“MICRO” ADJUSTABLE SPEED DRIVE INTERFACE

DeviceNet™

DEVICENET COMMUNICATIONS INTERFACE

FOR THE TOSHIBA S7 SERIES

ADJUSTABLE SPEED DRIVE

September, 2002
ICC #10290-002

Introduction

Thank you for purchasing the External DeviceNet Communications Interface for the Toshiba S7 Series Micro Adjustable Speed Drive. Before using the DeviceNet interface, please familiarize yourself with the product and be sure to thoroughly read the instructions and precautions contained in this manual. In addition, please make sure that this instruction manual is delivered to the end user of the drive units with which the DeviceNet interface is connected, and keep this instruction manual in a safe place for future reference or drive/interface inspection.

This instruction manual describes the device specifications, wiring methods, maintenance procedures, supported functions and usage methods for the external DeviceNet communications interface.

In conjunction with this manual, the following manuals are supplied by Toshiba, and are essential both for ensuring a safe, reliable system installation as well as for realizing the full potential of the DeviceNet interface:

- *TOSVERT VF-S7 Series Instruction Manual*
- *VF-S7 Industrial Inverter Serial Communications Option Manual*

If you do not have copies of these documents available, please contact Toshiba or your local Toshiba distributor to obtain them, or copies may be downloaded via the internet from http://www.tic.toshiba.com.

Before continuing, please take a moment to ensure that you have received all materials shipped with your kit. These items are:

- External DeviceNet interface in DIN rail mountable case
- 2 meter DB9-RJ45 MMI port cable
- This manual

• Usage Precautions

Operating Environment

- Please use the DeviceNet interface only when the ambient temperature of the environment into which the interface is installed is within the following specified temperature limits:

  Operation: -10 ~ +40°C (+14 ~ +104°F)
  Storage: -25 ~ +65°C (-13 ~ +149°F)
- Avoid installation locations that may be subjected to large shocks or vibrations.
- Avoid installation locations that may be subjected to rapid changes in temperature or humidity.

Installation • Wiring

- Do not touch charged parts of the drive such as the terminal block while the drive's CHARGE lamp is lit. A charge will still be present in the drive's internal electrolytic capacitors, and therefore touching these areas may result in an electrical shock. Always turn all drive input power supplies OFF, and wait at least 5 minutes after the CHARGE lamp has gone out before connecting communication cables or motor wiring.
- Proper ground connections are vital for both safety and signal reliability reasons. For proper grounding procedures, please refer to the ASD instruction manual for drive considerations and the *ODVA DeviceNet Specifications* for network considerations.
- Route all communication cables separate from drive input/output power wiring.
- To avoid the possibility of electric shock due to leakage currents, always ground the drive's E/GND terminal and the motor. To avoid misoperation, do not connect the DeviceNet network SHIELD terminal directly to either of the above-mentioned grounds or any other power ground.
- When making connections between the DeviceNet interface and the drives, do not use cables that exceed 5 meters in length.
- For further drive-specific precaution, safety and installation information, please refer to the appropriate Toshiba documentation supplied with your drive.

