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AMI-C Power Management EPoC System Description V0.90

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Abstract

This specification is based on the AMI-C 3033 Power Management EPoC System Description V0.90. This document outlines the EPoC (Embedded Proof of Concept) system of Power Management Specification for IEEE1394 devices.

Keywords

IEEE 1394, Serial Bus, AMI-C, Automotive, Power Management, EPoC

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Name	Phrase

Revision log

Document no. 3033	Version no. 0.90	Version date 2005-07-20
Document title **AMI-C Power Management EPoC system Document**		

Revision date	Affected sections
2005-07-20	Version 1.00 released for publication. This version is the basis for all future revisions.

Contents

Figures

Tables

Foreword

Introduction

This document outlines the EPoC (Embedded Proof of Concept) system of Power Management Specification for IEEE1394 devices.

1 Scope

This document describes the components (hardware and software) of this system, the interfaces between each component, and a rough description of the manner of operation.

2 References

2.1 Normative references

(1) AMI-C 2001 AMI-C network protocol requirements for vehicle interface access v1.0
(2) AMI-C 2002 AMI-C Common Message Set v1.02
(3) AMI-C 3023 AMI-C Power Management Specification v0.5
(4) AMI-C 4001 AMI-C physical specification v1.0

2.2 Informative references

(1) AMI-C 3003 AMI-C requirements and guidelines for 1394 Automotive networks v0.90
(2) AMI-C 3003-4 1394 Automotive proof-of-concept implementation (steps 4, 5, and 6) v1.00
(3) TA Document 2001018, 1394 Automotive Specification (IDB-1394) 1.0
(4) P-Mode Repeater specification (Sumitomo)
(5) AMI-C 1394 Power Management EPoC Key Position Application Specification (Tata Elxsi)
(6) AMI-C 1394 Power Management EPoC P-Mode I/F-BOX Specification r04 (Xanavi)
(7) AMI-C Power Management EPoC Architecture rev 0.6 (WIPRO)

3 Abbreviations

The abbreviations used by this document are described below.
AMI-C: Automotive Multimedia Interface Collaboration
ASN: Abstract Syntax Notation

CCP: Customer Convenience Port
CMS: Common Message Set
EPoC: Embedded Proof of Concept
LPM: Local Power Manager
PDU: Protocol Data Unit
POF: Plastic Optical Fiber
SPM: System Power Master
VI: Vehicle Interface
P-Mode: Power Mode
PM-Line: Power Mode Line

4 Definitions

The definitions used in this document are described below.

5 System Architecture Outline

5.1 Purpose

This prototype is used for system level evaluation of a part of function of AMI-C power management specification. Function evaluated in this prototype is shut-down and wake-up.

5.2 Overview

The AMI-C power management model shown in Figure 1.

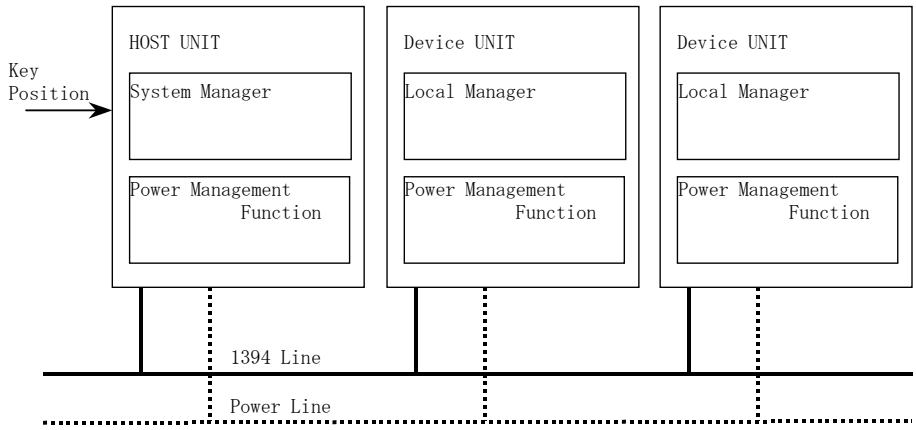

Figure 1 – AMI-C Power Management Model

The AMI-C power management EPoC system architecture outline is shown in Figure 2. This prototype was made to resemble AMI-C power management model (Figure 1).

