

Application Note

How to connect the Control board Interface (UART, Communication and Synchronization)

PREAMBLE:

This application note describes the hardware of OSRAM's Control board Interface. The interface is used to enable communication with the projector or PC (personal computer). Furthermore this interface enables engineering and maintenance matters, e.g. uploading firmware, reading lamp driver status information, error codes, programming the EEPROM on the fly...

This document however does neither describe the communication protocol, different synchronization modes nor the UART instructions, as for this purpose other application notes or specifications already exist (Standardized UART Protocol or older OSRAM UART Protocol).

Table of Contents

1	Introduction.....	2
2	Connector Types	3
3	Pin Assignment for FRONT Projection Applications with Gen3 CB.....	4
4	Pin Assignment for REAR Projection Applications with Gen3 CB	5
5	Pin Assignment of standardized Interface with Gen 4 or higher CB.....	6
6	Projector Interface	7
6.1	Recommended Projector Interface (Active Solution).....	7
6.1.1	Photo coupler timing in Active solution (desaturated operation mode)	8
6.2	Example of the recommended Interface at Standardized Interface (at Gen4/5 CBs)	9
7	Application Note Change Log	10

1 Introduction

The 5-pin interface offers a smart way to control a OSRAM VIP lamp driver via the front end electronics in a video projector or MDTV. Purposes of the interface are switching on and off, lamp frequency synchronization with a projector specific timing and serial communication.. The serial communication allows to upload Firmware, read out status information and to enable monitoring and control of the lamp driver. This interface is denominated with the acronym “UART”, which stands for **U**niversal **A**synchronous **R**eceiver **T**ransmitter. The UART timing is equal to the RS232-C standard, but the voltage levels are different due to the simple photo coupler interface.

Basically, the implemented UART interface is a two wire asynchronous serial interface without any handshake lines. It consists of a transmit data line (TxD, output to the projector) and a receive data line (RxD, input for the lamp driver). All interface lines are optically isolated from the mains via three optocouplers, which provide a SELV (Safety Extra Low Voltage) isolation according to VDE 0884 (> 8 mm creepage distance). The isolation property of the interface will be 100% tested during outgoing inspection of each lampdriver.

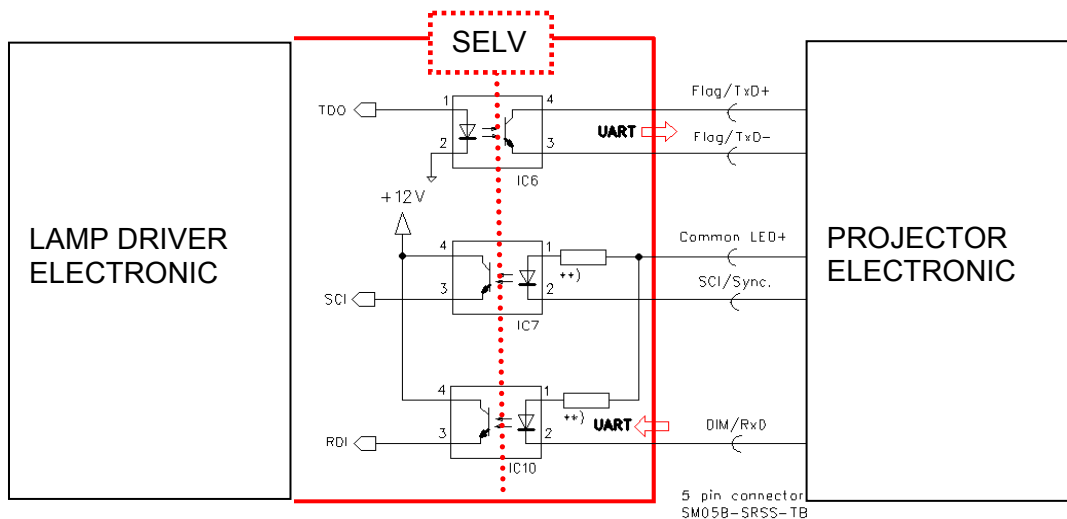


Fig. 1 Interface Schematic

For each LED input, the resistors symbolised with **) in the following schematic are the so called built-in (internal) series resistor; their values are depending on the interface type. Please refer to the dedicated lamp driver specification to get the value for the inbuilt resistors. This will be important for a proper design of the interface circuit.

