWER FROM THE INSTALLATION BEFORE ATTEMPTING TO INSTALL OR REMOVE THIS DEVICE. THIS INCLUDES L1, L2, L3, AS WELL AS THE CE3 TERMINALS.**

Remove all options which may be attached to the C395 option port. This port must be open in order to install the option (see Fig. 1). Any option that is presently attached to the overload may be directly plugged into the replacement option port on the DNA. See the Options Considerations section of this publication for special operating notes.



*Fig. 1 Option Port of the C395 Overload*

Align the DNA with the overload as shown in Figure 2. Snap the unit onto the C95 overload.

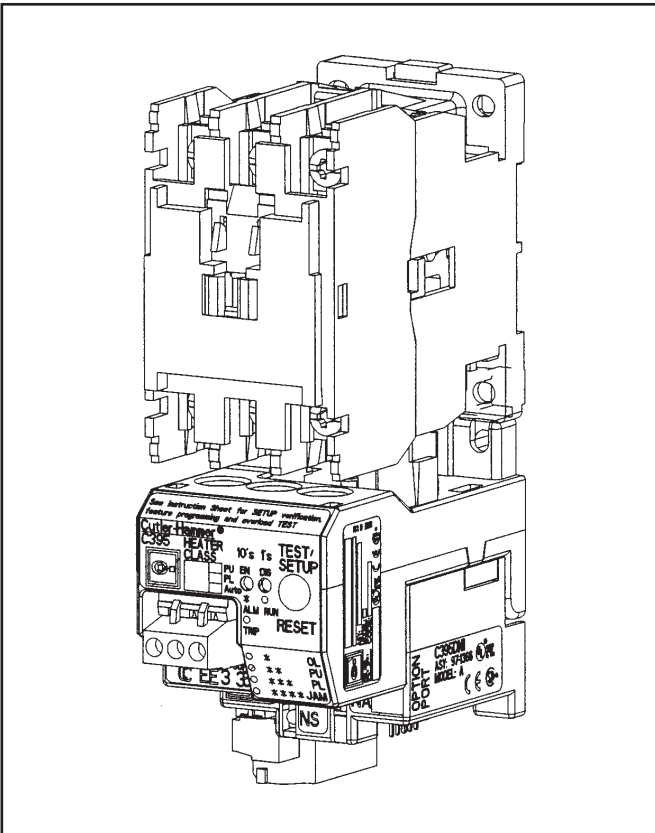


Fig. 2 Installation to the C395 Overload System

The five-point gray terminal block should be wired with wire that is approved by DeviceNet applications. Figure 3 lists some of the DeviceNet cable specifications.

Cable Type	Electrical Characteristic	Specification at 1Mhz
Both	Impedance	120 Ohm
Both	Propagation Delay	1.35nSec/ft Max.
Both	Capacitance between Conductors	12 pf/ft
Both	Capacitance between a Conductor and the Shield	24pf/ft
Thick	Capacitive Unbalance	370pf/1000ft
Thin	Capacitive Unbalance	620pf/1000ft
Thick	Attenuation at 125KHz	.13db/100ft
Thin	Attenuation at 125KHz	.29db/100ft

Fig. 3 Wire Specification Guide

In addition, the configuration of the wiring system must comply with the rules for trunk and drop cable configuration and length. The following are the basic wiring rules.

- Terminating resistors are required on each end of the trunk line.
- The truck must be configured as a linear bus.
- Drop lines may be as long as 6M(20ft) and may contain branches.
- Maximum total cable distance at all baud rates is 100M (328ft) for thin cable.
- Maximum total cable distance for thick cable is:
  - 120K baud = 500M (1640ft)
  - 250K baud = 250M (820ft)
  - 500K baud = 100M (328ft)

The maximum length of mixed cables may be found by solving the following equation:

$$L_{\text{Thick}} + 5 * L_{\text{Thin}} = 500 \text{ Meters}$$

$$L_{\text{Thin}} \text{ not to exceed } 156\text{M}$$

There are two basic power configurations which maybe used when wiring the DeviceNet connector. The first and most common configuration is to supply the DC power along with the DeviceNet signals. Figure 4 illustrates this configuration.

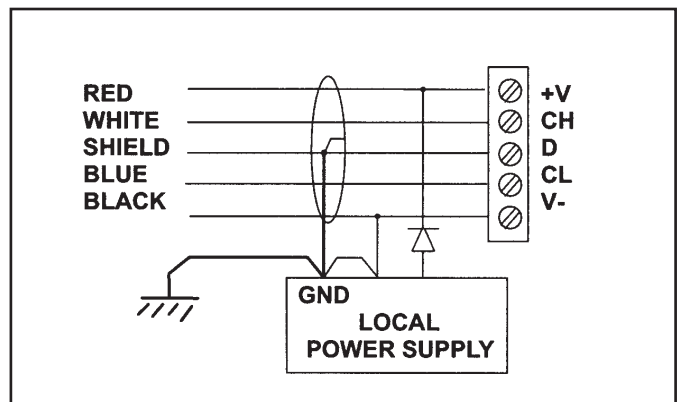


Fig. 4 Typical DeviceNet Wiring

In some applications where there are large installation distances or current draws involved, it may be desirable to supply the DC power from a locally-referenced source. Care must be taken not to ground the system in more than one place. Figure 5 illustrates how a separate power supply may be wired in at the DNA node.

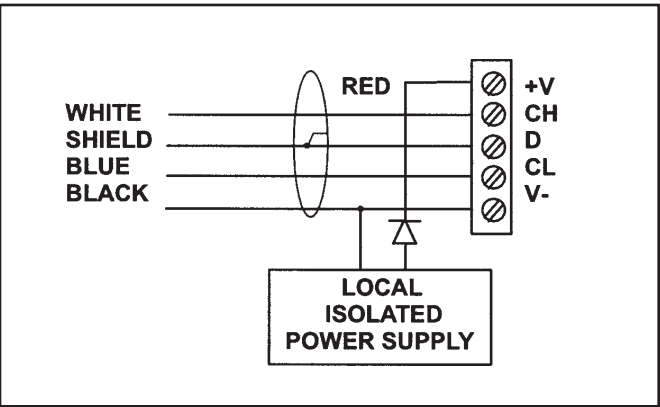


Fig. 5 Optional DeviceNet Wiring with Separate Power Source

The DeviceNet cable insulation should be stripped back approximately 1" from the end. Each of the wires should be stripped approximately 1/4". The terminals of the DeviceNet connector should be tightened to 5-7 in-lbs. Normally, it is possible to daisy-chain the drop cable by terminating both wires under one screw. However in some applications where trunk cable is used, this may not be possible. In these applications, the DNA supports the use of a dual DeviceNet connector. The connector part number **C395DNADC** may be used in these applications per Figure 6. Strain relief for the DeviceNet cable should be provided if long sections of trunk cable are to be connected from the DNA module.

