Model PDP Series 400 maxDPU4F Hardware Guide

278705 Rev. A3

Refer to this publication for complete and accurate information that helps you better operate and service Metso Automation equipment. Your comments and suggestions are welcome.

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Contents

Chapter 1

Introduction

Distributed Processing Unit Functionality

The Model PDP Distributed Processing Unit (DPU), which runs under the Windows CE.net real-time multitasking operating system, is the hardware processing engine of the maxDNA distributed control system. The DPU performs primary data acquisition, control, and data processing functions.

The DPU, also known as maxDPU4F, is a self-contained microprocessor-based, rack-mounted unit, which occupies a single slot in a Remote Processing Unit cabinet using an 8-wide maxPAC backplane. It is designed to operate with user-defined combinations of maxDNA Model IOP Input/Output Modules, and to communicate with other devices, such as Programmable Logic Controllers and Remote Terminal Units.

As a station on maxNET, the DPU scans and processes information for use by other devices in the maxDNA system. Each DPU performs:

• Comprehensive alarming and calculations.

• Logging of Sequence of Events (SOE) data at 1 millisecond resolution.

• Acquisition of trend information.

• Continuous scanning of Model IOP I/O modules.

• Execution of predefined algorithms, called Function Blocks, for process control and data acquisition.

Model Numbers

Model PDP401 – DPU4F #181550

Model PDP403 – DPU4F #181550, Backup Cable #050292

Model PDP406 – DPU4F w/IRIG & Comm. #181551

Model PDP408 – DPU4F w/IRIG & Comm #181551, Backup Cable #050292

Distributed Processing Unit Hardware

A DPU consists of a printed circuit board containing the Control Processor and Input/Output Processor (IOP) and is installed in a maxPAC chassis. The DPU's front panel contains status LEDs, a MODE Switch, Backup Connector, Network Connectors, and takeover and reset buttons. An optional assembly also contains a Serial Port Connector for interface to PLCs and a BNC Connector for interface to an IRIG-B time source. See "Front Panel Controls and Features," later in this chapter.

Control Processor

The DPU is comprised of a single printed circuit board that contains a Pentium class Control Processor and a dedicated micro-controller for scanning I/O. There are also sockets on the board for 64 Mbytes of CompactFlash and 128 Mbytes of DRAM.

Performance

A multi-speed processing system is built into the maxDPU4F, which allows objects to be executed in three different time classes. From as fast as 10 msec to 1/2 second. Up to 8,500 control objects (Function Blocks)can be executed in the DPU. Note also that Function Blocks can be combined to create libraries of Standard and Custom Blocks. A Function Block can be as small as an Atomic Block, such as an AND or OR gate.

A data point management system (DPMS) keeps track of the object size and the total execution time for each time class.

I/O Bus Interface

A Motorola 68332 32-bit I/O processor and field programmable gate array (FPGA) are used to interface to both the Model IOP I/O bus and to the I/O Bus Expander Module (BEM) for remote I/O applications. Up to 60 Model IOP I/O modules can reside on each electrical bus. See Publication 278596, *maxPAC Hardware Reference Guide*, and for earlier Model 564 I/O, see 278563, *Model IOP I/O System Installation and Preparation*. The maximum length of the Model 564 I/O bus is 30 ft. The length of the remote I/O link with fiber optic extenders is up to 2000 m.

Fully Self Describing Object Oriented Database

All information regarding the operation of the DPU is kept in DPU memory, including: tag names, descriptions, tuning constants, alarm limits, etc. In addition, all graphical configuration data (sheet number, object location, wiring) is stored in the DPU.

This means that there is no possibility that the configuration observed is different than that which is installed in the DPU.

Objects are stored in a fully hierarchical database, allowing for easy cut and paste changes and protection of control strategies.

Fully Software Backplane Compliant

With the software backplane installed, the DPU can access any exposed data stored anywhere in a connected system as long as the connected system also uses the SPB Protocol. Peer-to-peer transfers are rapid and transparent. No independent transfer agent is required.

The Software Backplane uses subscription services where data is only transmitted when changes are detected.

Sequence of Events

Each DPU includes a built-in Sequence-of-Events (SOE) recorder that can monitor up to 512 discrete inputs. These inputs are scanned 1,000 times a second and state changes are time stamped with 1 ms resolution and stored in the DPU's 10,000-event buffer. Each input has a separately configurable digital filter for contact debounce.

Distributed Processing Unit Specifications

Operating temperature range	0 to 60 degrees C
Storage temperature range	(-)25 to 70 degrees C
Relative humidity range	5 to 90% noncondensing
Power requirements	24 Vdc ±4 Vdc
Current:	0.9 A @ 24 Vdc

Powering the DPU

The DPU operates from the main redundant 24 Vdc power supply system in the maxDNA system cabinets.