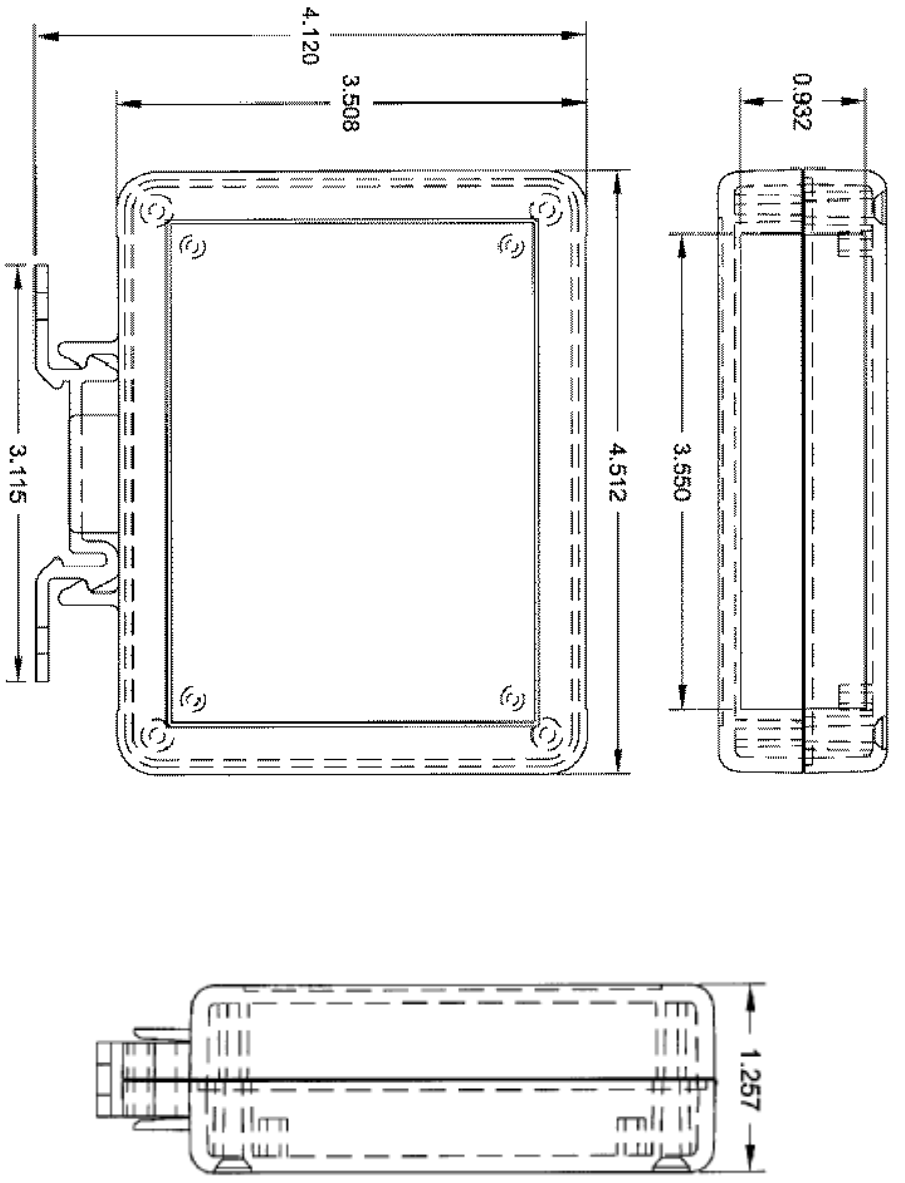
Other Precautions

- Do not touch or insert a rod or any other item into the DeviceNet interface's case while power is applied, as this may lead to electrical shock or device damage.
- Commission the disposal of the DeviceNet interface to a specialist.
- Do not assign the same MAC ID to more than one DeviceNet unit in the same network. For an explanation of station addressing, refer to section 8.
- Because the DeviceNet interface derives its control power from the DeviceNet network power supply, removing network power or unplugging the network connector from the unit will also cause the DeviceNet interface to lose power, even if power is still applied to the connected drives.

TABLE OF CONTENTS

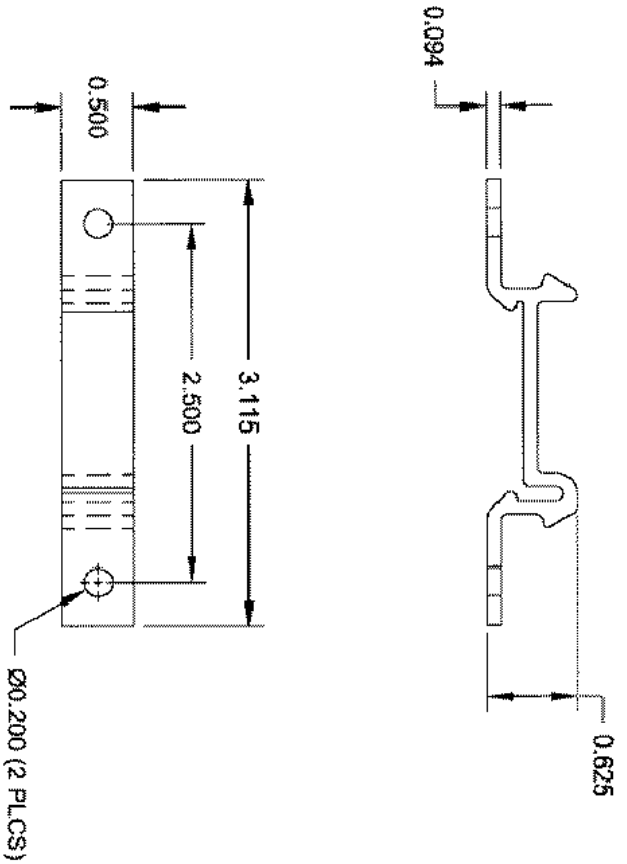
1. Mechanical Diagrams

1.1 Enclosure



(All units are in inches)

1.2 Mounting Clip



(All units are in inches)

2. General Specifications

Application

Toshiba 7-Series ASDs, externally mounted

Terminations

One 5-pin pluggable gold-plated connector for DeviceNet bus connection.
Two RJ45 jacks (TTL-level) for connection to ASDs
One RJ45 jack (RS232-level) for MMI port connection

Control Power Supply

SOURCE .....Supplied by DeviceNet network
VOLTAGE RANGE .....11 ~ 25 VDC

LED Indicators

One bicolor red/green Module Status LED

- Behavior according to ODVA DeviceNet Specifications

One bicolor red/green Network Status LED

- Behavior according to ODVA DeviceNet Specifications

One green LED on Channel A and Channel B interface ports

- Indicates local isolated circuitry power is being received from connected drive

One green LED on MMI interface port

- Context is application-specific, but under normal operation used as a 1-Hz "heartbeat" indicator
- When used with FlashLoader programming utility, indicates data transfer
- Upon interface initialization after a reset, heartbeat indicator will not begin until the unit has achieved the "on-line / unconnected" state

Compatibility

Group 2 Server Only device utilizing the Predefined Master / Slave Connection Set. Vendor-specific I/O POLL connection (8 bytes of data consumed and 8 bytes of data produced). This product has been self-tested by Toshiba International Corporation and found to comply with ODVA Conformance Test Software Version A-13.

Node Isolation

Each connected ASD is fully optically isolated from the control/network portion and from each other at the physical layer. This eliminates grounding differential problems and greatly improves noise immunity characteristics.

Bus Interface
Phillips 82C251 or equivalent transceiver.

Drive Connections

Provides support for simultaneous connection of two 7-series ASDs. Both drives share a common DeviceNet MAC ID. By supporting 2 drives per interface, the maximum number of drives that can be connected to 1 network segment increases from 63 (63 drives + 1 master) to 126 (63 external DeviceNet units + 1 master). Uses standard RJ-45 style 8-pin modular connectors. Any standard category-5 ethernet cable (found in most electronics stores) 5 meters or less in length can be used to connect the DeviceNet interface to the drives.

Drive AutoScan Algorithm

Connections to the drives are automatically established and continuously monitored. No drive configuration needs to be performed to connect the DeviceNet interface and communicate via the DeviceNet network. Just plug it in – it's that simple.

Versatile 3-Way DIN-Rail Mounting System

The interface unit enclosure is provided with a mounting clip attached to the rear of the unit. This clip allows the unit to be mounted 3 different ways:

- For DIN rail mounting, snap the mounting clip onto a standard DIN rail, and then snap the unit enclosure onto the clip's retaining tabs. This allows easy removal or repositioning of the unit on the DIN rail during wiring.
- For panel mounting, the mounting clip can be bolted directly to a flat panel via the two bolt holes at the top and bottom of the clip. Refer to section 1.2 for mounting clip mechanical details. Once the mounting clip is securely attached to the panel, the unit enclosure can be snapped onto the clip's retaining tabs.
- For fixed DIN rail mounting, a combination of the above two techniques can be employed. First, snap the mounting clip onto a DIN rail and position it in its desired location. Then, the mounting clip can be bolted to the DIN rail support panel, securing it in place. Lastly, the unit can be snapped onto the fixed mounting clip.

