



## **1394 PRINTER WORKING GROUP**

### **CSR and CONFIGURATION ROM for IMAGING DEVICE PROFILE**

**\*\*\* DRAFT PROPOSAL \*\*\***

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## **1 Scope and Purpose**

### **1.1 Scope**

This document specifies the Configuration and Status Registers (CSR) and the Configuration ROM of an SBP-2 target node that implements the minimal requirements to support the 1394 PWG Imaging Device Profile. This profile includes elements from released standards and work in progress by other groups referenced in Section 3.

This document does not address:

- Isochronous communication.
- Use with 1394.1 bridges.
- Security.
- Power Management Issues.

### **1.2 Purpose**

The 1394 PWG has focused on defining a general purpose solution which uses the ANSI SBP-2 protocol for peripheral devices. This document contains examples that can be used to provide consistent implementations of the CSR and Configuration ROM requirements for printers, scanners, copiers, digital still cameras and other imaging devices which support the 1394 PWG Imaging Profile.

The basic model can be scaled from simple single function devices to more complex compound devices.

Requirements are specified in conformance to applicable standards. In all areas that are mandatory, the applicable standards will apply. Where applicable standards allow more than one choice of implementation, this document defines either a choice or preference for the 1394 PWG Imaging Profile.

The term "image device" is used throughout the remainder of this document to refer to image devices in general including any of the devices listed above.

## **2 References**

This document makes reference to and contains excerpts from several standards or draft documents of proposed standards.

More recent revisions may or may not support the information contained in this document:

1. ISO/IEC 13213:1994 Control and Status Register Architecture for Microcomputer Buses.
2. IEEE Std 1394-1995, Standard for High Performance Serial Bus.
3. ANSI T10/1155x (SBP-2) Serial Bus Protocol 2
4. IEEE-p1394a Draft Standard for a High Performance Serial Bus (Supplement).
5. IEEE-1212r Draft – Revision to ISO/IEC 13213:1994

### **3 Definitions and Notation**

#### **3.1 Definitions**

See SBP-2 Section 3.1.x

#### **3.2 Notation**

See SBP-2 Section 3.2.x

## **4 CSR Definitions**

### **4.1 Requirements**

Compliant devices shall implement the minimal Configuration and Status registers as defined below. Optional registers may be implemented depending on the device requirements,

#### **4.1.1 Minimal**

The minimal implementation of Configuration and Status registers shall be as defined by ANSI SBP-2.

#### **4.1.2 Optional**

The following registers can be implemented to provide for a basic form of Target Initiated Operations as defined in the 1394 PWG Imaging Profile.

OFFSET	REGISTER NAME	USAGE
128-188	MESSAGE_REQUEST	Target Address for Messages
192-252	MESSAGE_RESPONSE	Target Address for Message Responses

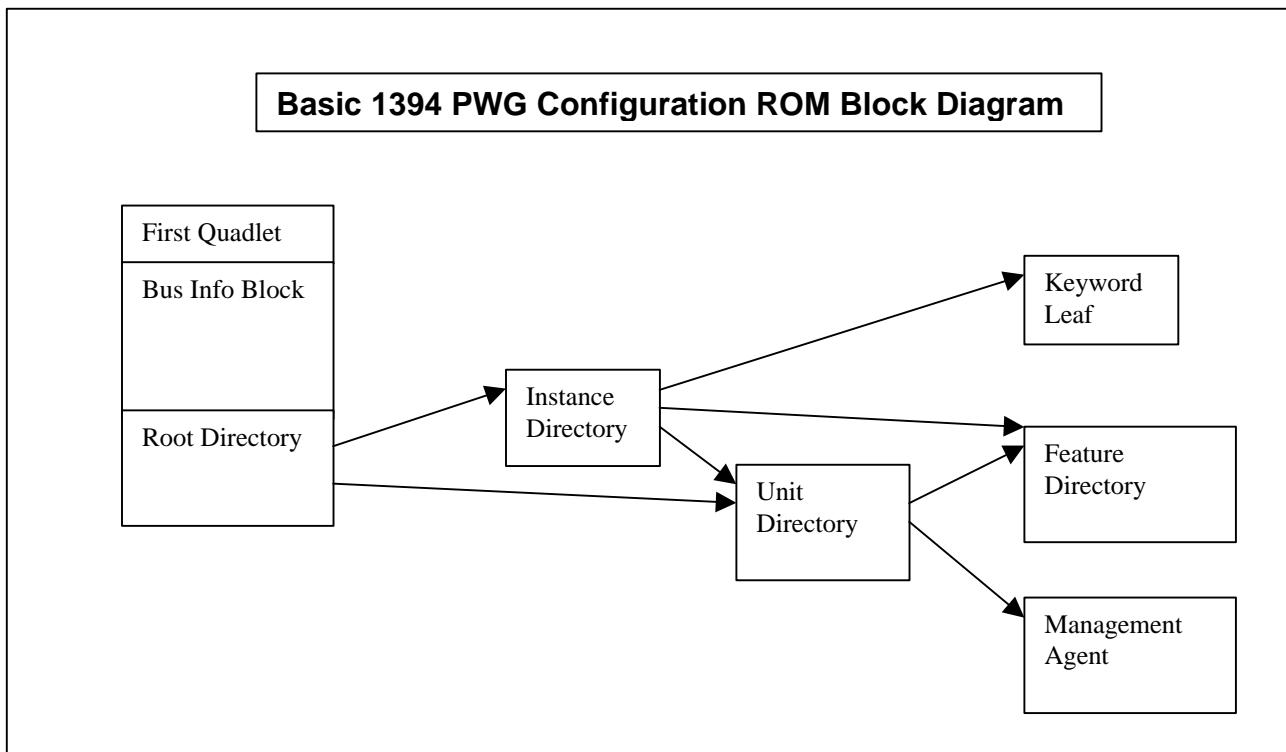
**Table 1 – Optional Configuration and Status Registers**



## **5 Configuration ROM**

### **5.1 Requirements**

Compliant devices shall implement general format configuration ROM in accordance with ANSI SBP-2, IEEE-p1212r and this profile. The block diagram below illustrates a minimum set of Configuration ROM objects required by this profile.



The locations of the initial blocks, *Bus\_Info\_Block* and *Root\_Directory*, are fixed. The locations of the other entries are specified in the *Root\_Directory* or associated directories.

**Note:**

Reserved fields shall be set to zero.

Length values in the Configuration ROM specify the number of Quadlets.

Refer to ISO 13213/IEEE 1212 section 8.2.4 table 21 for all key\_type definitions.

### 5.1.1 First Quadlet

MSB	Bus_info_length $04_{16}$	CRC_length $**_{16}$	ROM_CRC_value (calculated)	LSB

Compliant devices shall implement the first quadlet located at a base address offset of FFFF F000 0400<sub>16</sub>.

The CRC\_length value is set to the number of quadlets to be used in calculating the ROM\_CRC\_value. The minimum value used for the CRC\_length shall provide coverage for the Bus\_Info\_Block. The ROM\_CRC\_value is calculated according to the formula in ISO/IEC 13213:1994 Section 8.1.5.

### 5.1.2 Bus Information Block

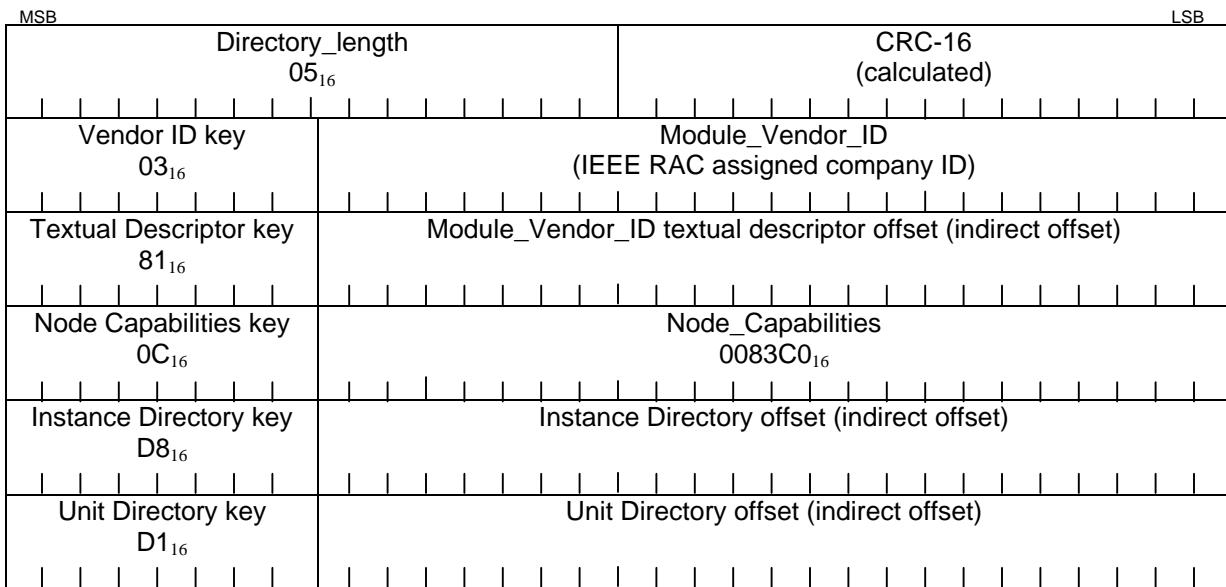
MSB	31 <sub>16</sub> "1"	33 <sub>16</sub> "3"	39 <sub>16</sub> "9"	34 <sub>16</sub> "4"	LSB
I R M M C C	C I S M M C	Resv	Cyc_Clk_Acc	Max_Rec	Reserved 0 <sub>16</sub>
Node_Vendor_ID					Chip_ID_High
Chip_ID_Low					

Compliant devices shall implement the bus information block located at a base address offset of FFFF F000 0404<sub>16</sub> in the format defined by the SBP-2 specification.

