



DMX512 - 4 Channel PWM Driver Board #805



Overview

The 4-channel PWM driver board provides four open drain (collector) type outputs that can be directly controlled from a DMX512 network. The four channels can operate independently or ganged. Each channel can be configured to operate with a 200Hz, 8-bit PWM signal, or digital on/off mode.

The base address can be set between 1 and 509 and data on this address controls the CH1 output. DMX data in the next three consecutive addresses above the base address is used for outputs CH2,CH3,CH4. In ganged mode the value in the DMX base address channel controls all four outputs.

Connections

DMXin: 3-pin screw terminal for DMX data+, data- and ground.

TERM: Jumper can be fitted to the 2-pin header to terminate the DMX input signal into a 120R resistor

Power: 4 pin screw terminal connection for ground, board power in and channel output power in.

VB+: Board input voltage 9-18V @ 25mA

VF+: Channel input voltage 3-36V @ 12 amps (3 amps / channel maximum)

GND: Two common ground inputs

A wire link (LK1) on the PCB can be fitted to allow the board power to be connected to the VF+ channel power if the input voltage is within the range 9-18 volts. This enables single power supply operation.

Channel Outputs: Four channel outputs are presented on screw terminal connectors. CH1, CH2, CH3, CH4

Each channel has an open-drain (collector) type, low-side output driven with either PWM or digital on/off signal. Maximum 3 amps per channel. There are four common VF+ connections between the Channel outputs to simplify wiring.

DMX Address and Configuration Setting

The DMX base address and configuration can be set using DIP switch SW1, or through DMX in-band configuration when JP1 jumper is on. Address and configuration are saved to non-volatile EEPROM .

The DIP switch is dual function, setting both the address and configuration modes which are then saved to EEPROM.

Dimensions:

PCB size: 100mm x 65mm. Four x 4mm mounting holes centred at 90mm x 50mm

Setting the DMX Base Address and Configuration using the DIP switch

The 10-way DIP switch allows both the DMX Base Address and Configuration Modes to be set. The settings read from the switch are saved to the microcontroller's internal EEPROM. If no switch is present, the saved settings from the microcontroller EEPROM are used.

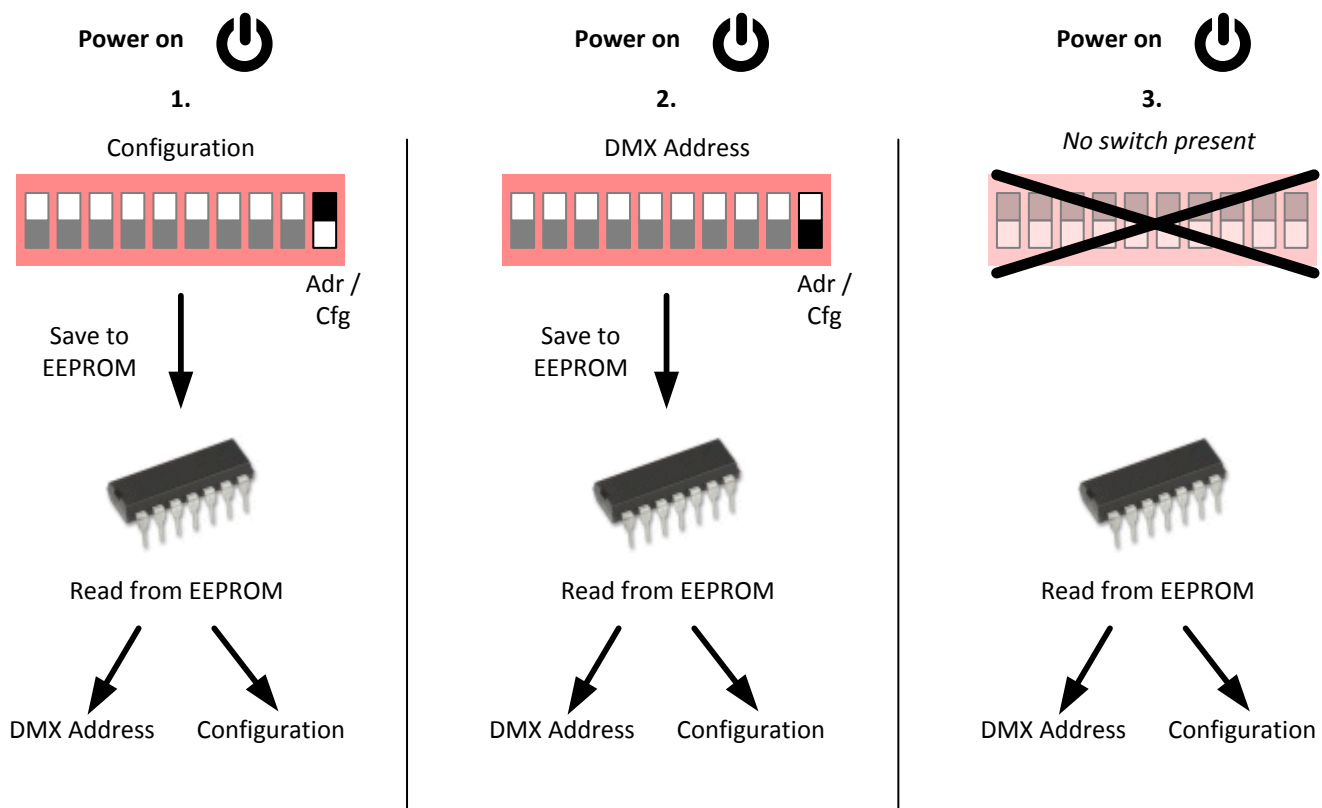
The Adr/Cfg DIP switch toggles between setting the DMX Base Address or Configuration Modes.

