YASKAWA

DeviceNet™ CM059 (SI-N1) Option Technical Manual

For Option: CM059 (SI-N1)
Models: CIMR-G5*, CIMR-F7*, CIMR-G7*, CIMR-ACA*

Document Number TM.AFD.13

ODVA
Open *DeviceNet* Vendor Association, Inc.

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Warnings and Cautions

This Section provides warnings and cautions pertinent to this product, that if not heeded, may result in personal injury, fatality, or equipment damage. Yaskawa is not responsible for consequences of ignoring these instructions.

⚠ WARNING

YASKAWA manufactures component parts that can be used in a wide variety of industrial applications. The selection and application of YASKAWA products remain the responsibility of the equipment designer or end user. YASKAWA accepts no responsibility for the way its products are incorporated into the final system design. Under no circumstances should any YASKAWA product be incorporated into any product or design as the exclusive or sole safety control. Without exception, all controls should be designed to detect faults dynamically and to fail safely under all circumstances. All products designed to incorporate a component part manufactured by YASKAWA must be supplied to the end user with appropriate warnings and instructions as to that part's safe use and operation. Any warnings provided by YASKAWA must be promptly provided to the end user. YASKAWA offers an express warranty only as to the quality of its products in conforming to standards and specifications published in the YASKAWA manual. NO OTHER WARRANTY, EXPRESS OR IMPLIED, IS OFFERED. YASKAWA assumes no liability for any personal injury, property damage, losses, or claims arising from misapplication of its products.

⚠ WARNING

- Read and understand this manual before installing, operating, or servicidriveng this drive. All warnings, cautions, and instructions must be followed. All activity must be performed by qualified personnel. The drive must be installed according to this manual and local codes.
- Do not connect or disconnect wiring while the power is on. Do not remove covers or touch circuit boards while the power is on. Do not remove or insert the Digital Operator while power is on.
- Before servicing, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. Status indicator LEDs and Digital Operator display will be extinguished when the DC bus voltage is below 50VDC. To prevent electric shock, wait at least 5 minutes after all indicators are OFF and measure the DC bus voltage level to confirm that it is at a safe level.
- Do not perform a withstand voltage test on any part of the unit. This equipment uses sensitive devices and may be damaged by high voltage.
- The drive is not suitable for circuits capable of delivering more than the specified RMS symmetrical amperes. Install adequate branch short circuit protection per applicable codes. Refer to the specification. Failure to do so may result in equipment damage and/or personal injury.
- Do not connect unapproved LC or RC interference suppression filters, capacitors, or overvoltage protection devices to the output of the drive. Capacitors may generate peak currents that exceed drive specifications.
- To avoid unnecessary fault displays, caused by contactors or output switches placed between drive and motor, auxiliary contacts must be properly integrated into the control logic circuit.
- YASKAWA is not responsible for any modification of the product made by the user, doing so will void the warranty. This product must not be modified.
- Verify that the rated voltage of the drive matches the voltage of the incoming power supply before applying power.
- To meet CE directives, proper line filters and proper installation are required.
- Some drawings in this manual may be shown with protective covers or shields removed, to describe details. These must be replaced before operation.
- Observe Electrostatic Discharge Procedures when handling the drive and drive components to prevent ESD damage.
- The attached equipment may start unexpectedly upon application of power to the drive. Clear all personnel from the drive, motor and machine area prior to applying power. Secure covers, couplings, shaft keys, machine beds and all safety equipment before energizing the drive.

This manual explains the specifications and handling of the Yaskawa DeviceNet™ CM059 (SI-N1) option.

The Option connects the drive to a DeviceNet™ network and facilitates the exchange of data.

Option Compatibility

The CM059 (SI-N1) option is compatible with these Yaskawa drive products:

Table 1: Compatible Yaskawa Drive Products for the CM059 (SI-N1) Option

Product Series	Models (Drive Nameplate)	Notes
GPD/515/G5	**CIMR-G5■**	—
F7	**CIMR-F7■**	—
G7	**CIMR-G7■**	—
ACA	**CIMR-ACA■**	**1.** The CM059 (SI-N1) option firmware must be **version 2.4** or later for operation with the ACA product series. Refer to the firmware lable on the CM059 (SI-N1) option to identify the firmware. Contact Yaskawa to obtain an updated CM059 (SI-N1) option if required. **2.** The ACA product will appear the the same as the G7 product series when viewed on the network.

Terminology

CM059 (SI-N1):
The CM059 option is also known as the SI-N1 option. They are one in the same.

Option:
Throughout this manual the term **"option"** will be used when referring to the CM059 (SI-N1) Option.

Inverter, drive, AC drive:
In this document, the word "inverter", "ac drive" and "drive" may be used interchangeably.

Related Documents

To ensure proper operation of this product, read and understand this manual. For details on installation and operation of the drive, refer to the appropriate drive Technical Manual. For details on specific parameters, refer to the appropriate drive MODBUS technical manual. All technical manuals and support files can be found on the CD that came with the drive and are available for download at **www.yaskawa.com**.

For information on DeviceNet™ contact the Open DeviceNet™ Vendor Association at **www.odva.org.**

GPD515/G5 Technical Manual document reference **TM 4515**

F7 document reference **TM.F7.01 (F7 User Manual) or TM.F7.02 (F7 Programming Manual)**

G7 document reference **TM.G7.01 (G7 User Manual)**

CIMR-ACA* document reference **TOEPC71063600 (Instruction Manual)**

GPD515/G5 MODBUS Technical Manual document reference **TM 4025**

F7 MODBUS Technical Manual document reference **TM.F7.11**

Overview

This manual describes the set-up and programming of the option. The option will allow communication between a DeviceNet Communication Network and one drive.

To connect a drive to the DeviceNet network, the following materials will be necessary:

- CM059 (SI-N1) option
- CM059 (SI-N1) option Technical Manual
- CM059 (SI-N1) option EDS Files (Found on www.yaskawa.com or CD.AFD7.01 included with the drive)
- Drive User Manual (TM 4515, TM.F7.01, or TM.G7.01).

The DeviceNet Network

DeviceNet is a low-cost communications link to connect industrial devices (such as limit switches, photoelectric switches, valve manifolds, motor starters, smart motor controllers, operator interfaces, and variable frequency drives) as well as control devices (such as programmable controllers and computers) to a network. Figure 1 shows an example DeviceNet network.

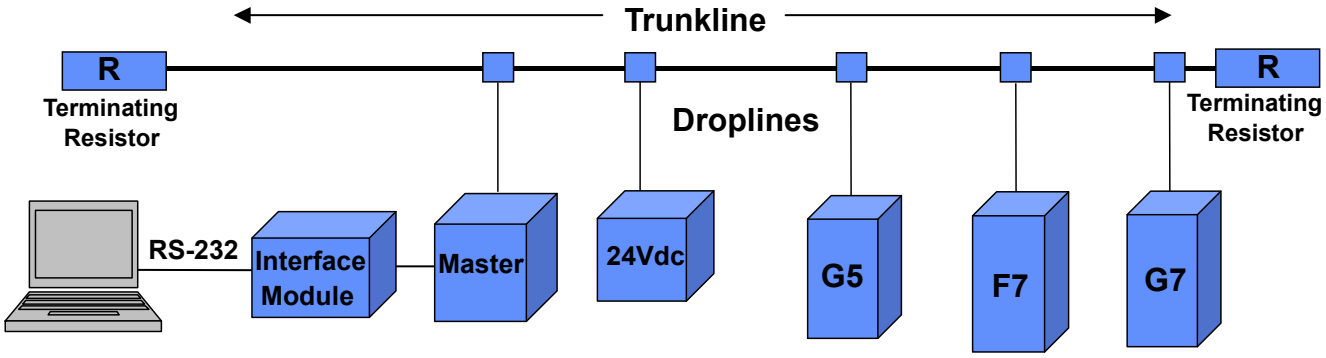

Fig. 1 Sample DeviceNet Network

DeviceNet is a simple, networking solution that reduces the cost and time to wire and install factory automation devices, while providing interchangeability of “like” components from multiple vendors.

DeviceNet is an “open device network standard”. The specifications and protocol are open - vendors are not required to purchase hardware, software, or licensing rights to connect devices to a system. Vendors who choose to participate may obtain the set of specifications from the Open DeviceNet Vendor Association (ODVA).

DeviceNet provides:

- A cost effective solution to low-level device networking
- Access to intelligence present in the devices
- Master/Slave capabilities

DeviceNet has two primary purposes:

- Transport of control-oriented information associated with the control/monitoring of devices
- Transport of configuration parameters which are indirectly related to system control

The list below presents a summary of the Physical/Media specific characteristics of DeviceNet:

- Trunkline-dropline configuration
- Support for up to 64 nodes
- Node removal without severing the network
- Simultaneous support for both network-powered and self-powered devices
- Use of sealed or open-type connectors
- Protection from wiring errors
- Selectable data rates of 125kBaud, 250kBaud, and 500kBaud
- Adjustable power configuration to meet individual application needs
- High current capability (up to 16 Amps per supply)
- Operation with off-the-shelf power supplies
- Power taps that allow the connection of several power supplies from multiple vendors that comply with DeviceNet standards

The list below summarizes additional communication features provided by DeviceNet:

- Use of Controller Area Network (CAN) technology
- Connection-based model to facilitate application to application communications
- Provisions for the typical request/response oriented network communications
- Provisions for the efficient movement of I/O data
- Fragmentation for moving larger quantities of data
- Duplicate MAC ID detection

The communication platform for the DeviceNet Network is based on the CAN (Controller Area Network) technology, which was first developed by Bosch for the automotive industry. Some of the benefits of this protocol are high noise immunity and high temperature operation. Because it uses a serial bus, it reduces signal wiring complexity and cost while providing high-speed digital control for optimum performance. These benefits make DeviceNet especially suitable for the industrial automation environment.

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Chapter 1
Installation

This chapter describes how to install and setup the DeviceNet Option

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DeviceNet™ Simplified Start-up Procedure

The following is a quick reference guide to install and configure the drive's option. For more details, please refer to the drive's DeviceNet Technical Manual sections referenced.

1. Verify that the drive functions properly without the option installed. This includes running the drive from the operator keypad, without communications.
2. Turn off the drive power supply and wait for at least 1 minute for the charge lamp to be completely out before removing the operator and front cover. Remove the option hold-down tab on the left side of the drive case by carefully compressing the top and bottom until it becomes free of its holder. Lift it out.
3. Install the option onto the drive. Mount the DeviceNet unit onto the drive making sure to connect 2CN securely. Replace the option hold-down. Install the operator keypad and front cover back onto the unit after securing the DeviceNet unit with screw.
4. Connect the DeviceNet communication wires to the screw terminals on the option.

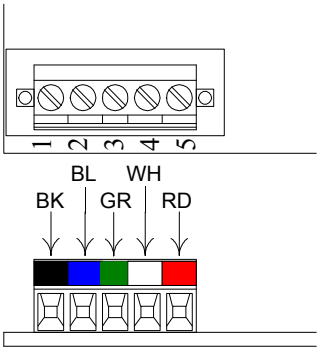

Table 2: DeviceNet Terminal Block Connections

Terminal No.	Terminal Color	Name	Wiring Color	Content
1	Black	V-	Black	Communication power supply GND
2	Blue	CAN_L	Blue	Communication data low side
3	Green	Shield	Bare	Shield wire
4	White	CAN_H	White	Communication data high side
5	Red	V+	Red	Communication power supply +24Vdc

5. Using the DIP switch bank on the DeviceNet option kit, set communication baud rate (switch 1, 2) and MAC ID (switch 3 – 8). Be sure to verify that no devices on the network have duplicate MAC IDs.

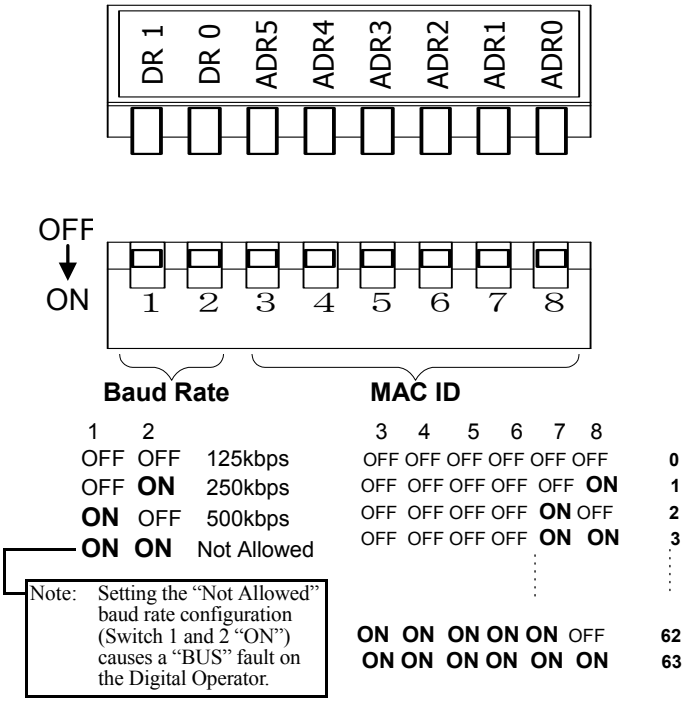

Fig. 2 DeviceNet DIP Switch Settings

6. Power up the drive and set the number of motor poles in parameter o1-03 to read and set the speed in motor RPMs.

7. Set the drive's run/stop and frequency reference to meet the application requirements as explained below.

Example 1. Control from DeviceNet network
When the drive is set to be controlled by the DeviceNet network, the frequency and the start/stop commands are issued through the master device. Set the drive parameters b1-01 and b1-02 as shown in the table.

Table 3: Drive Parameter Settings for DeviceNet Control

Parameter	Display Text	Value	Description
b1-01	Reference Source Option	3	Sets the frequency reference to come from the option.
b1-02	Run Source Option	3	Sets the sequence to come from the option.

Example 2. Monitor only
The drive can be connected to the DeviceNet network without being controlled.The motor speed and the status of the drive can be monitored via DeviceNet while controlling the drive from another source specified by parameters b1-01 and b1-02.
Please refer to the drive Technical Manual for the proper settings of parameters b1-01 and b1-02.

8. Download the proper EDS file for the corresponding drive model number from CD ROM - CD.AFD7.01 included with the drive or from www.yaskawa.com in the "Software Downloads" area. Refer to the table of EDS Files and Product Codes for a complete list of EDS files with the model number of the drive. Each model of drive has its own EDS file, so it is important to select the EDS file that matches the drive capacity. The EDS file is necessary to map the DeviceNet and drive parameters into the configuration tool where the user can access the parameters through DeviceNet. Install the EDS file in the configuration tool software, such as RSNetWorx™ for DeviceNet™ from Rockwell Software (Appendix B DeviceNet Configuration for RSNetWorx).

Note: The EDS files will be in zip format, so you must unzip the file before installing it in the configuration tool.

Unpack and Inspect

Prior to unpacking, check the package label and verify that the product received matches the product ordered. Unpack the option and verify that the following items are included in the product package and are undamaged.

Part Names

Option components are as follows:

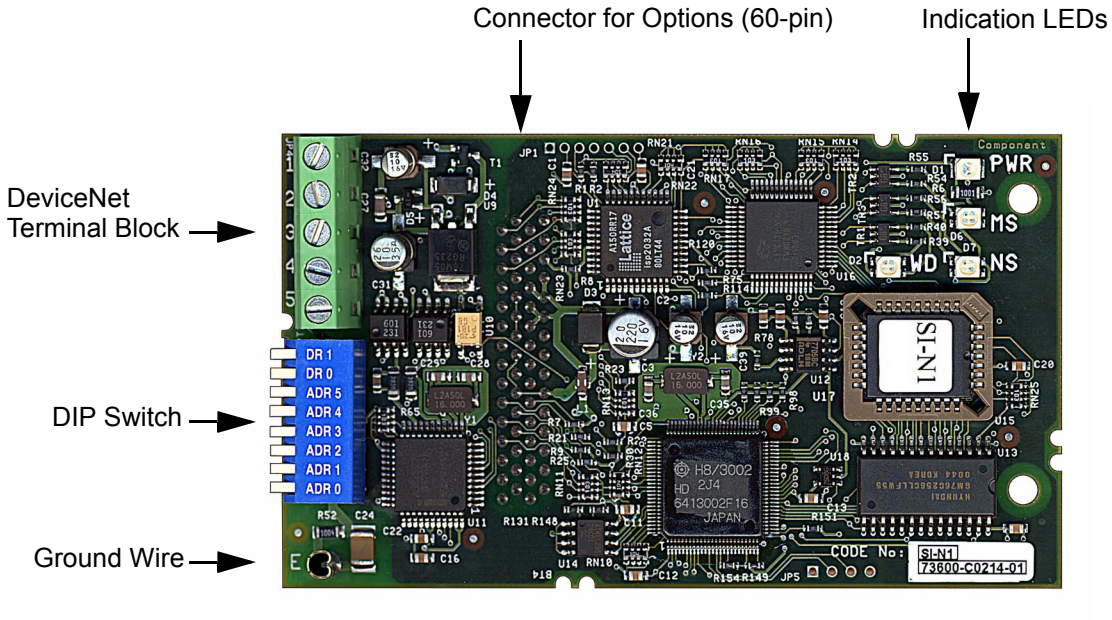

Fig. 3 CM059 (SI-N1) Option

Table 4: Option Kit Parts List

Part	Qty.
DeviceNet Option CM059 (SI-N1)	1
Installation Guide IG.AFD.13. DeviceNet CM059 (SI-N1)	1

Installation and Wiring

The following describes the installation and configuration of the *option*. For detailed information about the drive or the DeviceNet option, please refer to the appropriate sections of this manual or the appropriate drive Technical Manual**.**

Verify Drive Operation

- Connect power to the drive and verify that the drive functions properly. This includes running the drive from the operator keypad. Refer to the appropriate drive Technical Manual for information on connecting and operating the drive.
- Remove power from the drive and wait for the charge lamp to be completely extinguished. Wait at least five additional minutes for the drive to be completely discharged. Measure the DC BUS voltage and verify that it is at a safe level.
- Remove the operator keypad and drive cover(s).
- Remove the option hold-down on the left side of the drive case by carefully compressing the top and bottom until it becomes free of its holder. Lift it out.