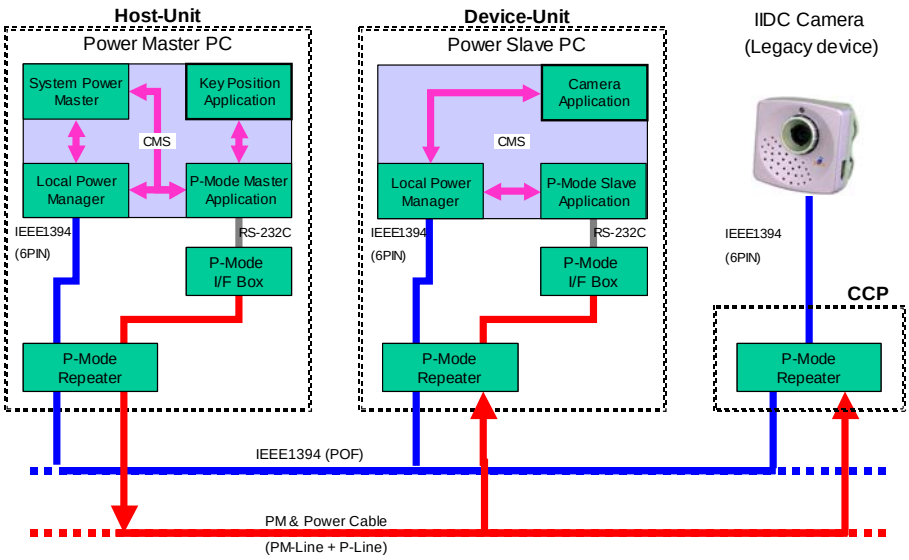

Figure 2 – Power Management EPoC System Overview

The Power Master PC emulates System Manager of host unit. The Power Slave PC emulates Local Manager of device unit. The Key Position Application emulates an ignition key in host unit.
The P-Mode Repeater and The P-Mode I/F Box are used for Power management function with low layer (PHY, Link) in this EPoC.
The IIDC camera is used as example of Legacy Device (this does not support AMI-C Power Management Specification), and this camera is controlled by Power Slave PC.
This CCP is not as specified as 1394TA.

5.3 Operation

(This is described at the future.)

6 Description of EPoC Components

The AMI-C power management EPoC components are shown in Figure 3.

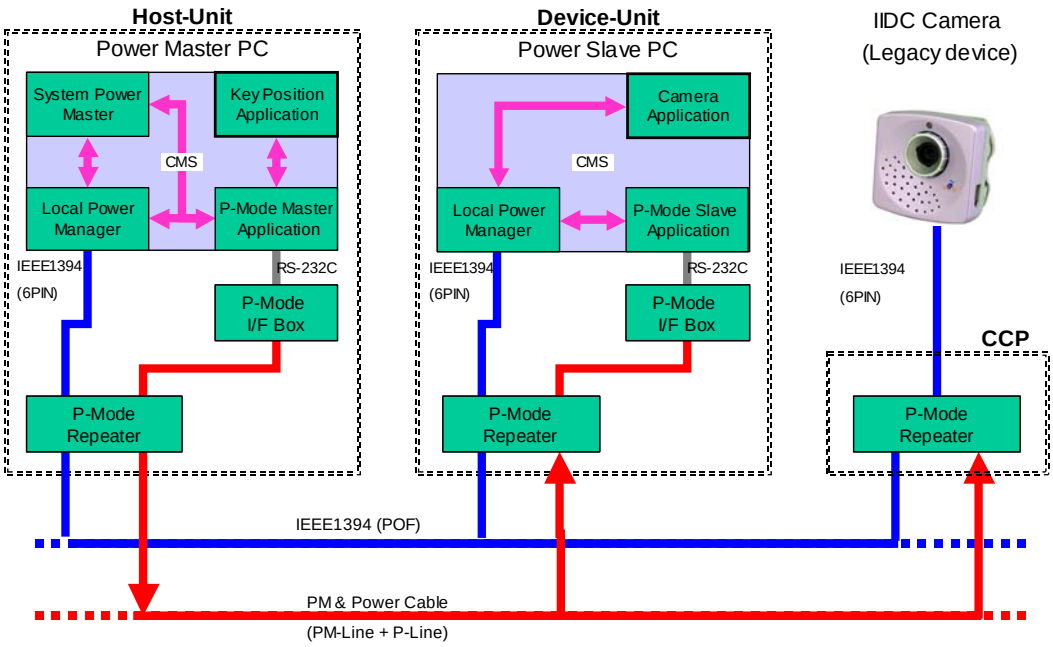

Figure 3 – Power Management EPoC System

6.1 Host Unit

The host unit is composed of a power master pc, its P-Mode repeater, and its P-Mode I/F Box.

6.2 Device Unit

The host unit is composed of a power slave pc, its P-Mode repeater, and its P-Mode I/F Box.

6.3 CCP

The CCP is composed of a P-Mode repeater itself. This CCP is not a specified as 1394TA Definition.

6.4 Power Master PC

This PC is used as a prototype of a host unit, providing power management for the other device units. (Power Slave PC / IIDC Camera)

6.5 Power Slave PC

This PC is used as a prototype of a device unit. It displays the power state as ordered by the Power Master PC.

6.6 IIDC Camera

This device serves as an example of a legacy device connected to the CCP. Just as with the Power Slave PC, it is a power control target. In this implementation, the camera is a commonly available IEEE1394 device.