In all cases, the unit can be easily unsnapped from the mounting clip to temporarily provide easier access to the configuration switches or network terminal block.

3. Installing the Interface

The DeviceNet Interface connects to each drive via the drive's communication port, located on either the right-hand side or the front of the drive enclosure (depending on drive series) under a small snap-on cover. Although no drive parameters need to be configured in order to use the DeviceNet interface, it is advantageous to check that the drive's communication data rate is set to its maximum speed. Because the interface will communicate to each drive only at the drive's configured data rate, this will provide the fastest response time for drive-to-network data transfers. For information on checking the drive's communication data rate, refer to the appropriate manual supplied with your drive. Note that this drive communication data rate setting is independent of the DeviceNet network data rate, which is configured solely by the interface's "Configuration" DIP switches on the bottom of the unit. Also note that the data communication parameters of each drive are handled independently; the drive connected to "Channel A" may simultaneously communicate to the DeviceNet interface at completely different baud rates, parity settings, etc. from the drive connected to "Channel B".

Installation of the External DeviceNet Interface should only be performed by a qualified technician familiar with the maintenance and operation of the connected drives. To install the unit, complete the following steps:

1.  **CAUTION!** Verify that all input power sources to the drives to be connected have been turned OFF and are locked and tagged out.
2.  **DANGER!**  Wait at least 5 minutes for the drive's electrolytic capacitors to discharge before proceeding to the next step. **Do not touch any internal parts with power applied to the drive, or for at least 5 minutes after power to the drive has been removed. A hazard exists temporarily for electrical shock even if the source power has been removed.** Verify that the CHARGE LED has gone out before continuing the installation process.
3. Attach the mounting clip and unit enclosure in your desired manner (refer to page 8 for more information).
4. Remove the drive's communication port cover, located on the right-hand side of the drive (as viewed when facing the drive) or on the front of the drive (location depends on specific drive series). Do not discard this cover, as it should be reinstalled if the DeviceNet interface is ever disconnected from the drive to minimize contamination of the port's electrical contacts.
5. Connect the communication port(s) of the drive(s) to "Channel A" and/or "Channel B" on the front of the DeviceNet unit. If only one drive is to be connected to the unit, it can be connected to either channel. The DeviceNet interface ships from the factory with dust covers in place on both Channel B and the MMI port. To minimize contamination to the port electrical contacts, keep these dust covers in place whenever a particular port is not in use.

   The communication cable(s) to connect the drive(s) to the DeviceNet interface are not included with the interface kit. When choosing cables for this connection, standard 24 AWG category-5 (CAT 5) shielded or unshielded twisted-pair (UTP) 8-conductor cables found in ethernet networks in most office environments can

be used. The maximum allowable length for these cables is 5 meters. Although there are many varieties and styles of CAT-5 ethernet cables available, Toshiba strongly recommends using only high-quality cables from reputable manufacturers to guarantee optimal noise immunity, cable reliability and cable longevity. Ensure that each end of the cable is fully seated into the modular connectors, and route the cable such that it is located well away from any drive input power or motor wiring. Also take care to route the cable away from any sharp edges or positions where it may be pinched.

6. Connect the DeviceNet network cable to the pluggable "Network" terminal block located on the bottom of the unit. Refer to Figure 1 for specific connector positions. Be sure to follow all cabling, grounding and termination requirements as outlined in the ODVA DeviceNet Specifications. Ensure that the network cable wires are tightly screwed into the terminal block, and route the cable such that it is located well away from any drive input power or motor wiring. Also take care to route the cable away from any sharp edges or positions where it may be pinched.

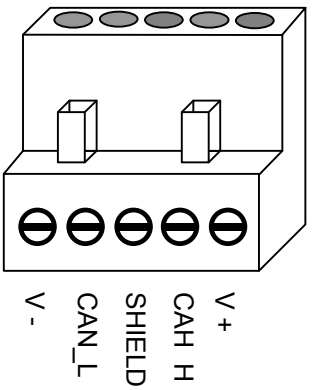


Figure 1: DeviceNet Network Wiring Connections

7. Take a moment to verify that the DeviceNet interface and all network cables have sufficient clearance from drives, motors, or power-carrying electrical wiring.
8. Turn the power sources to all connected drives ON, and verify that the drives function properly. If the drives do not appear to power up, or do not function properly, immediately turn power OFF. **Repeat steps 1 and 2 to remove all power from the drives.** Then, verify all connections. Contact Toshiba or your local drive distributor for assistance if the problem persists.

4. Grounding

Grounding is of particular importance for reliable, stable operation. Communication system characteristics may vary from system to system, depending on the system environment and grounding method used. In general, however, the following grounding checkpoints should be noted when connecting any communications system to adjustable speed drives:

Grounding method checkpoints

1. Make all ground connections such that no ground current flows through the case or heatsink of a connected drive.
2. Do not connect the DeviceNet network SHIELD to a power ground or any other potential noise-producing ground connection (such as a drive's "E" terminal).
3. Do not make connections to unstable grounds (paint-coated screw heads, grounds that are subjected to inductive noise, etc.)

For specific requirements regarding protective grounding and the DeviceNet network, refer to the ODVA DeviceNet Specifications.

5. Environmental Specifications

Item	Specification
Operating Environment	Indoors, less than 1000m above sea level, do not expose to direct sunlight or corrosive / explosive gasses
Operating Temperature	-10 ~ +40°C (+14 ~ +104°F)
Storage Temperature	-25°C ~ +65°C (-13 ~ +149°F)
Relative Humidity	20% ~ 90% (without condensation)
Vibration	5.9m/s^2 {0.6G} or less (10 ~ 55Hz)
Grounding	Refer to *ODVA DeviceNet Specifications*
Cooling Method	Self-cooled

6. Maintenance And Inspection

Preventive maintenance and inspection is required to maintain the external DeviceNet interface in its optimal condition, and to ensure a long operational lifetime. Depending on usage and operating conditions, perform a periodic inspection once every three to six months. Before starting inspections, always turn off all power supplies to the network and connected drives, and wait at least five minutes after each drive's "CHARGE" lamp has gone out.

