

Rev.3.8

HARDWARWE REFERENCE MANUAL FOR LED DISPLAY CONTROLLER DCA2X16

- I. General Description**
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- III. Connector description and DIP switch settings**
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I. General Description

This manual describes functions and connectors of LED Display controller DCA2X16 and external logic. Very easy to use, simple and flexible design, low count of cables, low consumption, low cost, light weight and small in dimensions make this series of LED controllers suitable for applications such as CNC control displays, exchange rate boards, traffic control systems, measurement instruments, led bar displays and etc. This manual refers only for common anode indicators and LED's. Block diagram is shown on fig. 1. LED controller provides all refresh cycle, light intensity control (global intensity), power supply for logic (+5V), anode power drivers and serial channel buffers. Each DCA2X16 can drive up to 320 seven segment display indicators common anode or 2560 single LED's. LED controller can drive different and mixed types of indicators, depending of application. Each indicator, connected to the LED controller occupied appropriate address in LED buffer. LED controller receives all commands via standard serial RS232C channel that takes flexibility to connect DCA2X16 to all microprocessors, micro controllers, terminals and personal computers that supports serial channel. Command protocol is very simple to us, and can be implemented in any Hi level Programming languages and assemblers. Refer for Command Reference Manual for detail in page **PRODUCTS** on our Web: <http://www.itsdisplays.com/products.htm>.

LED controller drives two LINES of displays, each one up to 160 seven segment displays that refers to two LED buffers 160 bytes each. Refresh rate of LINES is 100 Hz that provide excellent, free flicker views of the LED display. Duty cycle of refresh is 1 to 10, providing maximal possible light intensity. Loading of serial shift registers starts from Block 16 up to Block 1 that take ability to connect only required quantity of blocks for specifying application. Shift register clock is 375 KHz, and take ability to use signal cables up to 10 meters between LED controller DCA2X16 and driver blocks. User can measure input supply voltage (VIN), power supply for logic (+5V), light intensity using command set. Via measuring light intensity in room, user can adjust optimal PWM value. This technique void event of very bright displays in dark rooms and not enough visible displays in sunny environments. Each LINE require external buffers called in this description Blocks.

This hardware decision takes advantage to user to trace very easy PCB indicator boards and reduce extremely quantity of interconnection between PCB indicator boards. From other viewpoint is possible to build very large LED displays (up to 320 seven segment indicators driven from one LED controller).