The second quadlet of the bus information block at offset 408h contains capability bits. These bits are defined in IEEE-1394-1995. The 'g' field bits affect the CRC value in the first quadlet when the CRC\_Length in the first quadlet of configuration ROM covers the Bus\_Info\_Block. These bits shall be changed when the device updates information in the configuration ROM that alters the device configuration. After the bits are changed, the device must recalculate the CRC stored in the first quadlet of configuration ROM. The changes to the generate bits and the ROM\_CRC\_Value shall be effected during a bus reset.

The third and fourth quadlets of the bus information block contain the Node\_Vendor\_ID, Chip\_ID\_High and Chip\_ID\_Low values. Chip\_ID\_High and Chip\_ID\_Low values should be unique between different units supplied by the same vendor. Together, these values provide the globally unique identifier which is referred to as the EUI-64 (Extended Unique Identifier, 64 bits).

### 5.1.3 Root Directory



Compliant devices shall implement the root directory as defined in this specification located at a fixed address following the bus information block. This specification extends the SBP-2 root directory by including a Textual Descriptor, which provides a human readable form of the Module\_Vendor\_ID, and an Instance\_Directory entry in addition to the Module\_Vendor\_ID, Node\_Capabilities, and SBP-2 Unit\_Directory entries.

The Node\_Capabilities entry contains subfields specified by subclause 8.4.11 of ISO/IEC 13213:1994 for more details on this entry.

This profile defines an implementation which should operate with legacy and future bus enumerations strategies by including both Instance\_Directory\_offset and Unit\_Directory\_offset entries in the root directory.

### 5.1.4 Module\_Vendor\_ID\_Textual\_Descriptor

Compliant devices shall implement a textual descriptor leaf that is referenced from the Root Directory encoded using the minimal ASCII subset defined in ISO/IEC 13213:1994. The textual descriptor shall contain the name of the company referenced by the Module\_Vendor\_ID entry in the Root Directory.

### 5.1.5 Instance Directory

Compliant devices shall implement at least one Instance Directory off of the root directory. The Instance Directory has been defined as part of the IEEE p1212r effort. It contains a Keyword leaf, one or more Feature Directory entries, zero or more Unit Directory entries, and zero or more Instance Directory entries.

Vendors may implement various configurations of Instance directories, Feature directories, and Unit directories based on their design.

### 5.1.6 Keyword Leaf

Compliant devices shall implement at least one Keyword Leaf located off of the Instance Directory. The Keyword Leaf has been defined as part of the IEEE p1212r effort. A keyword leaf is a collection of one or more ASCII keywords that pertain to the parent directory which referenced the leaf. Refer to section x.x.x of this document for the preferred spelling of typical keywords.

Individual keywords within a keyword leaf shall be zero-terminated ASCII strings. The character set for keywords is an ASCII subset consisting of the characters 'A' through 'Z' (lowercase is not allowed), '0' through '9' and the hyphen '-'; neither spaces nor any other characters, printing or nonprinting, shall appear in keywords.

If the length, in bytes, of the keywords and separators are not a multiple of four, the last quadlet shall be padded with bytes whose value is  $00_{16}$ .

### 5.1.7 Feature Directory

MSB	Feature Directory Length $04_{16}$	Directory CRC (calculated)	LSB
Spec_ID key $12_{16}$		Spec_ID $00\ 5029_{16}$	
SW_Version key $13_{16}$		SW_Version $XX\ XXXX_{16}$	
PWG Service_List key $K1_{16}$		Service_List Offset $XX\ XXXX_{16}$	
PWG Device_ID key $K2_{16}$		PWG Device_ID Offset $XX\ XXXX_{16}$	

Compliant devices shall implement a PWG defined Feature directory. The Feature directory is a new structure defined in the IEEE-p1212r Draft.

Compliant devices shall implement at least one Feature Directory located at an offset that is pointed to from an Instance Directory and the associated Unit Directory. A Feature Directory contains a collection of feature entries. The feature entries are to be interpreted based on the Spec\_ID and SW\_Version fields in the directory.

The example shown above, for a simple device, provides for a list of features to be defined by the PWG. Implementations may provide for one or more feature directories. For example, devices may implement both a PWG and a vendor specific feature directory.

### **5.1.8 Service List**

Compliant devices shall implement at least one Service List. The Service List is implemented as a Keyword Leaf located off of the PWG Feature Directory. The keyword leaf has been defined as part of the IEEE p1212r effort. The 1394 PWG profile reuses the format of the keyword leaf to provide a mechanism which can be used to enumerate the supported services. Keywords used within the Service Keyword Leaf must follow the guidelines established by IANA for service names.

Individual keywords within a keyword leaf shall be zero-terminated ASCII strings. The character set for keywords is an ASCII subset consisting of the characters 'A' through 'Z' (lowercase is not allowed), '0' through '9' and the hyphen '-'; neither spaces nor any other characters, printing or nonprinting, shall appear in keywords.

If the length, in bytes, of the keywords and separators are not a multiple of four, the last quadlet shall be padded with bytes whose value is  $00_{16}$ .

### **5.1.9 Device\_ID Leaf**

Compliant devices shall implement at least one Device\_ID Leaf. The Device\_ID Leaf contains a string encoded using the minimal ASCII subset defined in ISO/IEC 13213:1994. The string uses the format defined in IEEE-1284-1994 Section 6.6

If the length, in bytes, of the string in the Device\_ID Leaf is not a multiple of four, the last quadlet shall be padded with bytes whose value is  $00_{16}$ .

### 5.1.10 Unit Directory

Compliant devices shall implement at least one unit directory as defined in this specification. Unit directories should be referenced from the root directory and the instance directory which describes the functional unit supported by the unit directory. This specification constrains the SBP-2 Unit directory definition by limiting the logical unit implementation. This specification extends the SBP-2 Unit directory by including a reference to one or more Feature Directory entries. The required entries are listed in the following table.

KEY	DOCUMENTED BY	REQUIRED BY	DEFINED BY
Unit_Spec_ID	IEEE-1212	IEEE-1212	SBP-2
Unit_SW_Version	IEEE-1212	IEEE-1212	SBP-2
Management_Agent	ANSI SBP-2	SBP-2	SBP-2
Command_Set_Spec_ID	ANSI SBP-2	SBP-2	1394 PWG Profile
Command_Set	ANSI SBP-2	SBP-2	1394 PWG Profile
Command_Set_Revision	ANSI SBP-2	SBP-2	1394 PWG Profile
Unit_Characteristics	ANSI SBP-2	SBP-2	1394 PWG Profile
Logical_Unit_Number	ANSI SBP-2	SBP-2	1394 PWG Profile
Reconnect_Timeout	ANSI SBP-2	1394 PWG Profile	1394 PWG Profile
Feature_Directory	IEEE p1212r	IEEE p1212r	1394 PWG Profile
Unit_Uncode_ID	ANSI SBP-2	(Optional)	(Optional)

The second column lists the specification that documents the key and usage. The third column lists the specification that requires the keys implementation. The fourth column lists the specification that defines the key value and usage.

Compliant devices shall implement one logical unit, logical unit zero, defined in the unit directory. Logical Unit Directory structures are beyond the scope of this specification.

The Unit\_Characteristics entry is  $00A008_{16}$  which defines the following characteristics.

- The queuing model is defined by this profile and associated command set.
- The unordered execution model is supported.
- Asynchronous mode is used.
- Management ORB timeouts (refer to SBP-2 specification)
- The ORB size field is set to eight bytes.

