
ADJUSTABLE SPEED DRIVE NETWORK INTERFACE



INDUSTRIAL CONTROL COMMUNICATIONS



PBDP-110

PROFIBUS-DP COMMUNICATIONS INTERFACE
FOR THE TOSHIBA 7-SERIES AND 9-SERIES
ADJUSTABLE SPEED DRIVES



Introduction

Thank you for purchasing the ICC PBDP-110 Profibus-DP Communications Interface for the Toshiba 7-Series and 9-Series Adjustable Speed Drives. Before using the PBDP-110 interface, please familiarize yourself with the unit 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 PBDP-110 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 PBDP-110 Profibus-DP 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 PBDP-110 interface:

- Toshiba *TOSVERT VF-S7 Series Instruction Manual*
- Toshiba *TOSVERT VF-S9 Series Instruction Manual*
- Toshiba *TOSVERT VF-A7 Series Instruction Manual*
- Toshiba *G7 Series Operation Manual*
- Toshiba *VF-S7 Industrial Inverter Serial Communications Option Manual*

If you do not have copies available of the documents relevant to your installation, please contact Toshiba or your local Toshiba distributor to obtain them, or copies may be downloaded from <http://www.tic.toshiba.com> (subject to availability).

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

- External PBDP-110 interface in DIN rail mountable case
- 2 meter DB9-RJ45 MMI port cable (part number 10369)
- This manual



PBDP-110 Profibus-DP Interface User's Manual

Part Number 10407-V1.00-000

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Notice to Users

INDUSTRIAL CONTROL COMMUNICATIONS INC.'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE-SUPPORT DEVICES OR SYSTEMS. Life-support devices or systems are devices or systems intended to sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling and user's manual, can be reasonably expected to result in significant injury.

No complex software or hardware system is perfect. Bugs may always be present in a system of any size. In order to prevent danger to life or property, it is the responsibility of the system designer to incorporate redundant protective mechanisms appropriate to the risk involved.

Usage Precautions

Operating Environment

- Please use the PBDP-110 only when the ambient temperature of the environment into which the PBDP-110 is installed is within the following specified temperature limits:
Operation: -10 ~ +50°C (+14 ~ +122°F)
Storage: -40 ~ +85°C (-40 ~ +185°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 section in this manual pertaining to grounding (section 4).
- Route all communication cables separate from the drive's 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 PBDP-110's Profibus shield terminal to either of the above-mentioned grounds or any other power ground.
- When making connections between the PBDP-110 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

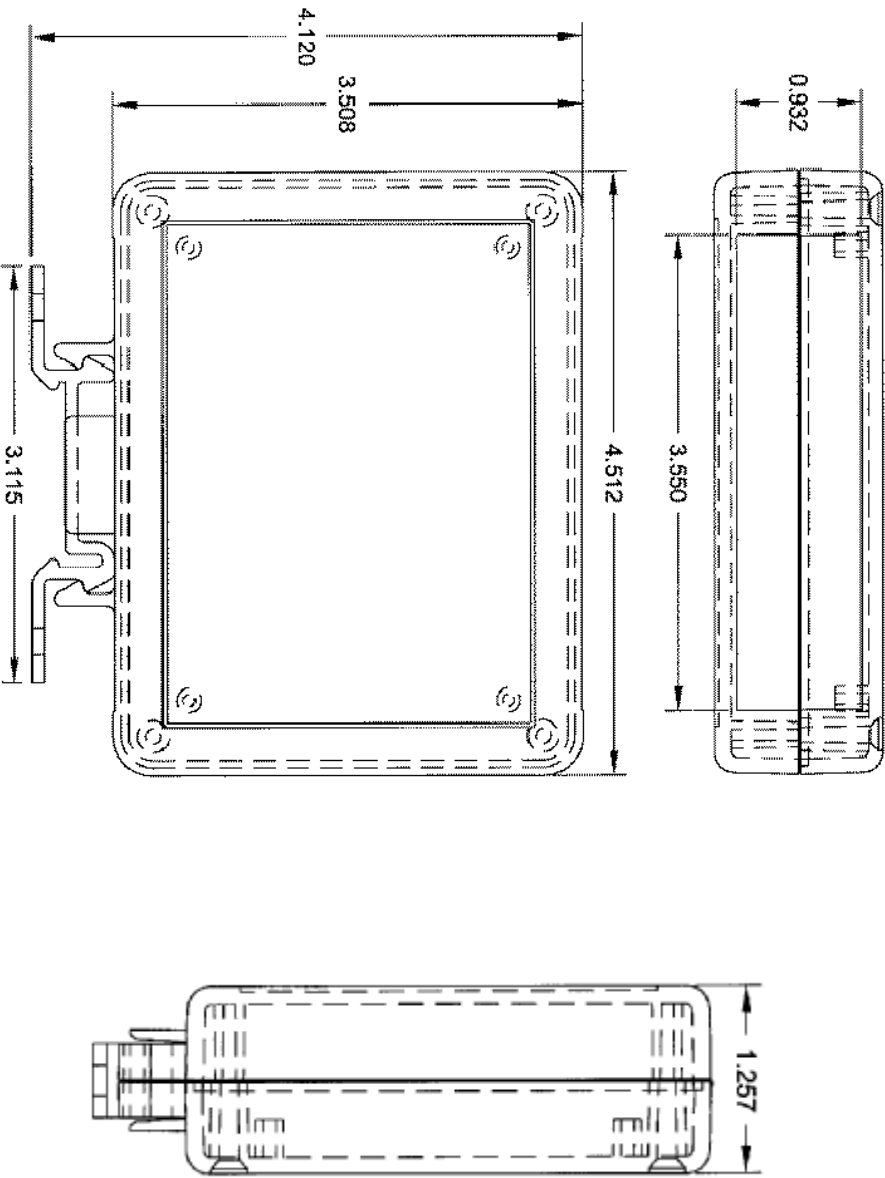
- Do not touch or insert a rod or any other item into the PBDP-110's case while power is applied, as this may lead to electrical shock or device damage.
- Commission the disposal of the PBDP-110 to a specialist.
- Do not assign the same network address to more than one PBDP-110 station in the same network. For a detailed explanation of station addressing, refer to section 8.
- Because the PBDP-110 derives its control power from the drive connected to Channel A, removing power from that drive will also cause the PBDP-110 to lose power, even if power is still applied to the drive connected to channel B.
- When only 1 drive is connected to the PBDP-110, it must be connected to Channel A.