The pre-programmed PIC is supplied with the EEPROM set to a DMX Base Address set of 1 and the Configuration Mode of all switches off. To reconfigure these settings using the DIP switch do the following:

- Set the Adr/Cfg switch to the Configuration position and remaining switches to the required configuration modes (see page 3.)
- Power on the board.
- Wait 5 seconds then power off the board.
- Set the Adr/Cfg switch to the DMX base address position and remaining switches to the required address (See page 4.)
- Power on the board.
- Wait 5 seconds
- The settings for both the DMX base address and Configuration are now saved to EEPROM

The DIP switch settings are only read when the board is first powered on. After power-up any changes to the switch settings will not be read until the next power-cycle.

1. When the Adr/Cfg switch is ON switches 1-9 are used to set the configuration modes. The DMX base address is set from the value previously saved to EEPROM in the microcontroller.
2. When the Adr/Cfg switch is OFF switches 1-9 are used to set the DMX base address. Configuration modes are set from the value previously saved to EEPROM in the microcontroller.
3. If no DIP switch is detected when the board is powered-on, both the DMX Base Address and Configuration mode settings previously saved in EEPROM will be used. If all DIP switches are set to the OFF position this is equivalent to having no DIP switch.



Setting the Configuration using the DIP switch

Adr/Cfg switch should be set to ON

Action on 'no DMX signal received'. When no DMX signal is received the driver can either turn all outputs off, or continue to drive the outputs with the last PWM or digital output value for the channel before the DMX data signal was lost.

Ganged Mode. In ganged mode all four outputs use the data from the Base DMX Address.

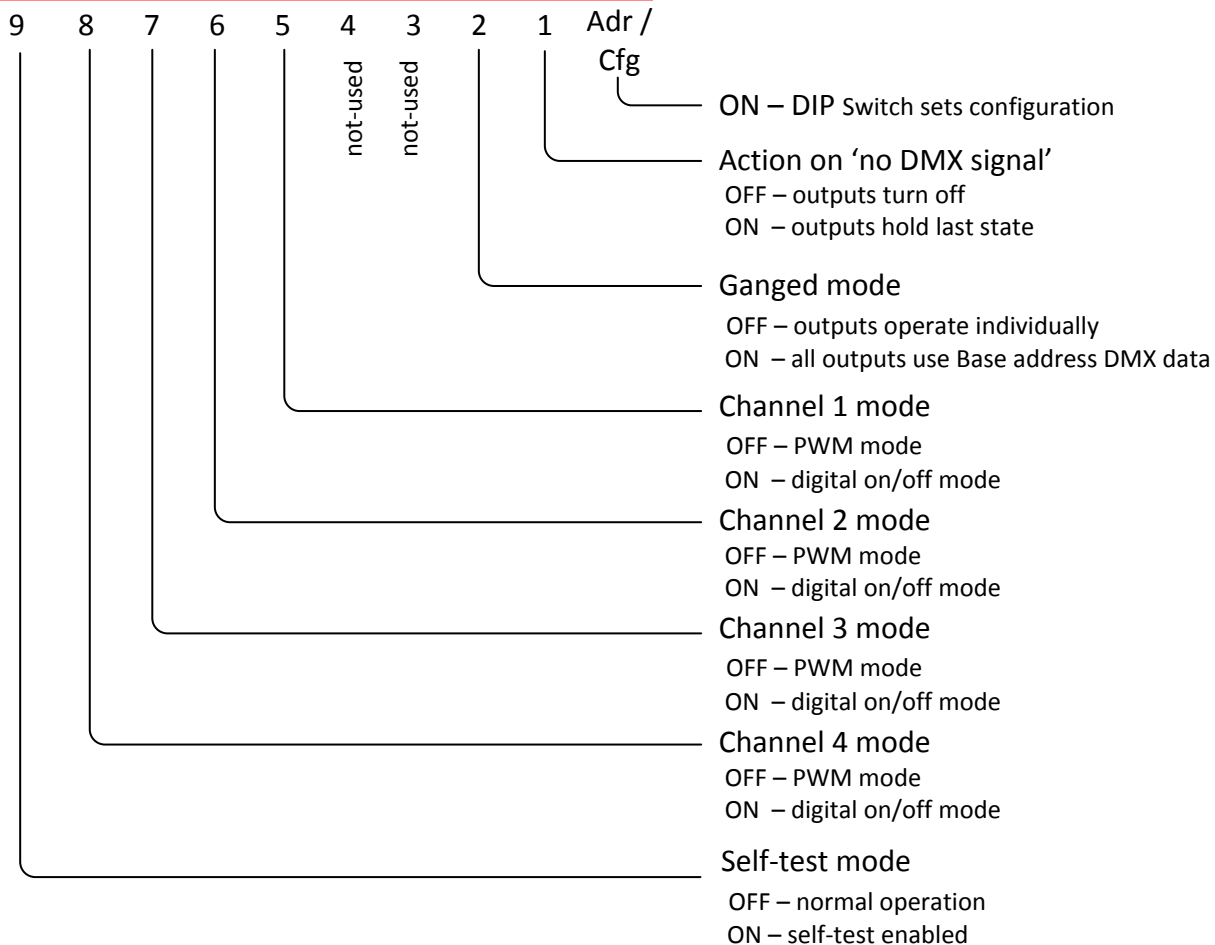
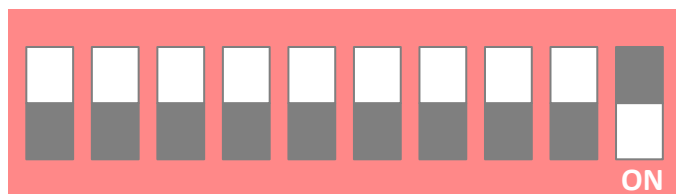
The table below shows the address used for the channel data depending on whether the switch is on or off