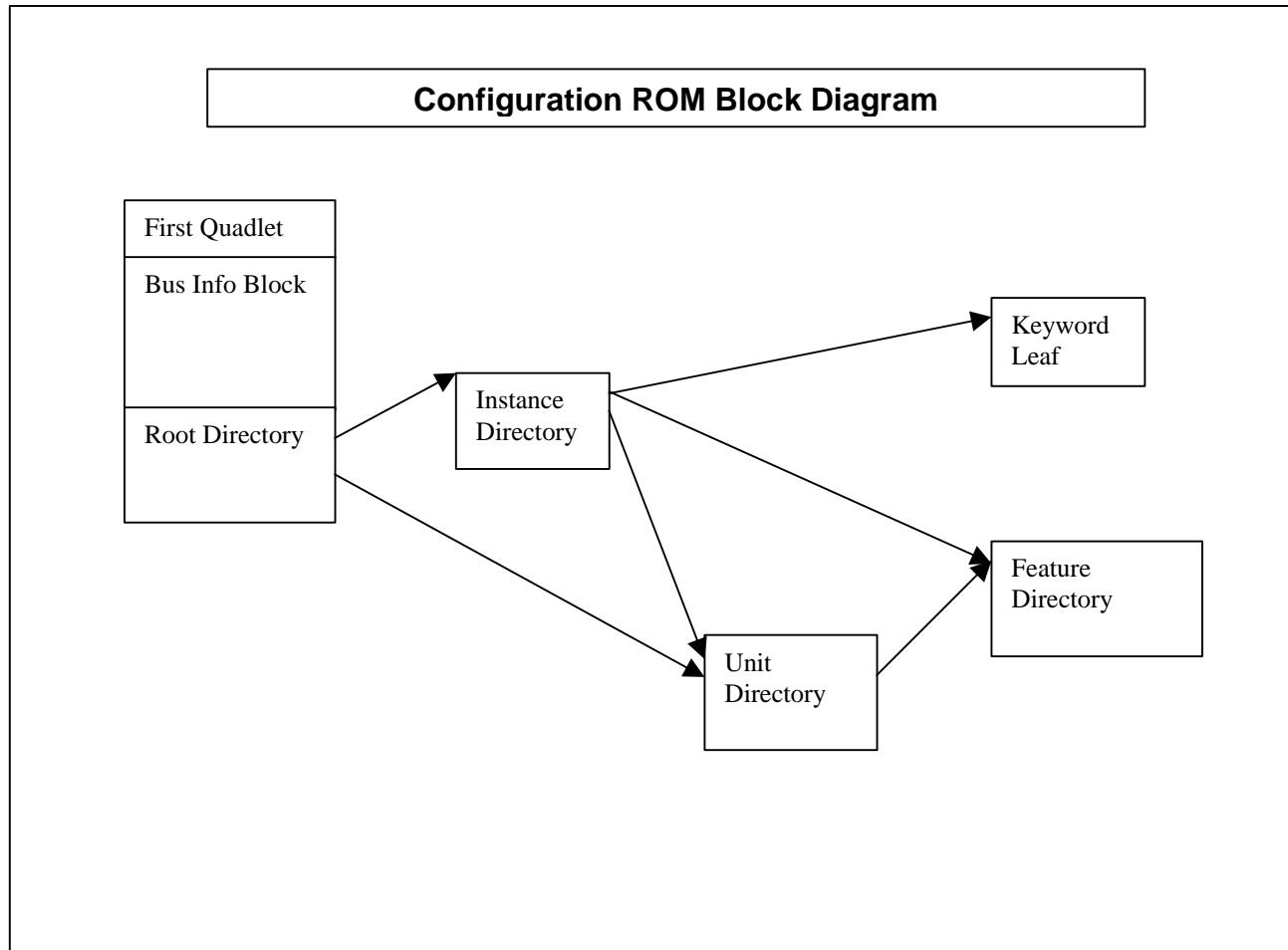
The Logical\_Unit\_Number entry is divided into three fields: a group of reserved bits, a five bit device\_type field, and a 16 bit Logical\_Unit\_Number field. Valid device\_type values range from  $00_{16}$  to  $1F_{16}$ . Defined values are:

$02_{16}$	-	Printer
$03_{16}$	-	Processor
$06_{16}$	-	Scanner
$09_{16}$	-	Comm Device
$1F_{16}$	-	Unknown – Needs Command_Set specific detection

## 5.2 Printer Device Example (Informative)

The sections contain information on a minimal implementation of Configuration ROM for a simple imaging device.

### 5.2.1 Block Diagram



### 5.2.2 First Quadlet

Offset:  $0400_{16}$

MSB	Bus_info_length $04_{16}$	CRC_length ** <sub>16</sub>	ROM_CRC_value (calculated)	LSB

### 5.2.3 Bus\_Info\_Block

Offset:  $0404_{16}$

MSB	$31_{16}$ "1"	$33_{16}$ "3"	$39_{16}$ "9"	$34_{16}$ "4"	LSB
I	C	I	B	P	Resv
R	M	S	M	M	
M	C	C	C	C	
Cyc_Clk_Acc				Max_Rec	Reserved $0_{16}$
Node_Vendor_ID				g	resv.
Chip_ID_High				link_spd	
Chip_ID_Low					

### 5.2.4 Root Directory

Offset:  $0414_{16}$

MSB	Directory_length $05_{16}$	CRC-16 (calculated)	LSB
Vendor ID key $03_{16}$		Module_Vendor_ID (can be the same as Node_Vendor_ID)	
Textual Descriptor key $81_{16}$		Module_Vendor_ID textual descriptor offset (indirect offset) 0x????	
Node Capabilities key $0C_{16}$		Node_Capabilities $0083C0_{16}$	
Instance Directory key $D8_{16}$		Instance Directory offset (indirect offset)	
Unit Directory key $D1_{16}$		Unit Directory offset (indirect offset)	

### 5.2.5 Instance Directory

Offset:  $042C_{16}$ 

MSB	Instance Directory Length $03_{16}$	Instance Directory CRC (calculated)	LSB
	Keyword Leaf key $99_{16}$	Keyword Leaf offset $XXXXXX_{16}$	
	Feature directory key $DA_{16}$	Feature directory offset $YYYYYY_{16}$	
	Unit Directory key $D1_{16}$	Unit directory offset $ZZZZZZ_{16}$	

### 5.2.6 Feature Directory

Offset:  $043C_{16}$ 

MSB	Feature Directory Length $04_{16}$	Directory CRC (calculated)	LSB
	Spec_ID key $12_{16}$	Spec_ID $00\ 5029_{16}$	
	SW_Version key $13_{16}$	SW_Version $XX\ XXXX_{16}$	
	PWG Service_List key $3E_{16}$	Service_List Offset $XX\ XXXX_{16}$	
	PWG Device_ID key $3F_{16}$	PWG Device_ID Offset $XX\ XXXX_{16}$	

### 5.2.7 Unit Directory

Offset:  $0450_{16}$ 

Unit Directory Length $0A_{16}$			Directory CRC (calculated)		
Unit_Spec_ID key $12_{16}$			Unit_Spec_ID $00\ 609E_{16}$		
Unit_SW_Version key $13_{16}$			Unit_SW_Version $01\ 0483_{16}$		
Cmd_Set_Spec_ID key $38_{16}$			Cmd_Set_Spec_ID $00\ 5029_{16}$		
Command_Set key $39_{16}$			Command_Set $YY\ YYYY_{16}$		
Command_Set_Rev key $3B_{16}$			Command_Set_Revision $000001_{16}$		
Firmware_Revision key $3C_{16}$			Firmware_Revision $000001_{16}$		
Reconnect_Timeout key $3D_{16}$			Reserved $00_{16}$	Reconnect_Timeout $000001_{16}$	
Management_Agent key $54_{16}$			Management_Agent_Offset (initial register space offset) (implementation dependent)		
Unit_Characteristics key $3A_{16}$			Q   o   I	Reserved $00000_2$	Mgt_ORB_Timeout (refer to SBP-2)
LUN key $14_{16}$			Resv. $00_{16}$	Device_type $02_{16}$	Logical_Unit_number $00_{16}$
					ORB_size $08_{16}$

### 5.2.8 Vendor Textual Descriptor

Offset:  $047C_{16}$ 

MSB	Leaf Length $05_{16}$		Leaf CRC (calculated)		LSB
	Specifier_ID $00\ 0000_{16}$				
	Language_ID $0000\ 0000_{16}$				
	$50_{16}$ "P"	$72_{16}$ "r"	$69_{16}$ "i"	$6E_{16}$ "n"	
	$74_{16}$ "t"	$65_{16}$ "e"	$72_{16}$ "r"	$20_{16}$ " "	
	$43_{16}$ "C"	$6F_{16}$ "o"	$2E$ ". "	$00_{16}$	

### 5.2.9 Keyword Leaf

Offset:  $0494_{16}$ 

MSB	Leaf Length $02_{16}$		Leaf CRC (calculated)		LSB
	50 <sub>16</sub> "P"		49 <sub>16</sub> "T"		4E <sub>16</sub> "N"
	$54_{16}$ "T"	$45_{16}$ "E"	$52_{16}$ "R"	$00_{16}$	

### 5.2.10 Service List

Offset:  $04A0_{16}$ 

MSB	Leaf Length $01_{16}$		Leaf CRC (calculated)		LSB
	$50_{16}$ "P"	$44_{16}$ "D"	$4C_{16}$ "L"	$00_{16}$	