Installation of the *Option*

Install the option on the drive control PCB after having removed the front cover of the drive body. Install the option in accordance with the following procedure:

- Align the JP2 connector on the back of the *option* with its mating 2CN connector on the drive control card.
- Align the two standoffs on the front of the drive control board with the two holes on the right side of the *option.*
- Press the *option* firmly onto the drive 2CN connector and standoffs until the JP2 connector is fully seated on 2CN and the drive standoffs have locked into their appropriate holes.
- Replace the option hold down.
- Connect the ground wire from the ground terminal E on the option to a ground terminal on the terminal assembly.
- After installing the option, make the terminal connections per the instructions on the next page and set the DIP switch to the correct settings. Thereafter, re-install the front cover and the operator in their original positions.

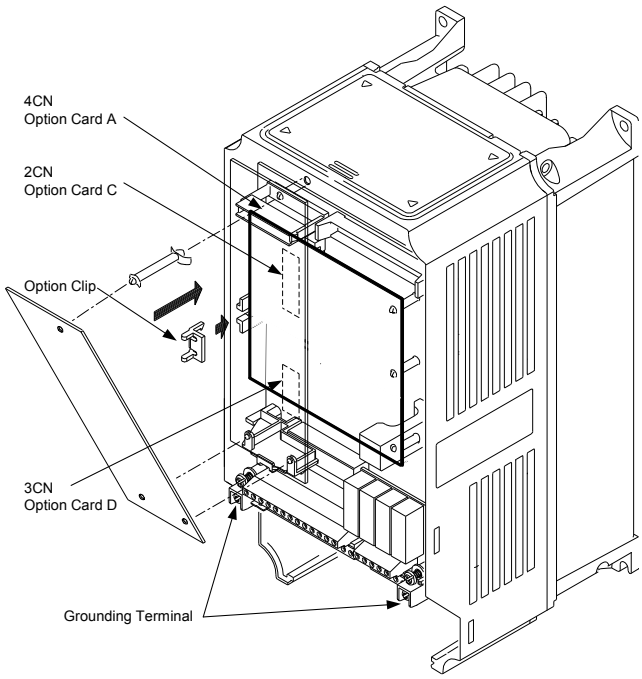

Fig. 4 Option Locations

Connect The Drive To The DeviceNet Network

Wire the DeviceNet communication cable to the terminal block according to the following procedures:

- Loosen terminal screws using a slotted screwdriver.
- Strip about 5.5mm of insulation from the end of each DeviceNet wire and insert it into the corresponding terminal according to the table and diagram below.
- Secure wires by tightening terminal screws (Tightening torque: 0.22 ～ 0.25 [N・m]).
- Tie the DeviceNet cable to a point near the terminal block to provide strain relief for the terminal block and cable connection.

Note: The shield is daisy chained between devices and should be grounded at the 24 Vdc power supply as specified by the Open DeviceNet Vendor Association (ODVA).

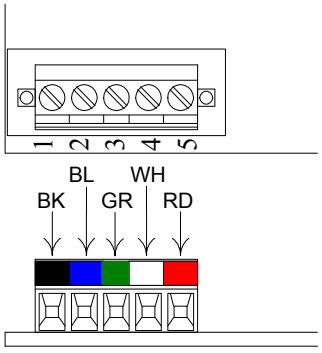

Table 5: DeviceNet Terminal Block Connections

Terminal No.	Terminal Color	Name	Wiring Color	Content
1	Black	V-	Black	Communication power supply GND
2	Blue	CAN_L	Blue	Communication data low side
3	Green	Shield	Bare	Shield wire
4	White	CAN_H	White	Communication data high side
5	Red	V+	Red	Communication power supply +24Vdc

Set Baud Rate and Node Address

The option is equipped with one 8-bit DIP switch for baud rate and node address set-up. The DIP switches are located next to the DeviceNet connector on the short side of the option. Set the network node address (MAC ID) by setting the DIP switches. All devices on the network must have unique node addresses. Check the network layout to verify that the node address selected is unique, falls between 3 and 62, and matches the master device configuration for that device. Node addresses 0 and 1 are typically reserved for master devices, while node address 2 is reserved for diagnostic/monitoring equipment, and address 63 for vendor-specific functions in some systems.

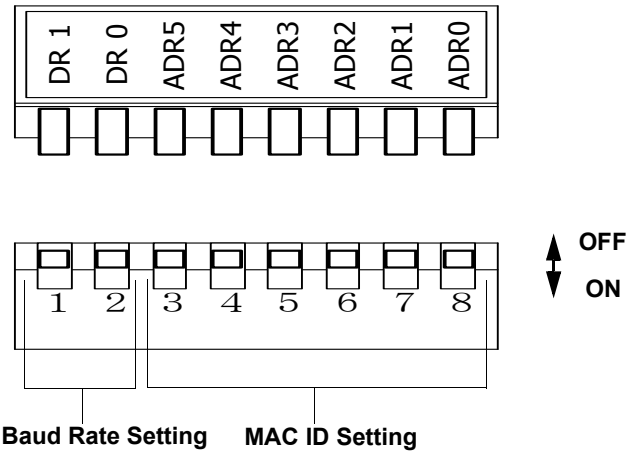

Fig. 5 DIP Switch Settings for Baud Rate and Node Address

Baud Rate Setting Switch

Table 6: Baud Rate DIP Switch Setting

Switch	500 kbps	250 kbps	125 kbps	Setting Prohibited
DR1	ON	OFF	OFF	ON
DR0	OFF	ON	OFF	ON
Note: If DR1 and DR0 are ON and set to Setting Prohibited, both MS and NS LEDs light up solid red.				

MAC ID Setting Switch

Table 7: MAC ID Switch Setting

DIP Switch	MAC ID											
	0	1	2	3	4	5	6	7	8	• • •	62	63
ADR5	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	• • •	ON	ON
ADR4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	• • •	ON	ON
ADR3	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	• • •	ON	ON
ADR2	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	• • •	ON	ON
ADR1	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	• • •	ON	ON
ADR0	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	• • •	OFF	ON

Termination Resistors

Terminating resistors must be mounted on the first and last node in a DeviceNet network, at both of the furthest ends of the cable. The value of the Terminating resistor is specified by the ODVA (Open DeviceNet Vendors Association) and is a value of 121 Ohms, 1% tolerance, and ¼ watt. Terminating resistors can be found in the ODVA product catalog.

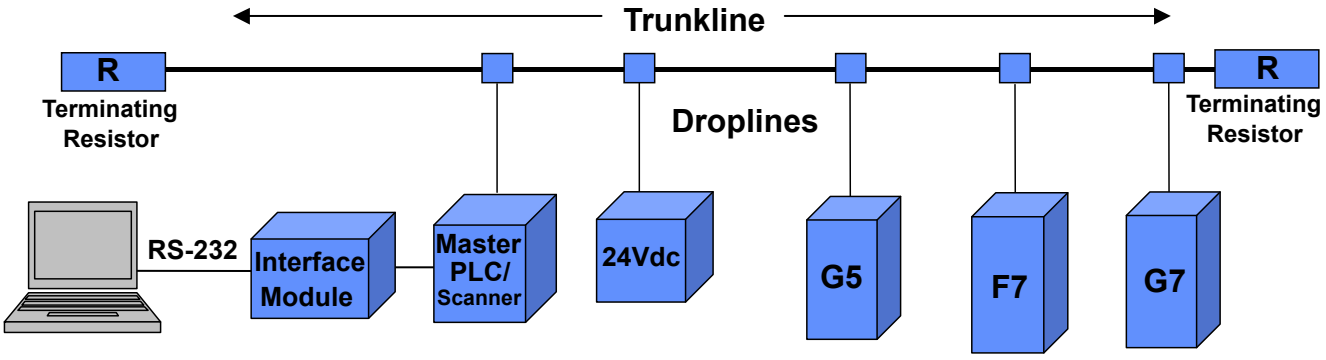

Fig. 6 Terminating Resistor Placement on DeviceNet Network

Option Indication LEDs

The option is equipped with four indication LEDs for module and DeviceNet status indication. The LEDs are located on the option according to the figure below.

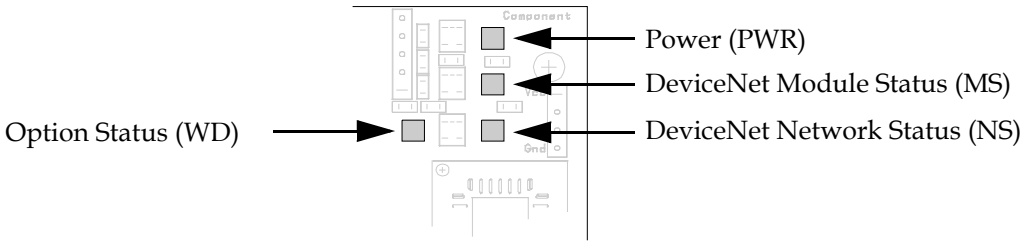

Fig. 7 DeviceNet Status Indication LEDs

Verify Option Operation

- Apply power to the drive.
- Verify that the diagnostic LEDs on the front of the *option* are in their correct state.

Table 8: Diagnostic LED States

LED Display				Content	State
PWR	MS	NS	WD		
Solid Green	Solid Green	Solid Green	Flashing Green	Normal	Normal Communication

- Remove power from the drive and wait for the charge lamp to be completely extinguished. Wait at least five additional minutes for the drive to be completely discharged. Measure the DC BUS voltage and verify that it is at a safe level.
- Install the operator keypad and all drive covers.

Initial Settings

Since the option utilizes the AC drive for many of its calculations; such as speed, please check the following parameters to verify the correct setting.

Table 9: Parameter o1-03 – Digital Operator Display Mode

Setting No.	Name	Description
o1-03	Frequency reference set/display unit selection	Make sure to set number of motor poles (2 ~ 39) to input and output motor speed in RPMs on DeviceNet control and operator display. DeviceNet indicates the motor speed unit as RPM. o1-03 setting value is used since the option converts frequency to RPM. Initial value is 0 for frequency reference in Hz.

Run/Stop and Frequency Selection

The run/stop commands and frequency reference command can originate from serial communication, the Digital Operator, the external terminals, or the option. The origin of the run/stop command does not have to be the same as the origin for the frequency reference command. Parameter b1-01 (Reference Selection) allows you to set up the origin of the frequency reference and parameter b1-02 (Operation Method Selection) sets up the origin of the run/stop commands. When the DeviceNet network is connected to the drive, the motor speed and the status of the drive can be monitored via DeviceNet while controlling the drive from another source specified by parameters b1-01 and b1-02. The table shown below illustrates the possible frequency reference and run/stop selections.

Table 10: Possible Frequency Reference and Run/Stop Selections

Parameter b1-01 Setting	Frequency Reference Selection
0	Digital Operator
1	Terminals
2	Serial Communication (Modbus)
3	Option (DeviceNet)
4	Pulse Input
Note: The default setting of parameter b1-01 is ‘1’. For DeviceNet Operation, use Setting ‘3’ – Option.	

Parameter b1-02 Setting	Operation Method Selection (Run/Stop)
0	Digital Operator
1	Terminals
2	Serial Communication (Modbus)
3	Option (DeviceNet)
Note: The default setting of parameter b1-02 is ‘1’. For DeviceNet Operation, use Setting ‘3’ – Option.	

Option Indication LEDs

The table below describes the function of DeviceNet specific LEDs.

Table 11: DeviceNet LED Function

LED Name	Display		Operation Status	Description
	Color	Status		
MS	Green	Lit	During option operation	The option is operating normally.
	Green	Flashing	During option preparation	Initial setting status or communication is not ready.
	Red	Lit	Recovery from fault impossible	Impossible recovery fault occurred in the option.
	Red	Flashing	Recovery from fault possible	Possible recovery fault such as switch settings occurred.
	—	Not lit	Power OFF	Power is not being supplied to the drive. the option has not been properly connected. Therefore, the power is not being supplied to the option.
NS	Green	Lit	Online communication is taking place	DeviceNet is communicating normally.
	Green	Flashing	Online communication is not taking place.	DeviceNet network is normal, but is not communicating with the master.
	Red	Lit	Communication fault	A fault that makes it impossible for the DeviceNet to communicate has occurred. ■ MAC ID overlap ■ Bus-off detection
	Red	Flashing	Communication timeout	Communication time out with master occurred.
	—	Not lit	Offline, Power OFF	DeviceNet is not set to online. Power is not being supplied to the option. Mismatch of baud rate.
PWR	Green	Lit	Power ON	Power to the option is supplied from the drive.
	—	Not lit	Power OFF	Power is not being supplied to the drive. The option has not been properly connected. Therefore, the power is not supplied to the option.
WD	Green	Flashing	During CPU operation	CPU of the option is operating normally.
	Red	Lit	CPU fault	Option CPU is being ready or has fault.
	—	Not lit	Power OFF	Power is not being supplied to the drive. The option has not been properly connected. Therefore, power is not being supplied to the option.

Notes:
1) If the baud rate configuration is set for “Not Allowed”, both the NS and MS diagnostic LEDs will be solid RED.
2) The LEDs will flash red once (100 ms) during initialization (Internal testing process to verify that the red LED is working properly).

Chapter 2
Network Configuration

This chapter describes how to properly adjust the parameter settings of a DeviceNet slave in a network system.

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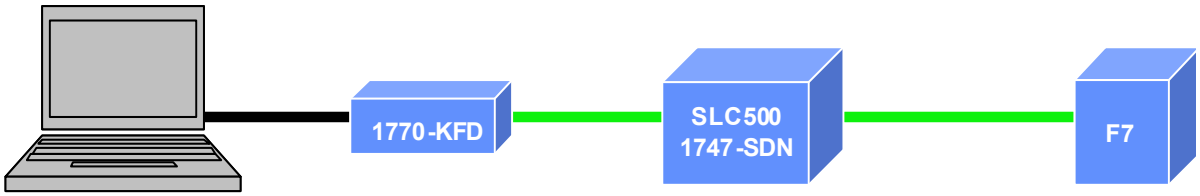
DeviceNet Configuration

DeviceNet configuration refers to properly setting the DeviceNet slave in a network system through its parameter settings. The option allows accessibility to DeviceNet parameters and drive parameters through its EDS file. The configuration software uses the EDS file to map the DeviceNet and drive parameters. The user can read and set parameters and save the configuration. The configuration software that this document will address is RSNetWorx for DeviceNet™ from Rockwell Software.

Note: This section is only intended to be used as a guide for configuration of the option using configuration tool software RSNetWorx. Any updates to the configuration tool software will not be noted in this section. Please reference the configuration tool technical manual as the primary reference. Use the contents of this section only as a general guide.

EDS files can be downloaded from the internet at www.yaskawa.com or www.odva.org. For correct scaling of parameters, be sure to select the version of the EDS file that corresponds to the drive capacity and version number of the Option. Each Yaskawa drive capacity has its own EDS file, so it is important to select the EDS file that matches the drive capacity. Install the EDS files in a subdirectory of the PC where the configuration software is located.

Note: The EDS files will be compressed in zip format, so unzip the file before installing in the configuration too.



The following steps will outline how to configure the Yaskawa drive on DeviceNet using RSNetWorx.

1. Install the drive EDS file.
2. Set drive parameters and select the proper Polled Producing Assembly (PPA) and Polled Consuming Assembly (PCA) of the drive for the application.
3. Configure the scanner by adding the drive to the scanner module scanlist.
4. AutoMap the drive in the Input and Output of the scanner's M File Memory.

EDS Files in General

EDS files are typically used together with a DeviceNet Network Configuration tool.