	Channel-1	Channel-2	Channel-3	Channel-4
Base Address	ON/OFF	ON	ON	ON
Base Address+1		OFF		
Base Address+2			OFF	
Base Address+3				OFF

Channel Mode. Each output can operate in either PWM or digital mode. In PWM mode the output is driven with a PWM signal, the duty cycle set by the DMX data value: 0 = 0% thru 255 = 100%

In digital mode the output is either on or off. When the DMX data value is 0 the output turns off. When the DMX data value is 255 the output turns on. DMX data between 1 and 254 is ignored and will not change the output. The mode can be set for each channel individually.

Self-Test. When Self-test is enabled each output turns on (100% PWM duty) at 0.5 second intervals until all four outputs are on. The outputs then turn off (0% PWM duty) at 0.5 second intervals. This repeats continuously until the Self-test switch is returned to the OFF position and the power is cycled.



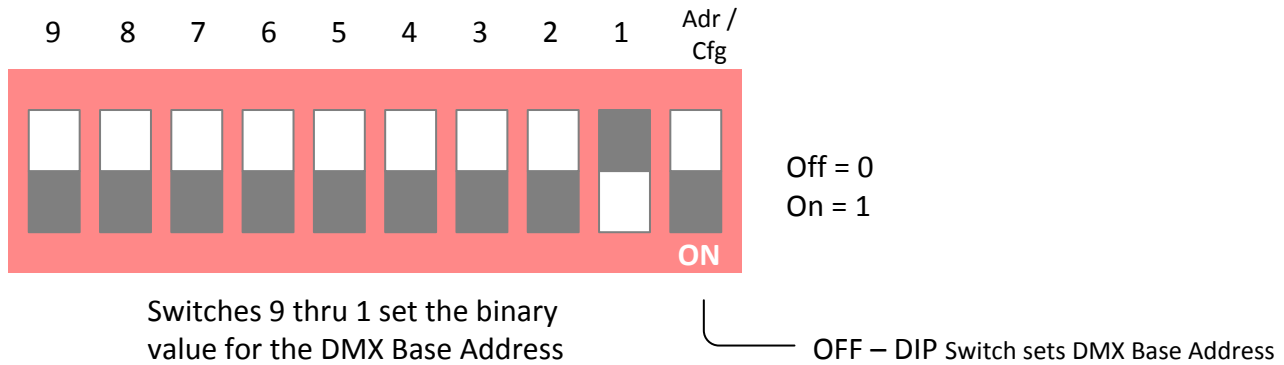
Setting the DMX Base Address using the DIP switch