The IIDC Camera obtains power through an IEEE1394 Cable (6PIN) from P-Mode Repeater.

6.7 P-Mode Repeater

P-Mode Repeater supplies electric power in IEEE1394 port (metal). There are three P-Mode Repeaters used in the power management EPoC.

The power management functions of the P-Mode repeater are controlled through the P-Mode I/F box and the Wakeup request button.

A P-Mode Repeater has one port for IEEE1394 metal (6PIN), 2 ports for 1394POF(2PIN), and 2 ports for PM & Power Connector.

The Table. 1 shows the relationships between the PM-Line signal from P-Mode I/F Box and P-Mode Repeater state

Table 1 – PM Repeater Mode Table

PM-Line State	P-Mode Repeater State
High (12V)	Sleep
Low (0V)	Active

The Figure 4 shows the relationships between the Wake up request signal from P-Mode I/F Box and P-Mode Repeater operation state.

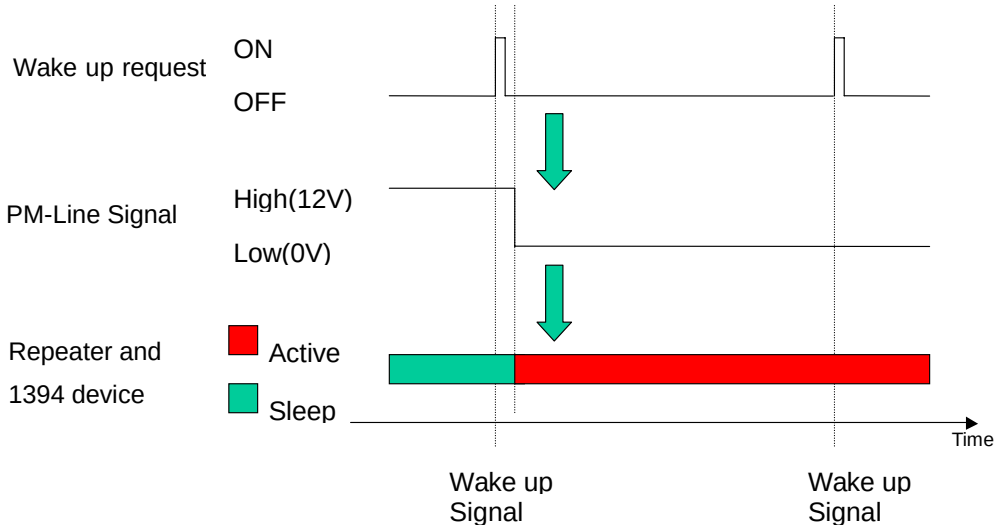

Figure 4 – Wakeup request time chart

Active state: Components are powered up and functioning.

Sleep state: Components can be in an ultra-low-power mode or powered off. (Note: This EPoC doesn't implement the ultra-low-power mode at this point)

6.8 P-Mode I/F Box

The P-Mode I/F box is the interface between the Power Master (or slave) PC and the P-Mode repeater. Basically, the P-Mode I/F Box receives a "Sleep" or "Wakeup" control data from the Power Master PC. It controls the power state of

all P-Mode Repeaters and notifies the power status to the Power Slave PC and Power Master PC.
Two P-Mode I/F Boxes are used by the Power Master PC and Power Slave PC one-on-one.
Each P-Mode I/F Box components has a RS-232C connector port (To provide a control and PC notification interface), a PM & Power Connector port (to connect to P-Mode Repeaters), and a Power connector port (to connect to external power supply).
The P-Mode I/F Box performs the following functions:

- ✓ Receive "Wakeup" or "Sleep" control data from Power Master PC, and change PM-Line to high or low.
- ✓ Receive "Wakeup" request from a P-Mode repeater, and change PM-Line from high to low.(This fucntion is not used in this power management EPoC.)
- ✓ Send the PM-Line status to the Power Master PC and the Power Slave PC.
- ✓ The I/F Box from the Power Master PC supplies DC power to all P-Mode repeaters, IIDC Camera and to the P-Mode I/F Box from the Power slave PC.

The Figure 5 shows the sequence of P-Mode I/F BOX in this EPoC.