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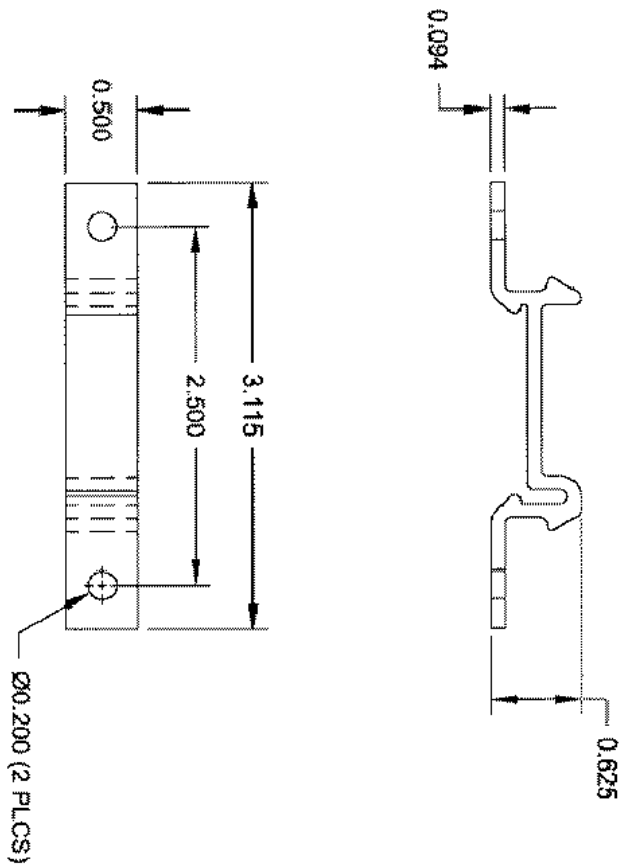
1. Mechanical Diagrams

1.1 Enclosure



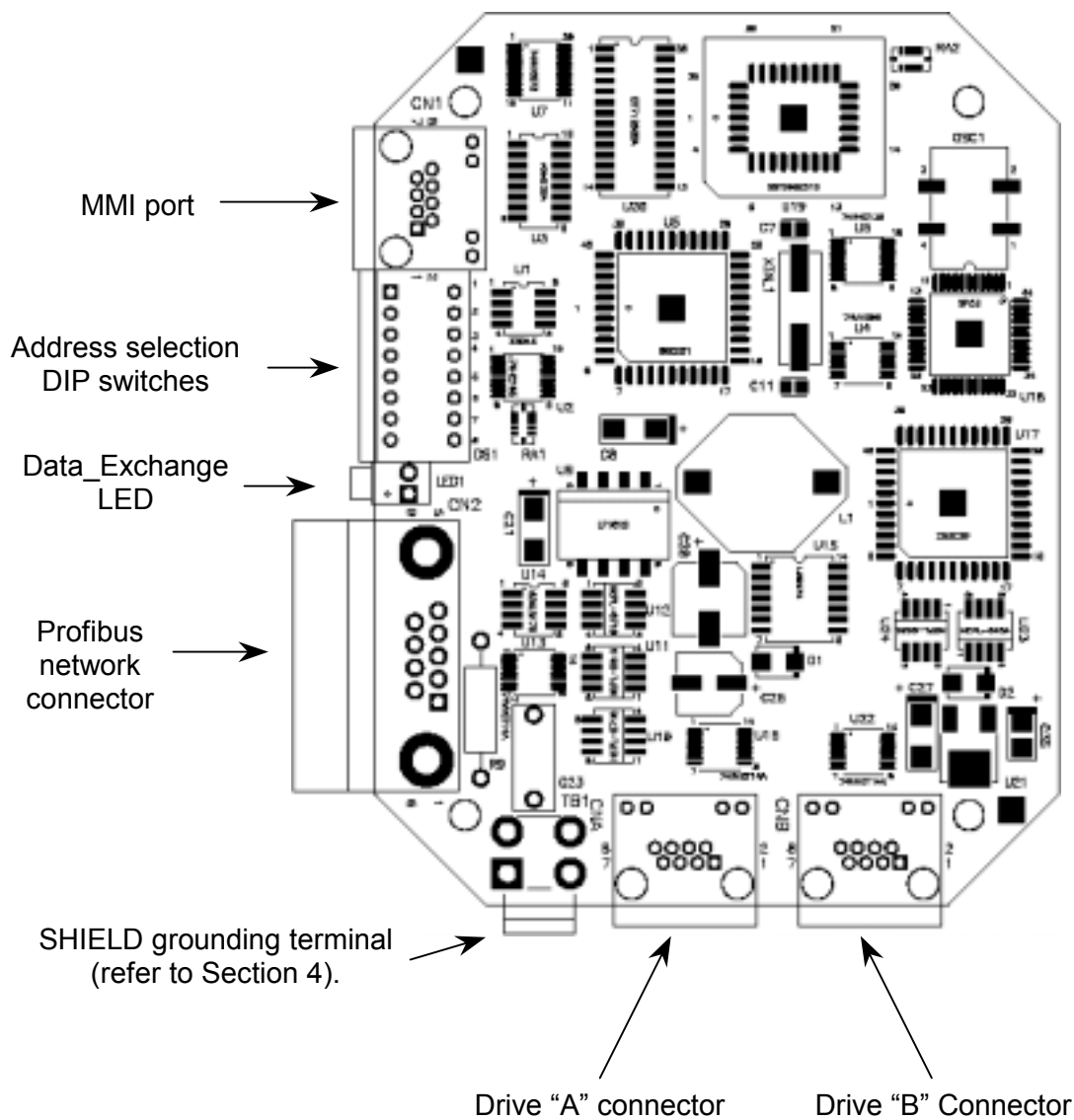
(All units are in inches)

1.2 Mounting Clip



(All units are in inches)

1.3 External Interface



Note that for clarity the above diagram shows the PBDP-110 unit removed from its case. However, it is not necessary to remove the unit from its case in order to install or configure the PBDP-110.

2. Feature Summary

The PBDP-110 interface provides a wide array of network data access and drive control features. Combined with the flexible configuration and high-speed data transfer capabilities of the Profibus network, this allows powerful networked control and monitoring systems to be designed. Some of the main features provided by the PBDP-110 which allow for this control and configurability are briefly described here:

Protocol

Profibus DP (Decentralized Periphery) as specified in European standard EN 50170. The PBDP-110 can also co-exist simultaneously on networks using Profibus-FMS.

Network Baud Rates

Supports all Profibus baud rates from 9.6kbaud to 12Mbaud. The network baud rate is automatically detected and continuously monitored during operation; no parameter settings are necessary.