DeviceNet Network Configuration tools are used to configure all nodes on a DeviceNet network. Network Configuration tools provide the ability to upload data from a device and download data to a device. The EDS files provide the Network Configuration tool with the following information:

- Description of each device parameter
- Maximum and Minimum values for each device parameter
- Default values for each device parameter
- Read/Write access for each device parameter
- Help Information for each device parameter
- Vendor ID of the device
- Device Type of the device
- Product Code of the device
- Revision of the device

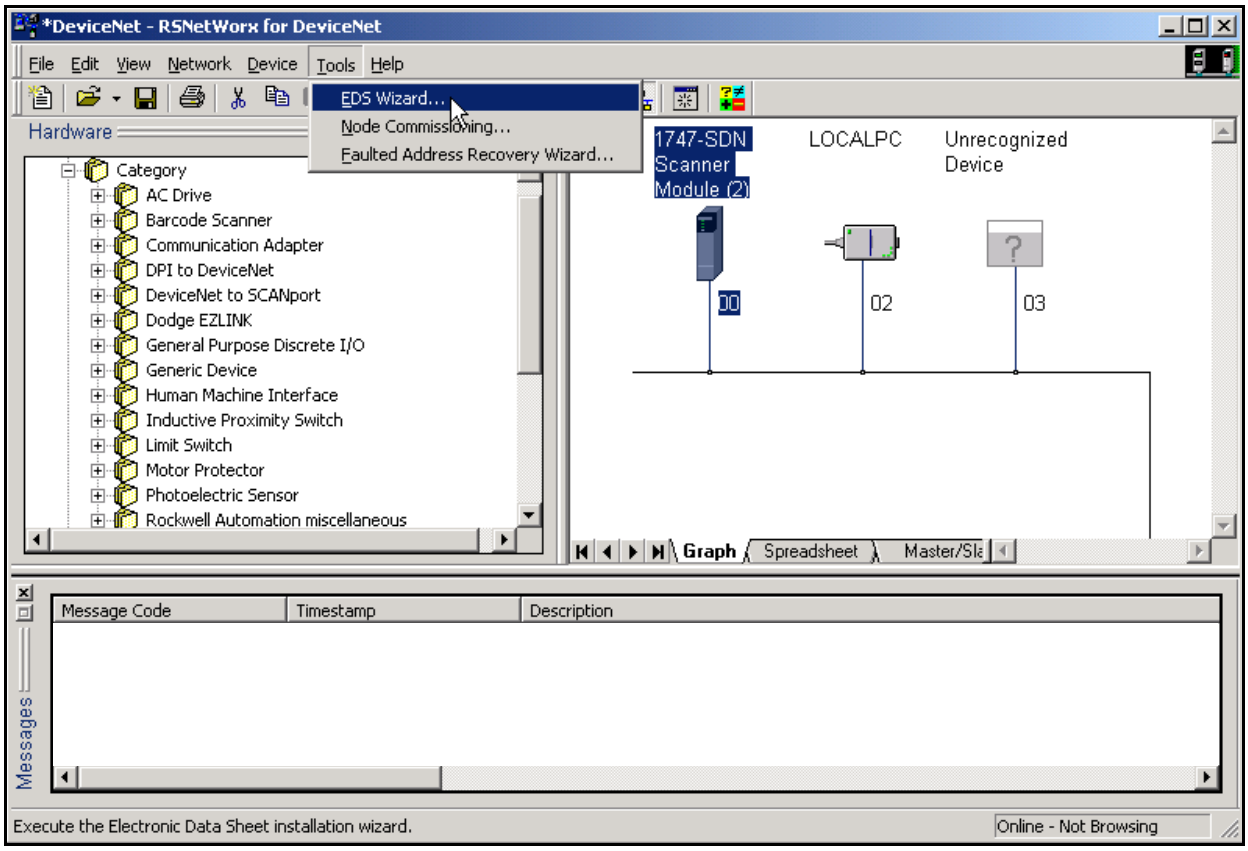
Each device on the network has the following values assigned to it:

- Vendor ID
- Device Type
- Product Code
- Revision
- Serial Number

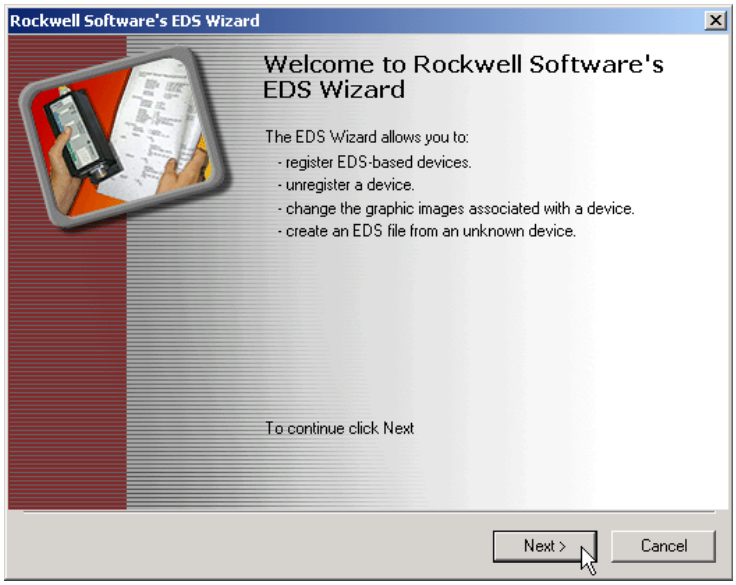
The Network Configuration tool will read these values from the device. When using EDS files, the tool will compare the values of Vendor ID, Device Type, Product Code, and Revision that were read from the device to the values in the EDS file. They **must** match.

Install EDS File

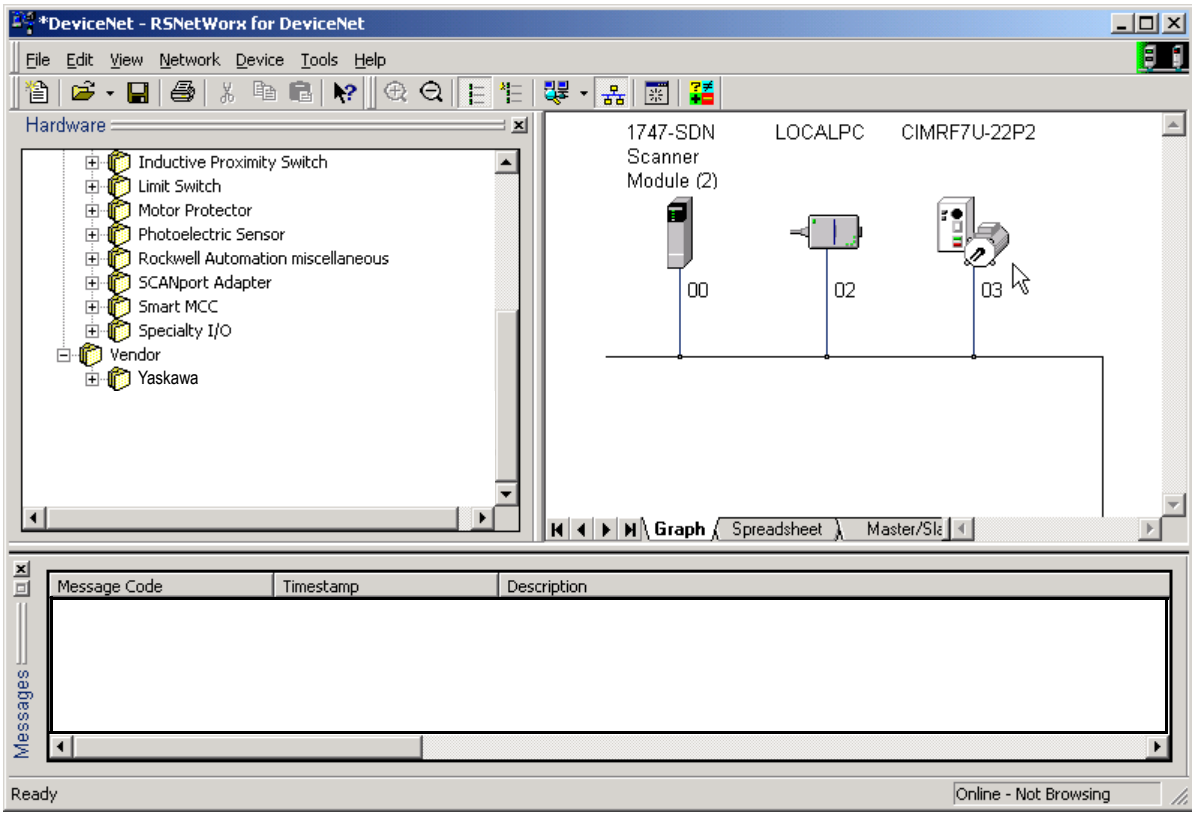
Install the drive's EDS file by selecting *EDS Wizard* and follow the appropriate steps.
In RSNetWorx, select EDS Wizard under Tools. Be sure that you have the drive EDS files downloaded and unzipped.



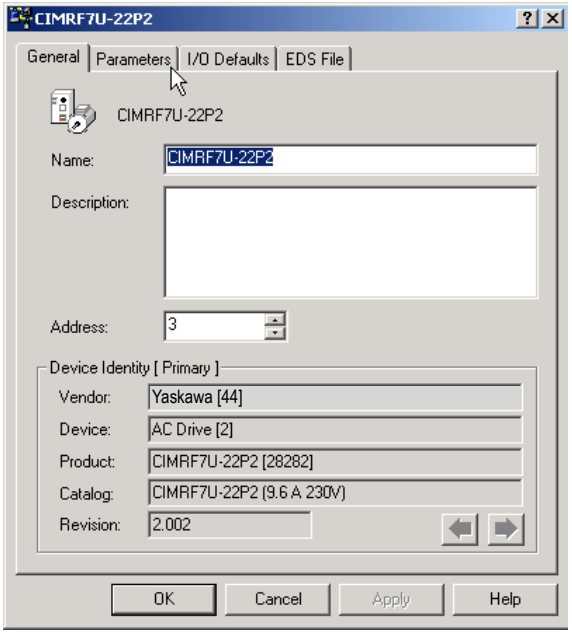
Follow the appropriate steps in the *EDS Wizard*.



Once the proper EDS file is installed, the drive icon will appear along with the drive model number.

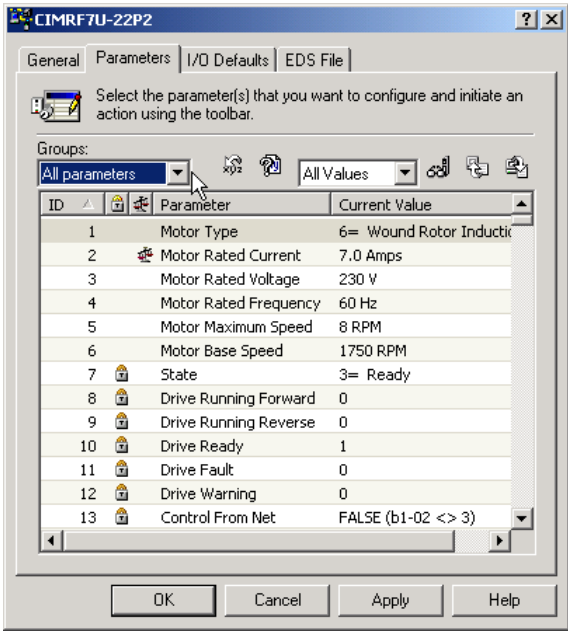


Double-click on the drive icon to access the drive's specifications and parameters.

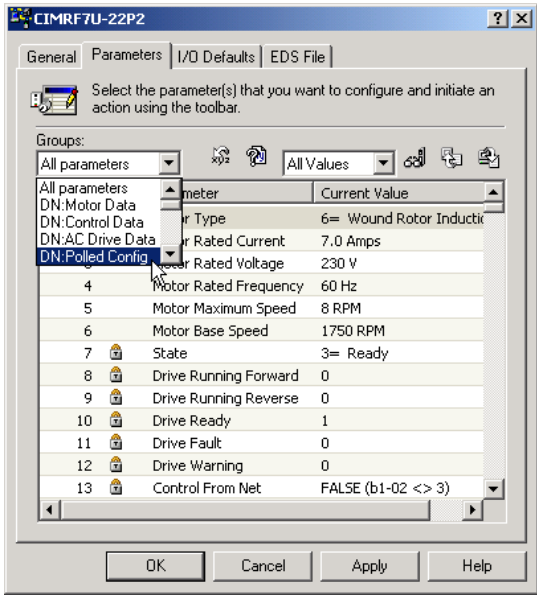


Set Application Parameters

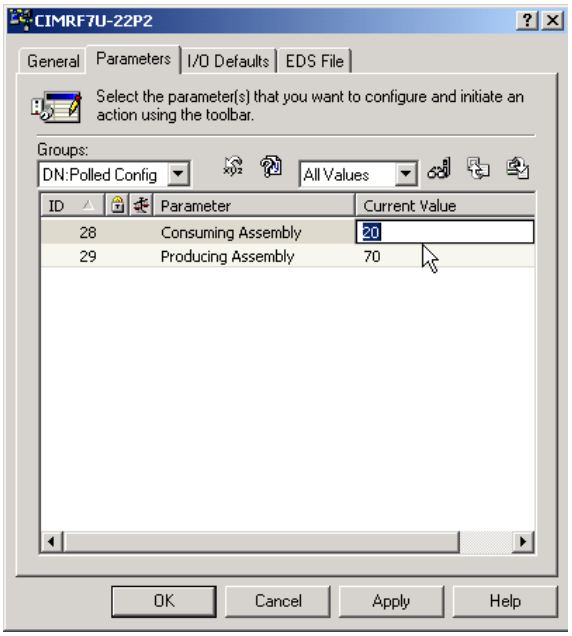
Select the *Parameters* tab to access DeviceNet and drive parameters and set the parameters according to the application.



The parameters are categorized into *Groups*, which allows you to filter the parameters that are displayed. *DN: Polled Config* group shows Polled Producing Assembly (PPA) and Polled Consuming Assembly (PCA).

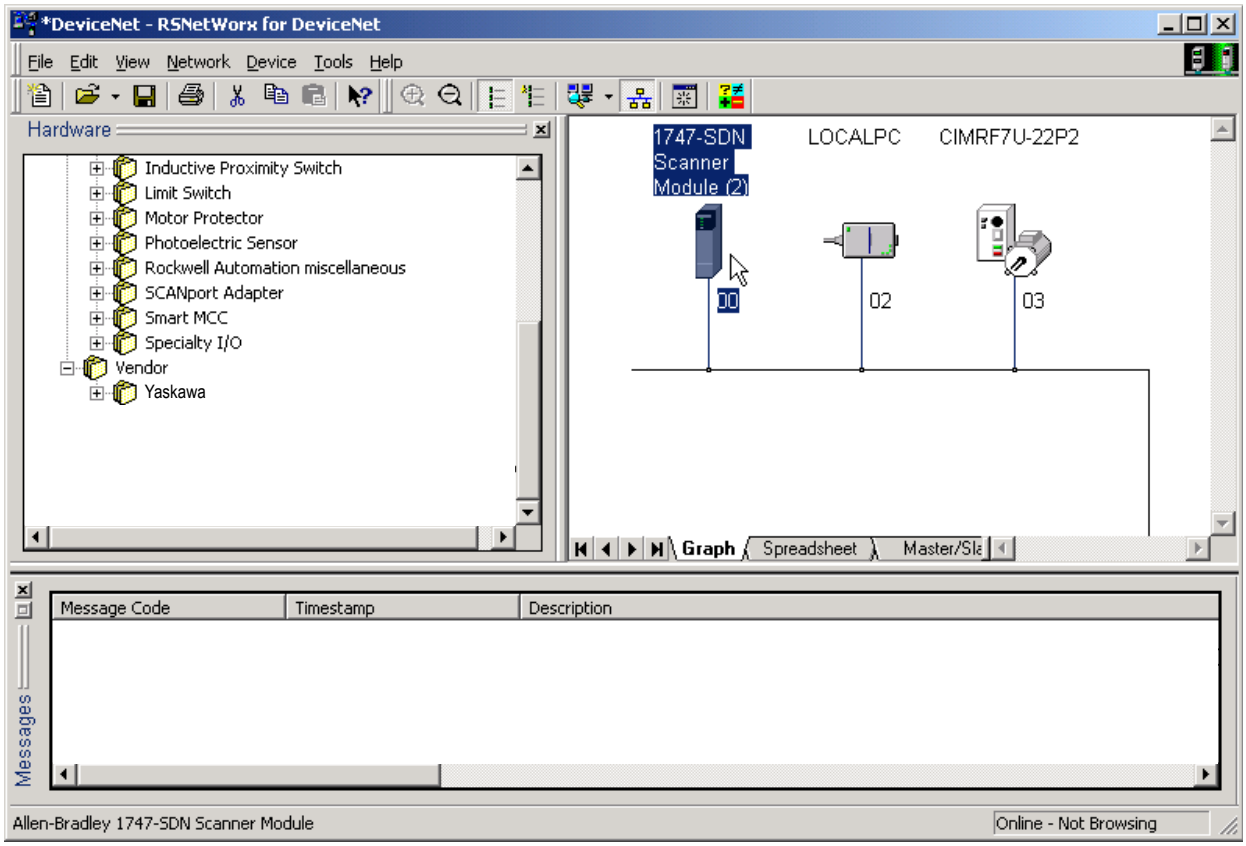


Enter appropriate PPA and PCA to use for polled communications. See Chapter 3 for a complete list of available PPA and PCA. Click *OK* or *Apply* to save any changes.