Mounting the DPU

The DPU is mounted on the Input/Output (I/O) backplane with maxPAC and earlier Model 564 Input/Output modules.

Positioning the DPU in a Standard maxPAC Chassis

The DPU must be mounted in the left most position of the Model IOP rack to allow for the best airflow. The Backup cable and Ethernet communications

cables should be laced to the left side of the chassis with at least a 1 inch bend radius to allow for easy removal of the DPU, while limiting the strain on the RJ45 connectors.

When using a second DPU for backup, it should be mounted vertically beneath the primary DPU for ease of connection of the two-foot backup cable. The cable is to be held in place by tying to the cable hold downs on the side of the IOP rack.

The DPU is designed to allow installation and removal with the +24 V dc power supply turned on.

Positioning the DPU When Upgrading

The DPU can be mounted on the right side of a Six Wide maxPAC chassis or any slot of the Four Wide Model 564 chassis. In either case, remove all mounting hardware and termination panels that supported the earlier model DPU. Install a *Chassis 4 Wide maxPAC* adapter (Metso Automation #047350) in the cleared space using the two mounting holes located in the back panel metal frame.

If the previous DPU was a DPU4E, the Ethernet cables that were plugged into the termination panel can be plugged directly into the front panel of the DPU card. Make sure that the settings of the Ethernet switch match the setup file. See Chapter 5 for the configuration setup.

If the previous DPU was a DPU3, DPU4A, or DPU4B; new Ethernet switches and cables will need to be installed. Consult the factory for details about this type of upgrade.

In all upgrade situations, the backup cable must be replaced with a DPU4F backup cable (Metso Automation # 050292).

Mounting Procedures

Before mounting any hardware, refer to the cabling and field wiring sections of Publication 278596, *maxPAC Hardware Reference Guide, and* Publication 278563, *Model IOP Input/Output System Installation and Preparation*.

To install the DPU in the rack, refer to Chapter 7 *Starting the DPU*.

DPU Front Panel Controls and Features

All DPU controls, indicator LEDs, and push button switches are accessible from the DPU's front panel. Use this front panel to monitor or control different aspects of the DPU. There are no internal switches or jumpers to be set during installation.

Mode Switch

The Mode Switch is a 16 position rotary switch. It is read after a reset or power up cycle of the DPU to determine its operational mode. The switch is also read during online operation to allow setting of the mode to "Running", "Locked", or "Offline". See Chapter 3 for details.

maxNET Interface Ports

Dual Ethernet 10/100Base-T ports are provided to interface with the maxNET communication network. The DPU communications is configured to be 10Mbit Full Duplex, 100Mbit Full Duplex, or Auto-Negotiate. This configuration setting is accomplished by inserting the DPU's CompactFlash into a reader/writer connected to the workstation and running the DPU4FSetup utility. See Chapter 5 for details.

Network Status LEDs

These LEDs report the status of maxNET Network A and B links.

Backup Port

A 100 MB Ethernet interface is provided to pass database information to a hot standby DPU. A custom Category 5 Ethernet cable (Part #050292) is used to connect both DPUs via this port. A status signals are also passed between DPUs through this port to indicate which DPU is in control.

Backup LED

This LED shows the status of redundancy for DPUs configured as a backup pair.

Serial Port (Optional)

The optional Serial port is an eight pin RJ45 connector which supports RS232 signal levels. This port will be used by the DPU to interface with external PLC type equipment.

Reset Button

Pressing this button will cause the DPU to stop controlling and go through a reset cycle. This should not be done casually as it can cause a severe disruption to your process.

Refer to Chapter 3 for more detailed information on the use of this button.

IOM Status LED

The IOM LED shows the operational state of the IOM Processor.

I/O Status LED

This LED shows the status of I/O bus transactions.

CP Status LED

The CP Status LED reports the health of the Control Processor.

State LED

The State LED reports the current control state of this DPU.

Takeover Button

Pressing the Takeover button can force a previously inactive DPU to go active. This should not be done casually as a manually forced takeover occurs regardless of the inactive DPU's ability to control. This can have severe consequences to your process.

Refer to Chapter 3 for more detailed information on the use of this button.

IRIG-B Port (Optional)

The IRIG port is a BNC connector that supports an interface to a GPS receiver. This option allows time synchronization to global time.

Chapter 2

DPU Front Panel Input/Output Connections

Overview

All input/output connections are contained on the front DPU chassis panel. The chassis contains:

- Two 10/100 Ethernet ports
- One Backup Link Port
- One Serial Port (Optional)
- One IRIG-B Interface Port (Optional)

This chapter describes each link in some detail.