2 Connector Types

The following picture (Fig.2) is a photo of the 5-pin SMT connector that enables communication between the OSRAM lamp driver and the PC. It is the input connector of older OSRAM PT-VIP lamp driver control boards (denoted “**CN1/CN2 control input**” connector in the lamp driver specification); its manufacturer is JST (part number: SM05B-SRSS-TB) and its data sheet can be found on the following internet page:

<http://www.jst-mfg.com/>

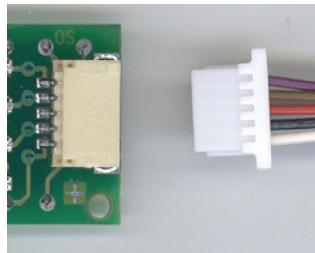


Fig. 2 Non-lock type JST 5-Pin Connector

At lamp driver with Control Board Generation 4 and Generation 5 or higher the lock type connector is mainly used (Fig.3). Its manufacturer is JST (part number: JST SM05B-GHS-TB).

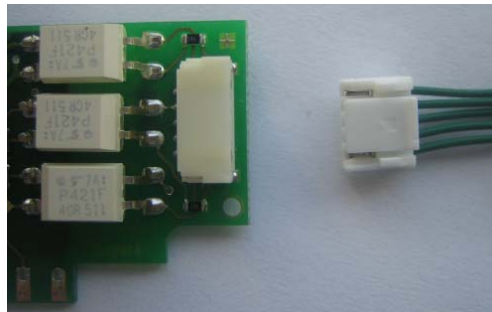


Fig. 3 Lock type JST 5-Pin Connector

3 Pin Assignment for FRONT Projection Applications with Gen3 CB

The connector in the previous picture is used both for front and rear projection lamp drivers. However the pin assignment is not the same in the two cases: following table specifies the pin assignment for front projection applications at lamp driver with Generation 3 Control Board. For example: PT VIP 3AC/380 O3, PT VIP 4AC/380 O3, PT VIP 5AC/380 O4, PT VIP 5AC/380 O1, PT VIP 4AC/380 O1. This is the so called OSRAM configuration, where the connector is situated in the “two photo couplers side” of the control board (see photo below).

control board connector CN1	PIN 5 : Flag / TxD+ (Phototransistor Collector)
	PIN 4 : Flag / TxD- (Phototransistor Emitter)
	PIN 3 : Common LED+ (LED Anodes)
	PIN 2 : SCI / Sync. (cathode LED)
	PIN 1 : DIM / RxD (cathode LED)

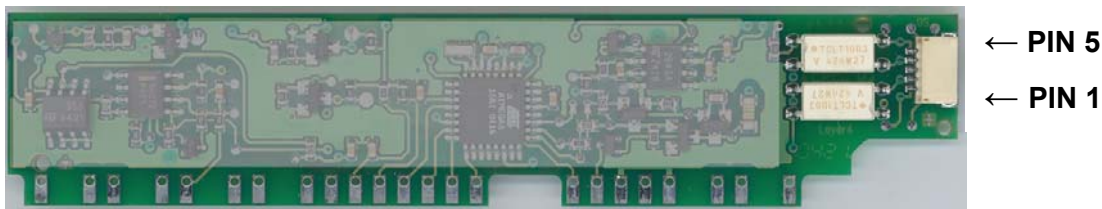


Fig. 4 Pin Assignment and Connector Position for FRONT Projection (“OSRAM Configuration”)