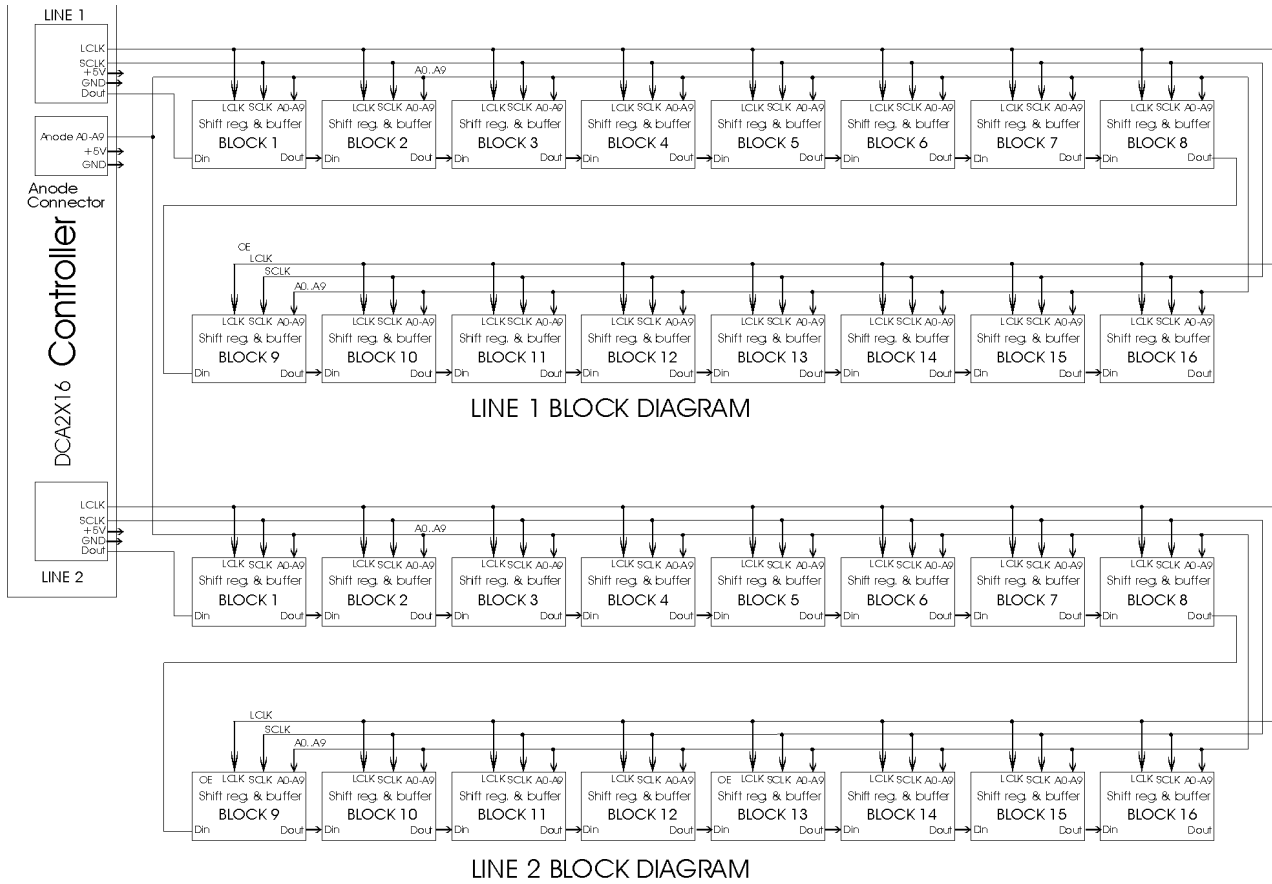
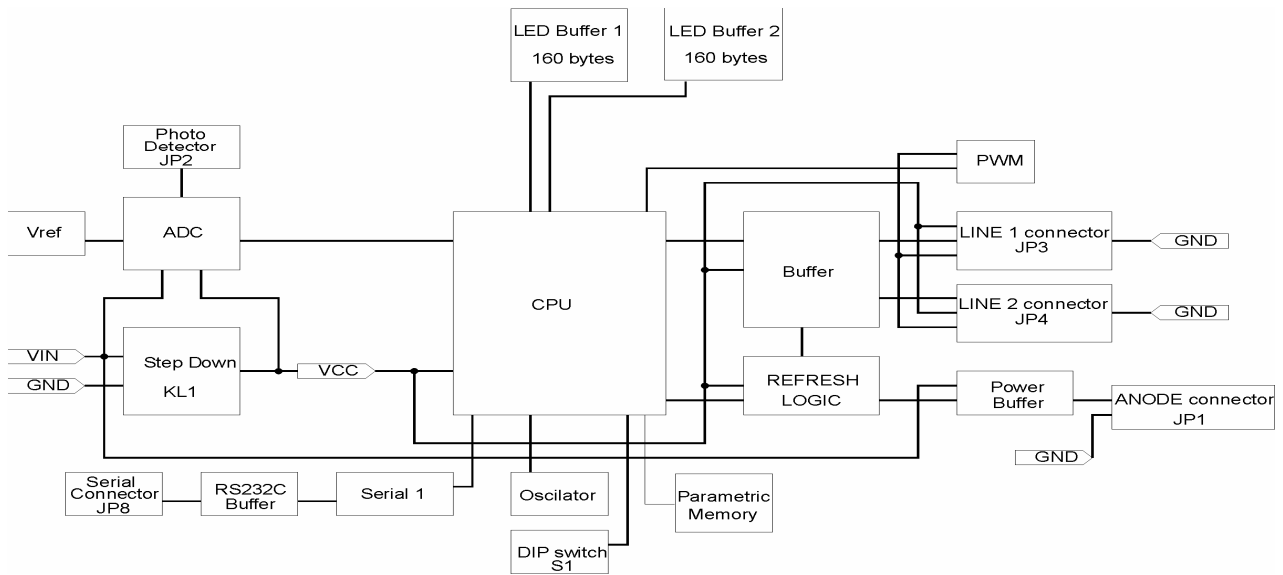