Adr/Cfg switch should be set to OFF

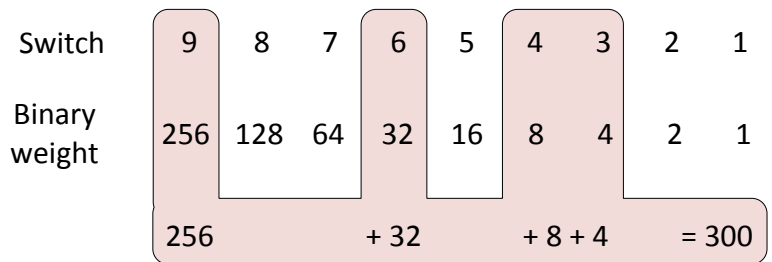
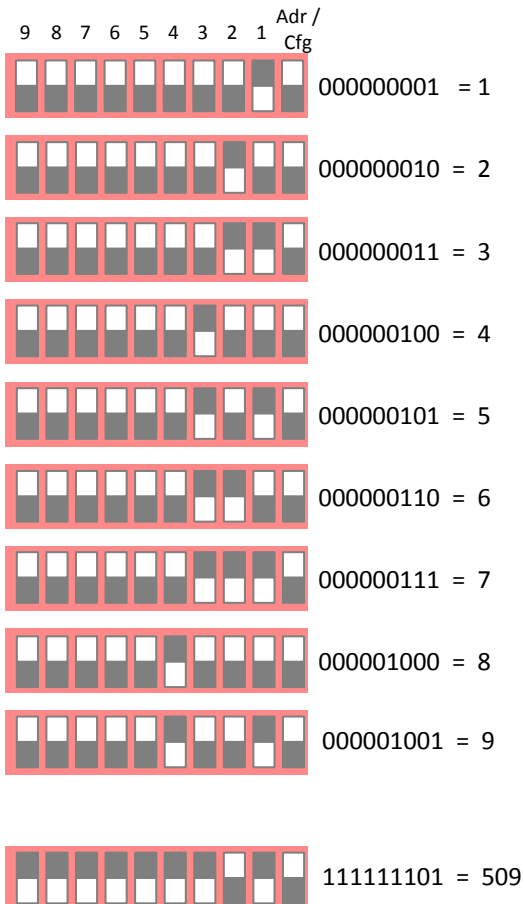
Switches 9 to 1 are used to set the binary value of the DMX Base Address used by the board.

- Switches set to the OFF position correspond to a binary value of 0
- Switches set to the ON position correspond to a binary value of 1

The DIP switch is only read when the board is powered-on. The address setting read from the switch is automatically saved to the microcontroller EEPROM. When no DIP switch is present, or the switch is set to Configuration Modes, the value previously saved to the EEPROM will be used.



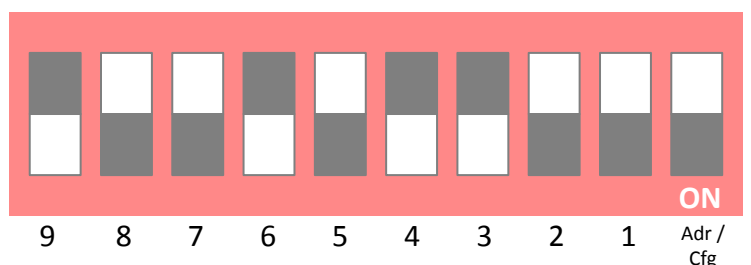
Example Base Address Switch Settings



To set DMX Base Address to 300

Set switches

- 9 = On
- 6 = On
- 4 = On
- 3 = On



Setting the DMX Base Address and Configuration using In-band DMX config

The firmware pre-programmed into the PIC microcontroller also supports In-band configuration over the DMX data channel. This allows the address and configuration mode settings to be set in custom designs that do not use the DIP Switch.

If JP1 jumper is fitted when the board is powered up the firmware waits for the first valid DMX frame and uses the data to configure the DMX address and configuration word. This is saved to EEPROM in the microcontroller.

When JP1 is fitted, regardless of the currently configured DMX base address the board reads the data from the first four channels of the DMX data frame.

- Channel 1 must contain the value 129 for the firmware to accept the frame.
- Channel 2 contains the 9th bit of the binary DMX base address
- Channel 3 contains bits 8 to 1 bit of the binary DMX base address
- Channel 4 contains the configuration mode byte.

After the firmware receives the complete frame the DMX address and configuration word are saved to the microcontrollers EEPROM. The firmware does not do any validation of the data at this time.