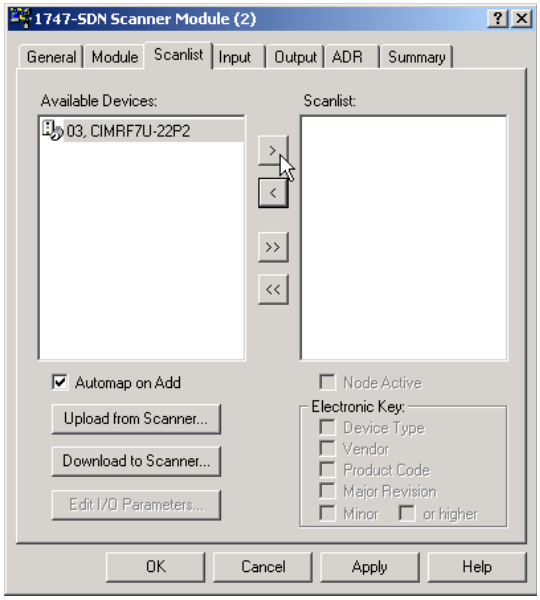
Configure the Scanner

Double-click on the Scanner Module icon to configure the Scanner.

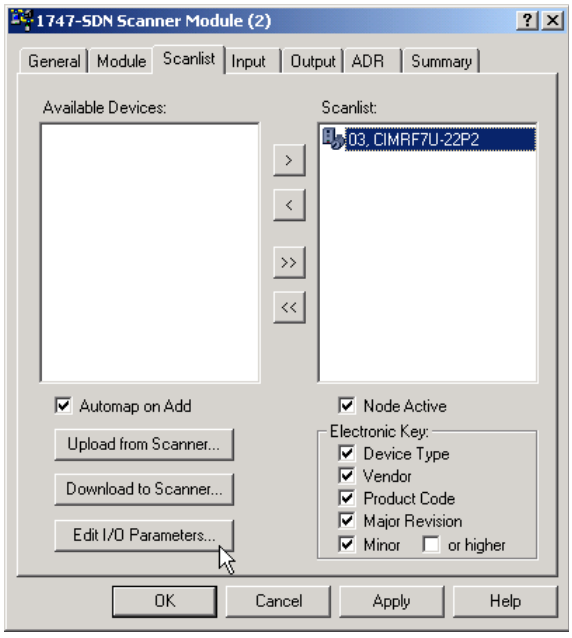


Add Drive to Scanlist and Specify Settings

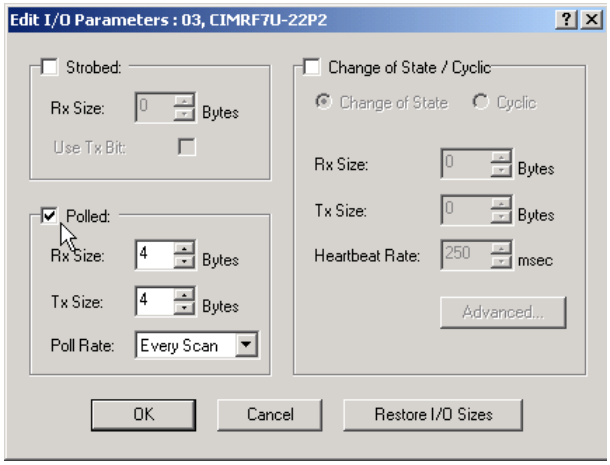
Select the *Scanlist* tab to show available devices for the scanlist.
Add the drive to the scanlist by highlighting the drive and click on the right arrow button (>).



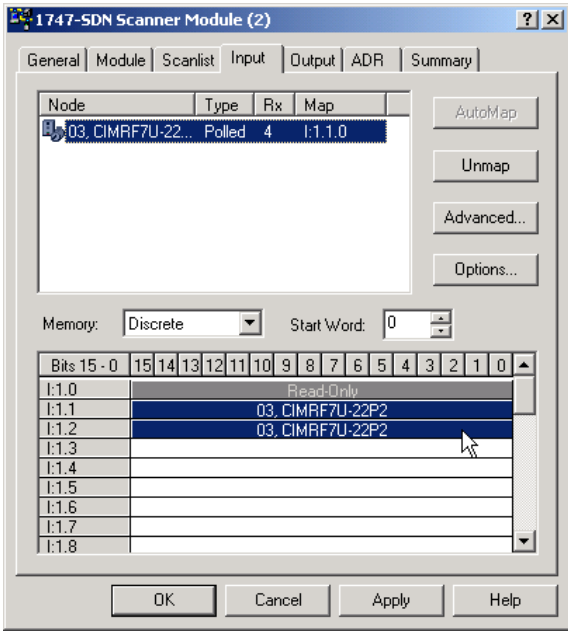
Click on Edit I/O Parameters to set the I/O data settings.



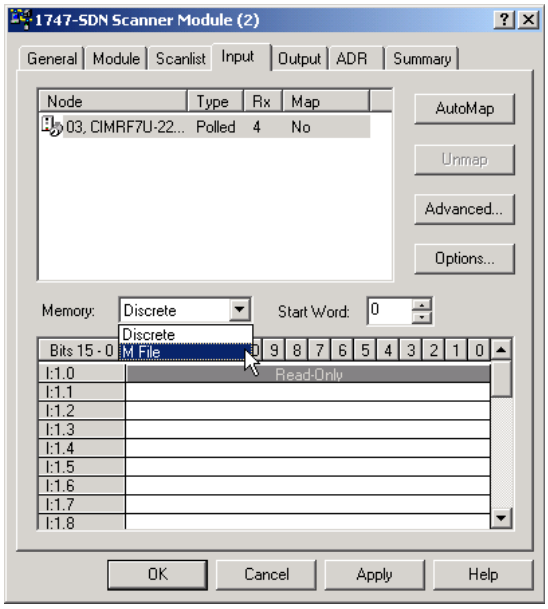
Select *Polled* communications and the correct amount of bytes for PCA (Rx) and PPA(Tx). Click *OK*.



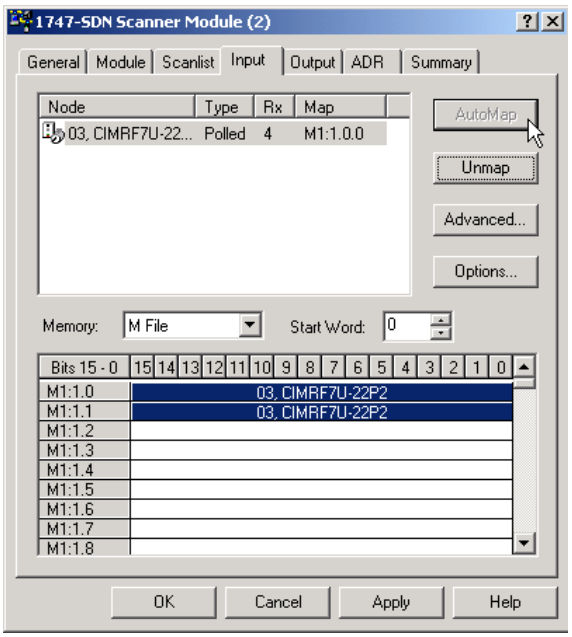
Select the *Input* tab and *Unmap* any data in the *Discrete Memory.*



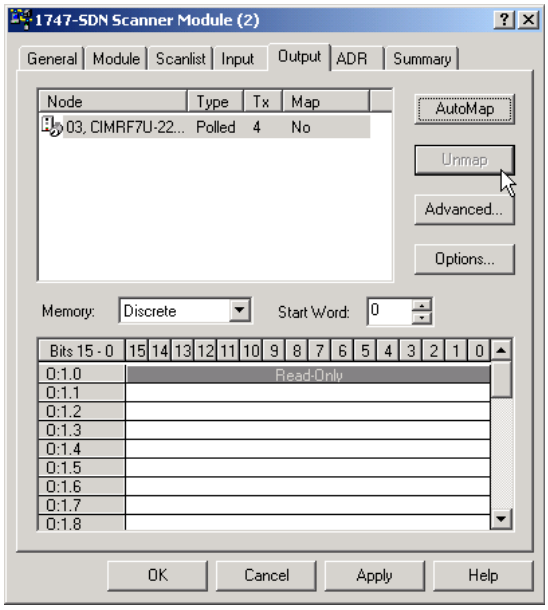
Select the *M File Memory.*



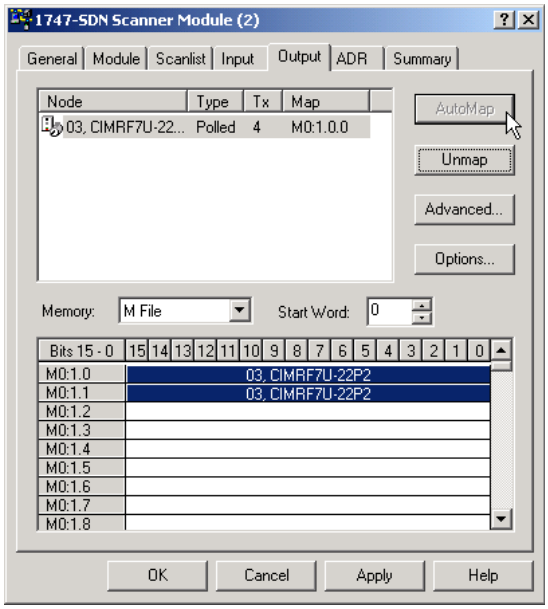
Click on the AutoMap button. The selected bytes of polled input data should appear in the scanlist. Click *OK*.



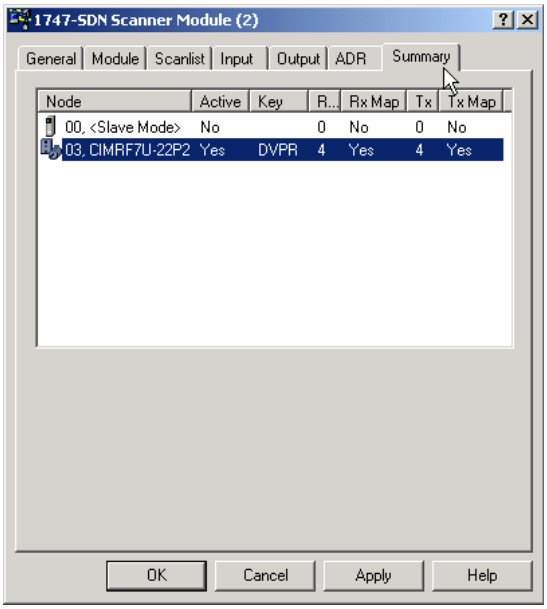
Select the *Output* tab and *Unmap* any data in the Discrete Memory.



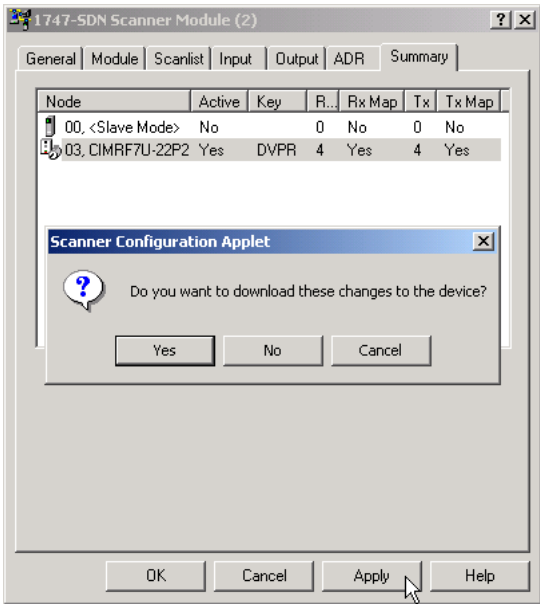
Select the *M File Memory.* Click on the *AutoMap* button. The selected bytes of polled output data should appear in the scanlist.



Select the *Summary* tab to make sure the correct number of I/O bytes are selected and are mapped.



Save the changes and download the configuration to the scanner by clicking *Apply*.



Data Storage of Option and Drive

The drive with option stores data in four locations:

- Active RAM memory on the drive
- Inactive RAM memory on the drive
- EEPROM memory on the drive
- EEPROM memory on the option

Data held in RAM memory, both Active and Inactive, is “Volatile”. Data held in Volatile memory will be lost when power is removed from the drive.

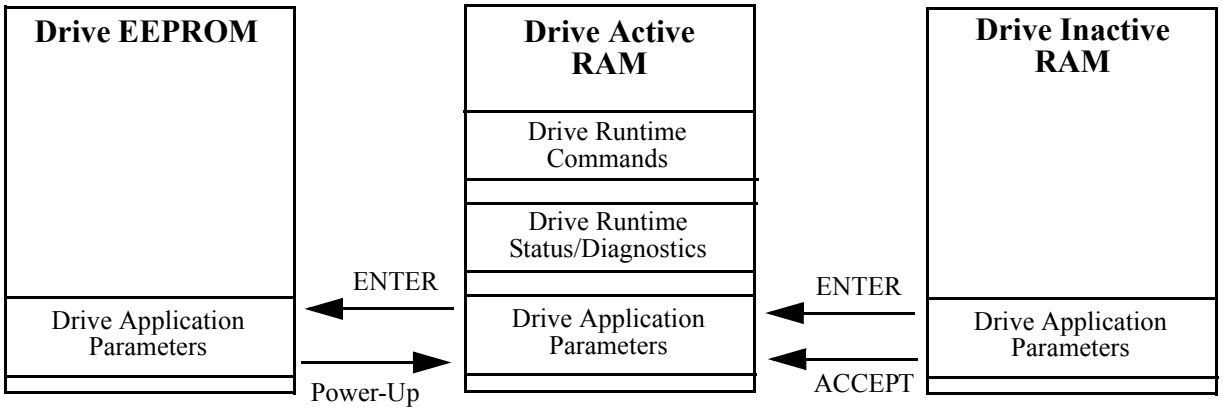
Data held in drive EEPROM and option EEPROM memory is “Non-Volatile”. Data held in Non-Volatile memory will be retained when power is removed from the drive.

The following table shows which memory location is used for the data available over the DeviceNet network.

DataType	MemoryType
Drive Runtime Commands Run/Stop Frequency Reference	Drive RAM
Drive Runtime Status and Diagnostics Run/Stop Status Frequency Output Current Output Fault Diagnostics	Drive RAM
Drive Application Parameters A1-00 through o3-02	Drive EEPROM & Drive RAM
DeviceNet Network Parameters Polled Consuming Assembly Polled Producing Assembly Motor Nameplate Data	Option EEPROM

The drive Application Parameters are held both in drive EEPROM and drive RAM. On power-up, the drive Application Parameters that are stored in drive EEPROM memory are transferred to drive RAM memory.

If drive Application Parameters are changed via DeviceNet, the new data will be placed into drive Inactive RAM memory. At this point, the new data will not be activated or retained if a drive power loss occurs. In order for the new data to be retained, the ‘ACCEPT’ command must be executed. When the ‘ACCEPT’ command is executed, the new data is transferred into Active RAM memory. In order for the new data to be retained, the ‘ENTER’ command must be executed. When the ‘ENTER’ command is executed, all of the drive Application Parameters in drive RAM memory are transferred into drive EEPROM memory.



Some Parameter Data registers may be written to while the drive is running. These parameters are called run operative parameters. For a list of these parameters refer to Appendix A of the drive User Manual.

All other Parameter Data registers may only be written to when the drive is stopped. These are called non-run operative parameters.

If new data is written to any parameter serially, and is not followed by an 'ENTER' command, a Busy Write Protected" message will flash on the Digital Operator display if an attempt is then made to change a parameter using the Digital Operator.

Save Data to EEPROM with the ENTER Command

The ENTER Command can be accomplished in the following way:

- **Perform a SET service on Yaskawa Class 64 Hex, Instance 09 Hex, Attribute 00 Hex**
  The value '0' should be SET to the ENTER Command attribute.

CAUTION

Use the ENTER Command only when necessary!
The life of the EEPROM on the drive will support a finite number of operations.
This means that the ENTER command can only be used a maximum of 100,000 times to store data in the EEPROM. After the specified number of operations, the EEPROM may fault (CPF04) requiring the drive control board to be replaced.

CAUTION

The DeviceNet Network parameters do not require the use of the ENTER Command.
They are automatically stored in EEPROM memory. The life of the EEPROM on the option will support a finite number of operations. This means that the DeviceNet Network parameters can only be changed a maximum of 100,000 times. After the specified number of operations, the EEPROM may fault,
requiring the option to be replaced.

Notes:

Chapter 3
Network Communications

This chapter describes how to install and setup the DeviceNet Option

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DeviceNet Polled I/O Messaging Communications

DeviceNet Communications between a Master (PLC or PC) and the drive (Slave) uses Polled I/O messaging, based from the following I/O Assemblies, to transfer control and diagnostic information to and from the drive. The “Input Data Assemblies” or “Polled Consuming Assemblies (PCA)” refer to a message sent from the Master to the drive. The “Output Data Assemblies” or “Polled Producing Assemblies (PPA)” refer to the response from the drive back to the Master. The factory default of the drive DeviceNet is Extended Speed Control Input Instance 21 and Extended Speed Control Output Instance 71.

