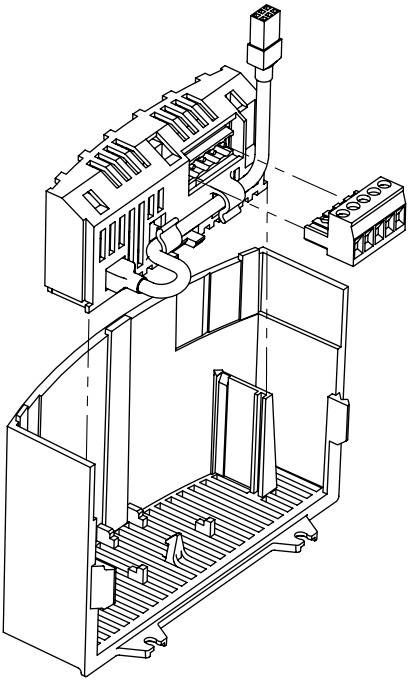
Lenze
AC Tech

SMVector



DeviceNet™ Communication Module

Communications Interface Reference Guide

CMVDVN01A

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About These Instructions

This documentation applies to the optional DeviceNet communications module for the SMVector inverter and should be used in conjunction with the SMVector Operating Instructions (Document SV01) that shipped with the drive. These documents should be read carefully as they contain important technical data and describe the installation and operation of the drive.

All information given in this documentation has been carefully selected and tested for compliance with the hardware and software described. Nevertheless, discrepancies cannot be ruled out. AC Tech does not accept any responsibility nor liability for damages that may occur. Any necessary corrections will be implemented in subsequent editions.

1 Safety Information

General

Some parts of Lenze controllers (frequency inverters, servo inverters, DC controllers) can be live, moving and rotating. Some surfaces can be hot.
Non-authorized removal of the required cover, inappropriate use, and incorrect installation or operation creates the risk of severe injury to personnel or damage to equipment.
All operations concerning transport, installation, and commissioning as well as maintenance must be carried out by qualified, skilled personnel (IEC 364 and CENELEC HD 384 or DIN VDE 0100 and IEC report 664 or DIN VDE0110 and national regulations for the prevention of accidents must be observed).
According to this basic safety information, qualified skilled personnel are persons who are familiar with the installation, assembly, commissioning, and operation of the product and who have the qualifications necessary for their occupation.

Application as directed

Drive controllers are components designed for installation in electrical systems or machinery. They are not to be used as appliances. They are intended exclusively for professional and commercial purposes according to EN 61000-3-2. The documentation includes information on compliance with the EN 61000-3-2.
When installing the drive controllers in machines, commissioning (i.e. the starting of operation as directed) is prohibited until it is proven that the machine complies with the regulations of the EC Directive 98/37/EC (Machinery Directive); EN 60204 must be observed.
Commissioning (i.e. starting drive as directed) is only allowed when there is compliance to the EMC Directive (89/336/EEC).
The drive controllers meet the requirements of the Low Voltage Directive 73/23/EEC. The harmonised standards of the series EN 50178/DIN VDE 0160 apply to the controllers.
The availability of controllers is restricted according to EN 61800-3. These products can cause radio interference in residential areas. In the case of radio interference, special measures may be necessary for drive controllers.

Installation

Ensure proper handling and avoid excessive mechanical stress. Do not bend any components and do not change any insulation distances during transport or handling. Do not touch any electronic components and contacts.
Controllers contain electrostatically sensitive components, which can easily be damaged by inappropriate handling. Do not damage or destroy any electrical components since this might endanger your health!

Electrical connection

When working on live drive controllers, applicable national regulations for the prevention of accidents (e.g. VBG 4) must be observed.
The electrical installation must be carried out according to the appropriate regulations (e.g. cable cross-sections, fuses, PE connection). Additional information can be obtained from the regulatory documentation.
The regulatory documentation contains information about installation in compliance with EMC (shielding, grounding, filters and cables). These notes must also be observed for CE-marked controllers.
The manufacturer of the system or machine is responsible for compliance with the required limit values demanded by EMC legislation.

Operation

Systems including controllers must be equipped with additional monitoring and protection devices according to the corresponding standards (e.g. technical equipment, regulations for prevention of accidents, etc.). You are allowed to adapt the controller to your application as described in the documentation.

Safety Information

DANGER!
- After the controller has been disconnected from the supply voltage, do not touch the live components and power connection until the capacitors have discharged. Please observe the corresponding notes on the controller.
- Do not continuously cycle input power to the controller more than once every three minutes.
- Please close all protective covers and doors during operation.

WARNING!
Network control permits automatic starting and stopping of the inverter drive. The system design must incorporate adequate protection to prevent personnel from accessing moving equipment while power is applied to the drive system.

Pictographs used in these instructions

Pictograph	Signal word	Meaning	Consequences if ignored
	**DANGER!**	Warning of Hazardous Electrical Voltage.	Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
	**WARNING!**	Impending or possible danger for persons	Death or injury
	**STOP!**	Possible damage to equipment	Damage to drive system or its surroundings
	**NOTE**	Useful tip: If observed, it will make using the drive easier	

2 Introduction

The following information is provided to allow the SMV Series drive to operate on a DeviceNet™ network; it is not intended to explain how DeviceNet™ itself works. Therefore, a working knowledge of DeviceNet™ is assumed, as well as familiarity with the operation of the SMV Series drive.

2.1 DeviceNet Implementation for the SMV Series Drive

The following describes the DeviceNet™ network protocol implementation on the SMV Series drive. The SMV Drive can be operated as a slave device (Group 2 Server) on a DeviceNet™ network. It supports Explicit Messages and the following I/O messages of the predefined master/slave connection set:

- Polled
- Bit Strobe
- Changed of state
- Cyclic

NOTE: The SMV does not support the Explicit Unconnected Message Manager!

To simplify setup and operation, implemented classes and behavior conform to the AC DRIVE profile as specified in the ODVA DeviceNet™ standard.

To assist in recovery from Communication Faulted condition, Offline Connection Set messages are supported. The SMV supports the following Group 4 message types:

Group 4 Message ID 2C - Communication Faulted Response Message

Group 4 Message ID 2D - Communication Faulted Request Message

Using these messages, the user will be able to identify a faulted drive and when possible, re-establish communication without disconnecting the network or resetting the drive. After receiving “Identify Request Message” while in Communication Faulted state, the value in parameter P419 will flash “1000/1777”.

The following baud rates are available: 125 kbps, 250 kbps, 500 kbps

The SMV drive supports these object classes:

1. Identity Object - Class 0x01
2. Message Router Object - Class 0x02
3. DeviceNet Object - Class 0x03
4. Assembly Object - Class 0x04
5. DeviceNet Connection Object - Class 0x05
6. Parameter Object - Class 0x0F
7. Parameter Group Object -Class 0x10
8. Motor Data Object - Class 0x28
9. Control Supervisor Object - Class 0x29
10. AC/DC Drive Object - Class 0x2A
11. Acknowledge Handler Object - Class 0x2B

3 Installation

3.1 Installing the Module into the Terminal Cover

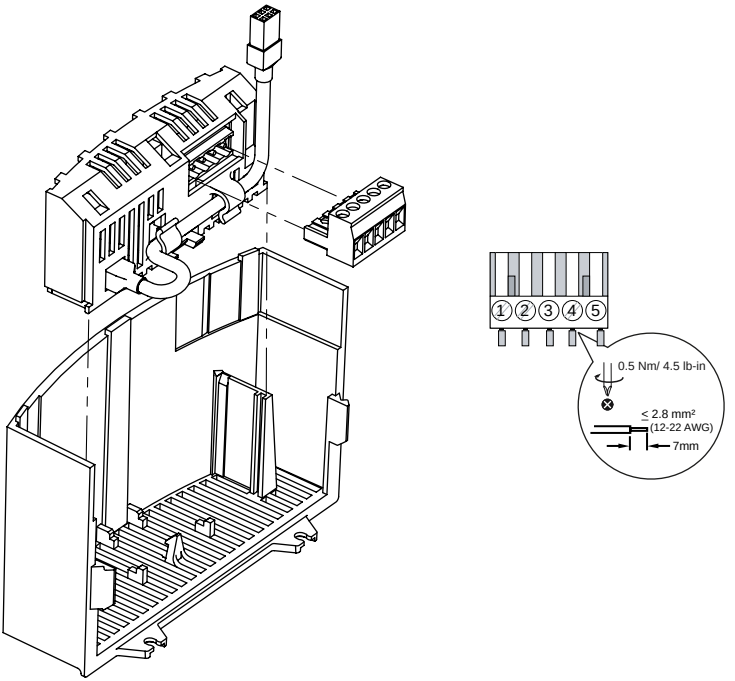

Figure 1: Installing the DeviceNet Communciations Module

3.2 DeviceNet™ Terminal Block

Terminal	Description	Recommended Wire Color	Important
1	V-	Black	
2	CAN_L	Blue	If controller is located at either end of the network, a terminating resistor (120 ohm, metal film, 1/4 Watt) should be connected across CAN_L and CAN_H.
3	Shield	Bare	Terminal 3 is not connected to Earth ground.
4	CAN_H	White	If controller is located at either end of the network, a terminating resistor (120 ohm, metal film, 1/4 Watt) should be connected across CAN_L and CAN_H.
5	V+	Red	11 - 25 VDC power supply; current consumption (100mA @ 11VDC max)

Notes:

- For DeviceNet™ power supply and network cabling details, refer to the DeviceNet™ specification.
- All terminals have basic isolation (single insulating distance).
- Protection against contact can only be ensured with additional measures (i.e. double insulation).