Drive Connections

The PBDP-110 provides support for simultaneous connection of two 7-series or 9-series Toshiba drives. Both drives share a common Profibus station address. By supporting 2 drives per interface, the maximum number of drives that can be connected to 1 Profibus network segment without requiring repeaters increases from 31 (31 drives + 1 master) to 62 (31 PBDP-110 units + 1 master).

Power Supply

Self-contained. Powered directly from the drive connected to the Channel A communications port. No external power supply devices or connections are required.

Isolation

The PBDP-110 has 3 separate isolated circuitry sections. Each drive is fully optically isolated from each other, and both drives are optically isolated from the Profibus network. By using optically isolated connections to the drives and the Profibus network, grounding differential problems are eliminated and noise immunity characteristics are greatly improved.

Drive AutoScan Algorithm

Connections to the drives are automatically established and continuously monitored. No drive configuration needs to be performed to connect the PBDP-110 and communicate via the Profibus network. Just plug it in – it's that simple.

Global Control Functions

- **Freeze mode:** Input (monitor) data values are held constant within the PBDP-110 until the next “freeze” command or an “unfreeze” command is received. Used primarily for synchronized monitoring of multiple Profibus nodes.
- **Sync mode:** Output (control) data values are held constant within the PBDP-110 until the next “sync” command or an “unsync” command is received. Used primarily for synchronized control of multiple Profibus nodes.
- **Clear Data:** All output (control) data values are cleared to “0”.

Network Watchdog

A network watchdog function is always operating within the PBDP-110. In the event of a disconnection from the Profibus network or loss of the network master, the PBDP-110 can automatically switch any attached drives over to local control (if selected at time of unit commissioning).

Indicators

- 1 green LED is provided to indicate when the PBDP-110 has achieved the DATA_EXCHANGE state with the Profibus network master. This serves as a convenient indicator that the Profibus master and PBDP-110 are configured properly and are exchanging data.
- 1 green LED on the MMI interface port. The context is application-specific, but under normal operation blinks at a 0.5Hz rate as a “heartbeat” indicator. Also indicates data transfer when used with the Flashloader programming utility.
- 1 green LED on each of the Channel A and Channel B drive connectors, which indicate that the port is receiving power from the corresponding drive.

Profibus Network Connector

The network interface is a standard DB9 female connector with the following signals provided:

Pin Number	Function	In/Out
3	Profibus network “B” (positive) data line	In/out
4	RTS signal – direction control for fiber optic network interface	Out
5	DGND – power supply ground internally connected to the interface board’s isolated ground	-
6	VP – power supply +5v internally connected to the interface board’s isolated P5.	-
8	Profibus network “A” (negative) data line	In/out
9	RTS signal ground reference – internally connected to the interface board’s isolated ground	-
1, 2, 7	No connection	-

In addition to the above signals, the metallic housing of the DB9 connector is connected to the shield section of the interface board. The shield section is attached to the metal ground terminal on the bottom of the unit, where a ground wire can be attached to connect the Profibus network cable shield to ground. Refer to section 4 of this document for more information related to grounding.

Drive Network Connectors

TTL-level. 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 PBDP-110 to the drives.

MMI Port Connector

RS232-level. Use the DB9-to-RJ-45 cable supplied with the PBDP-110 kit to interface with the unit via the Flashloader programming utility (refer to section 12).

Input/Output Data

The PBDP-110 presents a module interface, supporting 2 different modules depending on the number of drives connected to the unit.

If the PBDP-110 is configured for 1 drive (the Channel A drive), the interface's cyclic data sizes are fixed at 16 bytes of output (control) data configured as four 32-bit words, and 24 bytes of input (status) data configured as six 32-bit words.

If the PBDP-110 is configured for both drives (Channel A and B), the interface's cyclic data sizes are fixed at 32 bytes of output (control) data configured as eight 32-bit words, and 48 bytes of input (status) data configured as twelve 32-bit words.

Via these data structures, any data item (commands, monitor data and parameters) available in the drive can be accessed. For detailed explanations of the format and usage of this data, refer to sections 9 and 10 of this document.

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 connectors.

3. Installing The Interface

The PBDP-110 connects to each drive via the drive's common serial (logic level) communication port, typically located on either the main drive control board (G7), on the front of the drive enclosure under a small snap-on cover (A7, S9), or on the right-hand side of the drive enclosure under a small snap-on cover (S7). Although no drive parameters need to be configured in order to use the PBDP-110, it is advantageous to check that the drive's common serial communication data rate is set to its maximum speed. Because the PBDP-110 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 common serial communication data rate, refer to the appropriate manual supplied with your drive.

Note that this drive communication data rate setting is independent of the Profibus network data rate, which is configured solely by the Profibus master station. Also note that the common serial communication parameters of each drive are handled independently by the PBDP-110, which means that different drive families may be connected to different channels of the unit in any combination, and that the drives connected to each channel may simultaneously communicate to the unit at completely different baud rates, parity settings, etc.

Installation of the PBDP-110 Profibus interface should only be performed by a qualified technician familiar with the maintenance and operation of the connected drives. To install the PBDP-110, complete the following steps:

3.1 Installation for G7 Drives

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 10 for more information).
4. Remove the drive's front cover / open the drive's cabinet door (refer to the appropriate drive manual for instructions how to do this).
5. The drive's Electronic Operator Interface (EOI) can communicate with the drive via either the RS485/RS232 channel (CNU1/CNU1A) or the common serial channel (CNU2/CNU2A). Because the PBDP-110 uses the common serial channel, the EOI must be configured to use the RS485/RS232 channel. If the drive to be connected is currently using CNU2 (on the drive control board) and

CNU2A (on the EOI), then this connection must first be switched over to CNU1 (on the drive control board) and CNU1A (on the EOI). Refer to Toshiba's documentation for any precautions or notices regarding this connection change. If the EOI is already connected via the RS485/RS232 channel, then no change is required.

6. Connect the drive's common serial communication port (CNU2) to "Channel A" of the PBDP-110 with the communication cable (communication cable is not included with the interface kit). When choosing cables for this connection, standard 24 AWG category 5 (CAT5) 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 CAT5 UTP cables available, ICC strongly recommends using only high-quality cables from reputable manufacturers to guarantee optimal noise immunity and cable longevity. Ensure that each end of the cable is fully seated into the modular connector, 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.
7. Reinstall the drive's front cover / close the drive's cabinet door.
8. Repeat steps 1, 2, 4, 5, 6 and 7 to connect another drive to "Channel B" on the interface, if desired.
9. Connect the Profibus network cable to the DB9 connector marked "Network" on the PBDP-110. If a ground cable is going to be used, attach the ground cable to the terminal marked "Shield GND" on the bottom side of the PBDP-110 enclosure (refer to section 4). Refer to the Profibus Specification for detailed network wiring guidelines. Ensure that the Profibus network cable is tightly screwed onto the DB9 connector, 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.
10. Take a moment to verify that the PBDP-110 and all network cables have sufficient clearance from drives, motors, or power-carrying electrical wiring.
11. Configure the Profibus slave address via the DIP switches on the front of the interface (refer to section 8).
12. 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 ICC or your local drive distributor or manufacturer for assistance if the problem persists.