The configuration software uses the EDS file to change the PCA and PPA. By accessing the EDS file through configuration software, the PCA and PPA can be accessed under the DeviceNet Parameter Groups “Polled Consuming Assembly” and “Polled Producing Assembly”. Set the appropriate value using the table below and save the changes to the device.

Be sure to power down the drive, then power up to store the changes made to the PCA and PPA.

Table 12: Supported Service

Service Code (Hex)	Service Name	Description of Service
0E	Get_Attribute_Single	Designated attribute content is read.
10	Set_Attribute_Single	Designated attribute content is changed.

Class	Instance	Attribute	Type	Data	Description
101 (65 Hex)	1	1	PPA (Output Data Assembly)	70 (46 Hex)	Basic Speed Control Output Instance 70
				71 (47 Hex)	Extended Speed Control Output Instance 71 ***default***
				150 (96 Hex)	Drive Modbus I/O Control Output Instance 150
				151 (97 Hex)	Drive Standard Drive Control Output Instance 151
		2	PCA (Input Data Assembly)	20 (14 Hex)	Basic Speed Control Input Instance 20
				21 (15 Hex)	Extended Speed Control Input Instance 21 ***default***
				100 (64 Hex)	Drive Modbus I/O Control Input Instance 100
				101 (65 Hex)	Drive Standard Drive Control Input Instance 101

The tables in the following pages indicate the format and structure of the I/O Assemblies.

Note: 1. Regardless if I/O Data Exchange is enabled or disabled, communications will occur at the determined intervals set by the Master.

2. Input Data Assemblies = Polled Consuming Assemblies
   Output Data Assemblies = Polled Producing Assemblies

Basic Speed Control Input Instance 20 (14 Hex)

This function is the basic I/O instance of Assembly Object Class (04 Hex) Attribute (03 Hex), which defines DeviceNet AC Drive Profile. Both input/output use 4 bytes each.

Table 13: Drive Basic Speed Control Instance 20 (14 Hex) (INPUT ASSEMBLY)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	—	—	—	—	—	*Fault Reset*	—	*Fwd Run*
1	—	—	—	—	—	—	—	—
2	*Speed Reference (Lower Byte)*							
3	*Speed Reference (Upper Byte)*							

Data	Name	Description
Byte 0, Bit 0	*Run Fwd*	The drive runs forward 0: Stop 1: FWD run
Byte 0, Bit 2	*Fault Reset*	The drive from fault detection status is reset. 0: Fault reset off 1: Fault reset
Byte 2, 3	*Speed Reference*	The drive speed reference is set. Speed command data: Frequency reference [RPM]×$1/2^{SS}$ where ^{SS}: Speed Scale*1 Setting range: 0xFFFF Hex*2 Example: When setting 1800r/min reference, (Speed scale = 0) Speed reference data: 1800 X $1/2^{0}$ = 0708 Hex Lower Byte (byte 2) = 08 Hex, Upper Byte (byte 3) = 07 Hex

Notes: *1 Speed scale can be set by explicit messaging communication AC/DC Drive Object (Class 2A Hex) attribute 16.
*2 Setting of a speed exceeding the drive maximum output frequency (E1-04) will be limited by the maximum output frequency (E1-04).
*3 When applying a speed reference make sure to set No. of poles (2 ~ 39) to the drive parameter o1-03 (frequency reference set/display unit selection).

Basic Speed Control Output Instance 70 (46 Hex)

This function is the basic I/O instance of Assembly Object Class (04 Hex) Attribute (03 Hex), which defines DeviceNet AC Drive Profile. Both input/output use 4 bytes each.

Table 14: Drive Basic Speed Control Instance 70 (46 Hex) (OUTPUT ASSEMBLY)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	—	—	—	—	—	*During FWD Run (Fwd)*	—	*Fault*
1	—	—	—	—	—	—	—	—
2	*Speed Monitor (Lower Byte)*							
3	*Speed Monitor (Upper Byte)*							

Data	Name	Description
Byte 0, Bit 0	Fault	The drive fault detection status is displayed. 0: Normal 1: During fault detection
Byte 0, Bit 2	During FWD	The drive run status is displayed. 0: During Stop/REV. 1: During FWD/DC braking
Byte 2, 3	*Speed Monitor*	The drive speed is displayed. Speed monitor data: Frequency monitor [r/min]×$1/2^{SS}$ where ^{SS}: Speed Scale*1 Example: If speed monitor data is 1000RPM (03E8 Hex), speed scale = 0 Lower Byte (byte 2) = E8 Hex, Upper Byte (byte 3) = 03 Hex Frequency monitor: 03E8 Hex X $1/2^0$ X = 1000r/min.

Note: *1 Speed scale can be set by explicit messages communication AC/DC Drive Object (Class 2A Hex) attribute 16.
*2 When applying a speed reference make sure to set No. of poles (2 ~ 39) to the drive parameter o1-03 (frequency reference set/display unit selection).

Extended Speed Control Input Instance 21 (15 Hex)

This function is the basic I/O instance of Assembly Object Class (04 Hex) Attribute (03 Hex), which is defined by the DeviceNet AC Drive Profile. This is the Factory Default. Both I/O Assemblies use 4 bytes.

Table 15: Drive Extended Speed Control Instance21 (15 Hex) (INPUT ASSEMBLY)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	—	*NetRef*	*NetCtrl*	—	—	*Fault Reset*	*Rev Run*	*Fwd Run*
1	—	—	—	—	—	—	—	—
2	*Speed Reference (Lower Byte)*							
3	*Speed Reference (Upper Byte)*							

Data	Name	Description
Byte 0, Bit 0	*Fwd Run*	The drive runs forward. 0: Stop 1: Fwd run
Byte 0, Bit 1	*Rev Run*	The drive runs reverse. 0: Stop 1: Rev. run
Byte 0, Bit 2	*Fault Reset*	The drive resets at fault detection status. 0: Fault reset off 1: Fault reset
Byte 0, Bit 5	*NetCtrl*	Run command rights are set. 0: Run command input procedures are set by set run command selection (b1-02) 1: Run command (Byte 0 – Bit 0, 1) through DeviceNet enabled.
Byte 0, Bit 6	*NetRef*	Frequency reference rights are set. 0: Frequency reference input procedures set by frequency reference selection (b1-01) 1: Frequency reference (Byte 2, 3) through DeviceNet enabled.
Byte 2, 3	*Speed Reference*	The drive speed reference is set. This function is the same as the Speed Reference in the Basic Speed Control Input Instance 20 (14 Hex) section.

Extended Speed Control Output Instance 71 (47 Hex)

This function is the basic I/O instance of Assembly Object Class (04 Hex) Attribute (03 Hex), which is defined by the DeviceNet AC Drive Profile. This is the Factory default. Both I/O Assemblies use 4 bytes.

Table 16: Drive Extended Speed Control Instance 71 (47 Hex) (OUTPUT ASSEMBLY)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	*Speed Agree*	*Ref From Net*	*Ctrl From Net*	*Inverter Ready*	*During Reverse Run*	*During Forward Run*	*Alarm*	*Fault*
1	—	—	—	—	—	—	—	—
2	*Speed Monitor (Lower Byte)*							
3	*Speed Monitor (Upper Byte)*							

Data	Name	Description
Byte 0, Bit 0	*Fault*	The drive fault detection status is displayed: 0: Normal 1: During fault detection
Byte 0, Bit 1	*Alarm*	The drive alarm detection status is displayed: 0: Normal 1: During alarm detection
Byte 0, Bit 2	*During Fwd Run*	The drive run status is displayed: 0: During stop/reverse 1: During forward run/DC braking
Byte 0, Bit 3	*During Rev Run*	The drive run status is displayed: 0: During stop/forward run/DC brake 1: During reverse run
Byte 0, Bit 4	*Inverter Ready*	The drive ready status is displayed: 0: During fault detection/ready 1: Ready
Byte 0, Bit 5	*Ctrl From Net*	The drive run command input selection status is displayed. 0: Run command input is enabled other than the DeviceNet. 1: Run command input is enabled from the DeviceNet.
Byte 0, Bit 6	*Ref From Net*	The drive frequency input selection status is displayed. 0: Run command input is enabled other than the DeviceNet. 1: Run command input is enabled from the DeviceNet.
Byte 0, Bit 7	*Speed Agree*	The drive frequency agree detection status is displayed. 0: During stop/acceleration and deceleration 1: Frequency agree
Byte 2, 3	*Speed Monitor*	The drive speed is displayed. This function is the same as the Speed Monitor in the Basic Speed Control Output Instance 70 (46 Hex) section.

Drive Modbus I/O Control Input Instance 100 (64 Hex)

This I/O instance allows all drive parameters and monitors to be read/set. This instance is for Yaskawa drives only, and is not interchangeable with other DeviceNet drives, Assembly Object Class (04 Hex) Attribute (03 Hex). Both input/output use 5 bytes each. Refer to the Appendix A for a list of Modbus Registers.

Table 17: Drive Modbus I/O Control Instance 100 (64 Hex) (INPUT ASSEMBLY)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	*Function Code*							
1	*Register Number (Upper Byte)*							
2	*Register Number (Lower Byte)*							
3	*Register Data (Upper Byte)*							
4	*Register Data (Lower Byte)*							

Data	Name	Description
Byte 0	*Function Code*	Modbus (reference message) function code is set. 03 Hex: Read 10 Hex: Write 00 Hex: Undetermined
Byte 1, 2	*Register Number (Upper and Lower Byte)*	A drive Modbus register No. is set.
Byte 3, 4	*Register Data (Upper and Lower Byte)*	The write data at Modbus write command is set.

Drive Modbus I/O Control Output Instance 150 (96 Hex)

This I/O instance allows all drive parameters and monitors to be read/set. This instance is for Yaskawa drives only, and is not interchangeable with other DeviceNet drives, Assembly Object Class (04 Hex) Attribute (03 Hex). Both input/output use 5 bytes each. Refer to the Appendix A for a list of Modbus Registers.

Table 18: Drive Modbus I/O Control Instance 150 (96 Hex) (OUTPUT ASSEMBLY)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	*Function Code*							
1	*Register Number (Upper Byte)*							
2	*Register Number (Lower Byte)*							
3	*Register Data (Upper Byte)*							
4	*Register Data (Lower Byte)*							

Data	Name	Description
Byte 0	*Function Code*	The Modbus (response message) function code No. is displayed. 03 Hex: Read normal 10 Hex: Write normal 83 Hex: Read fault 90 Hex: Write fault
Byte 1, 2	*Register Number (Upper and Lower Byte)*	The processed Modbus register No. is displayed. For Read/write faults, Modbus error code is displayed.
Byte 3, 4	*Register Data (Upper and Lower Byte)*	The read data at Modbus read command is displayed.

The **ACCEPT/ENTER** parameter group contains only two parameters, the ACCEPT and ENTER parameters.

If the value of '0' is written to the ACCEPT parameter (0910 Hex), the drive will save the current values of the all drive parameters (A1-00 through o3-02) into RAM memory on the drive. Values saved in RAM memory will **not** be retained in case of power loss to the drive.
If the value of '0' is written to the ENTER parameter (0900 Hex), the drive will save the current values of all of the drive parameters (A1-00 through o3-02) into EEPROM memory on the drive. Values saved in EEPROM memory will be retained in case of power loss to the drive.

CAUTION

Use the ENTER Command only when necessary! The life of the EEPROM on the drive will support a finite number of operations. This means that the ENTER command can only be used a maximum of 100,000 times to store data in the EEPROM. After the specified number of operations, the EEPROM may fault (CPF04) requiring the drive control board to be replaced.

Standard Drive Control Input Instance 101 (65 Hex)

This I/O instance is for the input/output functions as well as the expansion I/O instance functions. This instance is for Yaskawa series drives only, and is not interchangeable with other DeviceNet drives, Assembly Object Class (04 Hex) Attribute (03 Hex). Both input and output use 8 bytes each.

Table 19: Standard Drive Control Instance 101 (65 Hex) (INPUT ASSEMBLY) *1

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	*Terminal S8*	*Terminal S7*	*Terminal S6*	*Terminal S5*	*Terminal S4*	*Terminal S3*	*Rev Run*	*Fwd Run*
1	*Terminal M5-M6*	*Terminal M3-M4*	*Terminal M1-M2*	—	—	—	*Fault Reset*	*External Fault*
2	*Speed Reference (Lower Byte)*							
3	*Speed Reference (Upper Byte)*							
4	Torque Reference/Torque Limit (Low Order Byte)							
5	Torque Reference/Torque Limit (High Order Byte)							
6	Torque Compensation (Low Order Byte)							
7	Torque Compensation (High Order Byte)							

Table 20: Standard Drive Control Instance 101 (65 Hex) (INPUT ASSEMBLY) *1

Data	Name	Description
Byte 0, Bit 0	*Forward Run*	The drive runs forward. 0: Stop 1: Forward run
Byte 0, Bit 1	*Reverse Run*	The drive runs reverse. 0: Stop 1: Reverse run
Byte 0, Bit 2	*Terminal S3*	Functions set in the drive multi-function input terminal S3 is input. The drive parameter H1-01 sets multi-function input terminal S3 functions. 0: Terminal S3 multi-function OFF 1: Terminal S3 multi-function ON
Byte 0, Bit 3	*Terminal S4*	Functions set in the drive multi-function input terminal S4 is input. The drive parameter H1-02 sets multi-function input terminal S4 functions. 0: Terminal S4 multi-function OFF 1: Terminal S4 multi-function ON
Byte 0, Bit 4	*Terminal S5*	Functions set in the drive multi-function input terminal S5 is input. The drive parameter H1-03 sets multi-function input terminal S5 functions. 0: Terminal S5 multi-function OFF 1: Terminal S5 multi-function ON
Byte 0, Bit 5	*Terminal S6*	Functions set in the drive multi-function input terminal S6 is input. The drive parameter H1-04 sets multi-function input terminal S6 functions. 0: Terminal S6 multi-function OFF 1: Terminal S6 multi-function ON
Byte 0, Bit 6	*Terminal S7*	Functions set in the drive multi-function input terminal S7 is input. The drive parameter H1-05 sets multi-function input terminal S7 functions. 0: Terminal S7 multi-function OFF 1: Terminal S7 multi-function ON
Byte 0, Bit 7	*Terminal S8*	Functions set in the drive multi-function input terminal S8 is input. The drive parameter H1-06 sets multi-function input terminal S8 functions. 0: Terminal S8 multi-function OFF 1: Terminal S8 multi-function ON

*1 Drive products may provide additional inputs and outputs that are not supported through DeviceNet. For example, G7 has 12 digital inputs; however; only 8 digital inputs are supported through DeviceNet.

Table 20: Standard Drive Control Instance 101 (65 Hex) (INPUT ASSEMBLY) *1 (Cont.)

Byte 1, Bit 0	*External Fault*	External fault (EF0) is input from option. 0: External Fault Off 1: External fault (EF0)
Byte 1, Bit 1	*Fault Reset*	The drive is reset at fault detection status. 0: Fault reset Off 1: Fault reset
Byte 1, Bit 5	*Terminal M1-M2*	The drive multi-function output terminal M1-M2 is operated. Only when "F" is set to the drive parameter H2-01 becomes enabled. 0: Terminal M1-M2 OFF 1: Terminal M1-M2 ON
Byte 1, Bit 6	*Terminal M3-M4*	The drive multi-function output terminal M3-M4 is operated. Only when "F" is set to the drive parameter H2-02 becomes enabled. 0: Terminal M3-M4 OFF 1: Terminal M3-M4 ON
Byte 1, Bit 7	*Terminal M5-M6*	The drive multi-function output terminal M5-M6 is operated. Only when "F" is set to the drive parameter H2-03 becomes enabled. 0: Terminal M5-M6 OFF 1: Terminal M5-M6 ON
Byte 2, 3	*Speed Reference*	Drive speed reference is set. This function is the same as the Speed Reference in Basic Speed Control Input Instance 20 (14 Hex) section.
Byte 4,5	*Torque Reference/ Torque Limit*	Sets the torque reference torque limit of the drive. The setting unit is fixed at 0.1%. Enabled only when the drive is set to the vector control mode with PG (A1-02=3). When the drive is in the torque control mode (d5-01=1), the torque reference is enabled. When in the speed control mode (d5-01=0), functions as the torque limit. When the drive parameter F6-06 is set to 0, it becomes disabled.
Byte 6,7	*Torque Compensation*	Sets the drive torque compensation. The setting unit is fixed at 0.1%. Enabled only when the drive is set into the torque control with Flux Vector Control mode (A1-02=3).

*1 Drive products may provide additional inputs and outputs that are not supported through DeviceNet. For example, G7 has 5 digital outputs; however, only 3 digital outputs are supported through DeviceNet.

Standard Drive Control Output Instance 151 (97 Hex)

This I/O instance is for the input/output functions as well as the expansion I/O instance functions. This instance is for Yaskawa series drives only, and is not interchangeable with other DeviceNet drives, Assembly Object Class (04 Hex) Attribute (03 Hex). Both input and output use 8 bytes each.

