## ZisWorks

# "ZWS X28"

## "ZWS X39"

## "DVI2LVDS"

## "DP2LVDS"

# "Flexible LED Backlight Driver"

## "ZWS 4K120 TCON"

## FIRMWARE UPDATE GUIDE

Document version : 26 January 2019

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#### CHANGELOG

Version 1.0 : 16 July 2017 : Original release Version 1.1: 31 July 2017 : Added vivado screenshots Version 1.2 : 18 August 2017 : Minor changes for public posting Version 1.3 : 18 May 2018 : Added information and link for Arduino IDE modifications Updated picture of BLDRIVER to production version Removed video mode flashing (feature development was not completed) Version 1.4 : 19 May 2018 : Added modifications to USB ↔ UART adapter Version 1.5 : 1 Jan 2018 : Changed recommendation for JTAG programmer to Digilent HS2 Added block diagram for R2 boards Version 1.6 : 26 Jan 2018 : Added pictures of R2 boards

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#### **OVERVIEW**

The ZWS X28 series contains an assortment of boards, each with one or more programmable devices. One of the unique aspects of the X28 displays is that they are modular and allow a certain degree user reconfiguration, upgradability, and updatability. To accommodate for this functionality, user upgradability of the various firmwares is needed. This guide will explain the update procedures for each aspect of the system.



#### SYSTEM BLOCK DIAGRAMS

## **REQUIRED HARDWARE**

For most firmwares in the system, a USB to UART adapter is needed. You will need one like this:



You will need to modify the commonly found board shown above. Use the jumper to set 3.3V IO voltage, use a blob of solder to bridge the two pins, cut the CTS trace, and remove the redundant ground pin. This 5pin adapter is ready for use with all ZWS boards.

In order to update the Xilinx FPGA on the TCON board, an additional JTAG programmer is required but not provided as an accessory. The official tool is "Xilinx platform cable USB II", but lower cost alternatives do exist. The Digilent HS2 is recommended and is pictured below. The 6pin interface matches the TCON pinout.



For details, see: https://store.digilentinc.com/jtag-hs2-programming-cable/

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## **REQUIRED SOFTWARE**

To update the FPGA, you will need Xilinx "Vivado Lab Edition". The software can be found here: <u>https://www.xilinx.com/support/download.html</u>

To update the displayport chip firmware, you will need "EPConsole" from Koryo. The software can be found here: <u>http://ap.koryo.com.tw/</u>

To update the Atmega328 microcontrollers, you will need the Arduino IDE. Please install version 1.8.2.

The software can be found here: <u>https://www.arduino.cc/en/Main/Software</u>

There are additional resources located at this link: <u>https://drive.google.com/open?id=1EjMDLpMxmDC6VtH07oL2-HQCTDjfcVRD</u>

If updating arduino-based firmwares, please extract ARDUINO\_ZWS\_core.zip to the avr subdirectory of your arduino installation. Usually, this is found at : "C:\Program Files (x86)\Arduino\hardware\arduino\avr"

The binary blob versions of FPGA and DP chip firmware are also in this shared directory.

#### ADDING SUPPORT IN THE ARDUINO IDE

In order program with the arduino IDE, some changes must be made to support the board. These notes are intended for use with version 1.82 of the IDE and may need modification for other versions.

Please download and extract ARDUINO\_ZWS\_core.zip to the avr subdirectory of your arduino installation. Usually, this is found at : "C:\Program Files (x86)\Arduino\hardware\arduino\avr"

If you use arduino for other boards, you should take the entries from the new boards.txt and append them to your existing boards.txt instead of overwriting the whole file. Example:

"C:\Program Files (x86)\Arduino\hardware\arduino\avr\boards.txt"