 **DANGER!**  **Do not touch any internal parts with power applied to the drives, or for at least 5 minutes after power to the drives has been removed. A hazard exists temporarily for electrical shock even if the source power has been removed.**

Inspection Points

- Check that the network connector screw terminals are not loose. Tighten if necessary.
- Check that the drive communication cables are not loose. Reinsert if necessary.
- Check that there are no defects in any attached grounding wire terminal crimp points. Visually check that the crimp points are not scarred by overheating.
- Visually check all wiring and cables for damage. Replace as necessary.
- Clean off any accumulated dust and dirt.
- If use of the DeviceNet interface is discontinued for extended periods of time, apply power at least once every two years and confirm that the unit still functions properly.
- Do not perform hi-pot tests on the drives or DeviceNet interface, as they may damage the units.

Please pay close attention to all periodic inspection points and maintain a good operating environment.

7. Storage And Warranty

7.1 Storage

Observe the following points when the DeviceNet interface is not used immediately after purchase or when it is not used for an extended period of time.

- Avoid storing the interface unit in places that are hot or humid, or that contain large quantities of dust or metallic dust. Store the interface unit in a well-ventilated location.
- When not using the interface unit for an extended period of time, apply power at least once every two years and confirm that it still functions properly.

7.2 Warranty

The Toshiba External DeviceNet Communications Interface is covered under warranty by Toshiba International Corporation for a period of 12 months from the date of installation, but not to exceed 18 months from the date of shipment from the factory. For further warranty or service information, please contact Toshiba International Corporation or your local distributor.

8. Configuration Switches

The 10-position piano-style “Configuration” DIP switches accessible from the bottom of the unit allow selection of the DeviceNet MAC ID and network baud rate. Switch positions #1 ~ #6 select the MAC ID and positions #7 and #8 select the network baud rate. Switch positions #9 and #10 are currently unused but are reserved for future configuration enhancements.

The MAC ID settings for the various switch configurations are as follows:

SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	MAC ID
OFF	OFF	OFF	OFF	OFF	OFF	**0**
ON	OFF	OFF	OFF	OFF	OFF	**1**
OFF	ON	OFF	OFF	OFF	OFF	**2**
ON	ON	OFF	OFF	OFF	OFF	**3**
OFF	OFF	ON	OFF	OFF	OFF	**4**
ON	OFF	ON	OFF	OFF	OFF	**5**
OFF	ON	ON	OFF	OFF	OFF	**6**
ON	ON	ON	OFF	OFF	OFF	**7**
OFF	OFF	OFF	ON	OFF	OFF	**8**
ON	OFF	OFF	ON	OFF	OFF	**9**
OFF	ON	OFF	ON	OFF	OFF	**10**
ON	ON	OFF	ON	OFF	OFF	**11**
OFF	OFF	ON	ON	OFF	OFF	**12**
ON	OFF	ON	ON	OFF	OFF	**13**
OFF	ON	ON	ON	OFF	OFF	**14**
ON	ON	ON	ON	OFF	OFF	**15**
OFF	OFF	OFF	OFF	ON	OFF	**16**
ON	OFF	OFF	OFF	ON	OFF	**17**
OFF	ON	OFF	OFF	ON	OFF	**18**
ON	ON	OFF	OFF	ON	OFF	**19**
OFF	OFF	ON	OFF	ON	OFF	**20**
ON	OFF	ON	OFF	ON	OFF	**21**
OFF	ON	ON	OFF	ON	OFF	**22**
ON	ON	ON	OFF	ON	OFF	**23**
OFF	OFF	OFF	ON	ON	OFF	**24**
ON	OFF	OFF	ON	ON	OFF	**25**
OFF	ON	OFF	ON	ON	OFF	**26**
ON	ON	OFF	ON	ON	OFF	**27**
OFF	OFF	ON	ON	ON	OFF	**28**
ON	OFF	ON	ON	ON	OFF	**29**
OFF	ON	ON	ON	ON	OFF	**30**
ON	ON	ON	ON	ON	OFF	**31**

SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	MAC ID
OFF	OFF	OFF	OFF	OFF	ON	**32**
ON	OFF	OFF	OFF	OFF	ON	**33**
OFF	ON	OFF	OFF	OFF	ON	**34**
ON	ON	OFF	OFF	OFF	ON	**35**
OFF	OFF	ON	OFF	OFF	ON	**36**
ON	OFF	ON	OFF	OFF	ON	**37**
OFF	ON	ON	OFF	OFF	ON	**38**
ON	ON	ON	OFF	OFF	ON	**39**
OFF	OFF	OFF	ON	OFF	ON	**40**
ON	OFF	OFF	ON	OFF	ON	**41**
OFF	ON	OFF	ON	OFF	ON	**42**
ON	ON	OFF	ON	OFF	ON	**43**
OFF	OFF	ON	ON	OFF	ON	**44**
ON	OFF	ON	ON	OFF	ON	**45**
OFF	ON	ON	ON	OFF	ON	**46**
ON	ON	ON	ON	OFF	ON	**47**
OFF	OFF	OFF	OFF	ON	ON	**48**
ON	OFF	OFF	OFF	ON	ON	**49**
OFF	ON	OFF	OFF	ON	ON	**50**
ON	ON	OFF	OFF	ON	ON	**51**
OFF	OFF	ON	OFF	ON	ON	**52**
ON	OFF	ON	OFF	ON	ON	**53**
OFF	ON	ON	OFF	ON	ON	**54**
ON	ON	ON	OFF	ON	ON	**55**
OFF	OFF	OFF	ON	ON	ON	**56**
ON	OFF	OFF	ON	ON	ON	**57**
OFF	ON	OFF	ON	ON	ON	**58**
ON	ON	OFF	ON	ON	ON	**59**
OFF	OFF	ON	ON	ON	ON	**60**
ON	OFF	ON	ON	ON	ON	**61**
OFF	ON	ON	ON	ON	ON	**62**
ON	ON	ON	ON	ON	ON	**63**

The network baud rate settings are configured as follows:

SW7	SW8	Network Baud Rate
OFF	OFF	125 kbps
ON	OFF	250 kbps
OFF	ON	500 kbps
ON	ON	Invalid selection (DO NOT SELECT: this setting used for factory production testing only)

Note that the “ON” position of each switch is the “down” position and that the “OFF” position is the “up” position. Refer to the indicator markings on the switch.