Ethernet Network Connections

The DPU chassis contains two 10/100 Ethernet ports using RJ-45 connectors to interface with the maxNET communication network. Network A and Network B operate as independent networks. Because the Ethernet channels are independent, a fault on one network or processor will not affect the operation of the other, or cause a DPU failover. Ethernet messages are sent/received based upon the DPU's Ethernet address with minimal control processor intervention.

Configuring the Ethernet Switch

Each DPU connects to the maxNET through two Ethernet switches – one for Network A and one for Network B. The Ethernet switch ports that connect to DPUs should be configured for 10Mbps or 100Mbpsfull-duplex operation. Auto-Negotiate is also supported but not the preferred setting. Switch ports that connect to other switches should be configured for 100Mbps or 1,000Mbps full-duplex operation. Refer to the user manuals that came with your Ethernet switch to learn how to change the port settings.

Note: When using the Cisco Catalyst 2950 Ethernet Switches, the switch and DPU should be set to Auto-Negotiate.

Backup Link

A 100 Mbps Ethernet link is used to pass database information between an active DPU and an inactive standby DPU. A custom Category 5e cable (Metso #050292) connects the DPU backup pair together via the backup link's RJ-45 connector. Secondary DPUs will typically be installed in the lower chassis just below the primary DPUs.

Serial Port

The DPU front panel contains a serial port utilizing an 8-pin RJ45 style connector.

Table 2-1 provides the pin-outs for the 8-pin port. The signal levels are standard RS232.

The serial port supports redundancy when a backup pair of DPUs is used. The serial port is only operational if the DPU is "Active". The RS232 drivers on the "Inactive" DPU are turned off. The use of this feature requires a redundancy cable to connect between the two DPUs and the RS232 device. (Metso Automation # 050355). This cable has an RJ45 for each DPU and a common DB9 connector with male pins.

Table 2-1. RJ-45 Serial Port Pin-outs

DPU4F Pin No. (RJ45)	Signal Name	Redundancy Cable #050355 Pin No. (DB9 – male pins)
1	NC	
2	NC	
3	NC	
4	Circuit Ground	5
5	RxD	2
6	TxD	3
7	CTS	8
8	RTS	7

IRIG-B Interface Port (Optional)

The DPU front panel optionally contains an IRIG-B ports for connecting to an external time source. The connector is a BNC and is transformer coupled on the DPU. See Chapter 8 for more details.

Chapter 3

DPU Switch Setting and Button Controls

Overview

The DPU front panel contains a hexadecimal rotary switch and pushbuttons for Reset and Takeover. The mode switch is used to determine the operational mode of the DPU. Refer to this chapter for discussions of these DPU front panel switches and buttons.

Setting the Mode Switch

The mode switch, a 16 position rotary switch located near the top of the DPU4F. The following defines the operation for each of the mode settings for normal and test functionality. An "X" in the "Normal Use" column indicates that the mode is one that DPU end users are expected to use. The other modes are intended for factory personnel use.

Setting	Normal Use	Description
0	X	On-line operation but Locked which inhibits database changes.
1	X	Off-line operation. In this mode the outputs are "Frozen" and therefore will not change. The State LED will be red. The mode switch can be changed from "1" and back to "F" without resetting the DPU.
2		(reserved)
3		(reserved)
4		(reserved)
5		(reserved)
6		(reserved)
7		(reserved)
8		Advanced Operational Mode – Operates as in normal mode with additional diagnostic features. The local keyboard, monitor, and mouse will be operational as well as serial diagnostic messages. Used for factory debug. Performance of the DPU will be degraded in this mode.
9		Execute diagnostics using the local keyboard, monitor, and mouse. Always reset the DPU when exiting this mode.
A		(reserved)
B	X	If this mode is set during a re-boot of the DPU, the DPU will clear the Configuration Database from CompactFlash

		and go on line as in mode “F”. Once the DPU is on-line the Mode switch should be moved back to the “F” position so that an unexpected restart of the DPU will not erase the new database.
C	X	Network Flash mode where DPU uses a fixed IP and MAC address. Used when the DPU needs to be configured for first time use or change of address. The software can also be upgraded on the DPU’s CompactFlash.
D		Debug mode. This is a factory test mode. The DPU applications will not start automatically.
E	X	Network Flash mode used to upgrade software on the DPU’s CompactFlash. Some configuration parameters can also be modified if necessary.
F	X	Normal operating mode. Will use the database stored in flash if available.

Using the Reset Button

Pressing this button will cause the DPU to stop controlling and go through a reset cycle. This should not be done casually as it can cause a severe disruption to your process.