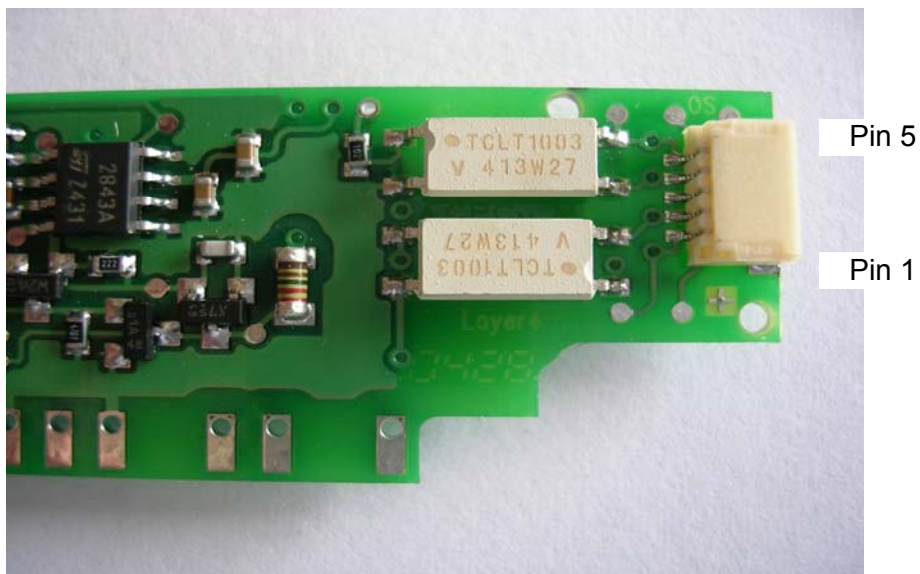


Fig. 5 Close up of “OSRAM Configuration” of Gen3 control boards

Hint: The lamp driver is “OSRAM” configured, if the 5pin connector is located on the side of the control board with the two photo couplers (IC 7 and IC10).

4 Pin Assignment for REAR Projection Applications with Gen3 CB

Following table describes the pin assignment for rear projection applications. It is valid for lamp drivers with Generation 3 Control Board. For example: PT VIP 2AC/380 O1, PT VIP 3AC/380 O1.

control board connector CN2	PIN 1 : Flag / TxD+ (Phototransistor Collector)
	PIN 2 : Flag / TxD- (Phototransistor Emitter)
	PIN 3 : Common LED+ (LED Anodes)
	PIN 4 : SCI / Sync. (cathode LED)
	PIN 5 : DIM / RxD (cathode LED)

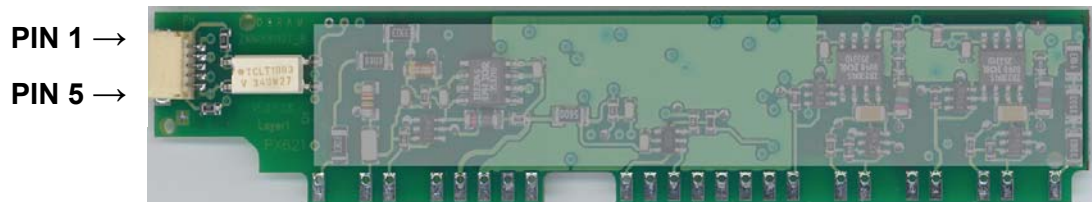


Fig. 6 Pin Assignment and Connector Position for REAR Projection (‘Philips Configuration’) of Gen3 control boards