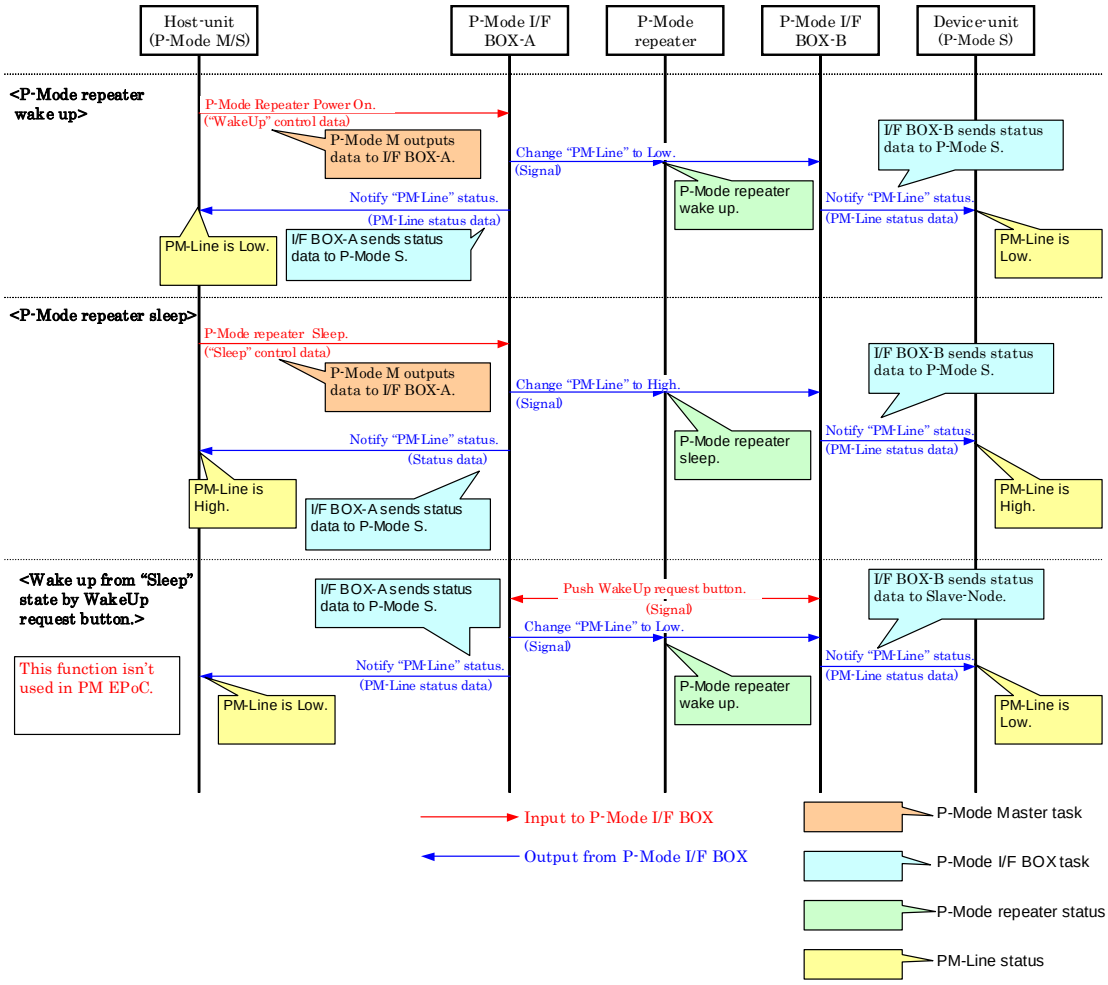

Figure 5 – Sequence of P-Mode I/F BOX

6.9 PM & Power Cable

The PM & Power Cable is used for power management in this EPoC. This cable connects P-Mode Repeater to P-Mode I/F Box. And also provide connection between repeaters.

The Figure 6 show the PM & Power Connector.

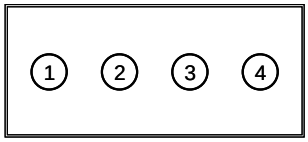

Figure 6 – PM & Power Connector

PM & Power connecter pin function

(1) PM-Line (High: 12V, Low:0V)

Power control signal line, The PM-Line's function is to wake-up or sleep a device unit and CCP.

This signal line is controlled from host unit in wake up button also this EPoC.

(2) Wakeup Line

Wake up request signal line, The Wakeup line senses a wakeup request from a device unit or P-Mode repeater.

This signal line is not used in this EPoC.

(3) Power Line (12V)

This line provides power from P-Mode I/F Box to P-Mode Repeaters and IIDC Camera.

(4) GND

Ground

6.10 System Power Master (SPM)

The system power master controls the power mode of the entire network. Every 1394 automotive network requires one system power master.

The following are the high-level requirements for the SPM:

1) Power mode change decision algorithm.
2) A SPM enabled device may receive information about the environmental power situation from several possible sources such as key-position application.
3) Whenever the trigger for power a mode change is activated, the SPM will ANNOUNCE the power mode change on the network thereby indicating the new power status. At this point, all LPM's can potentially switch to the new state.
4) The SPM will then send another message to all LPM's on the network directing them to SET the new power state.
5) In the event that any LPM does switch to the new power state, the SPM may override this decision and FORCE the new power state by sending a FORCE message on the network.

6.11 Local Power Manager (LPM)

A local power manager shall be included in each device that requires a specific sleep state in order to fulfill low power requirements.