If the Reset button is pressed for less than 2 seconds, the DPU will save the current configuration database and then reset itself (Soft Reset). If the Reset button is depressed for longer than 3 seconds, the DPU will immediately reset. (Hard Reset) NOTE: during normal operation the DPU continually saves the configuration database to CompactFlash. For typical databases, this will be done every 5 minutes. If a hard reset is performed, the DPU will still contain a recent database and will attempt control once restored. This is different from previous versions of the DPU where the configuration database was not routinely saved. In previous DPUs, a Hard reset would prevent the database save and the DPU would come up blank. To prevent control or the use of a previous database, set the Mode Switch to “B” and the DPU will clear the database during the boot cycle.

Using the Takeover Button

Pressing the Takeover button can force a previously inactive DPU to go active. This should not be done casually as a manually forced takeover occurs regardless of the inactive DPU’s ability to control. This can have severe consequences to your process.

If the Takeover button is pressed on an inactive standalone DPU (i.e., backup is not enabled), the inactive DPU will go active regardless of its health, database, or key switch position. In this mode

If the Takeover button is pressed on the inactive DPU of a DPU pair (backup enabled), the inactive DPU will go active regardless of its health or mode switch position as long as it is hot. A “hot” DPU is one that has a database that matches that of the other member of its pair (including the case where neither DPU has a database).

Once takeover occurs, the now inactive DPU will “warm” (synchronize) its database from the now active DPU. This will force the inactive DPU’s database to match that of the active DPU. When the inactive DPU becomes “hot”, it will automatically go active if the active DPU’s quality is significantly below the quality of the inactive DPU.

If you wish to guarantee that an inactive DPU goes active and stays active, you must “kill” the currently active DPU. This can be done by either unplugging the DPU from its chassis or by writing to the “ForceFatal” attribute of the active DPU.

Pressing the Takeover button on an active DPU has no effect.

Chapter 4

Interpreting Status LEDs

Overview

Refer to this chapter when you need to interpret the meanings of the 9 status LEDs on the DPU front panel. At various times the LEDs flash green, yellow, red or display no color to indicate the associated hardware's functional status. Discussions in the following sections explain what the color changes may indicate under different DPU states.

The status LEDs are divided into the following sections:

Network Status LEDs

maxNET Network A health – 1 Green and 1 Yellow
maxNET Network B health – 1 Green and 1 Yellow
Backup link health – 1 Multicolor Green/Red/Yellow

Operational Status LEDs

IOM Health – 1 Multicolor Green/Red/Yellow
I/O Status – 1 Multicolor Green/Red/Yellow
CP Health – 1 Multicolor Green/Red/Yellow
State – 1 Multicolor Green/Red/Yellow

All or some of the LEDs display a set of color codes associated with the following DPU states:

- DPU during a Windows CE boot
- DPU during normal operation
- DPU responding to soft reset

Interpreting LED Status While DPU Is Booting Windows CE

The following is a description of the LED sequencing starting from a reset to the completion of initialization.

After Reset

After a reset, the IOM and CP LEDs are Yellow, while all others are off. Once Windows CE is loaded into memory the CP initializes the FPGAs. This results in the IOM LED going red and the I/O LED going off. The CP then releases the IOM processor which causes it to execute startup diagnostics. The I/O LED changes colors rapidly while executing the diagnostics. When complete the IOM LED turns green and the I/O LED goes off.

If the BIOS on the CompactFlash is different than the one stored in onboard flash it will be written to the onboard flash. During this time the CP and State LEDs will alternately blink red. **DO NOT** stop the DPU during this period or the flash could become corrupt and the DPU will need to be returned to the factory for repair. Once the BIOS is written, the DPU will go through another reset cycle. Most updates will not require a BIOS change.

Next the CP goes yellow while rebuilding the database. This can be brief or up to 30 seconds depending on the size of the stored database. The CP LED then turns to blinking green/yellow. This is a "heartbeat" signifying that the CP is operational. The State LED goes red temporarily and then to green.

The network "A" and "B" LEDs start off blinking yellow until the DPU hears communication from another station in its domain. The LED goes solid yellow and then to green. If the LED remains solid yellow, it signifies that this DPU is receiving a message from another station and the message shows that the other station does not hear this DPU.

Interpreting LED Status during Normal DPU Operation

maxNET NETWORK LEDs

LED	Green	Yellow	Blinking Yellow	Off
Network A Or Network B	Network A Operational	Some Network Error **	Network failure - DPU does not hear from any station	DPU not Operational or LED Bad

** Each device (DPUs and Workstations) send messages that contain a list of all stations from which it is currently receiving messages. If the DPU receives messages from a station that does not report receiving messages from it, the DPU illuminates the Yellow LED. The problem may or may not be this DPU.