Table 21: Standard Drive Control Instance 151 (97 Hex) (OUTPUT ASSEMBLY) *1

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	*Fault*	*Alarm*	*Inverter Ready*	*Speed Agree*	*During reset*	*During reverse*	*During zero speed*	*During Run*
1	—	—	*Terminal M5-M6*	*Terminal M3-M4*	*Terminal M1-M2*	*Local/ Remote*	*During UV*	*During OPE*
2	*Speed Actual (Lower Byte)*							
3	*Speed Actual (Upper Byte)*							
4	—							
5	—							
6	*Output Current Monitor (Lower Byte)*							
7	*Output Current Monitor (Upper Byte)*							

Data	Name	Description
Byte 0, Bit 0	*During Run*	The drive run status is displayed. 0: During stop 1: During Forward/reverse/DC braking
Byte 0, Bit 1	*During Zero Speed*	The drive run status is displayed. 0: During forward/reverse 1: During stop/DC braking
Byte 0, Bit 2	*During Reverse Run*	The drive run status is displayed. 0: During forward run 1: During reverse run/reverse command input
Byte 0, Bit 3	*During Reset Input*	The drive reset signal input status is displayed. 0: Off 1: During reset signal input
Byte 0, Bit 4	*Speed Agree*	The drive frequency agree detection status is displayed. 0: During stop/acceleration and deceleration 1: Frequency agree
Byte 0, Bit 5	*Inverter Ready*	The drive ready status is displayed. 0: During fault detection/ready 1: Ready
Byte 0, Bit 6	*Alarm*	The drive alarm detection status is displayed. 0: Normal 1: During alarm detection
Byte 0, Bit 7	*Fault*	The drive fault detection status is displayed. 0: Normal 1: During fault detection
Byte 1, Bit 0	*During OPE*	The drive Modbus parameter setting error (OPE) detection status is displayed. 0: Normal 1: During OPE, (OPE1-OPE11) fault detection

*1 Drive products may provide additional inputs and outputs that are not supported through DeviceNet. For example, G7 has 5 digital outputs; however, only 3 digital outputs are supported through DeviceNet.

Table 21: Standard Drive Control Instance 151 (97 Hex) (OUTPUT ASSEMBLY) *1 (Cont.)

Byte 1, Bit 1	*During UV*	The drive low voltage error (UV) detection status is displayed. 0: Normal 1: During UV detection
Byte 1, Bit 2	*Local/Remote*	The drive run command input selection status is displayed. 0: Run command input is enabled other than the DeviceNet. 1: Run command input is enabled from DeviceNet.
Byte 1, Bit 3	*Terminal M1-M2*	The drive multi-function output terminal M1-M2 output status is displayed. 0: Terminal M1-M2 OFF 1: Terminal M1-M2 ON
Byte 1, Bit 4	*Terminal M3-M4*	The drive multi-function output terminal M3-M4 output status is displayed. 0: Terminal M3-M4 OFF 1: Terminal M3-M4 ON
Byte 1, Bit 5	*Terminal M5-M6*	The drive multi-function output terminal M5-M6 output status is displayed. 0: Terminal M5-M6 OFF 1: Terminal M5-M6 ON
Byte 1, Bit 6	*Not Used*	-
Byte 1, Bit 7	*During Zero Servo*	Displays the zero servo complete status of drive. 0: Zero servo not complete or not input. 1: Zero servo complete.
Byte 2, 3	*Speed Monitor*	The drive speed is displayed. This function is the same as the Speed Monitor in Basic Speed Control Output Instance 70 (46 Hex) section.
Byte 4, 5	*Torque Reference*	Displays the torque reference of the drive. The unit is fixed at 0.1%.
Byte 6, 7	*Output Current Monitor*	The drive output current is displayed. The unit (0.1A) is fixed. There is no effect on the current scale setting.

*1 Drive products may provide additional inputs and outputs that are not supported through DeviceNet. For example, G7 has 5 digital outputs; however, only 3 digital outputs are supported through DeviceNet.

DeviceNet Explicit Messaging Communications

The DeviceNet communications may also be accomplished by utilizing an “Explicit Message” to communicate with the master PLC or controller. The Explicit messaging communications is performed differently than Polled I/O type messaging in that commands are not sent cyclically in the scan of the controlling master, but one message is sent and one response is received. See table below for details on Explicit Message Format.

Table 22: Explicit Message Format

Header	MAC ID	Service Code	Class	Instance	Attribute	Data	Footer

Item	Description
Header	Since it is automatically set, there is no need to do anything.
MAC ID	Master/slave MAC ID is input for communication.
Service Code	Code, which shows data write/read, is input in the requested message. Also, the requested service code MSB (the most significant bit) inputs “1” at normal response, and “94” at fault. Example: 0E: Read request 8E: Read normal response 10: Write request 90: Write normal response 94: Fault response
Class	Each function of DeviceNet is classified by three codes. When you wish to designate data, use these 3 codes to do so.
Instance	
Attribute	
Data	Request: Write data is input. Response: Read data and error code are input.
Footer	Since it is automatically set, there is no need to do anything.

The following pages define the supported DeviceNet implemented objects and services for the drive option.

Identity Object Class (01 Hex):

The Identity object stores DeviceNet product information.

Table 23: Supported Services

Service Code (Hex)	Service Name	Description of Service
0E	Get_Attribute_Single	Designated attribute content is returned.
05	Reset	Option unit status is reset. (returns to initial status)

Table 24: Object Content

Instance (Hex)	Attribute (Hex)	Name	Description	Initial Value (Hex)	Read	Write	Size
00	01	*Object Software Revision*	Identity object software revision is displayed.	0001	*		Word
01	01	*Vendor ID*	Manufacturer code No. is displayed. 44 (2C Hex): Yaskawa Electric	002C	*		Word
	02	*Device Type*	Device profile of the compatible DeviceNet is displayed. The DeviceNet product is compatible with AC Drive Profile. 2: AC drive	0002	*		Word
	03	*Product Code*	Manufacturer's code.	(See Table of EDS Files and Product Codes on the following page)	*		Word
	04	*Revision*	Option unit software revision	2003	*		Word
	05	*Status*	Option unit communication status is displayed.	0000	*		Word
	06	*Serial Number*	Option unit serial number	Depends on product	*		Long
	07	*Product Name*	Product model is displayed.	(See Table of EDS Files and Product Codes on the following page)	*		String
	08	*Present Status*	Drive status is displayed. 3: Inverter ready	03	*		Byte

Table 25: Option Product Name and Product Codes

	CIMR-F7U or CIMR-G7U	Drive Capacity o2-04	F7/SI-N1		G7/SI-N1	
			Product Name	Product Code	Product Name	Product Code
208 - 230Vac	20P4	00 Hex	CIMRF7U20P4_SI-N1	8960 (2500 Hex)	CIMRG7U20P4_SI-N1	9984 (2700 Hex)
	20P7	01 Hex	CIMRF7U20P7_SI-N1	8961 (2501 Hex)	CIMRG7U20P7_SI-N1	9985 (2701 Hex)
	21P5	02 Hex	CIMRF7U21P5_SI-N1	8962 (2502 Hex)	CIMRG7U21P5_SI-N1	9986 (2702 Hex)
	22P2	03 Hex	CIMRF7U22P2_SI-N1	8963 (2503 Hex)	CIMRG7U22P2_SI-N1	9987 (2703 Hex)
	23P7	04 Hex	CIMRF7U23P7_SI-N1	8964 (2504 Hex)	CIMRG7U23P7_SI-N1	9988 (2704 Hex)
	25P5	05 Hex	CIMRF7U25P5_SI-N1	8965 (2505 Hex)	CIMRG7U25P5_SI-N1	9989 (2705 Hex)
	27P5	06 Hex	CIMRF7U27P5_SI-N1	8966 (2506 Hex)	CIMRG7U27P5_SI-N1	9990 (2706 Hex)
	2011	07 Hex	CIMRF7U2011_SI-N1	8967 (2507 Hex)	CIMRG7U2011_SI-N1	9991 (2707 Hex)
	2015	08 Hex	CIMRF7U2015_SI-N1	8968 (2508 Hex)	CIMRG7U2015_SI-N1	9992 (2708 Hex)
	2018	09 Hex	CIMRF7U2018_SI-N1	8969 (2509 Hex)	CIMRG7U2018_SI-N1	9993 (2709 Hex)
	2022	0A Hex	CIMRF7U2022_SI-N1	8070 (250A Hex)	CIMRG7U2022_SI-N1	9994 (270A Hex)
	2030	0B Hex	CIMRF7U2030_SI-N1	8071 (250B Hex)	CIMRG7U2030_SI-N1	9995 (270B Hex)
	2037	0C Hex	CIMRF7U2037_SI-N1	8072 (250C Hex)	CIMRG7U2037_SI-N1	9996 (270C Hex)
	2045	0D Hex	CIMRF7U2045_SI-N1	8973 (250D Hex)	CIMRG7U2045_SI-N1	9997 (270D Hex)
	2055	0E Hex	CIMRF7U2055_SI-N1	8974 (250E Hex)	CIMRG7U2055_SI-N1	9998 (270E Hex)
	2075	0F Hex	CIMRF7U2075_SI-N1	8975 (250F Hex)	CIMRG7U2075_SI-N1	9999 (270F Hex)
	2090	10 Hex	CIMRF7U2090_SI-N1	8976 (2510 Hex)	CIMRG7U2090_SI-N1	10000 (2710 Hex)
	2110	11 Hex	CIMRF7U2110_SI-N1	8977 (2511 Hex)	CIMRG7U2110_SI-N1	10001 (2711 Hex)
480Vac	40P4	20 Hex	CIMRF7U40P4_SI-N1	8992 (2520 Hex)	CIMRG7U40P4_SI-N1	10016 (2720 Hex)
	40P7	21 Hex	CIMRF7U40P7_SI-N1	8993 (2521 Hex)	CIMRG7U40P7_SI-N1	10017 (2721 Hex)
	41P5	22 Hex	CIMRF7U41P5_SI-N1	8994 (2522 Hex)	CIMRG7U41P5_SI-N1	10018 (2722 Hex)
	42P2	23 Hex	CIMRF7U42P2_SI-N1	8995 (2523 Hex)	CIMRG7U42P2_SI-N1	10019 (2722 Hex)
	43P7	24 Hex	CIMRF7U43P7_SI-N1	8996 (2524 Hex)	CIMRG7U43P7_SI-N1	10020 (2724 Hex)
	44P0	25 Hex	CIMRF7U44P0_SI-N1	8997 (2525 Hex)	CIMRG7U44P0_SI-N1	10021 (2725 Hex)
	45P5	26 Hex	CIMRF7U45P5_SI-N1	8998 (2526 Hex)	CIMRG7U45P5_SI-N1	10022 (2726 Hex)
	47P5	27 Hex	CIMRF7U47P5_SI-N1	8999 (2527 Hex)	CIMRG7U47P5_SI-N1	10023 (2727 Hex)
	4011	28 Hex	CIMRF7U4011_SI-N1	9000 (2528 Hex)	CIMRG7U4011_SI-N1	10024 (2728 Hex)
	4015	29 Hex	CIMRF7U4015_SI-N1	9001 (2529 Hex)	CIMRG7U4015_SI-N1	10025 (2729 Hex)
	4018	2A Hex	CIMRF7U4018_SI-N1	9002 (252A Hex)	CIMRG7U4018_SI-N1	10026 (272A Hex)
	4022	2B Hex	CIMRF7U4022_SI-N1	9003 (252B Hex)	CIMRG7U4022_SI-N1	10027 (272B Hex)
	4030	2C Hex	CIMRF7U4030_SI-N1	9004 (252C Hex)	CIMRG7U4030_SI-N1	10028 (272C Hex)
	4037	2D Hex	CIMRF7U4037_SI-N1	9005 (252D Hex)	CIMRG7U4037_SI-N1	10029 (272D Hex)
	4045	2E Hex	CIMRF7U4045_SI-N1	9006 (252E Hex)	CIMRG7U4045_SI-N1	10030 (272E Hex)
	4055	2F Hex	CIMRF7U4055_SI-N1	9007 (252F Hex)	CIMRG7U4055_SI-N1	10031 (272F Hex)
	4075	30 Hex	CIMRF7U4075_SI-N1	9008 (2530 Hex)	CIMRG7U4075_SI-N1	10032 (2730 Hex)
	4090	31 Hex	CIMRF7U4090_SI-N1	9009 (2531 Hex)	CIMRG7U4090_SI-N1	10033 (2731 Hex)
	4110	32 Hex	CIMRF7U4110_SI-N1	9010 (2532 Hex)	CIMRG7U4110_SI-N1	10034 (2732 Hex)
	4132	33 Hex	CIMRF7U4132_SI-N1	9011 (2533 Hex)	CIMRG7U4132_SI-N1	10035 (2733 Hex)
	4160	34 Hex	CIMRF7U4160_SI-N1	9012 (2534 Hex)	CIMRG7U4160_SI-N1	10036 (2734 Hex)
	4185	35 Hex	CIMRF7U4185_SI-N1	9013 (2535 Hex)	CIMRG7U4185_SI-N1	10037 (2735 Hex)
	4220	36 Hex	CIMRF7U4220_SI-N1	9014 (2536 Hex)	CIMRG7U4220_SI-N1	10038 (2736 Hex)
	4300	37 Hex	CIMRF7U4300_SI-N1	9015 (2537 Hex)	CIMRG7U4300_SI-N1	10039 (2737 Hex)
	Note: The EDS files will be in zip format, so unzip the file before installing in the DeviceNet configuration software tool.					

Message Router Object Class (02 Hex):

The Message Router object has the function of routing DeviceNet communication information to the correct object. DeviceNet messages are routed to each function through this object. The Message Router object itself performs the internal processes only.

Table 26: Supported Service

Service Code (Hex)	Service Name	Description of Service
0E	Get_Attribute_Single	Designated attribute content is returned.

Table 27: Object Content

Instance (Hex)	Attribute (Hex)	Name	Description	Setting Range	Initial Value (Hex)	Read	Write	Size
00	01	*Object Software Revision*	Message Router object software revision is displayed.	–	0001	o	–	Word

DeviceNet Object Class (03 Hex):

This object is for the DeviceNet communication information/functions.

Table 28: Supported Service

Service Code (Hex)	Service Name	Description of Service
0E	Get_Attribute_Single	Designated attribute content is returned.
10	Set_Attribute_Single	Designated attribute content is changed.

Table 29: Object Content

Instance (Hex)	Attribute (Hex)	Name	Description	Setting Range	Initial Value (Hex)	Read	Write	Size
00	01	*Object Software Revision*	DeviceNet object software revision is displayed.	–	0002	o	–	Word
01	01	*MAC ID*	MAC ID setting value is displayed according to the DIP switch setting.	0x63	00	o	–	Byte
	02	*Baud Rate*	Baud rate setting value is displayed according to the DIP switch settings. 0: 125kbps 1: 250kbps 2: 500kbps	0x02	00	o	–	Byte
	05	*Allocation Information*	DeviceNet communication connection information is displayed.	–	00,00	o	–	Byte ×2

Assembly Object Class (04 Hex):

The Assembly object is for the polled I/O message functions.

Table 30: Supported Service

Service Code (Hex)	Service Name	Description of Service
0E	Get_Attribute_Single	Designated attribute content is returned.
10	Set_Attribute_Single	Designated attribute content is changed.

Table 31: Object Content

Instance (Hex)	Attribute (Hex)	Name	Description	Setting Range	Initial Value (Hex)	Read	Write	Size
00	01	*Object Software Revision*	Assembly object software revision is displayed.	–	0002	o	–	Word
14	03	*I/O Data*	Same function as the basic I/O instance 20 (input/PCA)	*1	–	o	o	Byte ×4
15	03	*I/O Data*	Same function as the extended I/O instance 21 (input/PCA)	*1	–	o	o	Byte ×4
46	03	*I/O Data*	Same function as the basic I/O instance 70 (output/PPA)	–	–	o	–	Byte ×4
47	03	*I/O Data*	Same function as the extended I/O instance 71 (output/PPA)	–	–	o	–	Byte ×4
64	03	*I/O Data*	Same function as the Modbus I/O instance 100 (input/PCA)	*1	–	o	o	Byte ×5
65	03	*I/O Data*	Same function as the drive standard control I/O instance 101 (input/PCA/PPA)	*1	–	o	o	Byte ×8
96	03	*I/O Data*	Same function as the Modbus I/O instance 150 (output/PPA)	–	–	o	–	Byte ×5
97	03	*I/O Data*	Same function as the drive standard control I/O instance 151 (output/PPA)	–	–	o	–	Byte ×8

*1 Setting range is the same as the individual I/O message function.

DeviceNet Connection Object Class (05 Hex):

The DeviceNet Connection object has the function of keeping track of the DeviceNet communication connection information/ functions. On initialization, the communication connection with the master is established by using information and functions from this object. Please note that Instance 2 of DeviceNet Object Class 05 Hex supports only polled messaging.