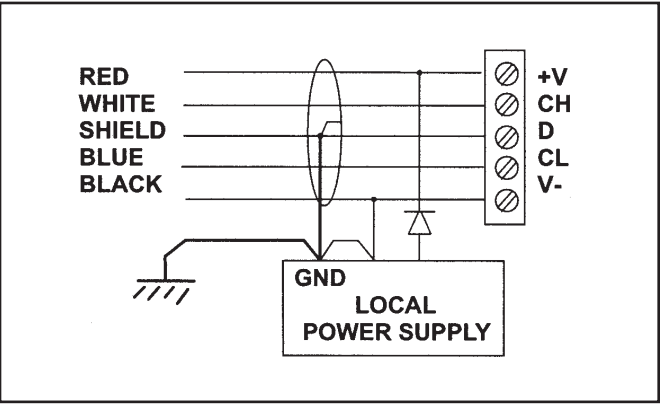


Fig. 6 DeviceNet Wiring with Dual Connector

The two-point DeviceNet Can Enable port is intended to allow the control functions of the DNA to be enabled or disabled locally via a hard contact. The **ES** terminal is a current limited 24V output which is intended to be the source of the voltage and wiring point for the **CE** input. The other terminal is the DeviceNet Can Enable input **CE**. If the node is always to have the DeviceNet selected as the control mode, then these two points can be jumpered. Figure 7 illustrates the use of these terminals to create a HAND/OFF/AUTO control circuit. In applications

where high vibration is anticipated, these two wires should be tie wrapped to the DeviceNet cable to ensure secure-ness.

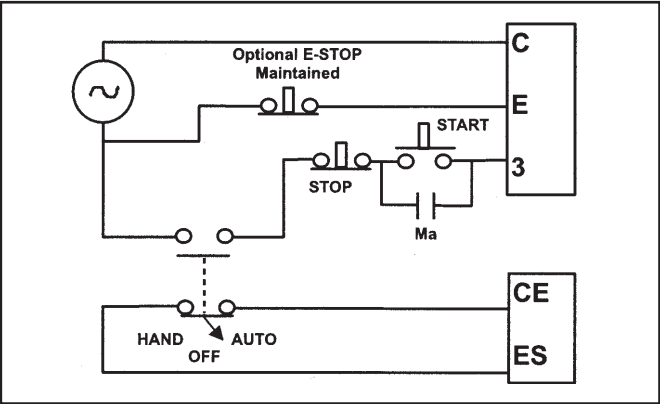


Fig. 7 DeviceNet Can Enable Wiring

### LED DEFINITION AND DIAGNOSTICS

Module Status **MS** provides information about the module such as the status to the power or memory systems.

STATE	LED	MEANING
No Power	Off	There is no power to the device
Operational	Green	Device is operating normally
Standby	Flashing Green	Device needs commissioning
Minor Fault	Flashing Red	Recoverable fault has been detected
Unrecoverable Fault	Red	A non-recoverable fault has been detected. The device may need to be replaced
Self-Test	Flashing Green-Red	The device is performing a self-test

Network Status **NS** provides the status of the network connection.

STATE	LED	MEANING
Not Powered Not On Line	Off	MS OFF - no power MS ON - no devices detected on network
On-Line Not Connected	Flashing Green	No connection established
Connected OK	Green	A connected has been established
Critical Link Failure	Red	Device cannot communicate on the network (DupMac or BusOff)

The Node Address **NA** LED blinks the MAC ID of the unit while it is powered. The unit displays the tens digit with red blanks, and the ones with green blinks.

The unit plays the tens units, then the ones, and finally delays about 2 seconds before repeating the sequence. An address of zero is not recommended. It will result in an "off" state for the NA LED. The Node Address NA LED will begin to flash the device address after the powerup initialization is completed (about 10 seconds).

## POWER UP AND CONFIGURATION

Be sure that the HAND/OFF/AUTO selector, if installed, is in the proper position. Apply power to both the C395 overload and the C395 DNA unit. Refer to the C395 overload installation leaflet to power the C395 overload. The C395 DNA may be powered by plugging the DeviceNet connector into the unit while the network is powered, or by powering the whole network up. The front panel LED's will play the pattern in Figure 8.

<b>MS</b>	- Green for ~.25 seconds
<b>MS</b>	- Red for ~.25 seconds
<b>MS</b>	- Green
<b>NS</b>	- Green for ~.25 second
<b>NS</b>	- Red for ~.25 seconds
<b>NS</b>	- OFF until the Dup_MAC_ID test and full ROM CRC check is completed (approximately 7 seconds)
<b>NA</b>	- Green for ~.25 seconds
<b>NA</b>	- Red for ~.25 seconds
<b>NA</b>	- OFF will begin to flash address sequence in approximately 10 seconds

Fig. 8 Power Up LED Pattern

There must be a minimum of two nodes with power for the Duplicate MAC ID check to complete successfully. All units power up with the MAC ID 63 programmed from the factory. Since the DeviceNet protocol checks for duplicate MAC ID's, the MAC ID of the unit will generally have to be changed. This may be accomplished by using the Cutler-Hammer configuration tool, NETVIEW. For more information configuring the unit and setting the MAC ID, see Appendix A.

There is a space provided on the label of the unit so that the MAC ID may be written for identification when the unit is not powered. Further network configuration parameters may need to be set for the specific application. Please refer to Appendix A for more details.

## REMOVING THE DNA

The DNA module is designed to snap on and remain snapped securely in high vibration applications. Therefore, the unit may be damaged if incorrectly removed from the

overload. To remove the unit, insert a small screwdriver in the slot as indicated. The screwdriver does not need to be turned or pried to release the snap. Insert the screwdriver and gently pull on the DNA module. Do not pry with the screwdriver. See Figure 9 for an illustration of the removal process.

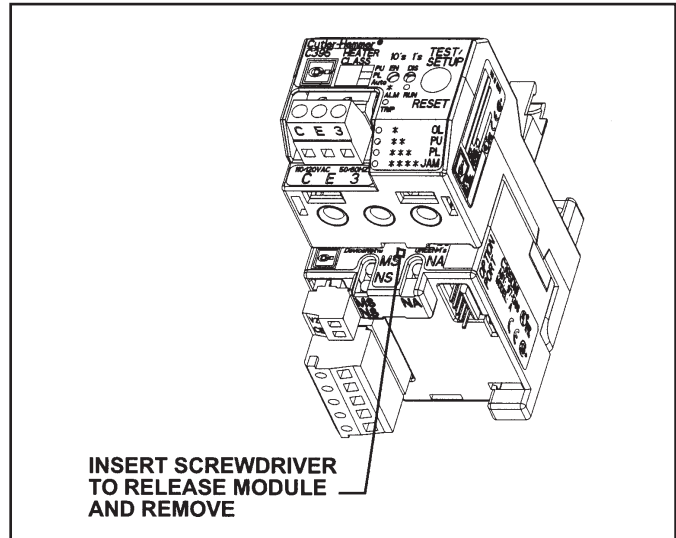


Fig. 9 Removal of the C395DNA

## OPTION CONSIDERATIONS WITH THE C395DNA

The options port on the DNA supports all the C395 options except the C395LPBSDN and C395LSO modules. If these modules are attached, the system will fault. The DNA is isolated from the C395 in order to reduce the possibility of common mode voltages and to isolate the DeviceNet system from the voltages on the motor. Therefore, the DeviceNet system supplies the power to operate the DNA module as well as options which are attached to it. Care must be taken to ensure proper option operation in the event that power to the DNA and the options is lost.