3.2 Installation for S7, S9 and A7 Drives

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 10 for more information).
4. Remove the drive's common serial communication port cover (refer to the appropriate drive manual for instructions how to do this). Do not discard this cover, as it should be reinstalled to minimize contamination of the port's electrical contacts if the interface is ever disconnected from the drive.
5. Connect the drive's common serial communication port to "Channel A" of the PBDP-110 with the communication cable (communication cable is not included with the interface kit). When choosing cables for this connection, standard 24 AWG category 5 (CAT5) 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 CAT5 UTP cables available, ICC strongly recommends using only high-quality cables from reputable manufacturers to guarantee optimal noise immunity and cable longevity. Ensure that each end of the cable is fully seated into the modular connector, 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. Repeat steps 1, 2, 4 and 5 to connect another drive to "Channel B" on the interface, if desired.
7. Connect the Profibus network cable to the DB9 connector marked "Network" on the PBDP-110. If a ground cable is going to be used, attach the ground cable to the terminal marked "Shield GND" on the bottom side of the PBDP-110 enclosure (refer to section 4). Refer to the Profibus Specification for detailed network wiring guidelines. Ensure that the Profibus network cable is tightly screwed onto the DB9 connector, 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.
8. Take a moment to verify that the PBDP-110 and all network cables have sufficient clearance from drives, motors, or power-carrying electrical wiring.
9. Configure the Profibus slave address via the DIP switches on the front of the interface (refer to section 8).
10. 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 ICC or your local drive distributor or manufacturer 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. The PBDP-110 Profibus interface is provided with a “Shield GND” terminal on the bottom of the unit. The “Shield GND” terminal is directly connected to the metallic housing of the DB9 connector, which should in turn be connected to the shield of the Profibus network cable through the Profibus connector. To ground the network cable shield, therefore, connect a wire to the Shield GND terminal, and then connect the other end of the wire to an appropriate ground. For specific requirements regarding protective grounding and the Profibus network, refer to the Profibus Standard (EN 50 170, part 1).

Please be sure to consider the following general points for making proper ground connections:

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 PBDP-110 Shield GND terminal 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.)

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 ~ +50°C (+14 ~ +122°F)
Storage Temperature	-40 ~ +85°C (-40 ~ +185°F)
Relative Humidity	20% ~ 90% (without condensation)
Vibration	5.9m/s ² {0.6G} or less (10 ~ 55Hz)
Grounding	According to EN 50 170, part 1
Cooling Method	Self-cooled

6. Maintenance And Inspection

Preventive maintenance and inspection is required to maintain the communication 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 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 dust covers for all unused RJ45 ports are seated firmly in their connectors.
- Check that the drive and network communication cables are not loose. Tighten / reseal as necessary.
- Where applicable, 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 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 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 communication interface is not used immediately after purchase or when it is not used for an extended period of time.

- Avoid storing the unit in places that are hot or humid, or that contain large quantities of dust or metallic dust. Store the unit in a well-ventilated location.
- When not using the 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

This communications interface is covered under warranty by ICC 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 Industrial Control Communications, Inc. or your local distributor.

8. Selecting the Profibus Network Address

The 8-position piano-style “Address” DIP switches accessible from the front of the unit allow selection of the Profibus slave address. Switch positions #1 ~ #7 select the address. Switch position #8 is reserved for production test use, and should always be kept in the “OFF” position. The PBDP-110 does not support the Profibus “set_slave_address” service.

The address settings for the various switch configurations are as follows:

SW1	SW2	SW3	SW4	SW5	SW6	SW7	Addr
OFF	OFF	OFF	OFF	OFF	OFF	OFF	0
ON	OFF	OFF	OFF	OFF	OFF	OFF	1
OFF	ON	OFF	OFF	OFF	OFF	OFF	2
ON	ON	OFF	OFF	OFF	OFF	OFF	3
OFF	OFF	ON	OFF	OFF	OFF	OFF	4
ON	OFF	ON	OFF	OFF	OFF	OFF	5
OFF	ON	ON	OFF	OFF	OFF	OFF	6
ON	ON	ON	OFF	OFF	OFF	OFF	7
OFF	OFF	OFF	ON	OFF	OFF	OFF	8
ON	OFF	OFF	ON	OFF	OFF	OFF	9
OFF	ON	OFF	ON	OFF	OFF	OFF	10
ON	ON	OFF	ON	OFF	OFF	OFF	11
OFF	OFF	ON	ON	OFF	OFF	OFF	12
ON	OFF	ON	ON	OFF	OFF	OFF	13
OFF	ON	ON	ON	OFF	OFF	OFF	14
ON	ON	ON	ON	OFF	OFF	OFF	15
OFF	OFF	OFF	OFF	ON	OFF	OFF	16
ON	OFF	OFF	OFF	ON	OFF	OFF	17
OFF	ON	OFF	OFF	ON	OFF	OFF	18
ON	ON	OFF	OFF	ON	OFF	OFF	19
OFF	OFF	ON	OFF	ON	OFF	OFF	20
ON	OFF	ON	OFF	ON	OFF	OFF	21
OFF	ON	ON	OFF	ON	OFF	OFF	22
ON	ON	ON	OFF	ON	OFF	OFF	23
OFF	OFF	OFF	ON	ON	OFF	OFF	24
ON	OFF	OFF	ON	ON	OFF	OFF	25
OFF	ON	OFF	ON	ON	OFF	OFF	26
ON	ON	OFF	ON	ON	OFF	OFF	27
OFF	OFF	ON	ON	ON	OFF	OFF	28
ON	OFF	ON	ON	ON	OFF	OFF	29
OFF	ON	ON	ON	ON	OFF	OFF	30
ON	ON	ON	ON	ON	OFF	OFF	31