3.3 Installing the Terminal Cover

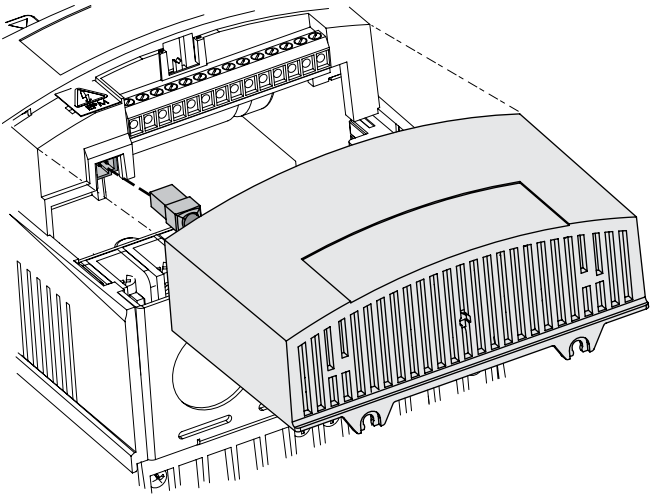

Figure 2: Re-Installing the SMV Terminal Cover

4 Commissioning DeviceNet™ Communications

4.1 Quick Set-up

With drive power disconnected, connect the DeviceNet™ communication module and network cable to the drive as shown in Section 3.1. Apply power to the drive. In the drive parameter menu, select parameter P400 Network Protocol and set it to 4 - - DeviceNet™. After this action, the module will be initialized with DeviceNet protocol and will enter Online Mode - P402 = 3.

Once the wiring is complete and the network power supply is ON and SMV drive is powered up, program the address and network baud rate to the required values. Do this using the programming buttons on the front of the drive (refer to Section 5.1- Parameter Menu) to set the following parameters:

P410 - DEVICENET NODE ADDRESS	Range is 0 to 63 (default = 63)
P411 - DEVICENET BAUD RATE	0 = 125 kbps (default = 125) 1 = 250 kbps 2 = 500 kbps

Once these parameters are set, cycle power to the drive. This will make the address and baud rate parameters take effect. Also, during power-up (and resets), the SMV drive will perform the following functions:

1. Power up initializations; sets all variables and states.
2. Sets the MAC address and baud rate base on values programmed in EPM (P410, P411).
3. Checks for duplicate node address to verify that its own address is unique on the network.

If the power-up or reset sequence fails, the SMV drive will enter DeviceNet failure mode. In that case, the drive will not be accessible to the network, but can still be operated in terminal mode. This failure state is indicated in parameter P419 DIAGNOSTIC by number “1093” (refer to Section 5.1 for details on parameter P419.)

4.2 Basic Mode of Operation

The SMV Series Drive can operate under DeviceNet™ control in any terminal configuration except remote keypad mode. Refer to SMV Operating Instructions (SV01), parameter P100. To enable DeviceNet control, one of the SMV drive's programmable digital inputs (terminals 13A, 13B or 13C) must be set to "Network Enable" and be activated. Refer to SMV Operating Instructions (SV01), Parameters P121, 122 and 123.

4.2.1 Sample Setup and Wiring for DeviceNet™ Control

This example uses Explicit or I/O Polled messaging for Run Forward/Reverse and speed control. NOTE: If P100>0, then Terminal 1 must be closed to Terminal 4 in order to start the drive through the DeviceNet™ interface. Parameters can be setup using the drive keypad, EPM Programmer, or DeviceNet™ configuration tool (for example RSNetWorx™) that uses the EDS file provided by AC Technology.

As a minimum, the following parameters should be set:

P121, P122, P123 - One of these parameters must be set to 09 (Network Enable)

P112 ROTATION DIRECTION - Set this parameter to FORWARD & REVERSE (01) if operation in both directions is required.

P305 MOTOR NOMINAL SPEED AT RATED FREQUENCY (RPM)

P304 MOTOR RATED FREQUENCY (Hz)

P400 DEVICENET NODE ADDRESS (0 - 63)

P401 DEVICENET BAUD RATE (125, 250, 500 kbps)

P430 DEVICENET OUTPUT ASSEMBLY SELECTION - Set this parameter to select output assembly for Polled connection. The following selections are available:

0 = "20 Basic Speed Ctrl”
1 = "21 Ext. Speed Ctrl RPM"
2 = "100 Ext. Speed Ctrl Hz + Digital + Analog I/O"
3 = "102 PID Setpoint + Digital + Analog I/O"
4 = "104 Torque Setpoint + Digital + Analog I/O"

The most versatile assemblies are #21 (selection 1) and #100 (selection 2). They allow RUN FORWARD and RUN REVERSE control as well as speed control. Refer to Section 5.2 for more assembly details.

P440 DEVICENET INPUT ASSEMBLY SELECTION - Set this parameter for Polled, COS or Cyclic I/O connection. Refer to Section 5.2 for more assembly details.

NOTE: If Parameter P400 (NETWORK ADDRESS) or P401 (BAUD RATE) have been changed, the drive must be reset by recycling power or by issuing a RESET command using Parameter P418 via the DeviceNet™ network before the new values take effect.

To simplify setup and assist in maintaining the DeviceNet™ network, the EDS file supporting the SMV Series drive is available from AC Technology. To obtain a copy of the appropriate EDS file, please contact AC Technology Corp, or visit www. actech.com. It is also included on the CD shipped with the drive.

4.2.2 Sample of Setup and Test Runs using Rsnetworx™ for DeviceNet

1. Make all necessary DeviceNetTM network connections.
2. Using "EDS Hardware Installation Tool" register the EDS file for SMV family of drives.
3. Switch mode to ONLINE. After browsing through all available addresses on the network, "AC Tech SMV Drive" should appear at the programmed address.
4. To access the drive parameters double click on the drive icon.
5. After uploading parameters from the SMV drive, they can be edited and downloaded back to the drive. SMV drive parameters accessed through the drive keypad correspond to the same Network ID, to simplify programming they have a drive parameter number in front of their name.

For example:

Parameter ID P160 corresponds to drive parameter "P160 Carrier Select"

Parameter ID P110 corresponds to drive parameter "P110 Start Method"

DeviceNetTM parameter IDs #1 to #99 are only accessible through the network connection. Refer to the Parameter Class section for parameter descriptions.

To assist in Network Controlled test runs, the EDS file consists of parameters that permit triggering RUN commands by changing the bits setable in ID#65 (Network Control Word).

NOTE: RUN and STOP commands must be triggered according to the table in Section 5.3.6

ID#61 - Network Reference Frequency: Controls the drive speed reference parameter if bit 6 (Network Reference) is set to Network Control.

WARNING!
Make sure it is safe to operate the driven equipment prior to starting the SMV Series drive from the network. Damage to equipment and/or injury to personnel can result!

5 Extended Parameters for DeviceNet™

In addition to the drive parameters (detailed in the Installation and Operation manual that accompanied the drive), the installation of the DeviceNet module will give access to the 400 series parameters that are exclusively for the DeviceNet communications module.

5.1 Parameter Menu

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
CANopen Module Specific Parameters				
P400	Network Protocol		0 Not Active	
			4 DeviceNet	
P401	Module Revision		Display reads 04.x.x where: 04 = DeviceNet Module x.x = Module Revision	Read only
P402	Module Status	0	0 Not Initialized	Read only
			1 Initialization: Module to EPM	
			2 Initialization: EPM to Module	
			3 Online	
			4 Failed Initialization Error	
			5 Time-out Error	
			6 Initialization Failed	Module type mismatch (P401)
			7 Initialization Error	Protocol Selection mismatch (P400)
P403	Module Reset	0	0 No Action	
			1 Reset Module parameter values to default.	Returns module parameters 401…499 to the default values shown in this manual.
P404	Module Time-out Action	3	0 Ignore	• Action to be taken in the event of a Module/ Drive Time-out. • Time-out is fixed at 200ms. • Selection 1 (STOP) is by the method selected in P111.
			1 STOP (see P111)	
			2 Quick Stop	
			3 Fault (F_nEF)	
P405	Network Fault	0	0 No Fault	Read only
			1 F_nF 1 - DeviceNet Lost	
			2 F_nF2 - Fault Triggered by DeviceNet	
P406	Proprietary		Manufacturer specific	Read only
DeviceNet™ / Configuration Parameters				
P410(1)	DeviceNet address (Node ID)	63	0 ... 63	
P411(1)	DeviceNet baud rate	0	0 125 kbps (max distance = 500m)	
			1 250 kbps (max distance = 250m)	
			2 500 kbps (max distance = 100m)	
P414	DeviceNet Idle Mode	0	0 Stop the drive 1 Hold the last state	