## FEATURES AVAILABLE VIA THE DNA

- Closed Contactor Contact Position - Off/Closed
- Three Phase Motor Currents - RMS
- Thermal Capacity - %
- Network Configurable Overload Set Up:
  - Trip Current
  - Overload Class
  - Phase Loss Enable/Disable
  - Phase Unbalance Enable/Disable
  - Jam Enable/Disable
  - Jam Time
  - Antirecycle Time
  - Pick Up Delay Time
- Percent Current Unbalance
- Fault Diagnostics
- Start/Stop Control
- Remote Reset

## TROUBLESHOOTING HINTS

If the C395DNA fails to perform as expected, check the following:

1. *LED's do not light on the module.*  
Check on the +24V on the DeviceNet plug.
2. *The device fail NS LED fails to blink green after the power up check.*  
Make sure there is a minimum of two devices with power on the network.
3. *The NS LED is red after the power up initialization is complete.*  
Check for a duplicate node address on the network.
4. *The device fails to make a connection.*  
Check for missing terminating resistor and correct baud rate.
5. *The overload will not start.*  
Check the \_\_\_\_\_ and be sure that the Can Enable is enabled. Check to be sure that the E terminal has voltage.
6. *The C395 trips on Communication Fault.*  
Check the connection between the DNA and the C395.

## Relative Humidity

20 to 95% non-condensing

## Vibration

Operating	5G
Non-Operational	5G

## Shock

Operating	15G
Non-Operational	35G

## Baud Rate

125 Kbaud  
250 Kbaud  
500 Kbaud

## Connections

1/O Poll Group 2 only  
Explicit  
No UCMM

## WIRING TERMINAL RATINGS

### DeviceNet Connections

**V+** Min. Voltage - 11V  
Max. Voltage - +27V  
Inrush - .3A  
40mA Steady State

**V-** Common

**CH** Reverse wiring protected to +/-27V

**CL** Reversing wiring protected to +/-27V

**D** Shield tie point

**NOTE:** Tighten terminals to 5 in-lbs

### DeviceNet Can Enable

**ES** Voltage Output for Can Enable  
ES uses V+ as its source  
Max. Output -24V at 2mA

**CE** Voltage Input for Can Enable  
Logic High 12V w/r to CL  
Max. Voltage 27V w/r to CL

**NOTE:** Tighten terminals to 5 in-lbs

### Ambient Temperature

Operating -25 to 70°C at device  
-25 to 40°C external ambient (enclosed)

Storage -40 to 85°C

## APPENDIX A - DEVICENET INFORMATION

The Communication Module allows a C395DNA to operate as a slave device on a DeviceNet network. The Communication Module supports Explicit Messages and Polled I/O Messages of the predefined master/slave connection set. It does NOT support the Explicit Unconnected Message Manager (UCMM).

This appendix defines the DeviceNet message types, class services, and objects that are supported by the Communication Module.

As a group 2 slave device, the Communication module supports the following message types:

CAN Identifier Type	Group 2 Message Type
10xxxxxx111	Duplicate MAC ID Check Messages
10xxxxxx110	Unconnected Explicit Request Messages
10xxxxxx101	Master I/O Poll Command Messages
10xxxxxx100	Master Explicit Request Messages
10xxxxxx011	Slave Explicit Response Messages
01111xxxxx	Slave Poll Response Messages

xxxxxx = Communication Module Node Address

The Communication Module supports the following object classes:

Class	Object
0x01	Identity
0x02	Message Router
0x03	DeviceNet
0x04	Assembly
0x05	Connection
0x08	Input Point
0x29	Control Supervisor
0x2C	Overload

Attributes listed in bold type in this appendix must be set during the configuration of the device. These attributes are stored in non-volatile memory and maintain their value after a power loss.



## IDENTITY OBJECT

### Identity Class (1), Class Attributes (0)

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Units String
1 0x01	Revision	Get_Attribute_Single	Revision of this object	1, 1, 1	C7	N/A
2 0x02	Max Instance	Get_Attribute_Single	Maximum instance number of an object currently created in this class level of the device	1, 1, 1	C7	N/A
176 0xB0	Object Name	Get_Attribute_Single	ASCII Name for the object Class	"Identity", "Identity", "Identity"	DA	N/A
180 0xB4	Class Attribute List	CH_Get_Member	Each Element describes a class attribute. The Array's elements are structs as described in the semantics section. Individual elements are accessed using the Get Member service.	N/A, N/A, N/A	A1 01 A2 06 C7 DA A1 01 C6	N/A
186 0xBA	Instance Attribute List	CH_Get_Member	Each element describes an instance attribute. The Array's elements are structs as described in the semantics section. Individual elements are accessed using the Get Member service	N/A, N/A, N/A	A1 01 A2 06 C7 DA A1 01 C6	N/A

### Identity Class (1), Instance Attributes (1)

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Units String
1 0x01	Vendor ID	Get_Attribute_Single	Identification of each vendor by number	68, 68, 68	C7	N/A
2 0x02	Device Type	Get_Attribute_Single	Indication of the general type of product	22, 3, 22	C7	N/A
3 0x03	Product Code	Get_Attribute_Single	This is a code assigned by the vendor to describe the device	395, 395, 395	C7	N/A
4 0x04	Revision	Get_Attribute_Single	Revision of the item the Identity Object represents	{1.2}, {1.2}, {1.2}	A2 02 C6 C6	N/A
5 0x05	Status	Get_Attribute_Single	Summary Status of the Device Bit6: Node Fault Bit7: System Fault	1, 0, 65535	D2	N/A
6 0x06	Serial Number	Get_Attribute_Single	Serial Number of the device	0, 0, 4294967295	C8	N/A
7 0x07	Product Name	Get_Attribute_Single	Human readable identification	"C395DNA", "C395DNA", "C395DNA"	DA	N/A
9 0x09	Config. Consist Value	Get_Attribute_Single	Contents identify configuration of device	31795, 0, 65535	C7	N/A
100 0x64	C395 Overload Size	Get_Attribute_Single	Identifies the device the C395 is plugged into	N/A, N/A, N/A	DA	N/A
176 0xB0	User Label	Get_Attribute_Single, Set_Attribute_Single	ASCII label given to the device by the user	"User Label", N/A, N/A	DA	N/A
177 0xB1	Fault Value	Get_Attribute_Single	Error code for this device 1 = Transmit Error 2 = Data Overrun 3 = Data Size Error 4 = Undefined 5 = Config. CRC Fault 6 = Transmitter Full	0, 0, 6	C6	N/A