SW1	SW2	SW3	SW4	SW5	SW6	SW7	Addr
OFF	OFF	OFF	OFF	OFF	ON	OFF	32
ON	OFF	OFF	OFF	OFF	ON	OFF	33
OFF	ON	OFF	OFF	OFF	ON	OFF	34
ON	ON	OFF	OFF	OFF	ON	OFF	35
OFF	OFF	ON	OFF	OFF	ON	OFF	36
ON	OFF	ON	OFF	OFF	ON	OFF	37
OFF	ON	ON	OFF	OFF	ON	OFF	38
ON	ON	ON	OFF	OFF	ON	OFF	39
OFF	OFF	OFF	ON	OFF	ON	OFF	40
ON	OFF	OFF	ON	OFF	ON	OFF	41
OFF	ON	OFF	ON	OFF	ON	OFF	42
ON	ON	OFF	ON	OFF	ON	OFF	43
OFF	OFF	ON	ON	OFF	ON	OFF	44
ON	OFF	ON	ON	OFF	ON	OFF	45
OFF	ON	ON	ON	OFF	ON	OFF	46
ON	ON	ON	ON	OFF	ON	OFF	47
OFF	OFF	OFF	OFF	ON	ON	OFF	48
ON	OFF	OFF	OFF	ON	ON	OFF	49
OFF	ON	OFF	OFF	ON	ON	OFF	50
ON	ON	OFF	OFF	ON	ON	OFF	51
OFF	OFF	ON	OFF	ON	ON	OFF	52
ON	OFF	ON	OFF	ON	ON	OFF	53
OFF	ON	ON	OFF	ON	ON	OFF	54
ON	ON	ON	OFF	ON	ON	OFF	55
OFF	OFF	OFF	ON	ON	ON	OFF	56
ON	OFF	OFF	ON	ON	ON	OFF	57
OFF	ON	OFF	ON	ON	ON	OFF	58
ON	ON	OFF	ON	ON	ON	OFF	59
OFF	OFF	ON	ON	ON	ON	OFF	60
ON	OFF	ON	ON	ON	ON	OFF	61
OFF	ON	ON	ON	ON	ON	OFF	62
ON	ON	ON	ON	ON	ON	OFF	63

(continued...)

SW1	SW2	SW3	SW4	SW5	SW6	SW7	Addr
OFF	OFF	OFF	OFF	OFF	OFF	ON	64
ON	OFF	OFF	OFF	OFF	OFF	ON	65
OFF	ON	OFF	OFF	OFF	OFF	ON	66
ON	ON	OFF	OFF	OFF	OFF	ON	67
OFF	OFF	ON	OFF	OFF	OFF	ON	68
ON	OFF	ON	OFF	OFF	OFF	ON	69
OFF	ON	ON	OFF	OFF	OFF	ON	70
ON	ON	ON	OFF	OFF	OFF	ON	71
OFF	OFF	OFF	ON	OFF	OFF	ON	72
ON	OFF	OFF	ON	OFF	OFF	ON	73
OFF	ON	OFF	ON	OFF	OFF	ON	74
ON	ON	OFF	ON	OFF	OFF	ON	75
OFF	OFF	ON	ON	OFF	OFF	ON	76
ON	OFF	ON	ON	OFF	OFF	ON	77
OFF	ON	ON	ON	OFF	OFF	ON	78
ON	ON	ON	ON	OFF	OFF	ON	79
OFF	OFF	OFF	OFF	ON	OFF	ON	80
ON	OFF	OFF	OFF	ON	OFF	ON	81
OFF	ON	OFF	OFF	ON	OFF	ON	82
ON	ON	OFF	OFF	ON	OFF	ON	83
OFF	OFF	ON	OFF	ON	OFF	ON	84
ON	OFF	ON	OFF	ON	OFF	ON	85
OFF	ON	ON	OFF	ON	OFF	ON	86
ON	ON	ON	OFF	ON	OFF	ON	87
OFF	OFF	OFF	ON	ON	OFF	ON	88
ON	OFF	OFF	ON	ON	OFF	ON	89
OFF	ON	OFF	ON	ON	OFF	ON	90
ON	ON	OFF	ON	ON	OFF	ON	91
OFF	OFF	ON	ON	ON	OFF	ON	92
ON	OFF	ON	ON	ON	OFF	ON	93
OFF	ON	ON	ON	ON	OFF	ON	94
ON	ON	ON	ON	ON	OFF	ON	95

SW1	SW2	SW3	SW4	SW5	SW6	SW7	Addr
OFF	OFF	OFF	OFF	OFF	ON	ON	96
ON	OFF	OFF	OFF	OFF	ON	ON	97
OFF	ON	OFF	OFF	OFF	ON	ON	98
ON	ON	OFF	OFF	OFF	ON	ON	99
OFF	OFF	ON	OFF	OFF	ON	ON	100
ON	OFF	ON	OFF	OFF	ON	ON	101
OFF	ON	ON	OFF	OFF	ON	ON	102
ON	ON	ON	OFF	OFF	ON	ON	103
OFF	OFF	OFF	ON	OFF	ON	ON	104
ON	OFF	OFF	ON	OFF	ON	ON	105
OFF	ON	OFF	ON	OFF	ON	ON	106
ON	ON	OFF	ON	OFF	ON	ON	107
OFF	OFF	ON	ON	OFF	ON	ON	108
ON	OFF	ON	ON	OFF	ON	ON	109
OFF	ON	ON	ON	OFF	ON	ON	110
ON	ON	ON	ON	OFF	ON	ON	111
OFF	OFF	OFF	OFF	ON	ON	ON	112
ON	OFF	OFF	OFF	ON	ON	ON	113
OFF	ON	OFF	OFF	ON	ON	ON	114
ON	ON	OFF	OFF	ON	ON	ON	115
OFF	OFF	ON	OFF	ON	ON	ON	116
ON	OFF	ON	OFF	ON	ON	ON	117
OFF	ON	ON	OFF	ON	ON	ON	118
ON	ON	ON	OFF	ON	ON	ON	119
OFF	OFF	OFF	ON	ON	ON	ON	120
ON	OFF	OFF	ON	ON	ON	ON	121
OFF	ON	OFF	ON	ON	ON	ON	122
ON	ON	OFF	ON	ON	ON	ON	123
OFF	OFF	ON	ON	ON	ON	ON	124
ON	OFF	ON	ON	ON	ON	ON	125
OFF	ON	ON	ON	ON	ON	ON	126

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 address switch settings are read by the interface only on power-up. Therefore, if the address is changed, be sure to power the PBDP-110 off momentarily by cycling power to the drive connected to “Channel A” or by disconnecting/reconnecting the cable connecting “Channel A” to the drive.