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P415	Action of Loss of DeviceNet	0	0 Trigger fault 'F_nt1' 1 Ignore 2 AC Tech specific - Switch off network controlled bits (STOP is not triggered)	Only active in Network Control (n.xxx)
P416	Bus Off	0	0 Hold in Error 1 Reset CAN	
P417	Bus Off Counter	0	Number of Bus Off Conditions 0.....255	Read-only Does not overflow
P418	Reset DeviceNet node	0	0 No action 1 Reset DeviceNet communication	On transition from 0 to 1, re-initializes DeviceNet controller and activates changes made to parameters marked with (1)
			**WARNING!** DeviceNet re-initialization may activate new assemblies configurations, which can result in changes to present controller state, including starting.	
P419	DeviceNet Status		4 Digit (See Below)	Read-only
	Digit 1 - Power Status		1 External power supply On	
	Digit 2 - Control Status		0 Local control and reference 1 Network control, local reference 2 Local control, network reference 3 Network control, network referencel	
	Digit 3 - Network Status		0 Network not connected 1 Network not connected 2 Network connection time out 3 Communication faulted 5 Network connected 8 Duplicate MAC ID failure 9 Network critical link failure	
	Digit 4 - I/O Status		0 I/O connection off 1 I/O connection idle state 3 I/O faulted 5 I/O active 9 I/O critical error	

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P429	CAN Peripheral Status		Bits:	• Read-only • CAN warnings and errors
			0 Error passive mode	
			1 Bus off mode	
			2 CAN Enabled	
			3 Receiver busy	
			4 Transmitter busy	
			5 Transmit error count > 128	
			6 Overload frame	
			7 Receive error count > 128	
Assembly Configuration Parameters				
P430[1)]	DeviceNet Output Assembly Selection (See Assembly Details)	1	0 Output assembly 20 - basic speed control	Length = 4 bytes
			1 Output assembly 21 - extended speed control	Length = 4 bytes
			2 Output assembly 100 - extended speed Hz + digital and analog output 1	Length = 8 bytes
			3 Output assembly 102 - PID setpoint + digital and analog output 1	Length = 8 bytes
			4 Output assembly 104 - torque setpoint + digital and analog output 1	Length = 8 bytes
		⚠	**WARNING!** DeviceNet re-initialization may activate new assemblies configurations, which can result in changes to present controller state, including starting..	
P439	Received Output Assembly Counter		Overflow above 255	Diagnostics-only
P440[1)]	DeviceNet Input Assembly Selection (See Assembly Details)	1	0 Input assembly 70 - basic speed control	Length = 4 bytes
			1 Input assembly 71 - extended speed control	Length = 4 bytes
			2 Input assembly 101 - extended speed Hz + digital and analog output I/O	Length = 8 bytes
			3 Input assembly 103 - PID setpoint, feedback	Length = 8 bytes
			4 Input assembly 105 - speed, actual torque, analog input	Length = 8 bytes
			5 Input assembly 106 - data words selectable with parameters P441 - P444	Custom: Length selectable via P441...P444 (0, 2, 4, 6 or 8 bytes)
1)	These parameters take effect only after power up when P418 is reset or DeviceNet™ is reset.			

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P441	Parameter ID of word 0	0	Value is placed in Word 0 of assembly 106	A value of 0 in Parameter P441 - P444 defines end of assembly 106
P442	Parameter ID of word 1	0	Value is placed in Word 1 of assembly 106	A value of 0 in Parameter P441 - P444 defines end of assembly 106
P443	Parameter ID of word 2	0	Value is placed in Word 2 of assembly 106	A value of 0 in Parameter P441 - P444 defines end of assembly 106
P444	Parameter ID of word 3	0	Value is placed in Word 3 of assembly 106	A value of 0 in Parameter P441 - P444 defines end of assembly 106
P449	Transmitted Assembly Counter	0	Overflow above 255	Diagnostic-only
DeviceNet™ Configuration Parameters				
P450	Explicit Message Instance State	0	0 Nonexistent	Read-only
			1 Configuring	
			2 Wait for connection ID	
			3 Established	
			4 Timed out	
			5 Deferred delete	
P452	Explicit Message Expected Packet Rate	0	0 ... 65535 {ms}	Read-only
P453	Explicit Message Status Bits Info Bit 0,1:		1 Auto delete - goes into non-existing state	Read-only
			3 Deferred delete	
	Explicit Message Timeout Info Bit 2:		1 Check timeout	
	Explicit Message Connection Info Bit 3:		1 Connection exists	
P460	Polled I/O Message Connection State	0	0 Nonexistent	Read-only
			1 Configuring	
			2 Wait for connection ID	
			3 Established	
			4 Timed Out	
P462	Polled I/O Expected Packet Rate	0	0 ... 65535 {ms}	Read-only

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P463	Polled I/O Status Bits Bit 0,1:		0 Transition to timed out - stays in timeout	Read-only
			1 Auto delete - goes into nonexistent state	
			2 Auto reset - reset the connection timeout timer	
	Polled I/O Timeout Info Bit 2:		1 Check timeout	
	Polled I/O Connection Info Bit 3:		1 Connection exists	
P470	Bit Strobe Message Connection State	0	0 Nonexistent	Read-only
			1 Configuring	
			2 Wait for connection ID	
			3 Established	
			4 Timed Out	
P472	Bit Strobe Expected Packet Rate	0	0 ... 65535 {ms}	Read-only
P473	Bit Strobe Status Bit Info Bit 0,1:		0 Transition to timed out - stays in timeout	Read-only
			1 Auto delete - goes into nonexistent state	
			2 Auto reset - reset the connection timeout timer	
	Bit Strobe Timeout Info Bit 2:		1 Check timeout	
	Bit Strobe Connection Info Bit 3:		1 Connection exists	
P480	Change of State/ Cyclic Message Connection State	0	0 Nonexistent	Read-only
			1 Configuring	
			2 Wait for connection ID	
			3 Established	
			4 Timed Out	
P482	Change of State/Cyclic Expected Packet Rate	0	0 ... 65535 {ms}	Read-only

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P483	Change of State/Cyclic Status Bits Bit 0,1:		0 Transition to timed out - stays in timeout	Read-only
			1 Auto delete - goes into nonexistent state	
			2 Auto reset - reset the connection timeout timer	
	Change of State/Cyclic Timeout Action Bit 2:		1 Check timeout	
	Change of State/Cyclic Connection Info Bit 3:		1 Connection exists	
P485	Change of State Trig-ger WORD selector	0	0 Word 0 of selected input assembly is used for COS trigger	Read/write
			1 Word 0 of selected input assembly is used for COS trigger	
			2 Word 0 of selected input assembly is used for COS trigger	
			3 Word 0 of selected input assembly is used for COS trigger	
P486	Change of State Status (16-bits)	0	0 ... 65535	Value from WORD selected in P485 Read-only
P487	Change of State Bit Mask (16-bits)	65535	0 ... 65535	Read/write Note: State change of bits in P486 masked with "1" in P487 trigger the COS I/O message if COS I/O connection is open
P490	Motor Type	7	0 Non-standard motor	
			1 PM DC motor	
			2 FC DC motor	
			3 PM synchronous motor	
			4 FC synchronous motor	
			5 Switched reluctance	
			6 Wound rotor induction	
			7 Squirrel cage induction	
CANopen Module Specific Parameters				
P494	Communication Module Software Version			• Read only • Format: x.yz
P495	Internal Code			• Read only • Alternating Display: xxx-; -yy
P498	Missed Messages Drive to Module			• Read only
P499	Missed Messages Module to Drive			• Read only

5.2 Input/Output Assembly Configuration Mappings

5.2.1 Output Assembly Details

P430 = 0: Output Assembly 20 Basic Speed Control

P430 = 1: Output Assembly 21 Extended Speed Control

	Bit	P430 = 0
WORD0	0	0 = NOT Run Forward 1 = Run Forward
	1	Reserved
	2	Fault reset on transition from 0 to 1
	3	Reserved
	4	Reserved
	5	Reserved
	6	Reserved
	7	Reserved
	8	Reserved
	9	Reserved
	10	Reserved
	11	Reserved
	12	Reserved
	13	Reserved
	14	Reserved
	15	Reserved
WORD1	Speed in RPMs (max 32767) • RPM calculation based on P304 and P305 • Example 1: P304 = 60Hz; P305 = 1750 RPM request setpoint forward (CW) at 25.0 HZ = 25.0 x 1750/60 = 729 = 0x02D9	

	Bit	P430 = 1
WORD0	0	0 = NOT Run Forward 1 = Run Forward
	1	0 = NOT Run Reverse 1 = Run Reverse
	2	Fault reset on transition from 0 to 1
	3	Reserved
	4	Reserved
	5	0 = Local Control 1 = Network Control
	6	0 = Local Speed Ref 1 = Network Speed Ref
	7	Reserved
	8	Reserved
	9	Reserved
	10	Reserved
	11	Reserved
	12	Reserved
	13	Reserved
	14	Reserved
	15	Reserved
WORD1	Speed in RPMs (max 32767) • RPM calculation based on P304 and P305 • Example 1: P304 = 60Hz; P305 = 1750 RPM request setpoint forward (CW) at 25.0 HZ = 25.0 x 1750/60 = 729 = 0x02D9	

Attention: To use this Output Assembly 20, Network Control and Network Reference must be set using explicit communication by writing into the control word at NetID65. The bit configuration of this word matches the WORD0 of Output Assembly 100.