Figure 1



Block diagram of the LED controller DCA2X16 is shown on **Figure2**

II. Controller Description

Figure 1 shows external buffer interconnection and **Figure 2** is block diagram of LED Display Controller DCA2X16.

1. **Power supply** – LED controller DCA2X16 is supplied from **KL1**. Input voltage V_{IN} must be in range from 8V to 15V. Internal Step down converter provides from input voltage (V_{IN}), 5V up to 500 mA for supply external logic via connectors **JP3** and **JP4**.

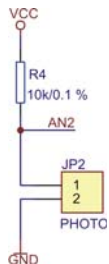
2. **PWM** – this block adjust light up intensity of the all LED displays. Value can be set from 0% (display is off) up to 99% (max intensity). This signal acts simultaneously to both LINE1 and LINE2. Changing of values of PWM is done with command described in Command Reference Manual.

3. **Parametric memory** – This non-volatile memory is used for save values of PWM and STATUS byte. After power up, LED controller restore values of PWM and STATUS byte without initialization. Refer to Command Reference Manual.

4. **Lines** - LED controller can drive up to two lines. Each line has own 10 pin header connector. These connectors provide all necessary signals and power supply for external Shift Registers.

5. **LED Buffers** – LED controller maintain two LED Buffers, each one consisting of 160 bytes. LED Buffers are RAM memory blocks. User can read and write LED Buffers, using commands described in Command Reference Manual. To LINE1 refers LED Buffer 1 and to LINE2 refers LED Buffer 2. Via writing of byte (bytes) in appropriate address in LED Buffer is performing controls of desired segments of selected indicator. After power up two LED buffers are filled with 00h (display is blanc).

6. **Power drivers and refresh logic** – they provide Anode driving of indicators and are in relation with LED buffer address position. Power transistors can drive each Anode up 3,5 A supply current for LED indicators. When is required more power, Anodes can be buffered externally. Refresh logic provides 100 Hz refresh rate on duty cycle 10/1.



7. **Serial channel** – LED controller receives all commands, data and parameters via standard serial channel RS232C. Protocol of communication is described in Command Set Manual. Mode is 8 bits, no parity, and 1 stop bit. Baud Rates – 9600 bps, 19200 bps, 38400 bps, and 57600 bps are selectable from DIP switch **S1**-1, 2. Changing of baud rate can be done via two ways. First one is to set desired baud rate (**S1** switch) and after switch on the power supply. Second one is to set desired baud rate (**S1** switch) and send via serial channel command reset. Keep your mind, that you must change also appropriate baud rate of the HOST too.

8. **Photo detector** - is photo resistor for measuring of light intensity. Photo detector is connected to **JP2**. Refer to Command Reference Manual for commands detail.

9. **Measurement block** - measures Input Voltage (V_{IN}) and supply voltage (V_{CC}). Refer to Command Reference Manual for commands detail.