The following are the high-level requirements for the LPM:

1) The LPM's function is the local power mode management of a particular node.
2) The LPM must be able to receive and process commands from the SPM.
3) Upon receiving an ANNOUNCE message from the SPM, the LPM must have the capability of deciding whether, it can go to the new power state.
4) In the case in which the LPM decides to go to the new power state, it must send an ACCEPT message to the SPM. Otherwise it must send a REJECT message to the SPM.

5) Within 100 msec of receiving a SET message from the SPM, the LPM must notify all the applications on the device about the new power state, save it's internal data, close all active connections and enter a power saving condition.
6) Within 100 msec of receiving a FORCE message from the SPM, the LPM shall put its ports into a sleep state and the higher layer into an in-active state. (Compliant with PM 1394TA Spec)

6.12 Power Distribution Manager (PDM)

PDM is implemented as part of the Bus Manager. At every bus reset, the PDM builds a knowledge base of power capabilities of each node in the network by tracking the power class information in the self-ID packet of serial bus power consumers. This information is used by the PDM to decide if a port is a legacy port that has to be Disabled/Enabled instead of being suspended/resumed when SPM sends out Suspend/Resume commands.

6.13 Key Position Application

The key position application is a GUI. Through this GUI the user will be able to control the power ON and power OFF positions of the Key.

The Figure 7 show Key Position Application GUI.

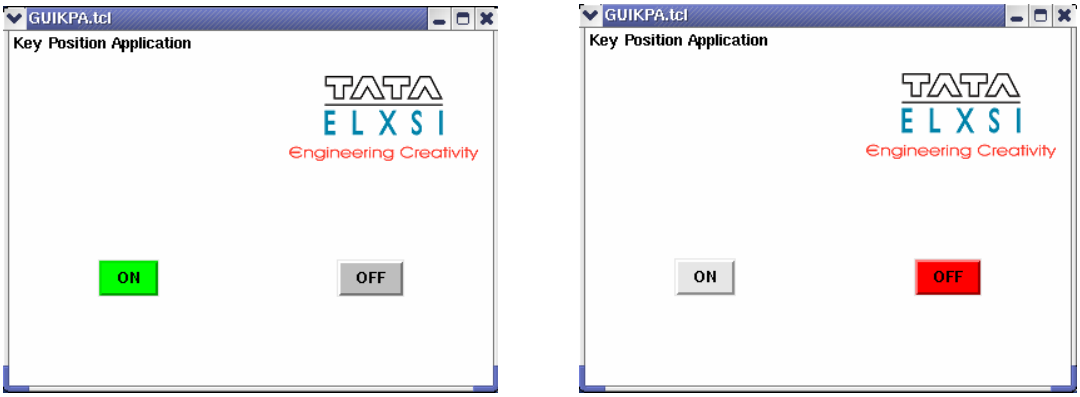

Figure 7 – Key Position Application GUI (ON / OFF)

6.14 P-Mode Master Application

The P-Mode master performs the following functions:

- ✓ Receive the ON/OFF signal from the GUI.
- ✓ Generate the control command for wake up/sleep and encapsulate this control command into a P-Mode I/F Box PDU .
- ✓ Transmit this PDU to the serial communication Module.
- ✓ Encode the messages "Shutdown the network" and "Wakeup the network" in CMS format.
- ✓ Transmit the encoded messages to the SPM.

The Figure 8 show Software architecture of the P-Mode Master application.

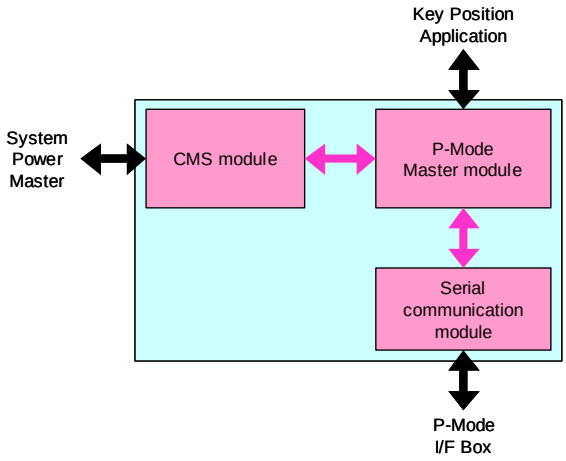

Figure 8 – Software architecture of the P-Mode Master application

6.15 P-Mode Slave Application

The P-Mode slave performs the following functions:

- ✓ Encode the message "Resume Local PHY + Link" in CMS format and transmit it to the LPM
- ✓ Decode and receive the CMS messages "PHY + Link resumed" and "PM-line deactivate" from the LPM
- ✓ Receive the PM-Line status PDU from the I/F box through the Serial Communication Module

The Figure 9 show Software architecture of the P-Mode Slave application.