P430 = 2: Output Assembly 100 Speed in Hz + Digital and Analog Output

P430 = 3: Output Assembly 102 PID Setpoint + Digital and Analog Output

	Bit	P430 = 2
WORD0	0	0 = NOT Run Forward 1 = Run Forward
	1	0 = NOT Run Reverse 1 = Run Reverse
	2	Fault reset on transition from 0 to 1
	3	Reserved
	4	Reserved
	5	0 = Local Control 1 = Network Control
	6	0 = Local Speed Ref 1 = Network Speed Ref
	7	Reserved
	8 9 10 11	Network Speed Reference (valid if bit 6 is set) 0 = Network 6 = Preset #3 1 = Keypad 7 = Preset #4 (1) 2 = 0 - 10VDC 8 = Preset #5 (1) 3 = 4 - 20 mA 9 = Preset #6 (1) 4 = Preset #1 10 = Preset #7 (1) 5 = Preset #2 11 = MOP
	12	0 = No Action 1 = Inhibit (Coast to Stop)
	13	0 = No Action 1 = Activate (Quick Stop)
	14	0 = No Action 1 = Force Manual Mode (active only in Network Control, PID mode will force open loop)
	15	0 = DC brake active 1 = DC brake not active
WORD1		Unsigned speed 0.1 Hz resolution • Received value = 0x01F0 = 49.6Hz
WORD2		Digital Output + Relay - Active when parameter P140, P142 = 25 Network Control Bit 9 - Open Collector Bit 10 - Relay Others - Reserved for future use
WORD3		Analog Output [0.1 VDC] - Active when parameter P150 = 9 Network Control • Received value = 0x024B = 5.87 [VDC]

	Bit	P430 = 3
WORD0	0	0 = NOT Run Forward 1 = Run Forward
	1	0 = NOT Run Reverse 1 = Run Reverse
	2	Fault reset on transition from 0 to 1
	3	Reserved
	4	Reserved
	5	0 = Local Control 1 = Network Control
	6	0 = Local Speed Ref 1 = Network Speed Ref
	7	Reserved
	8 9 10 11	Network Speed Reference (valid if bit 6 is set) 0 = Network 6 = Preset #3 1 = Keypad 7 = Preset #4 (1) 2 = 0 - 10VDC 8 = Preset #5 (1) 3 = 4 - 20 mA 9 = Preset #6 (1) 4 = Preset #1 10 = Preset #7 (1) 5 = Preset #2 11 = MOP
	12	0 = No Action 1 = Inhibit (Coast to Stop)
	13	0 = No Action 1 = Activate (Quick Stop)
	14	0 = No Action 1 = Force Manual Mode (active only in Network Control, PID mode will force open loop)
	15	0 = DC brake active 1 = DC brake not active
WORD1		Network PID setpoint • Signed value -999 to 31000
WORD2		Digital Output + Relay - Active when parameter P140, P142 = 25 Network Control Bit 9 - Open Collector Bit 10 - Relay Others - Reserved for future use
WORD3		Analog Output [0.1 VDC] - Active when parameter P150 = 9 Network Control • Received value = 0x024B = 5.87 [VDC]

(1) Presets #4, #5, #6 and #7 are ignored when the drive is operating in either PID mode or Torque mode.

P430 = 4: Output Assembly 104 Torque Setpoint + Digital and Analog Output

	Bit	P430 = 2
WORD0	0	0 = NOT Run Forward 1 = Run Forward
	1	0 = NOT Run Reverse 1 = Run Reverse
	2	Fault reset on transition from 0 to 1
	3	Reserved
	4	Reserved
	5	0 = Local Control 1 = Network Control
	6	0 = Local Speed Ref 1 = Network Speed Ref
	7	Reserved
	8	Network Speed Reference (valid if bit 6 is set) 0 = Network 6 = Preset #3 1 = Keypad 7 = Preset #4 (1) 2 = 0 - 10VDC 8 = Preset #5 (1) 3 = 4 - 20 mA 9 = Preset #6 (1) 4 = Preset #1 10 = Preset #7 (1) 5 = Preset #2 11 = MOP
	9	
	10	
	11	
	12	0 = No Action 1 = Inhibit (Coast to Stop)
	13	0 = No Action 1 = Activate Quick Stop)
	14	0 = No Action 1 = Force Manual Mode (active only in Network Control, PID mode will force open loop
	15	0 = DC brake active 1 = DC brake not active
WORD1		Unsigned torque setpoint •0 - 400% limited by parameter P330 Torque Limit
WORD2		Digital Output + Relay - Active when parameter P140, P142 = 25 Network Control Bit 9 - Open Collector Bit 10 - Relay Others - Reserved for future use
WORD3		Analog Output [0.1 VDC] - Active when parameter P150 = 9 Network Control • Received value = 0x024B = 5.87 [VDC]

(1) Presets #4, #5, #6 and #7 are ignored when the drive is operating in either PID mode or Torque mode.

5.2.2 Input Assembly Details

P440 = 0: Input Assembly 70 Basic Speed Control

P440 = 1: Output Assembly 71 Extended Speed Control

	Bit	P440 = 0
WORD0	0	1 = Faulted
	1	Reserved
	2	1 = Running Forward
	3	Reserved
	4	Reserved
	5	Reserved
	6	Reserved
	7	Reserved
	8	Reserved
	9	Reserved
	10	Reserved
	11	Reserved
	12	Reserved
	13	Reserved
	14	Reserved
	15	Reserved
WORD1		Speed in RPMs (max 32767) • RPM calculation based on P304 and P305 • Example 1: P304 = 60Hz; P305 = 1750 RPM request setpoint forward (CW) at 25.0 HZ = 25.0 x 1750/60 = 729 = 0x02D9

	Bit	P440 = 1
WORD0	0	1 = Faulted
	1	Reserved
	2	1 = Running Forward
	3	1 = Running Reverse
	4	1 = Ready
	5	0 = Local Control 1 = Network Control
	6	0 = Local Speed Ref 1 = Network Speed Ref
	7	1 = At Reference
	8	Reserved
	9	Reserved
	10	Reserved
	11	Reserved
	12	Reserved
	13	Reserved
	14	Reserved
	15	Reserved
WORD1		Speed in RPMs (max 32767) • RPM calculation based on P304 and P305 • Example 1: P304 = 60Hz; P305 = 1750 RPM request setpoint forward (CW) at 40.0 HZ = 40.0 x 1750/60 = 1166 = 0x048E

P440 = 2: Input Assembly 101 Speed in Hz + Digital and Analog Input

P440 = 3: Input Assembly 103 Speed in Hz + Actual PID Setpoint and Feedback

	Bit	P440 = 2
WORD0	0	1 = Faulted
	1	Reserved
	2	1 = Running Forward
	3	1 = Running Reverse
	4	1 = Ready
	5	0 = Local Control 1 = Network Control
	6	0 = Local Speed Ref 1 = Network Speed Ref
	7	1 = At Reference
	8 9 10 11	Actual Setpoint Source 0 = Keypad 6 = Preset #4 1 = 0 - 10VDC 7 = Preset #5 2 = 4 - 20 mA 8 = Preset #6 3 = Preset #1 9 = Preset #7 4 = Preset #2 10 = MOP 5 = Preset #3 11 = Network
	12	1 = PID Active (closed loop)
	13	1 = Torque Mode Active
	14	1 = Current Limit
	15	1 = DC Braking
WORD1		Unsigned actual frequency 0.1 Hz resolution
WORD2		Digital Input/Output State (See Note 1 for details)
WORD3		Analog Input 0 - 10 V TB [0.1VDC] Received value = 0x3A = 5.8 [VDC]

	Bit	P440 = 3
WORD0	0	1 = Faulted
	1	Reserved
	2	1 = Running Forward
	3	1 = Running Reverse
	4	1 = Ready
	5	0 = Local Control 1 = Network Control
	6	0 = Local Speed Ref 1 = Network Speed Ref
	7	1 = At Reference
	8 9 10 11	Actual Setpoint Source 0 = Keypad 6 = Preset #4 1 = 0 - 10VDC 7 = Preset #5 2 = 4 - 20 mA 8 = Preset #6 3 = Preset #1 9 = Preset #7 4 = Preset #2 10 = MOP 5 = Preset #3 11 = Network
	12	1 = PID Active (closed loop)
	13	1 = Torque Mode Active
	14	1 = Current Limit
	15	1 = DC Braking
WORD1		Unsigned actual frequency 0.1 Hz resolution
WORD2		Actual PID Setpoint Signed value -999 to 31000
WORD3		Actual PID Feedback Signed value -999 to 31000

Note 1:

WORD - Digital Input/Output State				
	Bit 0		Bit 8	TBC13C
	Bit 1		Bit 9	TB14 OutState
	Bit 2	Output Fault	Bit 10	Relay State
	Bit 3	Fast Current Limit State	Bit 11	Charge Relay
	Bit 4	TB1 ON	Bit 12	Assertion Level
	Bit 5		Bit 13	
	Bit 6	TB13A	Bit 14	
	Bit 7	TB13B	Bit 15	

P440 = 4: Input Assembly 105 Speed in Hz + Actual Torque and Analog Input

	Bit	P440 = 4
WORD0	0	1 = Faulted
	1	Reserved
	2	1 = Running Forward
	3	1 = Running Reverse
	4	1 = Ready
	5	0 = Local Control 1 = Network Control
	6	0 = Local Speed Ref 1 = Network Speed Ref
	7	1 = At Reference
	8	Actual Setpoint Source 0 = Keypad 6 = Preset #4 1 = 0 - 10VDC 7 = Preset #5 2 = 4 - 20 mA 8 = Preset #6 3 = Preset #1 9 = Preset #7 4 = Preset #2 10 = MOP 5 = Preset #3 11 = Network
	9	
	10	
	11	
	12	1 = PID Active (closed loop)
	13	1 = Torque Mode Active
	14	1 = Current Limit
	15	1 = DC Braking
WORD1		Unsigned actual frequency 0.1 Hz resolution
WORD2		Actual Torque [%]
WORD3		Analog Input 0 - 10 V TB [0.1VDC] • Received value = 0x3A = 5.8 [VDC]

Note: Value of Zero in Parameter P441 to P444 defines the end of Assembly 106.

P440 = 5: Input Assembly 106 Custom Selectable

	Bit	P440 = 5
WORD0	Data from Parameter/ID specified in Parameter P441 For Example: Setting P441 to 508 will place the value of parameter P508 Motor Current into the Word0 of Input Assembly 106	
WORD1	Data from Parameter/ID specified in Parameter P442 For Example: Setting P442 to 527 will place the value of parameter P527 Actual Frequency into the Word1 of Input Assembly 106	
WORD2	Data from Parameter/ID specified in Parameter P443 For Example: Setting P443 to 520 will place the value of parameter P527 0 - 10VDC Analog Input into the Word2 of Input Assembly 106	
WORD3	Data from Parameter/ID specified in Parameter P444 For Example: Setting P444 to 506 will place the value of parameter P506 Motor Voltage into the Word3 of Input Assembly 106	

Note: Value of Zero in Parameter P441 to P444 defines the end of Assembly 106.

5.3 Class Implementation Details

5.3.1 Identity Object - Class 0x01

IDENTITY CLASS ATTRIBUTES				
ATTRIBUTE ID	**ACCESS RULE**	**NAME**	**DATA TYPE**	**VALUE**
INSTANCE 0				
1	GET	REVISION	UINT	1
INSTANCE 1				
1	GET	VENDOR ID	UINT	587
2	GET	DEVICE TYPE	UINT	2 (AC drive)
3	GET	PRODUCT CODE	UINT	2 (SMV DeviceNet Module)
4	GET	MAJOR REV. MINOR REV.	USINT USINT	1 1
5	GET	STATUS	USINT	4 = Configured 5 = Owned
6	GET	SERIAL NUMBER	UDINT	Unique 32-bit number
7	GET	PRODUCT NAME	ASCII String	“AC Tech SMV Communication Module Drive”

5.3.2 Message Router Object - Class 0x02

MESSAGE ROUTER CLASS ATTRIBUTES				
ATTRIBUTE ID	**ACCESS RULE**	**NAME**	**DATA TYPE**	**VALUE**
INSTANCE 0				
1	GET	REVISION	UINT	1
INSTANCE 1				
1	GET	CLASS LIST	ARRAY	List of Implemented Classes
2	GET	MAXIMUM NUMBER OF CONNECTIONS	UINT	1
3	GET	CURRENTLY USED CONNECTIONS	UINT	1
4	GET	CURRENTLY USED ID's	Array of UINT	List of Connection ID

IDENTITY CLASS SERVICES			
SERVICE CODE	IMPLEMENTED FOR		SERVICE NAME
	CLASS	INSTANCE	
0x0E	YES	YES	Get_Attribute_Single
0x05	NO	YES	RESET

MESSAGE ROUTER CLASS SERVICES			
SERVICE	IMPLEMENTED FOR		SERVICE
CODE	CLASS	INSTANCE	NAME
0x0E	YES	YES	Get_Attribute_Single

5.3.3 DeviceNet Object - Class 0x03

DEVICENET CLASS ATTRIBUTES				
ATTRIBUTE ID	**ACCESS RULE**	**NAME**	**DATA TYPE**	**VALUE**
INSTANCE 0				
1	GET	REVISION	UINT	2
INSTANCE 1				
1	GET/SET	NODE ADDRESS	USINT	0 to 63
2	GET/SET	DATA RATE	USINT	0 to 2
3	GET/SET	BOI	BOOL	0 = Hold in Error
				1 = Reset CAN
4	GET/SET	BUS-OFF COUNTER	USINT	0 to 255
5	GET	ALLOCATION INFO		
		ALLOC. CHOICE	BYTE	Allocation Byte
		MASTER ADDRESS	USINT	0 to 63 Address

DEVICENET CLASS SERVICES			
SERVICE	IMPLEMENTED FOR		SERVICE
CODE	CLASS	INSTANCE	NAME
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

5.3.4 Assembly Object - Class 0x04

ASSEMBLY CLASS ATTRIBUTES				
ATTRIBUTE ID	**ACCESS RULE**	**NAME**	**DATA TYPE**	**VALUE**
INSTANCE 0				
1	GET	REVISION	UINT	2
2	GET	MAXIMUM NUMBER OF INSTANCES	USINT	11
INSTANCES (See Below)				
1	GET	NUMBER OF MEMBER	USINT	1
3	GET/SET	DATA	INSTANCE	

INSTANCE NUMBER AND NAME	**ACCESS RULE FOR ATTRIBUTE #3 DATA**
INSTANCE 20 = BASIC SPEED CONTROL	GET / SET
INSTANCE 21 = EXTENDED SPEED CONTROL	GET / SET
INSTANCE 100 = EXTENDED SPEED HZ + DIGITAL AND ANALOG OUTPUT	GET / SET
INSTANCE 102 = PID SETPOINT + DIGITAL AND ANALOG OUTPUT	GET / SET
INSTANCE 104 = TORQUE SETPOINT + DIGITAL AND ANALOG OUTPUT	GET / SET
INSTANCE 70 = BASIC SPEED CONTROL	GET
INSTANCE 71 = EXTENDED SPEED CONTROL	GET
INSTANCE 101 = EXTENDED SPEED HZ + ANALOG AND DIGITAL I/O	GET
INSTANCE 103 = CUSTOM: SPEED, PID SETPOINT, FEEDBACK	GET
INSTANCE 105 = CUSTOM: SPEED, ACTUAL TORQUE, ANALOG INPUT	GET
INSTANCE 106 = CUSTOM: DATA WORDS SELECTABLE WITH PARAMETERS P441 - P444	GET

ASSEMBLY CLASS SERVICES			
SERVICE	IMPLEMETED FOR		SERVICE
CODE	CLASS	INSTANCE	NAME
0x0E	YES	YES	Get_Attribute_Single
0x05	NO	YES	RESET

5.3.5 DeviceNet Connection Object - Class 0x05

DEVICENET CONNECTION CLASS ATTRIBUTES				
ATTRIBUTE ID	**ACCESS RULE**	**NAME**	**DATA TYPE**	**VALUE**
INSTANCE 0				
1	GET	REVISION	UINT	1
INSTANCE 1 - EXPLICIT MESSAGE INSTANCE				
1	GET	STATE	USINT	0 = Nonexistent 1 = Configuring 3 = Established 4 = Timed Out 5 = Deferred Delete
2	GET	INSTANCE TYPE	USINT	0 = Explicit
3	GET	TRANSPORT CLASS TRIGGER	USINT	0x83
4	GET	PRODUCED CONNECTION ID	UINT	
5	GET	CONSUMED CONNECTION ID	UINT	
6	GET	INITIAL COMM. CHARACTERISTICS	USINT	0x22
7	GET	PRODUCED CONNECTION SIZE	UINT	80 (max)
8	GET	CONSUMED CONNECTION SIZE	UINT	80 (max)
9	GET / SET	EXPECTED PACKET RATE	UINT	Timer Resolution of 2 ms
12	GET / SET	WATCHDOG ACTION	UINT	1 = Auto Delete 3 = Deferred Delete
13	GET	PRODUCED CONN. PATH LENGTH	UINT	0
14	GET	PRODUCED CONNECTION PATH		Null (No Data)
15	GET	CONSUMED CONN. PATH LENGTH	UINT	0
16	GET	CONSUMED CONNECTION PATH		Null (No Data)
17	GET	INHIBIT TIME	USINT	0