### 5.2.11 Device\_ID Key

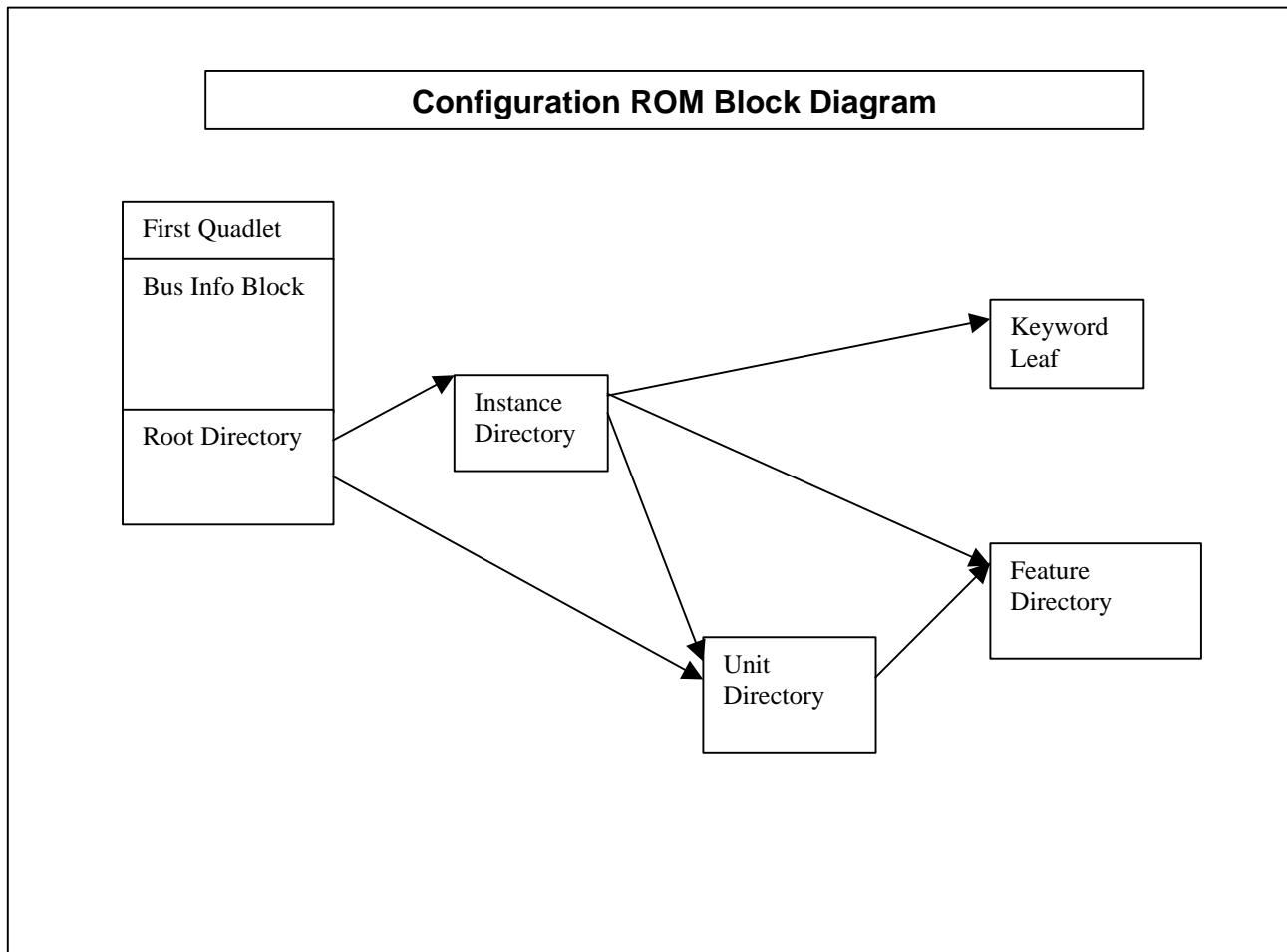
Offset:  $04A8_{16}$

MSB	Leaf Length $01_{16}$				Leaf CRC (calculated)				LSB
	$4D_{16}$ "M"				$46_{16}$ "F"				$47_{16}$ "G"
	$50_{16}$ "P"				$72_{16}$ "r"				$69_{16}$ "i"
	$74_{16}$ "t"				$65_{16}$ "e"				$72_{16}$ "r"
	$43_{16}$ "C"				$6F_{16}$ "o"				$2E_{16}$ ":"
	$0A_{16}$ (LF)				$4D_{16}$ "M"				$0D_{16}$ (CR)
	$3A_{16}$ ":"				$4E_{16}$ "N"				$44_{16}$ "D"
	$65_{16}$ "e"				$0D_{16}$ (CR)				$4C_{16}$ "L"
					$0A_{16}$ (LF)				$61_{16}$ "a"
									$6D_{16}$ "m"
									$00_{16}$

### 5.3 Scanner Device Example (Informative)

The sections contain information on a minimal implementation of Configuration ROM for a simple imaging device.

#### 5.3.1 Block Diagram



### 5.3.2 First Quadlet

Offset:  $0400_{16}$

MSB	Bus_info_length $04_{16}$	CRC_length ** <sub>16</sub>	ROM_CRC_value (calculated)	LSB

### 5.3.3 Bus\_Info\_Block

Offset:  $0404_{16}$

MSB	$31_{16}$ "1"	$33_{16}$ "3"	$39_{16}$ "9"	$34_{16}$ "4"	LSB
I	C	I	B	P	Resv
R	M	S	M	M	
M	C	C	C	C	
Cyc_Clk_Acc				Max_Rec	Reserved $0_{16}$
Node_Vendor_ID				g	resv.
Chip_ID_High				link_spd	
Chip_ID_Low					

### 5.3.4 Root Directory

Offset:  $0414_{16}$

MSB	Directory_length $05_{16}$	CRC-16 (calculated)	LSB
Vendor ID key $03_{16}$		Module_Vendor_ID (can be the same as Node_Vendor_ID)	
Textual Descriptor key $81_{16}$		Module_Vendor_ID textual descriptor offset (indirect offset) 0x????	
Node Capabilities key $0C_{16}$		Node_Capabilities $0083C0_{16}$	
Instance Directory key $D8_{16}$		Instance Directory offset (indirect offset)	
Unit Directory key $D1_{16}$		Unit Directory offset (indirect offset)	

### 5.3.5 Instance Directory

Offset:  $042C_{16}$ 

MSB	Instance Directory Length $03_{16}$	Instance Directory CRC (calculated)	LSB
	Keyword Leaf key $99_{16}$	Keyword Leaf offset $XXXXXX_{16}$	
	Feature directory key $DA_{16}$	Feature directory offset $YYYYYY_{16}$	
	Unit Directory key $D1_{16}$	Unit directory offset $ZZZZZZ_{16}$	

### 5.3.6 Feature Directory

Offset:  $043C_{16}$ 

MSB	Feature Directory Length $04_{16}$	Directory CRC (calculated)	LSB
	Spec_ID key $12_{16}$	Spec_ID $00\ 5029_{16}$	
	SW_Version key $13_{16}$	SW_Version $XX\ XXXX_{16}$	
	PWG Service_List key $3E_{16}$	Service_List Offset $XX\ XXXX_{16}$	
	PWG Device_ID key $3F_{16}$	PWG Device_ID Offset $XX\ XXXX_{16}$	

### 5.3.7 Unit Directory

Offset:  $0450_{16}$ 

Unit Directory Length $0A_{16}$			Directory CRC (calculated)		
Unit_Spec_ID key $12_{16}$			Unit_Spec_ID $00\ 609E_{16}$		
Unit_SW_Version key $13_{16}$			Unit_SW_Version $01\ 0483_{16}$		
Cmd_Set_Spec_ID key $38_{16}$			Cmd_Set_Spec_ID $00\ 5029_{16}$		
Command_Set key $39_{16}$			Command_Set $YY\ YYYY_{16}$		
Command_Set_Rev key $3B_{16}$			Command_Set_Revision $000001_{16}$		
Firmware_Revision key $3C_{16}$			Firmware_Revision $000001_{16}$		
Reconnect_Timeout key $3D_{16}$			Reserved $00_{16}$	Reconnect_Timeout $000001_{16}$	
Management_Agent key $54_{16}$			Management_Agent_Offset (initial register space offset) (implementation dependent)		
Unit_Characteristics key $3A_{16}$			Q   o   I	Reserved $00000_2$	Mgt_ORB_Timeout (refer to SBP-2)
LUN key $14_{16}$			Resv. $00_{16}$	Device_type $06_{16}$	ORB_size $08_{16}$
				Logical_Unit_number $00_{16}$	

### 5.3.8 Vendor Textual Descriptor

Offset:  $047C_{16}$ 

MSB	Leaf Length $05_{16}$		Leaf CRC (calculated)		LSB
	Specifier_type $00_{16}$		Specifier_ID $00\ 0000_{16}$		
			Language_ID $0000\ 0000_{16}$		
	$53_{16}$ "S"	$63_{16}$ "c"	$61_{16}$ "a"	$6E_{16}$ "n"	
	$6E_{16}$ "n"	$65_{16}$ "e"	$72_{16}$ "r"	$20_{16}$ "	
	$43_{16}$ "C"	$6F_{16}$ "o"	$2E$ "	$00_{16}$	