Existing file above ^^^^^ Additions below vvvv

\*\*\*\*\*\* optiboot\_328\_8M.name=[Optiboot] ATmega328p (3.3V, intOSC 8 MHz) optiboot\_328\_8M.upload.tool=avrdude optiboot\_328\_8M.upload.protocol=arduino optiboot\_328\_8M.upload.maximum\_size=31744 optiboot\_328\_8M.upload.maximum\_data\_size=2048 optiboot\_328\_8M.upload.speed=38400 optiboot\_328\_8M.bootloader.extended\_fuses=0xFD optiboot\_328\_8M.bootloader.high\_fuses=0xDC optiboot\_328\_8M.bootloader.low\_fuses=0xE2 optiboot\_328\_8M.bootloader.file=optiboot/optiboot\_atmega328p\_8MHz\_38400.hex optiboot 328 8M.bootloader.unlock bits=0x3F optiboot\_328\_8M.bootloader.lock\_bits=0x0F optiboot\_328\_8M.build.mcu=atmega328p optiboot\_328\_8M.build.f\_cpu=8000000L optiboot\_328\_8M.build.core=arduino optiboot\_328\_8M.build.variant=diy optiboot\_328\_8M.build.board=AVR\_OPTIBOOT\_328\_8M optiboot\_168\_8M.name=[Optiboot] ATmega168p (3.3V, intOSC 8 MHz) optiboot\_168\_8M.upload.tool=avrdude optiboot\_168\_8M.upload.protocol=arduino optiboot\_168\_8M.upload.maximum\_size=15872 optiboot\_168\_8M.upload.maximum\_data\_size=1024 optiboot\_168\_8M.upload.speed=19200 optiboot\_168\_8M.bootloader.extended\_fuses=0xFC optiboot\_168\_8M.bootloader.high\_fuses=0xDD optiboot\_168\_8M.bootloader.low\_fuses=0xE2 optiboot\_168\_8M.bootloader.file=optiboot/optiboot\_atmega168p\_8MHz\_19200.hex optiboot\_168\_8M.bootloader.unlock\_bits=0x3F optiboot\_168\_8M.bootloader.lock\_bits=0x0F optiboot\_168\_8M.build.mcu=atmega168p optiboot\_168\_8M.build.f\_cpu=8000000L optiboot\_168\_8M.build.core=arduino optiboot\_168\_8M.build.variant=diy optiboot\_168\_8M.build.board=AVR\_OPTIBOOT\_168\_8M 

### UPDATING THE DISPLAYPORT CHIP FIRMWARE

Usually, the user will not have to do this. However, if it is necessary, please follow these steps:

- 1) Power down the system.
- 2) Ensure that the IO voltage on your UART is set to 3.3v.
- 3) Connect the USB to UART adapter as shown:



4) Connect the USB cable to the USB <=> UART board.

- 5) Power on the DP board.
- 6) Open EPConsole.exe.
- 7.1) Select the correct COM port
- 7.2) Set 57600 baud
- 7.3) Click FILE and navigate to the
- new PROJECT.HEX file
- 7.4) Click the green arrow.
- 8) Wait until finished.
- 9) Power off the system.
- 10) Remove the USB <=> UART board.
- 11) Einichad
- 11) Finished.

Note that the DP chip will not operate normally until it has booted without the UART present.



### UPDATING THE MICROCONTROLLER ON DP2LVDS

1) Power down the system.

2) Ensure that the IO voltage on your UART is set to 3.3v.

3) Connect the USB to UART adapter as shown. If your board does not match the image, verify

location and orientation using the DTR/RXD/TXT/VCC/GND/GND labels on the bottom of the board.



- 4) Connect the USB cable to the USB <=> UART board.
- 5) Power on the DP board.
- 6) Open the firmware project in the arduino IDE
- 7) Select the correct COM port and board type : "[Optiboot] ATmega328p (3.3V, intOSC 8 MHz)".
- 8) Click the upload button

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13					[Optiboot] ATmega32	8p (3.3V, intOSC 8 1	/Hz) an CO	мз

- 9) Wait until finished.
- 10) Power off the system.
- 11) Remove the USB <=> UART board.
- 12) Finished.