DEVICENET CONNECTION CLASS ATTRIBUTES				
ATTRIBUTE ID	**ACCESS RULE**	**NAME**	**DATA TYPE**	**VALUE**
INSTANCE 2 - POLLED I/O MESSAGE CONNECTION				
1	GET	STATE	USINT	0 = Nonexistent 1 = Configuring 3 = Established 4 = Timed Out
2	GET	INSTANCE TYPE	USINT	1 = I/O Connection
3	GET	TRANSPORT CLASS TRIGGER	USINT	0x82
4	GET	PRODUCED CONNECTION ID	UINT	
5	GET	CONSUMED CONNECTION ID	UINT	
6	GET	INITIAL COMM. CHARACTERISTICS	USINT	0x01
7	GET	PRODUCED CONNECTION SIZE	UINT	0 to 8
8	GET	CONSUMED CONNECTION SIZE	UINT	0 to 4
9	GET / SET	EXPECTED PACKET RATE	UINT	Timer Resolution of 2 ms
12	GET / SET	WATCHDOG ACTION	UINT	0 = Time Out 1 = Auto Delete 2 = Auto Reset
13	GET	PRODUCED CONN. PATH LENGTH	UINT	3
14	GET	PRODUCED CONNECTION PATH		0x63 (Hex String) Hex String - Assembly #
15	GET	CONSUMED CONN. PATH LENGTH	UINT	3
16	GET	CONSUMED CONNECTION PATH		0x63 (Hex String) Hex String - Assembly #
17	GET	INHIBIT TIME	USINT	0

DEVICENET CONNECTION CLASS ATTRIBUTES				
ATTRIBUTE ID	**ACCESS RULE**	**NAME**	**DATA TYPE**	**VALUE**
INSTANCE 3 - BIT STROBE				
1	GET	STATE	USINT	0 = Nonexistent 1 = Configuring 3 = Established 4 = Timed Out
2	GET	INSTANCE TYPE	USINT	1 = I/O Connection
3	GET	TRANSPORT CLASS TRIGGER	USINT	0x82
4	GET	PRODUCED CONNECTION ID	UINT	
5	GET	CONSUMED CONNECTION ID	UINT	
6	GET	INITIAL COMM. CHARACTERISTICS	USINT	0x02
7	GET	PRODUCED CONNECTION SIZE	UINT	0 to 8
8	GET	CONSUMED CONNECTION SIZE	UINT	8
9	GET / SET	EXPECTED PACKET RATE	UINT	Timer Resolution of 2 ms
12	GET / SET	WATCHDOG ACTION	UINT	0 = Time Out 1 = Auto Delete 2 = Auto Reset
13	GET	PRODUCED CONN. PATH LENGTH	UINT	3
14	GET	PRODUCED CONNECTION PATH		0x63 (Hex String) Hex String - Assembly #
15	GET	CONSUMED CONN. PATH LENGTH	UINT	3
16	GET	CONSUMED CONNECTION PATH		0x63 (Hex String) Hex String - Assembly #
17	GET	INHIBIT TIME	USINT	0

DEVICENET CONNECTION CLASS ATTRIBUTES				
ATTRIBUTE ID	**ACCESS RULE**	**NAME**	**DATA TYPE**	**VALUE**
INSTANCE 4 - CHANGE OF STATE / CYCLIC INSTANCE				
1	GET	STATE	USINT	0 = Nonexistent 1 = Configuring 3 = Established 4 = Timed Out
2	GET	INSTANCE TYPE	USINT	1 = I/O Connection
3	GET	TRANSPORT CLASS TRIGGER	USINT	0x82
4	GET	PRODUCED CONNECTION ID	UINT	
5	GET	CONSUMED CONNECTION ID	UINT	
6	GET	INITIAL COMM. CHARACTERISTICS	USINT	0x01 or 0x0F
7	GET	PRODUCED CONNECTION SIZE	UINT	0 to 8
8	GET	CONSUMED CONNECTION SIZE	UINT	0
9	GET / SET	EXPECTED PACKET RATE	UINT	Timer Resolution of 2 ms
12	GET / SET	WATCHDOG ACTION	UINT	0 = Time Out 1 = Auto Delete 2 = Auto Reset
13	GET	PRODUCED CONN. PATH LENGTH	UINT	3
14	GET	PRODUCED CONNECTION PATH		0x63 (Hex String) Hex String - Assembly #
15	GET	CONSUMED CONN. PATH LENGTH	UINT	3
16	GET	CONSUMED CONNECTION PATH		0x63 (Hex String) Hex String - Assembly #
17	GET / SET	INHIBIT TIME	USINT	0

5.3.6 Parameter Object - Class 0x0F

DEVICENET CONNECTION CLASS SERVICES			
SERVICE	IMPLEMENTED FOR		SERVICE
CODE	CLASS	INSTANCE	NAME
0x0E	YES	YES	Get_Attribute_Single
0x10	NO	YES	Set_Attribute_Single

PARAMETER CLASS ATTRIBUTES NUMBER OF INSTANCES (PARAMETERS): 550				
ATTRIBUTE ID	**ACCESS RULE**	**NAME**	**DATA TYPE**	**VALUE**
INSTANCE 0				
1	GET	REVISION	UINT	2
2	GET	NUMBER OF INSTANCES	UINT	150
8	GET	PARAMETER CLASS	WORD	0x03
		DESCRIPTOR		
9	GET	CONFIGURATION	UINT	0
		ASSEMBLY #		
10	GET	NATIVE LANGUAGE	UINT	0 = English
INSTANCE 1 - 550				
1	GET / SET	PARAMETER VALUE		
2	GET	LINK PATH SIZE	USINT	0 to 2
3	GET	LINK PATH	DNET PATH	
4	GET	DESCRIPTOR	WORD	
5	GET	DATA TYPE	USINT	
6	GET	DATA SIZE	USINT	

NOTE: See next page for Parameter List

PARAMETER CLASS SERVICES			
SERVICE	IMPLEMENTED FOR		SERVICE
CODE	CLASS	INSTANCE	NAME
0x0E	YES	YES	Get_Attribute_Single
0x10	NO	YES	Set_Attribute_Single

Parameter Object Instance (Parameter List)

NOTE: The same parameters are present in the EDS File

ID NO	PARAMETER	OBJECT MAPPING
1-49	RESERVED	
50	DIGITAL OUTPUT BITS	0x0F-50-1
51-54	RESERVED	
55	TB30 ANALOG OUTPUT	0x0F-55-1
56-59	RESERVED	
60	KEYPAD COMMAND FREQUENCY	0x0F-60-1
61	NETWORK COMMAND FREQUENCY	0x0F-61-1
62	ACTUAL COMMAND FREQUENCY	0x0F-62-1
63	ACTUAL OUTPUT FREQUENCY	0x0F-63-1
64	RESERVED	
65	CONTROL WORD	0x0F-65-1
66	DEVICENET STATUS WORD	0x0F-66-1
67	DRIVE STATUS WORD	0x0F-67-1
68	DRIVE OPERATION STATE	0x0F-68-1
69	PRESENT FAULT	0x0F-69-1
70	KEYPAD PID SETPOINT COMMAND	0x0F-70-1
71	NETWORK PID SETPOINT COMMAND	0x0F-71-1
72	ACTUAL PID SETPOINT	0x0F-72-1
73	ACTUAL PID SETPOINT	0x0F-73-1
74	ACTUAL PID FEEDBACK	0x0F-74-1
75-79	RESERVED	
80	KEYPAD TORQUE SETPOINT (%)	0x0F-80-1
81	NETWORK TORQUE SETPOINT (%)	0x0F-81-1
82-90	RESERVED	
91	INTERNAL STATE FGD	0x0F-91-1
92	INTERNAL STATE PWM	0x0F-92-1
93-98	RESERVED	
99	DRIVE PARAMETER REVISION	0x0F-99-1
100-541	MATCH SMV PARAMETERS P100 TO P541	
542-550	RESERVED	

PARAMETER ATTRIBUTES			
ATTRIBUTE ID	**ACCESS RULE**	**BIT #**	**ATTRIBUTE**
50 Digital Output Bits	GET/SET	1	
		2	
		3	
		4	
		5	
		6	TB14 Out State (1 - ON; 0 - OFF)
		7	Relay State (1 - ON; 0 - OFF)
		8	
		9	
		10	
		11	
		12	
		13	
		14	
		15	
55 TB30 Analog Output	GET/SET		Min/Max (0/1000) corresponds to 0.00 to 10.00VDC
60 Keypad Command Frequency	GET/SET		Min/Max (0.0/500.0) Hz Default: 20 Hz Precision = 1 (1 place after decimal point)
61 Network Command Frequency	GET/SET		Min/Max (0.0/500.0) Hz Default: 20 Hz Precision = 1 (1 place after decimal point)
62 Actual Command Frequency	GET/SET		VMin/Max (0.0/500.0) Hz Default: 20 Hz Precision = 1 (1 place after decimal point)
63 Actual Output Frequency	GET/SET		Min/Max (0.0/500.0) Hz Default: 20 Hz Precision = 1 (1 place after decimal point)