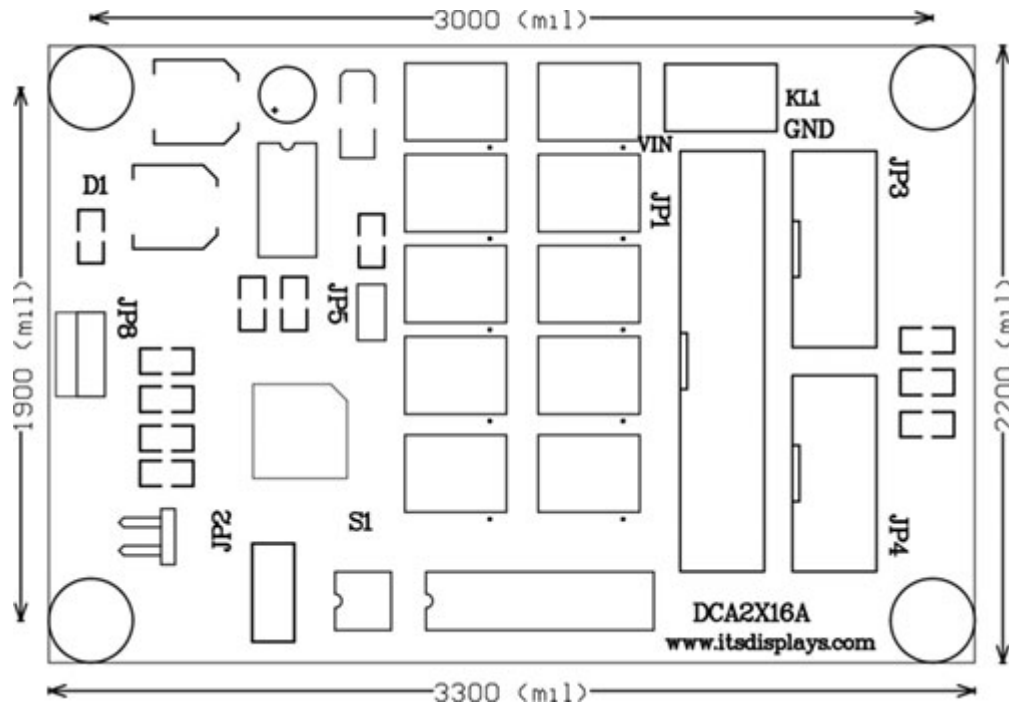


Figure 3

Top view of the DCA2X16 is shown on Figure 3

III. Connector description and DIP switch settings

Connector description:

JP1 – Anode Connector – 26 pin box header connector 0.1” pitch is used for anode drives, each LED controller can drive 10 anodes that are common for two lines. Maximal current that can drive each anode line is about 3.5 A. Duty cycle of refresh is 1/10 and refresh rate is 10mS or 100 Hz. Cables are 26 pin ribbon, crimped with 26 pin standard ribbon female connectors.

pin1	pin3	pin5	pin7	pin9	pin11	pin13	pin15	pin17	pin19	Pin21	Pin23	Pin25
A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	GND	GND	GND
pin2	pin4	pin6	pin8	pin10	pin12	pin14	pin16	pin18	pin20	Pin22	Pin24	Pin26
A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	GND	GND	GND

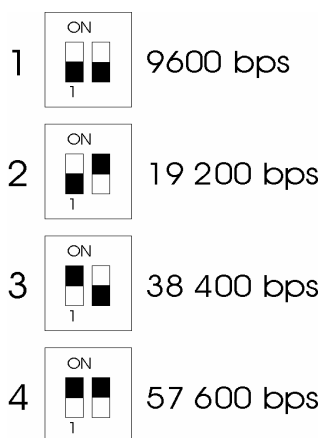
A1..10 – Anode numbering. Pin21 to pin 26 are connected to GND for convenience for external connections.

JP 3, JP4 – LINE 1 and LINE 2 connectors. This two 10 pin box connectors, drives external shift registers and provide power supply for external logic.

pin1	pin3	pin5	pin7	pin9
+5V	GND	GND	GND	GND
pin2	pin4	pin6	pin8	pin10
+5V	LCLK	SCLK	SDATA	GND

pin1	pin2
Photo input	GND

JP2 – Photo detector connector.