9. Exchanged Data Structures

9.1 Output (Control) Data Format

The size of the output data structure from the network master to the PBDP-110 depends on the module selected from the GSD file for the network configuration tool. Module #1, intended for applications where only 1 drive is connected to the PBDP-110 (via Channel A), is comprised of 16 bytes structured as four 32-bit words. Module #2, intended for applications where drives are connected to both Channel A and Channel B, is comprised of 32 bytes structured as eight 32-bit words.

Offset	Data	Offset	Data
0	Reserved	16	Reserved
1	Reserved	17	Reserved
2	Drive A command high byte	18	Drive B command high byte
3	Drive A command low byte	19	Drive B command low byte
4	Reserved	20	Reserved
5	Reserved	21	Reserved
6	Drive A frequency command high byte	22	Drive B frequency command high byte
7	Drive A frequency command low byte	23	Drive B frequency command low byte
8	Reserved / Drive A action bits	24	Reserved / Drive B action bits
9	Reserved	25	Reserved
10	Drive A parameter number high byte	26	Drive B parameter number high byte
11	Drive A parameter number low byte	27	Drive B parameter number low byte
12	Reserved	28	Reserved
13	Reserved	29	Reserved
14	Drive A parameter data to write high byte	30	Drive B parameter data to write high byte
15	Drive A parameter data to write low byte	31	Drive B parameter data to write low byte

Locations marked “Reserved” in the above table are reserved for future use. Although any data placed in these locations is currently ignored, future firmware releases may use these locations for data transfer.

The format of all information transferred for Drive B is identical to that for Drive A. Therefore, all data descriptions given here apply equally for both Drives A and B.

Command Word

Bit-mapped drive control command word (drive parameter number FA00). This is the location where run/stop, etc. commands are written. An example command word can be found in Table 1. Because the format of this command word depends on the drive manufacturer's specifications, please refer to your specific drive's *Serial Communications Manual* for the exact structure of this word.

Using the example command word in Table 1, some representative command words that can be used to control your drive via the Profibus network are:

0xC400Profibus command valid, Profibus frequency valid, drive run forward
 0xC600Profibus command valid, Profibus frequency valid, drive run reverse
 0xC000Profibus command valid, Profibus frequency valid, drive stop
 0xE000Profibus command valid, Profibus frequency valid, reset drive fault

Although the above examples all show Profibus command and frequency valid, input (status) data can always be monitored from the network regardless of the settings of bits 14 and 15 in the command word.

Table 1 : Example Command Word Format (S9 Drive)

		Bit	Function	0	1
High Byte		15	Command source	Local	Network
		14	Frequency command source	Local	Network
		13	Fault reset	N/A	Reset
		12	Emergency OFF command	N/A	EOFF
		11	Coast stop command	N/A	Coast stop
		10	Run / stop command	Stop	Run
		9	Forward / reverse selection	Forward	Reverse
		8	Jog command	N/A	Jog
Low Byte		7	DC injection braking	N/A	DC injection cmd.
		6	Accel / decel #1/#2 selection	#1	#2
		5	Reserved	--	--
		4	Reserved	--	--
		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

Drive parameter number FA01. 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 $55.34 \times 100 = 5534$, which converted to hexadecimal is 0x159E. The frequency command high byte (offset 6 or 22) must therefore contain 0x15, and the frequency command low byte (offset 7 or 23) must contain 0x9E.

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

Action Bits / Parameter Number

Parameter action bits and 16-bit parameter register number. Refer to section 10 for a detailed explanation of these items.

Parameter Data

During parameter register writes, this word contains the data to write. Refer to section 10 for a detailed explanation of this data word

Again, in case of any discrepancies, documentation provided by the drive manufacturer supercedes the examples given here.

9.2 Input (Status) Data Format

The size of the input data structure from the PBDP-110 to the network master depends on the module selected from the GSD file for the network configuration tool. Module #1, intended for applications where only 1 drive is connected to the PBDP-110 (via Channel A), is comprised of 24 bytes structured as six 32-bit words. Module #2, intended for applications where drives are connected to both Channel A and Channel B, is comprised of 48 bytes structured as twelve 32-bit words.

Offset	Data	Offset	Data
0	Reserved	24	Reserved
1	Reserved	25	Reserved
2	Drive A status high byte	26	Drive B status high byte
3	Drive A status low byte	27	Drive B status low byte
4	Reserved	28	Reserved
5	Reserved	29	Reserved
6	Drive A output frequency high byte	30	Drive B output frequency high byte
7	Drive A output frequency low byte	31	Drive B output frequency low byte
8	Reserved	32	Reserved
9	Reserved	33	Reserved
10	Drive A output current high byte	34	Drive B output current high byte
11	Drive A output current low byte	35	Drive B output current low byte
12	Reserved	36	Reserved
13	Reserved	37	Reserved
14	Drive A output voltage high byte	38	Drive B output voltage high byte
15	Drive A output voltage low byte	39	Drive B output voltage low byte
16	Reserved / Drive A response bits	40	Reserved / Drive B response bits
17	Reserved	41	Reserved
18	Drive A parameter number response high byte	42	Drive B parameter number response high byte
19	Drive A parameter number response low byte	43	Drive B parameter number response low byte
20	Reserved	44	Reserved
21	Reserved	45	Reserved
22	Drive A parameter data response high byte	46	Drive B parameter data response high byte
23	Drive A parameter data response low byte	47	Drive B parameter data response low byte

Locations marked “Reserved” in the above table are reserved for future use. Presently, all “Reserved” input data is set to 0 by the PBDP-110. Future firmware releases, however, may use these locations for data transfer.

The format of all information transferred for Drive B is identical to that for Drive A. Therefore, all data descriptions given here apply equally for both Drives A and B.

Status Word

Bit-mapped drive status word (drive parameter number FE01). This is the location where run/stop status, etc. values are monitored. An example status word can be found in Table 2. Because the format of this status word depends on the drive manufacturer’s specifications, please refer to your drive’s *Serial Communications Manual* for the exact structure of this word.

Note that bit #15 is normally “reserved” by the drive manufacturer. The PBDP-110 uses this bit, however, to indicate whether it 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. If an “Offline” indication appears intermittently during operation, check the quality of the drive communication cable connections, and verify that the drive communication cable is not routed near other electrical noise-producing cables or equipment.