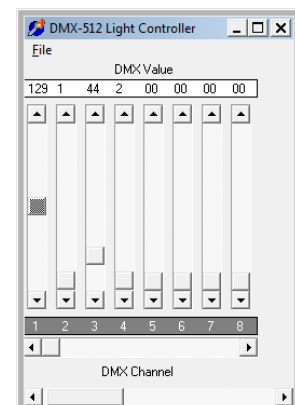
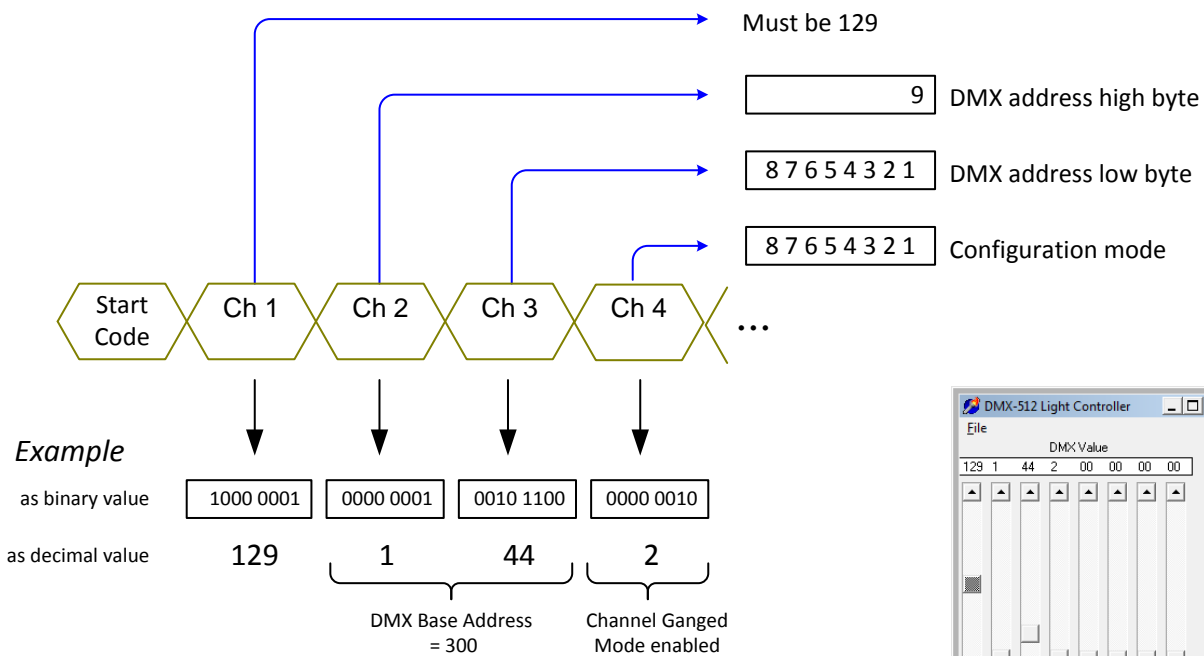
When the data has been written to the EEPROM the status LED1 will blink twice and repeat continually until JP1 jumper has been removed and the power cycled.

When the board restarts with JP1 jumper removed, the firmware validates the DMX address. If it is not in the range 1 to 509 it will signal an error through the status LED1 (see status LED error code page)

N.B. If a DIP switch is fitted, the address or configuration mode set in-band will be overwritten by the switch setting at the next power-cycle after JP1 jumper has been removed. However, if all DIP switches are set to the 'Off' position the switch is effectively not present and will not have any effect on the configuration.

The binary bit positions in the channel data bytes shown here correspond to the same DIP switch position number.

A '0' in the bit positions is the same as the DIP switch being set to OFF
 A '1' in the bit positions is the same as the DIP switch being set to ON



Status LED information and error codes

LED1 indicates operating status information and errors detected at power-on.

When power is first applied the microcontroller turns the status LED on while it initialises. This takes about 3 seconds after which the LED will indicate the current state or error code.

If there are no errors detected it will display one of the two Normal Operating states; either steady on to indicate valid DMX data is being received, or slow blinking to indicate no valid DMX data received.

Errors and inband configuration are shown by the status LED rapidly flashing a set number of times, pausing, then repeating the same code repeatedly. The number of rapid flashes indicates the error or state as detailed below.

Normal operation

Status LED is steady on - DMX data is being received
At power-on for ~4 seconds (even if no data received)

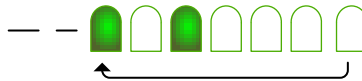


Status LED blinks slowly (0.5Hz) - no DMX signal is being received.



Inband configuration (JP1 jumper closed)

In-band configuration complete and saved to EEPROM



To clear. Turn off power to the board. Remove JP1 jumper and turn power back on.