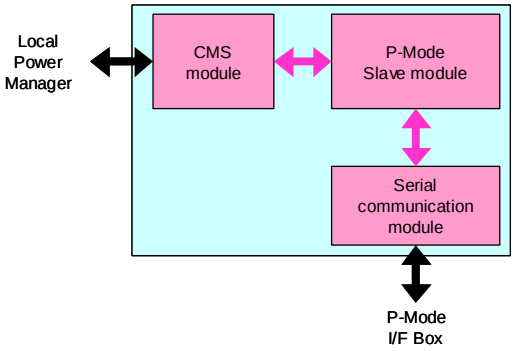

Figure 9 – Software architecture of the P-Mode Master application

6.16 CMS module

This module will have the necessary structure for the CMS messages. This module will take care of the encoding /decoding of all CMS messages which has to transmit/receive from/to SPM.

6.17 Serial communication module

The serial communication module

- Encodes and decodes the I/F box commands and status to and from RS232 format

- Transmits and receives the RS232 packets from the RS232 port.

6.18 Camera Application

7.18 Camera Application

The main functionality of the Camera Application is to control the legacy device, IIDC Camera, by providing a GUI which can be operated by a user for controlling the Camera operations. To realize this functionality, the Device Unit needs to have an IIDC Controller implemented in 1394 Driver layers with the Camera Application acting as the User Interface of the IIDC Controller.

This IIDC Controller is to be compliant with Instrumentation and Industrial Digital Camera (IIDC) protocol over 1394 network as specified by Instrumentation and Industrial Control Working Group (II-WG) of the 1394 Trade Association, Digital Camera Sub Working Group (DC-SWG). This also mandates that the Digital cameras be IIDC (v1.30 or v1.04) compliant. Some of the parameters for the IIDC Camera that can be controlled by the IIDC Controller and in turn the Camera Application could be Video Modes, Frame rates, Brightness, Auto Exposure, Sharpness, White balance, Hue, Saturation, etc.

Along with the Controlling GUI, the Camera Application is expected to display the Camera Images on its screen which arrive as Isochronous Video Stream from the Camera Application. Cameras continue sourcing isochronous video data until the Camera application instructs the cameras to stop streaming. If a bus reset occurs during camera operation, the camera continues sourcing isochronous data immediately after the bus reset using the same isochronous channel number.

In case of Power Status change, Camera Application turns the camera power ON/OFF by writing into the Status and Control register of the camera, provided, the camera supports this feature. The Camera application can determine this by examining the Inquiry register for basic function field, Cam_Power_Cntl, of the camera.

Whether this explicit control of Camera Power is required or not has to be verified during EPoC integration testing as it is likely that disabling of Camera port by SPM would also subsequently result in Camera power being switched off as the Camera is drawing power from the cable.

To interact with LPM in order to suspend/resume itself, the Camera Application uses VIP and CMS Messages. So, in terms of AMI-C Network Communications Model, the Camera Application is a Functional Module (FM) with a fixed I-Num as there is going to be only one Camera in this EPoC.

7 EPoC Power Management Scenario

7.1 Wakeup Scenario

The Procedure of wakeup is explained below.

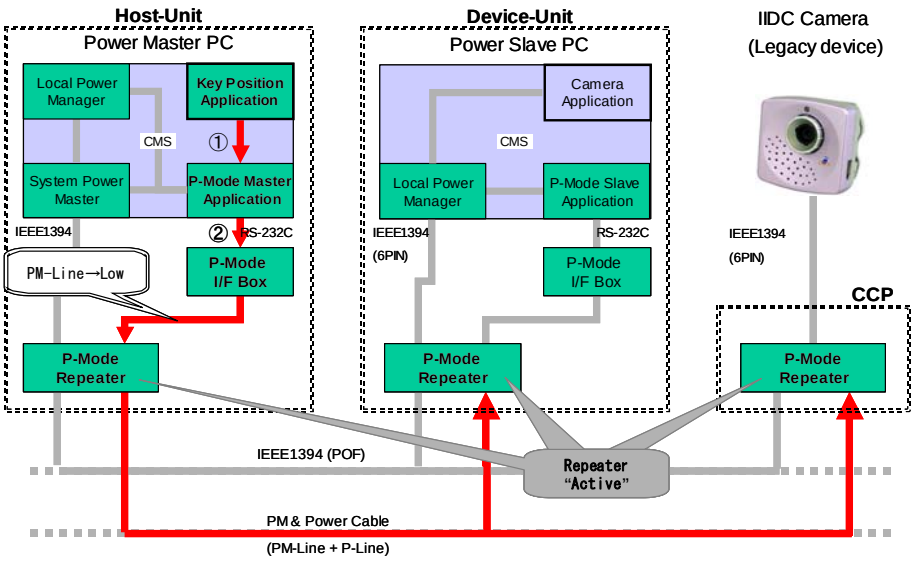

Figure 10 – Wakeup of PHY/Link Layer

1) When The Key Position Application detects ON of an ignition key. It is notified P-Mode Master Application of from Key position application.
2) P-Mode Master Application transmits "Wakeup" command to P-Mode I/F Box in host unit. P-Mode I/F Box turns a state of all P-Mode Repeater into "Active state".