Table 2 : Example Status Word Format (S9 Drive)

Bit	Function	0	1
15	Drive online / offline status	Offline	Online
14	Reserved	Always “0”	
13	Reserved	Always “0”	
12	Reserved	Always “0”	
11	Reserved	Always “0”	
10	Run / stop status	Stopped	Running
9	Forward / reverse status	Forward	Reverse
8	Jog status	Not jogging	Jogging
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”	

Output Frequency

Drive parameter number FD00. Continuously reports the drive's operating frequency. In order to determine the drive's actual output frequency, the data contained in the output frequency word offsets must first be converted from hexadecimal to decimal, and then divided 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.

Output Current

Drive parameter number FE03. Continuously reports the drive's output current in %. In order to determine the drive's actual output current, the data contained in the output current word offsets must first be converted from hexadecimal to decimal, and then divided by 100. For example, if the output current high byte is 0x23 and the output current low byte is 0x15, then 0x2315 converted to decimal is 8981. Dividing this number by 100, the actual output current of 89.91% rated drive current is obtained.

Output Voltage

Drive parameter number FE05. Continuously reports the drive's output voltage in %. The actual output voltage calculation method is identical to that for output current given above.

Action Bits / Parameter Number

Parameter action bits and 16-bit parameter register number. Refer to section 10 for a detailed explanation of these items.

Parameter Data

During parameter register reads, this word contains the requested data response. Refer to section 10 for a detailed explanation of this data word

Again, in case of any discrepancies, documentation provided by the drive manufacturer supercedes the examples given here.

9.3 Diagnostics

When one of the connected drives faults, 1 byte of high-priority user diagnostics is supplied to the Profibus master. The format of the diagnostics byte is shown here:

Bit #:	7	6	5	4	3	2	1	0
	Reserved	Reserved	Reserved	Drive B Faulted	Reserved	Reserved	Reserved	Drive A Faulted
	Drive B Diagnostics				Drive A Diagnostics			

Reserved bits indicated in the above table are currently set to “0” by the PBDP-110, but may be used to transfer data in future firmware releases.

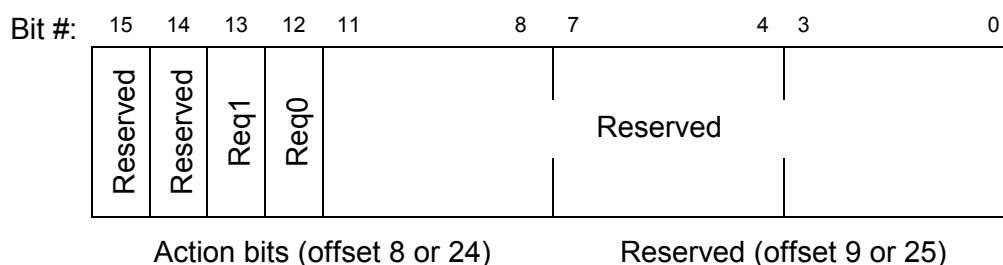
When a drive’s fault condition is cleared, a diagnostics status update is generated indicating the drive’s exit from the faulted state.

10. Parameter Register Access

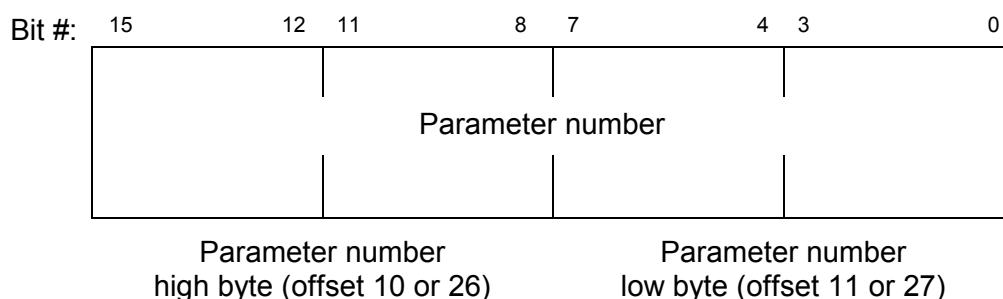
10.1 Parameter Number / Action Output Words

To access drive parameters, 2 output words and 2 action bits are provided in each drive's output data structure. The structure of these output words and action bits is as follows:

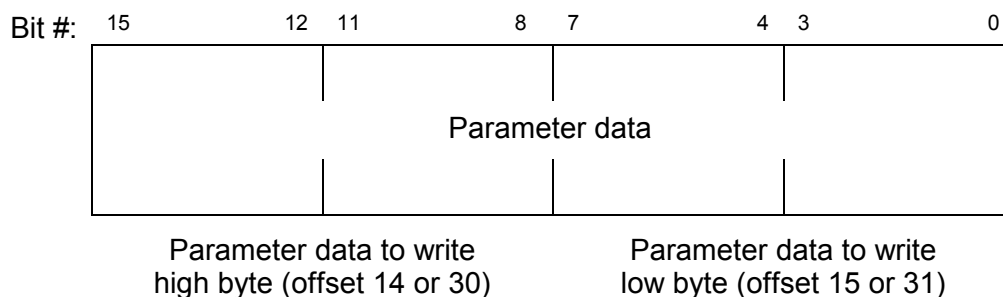
Action bits



Parameter number word



Parameter data write word

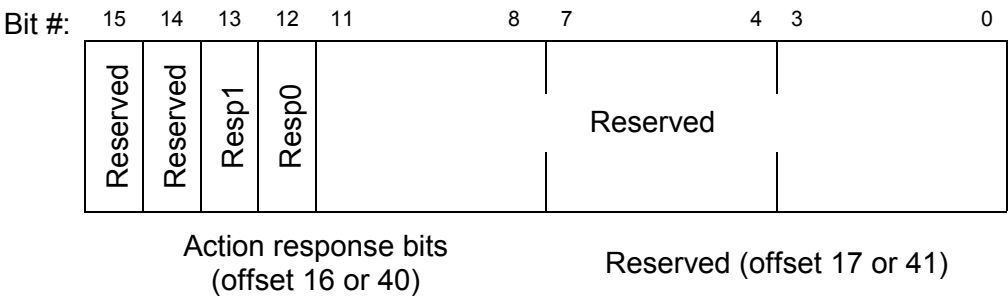


Note that all locations marked "Reserved" are ignored by the PBDP-110.