**Common Services**

Service Code	Implemented for:		Service Name
	Class	Instance	
0x05	No	Yes	Reset
0x0A	Yes	No	GetMember
0x0E	Yes	Yes	Get_Attribute_Single

**MESSAGE ROUTER**

## Message Router Class (2) - Class Attributes (0)

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Units String
176 0xB0	Object Name	Get_Attribute_Single	ASCII Name for the object Class	"Message Router", "Message Router", "Message Router"	DA	N/A

## Message Router Class (2) - Instance Attributes (1)

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Units String
1 0x01	Object_List	Get_Attribute_Single	This attribute contains a list of supported objects, the number of supported classes in the classes array, and a list of supported class codes	N/A, N/A, N/A	A2 04 C7 A1 01 C7	N/A

**Common Services**

Service Code	Implemented for:		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single



## DEVICENET OBJECT

### DeviceNet Class (3) - Class Attributes (0)

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Units String
1 0x01	Revision	Get_Attribute_Single	Revision of the DeviceNet Object Class. Definition upon which the implementation is based.	2, 2, 2	C7	N/A
176 0xB0	Object Name	Get_Attribute_Single	ACSII Name for the object Class	"DeviceNet", "DeviceNet", "DeviceNet"	DA	N/A
180 0xB4	Class Attribute List	Get_Attribute_Single	Each Element describes a class attribute. The Array's elements are structs as described in the semantics section. Individual elements are accessed using the Get Member service.	N/A, N/A, N/A	A1 01 A2 06 C7 DA DA A1 01 C6	N/A
186 0xBA	Instance Attribute List	Get_Attribute_Single	Each element describes an instance attribute. The Array's elements are structs as described in the semantics section. Individual elements are accessed using the Get Member service	N/A, N/A, N/A	A1 01 A2 06 C7 DA DA A1 01 C6	N/A

### DeviceNet Class (3) - Instance Attributes (1)

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Units String
1 0x01	MAC ID	Get_Attribute_Single Set_Attribute_Single	Node address	63, 0, 63	C6	N/A
2 0x02	Baud Rate	Get_Attribute_Single Set_Attribute_Single	The baud rate of the device 0 - 125K 1 - 250K 2 - 500K	0, 0, 2	C6	Kb/s
3 0x03	BOI	Get_Attribute_Single	Bus Off Interrupt 1 = Reset CAN chip and allow Group 4 faulted mode recovery	1, 0, 1	C1	N/A
4 0x04	Bus Off Counter	Get_Attribute_Single, Set_Attribute_Single	Number of times CAN went to the bus-off state	0, 0, 255	C6	N/A
5 0x05	Allocation Information	Get_Attribute_Single	Allocation Choice Master's MAC ID NOTE: Required if using Master/Slave Connection Set ODVA 1.3, unclear in 2.0	N/A, N/A, N/A	A2 02 D1 C6	N/A
192 0xC0	AddressLed Control	Get_Attribute_Single, Set_Attribute_Single	1 = Off 2 = Green 3 = Red	0, 0, 2	C6	N/A

### Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x0A	Yes	No	GetMember
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single
0x4B	No	Yes	Allocate_Master/Slave_Connection_Set
0x4C	No	Yes	Release/Master/Slave_Connection_Set

## ASSEMBLY OBJECTS

### Assembly Class (4) - Class Attributes (0)

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Units String
176 0xB0	Object Name	Get_Attribute_Single	ACSII Name for the object Class	"Assembly", "Assembly", "Assembly"	DA	N/A

### Assembly Class (4) - Class Attributes (1)

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Units String
3 0xB0	Input Assembly	Get_Attribute_Single	Input to master from device node	53, 50, 113	Defined by instance type. Ref. Connection path for this I/O polled connection	N/A

### Assembly Class (4) - Class Attributes (2)

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Units String
3 0x03	Output Assembly	Get_Attribute_Single	Output from master to device node	1, 1, 5	Defined by instance type. Ref. Connection path for this I/O polled connection	N/A

**Note:** Input and Output assembly instance values depend on what is set in the Connection Object Instance 2 Input and Output Assemblies

### Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single

### Input Assemblies

Instance 50 (32hex) Basic Overload/Contactor Assembly								
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0								Faulted

Instance 51 (33hex) Extended Overload/Contactor Assembly								
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0							Warning	Faulted

Input Assemblies, Cont'd

Instance 52 (34hex) Basic Motor Control								
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0						Running1		Faulted Trip

Instance 53 (35hex) Extended Motor Control 1 (see table for functional assignments)								
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0			CtrlFromNet	Ready		Running1	Warning	Faulted Trip

Instance 54 (36hex) Extended Motor Control 2 (see table for functional assignments)								
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0			CtrlFromNet	Ready	Running2	Running1	Warning	Faulted Trip

Instance 100 (64hex) C395DNA Contactor (see table for functional assignments)								
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Aux_FB		CtrlFromNet	Ready		Running1		Faulted Trip

Instance 101 (65hex) C395DNA Overload (see table for functional assignments)								
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0								Faulted
1	% Thermal Capacity							
2	Average Current (Low Byte)							
3	Average Current (High Byte)							
4	% Phase Imbalance							

Instance 102 (66hex) C395DNA Motor Starter (see table for functional assignments)								
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Closed		CtrlFromNet	Ready		Running1	Warning	Faulted
1	% Thermal Capacity							
2	Average Current (Low Byte)							
3	Average Current (High Byte)							
4	% Phase Imbalance							

## Input Assemblies, Cont'd

Instance 103 (67hex) Advantage Expanded Motor Starter (see table for functional assignments)								
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Aux_FB		CtrlFromNet	Ready	Running2	Running1	Warning	Faulted
1	% Thermal Capacity							
2	Average Current (Low Byte)							
3	Average Current (High Byte)							
4	% Phase Imbalance							

Instance 104 (68hex) C395DNA Starter Phase Currents (see table for functional assignments)								
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0							Warning	Faulted
1	Phase Current L1 (Low Byte)							
2	Phase Current L1 (High Byte)							
3	Phase Current L2 (Low Byte)							
4	Phase Current L2 (High Byte)							
5	Phase Current L3 (Low Byte)							
6	Phase Current L3 (High Byte)							

Instance 105 (69hex) C395DNA Starter Phase Currents (see table for functional assignments)								
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Closed		CtrlFromNet	Ready		Running1	Warning	Faulted
1	Phase Current L1 (Low Byte)							
2	Phase Current L1 (High Byte)							
3	Phase Current L2 (Low Byte)							
4	Phase Current L2 (High Byte)							
5	Phase Current L3 (Low Byte)							
6	Phase Current L3 (High Byte)							