The MAC ID and configured baud rate are read by the DeviceNet unit only on power-up or after a reset. Therefore, if either of these selections are changed be sure to either power the unit off momentarily by disconnecting it from the network power supply, or reset the unit by issuing a RESET service to the Identity Object (refer to section 10.1.4 on page 19).

9. Connection Information

9.1 Connection Sizes

Connection Instance	Produced	Consumed
Polled I/O	8 bytes	8 bytes
Explicit Messaging	40 bytes	40 bytes

Notes

- For the Explicit Messaging connection, this is the maximum message length: shorter messages are also acceptable.
- For the Polled I/O connection, if the actual consumed data size is less than the connection instance's consumed_connection_size attribute, the consumed data will be ignored, but the connection will otherwise produce normally. If the actual consumed data size is larger than the connection instance's consumed_connection_size attribute, the consumed data will be ignored and the connection will not produce.

9.2 I/O Assembly Instances

The following table indicates which polled I/O assembly instances are currently supported by the External DeviceNet Interface:

Number		Type	Name
Decimal	Hex		
100	0x64	Output	Toshiba-Specific Control Output
150	0x96	Input	Toshiba-Specific Status Input

For more detailed information about these assembly instances, refer to section 10.4.5.

10. Object Specifications

This section contains the object specifications for all DeviceNet objects currently supported by the External DeviceNet Interface. Table 1 outlines those objects covered:

Table 1: Supported Objects

Object Class	# of Instances	Page
Identity Object	1	18
Message Router	1	20
DeviceNet Object	1	21
Assembly Object	2	23
Connection class	2	28
Parameter Class	281	32

For definitions of all data types referred to in these object specifications, refer to the ODVA DeviceNet Specifications. In general, however, the following are some of the most prevalent types:

SINT .....Signed 8-bit integer value
USINT.....Unsigned 8-bit integer value
BYTE .....Bit string – 8-bits
INT.....Signed 16-bit integer value
UINT .....Unsigned 16-bit integer value
WORD .....Bit string – 16-bits
UDINT.....Unsigned 32-bit integer value

10.1 Identity Object

Class code 0x01. This object provides identification of and general information about the device.

10.1.1 Identity Object Class Attributes

Attribute ID	Access Rules	Name	Data Type	Description	Default Value
1	Get	Revision	UINT	Revision of this object	1
2	Get	Max Instance	UINT	Maximum instance number of an object currently created in this class level of the device	1
6	Get	Max ID number of class attributes	UINT	The attribute ID of the last class attribute of the class definition implemented in the device	7
7	Get	Max ID number of instance attributes	UINT	The attribute ID of the last instance attribute of the class definition implemented in the device	8

10.1.2 Identity Object Instance Attributes

Attribute ID	Access Rules	Name	Data Type	Description	Default Value
1	Get	Vendor	UINT	Identification of vendor by number	71
2	Get	Device Type	UINT	Indication of general type of product	12
3	Get	Product Code	UINT	Identification of a particular product of an individual vendor	50
4	Get	Revision	STRUCT of:	Revision of the item the Identity Object represents	--
		Major Revision	USINT		1
		Minor Revision	USINT		2

Attribute ID	Access Rules	Name	Data Type	Description	Default Value
5	Get	Status	WORD	Summary status of device	--
6	Get	Serial_ number	UDINT	Serial number of device	Unique for each unit
7	Get	Product Name	SHORT_ STRING	Human-readable identification	Toshiba Dual ASD Interface
8	Get	State	USINT	Present state of the device	--

10.1.3 Identity Object Common Services

Service Code	Supported		Service Name	Description of Service
	Class	Instance		
0x0E	Yes	Yes	Get_Attribute_ Single	Returns the contents of the specified attribute.
0x05	Yes	Yes	Reset	Invokes the Reset service for the device

Please note the following items about the Reset service:

- The Reset service resets only the interface board (not any connected drives).
- Both “Type 0” and “Type 1” resets are supported. With a “Type 0” reset, the DeviceNet unit is simply reset (same action as cycling power). With a “Type 1” reset, all nonvolatile parameters maintained internal to the DeviceNet unit are returned to their factory default settings and then the unit is reset. Therefore, if it is desired to maintain any changed nonvolatile parameters through a “Type 1” reset, be sure to record them prior to issuing the reset service so that they may be reentered after the unit has come back on-line.

10.1.4 Identity Object Specific Services

The Identity Object provides no object specific services.

10.2 Message Router

Class code 0x02. The Message Router Object provides a messaging connection point through which a Client may address a service to any object class or instance residing in the DeviceNet interface unit.

10.2.1 Message Router Class Attributes

Attribute ID	Access Rules	Name	Data Type	Description	Default Value
1	Get	Revision	UINT	Revision of this object	1
6	Get	Max ID number of class attributes	UINT	The attribute ID of the last class attribute of the class definition implemented in the device.	7
7	Get	Max ID number of instance attributes	UINT	The attribute ID of the last instance attribute of the class definition implemented in the device	2

10.2.2 Message Router Instance Attributes

Attribute ID	Access Rules	Name	Data Type	Description	Default Value
2	Get	Number Available	UINT	Maximum number of connections supported.	2

10.2.3 Message Router Common Services

Service Code	Supported		Service Name	Description of Service
	Class	Instance		
0x0E	Yes	Yes	Get_Attribute_ Single	Returns the contents of the specified attribute.

10.2.4 Message Router Specific Services

The Message Router provides no object specific services.