## UPDATING THE MICROCONTROLLER ON DVI2LVDS

1) Power down the system.

2) Ensure that the IO voltage on your UART is set to 3.3v.

3) Connect the USB to UART adapter as shown. If your board does not match the image, verify

location and orientation using the DTR/RXD/TXT/VCC/GND/GND labels on the bottom of the board.



4) Connect the USB cable to the USB <=> UART board.

5) Power on the DVI board.

6) Open the firmware project in the arduino IDE

7) Select the correct COM port and board type : "[Optiboot] ATmega328p (3.3V, intOSC 8 MHz)".

Please note: older versions of DVI2LVDS may have ATMEGA168 instead of ATMEGA328. 8) Click the upload button

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- 9) Wait until finished.
- 10) Remove the USB <=> UART board.
- 11) Power off the system.
- 12) Finished.

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## **UPDATING THE MICROCONTROLLER ON 4K120 TCON**

- 1) Power down the system.
- 2) Ensure that the IO voltage on your UART is set to 3.3v.
- 3) Connect the USB to UART adapter as shown. If your board does not match the image, verify

location and orientation using the DTR/RXD/TXT/VCC/GND/GND labels on the board.



- 4) Connect the USB cable to the USB <=> UART board.
- 5) Power on the board.
- 6) Open the firmware project in the arduino IDE
- 7) Select the correct COM port and board type :
- "[Optiboot] ATmega328p (3.3V, intOSC 8 MHz)".
- 8) Click the upload button

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- 9) Wait until finished.
- 10) Remove the USB <=> UART board.
- 11) Power off the system.
- 12) Finished.

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## **UPDATING THE "Flexible LED Backlight Driver"**

- 1) Power down the system.
- 2) Ensure that the IO voltage on your UART is set to 3.3v.
- 3) Connect the USB to UART adapter as shown. If your board does not match the image, verify

location and orientation using the DTR/RXD/TXT/VCC/GND/GND labels on the bottom of the board.



- 4) Connect the USB cable to the USB <=> UART board.
- 5) Open the firmware project in the arduino IDE
- 6) Select the correct COM port and board type : "[Optiboot] ATmega328p (3.3V, intOSC 8 MHz)".
- 7) Click the upload button



- 8) Wait until finished.
- 9) Power off the system.
- 10) Remove the USB <=> UART board.
- 11) Finished.

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## UPDATING THE XILINX FPGA ON THE ZWS TCON (JTAG)

- 1) Power down the system.
- 2) Connect the JTAG programmer as shown.
- 3) Power up the system.
- 4) Connect the USB cable to the programmer



5) Open Vivado, select "Open Hardware Manager"



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6a) Automatically connect to local hardware target.

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6b) If 6a fails, open new target, select the programmer, and select the slowest available JTAG speed.

7) Add configuration memory device



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8) Search for N25Q128-3.3V

🙏 Add Configuration Memory Device						×
Choose a configuration memory	part. This can be ch	anged later.				
Device: 📵 xc7a35t_0						
Filter						
Manufacturer All	~		Туре	All		~
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9) Right click the newly added memory device and select "Program Configuration Memory Device". Enter the provided .MCS file. The PRM file does not need to be supplied.

🍌 Program Configuration Memory	Device	• X				
Select a configuration file and set programming options.						
Memory Device:		mt25ql128-spi-x1_x2_x4				
Configuration file:		pga fw/spi_flash_rom.mcs 💿 🚥				
PRM file: fpga fw/spi_flash_rom.prm 💿						
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Program Operations						
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Verify Checksum						
SVF Options						
Create <u>S</u> VF Only (no program operations)						
SVF File:						
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9) Wait until finished. This can take a few moments. At the slowest speeds, it may take up to 10 minutes.

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- 10) Power off the system.
- 11) Remove the JTAG programmer
- 12) Finished.