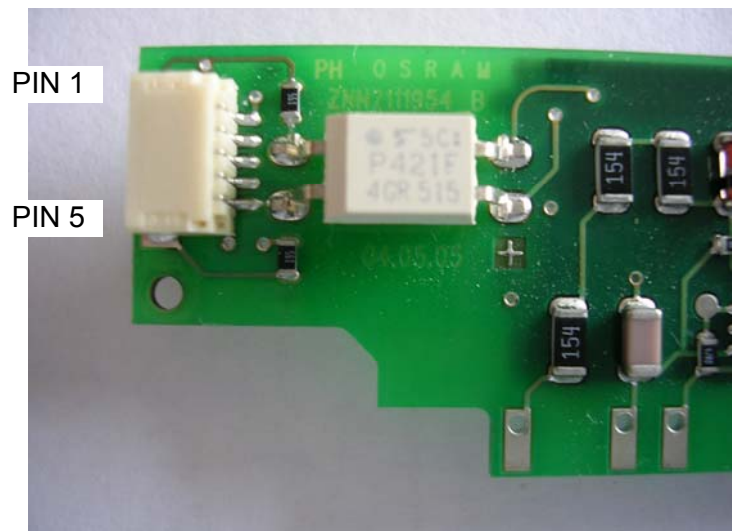


Fig. 7 Close up of REAR projection - ‘Philips Configuration’

Hint: The lamp driver is ‘Philips’ configured when the 5pin connector is located on the ‘single photo coupler side’ of the control board.

5 Pin Assignment of standardized Interface with Gen 4 or higher CB

Following table describes the pin assignment of the standardized UART interface.

Our Control Boards Gen4, Gen5 include the internationally standardized interface (see photo below).
 In the future there will be only the standardized version available.

control board	PIN 1 : Flag / TxD+ (Phototransistor Collector)
connector CN2	PIN 2 : Flag / TxD- (Phototransistor Emitter)
	PIN 3 : Common LED+ (LED Anodes)
	PIN 4 : SCI / Sync. (cathode LED)
	PIN 5 : DIM / RxD (cathode LED)



Fig. 8 Pin Assignment and Connector Position of standardized interface.

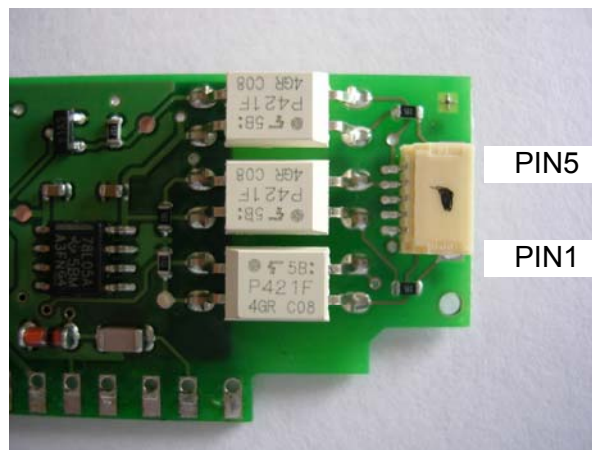


Fig. 9 Close up of “Standardized Configuration”

6 Projector Interface

The projector interface has to drive the LED lines (Rx/D/SCI) with the rated current and has to read the state of the phototransistor output (Tx/D) and to translate it into a proper digital signal. The user has to keep care about the switching delay time of the phototransistor which may cause timing problems in UART communication. To avoid this problem, an easy circuit expansion for the phototransistor output with an additional PNP transistor should be implemented on the projector side. Paragraph 6.1 shows the benefits and the superior switching behaviour of this technique (“active solution”).

6.1 Recommended Projector Interface (Active Solution)

It is recommended to use the circuitry which ensures the desaturated photo coupler operation. As it is represented in the following schematic, the additional active speed-up circuit consists of a PNP transistor (T1, SMBT3906 or equivalent) and two resistors (1k pull-up resistor between base and emitter and 2k2..10k resistor between collector and projector reference GND). The circuit enhances the rise and fall times of the output signal, in order to avoid communication errors due to a timing mismatch. **This circuit is highly recommended to ensure reliable function of the LampLit Flag / Tx/D communication line.**

As in the Fig. 1 and Fig.10 schematic, the resistors symbolised with **) are the built-in (internal) series resistors; whose values depend on the interface type.

For R1 and R2 values, refer to the system specification.