65 Control Word	GET/SET	0	0 = NOT Run Forward; 1 = Run Forward
		1	0 = NOT Run Reverse; 1 = Run Reverse
		2	Fault reset on transition from 0 to 1
		3	Reserved
		4	Reserved
		5	0 = Local Control; 1 = Network Control
		6	0 = Local Speed Ref; 1 = Network Speed Ref
		7	Reserved
		8 9 10 11	Network Speed Reference (valid if bit 6 is set) 0 = Network 6 = Preset #3 (1) 1 = Keypad 7 = Preset #4 (1) 2 = 0 - 10VDC 8 = Preset #5 (1) 3 = 4 - 20 mA 9 = Preset #6 (1) 4 = Preset #1 10 = Preset #7 (1) 5 = Preset #2 11 = MOP
		12	0 = No Action; 1 = Inhibit (Coast to Stop)
		13	0 = No Action; 1 = Activate Quick Stop
		14	0 = No Action; 1 = Force Manual Stop
		15	0 = DC Brake Active; 1 = DC Brake NOT Active
66 DeviceNet Status Word	Read Only	0	1 = Faulted
		1	Reserved
		2	1 = Running Forward
		3	1 = Running Reverse
		4	1 = Ready
		5	0 = Local Control; 1 = Network Control
		6	0 = Local Speed Ref; 1 = Network Speed Ref
		7	1 = At Reference
		8 9 10 11	Network Speed Reference (valid if bit 6 is set) 0 = Keypad 6 = Preset #4 1 = 0 - 10 VDC 7 = Preset #5 2 = 4 - 20 mA 8 = Preset #6 3 = Preset #1 9 = Preset #7 4 = Preset #2 10 = MOP 5 = Preset #3 11 = Network
		12	1 = PID Active (closed loop)
		13	1 = Torque Mode Active
		14	1 = Current Limit
		15	1 = DC Braking
(1) Presets #4, #5, #6 and #7 are ignored when the drive is operating in either PID mode or Torque mode.			

67 Drive Status Word	Read Only	0	0 = Stop; 1 = Run
		1	1 = Quick Stop (ramp to stop) Active
		2	0 = Direction Forward (commanded) 1 = Direction Reverse
		3	0 = Direction Forward (actual) 1 = Direction Reverse
		4	0 = NET REF not active 1 = NET REF sets the active source
		5	0 = Speed Mode; 1 = Torque Mode
		6	0 = Open Loop (PID Off) 1 = Closed Loop (PID On)
		7	0 = Manual Mode; 1 = AUTO mode
		8	Actual Setpoint Source 0 = Keypad 6 = Preset #4 1 = 0 - 10 VDC 7 = Preset #5 2 = 4 - 20 mA 8 = Preset #6 3 = Preset #1 9 = Preset #7 4 = Preset #2 10 = MOP 5 = Preset #3 11 = Network
		9	
		10	
		11	
		12	
		13	Control 0 = Keypad 2 = Remote Keypad 1 = Terminal 3 = Network
		14	0 = Network Control Disabled 1 = Network Control Enabled
		15	1 = DC Braking
68 Drive Operation State	AC Tech Diagnostics Only		
69 Present Fault	Read Only	1	Temperature Output Fault
		2	Overcurrent Fault
		3	Ground (Short to Earth) Fault
		4	Excessive Drive Temperature Fault
		5	Fly Start Fault
		6	High Bus Voltage (Over Voltage) Fault
		7	Low Bus Voltage Fault
		8	Motor Overload Fault
		9	OEM Defaults Corrupted
		10	Illegal Setup Fault
		11	Dynamic Brake Overheated Fault
		12	Single Phase, Voltage Ripple to High
		13	External Fault
		14	Control EEPROM fault

		15	Start Power Loss Fault
		16	Incompatibility Fault
		17	EEPROM Hardware Failure
		18	Edge Over Run; Soft Intr Re-entry Fault
		19	PW Move Run Fault
		20	Stack Over Voltage Fault
		21	Stack Under Voltage Fault
		22	BGD Missing Fault
		23	Watchdog Timeout Fault
		24	Illegal OPCO Fault
		25	Illegal Address Fault
		26	Drive Hardware Fault
		27	AD Offset Fault
		28	RKPD Lost Fault
		29	Assertion Level switched during operation Fault
		30	FGD Missing: Fault
		31	PW Missing Fault
		32	Current Loop Fault
		33	Internal communication from JK1 Lost Fault
		34	Module Communication (SPI) Timeout Fault
		35	FNR (Invalid Message Received) Fault
		36	Network Fault #1
		37	Network Fault #2
		38	Network Fault #3
		39	Network Fault #4
		40	Network Fault #5
		41	Network Fault #6
		42	Network Fault #7
		43	Network Fault #8
		44	Network Fault #9
70 Keypad PID Setpoint Command	GET/SET		Min: -99.9 Max: 3100.0 Default = 0 Precision = 1 (1 place after decimal point)
71 Network PID Setpoint Command	GET/SET		Min: -99.9 Max: 3100.0 Default = 0 Precision = 1 (1 place after decimal point)

72 Actual PID Setpoint	Read Only		Min: -99.9 Max: 3100.0 Default = 0 Precision = 1 (1 place after decimal point)
73 Actual PID Setpoint	Read Only		Min: -99.9 Max: 3100.0 Default = 0 Precision = 1 (1 place after decimal point)
74 Actual PID Feedback	Read Only		Min: -99.9 Max: 3100.0 Default = 0 Precision = 1 (1 place after decimal point)
80 Keypad Torque Setpoint (%)	GET/SET		Min: 0[%] Max: 400[%] Default = 0 Precision = 0
81 Network Torque PID Setpoint (%)	GET/SET		Min: 0[%] Max: 400[%] Default = 0 Precision = 0
91 Internal State FGD	AC Tech Diagnostics Only		
92 Internal State PWM	AC Tech Diagnostics Only		

5.3.7 Parameter Group Object - Class 0x10

PARAMETER GROUP CLASS ATTRIBUTES				
ATTRIBUTE ID	**ACCESS RULE**	**NAME**	**DATA TYPE**	**VALUE**
INSTANCE 0				
1	GET	REVISION	UINT	1
2	GET	NUMBER OF INSTANCES	UINT	4
8	GET	NATIVE LANGUAGE	UINT	0 = English
INSTANCE 1 - 3				
1	GET	GROUP NAME	SHORT STRING	
2	GET	NUMBER OF MEMBERS IN THE GROUP	UINT	
3	GET	1st PARAMETER IN THE GROUP	UINT	
4	GET	2nd PARAMETER IN THE GROUP	UINT	
n	GET	(n-2) th PARAMETER IN THE GROUP	UINT	

5.3.8 Motor Data Object - Class 0x28

MOTOR GROUP CLASS ATTRIBUTES				
ATTRIBUTE ID	**ACCESS RULE**	**NAME**	**DATA TYPE**	**VALUE**
INSTANCE 0				
1	GET	REVISION	UINT	1
2	GET	NUMBER OF INSTANCES	UINT	1
INSTANCE 1				
1	GET	NUMBER OF SUPPORTED ATTRIBUTES	USINT	7
2	GET	ATTRIBUTE LIST	ARRAY	
3	GET/SET	MOTOR TYPE	USINT	0 - 10
6	GET/SET	RATED CURRENT	UINT	RATED STATOR CURRENT (0.1A)
7	GET/SET	RATED VOLTAGE	UINT	RATED BASE VOLTAGE (V)
9	GET/SET	RATED FREQUENCY	UNIT	RATED FREQUENCY (Hz)
11	GET/SET	NOMINAL SPEED AT RATED FREQUENCY	UNIT	NOMINAL SPEED (RPM)

MOTOR DATA CLASS SERVICES			
SERVICE CODE	**IMPLEMENTED FOR**		**SERVICE NAME**
	CLASS	**INSTANCE**	
0x0E	YES	YES	GET_ATTRIBUTE_SINGLE
0x10	NO	YES	SET_ATTRIBUTE_SINGLE

5.3.9 Control Supervisor Object - Class 0x29

CONTROL CLASS ATTRIBUTES				
ATTRIBUTE ID	**ACCESS RULE**	**NAME**	**DATA TYPE**	**VALUE**
INSTANCE 0				
1	GET	REVISION	UINT	1
2	GET	NUMBER OF INSTANCES	UINT	1
INSTANCE 1				
1	GET	NUMBER OF SUPPORTED ATTRIBUTES	USINT	16
2	GET	ATTRIBUTE LIST	ARRAY	
3	GET/SET	RUNFWD	BOOL	0 to 1
4	GET/SET	RUNREV	BOOL	0 to 1

5	GET/SET	NETCTRL	BOOL	0 to 1
6	GET	STATE	UNIT	3 = READY 4 = ENABLED 5 = FAULTED
7	GET	RUNNINGFWD	BOOL	0 to 1
8	GET	RUNNINGREV	BOOL	0 to 1
9	GET	READY	BOOL	0 to 1
10	GET	FAULTED	BOOL	0 to 1
11	GET	WARNING	UNIT	0 (Not Supported)
12	GET/SET	FAULTRST	BOOL	0 to 1
13	GET	FAULT CODE	UNIT	0 to 65535
15	GET	CTRLFROMNET	US INT	0 to 1
16	GET/SET	ACTION ON LOSS OF DEVICE NET	US INT	0 = FAULT 1 = IGNORE COMM FAULT 2 = AC TECH SPECIFIC
17	GET/SET	FORCE TRIP	BOOL	0 to 1
The drive shows the "nF" fault on the LED display.				