### 5.3.9 Keyword Leaf

Offset:  $0494_{16}$ 

MSB	Leaf Length $02_{16}$		Leaf CRC (calculated)		LSB
	53 <sub>16</sub> "S"		41 <sub>16</sub> "A"		4E <sub>16</sub> "N"
	$4E_{16}$ "N"	$45_{16}$ "E"	$52_{16}$ "R"	$00_{16}$	

### 5.3.10 Service List

Offset:  $04A0_{16}$ 

MSB	Leaf Length $01_{16}$		Leaf CRC (calculated)		LSB
	$53_{16}$ "S"	$43_{16}$ "C"	$41_{16}$ "A"	$4E_{16}$ "N"	

### 5.3.11 Device\_ID Key

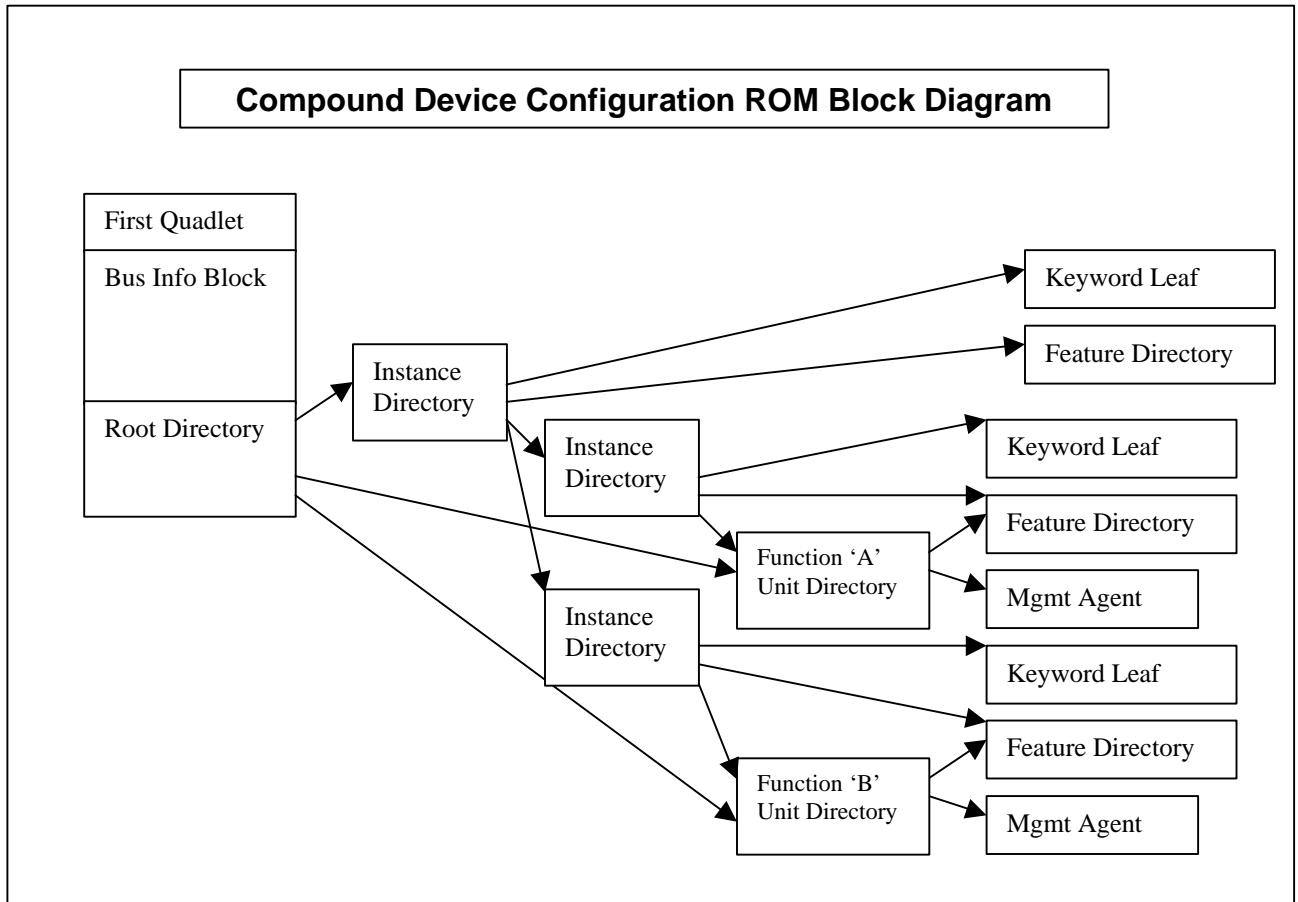
Offset:  $04A8_{16}$ 

MSB	Leaf Length $01_{16}$				Leaf CRC (calculated)				LSB
	$4D_{16}$ "M"				$46_{16}$ "F"				$47_{16}$ "G"
	$53_{16}$ "S"				$63_{16}$ "c"				$61_{16}$ "a"
	$6E_{16}$ "n"				$65_{16}$ "e"				$72_{16}$ "r"
	$43_{16}$ "C"				$6F_{16}$ "o"				$2E_{16}$ ":"
	$0A_{16}$ (LF)				$4D_{16}$ "M"				$44_{16}$ "D"
	$3A_{16}$ ":"				$4E_{16}$ "N"				$4C_{16}$ "L"
	$65_{16}$ "e"				$0D_{16}$ (CR)				$61_{16}$ "a"
									$6D_{16}$ "m"
									$0A_{16}$ (LF)
									$00_{16}$

#### **5.4 Compound Imaging Device (Informative)**

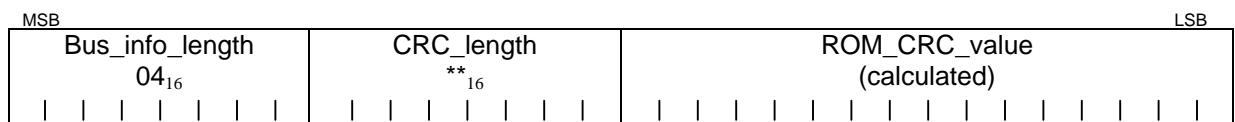
The sections contain information on a minimal implementation of Configuration ROM for a compound imaging device with two distinct functions. In this example, one function is a printer and the other is a scanner.

### 5.4.1 Block Diagram



### 5.4.2 First Quadlet

Offset: 0400<sub>16</sub>



### 5.4.3 Bus\_Info\_Block

Offset:  $0404_{16}$ 

MSB								LSB															
$31_{16}$ "1"								$33_{16}$ "3"															
I R M M	C M C C	I S C C	B M C C	P M C C	Resv	Cyc_Clk_Acc								Max_Rec	Reserved $0_{16}$								
Node_Vendor_ID														Chip_ID_High									
Chip_ID_Low														g	resv.								
														link_spd									

### 5.4.4 Root Directory

Offset:  $0414_{16}$ 

MSB		LSB	
Directory_length $05_{16}$		CRC-16 (calculated)	
Vendor ID key $03_{16}$		Module_Vendor_ID (can be the same as Node_Vendor_ID)	
Textual Descriptor key $81_{16}$		Module_Vendor_ID textual descriptor offset (indirect offset) 0x????	
Node Capabilities key $0C_{16}$		Node_Capabilities $0083C0_{16}$	
Instance Directory key $D8_{16}$		Instance Directory offset (indirect offset)	
Unit Directory key $D1_{16}$		Printer Unit Directory offset (indirect offset)	
Unit Directory key $D1_{16}$		Scanner Unit Directory offset (indirect offset)	

### **5.4.5 Instance Directory (Root)**

Offset: 0430<sub>16</sub>

The diagram illustrates the structure of an Instance Directory. It consists of several fields arranged horizontally:

- Instance Directory Length:** A field containing the value  $03_{16}$ .
- Instance Directory CRC (calculated):** A field representing the calculated CRC.
- Keyword Leaf key:** A field containing the value  $99_{16}$ .
- Keyword Leaf offset:** A field containing the value  $XXXXXX_{16}$ .
- Feature directory key:** A field containing the value  $DA_{16}$ .
- Feature directory offset:** A field containing the value  $YYYYYY_{16}$ .
- Instance Directory key:** A field containing the value  $D8_{16}$ .
- Instance offset:** A field representing the offset of the instance.

MSB (Most Significant Bit) is at the top, and LSB (Least Significant Bit) is at the bottom of the structure.

#### **5.4.6 Instance Directory (Printer)**

Offset: 0440<sub>16</sub>

The diagram illustrates the structure of an Instance Directory. It consists of several fields arranged horizontally:

- Instance Directory Length:** A 16-bit field containing the value  $03_{16}$ .
- Instance Directory CRC (calculated):** A 16-bit field.
- Keyword Leaf key:** A 16-bit field containing the value  $99_{16}$ .
- Keyword Leaf offset:** A 16-bit field containing the value  $XXXXXX_{16}$ .
- Feature directory key:** A 16-bit field containing the value  $DA_{16}$ .
- Feature directory offset:** A 16-bit field containing the value  $YYYYYY_{16}$ .
- Unit Directory key:** A 16-bit field containing the value  $D1_{16}$ .
- Unit directory offset:** A 16-bit field containing the value  $ZZZZZZ_{16}$ .