General Status LEDs

LED	Green	Yellow	Red	Off
Backup Network	Backup Network Operational	Some Backup Network Failures	Communications Not Established to Backup DPU	DPU not Operational or LED Bad
IOM	Operational IOM	N/A	IOM Failed / Timed-out Reset Required	IOM not initialized
I/O	All configured I/O cards are working correctly	Some configured I/O cards are working correctly, some are not	No configured I/O cards are working correctly	No I/O cards configured in the database or IOM failure
CP	Blink Yellow/Green – Healthy Heartbeat Solid Green- CP failure	Blink Yellow/Green – Healthy Heartbeat Solid Yellow (<20sec)– Loading, or saving the Database Solid Yellow (>20sec) – CP failure	Card Failure	Card Failure
State	See Below	See Below	See Below	DPU not Operational or LED Bad

DPU STATE LED

DPU States	Active DPU State/LED	Inactive DPU State/LED
Standalone DPUs	Green	Yellow
Backup Warming	Blinking Green/Red	Blinking Yellow/Red
Hot Backup	Blinking Green/Yellow	Blinking Yellow/Off
Backup Enabled No Backup Available	Blinking Green/Off	N/A
Offline	Red	Red
Booting	Off then Blinking Red	Off then Blinking Red

Interpreting Virtual I/O LED Status during Normal DPU Operation

The previous DPU (DPU4E) contained four I/O LEDs. The DPU4F contains one I/O LED that is the combination of the four. The maxVUE DPU4F Detail and DPU4FPair Detail displays show the four individual "virtual" LEDs. These LEDs display the status of each of the four I/O queues. In general, the I/O cards of a given type are assigned to the labeled LEDs; however, due to I/O bus transaction processing requirements, some of the I/O modules of different types or different applications are assigned to different queues. The following table shows the queue assignments for each type or application of an I/O module.

I/O Card	DI LED	AO/DO LED	AI LED	Unlabeled LED (Item Queue)
SOE DI	X			
Slow DI			X	
AI 564			X	
TC 564			X	
RTD 564			X	
AO 564		X		
Counter Timer 564			X	
Quad PAT 564 or maxPAC		X	X	
Output Driver 564				X
DO 564 or maxPAC		X		
AI maxPAC			X	X
TC maxPAC			X	X
RTD maxPAC			X	X
AO maxPAC		X	X	
Counter Timer maxPAC			X	X
Over Speed Module maxPAC			X	X
Turbine Valve Module maxPAC			X	X

LED Indications During Soft Reset

The CP and State LEDs turn red during the save of the database to the CompactFlash. The DPU will then reset causing the I/O and CP LEDs to turn yellow and all others off. See the startup sequence for details about the restart.

Chapter 5

Installing Windows CE and maxDNA Software onto the DPU CompactFlash Memory

Overview

The DPU utilizes a CompactFlash for storing and retrieving all software and configuration information for the DPU. The CompactFlash is non-volatile and can be removed to allow updating or moving a configuration from one DPU4F to another. The CompactFlash is 64 Megabytes and is industrial grade to allow for operation in harsh environments, as well as, supporting a very large number of write cycles. If replacing the CompactFlash, always use Metso part # 050263.

The CompactFlash contains the following files:

- Core Processor's CE Windows operating system and application firmware
- Input Output Manager (IOM) Flash Firmware
- Configuration File for Shared Memory FPGA
- Configuration File for IO FPGA
- IOM Diagnostic Code Firmware
- BIOS – Embedded BIOS code
- Initialization file containing DPU Name, IP Address, and general configuration information

From time to time, the DPU will need to be upgraded to receive the latest firmware updates.

Writing the CompactFlash Using the DPU4FSetup Utility

There are two basic methods for updating the CompactFlash.

1. Update the CompactFlash over the Ethernet network while the DPU is installed in an I/O chassis. Mode "E" on the DPU would be used to update the software. Mode "C" on the DPU would be for updating the software and changing the entire configuration file on the DPU. Mode "C" even allows the IP address to be changed.

2. Update the CompactFlash reader/writer connected to a USB port of the maxSTATION while the DPU is not installed in a chassis.

Detailed instructions on performing these updates can be found by running the DPU4FSetup program and clicking on the "?" at the top of the dialog.

To run the DPU4FSetup Utility select Start-AllPrograms-maxDNA-maxDPU Utilities-DPU4FSetup.

Chapter 6

Redundant DPU Operation

Overview

In a redundant configuration, two DPUs are connected to form a backup pair. One DPU is designated as the primary unit and the other DPU the secondary unit. The IP address of the secondary DPU is always one number greater than the address of the primary DPU. The primary is always the even address while the Secondary is the odd address.

The installation, preparation, and adjustment procedures included in this publication apply to both DPUs in a redundant configuration. This chapter provides information on switches and cabling in a redundant configuration.

Automatic Failover / Manual Takeover

Process control can be transferred automatically (Failover), or can be manually commanded to takeover. Automatic Failover can occur from either the primary DPU to the secondary DPU or from the secondary to primary based on the health of each DPU.