Power-on errors

DMX Address = 0



DMX Address >509



Microcontroller EEPROM write failure



Microcontroller internal memory fault



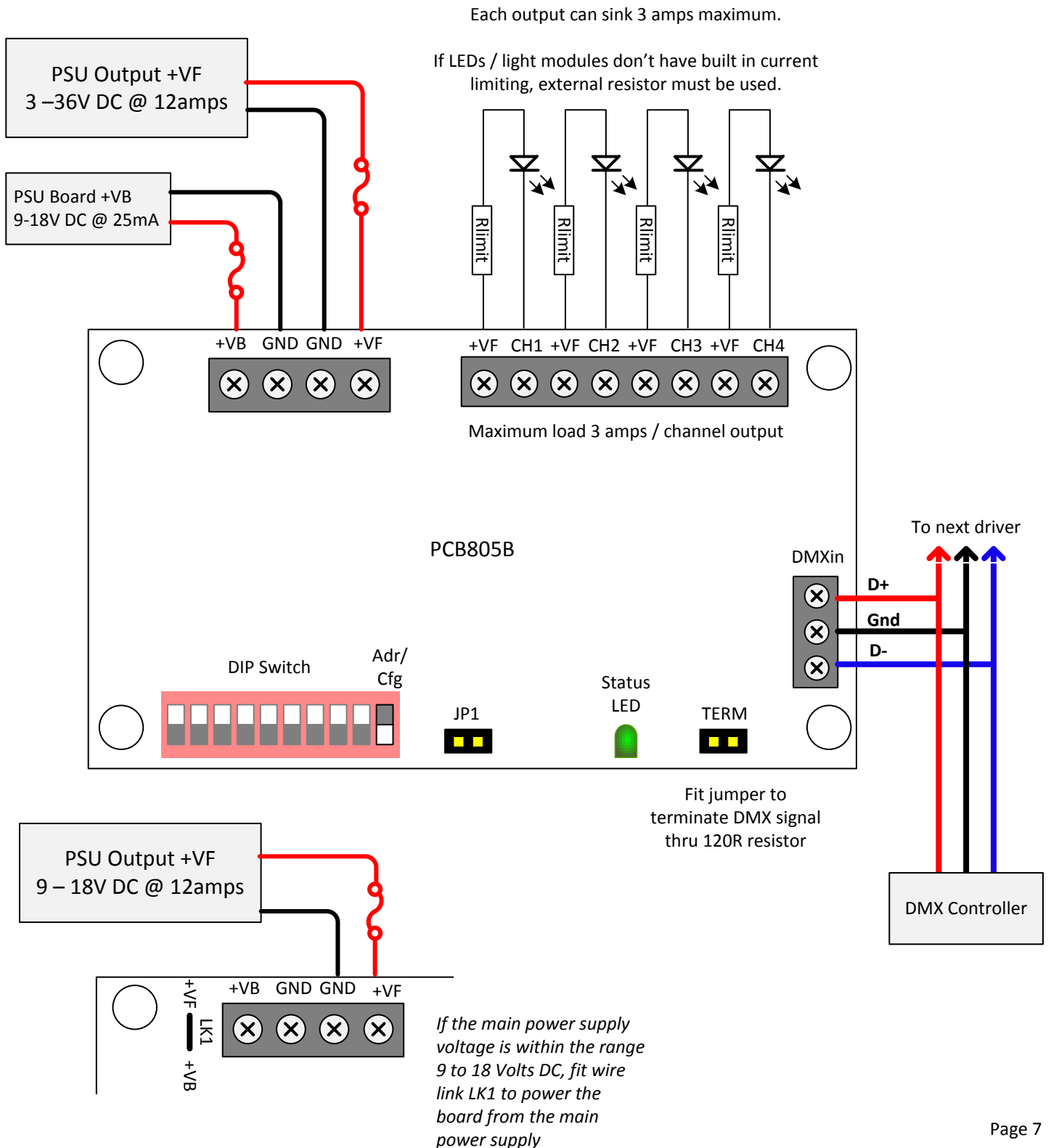
The DMX address errors can be cleared by setting a valid DMX address in the range 1 to 509 either using the DIP switch or the JP1/inband configuration method.

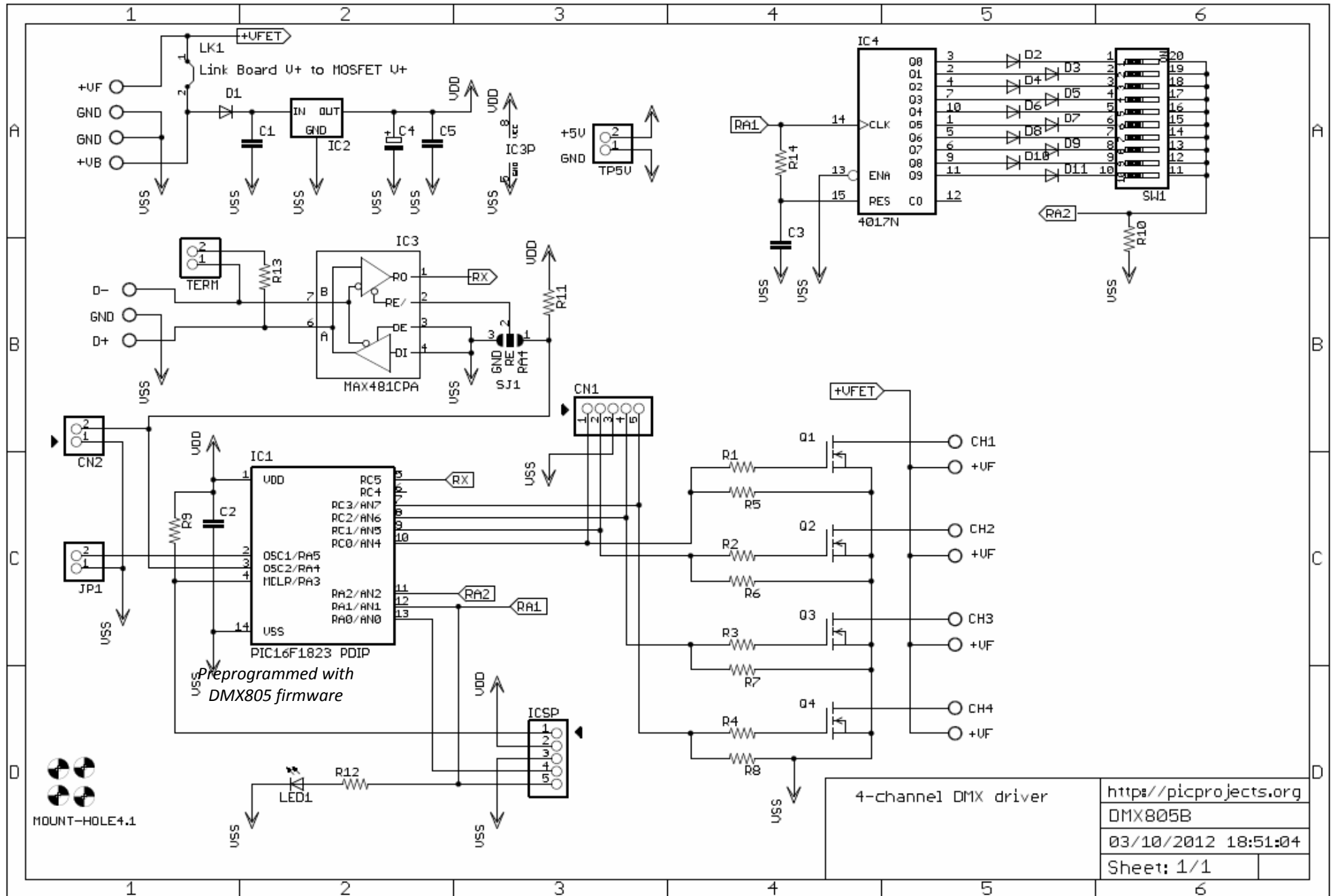
In the unlikely event the microcontroller detects an EEPROM or memory error try switching the power off and on. If this does not clear the error the microcontroller has developed a fault and will need replacing.