Table 32: Supported Service

Service Code (Hex)	Service Name	Description of Service
0E	Get_Attribute_Single	Designated attribute content is returned.
10	Set_Attribute_Single	Designated attribute content is changed.

Table 33: Object Content

Instance (Hex)	Attribute (Hex)	Name	Description	Setting Range	Initial Value (Hex)	Read	Write	Size
00	01	*Object Software Revision*	DeviceNet connection object software revision is displayed.	—	0001	o	—	Word
01 Explicit Message	01	*Instance State*	This instance status is displayed. 00: It does not exist in the Network yet, and is being prepared. 01: On-line status and waiting for the connection from the master. 02: Waiting for the connection ID write. 03: Connection is completed. 04: Time out.	—	03	o	—	Byte
	02	*Instance type*	This instance type is displayed. 00: Explicit message 01: I/O message	—	00	o	—	Byte
	03	*Connection operation*	The option unit communication status is displayed by a code.	—	83	o	—	Byte
	04	*Output (PPA) connection ID*	The level used by the option unit communication header is displayed. This function is set when communication connection is completed.	—	71	o	—	Word
	05	*Input (PCA) connection ID*		—	21	o	—	Word
	06	*Message group*	The option unit communication status is displayed by a code.	—	21	o	—	Byte
	07	*No. of Max. output (PPA) bytes*	No. of Max. output (PPA) bytes is displayed.	—	0020	o	—	Word
	08	*No. of Max. input (PCA) bytes*	No. of Max. input (PCA) bytes is displayed.	—	0020	o	—	Word
	09	*Timeout time*	Internal process timeout time is displayed when communication request is received. (Round up 10ms unit)	65535 (ms)	09C4 (2500ms)	o	o	Word
	0C	*Watchdog timeout process*	Timeout internal process regarding communication is displayed. 00: Holds until reset/shut off 01: Automatically shut off 02: Restart with connected status.	—	01	o	—	Byte
	0D	*No. of output (PPA) connection bus bytes*	No. of output (PPA) connection bus bytes is displayed.	—	0000	o	—	Word
	0E	*Output (PPA) Connection Bus*	The application object received the data through this instance is displayed.	—	—	o	—	Array
	0F	*No. of input (PCA) connection bus bytes*	No. of input (PCA) connection bus bytes is displayed.	—	0000	o	—	Word
	10	*Input (PCA) connection bus*	The application object received the data through this instance is displayed.	—	—	o	—	Array

Table 33: Object Content (Continued)

Instance (Hex)	Attribute (Hex)	Name	Description	Setting Range	Initial Value (Hex)	Read	Write	Size
02 Polled Message Only	01	*Instance status*	This instance status is displayed. 00: It does not exist in the Network yet, and is being prepared. 01: On-line status and waiting for the connection from the master. 02: Waiting for the connection ID write. 03: Connection is completed. 04: Time out.	—	03	o	—	Byte
	02	*Instance type*	This instance type is displayed. 00: Explicit message 01: I/O message	—	01	o	—	Byte
	03	*Connection operation*	The option unit communication status is displayed by a code.	—	82	o	—	Byte
	04	*Output (PPA) Connection ID*	The level used by the option unit communication header is displayed. This function is set when communication connection is completed.	—	71	o	—	Word
	05	*Input (PCA) connection ID*		—	21	o	—	Word
	06	*Message group*	The option unit communication status is displayed by the code.	—	01	o	—	Byte
	07	*No. of Max. output (PPA) bytes*	No. of max. output (PPA) bytes is displayed.	—	0004	o	—	Word
	08	*No. of Max. input (PCA) bytes*	No. of max. input (PCA) bytes is displayed.	—	0004	o	—	Word
	09	*Timeout time*	Internal process timeout time is displayed when communication request is received. (Round up 10ms unit)	65535 (ms)	0000 (0ms)	o	o	Word
	0C	*Watchdog timeout process*	Timeout internal process regarding communication is displayed. 00: Holds until reset/shut off 01: Automatically shut off 02: Restart with connected status.	—	01	o	o	Byte
	0D	*No. of output (PPA) connection path bytes*	No. of output (PPA) connection path bytes is displayed.	—	0003	o	—	Word
	0E	*Output communication path Polled Producing Assembly (PPA)*	The application object received the data through this instance is displayed.	—	62 34 37	o	o	Array
	0F	*No. of input (PCA) communication path bytes*	No. of input (PCA) connection bus bytes is displayed.	—	0003	o	—	Word
	10	*Input communication path Polled Consuming Assembly (PCA)*	The application object received the data through this instance is displayed.	—	62 31 35	o	o	Array

Motor Data Object Class (28 Hex):

The motor data object is for the information and functions related to the motor connected to the drive. Motor rated current and rated voltage can be set and read.

Table 34: Supported Service

Service Code No. (Hex)	Service Name	Description of Service
0E	Get_Attribute_Single	Designated attribute content is returned.
10	Set_Attribute_Single	Designated attribute content is changed.

Table 35: Object Content

Instance (Hex)	Attribute (Hex)	Name	Description	Setting Range	Initial Value (Hex)	Read	Write	Size
00	01	*Object Software Revision*	Motor Data object software revision is displayed.	–	0001	o	–	Word
01	03	*Motor Type*	Used motor type is displayed, 7: Squirrel-cage induction motor	–	07	o	–	Byte
	06	*Motor Rated Current*	Motor rated current can be set and read. Setting unit: 0.1A	10~20% of drive rated current	*1	o	o	Word
	07	*Motor Rated Voltage*	Motor rated voltage can be set and read. Setting unit: 1V	255V *2	00C8 *2	o	o	Word

*1 The motor rated current initial value varies according to drive capacity.

*2 The initial value and setting range are for the 200V class. For the 400V class, the value is twice that of the 200V class.

Control Supervisor Object Class (29 Hex):

The control supervisor object is dedicated to the information and services related to the drive control functions. The basic control functions such as, inverter run, stop, and fault detect are implemented. The control supervisor object functions are commonly used with polled I/O messaging functions.

Table 36: Supported Service

Service Code No. (Hex)	Service Name	Description of Service
0E	Get_Attribute_Single	Designated attribute content is returned.
10	Set_Attribute_Single	Designated attribute content is changed.
05	Reset	Option unit status is reset. (returns to initial status)

Table 37: Object Content

Instance (Hex)	Attribute (Hex)	Name	Description	Setting Range	Initial Value (Hex)	Read	Write	Size
00	01	*Object Software Revision*	Control supervisor object software revision is displayed.	—	0001	o	—	Word
01	03	*Forward Run*	The drive runs forward. 00: Stop 01: Forward run	00,01	00	o	o	Byte
	04	*Reverse Run*	The drive runs reverse. 00: Stop 01: Reverse run	00,01	00	o	o	Byte
	05	*NetCtrl*	Run command rights displayed. *1 00: Run command input method set by run command selection (n003) 01: Run command (byte 0 – bit 0, 1) is enabled through DeviceNet.	00,01	00	o	o	Byte
	06	*Inverter Status*	The drive status is displayed. 03: Inverter ready	—	03	o	—	Byte
	07	*During Forward Run*	The drive run status is displayed. 00: During stop/reverse 01: During forward run/DC braking	—	00	o	—	Byte
	08	*During Reverse Run*	The drive run status is displayed. 00: During stop/forward/DC braking 01: During reverse	—	00	o	—	Byte
	09	*Inverter Ready*	The drive operation preparing status is displayed. 00: During fault detection/preparation 01: Ready	—	00	o	—	Byte
	0A	*Fault*	The drive fault detection status is displayed. 00: Normal 01: During fault detection	—	00	o	—	Byte
	0B	*Alarm*	The drive alarm detection status is displayed. 00: Normal 01: During alarm detection	—	00	o	—	Byte
	0C	*Fault Reset*	The drive is reset through fault detection status. 00: Fault reset off 01: Fault reset	00,01	00	o	o	Byte
	0D	*Fault Code*	The drive fault detection content is displayed by the code listed in the table below. *3	—	0000	o	—	Word
	0F	*Ctrl From Net*	The drive run command input selection status is displayed.*1 00: Run command input other than the DeviceNet is enabled. 01: Run command input is enabled through DeviceNet.	—	00	o	—	Byte
	10	*DeviceNet Fault Mode*	Mode selection is displayed when DeviceNet becomes fault.*2 02: Manufacturer	—	02	o	—	Byte
	11	*External Fault from Option*	External fault (EF0) is input 00: EF0 Not Active 01: External fault (EF0)	00,01	00	o	o	Byte
	12	*External Fault Input Status from Option*	External fault (EF0) input status is displayed. 00: EF0 Not Active 01: During external fault (EF0) input	—	00	o	—	Byte

Notes:
*1 A setting during drive operation cannot be changed.
*2 DeviceNet communication fault cannot be set. The drive detects fault and stops at DeviceNet communication fault. The drive stopping method at communication fault can be selected by time-over detection selection parameter (n151).
*3 Fault Code (See below table for interpretation)

AC/DC Drive Object Class (2A Hex):

The AC/DC Drive Object is also dedicated to the information and function related to the drive operation. Frequency reference settings, individual monitor parameters, and data unit settings can be changed. The AC/DC Drive Object function is commonly used with I/O message functions for setting or returning drive status information.

Table 38: Supported Service

Service Code No. (Hex)	Service Name	Description of Service
0E	Get_Attribute_Single	Designated attribute content is returned.
10	Set_Attribute_Single	Designated attribute content is changed.

Table 39: Object Content

Instance (Hex)	Attribute (Hex)	Name	Description	Setting Range	Initial Value (Hex)	Read	Write	Size
00	01	*Object Software Revision*	AC/DC Drive Object software revision is displayed.	—	0001	o	—	Word
01	03	*Speed agree*	Drive frequency agree detection status is displayed. 00: During stop/decel/accel 01: Frequency agree	00,01	00	o	—	Byte
	04	*NetRef*	Frequency reference rights is set.*1 00: Frequency reference input method set by frequency reference selection (b1-01). 01: Frequency reference (byte 2, 3) through DeviceNet is enabled.	00,01	00	o	o	Byte
	06	*Control mode*	Drive control mode is set.*3 00: V/F control 01: Vector control	00,03	01	o	o	Byte
	07	*Speed monitor*	Drive speed is displayed.*2 Min. unit: [r/min/2^{SS}] where SS: Speed scale: attribute 16	—	0000	o	—	Word
	08	*Speed reference*	Frequency Reference is set/read*2 Min. unit: [r/min/2^{SS}] where SS: Speed scale: attribute 16	0-E1-04	0000	o	o	Word
	09	*Output current*	Drive output current is displayed:*2 Current Unit: [0.1A/2^{CS}] where CS: Current scale: attribute 17	—	0000	o	—	Word
	0F	*Output power*	Drive output power is displayed:*2 Power Unit: [W/2^{PS}] where PS: Power scale: attribute 1A	—	0000	o	—	Word
	10	*Input Voltage*	Drive input voltage is displayed: Min. Unit: [V/2^{VS}] where VS: Voltage scale: attribute 1B	—	0000	o	—	Word
	11	*Output Voltage*	Drive output voltage is displayed: Min. Unit: [V/2^{VS}] where VS: Voltage scale: attribute 1B	—	0000	o	—	Word
	12	*Accel Time*	Acceleration time 1 is set/read. Min. Unit: [ms/2^{TS}] where TS: Time scale: attribute 1C	0-655.35s	0x2710 (10.0s)	o	o	Word
	13	*Decel Time*	Deceleration time 1 is set/read. Min. : Unit: [ms/2^{TS}] where TS: Time scale: attribute 1C	0-655.35s	0x2710 (10.0s)	o	o	Word
	14	*Low Speed Limit*	Drive Frequency Reference lower limit value is set/read.*2 *3 Min. : Unit: [r/min/2^{SS}] where SS: Speed scale: attribute 16	0-100.0%	0000	o	o	Word

Table 38: Object Content (continued)

01	15	*High Speed Limit*	Drive Frequency Reference upper limit value is set/read.*2 *3 Min. :Unit: [r/min/2^{SS}] where SS: Speed scale: attribute 16	0-100.0%	0x0708 (1800r/m)	o	o	Word
	16	*Speed Scale*	Data unit coefficient regarding speed is set/read. Min. Unit: 1 [r/min]×$1/2^{SS}$ where SS: Speed scale setting value	-15-15 (F1-0F)	00	o	o	Byte
	17	*Current Scale*	Data Coefficient regarding current is set/read. Current Unit: 0.1 [A]×$1/2^{CS}$ where CS: Current scale setting value	-15-15 (F1-0F)	00	o	o	Byte
	1A	*Power Scale*	Data Coefficient regarding power is set/read. Power Unit: 1 [W]×$1/2^{PS}$ where PS: Power scale setting value	-15-15 (F1-0F)	00	o	o	Byte
	1B	*Voltage Scale*	Data unit coefficient regarding voltage is set/read. Voltage Unit: 1 [V]×$1/2^{VS}$ where VS: Voltage scale setting value	-15-15 (F1-0F)	00	o	o	Byte
	1C	*Time Scale*	Data unit coefficient regarding time is set and read. Time Unit: 1 [ms]×$1/2^{TS}$ where TS: Time scale setting value	-15-15 (F1-0F)	00	o	o	Byte
	1D	*Ref From Net*	Drive frequency reference input selection status is displayed*1 00: Frequency Reference input other than DeviceNet is enabled. 01: Frequency Reference input from DeviceNet is enabled.	00,01	00	o	—	Byte

Notes:

*1 A setting during drive operation cannot be changed.

*2 An application of speed command, speed monitor, speed lower limit value, and speed upper limit value must be set as a motor pole value (2~39) to the drive parameter o1-03 (frequency reference set/display unit selection)

*3 Control mode, speed lower limit, and speed upper limit cannot be set during drive operation.

SS: Speed Scale (AC/DC Drive Object Attr. 22)

CS: Current Scale (AC/DC Drive Object Attr. 23)

PS: Power Scale (AC/DC Drive Object Attr. 26)

VS: Voltage Scale (AC/DC Drive Object Attr. 27)

TS: Time Scale (AC/DC Drive Object Attr. 28)

Drive Parameters Object Class 100 (64 Hex):

This DeviceNet Object Class can read and write all of the same parameters and monitors available via drive digital operator keypad. This Object Class is designed specifically for Yaskawa drives.

A built-in Modbus protocol and addressing scheme is standard in all Yaskawa drives. The option converts the DeviceNet message to Modbus for use internally in the drive.

Yaskawa Drive Parameter Object Class 100 is modeled after the drive's internal Modbus addressing scheme. The DeviceNet path for each drive parameter is derived by converting the drive's Modbus register number to the DeviceNet path, Class/ Instance/Attribute. Reading or writing parameters to the drive via DeviceNet is simplified because the DeviceNet path closely matches the drive's Modbus register numbers.

Table 40: Supported Service

Service Code No. (Hex)	Service Name	Description of Service
0E	Get_Attribute_Single	Designated attribute content is returned.
10	Set_Attribute_Single	Designated attribute content is changed.

Table 41: Converting the Modbus Register Number to the DeviceNet Path

Modbus Register: 0180 Hex			DeviceNet Path: 64/01/80 Hex	
	Example Data			Example Data
-	-		Class	64 Hex
Byte 1	01 Hex	→	Instance	01 Hex
Byte 0	80 Hex	→	Attribute	80 Hex

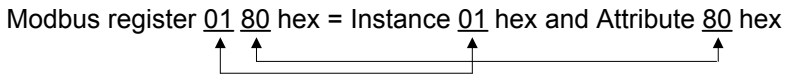
- The DeviceNet Class for parameter access is always “64”.
- The DeviceNet Instance is always equal to Modbus register byte 1 or the MSB (most significant byte).
- The DeviceNet Instance is always equal to Modbus register byte 0 or the LSB (least significant byte).
- The data size for each Attribute is 2 bytes.

Refer to the drive User Manual for description on the parameters and Modbus Manual for Modbus registers.

Example 1:

Reading the Reference Source Parameter b1-01 Value by Explicit Messaging

To read parameter b1-01 (Modbus register 0180 Hex) Reference Source, first convert the Modbus register number to DeviceNet Instance and Attribute.



Then, send an explicit message with Service Code 0E Hex (Get Attribute Single) to *Class 64/Instance 1/Attribute 80 Hex*. If the returned value is *0001 Hex*, then Reference Source is set to Parameter Setting 1, Terminals.

Note: The same Class/Instance/Attribute paths are used in the EDS file provided by Yaskawa.

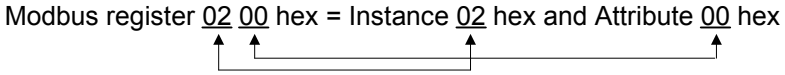
Table 42: Reference Source Parameter b1-01 Settings

Class 100/ Instance/ Attribute (Hex)	Modbus Register (Hex)	Parameter	Function	Setting	Description
64/1/80	180	b1-01	Reference Source	0	Operator
				1	Terminals
				2	Serial Communication
				3	Option
				4	Pulse Input

Example 2:

Setting the Accel Time 1 Parameter C1-01 Value by Explicit Messaging

To set parameter C1-01 (Modbus register 0200 Hex) Acceleration Time 1 to 3.5 seconds, first convert the Modbus register number to DeviceNet Instance and Attribute.