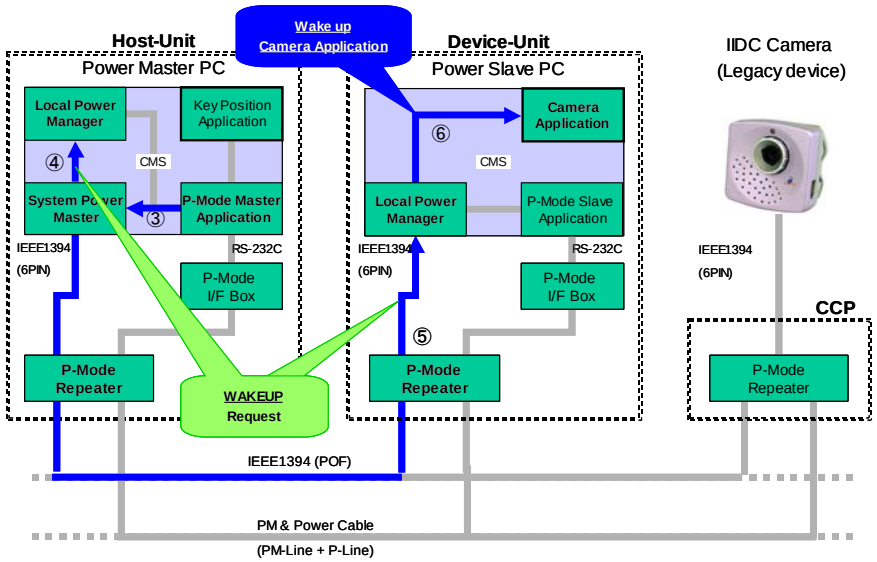

Figure 11 – Send "Wakeup" Command

3) P-Mode Master Application notifies to System Power Master that a network was started.
4) System Power Master transmits a Wakeup command to every Local Power Manager.
5) The Local Power Master in Device Unit receives the message of Wakeup command through the 1394 network.
6) When Local Power Master in Device Unit receives the message of Wakeup command, Camera Application is activated.

7.2 Shutdown Scenario

The Procedure of shut down is explained below.

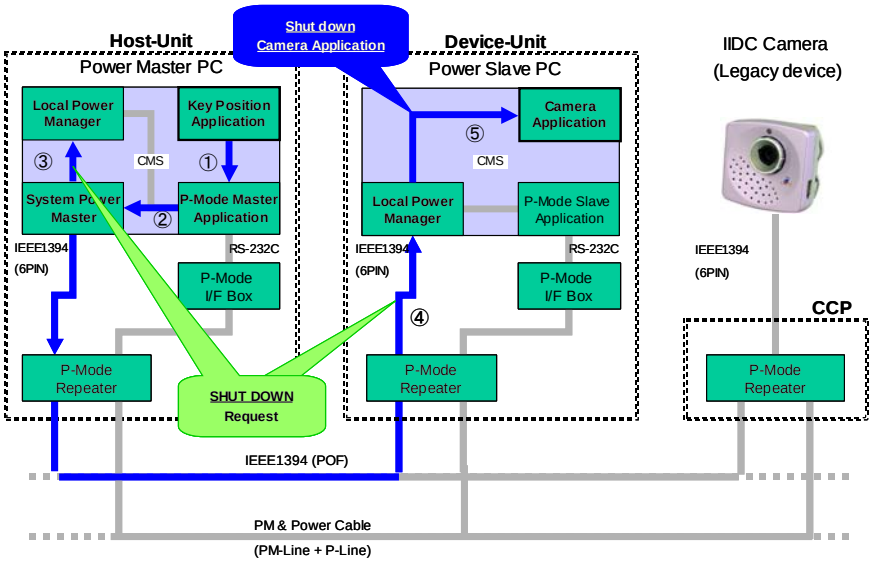

Figure 12 – Send "Wakeup" Command

1) When the Key Position Application detects OFF of an ignition key. It is notified P-Mode Master Application of from Key position application.
2) P-Mode Master Application converts OFF status into a CMS format and sends it to SPM.
3) SPM sends a SHUTDOWN request message to LPM in Host-Unit.
4) And SPM transmits to LPM in Device-Unit through IEEE1394 network at the same time.
5) LPM orders shut down to local application. (Ex: camera application)