Automatic Failover

Process control is automatically transferred from the primary DPU to the secondary DPU when the primary DPU experiences a severe diagnostic alarm or when communication between primary and secondary DPU is lost. However, if the secondary DPU is itself experiencing a severe diagnostic alarm, it will refuse control, unless the primary DPU loses power or is reset.

Manual Takeover

To manually command either DPU to assume control, press the takeover button on the front panel of the unit. Manual takeover will occur only if the inactive DPU is healthy enough to assume control. If a severe diagnostic alarm or a fatal alarm condition exists in the inactive DPU then the Take button will be ignored. For a more complete discussion of manual takeover, see Chapter 3, “Using the Takeover Button.”

Backup State Definition

The following backup states are used to decide which DPU will remain or assume control:

1: Fully Healthy or Healthy Enough
- Some IO_Errors below threshold
- Active but can't hear backup

Net A and/or Net B functional (outage of one for more than 5 minute persistence)

2: Some Errors: would rather not run
Net A and/or Net B functional (outage of one for more than 5 minutes)
IO Errors above threshold while some IO good
- Pulse Faults
- Time Errors

3: Serious Errors: will only run if necessary
- Net A and Net B both non-functional
- Database out of date
- IOM_Diag_Errors
- All IO Bad

4: Fatal Errors: cannot run regardless

The following table represents which DPU will be the Active DPU based on the backup health state:

Currently Active DPU State

STATE	1	2	3	4
1	CUR_ACTIVE	STANDBY	STANDBY	STANDBY
2	CUR_ACTIVE	CUR_ACTIVE	STANDBY	STANDBY
3	CUR_ACTIVE	CUR_ACTIVE	CUR_ACTIVE	STANDBY
4	CUR_ACTIVE	CUR_ACTIVE	CUR_ACTIVE	NEITHER

Chapter 7

Starting the DPU

Startup States

Refer to this chapter to learn how to:

- Start a standalone DPU
- Start DPUs in a backup pair
- Replace a DPU in a backup pair

When a DPU is first powered, it checks for a valid configuration and database existing in its flash memory and proceeds to load it. The DPU then listens over the backup link to see if another DPU is active and in control before it operates on the loaded configuration.

If no backup DPU is present (no backup link communications, no Network A/B communications, no active pulses on the backup link cable) then, the DPU continues to operate with its loaded configuration and intended operation as either a standalone DPU or a backup DPU. It becomes the Active DPU since no other DPU is in control.

If a backup DPU is present then, this DPU listens to the other DPU over the backup link as to its current operation as Standalone or Redundant DPU. If the other active DPU is set as a Redundant DPU (NOT Standalone) then, this inactive DPU will erase its configuration/database and proceed to gather configuration and database information over the backup link. This DPU will move from an empty state to a warming state and then to a hot standby state and becomes ready to assume control when commanded to take over.

Demanding a Blank Startup

When a DPU is first placed in service it is advisable to clear any previous configuration data that may remain in its flash memory. To do this, before applying power to the DPU, set the Mode switch to ‘B’ on the DPU. After the DPU has gone through its startup sequence as described in "Starting a Standalone DPU," be sure to set the Mode switch back to ‘F’ to prevent future Cold startups.

Note: if a DPU is moved from one location to another where the IP Address is different, the initialization file on the DPU CompactFlash needs to be modified. Use the DPU4Setup utility to make the necessary changes. The default setting on the utility is to automatically erase any configuration databases. It is still advisable to set the Mode switch to 'B' before installing the DPU in the new location to additionally guarantee that it will come up cold.

Starting a Standalone DPU

Perform the following steps to ensure that a DPU is completely configured before it is allowed to assume control. It is important that the DPU not be placed in the Online State until it has been fully configured.

To start a standalone DPU:

1. Remove the CompactFlash from the DPU and inset it into a reader/writer attached to a Workstation. Use the Workstation utility DPU4FSetup program to initialize the CompactFlash. This utility will configure the IP Address, Redundancy (select StandAlone), Network Speed/Duplex, and Version of Software. Reinstall the CompactFlash in the DPU. Note: if you select Primary instead of StandAlone, the DPU will not be able to go into the online state unless a backup cable is installed.

2. Set front panel mode switches to "B" to demand a Cold startup.

3. Insert the DPU into the chassis slot and secure the DPU using the two thumbscrews.

4. Insert the 'A' network cable into the top RJ45 connector and, if available, the 'B' network cable into the second RJ45 connector.

5. Software release Version 4.0 required that either a backup cable (Metso # 050292) or jumper plug (Metso # 081388) is installed in the Backup connector in order to come on line. In Version 4.1 the jumper plug is not needed for a single DPU, if "StandAlone" Redundancy was selected in the DPU4FSetup program.