Connection Overview Diagram

This is a general overview of the connections to the 4 Channel DMX512 Driver PCB805B.

- When connecting LED or LED modules to the controller consult the datasheet for the specific devices being used to ensure voltage and current limits are met.
- Do not operate the board at currents or voltages outside the ranges shown here.
- Do not use with inductive loads
- Ensure appropriate rated fuses are used in the power supply connections





Components

R1,R2,R3,R4	120R 0.125Watt
R5,R6,R7,R8,R10,R11	10K 0.125Watt
R12	330R 0.125Watt
R13	120R (0.25W or 0.5Watt)
R14	1K 0.125Watt
R9	not used
<i>All resistors 5% carbon film.</i>	
<i>Where 0.125Watt parts are specified these are required to fit on the PCB due to size constraints.</i>	
C1	330nF polyester
C2,C3,C5	100nF Y5V multilayer ceramic
C4	not used
D1-D11	1N4148
IC1	PIC 16F1823 (pre-programmed)*
IC2	78L05
IC3	MAX481 (or equivalent)
IC4	HCF4017B
Q1-Q4	STP20NF06L
LED1	5mm LED green
SW1	10-way DIP switch
CN1	5-pin 0.1" header (not used)
ICSP	5-pin 0.1" header (not used)
CN2	2-pin 0.1" header (not used)
JP1	2-pin 0.1" header
TERM	2-pin 0.1" header
	2,54mm jumper links for shorting JP1 / TERM
DMXin	3-way, 5mm, screw-terminal
Power-in	4-way, 5mm, screw-terminal, 16 amp (2 x 2-way end stackable)
Channel output	8-way, 5mm, screw-terminal, 16 amp (4 x 2-way end stackable)
IC Sockets	
IC1	14-pin DIP socket
IC3	8-pin DIP socket
IC4	16-pin DIP socket
Misc item x 4	M3 nut + M3 x 6mm machine screw to mount MOSFETs to PCB

JP1 in-band configuration

If configuration will only be done in-band the DIP switch and associated circuit components can be omitted. These are:

R14, C3, IC4, D2-D11 and SW1

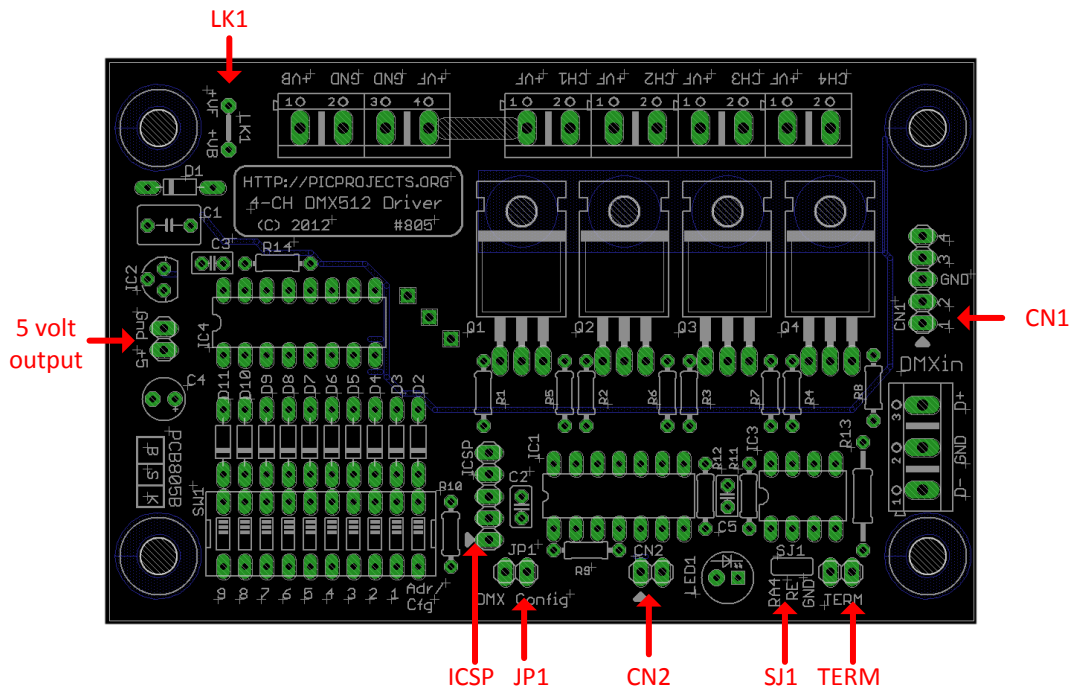
Notes:

- The output driver MOSFETs Q1-Q4 are STP20NF06L. These are logic level devices designed to operate with a low gate drive voltage.

If an alternative non-logic level part is substituted you may need to derate the maximum output current per channel

- Alternative pin-compatible parts exist for the RS-485 transceiver, IC3.
 - SP485 (EXAR)
 - ST485 (ST)
 - MAX483 (Maxim)
 - MAX485 (Maxim)

Description of other connectors on PCB805B

**CN1: 5-way 0.1" SIL header**

Direct connection from the microcontroller's four channel driver outputs + one Gnd

ICSP: 5-way 0.1" SIL header

In-circuit serial programming header. Connections as Microchip ICSP standard 5 way header.

CN2: 2-way 0.1" SIL header

Presents the microcontroller's RA4 I/O pin + Gnd connection (see also SJ1)

SJ1: 3-way solder jumper on PCB

The RS485 transceiver's 'RE' receive enable input can be connected directly to ground making it permanently enabled, or to the microcontroller's RA4 output. When connected to RA4, the 'Receiver Enable' input is under firmware control and is held high until the microcontroller has initialised and is ready to receive the DMX signal.

LK1: on-PCB wire link

The driver board's on board 5 volt regulator requires an input voltage between 9 and 18 volts. The channel outputs can operate between 3 and 48 volts. When the +VF channel output supply is outside the 9-18 volts required by the board a separate power input to +VB must be used. If the main +VF output supply is within 9-18 volts, fit wire link to position LK1 to allow the board to derive power from main channel power supply input +VF.

TERM: 2-way 0.1" SIL header

Fit jumper to terminate the DMX D+/D- signals into the on-board 120R resistor.

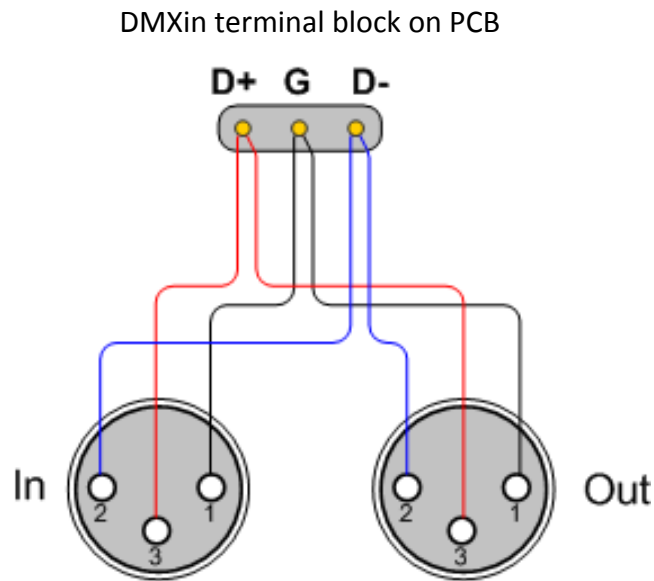
JP1 / DMX Config: 2-way 0.1" SIL header

Fit jumper to enable in-band configuration through the DMX data channel.

5 volt output: 2-way 0.1" SIL header

Presents the 5 volt output from the onboard regulator. If used to power an external circuit, ensure load current / +VB input voltage does not exceed the current or power dissipation limits of the 78L05

3-pin XLR Wiring for DMX512



DMX512 XLR Connector
Female (socket)
View from front

On some equipment the D+ and D- connections may be reversed

Links

Latest revision of this document can be found at:
<http://picprojects.org/projects/dmx/dmx805/DMX805manual.pdf>



Full construction details for the 4-channel DMX PWM Driver board based on PCB805 described in this document can be found at:
<http://picprojects.org/projects/dmx/dmx805/>



Buy the kit for this 4-channel DMX PWM Driver board at:
<http://picprojects.biz>