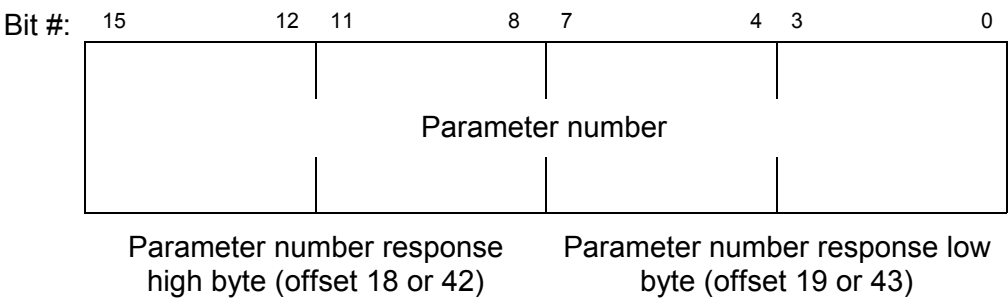
10.2 Parameter Number / Action Input Words

The response by the PBDP-110 to parameter read and write requests is placed in 2 input words and 2 input bits of the input data structure. The structure of these data items is as follows:

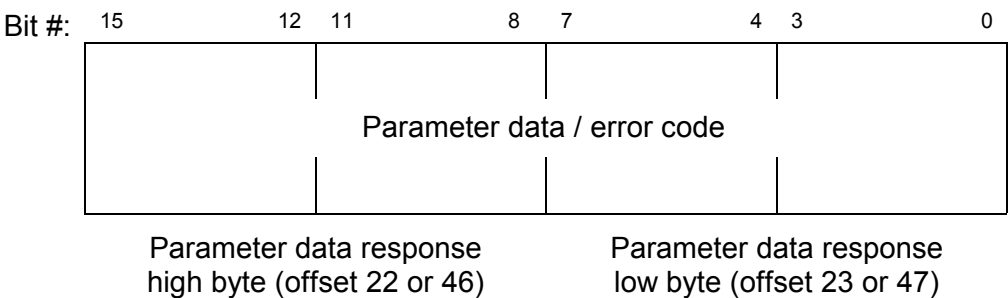
Response bits



Parameter number response word



Parameter data / error code response word



Note that all locations marked “Reserved” are set to 0 by the PBDP-110.

10.3 Parameter Access Procedure

In order to read from a parameter or write to a parameter, 2 control bits are provided for each drive's data structure. These bits, labeled Req1 and Req0 in the Action Bits word, can have the following values:

<u>Req1</u>	<u>Req0</u>	<u>Meaning</u>
0	0	No action (idle state)
0	1	Parameter read
1	0	Parameter write (RAM & EEPROM)
1	1	Parameter write (RAM only)

Similarly, when a drive responds to a parameter read or write request, 2 status bits per data structure are provided. These bits, labeled Resp1 and Resp0 in the Action Bits Response word, can have the following values:

<u>Resp1</u>	<u>Resp0</u>	<u>Meaning</u>
0	0	No action (idle state acknowledge)
0	1	Parameter read success acknowledge
1	0	Parameter write success acknowledge
1	1	Error indication

Note that the PBDP-110 will respond with Resp1:Resp0 = 1:0 upon a successful parameter write, regardless of whether the write was to RAM & EEPROM or to RAM only.

Performing a parameter read or write action from the Profibus master involves the following process:

1. Send a "no action" code (Req1=0 and Req0=0). Every parameter access must begin from the idle state. Once this state is sent, the Profibus master must then wait for the PBDP-110 to respond with an idle state acknowledge (Resp1=0 and Resp0=0).
2. If the action is to be a data write, set the parameter data in the parameter data write word. If the action is to be a data read, the parameter data write word value is irrelevant.
3. Set the parameter register number and action code (Req1 and Req0). For an explanation of parameter register numbers, refer to section 11.
4. Once the PBDP-110 receives the read or write request, it will begin processing it. The time required to complete the request depends primarily on the connected drive's baud rate setting and internal processing state, but can vary from several milliseconds to several tens of milliseconds.
5. Once the PBDP-110 has completed the request, it will place its response in the action bits response, parameter number response, and data / error code response locations:
 - If the request was a read, and the read was performed successfully, this will be indicated to the master by Resp1:Resp0 changing from 0:0 to 0:1. The parameter number response will equal the accessed parameter number, and the resulting data read will be placed in the data / error code response word.

- If the request was a write, and the write was performed successfully, this will be indicated to the master by Resp1:Resp0 changing from 0:0 to 1:0. The parameter number response will equal the accessed parameter number, and the data written to the drive will be reflected in the data / error code response word.
 - If an error occurred during the read or write request, this will be indicated to the master by Resp1:Resp0 changing from 0:0 to 1:1. The parameter number response will equal the parameter number that the master was attempting to access, and an error code reflecting the failure cause will be placed in the data / error code response word. For a list of possible error codes, refer to section 10.4.
6. In order to perform another parameter read or write, the master must once again send a “no action” code (Req1=0 and Req0=0), and the PBDP-110 must once again respond with an idle state acknowledge (Resp1=0 and Resp0=0) before the next read or write action can take place. Until a “no action” code is sent to the PBDP-110, the interface will ignore all data in the action bits, parameter number and parameter write data words. Also, as long as the master sends the “no action” code, the PBDP-110 will loop-back in the parameter number response word and parameter data / error code response word whatever data is sent to it in the corresponding output words.

The above procedure explanation holds true for both drives A and B, using the respective request and response locations in the output and input data structures.

10.4 Register Access Error Codes

When a parameter read or write error occurs, one of the following error codes will be returned in the parameter data response word:

<u>Error Code</u>	<u>Meaning</u>
0x0000	cannot execute
0x0001	data error (written data value outside of valid range)
0x0002	invalid parameter number
0x0064	attempt to write to a read-only parameter
0x0065	attempt to read from a write-only parameter
0x0066	other / unclassified error

11. Parameter Registers

The parameters that can be accessed via the parameter register access method outlined in section 10 are defined by the drive manufacturer. For a listing of the available parameters, their adjustment ranges and notable access behavior, refer to the appropriate “Parameter Reference” section of the drive’s *Serial Communications Option Manual*.

The following parameter numbers, which are not implemented in the drives, are used to access local information on the PBDP-110 interface:

Communication Number	Function	Read / Write	Adjustment Range
0xFC82	PBDP-110 application firmware version	Read only	High byte = firmware version Low byte = firmware revision

When accessing local parameters, it does not matter whether Channel A’s or Channel B’s parameter access registers are used; since these local registers are channel-independent, the same data/function will be accessed from both channels.

12. MMI Port Use / GSD Files

The PBDP-110 Profibus 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 Microsoft Windows platforms. This utility allows the 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 GSD files) can be downloaded as complete support packages from <http://www.iccdesigns.com>. It is suggested that you check this internet site prior to installation, and then periodically afterwards to determine if new support packages have been released and are available to upgrade your interface unit.

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Handwriting practice lines consisting of 20 horizontal lines.



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