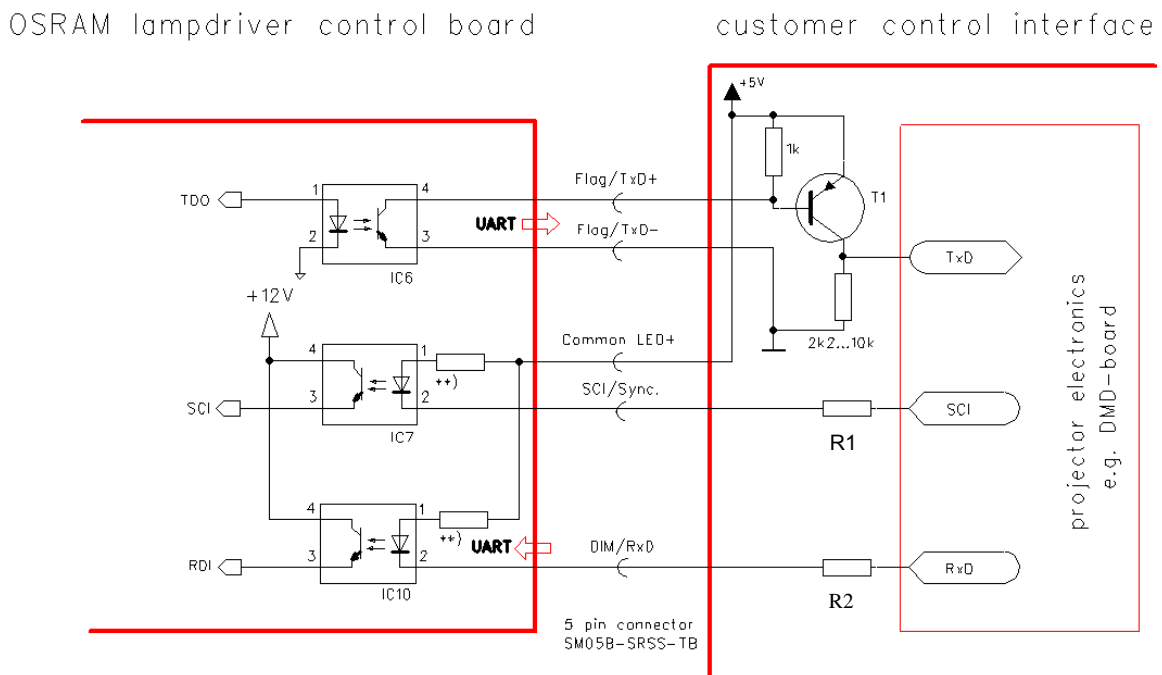


Fig. 10 Active Solution Wiring Diagram

6.1.1 Photo coupler timing in Active solution (desaturated operation mode)

The main problem connected with the use of photo couplers with phototransistor output for data transfer is the huge switching delay time of the phototransistor, that occurs if the phototransistor is operated in saturated mode (passive solution =not recommended). As this delay time results in different lengths of the low and high bits, it can generate communication errors at higher baud rates.

Following oscilloscope picture (Fig.11) shows the measured delay times with the recommended active solution (desaturated mode) explained above in Chapter 6.1. Typically 2-3µs. With the recommended circuitry and component values UART operation is working at baud rate 9600±1% as specified under allowed operating conditions.

