DIGWDF 675 Controller – Construction/Operation Manual

Self-standing line powered light controller from DIGWDF

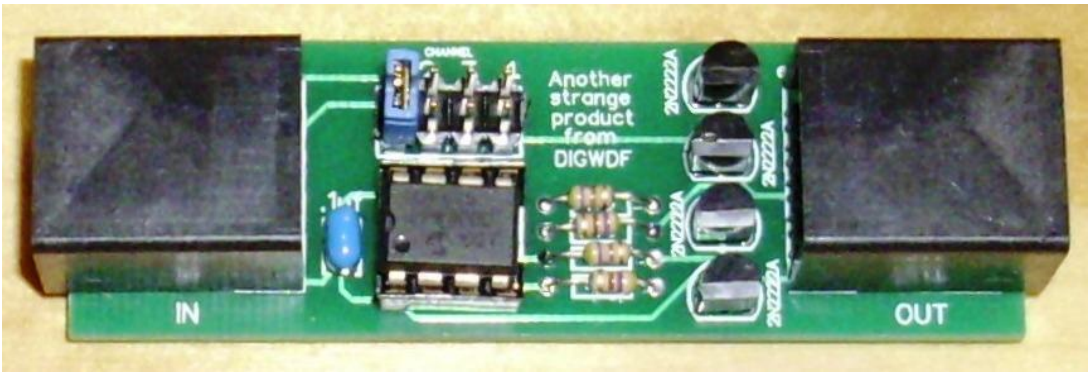
Overview

The 675 is a small, 4-channel self-standing light controller that connects to common DIYC SSRs to control lights. Because of its small size and inexpensive components, it can be built into the display piece itself or optionally, installed centrally. It is normally connected to the SSR via common cat5 cable using the normal DIYC cabling method. The device itself is powered via the input cat5 control cable where 5vdc and ground are provided in the normal DIYC pinout design with pin 1 at +5vdc and pins 2-4-6-8 ground. The 675 requires approximately 160ma current at 5vdc when all four channels are on simultaneously.

BOM – Bill of Materials

The 675 shares many common parts with other popular controllers except for one, the PIC12F675 chip itself.

Qty	Mouser Part#	Item Description
4	299-470-RC	Resistors, 470 ohm, 1/8 watt (1/4 is okay)
1	80-C322C104K5R	.1uf 50v non-polarized capacitors
1	579-PIC12F675-I/P	PIC12F675 microprocessor (or PIC12F629/PIC12F683)
4	863-P2N2222AG	2N2222A transistor (or equivalent)
1	571-1-390261-2	8-pin DIP socket (optional, for PIC12F675)
2	538-95503-2881	RJ45 jacks, vertical PCB mount
		Note: You may want side-entry jacks instead
1	538-42375-1863	10-pin breakaway single row header
1	151-8000-E	Shunt jumper



Note: eBay can be an excellent source for inexpensive electronic components in bulk, such as 5mm terminal blocks, breakaway header pins, DIP sockets, resistors and capacitors, fuses, voltage regulators, triacs and LEDs. Buying common parts in bulk (even from Mouser) can require a slightly greater investment up-front, but you'll save tens and even hundreds of dollars later in terms of convenience and eliminating expensive shipping fees for small orders. At the end of this document is a listing of parts common to a lot of DIY electronic gear.

Step-by-Step Construction

General concepts: It is usually advisable to assemble a circuit board by the height of the parts themselves, starting with the smallest/thinnest parts that are mounted so they lie low right on the board and graduating to the taller and finally the tallest parts such as large capacitors and transformers. In this fashion, you can usually insert several common-height parts into their respective mounting holes, flip the board over and solder them as a group which is more

convenient because the parts stay in the holes instead of falling out. In these general construction tips, some items may not be applicable if the board does not require those parts; just skip to the next item on the list. The word “install” implies both mounting and soldering the part to the board and clipping off any extra leads after soldering. Note that many parts are polarized and require that they be installed in a specific orientation on the board. Also, most electrical parts are pretty robust and can withstand some heat, but in general, over-soldering by using too much solder and/or too much heat can create problems and damage either the part or the board itself.