10.3 DeviceNet Object

Class Code 0x03. The DeviceNet Object provides for the configuration and status of a DeviceNet port.

10.3.1 DeviceNet Object Class Attributes

Attribute ID	Access Rules	Name	Data Type	Description	Default Value
1	Get	Revision	UINT	Revision of this object.	2

10.3.2 DeviceNet Object Instance Attributes

Attribute ID	Access Rules	Name	Data Type	Description	Default Value
1	Get	MAC ID	USINT	Node address	--
2	Get	Baud Rate	USINT	Baud rate	--
3	Get / Set	BOI	BOOL	Bus-off interrupt	0
4	Get / Set	Bus-Off Counter	USINT	Number of times CAN went to the bus-off state	0
5	Get	Allocation Information	STRUCT of:		
		Allocation Choice Byte	BYTE		0
		Master's MAC ID	USINT	MAC ID of master	0xFF

Notes

- The MAC ID and Baud Rate attributes are not settable via the network (they are set via the "Configuration" switches on the bottom of the unit). Attempting a *Set* service will result in a "Service Not Supported" error.
- The setting of the BOI attribute is saved in the DeviceNet unit's internal EEPROM. If the BOI value is set to TRUE, the DeviceNet interface will attempt to restart the network interface on the occurrence of a CAN bus-off event. This will continue to be the behavior until the Bus-Off Counter attribute achieves a value of 255. If a CAN bus-off event occurs after this point, the

unit will not attempt to restart the network interface: it will remain faulted and isolated from the network until reset (power removed from the unit).

10.3.3 DeviceNet Object Common Services

Service Code	Supported		Service Name	Description of Service
	Class	Instance		
0x0E	Yes	Yes	Get_Attribute_ Single	Returns the contents of the specified attribute.
0x10	N / A	Yes	Set_Attribute_ Single	Modifies the value of the specified attribute.

10.3.4 DeviceNet Object Specific Services

Service Code	Supported		Service Name	Description of Service
	Class	Instance		
0x4B	N / A	Yes	Allocate_ Master/Slave _Connection_Set	Requests the use of the Predefined Master/Slave Connection Set.
0x4C	N / A	Yes	Release_Group_2 _Identifier_Set	Indicates that the specified connections within the *Predefined Master/Slave Connection Set* are no longer desired. These connections are to be released (deleted).

10.4 Assembly Object

Class code 0x04. The Assembly Object binds attributes of multiple objects, which allows data to or from each object to be sent or received over a single connection.

10.4.1 Assembly Object Class Attributes

Attribute ID	Access Rules	Name	Data Type	Description	Default Value
1	Get	Revision	UINT	Revision of this object.	2
2	Get	Max Instance	UINT	Maximum instance number of an object created in this class level of the device.	150

10.4.2 Assembly Object Instance Attributes

The DeviceNet unit contains 2 static assembly instances, with assigned instance IDs 100 (output assembly) and 150 (input assembly). Refer to section 10.4.5 for more details.

Attribute ID	Access Rules	Name	Data Type	Description	Default Value
3	Get / Set	Data	ARRAY	The data contained in the assembly object.	--

10.4.3 Assembly Object Common Services

Service Code	Supported		Service Name	Description of Service
	Class	Instance		
0x0E	Yes	Yes (100 and 150)	Get_Attribute _Single	Returns the contents of the specified attribute.
0x10	N / A	Yes (100 only)	Set_Attribute _Single	Modifies the value of the specified attribute.

10.4.4 Assembly Object Specific Services

The Assembly Object for static assemblies provides no object specific services.

10.4.5 Assembly Instance Details

As mentioned previously, the External DeviceNet Interface is pre-configured to consume 8 bytes of I/O data and produce 8 bytes of I/O data. As each DeviceNet unit acts as the interface for 2 ASDs, the produced and consumed data is divided equally between these drives. Currently, the External DeviceNet Interface directly supports the Toshiba S7 drive series, and all command and status data provided in sections 10.4.5.1 and 10.4.5.2 relate to this drive series only.

This data allocation may include more configurations and support for more drive lines as future firmware versions are released. Be sure to periodically check the Internet for new downloadable firmware versions and documentation to support your DeviceNet unit and attached drives (refer to section 11).

10.4.5.1 Output Instance 100 (ASD Command)

	Byte #	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
ASD Channel A	0	DC Inject. Braking	Acc / Dec #1 / #2	Reserved	Reserved	Preset Speed 4	Preset Speed 3	Preset Speed 2	Preset Speed 1
	1	DeviceNet Cmd. Valid	DeviceNet Freq. Valid	Fault Reset	Emerg. OFF	Free Run	Run / Stop	FWD / REV	Jog
	2	Drive A Frequency Command (Low Byte)							
	3	Drive A Frequency Command (High Byte)							
ASD Channel B	4	DC Inject. Braking	Acc / Dec #1 / #2	Reserved	Reserved	Preset Speed 4	Preset Speed 3	Preset Speed 2	Preset Speed 1
	5	DeviceNet Cmd. Valid	DeviceNet Freq. Valid	Fault Reset	Emerg. OFF	Free Run	Run / Stop	FWD / REV	Jog
	6	Drive B Frequency Command (Low Byte)							
	7	Drive B Frequency Command (High Byte)							

Command Word

Bytes #0 / #1 and #4 / #5 represent the bit-mapped drive control command words. These are the locations where run/stop, etc. commands are written. A more detailed view of the command words with indicated values can be found in Table 2.

Using the example command word in Table 2, some representative command words that can be used to control each of the attached drives via the DeviceNet network are:

0xC400 .....DeviceNet command valid, DeviceNet frequency valid, run forward
0xC600 .....DeviceNet command valid, DeviceNet frequency valid, run reverse
0xC000 .....DeviceNet command valid, DeviceNet frequency valid, drive stop
0xE000 .....DeviceNet command valid, DeviceNet frequency valid, reset drive fault
0x0000.....Drive command and frequency source local (not from DeviceNet)

Note that whether or not the drive's command and frequency command are selected to be from the DeviceNet network, input (status) data is still available and will always be returned to the DeviceNet scanner as I/O connection response data.