## Input Assemblies, Cont'd

Instance 106 (6Ahex) C395DNA Expanded Starter Phase Currents (see table for functional assignments)								
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Closed		CtrlFromNet	Ready	Running2	Running1	Warning	Faulted
1	Phase Current L1 (Low Byte)							
2	Phase Current L1 (High Byte)							
3	Phase Current L2 (Low Byte)							
4	Phase Current L2 (High Byte)							
5	Phase Current L3 (Low Byte)							
6	Phase Current L3 (High Byte)							

The following table indicates the I/O Assembly Data Attribute mapping for Input Assemblies

Data Component Name	Class Name	Class Number	Instance Number	Attribute Name	Attribute Number
Faulted	Supervisor	29hex	1	Faulted	10
Warning	Supervisor	29hex	1	Warning	11
Running1	Supervisor	29hex	1	Running1	7
Running2	Supervisor	29hex	1	Running2	8
Ready	Supervisor	29hex	1	Ready	9
Fault Code	Supervisor	29hex	1	FaultCode	13
CtrlFromNet	Supervisor	29hex	1	CtrlFromNet	15
Closed	Input Point	8hex	1	Value	3
Average Current	Overload	2Chex	1	AvgCurrent	5
% Phase Imbalance	Overload	2Chex	1	%PhImbal	6
% Thermal Capacity	Overload	2Chex	1	%Thermal	7
Phase Current L1	Overload	2Chex	1	PhaseCurrentL1	8
Phase Current L2	Overload	2Chex	1	PhaseCurrentL2	9
Phase Current L3	Overload	2Chex	1	PhaseCurrentL3	10

## Output Assemblies

Instance 01 (01hex) Basic Contactor Assembly								
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0								Run1

Instance 02 (02hex) Basic Overload Assembly								
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0						FaultReset		

Instance 03 (03hex) Basic Motor Starter								
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0						FaultReset		Run1

Instance 04 (04hex) Extended Contactor Assembly								
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0							Run2	Run1

Instance 05 (05hex) Extended Motor Starter Assembly								
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0						FaultReset	Run2	Run1

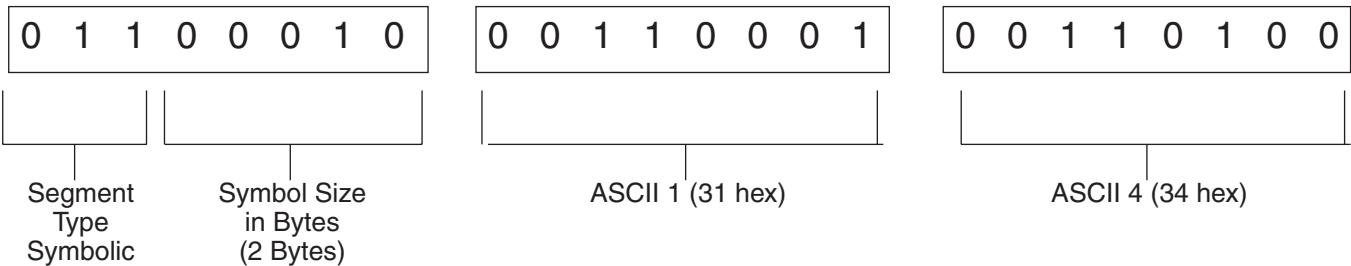
The following table indicates the I/O Assembly Data Attribute mapping for Output Assemblies

Data Component Name	Class Name	Class Number	Instance Number	Attribute Name	Attribute Number
Run1	Supervisor	29hex	1	Run1	3
Run2	Supervisor	29hex	1	Run2	4
FaultReset	Supervisor	29hex	1	FaultReset	12

### Connection Paths to I/O Assembly Instances

Motor Control Devices use the Symbolic Segment Type (see Appendix I, Volume 1) to specify paths to the I/O Assembly Instances in the Motor Control Hierarchy. I/O Assembly Instances are represented by ASCII strings that contain the hex number of the Assembly Instance whose path is to be chosen.

The following example shows the Symbolic Segment used to specify Output Assembly Instance 20 (14hex).



## DEVICENET CONNECTION OBJECT

DeviceNet Connection Class (5), Class Attributes (0)

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Tyoe	Units String
1 0x01	Revision	Get_Attribute_Single	Revision of this Connection Object Class. Definition upon which the implementation is based. See description below for more details.	1, 1, 1	C7	N/A
176 0xB0	Object Name	Get_Attribute_Single	ACSII Name for the object Class	"DeviceNet Connection", "DeviceNet Connection", "DeviceNet Connection"	DA	N/A
180 0xB4	Class Attribute List	CH_Get_Member	Each Element describes a class attribute. The Array's elements are structs as described in the semantics section. Individual elements are accessed using the Get Member service.	N/A, N/A, N/A	A1 01 A2 06 C7 DA DA A1 01 C6	N/A
186 0xBA	Instance Attribute List	CH_Get_Member	Each element describes an instance attribute. The Array's elements are structs as described in the semantics section. Individual elements are accessed using the Get Member service	N/A, N/A, N/A	A1 01 A2 06 C7 DA DA A1 01 C6	N/A



## DeviceNet Connection Class (5), Explicit Connection Instance (1)

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Units String
1 0x01	State	Get_Attribute_Single	State of the object 0 = nonexistent 1 = configuring 2 = waiting for connection ID 3 = established 4 = timed out 5 = deferred delete	3, 0, 5	C6	N/A
2 0x02	Instance Type	Get_Attribute_Single	Indicates either IO or messaging connection	0, 0, 1	C6	N/A
3 0x03	Transport Class Trigger	Get_Attribute_Single	Defines Behavior of the connection	0x83, 0, 255	D1	N/A,
4 0x04	Produced Cnxn Id	Get_Attribute_Single	Placed in CAN Identifier field when the Connection Transmits	0x5FB, 0, 65535	C7	N/A
5 0x05	Consumed Cnxn Id	Get_Attribute_Single	CAN Identifier Field value that denotes message to be received	0x5FC, 0, 65535	C7	N/A
6 0x06	Initial Comm Characteristics	Get_Attribute_Single	Defines the Message Group(s) across which productions and consumptions associated with this	0x21, 0, 255	D1	N/A
7 0x07	Produced Connection Size	Get_Attribute_Single	Maximum number of bytes transmitted across this Connection	37, 1, 65535	C7	N/A
8 0x08	Consumed Connection Size	Get_Attribute_Single	Maximum number of bytes received across this Connection	37, 1, 65535	C7	N/A
9 0x09	Expected Packet Rate	Get_Attribute_Single, Set_Attribute_Single	Defines timing associated with this Connection	0, 0, 65535	C7	msec
12 0x0C	Watchdog Timeout Action	Get_Attribute_Single, Set_Attribute_Single	Defines how to handle Inactivity/Watchdog timeouts 0 - Transition to time out 1 - Auto Delete 2 - Auto Reset 3 - Deferred Delete	1, 0, 3	C6	N/A
13 0x0D	Produced Connection Path Length	Get_Attribute_Single	Number of bytes in the produced_connection_path length attribute	0, 0, 65535	C7	N/A
14 0x0E	Produced Connection Path	Get_Attribute_Single	Application Object producing data on this connection	{ }, { }, { }	A1 01 C6	N/A
15 0x0F	Consumed Connection Path Length	Get_Attribute_Single	Number of bytes in the consumed_connection_path length attribute	0, 0, 65535	C7	N/A
16 0x10	Consumed Connection Path	Get_Attribute_Single	Specifies the Application Object(s) that are to receive the data consumed by this Connection Object	{ }, { }, { }	A1 01 C7	N/A