6. Wait until the CP LED begins to blink Yellow/Green signifying that the DPU is operational.

7. Return Mode switch to "F."

8. Use the DPU4F Detailed Status Display to verify that the DPU is operational.

9. Reload the DPU configuration using the maxDPUTools Download Program from the maxSTATION.

10. Acknowledge all alarms from the DPU and make sure that they all clear.

11. Utilize the Unfreeze feature to allow all or selective outputs to go to their new computed values.

Starting a Backup Pair of DPUs

When starting a backup pair of DPUs, it is preferred (but not required), to bring the primary DPU up first and make sure it is running properly before starting the secondary.

To start DPU backup pairs:

1. Remove the CompactFlash from the primary DPU and inset it into a Reader/writer attached to a Workstation. Use the Workstation utility DPU4FSetup program to initialize the CompactFlash. This utility will configure the IP Address, Pair Mode (Select Primary), Network Speed/Duplex, and Version of Software. Reinstall the CompactFlash in the DPU. Repeat for the secondary (Select Secondary).

2. Set the Primary DPU Mode Switch to "B" to demand a Cold startup.

3. Insert the Primary DPU into the chassis slot but not far enough to make contact with the back plane connector.

4. Insert the 'A' network cable into the top RJ45 connector and, if available, the 'B' network cable into the second RJ45 connector.

5. Insert the 'Backup' network cable into the backup connector. NOTE: If the DPU is restarted without the backup cable installed, the DPU will not be permitted to go online. The DPU must be reset after the cable is installed.

6. Fully insert the Primary DPU into the chassis slot and secure it using the two thumbscrews.

7. Wait until the CP LED begins to blink Yellow/Green signifying that the DPU is operational.

8. Set the Mode Switch to "F".

9. Verify that the status LEDs on the DPU front panel are in the proper state:

   - "A" Network - Green
   - "B" Network – Green if dual network and off if single network.
   - Backup – Off (will turn Yellow when Secondary operational, Secondary LED will also be Yellow)

- IOM - Green
- I/O - Off
- CP – Blinking Green/Yellow
- State – Green (when Secondary becomes operational, the Secondary State LED will be Yellow)

10. Use the DPU4F Detailed Status Display to verify that the DPU is operational. The Primary DPU State should be Active StandAlone.

11. Repeat steps 2 to 10 for the Secondary DPU. The Primary DPU should remain Active StandAlone and the Secondary should be Inactive StandAlone.

12. Acknowledge all DPU alarms and verify that they clear.

13. Load the Primary DPU using the maxDPUTools utility program from the maxSTATION.

14. Enable Backup and make sure the Secondary DPU properly warms up.

15. Utilize the Unfreeze feature to allow all or selective outputs to go to their new computed values.

Replacing a DPU in a Backup Pair

When replacing a DPU in a backup pair, it is necessary to prevent the new unit from gaining control until it is properly configured and up to date. Perform the following steps to ensure that an unexpected failover does not occur during the replacement process.

To replace a DPU in a backup pair:

1. Make sure the DPU that is to remain in place is active and there are no severe outstanding alarms.

2. Pull the DPU being replaced far enough out of its chassis to disconnect power.

3. Remove the Backup Cable, Network, “A” Cable, and optionally Network “B” Cable from the extracted DPU.

4. Remove the DPU from the chassis.

5. Either move the CompactFlash from the original DPU to the replacement DPU or configure the new CompactFlash using the DPU4FSetup utility. It is very important that the configuration file on the CompactFlash have the proper DPU name and IP address and other configuration parameters.

6. Set the Mode Switch on the front of the DPU to "B" to demand a Cold startup.

7. Insert the DPU into the chassis slot but not far enough to make contact with the back plane connector.

8. Insert the 'A' Network cable into the top RJ45 connector and, if available, the 'B' Network cable into the second RJ45 connector.

9. Insert the 'Backup' Network cable into the backup connector. NOTE: If the DPU is restarted without the backup cable installed, the DPU will not be permitted to go online. The DPU must be reset after the cable is installed.

10. Fully insert the DPU into the chassis slot and secure it using the two thumbscrews.

11. Wait until the CP LED begins to blink Yellow/Green signifying that the DPU is operational.

12. Set the Mode Switch to 'F'.

13. Once the DPU has 'warmed', the following are the expected states of the LEDs:

    - 'A' Network – Green
    - 'B' Network – Green if dual network and off if single network
    - Backup – Green
    - IOM – Green
    - I/O – Green if any Redundant I/O defined, Off if no Redundant I/O
    - CP – Blinking Green/Yellow
    - State – blinking Yellow/Off

14. Acknowledge all alarms from the new DPU and make sure they clear.

Restarting a DPU after Failover

If an inactive DPU detects a problem with the active DPU, it will immediately take control of the process and force the other DPU to become inactive. If the originally active DPU is still operating, it will detect the loss of control and go into an offline mode, setting its State LED to red. In this mode the DPU will not warm from the new active DPU until manual intervention.

