

## Pcm4l

### Basic Debugging Steps for Renesas PTP Clock Manager Software v4.0.1

#### Abstract

This document explains how to debug the integration of pcm4l (PTP Clock Manager Software) version 4.0.1. The user should confirm the operation of ptp4l before running pcm4l. For ptp4l to work correctly, the Linux drivers for both the time stamper and the ClockMatrix device need to be working correctly. The pcm4l program uses the same interfaces as ptp4l to add more advanced filtering of the time stamps for networks with high PDV and other features needed to support the ITU PTP profiles.

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## 1. Introduction

The important messages are in the SyncAnalysis log category (the debug log category is also available to provide more detail). The source of these messages can be Supervisor or Tracker#n (for a system tracking a single master, the log will only show Tracker#0). The log level is set in the configuration using **selectionMask**: under the **stdoutLog** category in the JSON configuration file. Additional information is available in the *PTP Clock Manager Software Reference Manual*.

The messages will depend on the referenceTrackerType setting in the JSON file, AdaptiveTime, or WritePhase.

This document divides the messages into three groups: common messages, message for the AdaptiveTime mode only, and messages for the WritePhase mode only.

Before starting debugging pcm4l, the system should be checked with ts2phc and ptp4l to ensure that the kernel interfaces are working correctly between the user space programs, the PHC (PTP hardware clock) subsystem, and the hardware (time stamper and clock generator).

The user should compare the system log from a system connected to a master with no PDV to the messages in this document.

For both reference tracker types, the system (LO) has the following states: Initial, Free Run, Lock Acquisition, Frequency Locked, Time Locked, Holdover, and Holdover In Spec.

For the following messages, the "\*\*\*\*" represents the date, time, and nanoseconds of the log message that are removed to shorten the log line examples in this document.

## 2. Important Log Message from pcm4l with both "AdaptiveTime" and "WritePhase"

### 2.1 State of the servo in pcm4l (3066)

This message shows the transitions of the system servo state.

**Criteria:** For a system directly connected to a master with no PDV, the system should go from free run to time locked in less than 10 minutes.

```
RE::SyncAnalysis: *** [2, Supervisor] (3066) LO state: 'Initial' to 'Free Run'  
Event: 'LO initialized'  
RE::SyncAnalysis: *** [2, Supervisor] (3066) LO state: 'Free Run' to 'Lock  
Acquisition' Event: 'LO reference acquired'  
RE::SyncAnalysis: *** [2, Supervisor] (3066) LO state: 'Lock Acquisition' to  
'Frequency Locked' Event: 'LO frequency locked'  
RE::SyncAnalysis: *** [2, Supervisor] (3066) LO state: 'Frequency Locked' to 'Time  
Locked' Event: 'LO time locked'
```

### 2.2 Frequency Adjustment (3109)

This message shows the frequency adjustments. The units of this message are frequency (ppb).

**Criteria:** For a system directly connected to a master, the corrected value should be less than  $\pm 1$  ppb with an average of zero.

```
RE::SyncAnalysis: *** [2, Supervisor] (3109) Corrected: -0.126142 ppb Tracker#0  
Total Aged/Raw: -0.088426 / -0.383772 ppb
```

## 2.3 Time Adjustment (3121)

This message shows the frequency adjustments. The units are in phase (ns).

**Criteria:** For a system directly connected to a master, there should be a large phase adjustment when first locking to a new master and then no additional adjustments.

```
RE::SyncAnalysis: *** [2, Supervisor] (3121) Corrected: -2198.0 ns Tracker#0  
Max FFO req/gnt: 1000.000000 / 1000.000000 ppb
```

## 3. Important Log Messages from pcm4l with “AdaptiveTime”

### 3.1 Tracker State and Transitions

This message shows the state of the tracker and its transitions. For debugging search for “Tracker run mode:” since this message has multiple message ids.

The tracker states are:

- Rough Time and Freq Correction
- High Precision Freq Correction Time Mode
- ToD Correction

**Criteria:** For a system directly connected to a master, the tracker mode should go through all the states to “ToD Correction” in less than 10 minutes.

```
RE::SyncAnalysis: *** [3, Tracker#0] (XXX) Tracker run mode: 'Rough Time and Freq  
Correction'  
RE::SyncAnalysis: *** [3, Tracker#0] (XXX) Tracker run mode: 'High Precision Freq  
Correction Time Mode' to 'ToD Correction'
```

### 3.2 Offset Estimate Overall per Tracker (3200)

This message shows the offset to the master and the floor delay as estimated by this tracker to its master.