DIP SWITCH S1 POSITIONS

S1 – Dipswitch for setting of baud rate for serial channel.

JP5 – data inverter jumper. This jumper inverts data that dumps external shift registers. When is open data is positive (none inverted) and when is open data is negative (inverted). Purpose of this function is to expand flexibility when external buffers is designed. Also can be used for simple PCB boards test without any additional software and hardware aids when LED display PCB boards are ready. Via closing jumper **JP5** – all segments (LED's) must light up. Via opening jumper **JP5** – all segments (LED's) must light off (LED display is blank).

KL1 – Input Voltage connector. This is supply voltage input. It must be from 8V up to 15V. Supply current depending of quantity and type of LED Displays. Refer for correct power polarity. Ground pad is square.

pin1	pin2
GND	VIN

Caution: Check carefully polarity of power supply when connecting LED controller DCA2X16. If polarity is wrong, it will damage LED controller permanently!!!

JP8 – Serial RS232C connector.

pin1	pin2	pin3
RX data	TX data	GND

Pin1 – **RX data** – Receive Data input.
Pin2 – **TX data** – Transmit Data Output.
Pin3 – **GND** – Signal Ground.

IV. External Components

External components (blocks) drive directly LED's (segments) of designed LED Display. This technique takes advantage of building and controlling very large amount of LED's and multiple LED's in single segment for building of large in dimensions LED displays. Also this technology reducing extremely total power consumption and heat losses.

Anodes - is connected via Anode connector **JP1** directly to the appropriate Anodes of indicators. When

designing PCB boards keep you mind to follow exact interconnection between anode connector **JP1** and anodes of connected indicators. Interconnection of all anodes is repeated in parallel in all used blocks. They are common for Both LINES.

Example: If **A1** from **JP1** connector is connected to the second seven segment indicator but **A2** is connected to the first seven segment indicator as result when writing byte in LED buffer in address 00h will light up second indicator. Also such wrong connection will acts in cases when is used internal character generator for dumping ASCII characters and seven segment displays.

Cathodes – is connected to the outputs of driver buffers via load resistors. When in single segment is connected more than one LED in parallel, to the each one must be provided separate load resistor. In each segment can connected more than one LED serially and parallel. Quantity of connected LED's depends from voltage and provided current from power supply.

Serial Shift Registers – is 8-bit serial-in/serial or parallel-out shift register with output latches with 3-state. Can Used 74HC/HCT595, TPIC6B595 and etc. All refresh cycles and loading of shift registers is provided from LED Controller. User does not need to care about any process of loading or refresh. Loading and Refreshing process is started after power up or reset when LED controller transmit appropriate message. Loading and refreshing process is stopped for small amount of time when is uploading character generator after that process is restarting automatically.

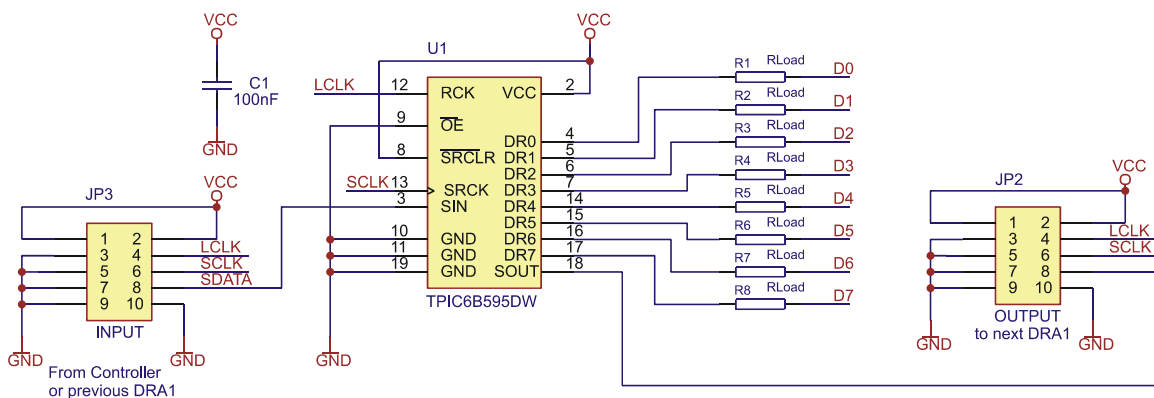


Figure 4 shows block of external logic example.