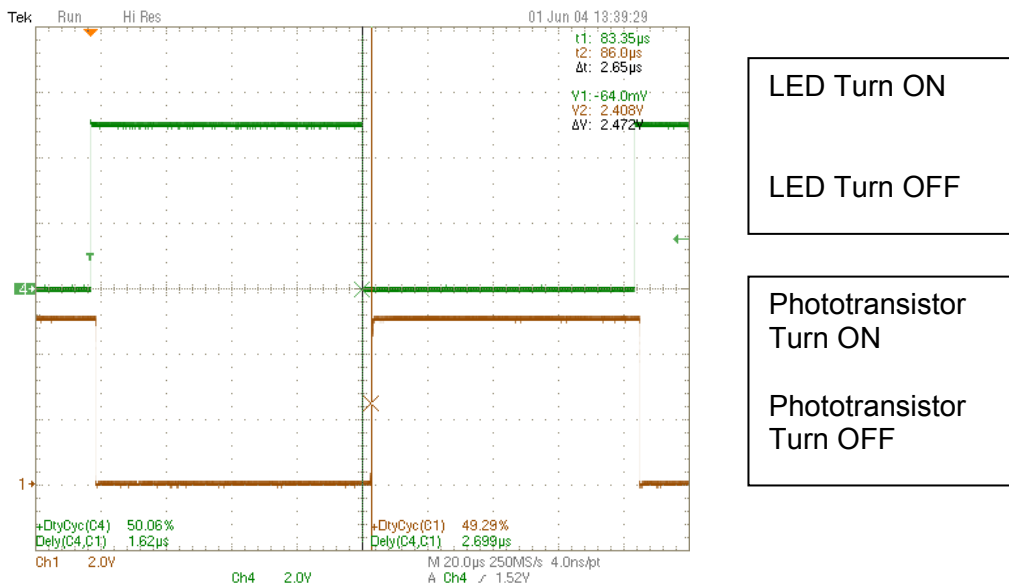


Fig. 11 Typical photo coupler Delay Times with implemented External PNP Transistor T1 (with 2k2 pull down at T1 collector from Fig.10)

In this case when the delay times are 2-3µs, the difference between “low to high” and “high to low” times is **less than 3%** of the bit length, for a bit transmission time of 104,2 µs @9600 baud.

6.2 Example of the recommended Interface at Standardized Interface (at Gen4/5 CBs)

Example from a typical OSRAM P-VIP system specification chapter "Control board Interface":

LED interface current level requirements

- LED OFF current (Pin 4 or 5) 0 ... 0.1 mA
- LED ON current (Pin 4 or 5) 4...6...20 mA

Dimensioning of LED series resistors;

Recommended values of R1, R2 for best operation conditions

U _{+LED}	R1	R2
3,3V	100R	100R
5V	390R	390R
10V	1k2	1k2
15V	2k2	2k2

Flag output (open collector), only for non UART mode

PIN 1 → PIN 2 closed if lamp is on (max. 3mA)

PIN 1 → PIN 2 open if lamp is off

Note: signal must stay stable for min. 0.5s for right indication

TxD UART output

PIN 1 → PIN 2 please refer to Fig.10 concerning interface

SCI input (Lamp driver enable and/or synchronization input)

- input current rise / fall time < 1µs

7 Application Note Change Log

2010-02-02 Version 2.9:

- Slightly modified section 6.2 "Example of the recommended Interface at Standardized Interface (at Gen4/5 CBs)"

2009-05-13 Version 2.8:

- Minor layout and orthographic corrections

2009-01-19 Version 2.7:

- Minor layout and orthographic corrections

2008-11-19 Version 2.6:

- Chapter names updated
- Added picture of lock type connector
- Added Section 6.2 "Example of the recommended Interface at Standardized Interface (at Gen4/5 CBs)"

2008-07-09 Version 2.5:

- Slightly modified section 6.1. "Recommended Projector Interface (Active Solution)"

2008-06-17 Version 2.4:

- Added section 6.1 "Recommended Projector Interface (Active Solution)"

2007-03-14 Version 2.3:

- Moved chapter "VIP-PC-Interface" to a separate application note.

2005-10-05 Version 2.2:

- Updating of chapter "VIP-PC-Interface".
- Remove of chapter "Interface Mode" because this could differ for each version of VIP lamp driver and thus has to be described according the functionality of the firmware and configuration.

2005-08-04 Version 2.1:

- Slight paragraph organization changes and relocation of the "communication timing" description in the application note "UART Protocol".

2005-08-02 Version 2.0:

- Relocation of UART instructions in a specific application note ("UART Protocol");
- New layout and various other little modifications.

2005-07-22 Version 1.0:

- First release

Authors: A.Veser, U.Lühlf, B.Dobler, E.Garavini, A.Huber, C.Breuer, B.Reiter