### 5.4.7 Instance Directory (Scanner)

Offset: 0450<sub>16</sub>

The diagram illustrates the structure of an Instance Directory. It consists of two main sections: the Instance Directory Length and the Instance Directory CRC (calculated). Below these are four pairs of fields, each consisting of a key and its corresponding offset. The fields are arranged from most significant bit (MSB) at the top to least significant bit (LSB) at the bottom.

Instance Directory Length	Instance Directory CRC (calculated)
$03_{16}$	
Keyword Leaf key $99_{16}$	Keyword Leaf offset $XXXXXX_{16}$
Feature directory key $DA_{16}$	Feature directory offset $YYYYYY_{16}$
Unit Directory key $D1_{16}$	Unit directory offset $ZZZZZZ_{16}$

### 5.4.8 Feature Directory (Root)

Offset:  $0460_{16}$ 

MSB	Feature Directory Length $04_{16}$	Directory CRC (calculated)	LSB
	Spec_ID key $12_{16}$	Spec_ID $00\ 5029_{16}$	
	SW_Version key $13_{16}$	SW_Version $XX\ XXXX_{16}$	
	PWG Service_List key $3E_{16}$	Service_List Offset $XX\ XXXX_{16}$	
	PWG Device_ID key $3F_{16}$	PWG Device_ID Offset $XX\ XXXX_{16}$	

### 5.4.9 Feature Directory (Printer)

Offset:  $0474_{16}$ 

MSB	Feature Directory Length $04_{16}$	Directory CRC (calculated)	LSB
	Spec_ID key $12_{16}$	Spec_ID $00\ 5029_{16}$	
	SW_Version key $13_{16}$	SW_Version $XX\ XXXX_{16}$	
	PWG Service_List key $3E_{16}$	Service_List Offset $XX\ XXXX_{16}$	
	PWG Device_ID key $3F_{16}$	PWG Device_ID Offset $XX\ XXXX_{16}$	

#### **5.4.10 Feature Directory (Scanner)**

Offset: 0488<sub>16</sub>

The diagram illustrates the structure of a Feature Directory. It consists of several fields arranged horizontally:

- Feature Directory Length:** A 16-bit field with the value  $04_{16}$ .
- Directory CRC (calculated):** A 16-bit field.
- Spec\_ID key:** A 16-bit field with the value  $12_{16}$ .
- Spec\_ID:** A 16-bit field with the value  $00\ 5029_{16}$ .
- SW\_Version key:** A 16-bit field with the value  $13_{16}$ .
- SW\_Version:** A 16-bit field with the value  $XX\ XXXX_{16}$ .
- PWG Service\_List key:** A 16-bit field with the value  $3E_{16}$ .
- Service\_List Offset:** A 16-bit field with the value  $XX\ XXXX_{16}$ .
- PWG Device\_ID key:** A 16-bit field with the value  $3F_{16}$ .
- PWG Device\_ID Offset:** A 16-bit field with the value  $XX\ XXXX_{16}$ .

### 5.4.11 Unit Directory (Printer)

Offset: 049C<sub>16</sub>

Unit Directory Length			Directory CRC (calculated)		
0A <sub>16</sub>					
Unit_Spec_ID key 12 <sub>16</sub>			Unit_Spec_ID 00 609E <sub>16</sub>		
Unit_SW_Version key 13 <sub>16</sub>			Unit_SW_Version 01 0483 <sub>16</sub>		
Cmd_Set_Spec_ID key 38 <sub>16</sub>			Cmd_Set_Spec_ID 00 5029 <sub>16</sub>		
Command_Set key 39 <sub>16</sub>			Command_Set YY YYYY <sub>16</sub>		
Command_Set_Rev key 3B <sub>16</sub>			Command_Set_Revision 000001 <sub>16</sub>		
Firmware_Revision key 3C <sub>16</sub>			Firmware_Revision 000001 <sub>16</sub>		
Reconnect_Timeout key 3D <sub>16</sub>			Reserved 00 <sub>16</sub>	Reconnect_Timeout 000001 <sub>16</sub>	
Management_Agent key 54 <sub>16</sub>			Management_Agent_Offset (initial register space offset) (implementation dependent)		
Unit_Characteristics key 3A <sub>16</sub>			Q   O   I	Reserved 00000 <sub>2</sub>	Mgt_ORB_Timeout (refer to SBP-2)      ORB_size 08 <sub>16</sub>
LUN key 14 <sub>16</sub>			Resv. 00 <sub>16</sub>	Device_type 02 <sub>16</sub>	Logical_Unit_number 00 <sub>16</sub>

### 5.4.12 Unit Directory (Scanner)

Offset: 04C8<sub>16</sub>

Unit Directory Length			Directory CRC (calculated)		
0A <sub>16</sub>					
Unit_Spec_ID key 12 <sub>16</sub>			Unit_Spec_ID 00 609E <sub>16</sub>		
Unit_SW_Version key 13 <sub>16</sub>			Unit_SW_Version 01 0483 <sub>16</sub>		
Cmd_Set_Spec_ID key 38 <sub>16</sub>			Cmd_Set_Spec_ID 00 5029 <sub>16</sub>		
Command_Set key 39 <sub>16</sub>			Command_Set YY YYYY <sub>16</sub>		
Command_Set_Rev key 3B <sub>16</sub>			Command_Set_Revision 000001 <sub>16</sub>		
Firmware_Revision key 3C <sub>16</sub>			Firmware_Revision 000001 <sub>16</sub>		
Reconnect_Timeout key 3D <sub>16</sub>			Reserved 00 <sub>16</sub>	Reconnect_Timeout 000001 <sub>16</sub>	
Management_Agent key 54 <sub>16</sub>			Management_Agent_Offset (initial register space offset) (implementation dependent)		
Unit_Characteristics key 3A <sub>16</sub>			Q o I	Reserved 00000 <sub>2</sub>	Mgt_ORB_Timeout (refer to SBP-2)
LUN key 14 <sub>16</sub>			Resv. 00 <sub>16</sub>	Device_type 06 <sub>16</sub>	ORB_size 08 <sub>16</sub>
				Logical_Unit_number 00 <sub>16</sub>	

### 5.4.13 Vendor Textual Descriptor

Offset:  $04F4_{16}$ 

MSB	Leaf Length $05_{16}$		Leaf CRC (calculated)		LSB
	Specifier_type $00_{16}$		Specifier_ID $00\ 0000_{16}$		
			Language_ID $0000\ 0000_{16}$		
	$50_{16}$ "P"	$72_{16}$ "r"	$69_{16}$ "i"	$6E_{16}$ "n"	
	$74_{16}$ "t"	$65_{16}$ "e"	$72_{16}$ "r"	$20_{16}$ " "	
	$43_{16}$ "C"	$6F_{16}$ "o"	$2E_{16}$ ". "	$00_{16}$	

### 5.4.14 Keyword Leaf (Printer)

Offset:  $050C_{16}$ 

MSB	Leaf Length $02_{16}$		Leaf CRC (calculated)		LSB
	50 <sub>16</sub> "P"		49 <sub>16</sub> "I"		4E <sub>16</sub> "N"
	$54_{16}$ "T"	$45_{16}$ "E"	$52_{16}$ "R"	$00_{16}$	

### 5.4.15 Service List (Printer)

Offset:  $0518_{16}$ 

MSB	Leaf Length $01_{16}$		Leaf CRC (calculated)		LSB
	50 <sub>16</sub> "P"		4C <sub>16</sub> "L"		$00_{16}$

### 5.4.16 Device\_ID Key (Printer)

Offset:  $0520_{16}$ 

MSB	Leaf Length $01_{16}$								Leaf CRC (calculated)								LSB
	4D <sub>16</sub> "M"								46 <sub>16</sub> "F"								3A <sub>16</sub> ":"
	50 <sub>16</sub> "P"								72 <sub>16</sub> "r"								6E <sub>16</sub> "n"
	74 <sub>16</sub> "t"								65 <sub>16</sub> "e"								20 <sub>16</sub> "
	43 <sub>16</sub> "C"								6F <sub>16</sub> "o"								0D <sub>16</sub> (CR)
	0A <sub>16</sub> (LF)								4D <sub>16</sub> "M"								4C <sub>16</sub> "L"
	3A <sub>16</sub> ":"								4E <sub>16</sub> "N"								6D <sub>16</sub> "m"
	65 <sub>16</sub> "e"								0D <sub>16</sub> (CR)								00 <sub>16</sub>

#### 5.4.17 Keyword Leaf (Scanner)

Offset:  $0540_{16}$ 

MSB	Leaf Length $02_{16}$								Leaf CRC (calculated)								LSB
	53 <sub>16</sub> "S"								43 <sub>16</sub> "C"								41 <sub>16</sub> "A"
																	4E <sub>16</sub> "N"
	4E <sub>16</sub> "N"								45 <sub>16</sub> "E"								52 <sub>16</sub> "R"
																	00 <sub>16</sub>