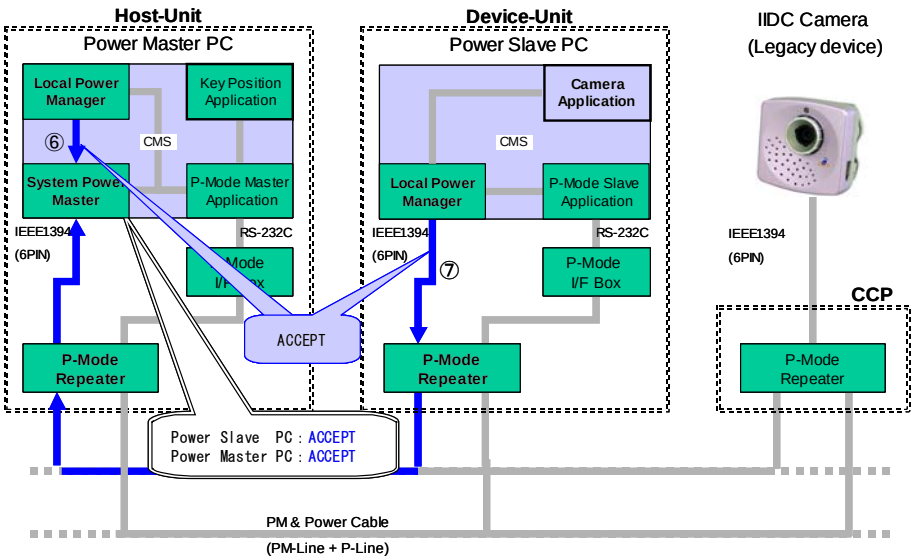

Figure 13 – Receive "ACCEPT" response

6) LPM in host unit transmits response of SHUTDOWN request to SPM.
7) LPM in device unit transmits response of SHUTDOWN request to SPM through IEEE1394 network.

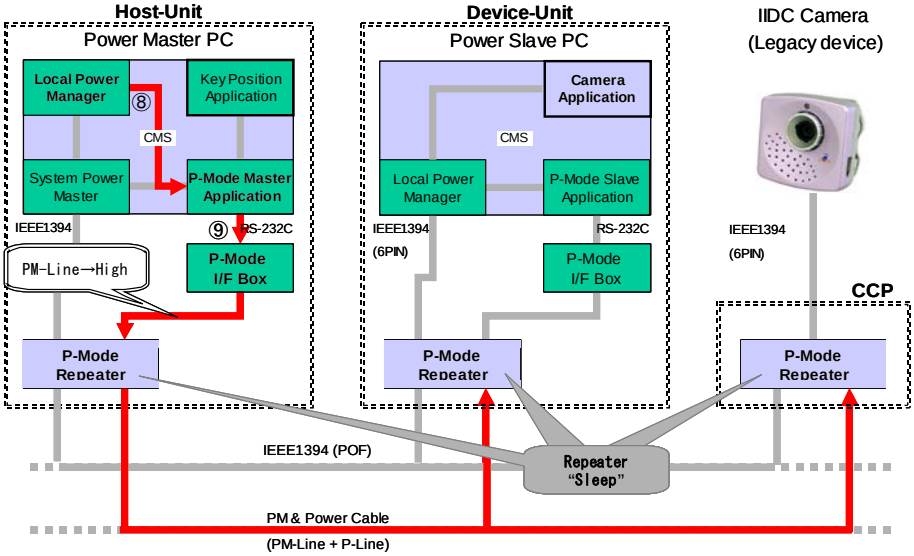

Figure 14 – Shutdown of PHY/Link Layer

8) LPM orders to P-Mode Master Application. This order turns P-Mode Repeater into Sleep State.
9) P-Mode Master Application transmits "Sleep" command to P-Mode I/F Box in host unit. P-Mode I/F Box turns a state of all P-Mode Repeater into "Sleep state".

Annex A Requirement and recommendation language

A.1 Requirements

The following verbal forms are indicative of requirements that are to be followed in order to achieve conformance to this specification. No deviation is permitted from a requirement.

Verbal Form	Equivalent Expressions
Shall, Must, Will	Is to Is required to It is required that Has to Only … is permitted It is necessary
Shall Not, Will Not	Is not allowed [permitted] [acceptable] [permissible]

A.2 Recommendations

The following verbal forms are indicative of recommendations or courses of action that are preferred, but are not necessarily required.

Verbal Form	Equivalent Expressions
Should	It is recommended that Ought to
Should Not	It is not recommended that
May	Is permitted Is allowed Is permissible
May Not	Need not It is not required that No … is required
Can	Be able to There is a possibility of It is possible to
Cannot	Be unable to There is no possibility of It is not possible to

Annex B Request for change form

Use this form to identify errors or deficiencies or to recommend general changes.

Document No.	**Version No.**	**Version Date**
Document Title		

Requestor Information	
Name:	
Organization:	
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Description of Change:	
Section number:_____	
Rational for Change:	
Proposed Revision:	
Affected Sections:	