1. Install resistors first in the four locations marked “470.” Resistors do not have a polarity, but it’s the best technique to install them all the same way, reading the colored stripe values from left-to-right.
2. Install the DIP socket (if used). Take care to orient the notches on the sockets with the markings on the board. Note: DIP sockets are optional; some users solder the chips directly to the board, which is fine. If you do, solder them in place of the DIP sockets and understand that they are usually quite heat-sensitive.
3. Install the .1uf decoupling capacitor. This is a non-polarized part.
4. Install the four 2N2222A transistors, making sure to orient them in the holes according to the outlines on the circuit board. Transistors are heat-sensitive; don’t over solder and take care not to bridge solder across the solder pads as they are rather close together.
5. Install two rows of header pins at the 1-2-3-4 channel areas. The breakaway header pins are handy to use (and less expensive overall) because you can cut off the number you need.
6. Place a shunt-jumper across the two pins beneath the channel 1 marking. The shunt jumper selects which control channel will be used to power the 675 board.
7. Install the two RJ45 jacks. You may wish to use side-entry jacks in place of vertical mount jacks depending on the enclosure into which you mount the controller. Before soldering, press-fit the jacks and test for a fit in the enclosure you’ve selected.
8. Check both the top and bottom of the board for any bits of wire or solder which may be leftover from construction, and check the bottom of the board to ensure that no solder points have been missed, which is a rather common assembly mistake.
9. At this point and for the purpose of these instructions, it is assumed that the PIC12F675 processor chip has been properly flashed with the appropriate firmware. This is a separate topic that are quite adequately addressed elsewhere. If the PIC12F675 is not configured properly, the controller’s function will be unpredictable at best.
10. Prior to inserting the PIC12F675 chip into the socket, you may wish to review the Making connections and Pre-Testing sections (below). Otherwise, be sure to orient the chip properly with the notch on the sockets, which should also match the notch marked on the board. Some chips may not have a notch but use a dot or other mark adjacent to what is “pin #1” on the chip. You may have to gently bend the legs on the chips so they fit easily into the socket. When

done, double-check each socket to make sure there are no bent pins and that the chips are securely mounted.

11. Live testing can now be performed using a sequence that has appropriate channel setups. It is assumed that the sequencing software is properly configured to send its output to the controller and that a suitable cat5 cable is in use. These issues are outside the scope of this manual and are adequately addressed elsewhere.

Making Connections

The 675 controller is powered by another controller or other 5v power source. The input pin connections are as follows, and match the basic DIYC standard for cat5 cabling:

- Pin 1 +5vdc
- Pin 2 channel 1 (ground)
- Pin 4 channel 2 (ground)
- Pin 6 channel 3 (ground)
- Pin 8 channel 4 (ground)
- All other pins: no contact

Note: in the list above the channel number is relative to the cable and not to the overall sequence itself; channel 1 means the first channel of the 4 channels being sent through the cat5 cable. The header pins marked 1-2-3-4 are used to select which of the four possible channels the 675 will use as its power supply. Since the power is coming from the output of another controller, and because the total draw on the supply can be upwards of 160ma, be sure that the outputs from the source controller can manage at least that amount. For example, connecting the 675 directly to the output of a PIC16F688 will exceed the 16F688 chip's capability. However, connecting the 675 to the outputs from a MiniRen8XBLSD or Ren48LSD is acceptable since those outputs are rated at up to 400ma of output current.

Pre-Testing

Using a standard, straight-through cat5 cable, connect the 675 to the output controller of your choice. Use the channel test feature of your sequencing software to turn on all four channels that are now connected to the 675. (Note: You may wish to remove the PIC12F675 chip during pre-testing.)

1. Using a DVM, measure the voltage between the 1-2-3-4 channel pins – the top pin should be ground and the bottom row of pins +5v. All four channels should measure +5vdc.
2. Set your sequencing software to turn on only the first channel that is connected to the 675. Using a DVM, +5v should be on the 675's channel 1 but none of the other channels.
3. Repeat test #2 on each of the other three channels to ensure that the channel signals are unique and of the proper voltage when they are on, and also to become familiar with the 675 powering concept.