#### 5.4.18 Service List (Scanner)

Offset:  $054C_{16}$ 

MSB	Leaf Length $01_{16}$								Leaf CRC (calculated)								LSB
	53 <sub>16</sub> "S"								43 <sub>16</sub> "C"								41 <sub>16</sub> "A"
																	4E <sub>16</sub> "N"

### 5.4.19 Device\_ID Key (Scanner)

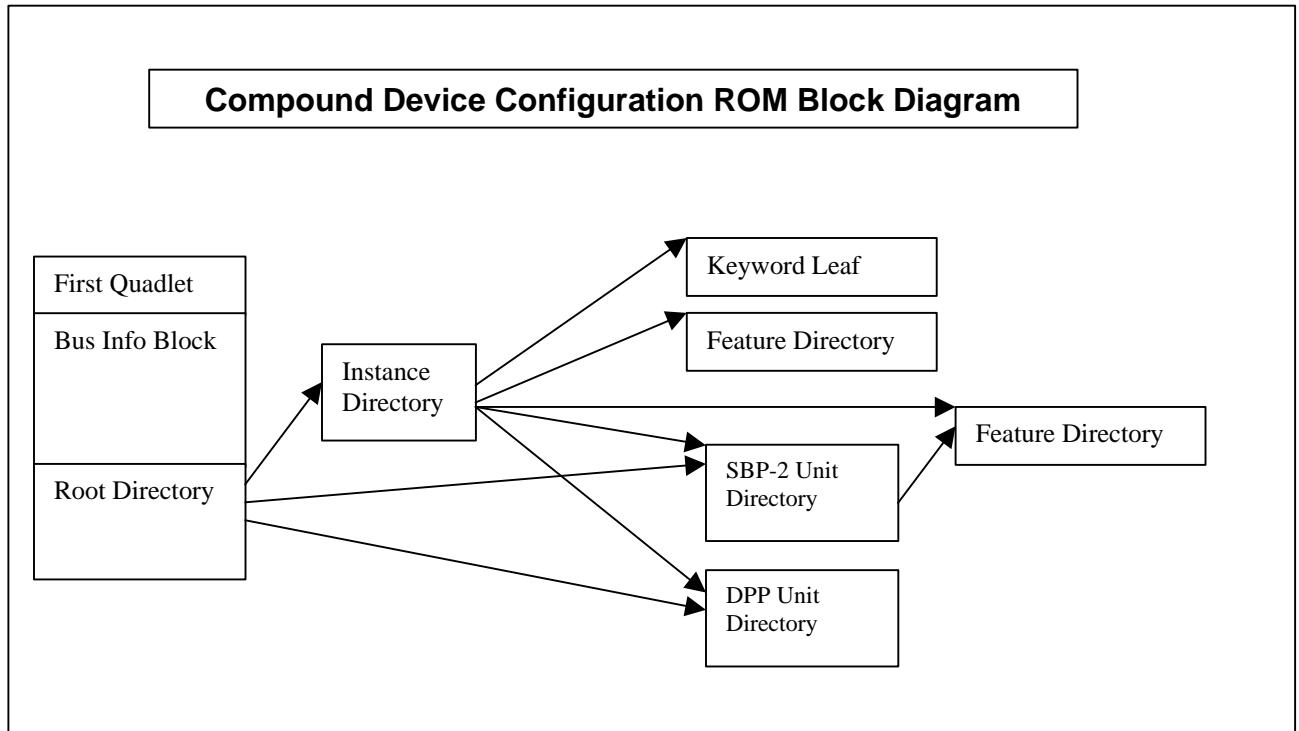
Offset:  $0554_{16}$ 

MSB	Leaf Length $01_{16}$				Leaf CRC (calculated)				LSB
	4D <sub>16</sub> "M"				46 <sub>16</sub> "F"				47 <sub>16</sub> "G"
	53 <sub>16</sub> "S"				63 <sub>16</sub> "c"				61 <sub>16</sub> "a"
	6E <sub>16</sub> "n"				65 <sub>16</sub> "e"				72 <sub>16</sub> "r"
	43 <sub>16</sub> "C"				6F <sub>16</sub> "o"				2E <sub>16</sub> ":"
	0A <sub>16</sub> (LF)				4D <sub>16</sub> "M"				0D <sub>16</sub> (CR)
	3A <sub>16</sub> ":"				4E <sub>16</sub> "N"				44 <sub>16</sub> "D"
	65 <sub>16</sub> "e"				0D <sub>16</sub> (CR)				61 <sub>16</sub> "a"
	0A <sub>16</sub> (LF)				0A <sub>16</sub> (LF)				6D <sub>16</sub> "m"
									00 <sub>16</sub>

## 5.5 Multi-Protocol Imaging Device (Informative)

The sections contain information on a minimal implementation of Configuration ROM for a Multi-Protocol imaging device. In this example, the printer function is accessed either via the PWG Imaging Profile or the PWG-C DPP command set.

### 5.5.1 Block Diagram



### 5.5.2 First Quadlet

Offset:  $0400_{16}$

MSB	Bus_info_length $04_{16}$	CRC_length $**_{16}$	ROM_CRC_value (calculated)	LSB

### 5.5.3 Bus\_Info\_Block

Offset:  $0404_{16}$ 

MSB										LSB									
31 <sub>16</sub> "1"					33 <sub>16</sub> "3"					39 <sub>16</sub> "9"					34 <sub>16</sub> "4"				
I	C	I	B	P	Resv	Cyc_Clk_Acc					Max_Rec	Reserved 0 <sub>16</sub>					g	resv.	link_spd
R	M	S	M	M		Node_Vendor_ID										Chip_ID_High			
M	C	C	C	C		Chip_ID_Low													

### 5.5.4 Root Directory

Offset:  $0414_{16}$ 

MSB										LSB									
Directory_length 05 <sub>16</sub>										CRC-16 (calculated)									
Vendor ID key 03 <sub>16</sub>										Module_Vendor_ID (can be the same as Node_Vendor_ID)									
Textual Descriptor key 81 <sub>16</sub>										Module_Vendor_ID textual descriptor offset (indirect offset) 0x????									
Node Capabilities key 0C <sub>16</sub>										Node_Capabilities 0083C0 <sub>16</sub>									
Instance Directory key D8 <sub>16</sub>										Instance Directory offset (indirect offset)									
Unit Directory key D1 <sub>16</sub>										SBP-2 Printer Unit Directory offset (indirect offset)									
Unit Directory key D1 <sub>16</sub>										DPP Printer Unit Directory offset (indirect offset)									

### 5.5.5 Instance Directory (Root)

Offset:  $0430_{16}$ 

MSB	Instance Directory Length $04_{16}$	Instance Directory CRC (calculated)	LSB
	Keyword Leaf key $99_{16}$	Keyword Leaf offset $XXXXXX_{16}$	
	Feature directory key $DA_{16}$	Feature directory offset $YYYYYY_{16}$	
	Unit Directory key $D1_{16}$	SBP-2 Printer Unit Directory offset $ZZZZZZ_{16}$	
	Unit Directory key $D1_{16}$	DPP Printer Unit Directory offset $ZZZZZZ_{16}$	

### 5.5.6 Feature Directory (Root)

Offset:  $0444_{16}$ 

MSB	Feature Directory Length $04_{16}$	Directory CRC (calculated)	LSB
	Spec_ID key $12_{16}$	Spec_ID $00\ 5029_{16}$	
	SW_Version key $13_{16}$	SW_Version $XX\ XXXX_{16}$	
	PWG Service_List key $3E_{16}$	Service_List Offset $XX\ XXXX_{16}$	
	PWG Device_ID key $3F_{16}$	PWG Device_ID Offset $XX\ XXXX_{16}$	

### 5.5.7 Feature Directory (SBP-2 Printer)

Offset:  $0458_{16}$

MSB			LSB
	Feature Directory Length $04_{16}$		Directory CRC (calculated)
	Spec_ID key $12_{16}$		Spec_ID $00\ 5029_{16}$
	SW_Version key $13_{16}$		SW_Version $XX\ XXXX_{16}$
	PWG Service_List key $3E_{16}$		Service_List Offset $XX\ XXXX_{16}$
	PWG Device_ID key $3F_{16}$		PWG Device_ID Offset $XX\ XXXX_{16}$