## DeviceNet Connection Class (5), Polled IO Connection Instance (2)

IO Poll Connection must be allocated to read these attributes and in the configuration status to write attributes 14 and 16

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Units String
1 0x01	State	Get_Attribute_Single	State of the object 0 = nonexistent 1 = configuring 2 = waiting for connection ID 3 = established	1, 0, 5	C6	N/A
2 0x02	Instance Type	Get_Attribute_Single	Indicates either IO or messaging connection 0 = Explicit message      1 = I/O message	1, 0, 1	C6	N/A
3 0x03	Transport Class Trigger	Get_Attribute_Single	Defines Behavior of the connection	0x82, 0, 255	D1	N/A
4 0x04	Produced Cnxn Id	Get_Attribute_Single	Placed in CAN Identifier field when the Connection Transmits	0x3FF, 0, 65535	C7	N/A
5 0x05	Consumed Cnxn Id	Get_Attribute_Single	CAN Identifier Field value that denotes message to be received	0x5FD, 0, 65535	C7	N/A
6 0x06	Initial Comm Characteristics	Get_Attribute_Single	Defines the Message Group(s) across which productions & consumptions associated w/this	1, 0, 255	D1	N/A
7 0x07	Produced Connection Size	Get_Attribute_Single	Maximum number of bytes transmitted across this Connection	1, 0, 7	C7	N/A
8 0x08	Consumed Connection Size	Get_Attribute_Single	Maximum number of bytes received across this Connection	1, 0, 1	C7	N/A
9 0x09	Expected Packet Rate	Get_Attribute_Single, Set_Attribute_Single	Defines timing associated with this Connection	0, 0, 65535	C7	msec
12 0x0C	Watchdog Timeout Action	Get_Attribute_Single	Defines how to handle Inactivity/Watchdog timeouts 0 - Transition to time out 1 - Auto Delete 2 - Auto Reset 3 - Deferred Delete	0, 0, 3	C6	N/A
13 0x0D	Produced Connection Path Length	Get_Attribute_Single	Number of bytes in the produced_connection_path length attribute	3, 3, 3	C7	N/A
14 0x0E	Produced Connection Path	Get_Attribute_Single, Set_Attribute_Single	Application Object producing data on this connection	{0x62, 0x36, 0x42}, {0x62, 0x36, 0x42}, {0x62, 0x36, 0x42}	A1 01 C6	N/A
15 0x0F	Consumed Connection Path Length	Get_Attribute_Single	Number of bytes in the consumed_connection_path length attribute	3, 3, 3	C7	N/A
16 0x10	Consumed Connection Path	Get_Attribute_Single	Specifies the Application Object(s) that are to receive the data consumed by this Connection Object	{0x62, 0x30, 0x31}, {0x62, 0x30, 0x31}, {0x62, 0x30, 0x31}	A1 01 C7	N/A
100 0x64	Input Assembly Type	Get_Attribute_Single, Set_Attribute_Single	Input Assembly Type 50=Basic Overload 51=Extended Overload 52=Basic Motor Control 53=Extended Motor Control 1 54=Extended motor Control 2 100=C395DNA Contactor 101=C395DNA Overload 102=C395DNA Motor Starter 104=C395DNA Overload Phase Currents 105=C395DNA Starter Phase Currents 106=C395DNA Exp Starter Plus Currents	53, 50, 106,	C6	N/A
101 0x65	Output Assembly Type	Get_Attribute_Single, Set_Attribute_Single	Output Assembly Type 1=Basic Contactor 2=Basic Overload 3=Basic Motor Starter 4 = Extended Contactor 5=Extended Motor Starter	3,1,5	C6	N/A

**Common Services**

Service Code	Implemented for:		Service Name
	Class	Instance	
0x05	No	Yes	Reset
0x0A	Yes	No	Get_Member
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

**DISCRETE INPUT POINT**

## Discrete Input Point Class (8), Class Attributes (0)

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Units String
1	Revision 0x01	Get_Attribute_Single	Revision of this object	2, 1, 2	C7	N/A
2 0x02	Max Instance	Get_Attribute_Single	Maximum instance number of an object currently created in this class level of the device	1, 1, 66535	C7	N/A
176 0xB0	Class Name	Get_Attribute_Single	ACSII Name for the object Class	"Input Point", "Input Point", "Input Point"	DA	N/A
180 0xB4	Class Attribute List		Each Element describes a class attribute. The Array's elements are structs as described in the semantics section. Individual elements are accessed using the Get Member service.	N/A, N/A, N/A	A1 01 A2 06 C7 DA DA A1 01 C6	N/A
186 0xBA	Instance Attribute List		Each element describes an instance attribute. The Array's elements are structs as described in the semantics section. Individual elements are accessed using the Get Member service	N/A, N/A, N/A	A1 01 A2 06 C7 DA DA A1 01 C6	N/A

## Discrete Input Point Class (8), Instance Attributes (1)

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Units String
3 0x03	Closed	Get_Attribute_Single	Input point value	0, 0, 1	C1	N/A
4 0x04	Status	Get_Attribute_Single	Input point status	0, 0, 1	C1	N/A

**Common Services**

Service Code	Implemented for:		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get_Attribute_Single

## CONTROL SUPERVISOR

### Control Supervisor Object Class (41), Class Attributes (0)

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Units String
1 0x01	Revision	Get_Attribute_Single	Revision of this object. NOTE: All class definitions are required to include this attribute. If the value is 01, then this attribute is optional in implementation. Otherwise, this attribute is required.	1, 1, 1	C7	N/A
2 0x02	Max Instance	Get_Attribute_Single	Maximum instance number of an object currently created in this class level of the device	1, 1, 1	C7	N/A
176 0xB0	Class Name	Get_Attribute_Single	ACSII Name for the object Class	"Control Supervisor", "Control Supervisor", "Control Supervisor"	DA	N/A
180 0xB4	Class Attribute List	CH_Get_Member	Each Element describes a class attribute. The Array's elements are structs as described in the semantics section. Individual elements are accessed using the Get Member service.	N/A, N/A, N/A	A1 01 A2 06 C7 DA DA A1 01 C6	N/A
186 0xBA	Instance Attribute List	CH_Get_Member	Each element describes an instance attribute. The Array's elements are structs as described in the semantics section. Individual elements are accessed using the Get Member service	N/A, N/A, N/A	A1 01 A2 06 C7 DA DA A1 01 C6	N/A