Table 2 : Toshiba S7 ASD Command Word Format

	Bit	Function	0	1
Bytes #1 / #5	7	Command source	Local	Network
	6	Frequency command source	Local	Network
	5	Fault reset	N/A	Reset
	4	Emergency OFF command	N/A	EOFF
	3	Coast stop command	N/A	Coast stop
	2	Run / stop command	Stop	Run
	1	Forward / reverse selection	Forward	Reverse
	0	Jog command	N/A	Jog
Bytes #0 / #4	7	DC injection braking	N/A	DC injection cmd.
	6	Accel / decel #1/#2 selection	#1	#2
	5	Reserved	Value ignored	
	4	Reserved	Value ignored	
	3	Preset speed 4	OFF	ON
	2	Preset speed 3	OFF	ON
	1	Preset speed 2	OFF	ON
	0	Preset speed 1	OFF	ON

Frequency Command

The data contained in the frequency command word is the desired frequency command multiplied by 100, and then converted to hexadecimal. In other words, if a frequency command of 55.34Hz is desired, then 55.34 x 100 = 5534, which converted to hexadecimal is 0x159E. The frequency command low byte (byte #2 or #6) must therefore contain 0x9E and the frequency command high byte (byte #3 or #7) must contain 0x15.

If the frequency command exceeds limiting drive parameters (such as UL or FH), the drive will ignore it, maintaining its current setting.

10.4.5.2 Input Instance 150 (ASD Status)

	Byte #	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
ASD Channel A	0	DC Inject. Braking Status	Acc / Dec #1 / #2 Status	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
	1	Online / Offline	Fault Status	Reserved	Reserved	Reserved	Run / Stop Status	FWD/REV Status	Jog Status
	2	Drive A Output Frequency (Low Byte)							
	3	Drive A Output Frequency (High Byte)							
ASD Channel B	4	DC Inject. Braking Status	Acc / Dec #1 / #2 Status	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
	5	Online / Offline	Fault Status	Reserved	Reserved	Reserved	Run / Stop Status	FWD/REV Status	Jog Status
	6	Drive B Output Frequency (Low Byte)							
	7	Drive B Output Frequency (High Byte)							

Status Word

Bytes #0 / #1 and #4 / #5 represent the bit-mapped drive status words. These are the locations where run/stop, etc. status values are monitored. A more detailed view of the status words with indicated values can be found in Table 3.

Note that bits #14 and #15 of each status word is allocated to the DeviceNet Interface. Bit #15 is used to indicate whether the DeviceNet Interface has established an open line of communications with the drive connected to that channel. Once a connection has been established with the drive, this bit will normally indicate “Online”. While searching for a drive (such as during initialization) and when no drive is connected, this bit will indicate “Offline”, and all other input data will be “0”. If this status bit indicates “Offline”, but there is a drive connected to the channel in question, check the cable connections and verify that the drive is powered.

As a user convenience, because the S7 ASD does not provide a “faulted” status bit in its standard status word, bit #14 of each status word from the DeviceNet unit is used to reflect the current faulted/not faulted status of the corresponding attached drive.

Output Frequency

Continuously reports the drive’s operating frequency. The value returned in this field is the drive’s actual output frequency times 100. Therefore, in order to determine the drive’s actual output frequency, divide this number by 100. For example, if the output frequency high byte is 0x12 and the output frequency low byte is 0x34, then 0x1234 converted to decimal is 4660. Dividing this number by 100, the actual operating frequency of 46.60Hz is obtained.

Table 3 : Toshiba S7 ASD Status Word Format

	Bit	Function	0	1
Bytes #1 / #5	7	Drive online / offline status	Offline	Online
	6	ASD fault status	Not faulted	Faulted
	5	Reserved	Always “0”	
	4	Reserved	Always “0”	
	3	Reserved	Always “0”	
	2	Run / stop status	Stopped	Running
	1	Forward / reverse status	Forward	Reverse
	0	Jog status	Not jogging	Jogging
Bytes #0 / #4	7	DC injection braking status	Not DC injection braking	DC injection braking
	6	Accel / decel #1/#2 status	#1	#2
	5	Reserved	Always “0”	
	4	Reserved	Always “0”	
	3	Reserved	Always “0”	
	2	Reserved	Always “0”	
	1	Reserved	Always “0”	
	0	Reserved	Always “0”	

10.5 Connection class

Class code 0x05. The Connection Class allocates and manages the internal resources associated with both I/O and Explicit Messaging Connections.

10.5.1 Connection Class Attributes

Attribute ID	Access Rules	Name	Data Type	Description	Default Value
1	Get	Revision	UINT	Revision of this object.	1

10.5.2 Connection Class Instance Attributes

The Instance IDs utilized by the DeviceNet Interface connection objects are shown in the following table:

Connection Instance ID #	Description
1	References the Explicit Messaging Connection
2	References the Polled I/O Connection

10.5.2.1 Master/Slave Explicit Messaging Connection Object Instance Attributes

Attribute ID	Access Rules	Name	Data Type	Description	Default Value
1	Get	state	USINT	State of the object	--
2	Get	instance_type	USINT	Indicates connection type	0
3	Get	transportClass _trigger	USINT	Connection behavior	0x83
4	Get	produced_ connection_id	UINT	Placed in CAN ID field when transmitting	0x0403 + (MAC ID << 3)
5	Get	consumed_ connection_id	UINT	CAN ID field value denoting received messages	0x0404 + (MAC ID << 3)
6	Get	initial_comm _characteristics	USINT	Defines producing / consuming message groups	0x21
7	Get	produced _connection _size	UINT	Max number of bytes transmitted across this connection	40
8	Get	consumed _connection _size	UINT	Max number of bytes received across this connection	40
9	Get / Set	expected_ packet_rate	UINT	Defines timing associated with this connection	2500
12	Get / Set	watchdog_ timeout_action	USINT	Inactivity/watchdog timeout action	1
13	Get	produced_ connection_ path_length	UINT	Number of bytes in produced_connection _path attribute	0
14	Get	produced_ connection_ path	Array of USINT	Specifies Application Object(s) whose data is to be produced by this connection	Empty
15	Get	consumed_ connection_ path_length	UINT	Number of bytes in consumed_ connection_path attribute	0
16	Get	consumed_ connection_ path	Array of USINT	Specifies Application Object(s) whose data is to be consumed by this connection	Empty
17	Get	production_ inhibit_time	UINT	Defines minimum time between new data production	0