### 5.5.8 Unit Directory (SBP-2 Printer)

Offset: 046C<sub>16</sub>

Unit Directory Length 0A <sub>16</sub>			Directory CRC (calculated)		
Unit_Spec_ID key 12 <sub>16</sub>			Unit_Spec_ID 00 609E <sub>16</sub>		
Unit_SW_Version key 13 <sub>16</sub>			Unit_SW_Version 01 0483 <sub>16</sub>		
Cmd_Set_Spec_ID key 38 <sub>16</sub>			Cmd_Set_Spec_ID 00 5029 <sub>16</sub>		
Command_Set key 39 <sub>16</sub>			Command_Set YY YYYY <sub>16</sub>		
Command_Set_Rev key 3B <sub>16</sub>			Command_Set_Revision 000001 <sub>16</sub>		
Firmware_Revision key 3C <sub>16</sub>			Firmware_Revision 000001 <sub>16</sub>		
Reconnect_Timeout key 3D <sub>16</sub>			Reserved 00 <sub>16</sub>	Reconnect_Timeout 000001 <sub>16</sub>	
Management_Agent key 54 <sub>16</sub>			Management_Agent_Offset (initial register space offset) (implementation dependent)		
Unit_Characteristics key 3A <sub>16</sub>			Q   O   I 	Reserved 000002	Mgt_ORB_Timeout (refer to SBP-2)
LUN key 14 <sub>16</sub>			Resv. 00 <sub>16</sub>	Device_type 02 <sub>16</sub>	ORB_size 08 <sub>16</sub>
				Logical_Unit_number 00 <sub>16</sub>	

### 5.5.9 Unit Directory (DPP Printer)

Offset:  $0498_{16}$ 

MSB	Unit Directory Length $0A_{16}$	Directory CRC (calculated)	LSB
Unit_Spec_ID key $12_{16}$		Unit_Spec_ID $00 A02D_{16}$	
Unit_SW_Version key $13_{16}$		Unit_SW_Version $01 0483_{16}$	
Cmd_Set_Spec_ID key $38_{16}$		Cmd_Set_Spec_ID $00 A02D_{16}$	
Command_Set key $39_{16}$		Command_Set $YY YYYY_{16}$	
Command_Set_Rev key $3B_{16}$		Command_Set_Revision $000001_{16}$	
Firmware_Revision key $5B_{16}$		Connection Register offset $004000_{16}$	

### 5.5.10 Vendor Textual Descriptor

Offset:  $04B4_{16}$ 

MSB	Leaf Length $05_{16}$	Leaf CRC (calculated)	LSB
Spec_type $00_{16}$		Specifier_ID $00 0000_{16}$	
	Language_ID $0000 0000_{16}$		
$50_{16}$ "P"	$72_{16}$ "r"	$69_{16}$ "i"	$6E_{16}$ "n"
$74_{16}$ "t"	$65_{16}$ "e"	$72_{16}$ "r"	$20_{16}$ "
$43_{16}$ "C"	$6F_{16}$ "o"	2E ":"	$00_{16}$

### 5.5.11 Keyword Leaf (Printer)

Offset: 04CD<sub>16</sub>

MSB	Leaf Length 02 <sub>16</sub>								Leaf CRC (calculated)								LSB
	50 <sub>16</sub> "P"								52 <sub>16</sub> "R"								
	54 <sub>16</sub> "T"								45 <sub>16</sub> "E"								
	46 <sub>16</sub> "D"								50 <sub>16</sub> "P"								
	53 <sub>16</sub> "S"								42 <sub>16</sub> "B"								
									50 <sub>16</sub> "P"								
									32 <sub>16</sub> "2"								

### 5.5.12 Service List (Printer)

Offset: 04E0<sub>16</sub>

MSB	Leaf Length 01 <sub>16</sub>								Leaf CRC (calculated)								LSB
	50 <sub>16</sub> "P"								44 <sub>16</sub> "D"								
									4C <sub>16</sub> "L"								

### 5.5.13 Device\_ID Key (Printer)

Offset:  $4E8_{16}$ 

MSB	Leaf Length $01_{16}$				Leaf CRC (calculated)				LSB
	4D <sub>16</sub> "M"				46 <sub>16</sub> "F"				47 <sub>16</sub> "G"
	50 <sub>16</sub> "P"				72 <sub>16</sub> "r"				69 <sub>16</sub> "i"
	74 <sub>16</sub> "t"				65 <sub>16</sub> "e"				72 <sub>16</sub> "r"
	43 <sub>16</sub> "C"				6F <sub>16</sub> "o"				2E <sub>16</sub> ":"
	0A <sub>16</sub> (LF)				4D <sub>16</sub> "M"				0D <sub>16</sub> (CR)
	3A <sub>16</sub> ":"				4E <sub>16</sub> "N"				44 <sub>16</sub> "D"
	65 <sub>16</sub> "e"				0D <sub>16</sub> (CR)				61 <sub>16</sub> "a"
	0A <sub>16</sub> (LF)				00 <sub>16</sub>				6D <sub>16</sub> "m"

## **6 Discovery (Informative)**

The primary method for discovering devices on the Serial Bus is through information read from the Configuration ROM. This profile defines information in addition to that defined in the referenced specifications.

### **6.1 Device Information Model**

#### **6.1.1 Device Availability**

Availability of the configuration ROM data is determined by the first quadlet at location FFFF F000 0400<sub>16</sub>.

#### **6.1.2 Configuration ROM Changes**

Devices that change values in their configuration ROM shall only change those values during a bus reset.

#### **6.1.3 Change Indicator**

Devices shall implement the generate bits defined in IEEE-p1394a. The value of this field is incremented if any portion of the configuration ROM has changed during a bus reset. The coverage of the Bus\_Info\_Block in the first quadlet via the CRC\_Length field causes the the CRC value in the first quadlet to be recalculated each time the generate bits are modified.

#### **6.1.4 Device Class Detection**

This section is provided to understand the detection mechanism for the device class.

1394 PWG Profile compliant nodes are required to implement an instance directory which contains a Keyword Leaf, Feature Directory and Unit\_Directory\_Offset entries.

A bus enumerator can perform a top level search of the bus by inspecting the keyword leaf. The Feature Directory provides more specific information related to the device class listed in the Keyword Leaf.

In addition to these new extensions to Configuration ROM, legacy SBP-2 enumerators can inspect the five-bit device\_type field contained within the Logical\_Unit\_Number entry in the Unit Directory.

#### **6.1.5 Protocol Detection**

This section is provided to understand the detection mechanism for the protocol driver stack.

SBP-2 compliant nodes are required to implement a unit directory that contains a Unit\_Spec\_ID and Unit\_SW\_Version entries. The concatenated values of key type and key value for the Unit\_Spec\_ID is 12<sub>16</sub> and Unit\_SW\_Version is 13<sub>16</sub>. The SBP-2 Unit\_Spec\_ID value is 00 609E<sub>16</sub> and the Unit\_SW\_Version value is 01 0483<sub>16</sub>.

1394 PWG Profile compliant nodes are required to implement a unit directory which contains a Cmd\_Set\_Spec\_ID and Command\_Set entries. The concatenated values of key type and key value for the Cmd\_Set\_Spec\_ID is 12<sub>16</sub> and Unit\_SW\_Version is 13<sub>16</sub>. The 1394 PWG Profile Cmd\_Set\_Spec\_ID value is 005029<sub>16</sub> and the Command\_Set value is XX XXXX<sub>16</sub>. In addition, the Logical\_Unit\_Number entry in the Unit Directory contains a five-bit device\_type field.

#### **6.1.6 Plug & Play Support**

Devices may provide additional configuration ROM entries in addition to those defined in this profile. The specification for these additional entries is vendor dependent.



## **7 Identifiers**

1394 nodes require 24 bit identifiers to correctly identify the software interface for a node.

### **7.1 SBP-2 Defined Identifiers**

Unit\_Spec\_ID == 00 609E<sub>16</sub>  
Unit\_SW\_Version == 01 0483<sub>16</sub>.

### **7.2 1394 PWG Organization Unique Identifier (OUI)**

The 1394 PWG Profile implements the following references to 24 bit identifiers.

#### **7.2.1 Cmd\_Set\_Spec\_ID.**

The 24 bit value for Cmd\_Set\_Spec\_ID == 005029<sub>16</sub>

#### **7.2.2 Command\_Set.**

The 1394 PWG Transport Command Set 24 bit value for Command\_Set == XX XXXX<sub>16</sub>.

#### **7.2.3 Feature Directory Spec\_ID**

Spec\_ID == XX XXXX<sub>16</sub>

### **7.3 1394 PWG Keyword Definitions**

The 1394 PWG has defined the following keywords as the standard format for use within the Keyword Leaf.

PRINTER  
SCANNER  
MFP  
CAMERA  
DISK  
MODEM  
FAX  
SEND  
RECEIVE  
IMAGE  
PHOTO  
COLOR

### **7.4 1394 PWG Key Feature Directory Definitions**

The 1394 PWG Profile defines the following values and keys for use within the PWG Feature Directory.

#### **7.4.1 Unit\_SW\_Version Value**

Unit\_SW\_Version == XX XXXX<sub>16</sub>

#### **7.4.2 PWG Service\_List Key Value**

Service\_List == 3E<sub>16</sub>

#### **7.4.3 PWG Device\_ID Key Value**

Device\_ID == 3F<sub>16</sub>

### **7.5 OUI Source**

OUI values are available from the IEEE Registration Authority Committee (RAC). Their address is:

Registration Authority Committee  
The Institute of Electrical and Electronic Engineers, Inc.  
445 Hoes Lane  
Piscataway, NJ 08855-1331  
USA  
(908) 562 3813