Then, send an explicit message with Service Code 10 Hex (Set Attribute Single) to *Class 64/Instance 2/Attribute 00 Hex*, with the data field as *23 Hex (35)*. The data field does not recognize decimal places, so the data must be written as a whole number. Also, in reading and setting to parameters C1-01 to C1-09 Accel/Decel Time 1 to 4, be sure to check the setting of parameter C1-10 Accel/Decel Time Setting Unit. For instance, in the above example, if C1-10 is set to value of 1 (0.01 – two decimal places) instead of the default value (0.1 - one decimal place), the data field to set acceleration time to 3.50 seconds would be *15E Hex (350)*. Refer to the drive User Manual for further drive parameter descriptions.

Table 43: Accel Time 1 Parameter C1-01 Settings

Class 100/ Instance/ Attribute (Hex)	Modbus Register (Hex)	Parameter	Function	Setting	Description
64/2/00	200	C1-01	Acceleration Time 1	0.00 to 600.0 seconds or 0.0 to 6000.0 seconds	
64/2/09	209	C1-10	Accel/Decel Time Setting Unit	0	0.01 (two decimal places)
				1 default	0.1 (one decimal place)

DeviceNet Fault Diagnostics
Drive Faults

Table 44: DeviceNet Fault Codes

DeviceNet Fault Code No. (Hex)	Operator Fault Display	Content
0000	-	Drive normal
2120	GH	Ground fault
2130	SC	Load short
2200	OL2	Drive overload
2220	OL1	Motor overload
2221	OL3	Overtorque 1
2222	OL4	Overtorque 2
2300	OC	Overcurrent
3130	PF	Main circuit voltage fault
	LF	Output phase missing
3210	OV	Main circuit overvoltage
3220	UV1	Main circuit low voltage
3222	UV3	Surge protection circuit fault
4200	OH	Heat sink fin overheat
5110	UV2	Control power fault
5120	PUF	Fuse open
5300	OPR	Operator not connected
6320	ERR	EEPROM write failure
7110	RR	Braking transistor fault
7112	RH	Braking resistor overheat
7301	PGO	PG wire broken detection
7310	OS	Excessive speed
	DEV	Speed deviation excessive
7500	BUS	Option communication error
9000	EF3	External fault (Input terminal S3)
	EF4	External fault (Input terminal S4)
	EF5	External fault (Input terminal S5)
	EF6	External fault (Input terminal S6)
	EF7	External fault (Input terminal S7)
	EF8	External fault (Input terminal S8)
	EF0	Option external fault

Fault Diagnostics

The following is a table of faults caused by the option that will be displayed on the Digital Operator, their causes, and possible solutions. For any fault displayed on the operator that is not listed in the following table, please see the drive Users Manual.

Table 45: Drive Faults Caused by the Option

Fault Display	Content	Cause	Solution
BUS	Option Communication error	Communication is not established between DeviceNet master and the drive.	Check DeviceNet communication LED display and connection at DeviceNet terminal. The network and/or 24VDC power supply may be down.
EF0	External Fault from Option	External fault is active from DeviceNet option.	Turn OFF external fault input.
CPF06	Option Connection Fault	The drive and communication are not correctly connected.	Turn OFF the drive power supply. Check the connection of the option and drive, and then, turn ON the drive power supply. If the fault persists, change the option.
CPF21	Communication Option Self-diagnostic Fault	Communication option is not working.	Turn the drive power supply back ON. If the fault persists, change the option.
CPF22	Communication Option Model Code No. Fault		
CPF23	Communication Option Mutual Diagnostic Fault		

DeviceNet Communication LED Faults and Operation

Table 46: DeviceNet Communication LED Faults and Operation

LED Display				Content	Cause	Solution
PWR	MS	NS	WD			
Not Lit	Not Lit	Not Lit	Not Lit	Power OFF	The drive is not powered.	Check the drive main circuit wiring, and then turn ON the power.
					The option is not correctly connected, thus, the power does not supply to the option.	Turn Off the drive power, check the connection of the option and the drive, and re-power the drive.
Solid Green	Not Lit	Not Lit	Solid Red	CPU Fault	The option CPU is being initialized or has a fault.	Cycle drive power. If the fault persists, change the option.
Solid Green	FlashGreen	Not Lit	FlashGreen	During Option Unit Preparation	Initial setting status or the communication is being initialized.	Cycle drive power. If the fault persists, change the option.
Solid Green	Flash Red	Not Lit	Flash Green	Option Unit Possible Fault	A wrong setting of a switch or a recovery fault is occurring.	Check baud rate setting (DIP switch, DR1 and DR0), and then re-cycle the power. If the fault persists, change the option.
Solid Green	Solid Red	Not Lit	Flash Green	Option Unit Unrecoverable Fault	An Unrecoverable fault is occurring to the option.	Cycle drive power. If the fault persists, change the option.
Solid Green	Solid Red	Solid Red	Flash Green	Baud Rate Setting Fault	Baud rate settings (DIP switch, DR1 and DR0) are both ON.	Set the baud rate switches correctly, and cycle the drive power.
Solid Green	Solid Green	Flash Red	Flash Green	Communication Timeout	A master communication timeout occurred.	Check if the end termination resistor is correctly connected to the communication bus. Check if the communication device is correctly connected per wiring diagrams. Check if the communication bus wiring is separated from the main circuit wiring.
Solid Green	SolidGreen	Solid Red	Flash Green	Communication Error	Communication Unrecoverable fault occurred.	Check if other device's MAC ID is not unique per the network. Check if the master is correctly configured. Check if the end termination resistor is correctly connected to the communication bus. Check if the communication device is correctly connected per wiring diagrams. Check if the communication bus wiring is separated from the main circuit wiring.
Solid Green	Solid Green	FlashGreen	Flash Green	Normal (Communication data: No)	Although the fault does not occur, it is connected to the master controller.	Send explicit message or I/O message from the master as necessary.
Solid Green	Solid Green	SolidGreen	Flash Green	Normal (Communication data: Yes)	Drive is communicating normally.	–

Explicit Message Communication Error

If a requested message has an error response from the master when performing Explicit message communication, the communication option sends a response message which the following error code shown in the table, is attached as data, as well as the service code “94”.

Table 47: Explicit Message Communication Error Codes

Error Code	Content	Cause	Solution
08FF	*Service not requested*	Wrong service code.	Correct service code.
09FF	*Invalid attribute value detection*	Wrong attribute value.	Correct attribute value.
0CFF	*Executing requested service is impossible*	A non run-operative drive parameter is being attempted to be set during drive operation.	Stop drive operation.
0EFF	*Setting prohibit attribute*	Cannot write to Attribute.	Correct service code and attribute value.
13FF	*Not enough data*	Data size is not matched.	Correct data size.
14FF	*Unauthorized Attribute*	Unauthorized service was attempted to operate on the attribute.	Correct service code and attribute value.
15FF	*Excessive data*	Data size is not matched.	Correct data size.
16FF	*Object does not exist*	Object is not defined in the option.	Correct class and option value.
1FFF	*Manufacturer specific error*	An unsettable drive setting was attempted to be written to during drive operation. A drive setting is attempted to be written outside the setting range.	Stop the drive. Correct the data within the setting range.
20FF	*Parameter fault*	A data write is attempted that is outside of the setting range.	Correct the data within the setting range.

I/O Message Communication Modbus I/O Instance Errors

Table 48: Modbus I/O Instance Errors and Their Causes

Error Code	Content	Causes
01 Hex	Function code error	Function code from the master was other than 00 Hex, 03 Hex, and 10 Hex.
02 Hex	Register No. error	A register # was not found. Enter command (0900 Hex) registered for write started to read.
21 Hex	Data setting error	Parameter setting error occurred by a parameter write. Upper and lower byte values were out of alignment, swapped.
22 Hex	Write mode error	A parameter was attempted to write from the master during run. Enter command was attempted write from the master during UV. A parameter was attempted to write from the master during UV. Enter command was attempted to write from the master during UV. A parameter was attempted to write from the master during data store. Data for read only was attempted to write from the master.
23 Hex	Write during UV	Attempted to write a parameter from the master while UV was occurring. Attempted to write an enter command from the master while UV was occurring.
24 Hex	Write during parameter processing	Attempted to write a parameter from the master while data was being stored.

Appendix A
Product Specifications

This chapter describes the product specifications of a DeviceNet network system.

DeviceNet Product Specification 64

Product Specifications

Item	Specifications
I/O Message	4 types of I/O instance are supported: 1) Basic I/O instance (Input 4 bytes, output 4 bytes) 2) Expansion I/O instance (Input 4 bytes, output 4 bytes) 3) Modbus I/O instance (Input 5 bytes, output 5 bytes) 4) Standard drive control I/O instance (Input 8 bytes, output 8 bytes)
Explicit Message	Suitable for DeviceNet AC/DC Drive Profile. Data communication Max. 32 byte
Communication Power Supply	DC 11V~25V (20mA or less)
Operation Power Supply	DC 4.75V~5.25V (Supplied from the drive)
Ambient Temperature	-10°C ~ +45°C
Humidity	95%RH or less (Non-condensing)
Storage Temperature	-20°C ~ +60°C
Location	Indoor (Protected from corrosive gas and dust)
Altitude	1000m or less
Voltage	11~25 Vdc
Current	100mA

Appendix B
Cable Specifications

This chapter describes the cable specifications for a DeviceNet network system.

DeviceNet Cable Specifications 66
DeviceNet Cable Vendor Table 66
DeviceNet Network Topology 67
DeviceNet Maximum Cable Distance 67

Cable Specifications

Thick Cable

This cable consists of two shielded pairs twisted on a common axis with a drain wire in the center covered with an overall braid shield and is commonly used as trunkline when length is important.

The thick cable specified for DeviceNet network connections consists of:

- One twisted signal pair (#18): blue/white
- One twisted power pair (#15): black/red
- Separate aluminized mylar shields around power pair and signal pair
- Overall foil/braid shield with drain wire (#18): bare

Thin Cable

Thin Cable is smaller and more flexible than Thick Cable. It is commonly used for droplines, but can also be used, for shorter distances, as trunkline.

The thin cable specified for DeviceNet network connections consists of:

- One twisted signal pair (#24): blue/white
- One twisted power pair (#22): black/red
- Separate aluminized mylar shields around power pair and signal pair
- Overall foil/braid shield with drain wire (#22): bare

Cable Vendors

DeviceNet cables are available from various vendors. Two sources are listed below:

Table 49: DeviceNet Cable Sources

Belden Wire & Cable Company					
Part #	Thick/Thin	Pair	AWG	Insulation	Outer Jacket
3082A	Thick	Data	18	Datalene	Lt. Gray PVC
		Power	15	PVC/Nylon	
3084A	Thin	Data	24	Datalene	Lt. Gray PVC
		Power	22	PVC/Nylon	
3083A	Thick	Data	18	Datalene	Yellow CPE
		Power	15	PVC/Nylon	
3085A	Thin	Data	24	Datalene	Yellow CPE
		Power	22	PVC/Nylon	

Berk-Tek					
Part #	Thick/Thin	Pair	AWG	Insulation	Outer Jacket
210051	Thick	Data	18	FPE/HDPE	Lt. Gray PVC
		Power	15	PVC/Nylon	
210144	Thin	Data	24	FPE/HDPE	Lt. Gray PVC
		Power	22	PVC/Nylon	

DeviceNet Network Topology

The DeviceNet media has a linear bus topology. Terminating resistors are required on each end of the trunkline. Droplines as long as 6 meters (20 feet) each are permitted, allowing one or more nodes to be attached. DeviceNet allows branching structures only on the dropline. The figure below shows an example of a DeviceNet network. The thick lines indicate a trunkline, whereas the thin lines indicate a dropline.

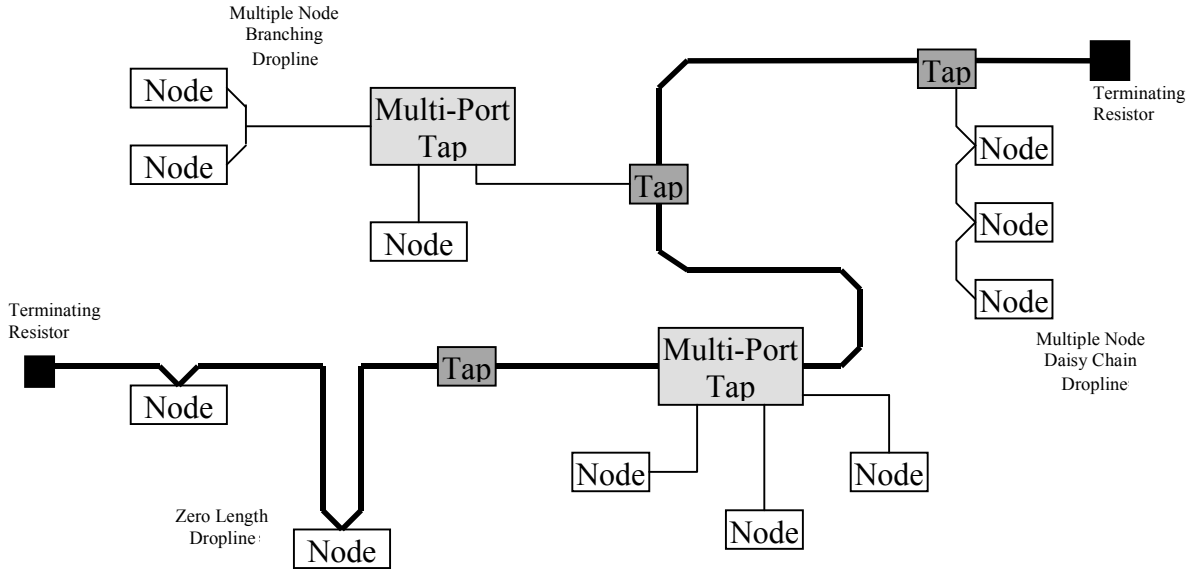


Fig. 8 DeviceNet Topology

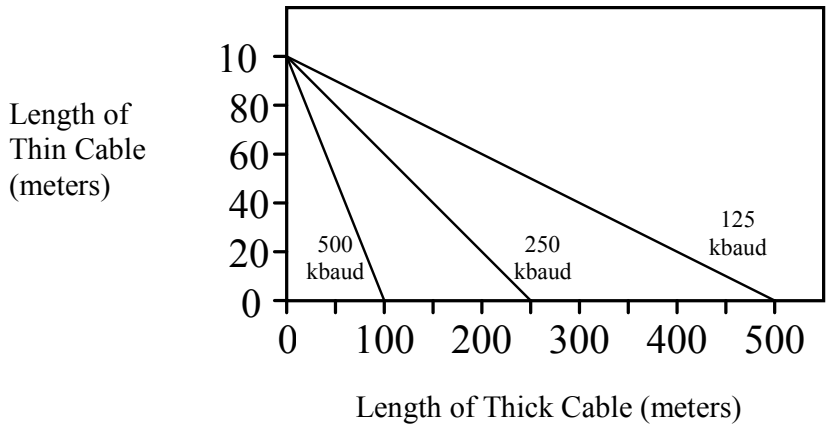
Maximum Cable Distance

The total amount of trunkline allowable on the network depends upon the data rate and the type of cable (thick or thin) used. The cable distance between any two points in the cable system must not exceed the Maximum Cable Distance allowed for the baud rate. For trunklines constructed of only one type of cable, refer to the following table to determine the Maximum Cable Distance based on the data rate and the type of cable used. Cable distance between two points includes both trunkline cable and dropline cable length that exists between the two points.

Table 50: Maximum Cable Distance Allowed per Baud Rate

Baud Rate	Maximum Cable Distance for 100% Thick Cable	Maximum Cable Distance for 100% Thin Cable
125 kbaud	500 meters (1640 feet)	100 meters (328 feet)
250 kbaud	250 meters (820 feet)	
500 kbaud	100 meters (328 feet)	

DeviceNet allows the use of either thick or thin cable to be used to construct trunklines. DeviceNet also allows a combination of both types of cable to be used on the same network. To determine the maximum cable distance with a mix of both thick and thin cable, use the following figure.



At 125 kbaud: $L_{thick} + (5.0 \times L_{thin}) = 500$

At 250 kbaud: $L_{thick} + (2.5 \times L_{thin}) = 250$

At 500 kbaud: $L_{thick} + L_{thin} = 100$

(where L_{thick} is the length of thick cable and L_{thin} is the length of thin cable.)

Fig. 9 Maximum Cable Distance

Dropline length is the longest cable distance measured from the tap on the trunkline to each of the transceivers of the nodes on the dropline. The total amount of dropline allowable on the network depends upon the data rate. Refer to the following dropline budget when determining the number and length of droplines.

Baud Rate	Drop Length	
	Maximum	Cumulative
125 kbaud	6 meters (20 ft)	156 meters (512 feet)
250 kbaud		78 meters (256 feet)
500 kbaud		39 meters (128 feet)

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DeviceNet™ CM059 (SI-N1) Option

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