DO NOT reset the active DPU since there is no available backup and all the outputs will be reset. Pressing the reset button on the inactive DPU will

cause it to restart and, if capable, warm from the active. If it does not properly warm, it should be replaced.

Alarm Annunciation

Diagnostic alarms originating at a DPU are posted as remote alarms on the maxSTATION Alarm List. Refer to Publication 278558, *Alarm Message Reference Guide*, for a description of these alarms. DPU front panel LEDs also indicate certain fatal diagnostic alarms.

Chapter 8

IRIG-B Interface

Overview

IRIG-B is an international time signal standard. Many vendors sell very accurate clocks that generate IRIG-B signals. IRIG-B is also available as an output from many GPS satellite receivers. Such IRIG time signals are typically accurate to within microseconds.

The maxDPU4F is available with an optional IRIG-B input (models PDP406 and PDP408, DPU assembly #181551). These DPUs have a BNC connector through which the IRIG-B signal is applied and internal circuitry to decode the signal. Once it decodes the signal, the DPU uses it as the basis for its internal clock. Normally, the IRIG DPU is assigned the roll of a Time Master (via a database setting) and it broadcasts the accurate time to the rest of the DPUs, DBMs and direct access workstations in its domain. In this way, the entire domain can be synchronized to an accurate clock.

The IRIG signal should be applied to both the primary and secondary of a maxDPU4F pair to provide a redundant time source should one of the DPUs fail.

The IRIG-B (B122) time signal is an amplitude modulated 1KHz sine wave. Figure 1 shows a portion of a typical waveform. V1 and V2 represent the peak-to-peak amplitudes of the two modulation levels.

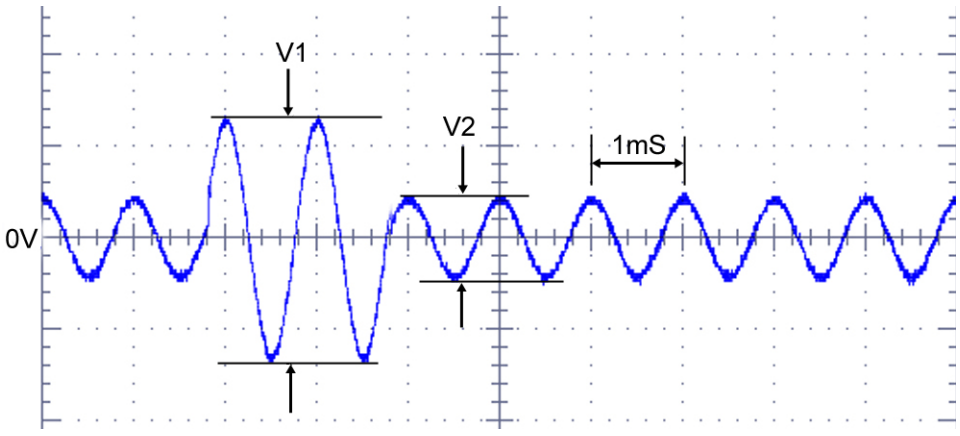

Figure 1. IRIG-B Waveform

maxDPU4F IRIG-B Specifications

Interface Supported: IRIG-B Amplitude Modulated (B122)

Input range (V1): 3V to 10V peak-to-peak with 0VDC offset

Modulation Ratio (V1/V2): 2:1 to 4:1 (3:1 is optimal)

Input Impedance: >10K ohms

Input connector: BNC for coaxial cable

IRIG-B Cabling

The IRIG-B input is transformer coupled within the DPU. The BNC connector is not grounded at the DPU. To prevent ground loop problems, the IRIG-B signal/coaxial cable should only be grounded at the IRIG source.

The IRIG-B input does not have surge or transient protection so care should be taken to ensure that the IRIG cable is not routed through electrically hostile (noisy) areas. Keep it away from field wires, motor wires and other noisy signals. To reduce the likelihood of noise pickup, do not run the IRIG cable parallel to noisy wires.

Since the IRIG input on the DPU is high impedance and the IRIG sources have low output impedance (typically 50 or 600 ohms), the signal may be applied in parallel to multiple DPUs via BNC "T" or "Y" connectors. However, if that single cable is damaged, all of the parallel-wired DPUs could lose their IRIG signal. For more redundancy in an installation use separate outputs from the IRIG source and wire each output to only one DPU. For even more redundancy, use more than one IRIG source with one driving a primary DPU and the other driving the secondary.

DPU Configuration for IRIG

The TimeSync atom in the DPU4F must be configured for IRIG operation.

Configuration and operating information is contained in the time synchronization chapter in the System Resources Guide (manual #278609). That chapter also contains other important information on time synchronization.