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Application Note No. 0001

Potential Interoperability Problems of CAN/402-Boards with Windows® or Linux® OS

www.esd.eu

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About

This document is to alert users to potential interoperability problems that affect esd CAN/402 boards which are equipped with the Pericom® PCI-to-PCI bridge PI7C9X111SL.

Affected Products

CAN-PCI/402

Article	Order No.	PLM Status
CAN-PCI/402-1	C.2049.02	Available (VERF)
CAN-PCI/402-1-D	C.2049.03	Not available (NV)
CAN-PCI/402-2	C.2049.04	Available (VERF)
CAN-PCI/402-2-D	C.2049.05	Not available (NV)
CAN-PCI/402-4/2Slot	C.2049.06	Available (VERF)
CAN-PCI/402-1-LP	C.2049.32	Available (VERF)
CAN-PCI/402-2-FD	C.2049.64	Available (VERF)

PMC-CAN/402

Article	Order No.	PLM Status
PMC-CAN/402-4-FD	C.2028.68	Available (VERF)
PMC-CAN/402-4-FD-IRIG-B	C.2028.69	Available (VERF)
PMC-CAN/402-4-FD-T	C.2028.78	Available (VERF)

CPCI-CAN/402

Article	Order No.	PLM Status
CPCI-CAN/402-4	I.2332.08	Not available (NV)
CPCI-CAN/402-4-FD	I.2332.68	Available (VERF)
CPCI-CAN/402-4-FD-T	I.2332.76	Available (VERF)
CPCI-CAN/402-4-FD-R	I.2332.78	

Contact for Questions

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Windows Operating System

Potential Interoperability Problem with enabled PCI Express Native Control Mode

Background and Information

Microsoft Windows operating systems including Windows® Vista, Windows Server 2008, and later versions include a feature called “PCI Express Native Control”. Many current motherboards offer support for the PCI Express Native Control feature in their BIOS.

If this feature is enabled by Windows, it enforces additional mandatory features which are not implemented in the bridge of the CAN-PCI/402 / PMC-CAN/402 / CPCI-CAN/402 boards. This may prevent the start of the default PCI-to-PCI bridge driver (Code 10).

This problem occurs for example on most ACER PC Windows systems.

Based on our information Pericom does not plan to revise the silicon of the PCI-to-PCI bridge to be compatible with the Windows supplied bridge driver.

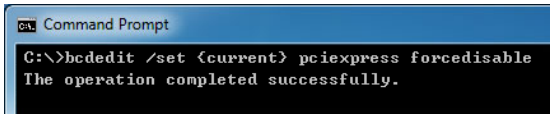
Necessary changes in application

Solution: Disabling PCI Express Native Control Feature in Windows

The PCI Express Native Control can be switched off by commands in the command prompt window with administrator rights.

Use the command
`BCDEdit /set`
to set a boot entry option value in the Windows boot configuration data store (BCD):

1. Boot the Windows system.
2. Open the command prompt window with administrator rights (right-click to C:\Windows\System32\cmd.exe and select “Run as Administrator”).
3. Enter the command
   `bcdedit /set {current) pciexpress forcedisable`



4. Restart your computer.

Note:

If you disable the PCI Express Native mode this may cause loss of other system features, such as Hot Plug, which requires the PCI Express Native mode (see link to MSDN for more details).

To restore the previous state type the following commands:

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```
bcdedit /deletevalue {current} pciexpress
      or
bcdedit /set {current} pciexpress default
```

Links to further Information

- About BCDEdit /set command:
  https://learn.microsoft.com/en-us/windows-hardware/drivers/devtest/bcdedit--set
- About PCI Express Native Control:
  https://learn.microsoft.com/en-us/previous-versions/windows/hardware/design/dn631753(v=vs.85)
- PCI-SIG website:
  https://pcisig.com/

Linux Operating System

Potential Interoperability Problem caused by Active State Power Management Reconfiguration

Background and Information

Recent Linux kernels try to reconfigure and optimize the Active State Power Management settings of PCI Express links. In the course of the reconfiguration the kernel triggers an erratum of the PCI-to-PCIe reverse bridge PI7C9X111SL that is used on the shown products. Caused by this erratum the PCIe link stays in the link retraining state and is not usable.

This can be diagnosed by looking at the lspci output for the PCIe device behind the Pericom bridge that looks like this in the failure case:

```
root@host# lspci -s 3:0.0 -v -x
03:00.0 CANBUS: ESD Electronic System Design GmbH Device 0402 (rev ff) (prog-if ff)
        !!! Unknown header type 7f
00: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
10: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
20: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
30: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
```

Necessary changes in application

Solution: Booting the System with the additional Kernel Parameter "`pcie_aspm=off`"

As a workaround you may boot the system with the additional kernel parameter "`pcie_aspm=off`" which will disable ASPM reconfiguration for the whole machine.

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If you are able to build your Linux kernel yourself, you may apply this patch to introduce a workaround for this Pericom reverse bridge.

```
--- drivers/pci/pcie/aspm-orig.c        2018-04-01 23:20:27.000000000 +0200
+++ drivers/pci/pcie/aspm.c     2018-11-07 14:08:58.301927694 +0100
@@ -218,6 +218,7 @@
        child = list_entry(linkbus->devices.next, struct pci_dev, bus_list);
        BUG_ON(!pci_is_pcie(child));

+
        /* Check downstream component if bit Slot Clock Configuration is 1 */
        pcie_capability_read_word(child, PCI_EXP_LNKSTA, &reg16);
        if (!(reg16 & PCI_EXP_LNKSTA_SLC))
@@ -251,6 +252,16 @@
        /* Retrain link */
        reg16 |= PCI_EXP_LNKCTL_RL;
        pcie_capability_write_word(parent, PCI_EXP_LNKCTL, reg16);
+       if (0x12d8 == parent->vendor && 0xe111 == parent->device) {
+            /*
+             * Due to an erratum in the Pericom PI7C9X111SLB bridge in
+             * reverse mode the retrain link bit needs to be cleared
+             * manually to allow the link training to succeed.
+             */
+            pci_info(parent,"PI7C9X111SLB workaround: Clear PCI_EXP_LNKCTL_RL again.\n");
+            reg16 &= ~PCI_EXP_LNKCTL_RL;
+            pcie_capability_write_word(parent, PCI_EXP_LNKCTL, reg16);
+       }

        /* Wait for link training end. Break out after waiting for timeout */
        start_jiffies = jiffies;
```

An equivalent patch was submitted to the linux-pci kernel mailing list (see https://lore.kernel.org/linux-pci/20190406143031.GB200379@google.com/T/) but it will take some time until it will show up in the production kernels of Linux distributions.

The mentioned patch hit the Linux mainline kernel with version 5.2.0.

The patch also has been backported to the following mainline stable kernels:

- 5.1.5
- 5.0.19
- 4.19.46
- 4.9.179
- 3.16.74

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Legal Notes

Document History

Rev.	Changes	Date
1.0	Initial version of the application note for CAN-PCI/402 and Windows	2015-08-11
1.1	Added PMC-CAN/402 and CPCI-CAN/402	2018-03-07
1.2	Added Linux interoperability issue and solution	2018-12-14
1.3	Updated link to kernel mailing list message	2019-04-11
1.4	Extended list of affected devices added reference to the accepted patch in the mainline Linux kernel	2023-06-09
1.5	Document-format changes to new esd Application Note standard Removed Article without relevance	2024-06-06

Technical details are subject to change without further notice.

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