**Criteria:** For a system directly connected to a master, the offset in the time locked state should be less than 200ns. The floor delay will depend on the network delay between the master and the system under test.

```
RE::SyncAnalysis: *** [3, Tracker#0] (3200) ToD offset: [ 2198.0 ns ] (prev 0.0  
ns) Floor delay: 13237.0 ns
```

### 3.3 PDV Estimate per Direction per Tracker (3202)

This message shows the variation in the PDV for either directions of the link (uplink and downlink).

**Note:** The uplink is from the slave to the master and the downlink to from the master to the slave.

**Criteria:** For a system directly connected to a master, the standard deviation (std dev) of the each direction should be much less than 1ns (1E-9 s).

```
RE::SyncAnalysis: *** [3, Tracker#0] (3202) PDV DL: Std dev: 6.105348e-10  
Var: 3.727527e-19 logVar: -6.121841e+01  
RE::SyncAnalysis: *** [3, Tracker#0] (3202) PDV UL: Std dev: 1.700814e-09  
Var: 2.892767e-18 logVar: -5.826226e+01
```

### 3.4 Offset Estimate for Tracker (3110 and 3112)

These messages show the estimate of the delay in a single direction or the estimate of the delay combined between both directions.

**Criteria:** A normal system should be using “Min tracking – Both”, but may only display the statistics of one direction.

```
RE::SyncAnalysis: *** [3, Tracker#0] (3112) Correction ToD: UL      10.6 ns   (Min
Tracking - Uplink only)
RE::SyncAnalysis: *** [3, Tracker#0] (3110) Correction ToD: DL      8289.6 ns   UL
-9230.8 ns   (Min Tracking - Both)
```

### 3.5 Packet Rate (3026)

This message shows the estimated packet rate for a tracker.

**Criteria:** For a system directly connected to a master, this should match the rate provided by the master within 5%.

```
RE::SyncAnalysis: *** [3, Tracker#0] (3026)           Estimated packet rates in pps
(DL/UL): 16.00 / 15.76
```

## 4. Important Log Messages from pcm4l with “WritePhase”

### 4.1 Tracker State Indications in WritePhase Mode

This message shows the states and the state transitions of the tracker. For debugging, search for “Tracker run mode:” since this message has multiple message ids.

The tracker states are:

- Snapping – ToD step occurring
- Converging – rough acquisition
- Statistics Collect – fine acquisition
- Tracking – stable mode (write phase)

**Criteria:** For a system directly connected to a master, the tracker should go from Snapping to Tracking within 5 minutes.

```
RE::SyncAnalysis: *** [3, Tracker#0] (XXX) Tracker run mode: 'Snapping'
RE::SyncAnalysis: *** [3, Tracker#0] (XXX) Tracker run mode: 'Snapping' to
'Converging'
```

### 4.2 Instantaneous (Unfiltered) Offset from Master (3240)

This message shows the instantaneous offset from master.

**Criteria:** For a locked system directly connected to a master, the offset should average within  $\pm 50$  ns but may have some larger values.

```
RE::SyncAnalysis: 2020-12-11 00:21:28 504993135 ns [3, Tracker#0] (3240) offset: -
1.0 ns   delay: 8792.0 ns
```

---

### 4.3 Filtered Offset from Master (3203)

This message shows the mean offset from master.

**Note:** Number of corrections is a counter of the sets of time stamps. A set of time stamps is two time stamp pairs, which cover both directions.

**Criteria:** For a locked system directly connected to a master, the offset should be within  $\pm 50$  ns.

```
RE::SyncAnalysis: *** [3, Tracker#0] (3203)          numberOfCorrection: 38437, mean:  
0.0 ns, std: 0.8 ns
```

## 5. References

*PTP Clock Manager Software Reference Manual (Software Version 4.0.1)*

**Note:** Contact Renesas Application Engineering for this document.

## 6. Revision History

Revision	Date	Description of Change
1.0	December 17, 2020	Initial release.

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