If Attribute #5 NET CONTROL is set to 1, the RUN and STOP events are triggered according to the following event table:

ATTRIBUTE RUN FWD	ATTRIBUTE RUN REV	TRIGGER EVENT	RUN TYPE
0	0	STOP	N/A
0 -> 1	0	RUN	RUN FORWARD
0	0 -> 1	RUN	RUN REVERSE
0 -> 1	0 -> 1	NO ACTION	N/A
1	1	NO ACTION	N/A
1 -> 0	1	RUN	RUN REVERSE
1	1 -> 0	RUN	RUN FORWARD

NOTE: If ACT PARAMETER #17 DIRECTION is set to FORWARD ONLY, the drive will not be able to run in the reverse direction.

Fault Codes:

FAULT CODES		
Fault Code	**Fault Number**	**Fault Description**
0x0000	0	NO FAULT
0x2220	1	Temperature Output Fault
0x2220	2	Over Current Fault
0x2240	3	Ground (Short to Earth) Fault
0x4310	4	Excess Drive Temperature Fault
0x0000	5	Fly Start Fault
0x3210	6	High Bus Voltage (Over Voltage) Fault
0x3220	7	Low Bus Voltage (Under Voltage) Fault
0x7122	8	Motor Overload Fault
0x6320	9	OEM Defaults Corrupted Fault
0x6320	10	Illegal Setup Fault
0x7110	11	Dynamic Brake Overheated Fault
0x3130	12	Single Phase Voltage Ripple to High Fault
0x9000	13	External Fault
0x6310	14	Control EEPROM Fault
0x3120	15	Start Power Loss Fault
0x6320	16	Incompatibility Fault
0x6100	17	EEPROM Harfware Failure
0x6100	18	Edge Over Run; Soft Intr Re-entry
0x6100	19	PW Move Run Fault
0x6100	20	Stack Over Voltage Fault
0x6100	21	Stack Under Voltage Fault
0x6100	22	BGD Missiong Fault
0x6010	23	Watchdog Timed Out Fault
0x6100	24	Illegal OPCO Fault
0x6100	25	Illegal Address Fault
0x6100	26	Drive Hardware Fault
0x6100	27	AD Offset Fault
0x7501	28	RKPD Lost Fault
0x5200	29	Assertion Level switched during Operation Fault
0x6100	30	FGD Missing Fault
0x6100	31	PW Missing Fault

0x6100	32	Current Loop Fault
0x7500	33	Internal Communication from JK1 Lost Fault
0x7501	34	Module Communication (SPI) Timeout Fault
0x7502	35	FNR (Invalid Message Received)Fault
0x7511	36	Network Fault #1
0x7512	37	Network Fault #2
0x7513	38	Network Fault #3
0x7514	39	Network Fault #4
0x7515	40	Network Fault #5
0x7516	41	Network Fault #6
0x7517	42	Network Fault #7
0x7518	43	Network Fault #8
0x7519	44	Network Fault #9
0x1000	46 - 50	RESERVED

CONTROL SUPERVISOR CLASS SERVICES			
Service Code	Implemented For		Service Name
	Class	Instance	
0x0E	YES	YES	Get_Attribute_Single
0x10	NO	YES	Set_Attribute_Single

5.3.10 AC/DC Drive Object - Class 0x2A

AC/DC DRIVE CLASS ATTRIBUTES				
Attribute ID	**Access Rule**	**Name**	**Data Type**	**Value**
INSTANCE 0				
1	GET	REVISION	UINT	1
2	GET	NUMBER OF INSTANCES	UINT	1
INSTANCE 1				
1	GET	NO. OF SUPPORTED ATTRIBUTES	USINT	12
2	GET	ATRIBUTE LIST	ARRAY	
3	GET	AT REFERENCE	BOOL	Speed AtRef
4	GET/SET	NET REFERENCE	BOOL	0 = Local SpdRef 1 = Net SpdRef
6	GET	DRIVE MODE	USINT	1 = Open Loop Spd Control 2 = Vector Mode 3 = Torque Mode 4 = PID Mode
7	GET	ACTUAL SPEED	INT	Actual Speed (RPM)
8	GET/SET	SPEED REFERENCE	INT	Speed Reference (RPM)
9	GET	MOTOR PHASE CURRENT	INT	Actual Current (0.1A)
15	GET	MOTOR PHASE CURRENT	INT	Actual Power (W)
16	GET	INPUT VOLTAGE	INT	(V)
17	GET	OUTPUT VOLTAGE	IN	(V)
29	GET	STATUS OF SPEED REFERENCE	INT	0 = Local Spd Ref 1 = Net Spd Ref

AC DRIVE CLASS SERVICES			
Service Code	Implemented For		Service Name
	Class	Instance	
0x0E	YES	YES	Get_Attribute_Single
0x10	NO	YES	Set_Attribute_Single

5.3.11 Acknowledge Handler Object 0x2B

ACKNOWLEDGE HANDLER CLASS ATTRIBUTES				
Attribute ID	**Access Rule**	**Name**	**Data Type**	**Value**
INSTANCE 0				
1	GET	REVISION	UINT	1
2	GET	NUMBER OF INSTANCES	UINT	1
INSTANCE 1				
1	GET/SET	ACKNOWLEDGE TIMER	UINT	1 to 65535 ms
2	GET/SET	RETRY LIMIT	USINT	0 to 255
3	GET	COS PRODUCING CONN INSTANCE	UINT	4

ACKNOWLEDGE HANDLER CLASS SERVICES			
Service Code	Implemented For		Service Name
	Class	Instance	
0x0E	YES	YES	Get_Attribute_Single
0x10	NO	YES	Set_Attribute_Single

6 Troubleshooting and Fault Elimination

6.1 Faults

The table herein lists the faults common to the DeviceNet Communications Module.

STATUS		POSSIBLE CAUSE	REMEDY
F_nEF	Module to Drive communication timeout	Connection between drive and module is not made.	Check cable and connection between module and drive.
F_nE 1	DeviceNet Lost	Established connection has timed out.	See parameters P415, P419, P430, P450 and P460, P470.
F_nE2	Message Monitoring timeout	Trigger via Supervisor Object 0x29 - 1-17 Force Fault Trip.	Check Master/Scanner Setup

6.2 Troubleshooting

The table herein lists some common DeviceNet Communications problems and possible corrective action.

NETWORK TROUBLESHOOTING		
SYMPTOM	POSSIBLE CAUSE	REMEDY
No communication from the drive.	Module is not initialized properly	- Verify the module connection - CheckP400 and P402
	Incorrect DeviceNet settings	- Use P403 to reset DeviceNet parameters - Verify P410 and P411
	Improper writing	- Check wiring between DeviceNet Network and Communications Module. - Ensure the terminal block is properly seated. - Check connection between module and drive.
DeviceNet write commands are ignored or return exceptions	Network enabled terminal is either open or not configured	Configure one of the input terminals (P121, P122 or P123) to "Network Enabled" function and close the corresponding contact.
SMV Drive cannot be accessed from network; P419 = "00"	Communication section is not receiving power	Check DeviceNet connections and power.
SMV Drive cannot be accessed from network; P419 code is “1093”.	Bus Failure	- Check DeviceNet connections and power. - Ensure SMV drive address is unique. - Check the baud rate. - Ensure bias resistors were placed correctly. - Reset SMV drive by cycling power. - Contact AC Tech Service Dept.
SMV drive cannot be accessed from network; P419 code is different than 1090 or “1093”.	- Communication section is not receiving power. - Connection problem; shorted signal wires for example. - Scanner device failure.	- Check DeviceNet connections and power. - Check the scanner device.
SMV drive cannot be accessed from the network; P419 Code is "083"	Duplicate DeviceNet address	- Ensure SMV drive address is unique. - Reset SMV drive by cycling power. - Use Faulted Node Recovery utility.
SMV drive stops and “F.nF1” fault is displayed; P419 code is “1x3x” or “1xx3” (x = any number except 9).	- SMV communication has been lost and the Watchdog Timer shut down the drive. - Communication was lost after the Master established communication. - Scanner device failure.	- Check the Master device. - Change expected packet rate if Master cannot handle the update rate. - Re-establish communication and clear the fault.
SMV drive stops without a fault; P419 code is “1111”.	Master device closed established connection when SMV drive was in Network Control Mode, and Parameter P419 DeviceNet Idle Mode is set to 0 (“Stop the Drive”).	- Switch Off Network Control before established connection is closed. - Set the DeviceNet Parameter P419 DeviceNet Idle Mode to 1 (“Hold Last State”). - Re-establish connection and re-start the SMV drive.
SMV drive stops and “F.nF2” fault is displayed; P419 code is “1xxx” (x = any number).	Master device forced Network fault; Control Supervisor Object 0x29-1-17 “Force Fault Trip”.	Check Master device control logic.

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