Troubleshooting

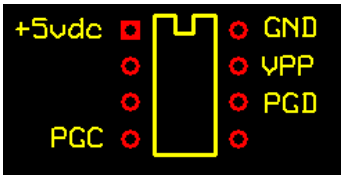
As long as the board has been assembled carefully and properly, there is very little that can go physically wrong with a 675 controller, and any problems likely lie in one of the following areas:

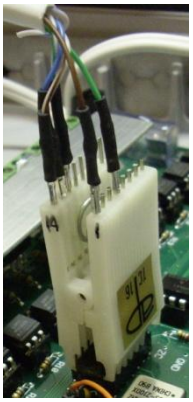
- The chosen channel that's used to power the 675 is not "on" in the sequence.
- A bad connection cable between either the power supply controller and the 675 or the 675 and the SSR.
- The 675's shunt jumper is either not on or is on the wrong pair of channel headers.
- The 675 firmware is not configured properly. The default ASM firmware provided by DIGWDF turns on the channels in 1-2-3-4 order and keeps them on until power is removed from the 675.
- The lights are not plugged into the SSR, or the SSR is not powered with 120vac.
- It's possible that a pin inside one of the 675's RJ45 jacks could move and short with another pin. While this is very rare, it's always worth checking.

ICSP Programming of the PIC12F675/PIC12F629 chip

- While a dedicated ICSP header hasn't been provided, the functionality of it can be created by connecting the PIC Programmer to various pins on the PIC12F675 chip:

    - PGD connection PIC pin #6)
    - VPP connection PIC pin #7)
    - PGC connection PIC pin #4)
    - GND: G pin PIC pin #8)
    - VCC connection: PIC pin #1)





- An easier and faster method can be by using a clamp-on test clip that is appropriately connected to your PIC programmer's ICSP port, and simply clamping it directly onto the pins of the 12F675 chip itself. Note that the 12F675 uses the same relative pins as the 16F688 chip, so the same clamp-on test clip can be used with the 12F675 as the 16F688.

Compatibility/Connectivity with other controllers

The 675 is not tied to any specific controller, and in fact, can be powered by a battery pack or wall wart providing the polarity of the connection to the INput jack of the 675 follows the values outlined earlier (see Making Connections). The 675 will simply run the pre-programmed sequence continuously as long as the 675 is powered on.

Controllers/boards that the 675 is designed to be used with include (but are not limited to):

- MiniRen8XBLSD (may require supplemental 5vdc power)
- MiniRenServoXB (using Regular firmware, not servo firmware; may also require supplemental 5vdc power)
- Ren48LSD (in 5v output mode)
- Ren24LV (may require supplemental 5vdc power)
- Any controller that switches adequate 5vdc power to its outputs.
- Battery power or wall-wart that supplies adequate and continuous 5vdc power.

Controllers/boards that may work with the 675 but are untested:

- Olsen 595
- Grinch
- Helix

Controllers/boards that should specifically NOT be used include (but are not limited to):

- Any controller that outputs A/C voltage out its control channels.
- Any controller that outputs more than 5vdc out its control channels.
- Ren64 (any version).
- SimpleRen32 (or any of the SimpleRen controllers)
- Any E1.31 or other Ethernet-based controller

Questions/Answers

- **Is the DIGWDF 675 dimmable?** The original version of the firmware supports only on/off control. A version of the firmware that supports dimming is planned but no work has been made in that direction as yet. The PIC12F675 chip does not have native PWM capability but the PIC12F683 chip (which also works) does, and we're exploring that as a possibility.

- **Will the 675 work with A/C and D/C SSRs?** Yes. It should work with any SSR that uses the normal, DIYC pin connection method, whether the SSR controls A/C or D/C electricity.

- **Are there alternatives to the PIC12F675 chip?** Yes. You can substitute a PIC12F629 or PIC12F683. We've tested all three with the HEX code that was compiled for the 675 and found them all to work just fine without recompiling the firmware for each specific chip.

- **Can you get more than 4 channels out of the 675 chip?** Yes, it has six I/O pins that you can use. You can revise the firmware on your own to add the two otherwise unused pins on the 675 chip, but remember, the 675 board has circuitry for only four channels. You'll have to devise your own board to use all six.

- **Does the board support DMX?** The 675 is an on/off device and does not have any capability to gather a serial signal of any kind. If a DMX device has the capability to supply +5v and ground to the 675, there's no reason why it wouldn't work. However, realize that the 675 merely runs its embedded firmware when power is applied, nothing more, so don't expect DMX effects.

- **How much does it cost to build a 675?** About $10 including the circuit board.

- **I want to etch my own board, is the layout available?** No, neither the source DipTrace file or the Gerber files are available. The DIGWDF store tries to keep a stock of all its products on hand at reasonable prices.