For more detailed information, documentation and free source schematics, please refer to our Web site : <http://www.itstdisplays.com/products.htm>

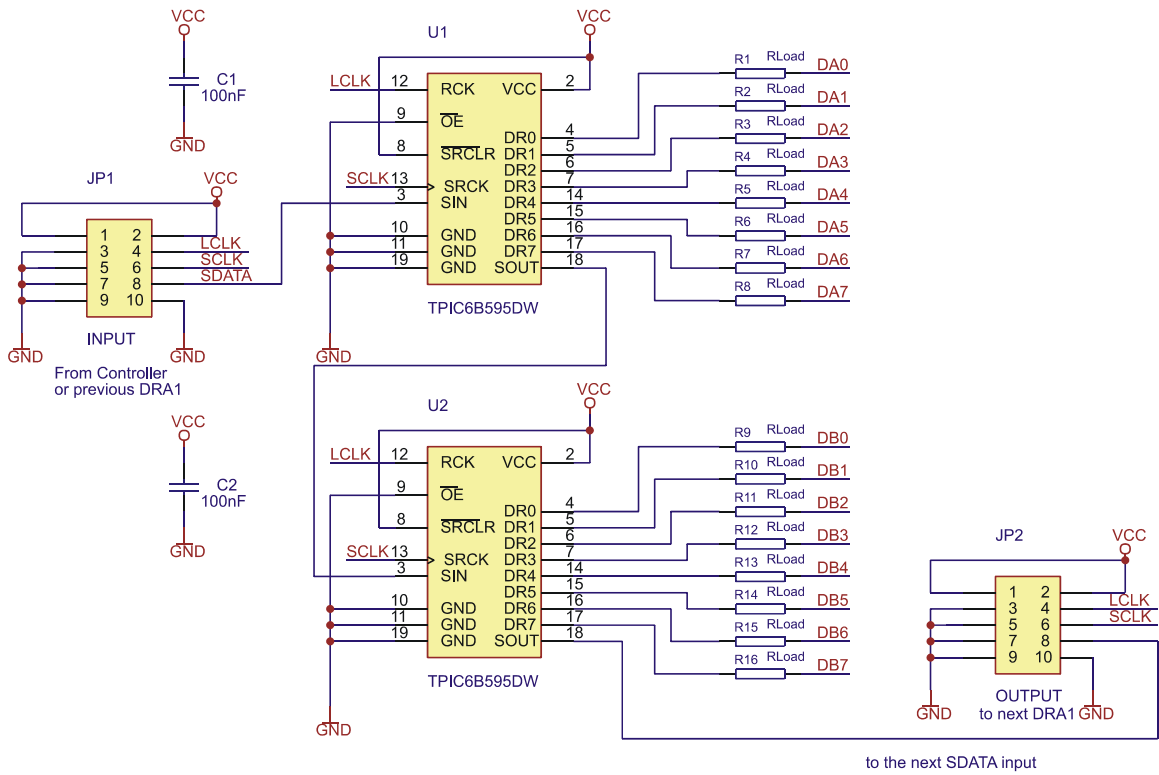


Figure 5 shows two consequential blocks of external logic.

If you have any questions or find some mistakes in this document, do not hesitate to contact us on the next E-mails: its@itsdisplays.com or support@itsdisplays.com, and we try to answer you as soon as possible.

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