### Control Supervisor Object Class (41), Instance Attributes (1)

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Units String
1 0x01	NumAttrib	Get-Attribute_Single		16,0,65535	C6	N/A
3 0x03	Run 1	Get_Attribute_Single, Set_Attribute_Single	See Run/Stop event matrix	0, 0, 1	C1	N/A
4 0x04	Run 2	Get_Attribute_Single, Set_Attribute_Single	See Run/Stop event matrix	0, 0, 1	C1	N/A
5 0x05	NetCtrl	Get_Attribute_Single, Set_Attribute_Single	<b>Requests Run/Stop control to be local or from network</b> <b>0 = Local Control</b> <b>1 = Network Control</b> <b>Note that the actual status of Run/Stop control is reflected in attribute 15, CtrlFromNet.</b>	<b>0, 0, 1</b>	<b>C1</b>	<b>N/A</b>
6 0x06	State	Get-Attribute_Single	0 = Vendor Specific 1 = Startup 2 = Not_Ready 3 = Ready 4 = Enabled 5 = Stopping 6 = Fault_Stop 7 = Faulted	3, 0, 7	C6	N/A
7 0x07	Running 1	Get_Attribute_Single	1 = (Enabled and Run1) or (Stopping and Running1) or (Fault_Stop and Running 1) 0 = Other state	0, 0, 1	C1	N/A
8 0x08	Running 2	Get_Attribute_Single	1 = (Enabled and Run2) or (Stopping and Running2) or (Fault_Stop and Running 2) 0 = Other state	0, 0, 1	C1	N/A

## Control Supervisor Object Class (41), Instance Attributes (1), Cont'd

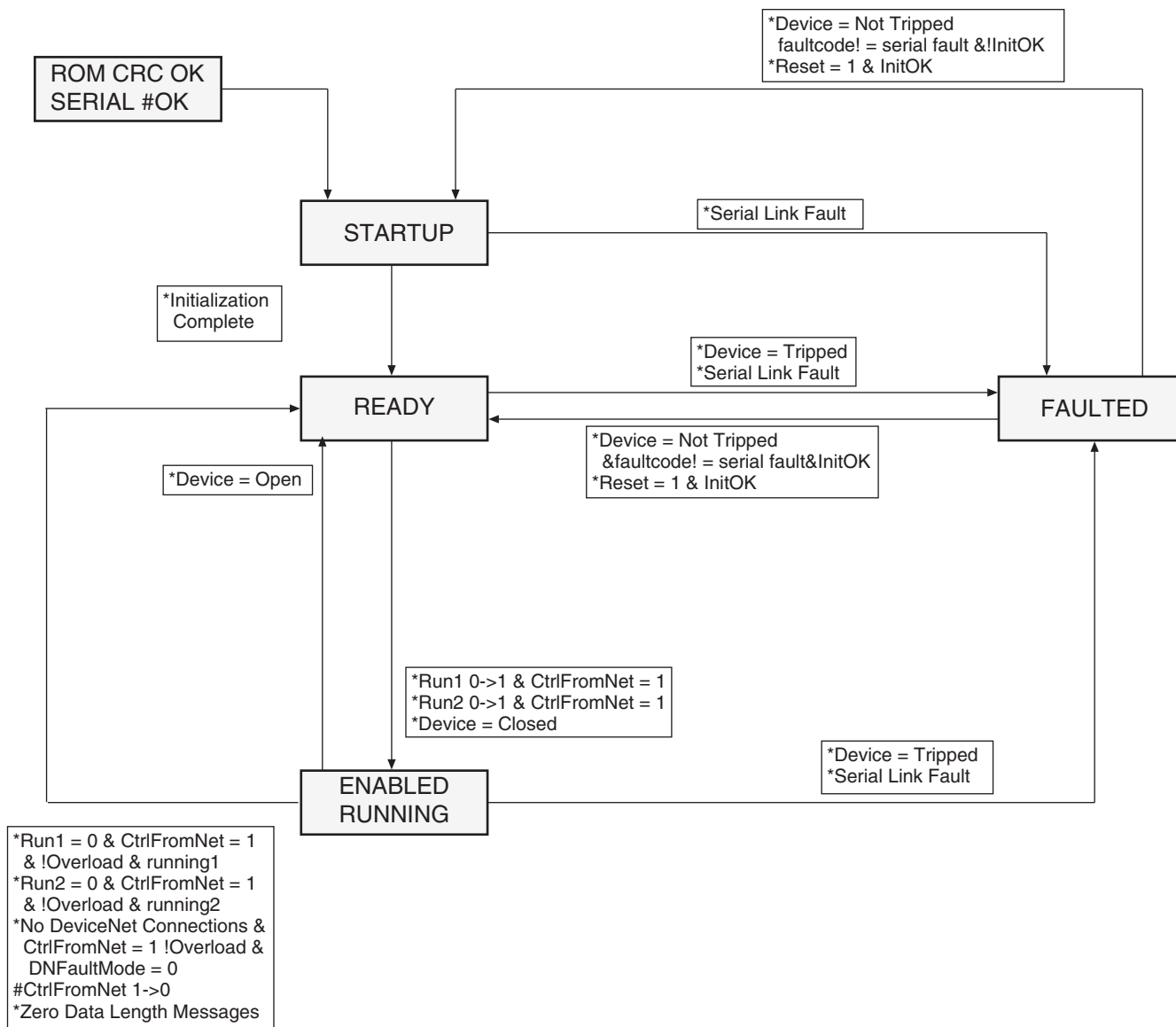
Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Units String
9 0x09	Read	Get_Attribute_Single	1 = Ready or Enabled or Stopping 0 = Other state	1, 0, 1	C1	N/A
10 0x0A	Faulted	Get_Attribute_Single	1 = Fault Occurred (latched) 0 = No Faults present	0, 0, 1	C1	N/A
11 0x0B	Warning	Get_Attribute_Single	1 = Warning (not latched) 0 = No Warnings present (If warnings are not supported, this attribute should always be 0)	0, 0, 1	C1	N/A
12 0x0C	FaultRst	Get_Attribute_Single, Set_Attribute_Single	0->1 = Fault Reset 0 = No action	0, 0, 1	C1	N/A
13 0x0D	FaultCode	Get_Attribute_Single	If in Faulted state, FaultCode indicates the Fault that caused the transition to Faulted state. If multiple faults occurred simultaneously, the vendor chooses which to report, and the rest are lost. If not in Faulted state, FaultCode indicates the fault that caused the last transition to the Faulted state. Power-up state of fault code is vendor specific. Fault codes for drives are different than fault codes for starters. See appropriate device profile for fault codes.	0, 0, 71	C7	N/A
14 0x0E	Warning Code	Get_Attribute_Single	Code word indicating warning present. If multiple warnings are present, the lowest code value is displayed. Note that fault codes for drives and servos are different than fault codes for starters. See appropriate device profile for fault codes.	0, 0, 71	C7	N/A
15 0x0F	CtrlFromNet	Get_Attribute_Single	Status of Run/Stop control source. 0 = Control is local 1 = Control is from network	0, 0, 1	C1	N/A
16 0x010	DNFaultMode	Get_Attribute_Single, Set_Attribute_Single	<b>Action on loss of DeviceNet</b> <b>0 = Fault + Stop</b> <b>1 - Ignore (Warning Optional)</b> <b>2 = Lock ACM (Lockable ACM only)</b> <b>ATTENTION: Ignoring communication faults may result in equipment damage, personal injury, or death. Ensure that you understand how ignoring a communication fault may affect the operation of your system.</b>	0, 0, 1	C6	N/A
100 0x64	Anti-Recycle	Get_Attribute_Single Set-Attribute_Single	Time in tenths of seconds Range (0.0 to 300.0) seconds	0, 0, 3000	C7	N/A

## Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x0A	Yes	No	Get_Member
0Ehex	No	Yes	Get_Attribute_Single
10hex	No	Yes	Set_Attribute_Single

**BEHAVIOR****State Transition Diagram**

The following Status Transition Diagram provides a graphical description of the states and state transitions that are reflected in attribute 6. Each “\*” represents a transition if it evaluates to a true state.



### Run/Stop Event Matrix

If attribute 15 CtrlFromNet is equal to 1, the events Run and Stop are triggered by a combination of the Run1 and Run2 attributes as shown in the following table.

Run1	Run2	Trigger Event	Run Type ATL	Run Type F/R	Run Type F/S
0	0	Stop	N/A	N/A	N/A
1	0	Run	Run1	Run/Fwd	RunSlow
0	1	Run	N/A	Run/Rev	RunFast
1	1	No Change	N/A	N/A	N/A

## OVERLOAD OBJECT

Overload Object Class (44), Class Attributes (0)

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Units String
1 0x01	Revision	Get_Attribute_Single	Revision of this object. NOTE: All class definitions are required to include this attribute. If the value is 01, then this attribute is optional in implementation. Otherwise, this attribute is required.	1, 1, 1	C7	N/A
2 0x02	Max Instance	Get_Attribute_Single	Maximum instance number of an object currently created in this class level of the device	1, 1, 1	C7	N/A
176 0xB0	Class Name	Get_Attribute_Single		"Overload", 'Overload', "Overload"	DA	N/A
180 0xB4	Class Attribute List	CH_Get_Member	Specifies the encoding of a single instance attribute list	{0x08, {0x01, 0x02, 0x03, 0x04, 0x05, 0x29, 0x2C, 0x08}} {0x08, {0x01, 0x02, 0x03, 0x04, 0x05, 0x29, 0x2C, 0x08}} {0x08, {0x01, 0x02, 0x03, 0x04, 0x05, 0x29, 0x2C, 0x08}}	A2 04 C7 A101 C7	N/A
186 0xBA	Instance Attribute List	CH_Get_Member	Specifies the encoding of a single instance attribute list	N/A, N/A, N/A	A1 01 A2 06 C7 DA DA A1 01 C6	N/A



## Overload Object Class (44), Instance Attributes (1)

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Units String
1 0x01	NumAttr	Get_Attribute_Single	Number of attributes supported	15,0,255	C6	N/A
3 0x03	TripFLCSet	Get_Attribute_Single Set_Attribute_Single	Overload Full Load Current Setting Units: 100ma / 2CurrentScale where CurrentScale is attribute 12	1430, 64, 5825	C3	N/A
4 0x04	TripClass	Get_Attribute_Single Set_Attribute_Single	Trip Class Setting 4 to 201	10, 4, 201	C6	N/A
5 0x05	AvgCurrent	Get_Attribute_Single	Average of the three phase current. Units: 100ma / 2CurrentScale where CurrentScale is attribute 12	0, 0, 32767	C3	N/A
6 0x06	%PhImbal	Get_Attribute_Single	% Phase Imbalance	0, 0, 100	C6	N/A
7 0x07	% Thermal Capacity	Get_Attribute_Single	% Thermal Capacity	0, 0, 100	C6	N/A
8 0x08	CurrentL1	Get_Attribute_Single	Actual motor phase current L1 Units: 100ma / 2CurrentScale where Current/Scale is attribute 12	0, 0, 32767	C3	N/A
9 0x09	CurrentL2	Get_Attribute_Single	Actual motor phase current L2 Units: 100ma / 2CurrentScale where Current/Scale is attribute 12	0, 0, 32767	C3	N/A
10 0x0A	CurrentL3	Get_Attribute_Single	Actual motor phase current L3 Units: 100ma / 2CurrentScale where Current/Scale is attribute 12	0, 0, 32767	C3	N/A
12 0x0C	CurrentScale	Get_Attribute_Single	Current scaling factor. Scaling is accomplished as follows: Scaled Current = 100ma/2 Current Scale Range: -128 .. 127	4, 0, 127	C2	N/A
100 0x64	AutoEnable Reset	Get_Attribute_Single Set_Attribute_Single	0 = Manual Reset 1 = Auto Reset	0, 0, 1	C1	N/A
101 0x65	Phase Imbalance Enable	Get_Attribute_Single Set_Attribute_Single	0 = Disable 1 = Enable	0, 0, 1	C1	N/A
102 0x66	Phase Loss Enable	Get_Attribute_Single Set_Attribute_Single	0 = Disable 1 = Enable	0, 0, 1	C1	N/A
103 0x67	Jam Enable	Get_Attribute_Single Set_Attribute_Single	0 = Disable 1 = Enable	0, 0, 1	C1	N/A
104 0x68	Jam Time	Get_Attribute_Single Set_Attribute_Single	Time in tenths of seconds Range (0.0 to 25.5) seconds	0, 0, 255	C6	N/A

## Trip FLC Set Table A

Frame	Scale	Minimum	Maximum	Max Design E	Example
C395AD	5	.22 69d	17.43 5577d	13.09 4190d	$5577/2^5 = 174.3(.1 \text{ amps}) = 17.4$
C395CF	4	8.94 1431d 0597hex	30.88 4940d 1340hex	23.19 3711d 0e7fhex	$3711/2^4 = 231.9(.1 \text{ amps}) = 23.1$ 9 amps
C395GK	3	19.17 1534d 05FEhex	72.81 5825d 16c1hex	54.70 4376d 1118hex	$1534/2^3 = 191.7(.1 \text{ amps}) = 19.1$ 7 amps

**Common Services**

Service Code	Implemented for:		Service Name
	Class	Instance	
0x0A	Yes	No	Get-Member
0x0E	No	Yes	Get_Attribute_Single

**APPENDIX B**

Fault Codes and Warning Codes	
No Fault	0
Test	10
Thermal Overload	21
Phase Loss	22
Phase Imbalance	26
Ground Current-Sensing Fault	27
Jam	28
Memory Fault	62
Hardware Link Fault	63
No Device Power	64
Miscellaneous Device Trip	70
Fail to Close	71

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