10.5.2.2 Poll Connection Object Instance Attributes

Attribute ID	Access Rules	Name	Data Type	Description	Default Value
1	Get	state	USINT	State of the object	--
2	Get	instance_type	USINT	Indicates connection type	1
3	Get	transportClass _trigger	USINT	Connection behavior	0x82
4	Get	produced_ connection_id	UINT	Placed in CAN ID field when transmitting	0x03C0 + MAC ID
5	Get	consumed_ connection_id	UINT	CAN ID field value denoting received messages	0x0405 + (MAC ID << 3)
6	Get	initial_comm _characteristics	USINT	Defines producing / consuming message groups	0x01
7	Get	produced _connection _size	UINT	Max number of bytes transmitted across this connection	8
8	Get	consumed _connection _size	UINT	Max number of bytes received across this connection	8
9	Get / Set	expected_ packet_rate	UINT	Defines timing associated with this connection	0
12	Get / Set	watchdog_ timeout_action	USINT	Inactivity/watchdog timeout action	0
13	Get	produced_ connection_ path_length	UINT	Number of bytes in produced_connection _path attribute	6
14	Get	produced_ connection_ path	Array of USINT	Specifies Application Object(s) whose data is to be produced by this connection	20 04 24 96 30 03
15	Get	consumed_ connection_ path_length	UINT	Number of bytes in consumed_ connection_path attribute	6
16	Get	consumed_ connection_ path	Array of USINT	Specifies Application Object(s) whose data is to be consumed by this connection	20 04 24 64 30 03
17	Get	production_ inhibit_time	UINT	Defines minimum time between new data production	0

10.5.3 Connection Class Common Services

Service Code	Supported		Service Name	Description of Service
	Class	Instance		
0x05	No	Yes	Reset	Used to reset all resettable connection objects.
0x0E	Yes	Yes	Get_Attribute _Single	Returns the contents of the specified attribute.
0x10	N / A	Yes	Set_Attribute _Single	Modifies the value of the specified attribute.

10.5.4 Connection Class Specific Services

The Connection Class provides no object specific services.

10.6 Parameter Class

Class code 0x0F. The parameter class provides access to the various configuration parameters for each connected drive as well as for the External DeviceNet Interface itself. The supported parameters for each drive and their allowable adjustment ranges are defined in the appropriate Electronic Data Sheet (EDS). EDS sheets for all available DeviceNet interface firmware versions and supported drive series and configurations can be downloaded via the internet from http://www.iccdesigns.com.

Accessing parameter object instances associated with connected drive parameters accesses those drive parameters directly (i.e. a GET service will read a parameter value from the drive, and a SET service will write a parameter value to the drive).

One parameter group is reserved for configuration of parameters resident on the DeviceNet interface itself. The supported parameters comprising this group are detailed in Table 4.

Table 4: DeviceNet Interface Configuration Group Parameters

Parameter Name	Access Rules	Data Type	Adjustment Range
Drive A Network Communication Loss Action	Get / Set	USINT	0 = Set all consumed data to 0 (default) 1 = Do nothing (retain last data values) 2 = Stop motor with decelerated stop 3 = Stop motor with coast stop 4 = Trip drive "E" (emergency off) 5 = Run a preset speed
Drive A Preset Speed	Get / Set	USINT	1 ~ 15 = preset speeds #1 ~ #15 (default = 1, applies only when above parameter is set to "Run a preset speed")
Drive B Network Communication Loss Action	Get / Set	USINT	0 = Set all consumed data to 0 (default) 1 = Do nothing (retain last data values) 2 = Stop motor with decelerated stop 3 = Stop motor with coast stop 4 = Trip drive "E" (emergency off) 5 = Run a preset speed
Drive B Preset Speed	Get / Set	USINT	1 ~ 15 = preset speeds #1 ~ #15 (default = 1, applies only when above parameter is set to "Run a preset speed")
DNETOBJ BOI attribute	Get / Set	BOOL	Sets DeviceNet object's bus-off interrupt attribute selection (default = 0)
Interface firmware Application version	Get	STRUCT of:	
		USINT	Version
		USINT	Revison
Interface firmware Bootstrap Loader version	Get	STRUCT of:	
		USINT	Version
		USINT	Revision

11. MMI Port Use

The External DeviceNet Interface is equipped with an on-board RS232 Man-Machine Interface (MMI) port. This port allows the unit to communicate to a standard personal computer via its serial (COM) port. This can be accomplished by using the 2-meter DB9-to-RJ45 MMI port cable provided with your interface kit.

Current support for the MMI port is provided by the free ICC FlashLoader utility, which runs on the Microsoft Windows NT/95/98/2000 operating systems. This utility allows the DeviceNet interface's internal flash memory to be upgraded in the field, providing alternative control data, new parameter access, and future drive series support.

We are continually striving to enhance the functionality and flexibility of our products, and therefore periodically release new embedded firmware to achieve these goals and meet customer requests. The FlashLoader utility, usage instructions, new flash firmware files and all related documentation (such as updated user manuals and Electronic Data Sheet (EDS) files) can be downloaded as complete support packages from http://www.iccdesigns.com. Check this internet site periodically to determine if new support packages have been released for your DeviceNet interface unit.

12. Notes

TOSHIBA

TOSHIBA INTERNATIONAL CORPORATION

INDUSTRIAL DIVISION
13131 West Little York Rd., Houston, TX 77041
Tel: [800] 231-1412 / [713] 466-0277 Fax: [713] 466-8773
World Wide Web http://www.tic.toshiba.com

Printed in U.S.A

ICC

INDUSTRIAL CONTROL COMMUNICATIONS