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Universal Light Control Module

User Guide

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Overview

The Universal Light Control Module is capable of controlling the operation of external warning lights (also known as Christmas tree lights) on cranes to suit various regulations based on changing inputs.

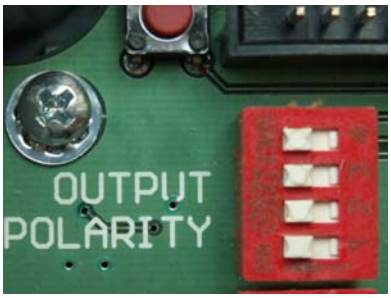
The outputs operate based on a priority principle as follows:

1. If an input activating the red (and buzzer) output(s) is activated then the red light will turn on
2. If no red input is activated and an orange input is activated then the orange light will turn on
3. If no inputs are activated then the green light will turn on.

The unit is equipped with the following features:

- Unit operates on 12V and 24V systems
- Short circuit and over voltage protected outputs
- Programmable input level thresholds to handle different input signals ie from LEDs, relays, solenoids etc.
- Reverse polarity protected power supply
- Solid state technology – no moving parts
- Four outputs – green, orange, red, buzzer

- Six inputs – 1 for activating orange output and 5 for activating red output and buzzer
- Programmable active high or active low inputs to activate outputs
- Individually programmable flashing outputs – no flasher cans needed
- Time delay on the orange input so that output stays on orange as long as an input is received within every second. (unless a red input is received) eg. An intermittent buzzer input can be used to trigger orange output.
- Outputs can sink or source current allowing any type of light to be connected.
- Separate red and buzzer outputs

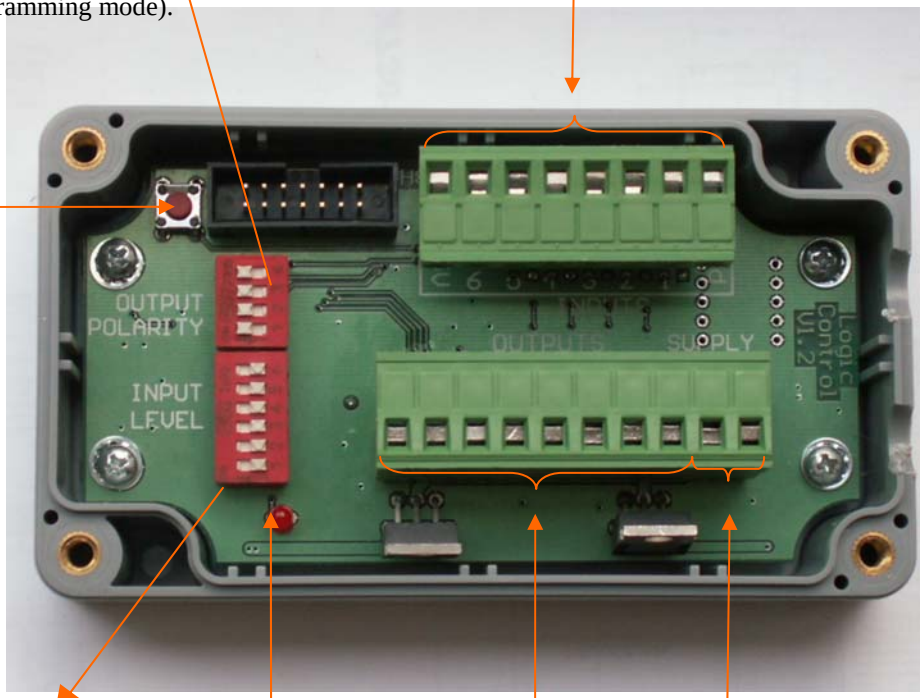


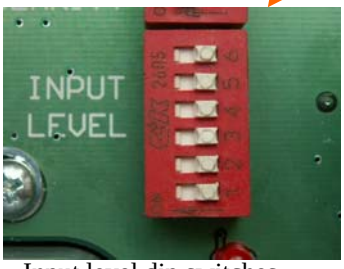
Output Polarity dip switches.
(Also used to set flashing outputs in programming mode).

Input connections:
Inputs activating the red output – 1, 2, 4, 5, 6
Input activating the yellow output – 3

Output connections:
Gnd – Ground output
+5V – 5V output capable of supplying 60mA

Programming switch





Input level dip switches.
(Also used to set input level thresholds in programming mode)
Note: if input 6 is not used then leave dip switch 6 turned on.

LED

Power Supply
Inputs:
+24V – 12/24V input
Gnd – Ground input

Outputs:
4 – Buzzer output
3 – Green output
2 – Orange output
1 – Red output
+24V – 12/24V output depending on supply
GND – Ground supply for lights

Figure 1. Layout of Universal Light Control Module

Output Connections

Connections to the outputs are made via the 10 way terminal block. Printed on the circuit board are the labels for the terminal block connections. The outputs to a light are as follows:

Terminal 4	– Buzzer output
Terminal 3	– Green output
Terminal 2	– Yellow output
Terminal 1	– Red output
+24V terminals	– 12V or 24V power supply to lights depending on the input supply
GND terminals	– Ground supply to the lights

Setting Output polarities

Using the output polarity dip switches (see Fig 1) it is possible to select whether the output will source current (output 12/24V depending on input supply) or sink current (supply a ground signal) to activate the lights.

The dipswitches are as follows:

Dip switch 1 – Output polarity for red light
Dip switch 2 – Output polarity for yellow light
Dip switch 3 – Output polarity for green light
Dip switch 4 – Output polarity for buzzer

If the switch for an output is turned “On” then the output will supply 12/24V.

If the switch for an output is turned “Off” then the output will supply ground.

Outputs can be individually set to source or sink current although most of the time all the outputs will be set to the same output polarity.

Input Connections

Connections to the inputs are made via the 8 way terminal block. Printed on the circuit board are the labels for the terminal block connections. The inputs are as follows:

Inputs to turn red and buzzer outputs on – 1, 2, 4, 5 and 6
Inputs to turn yellow output on – 3

If any of the inputs to activate the red light and buzzer are triggered then the red and buzzer outputs are turned on regardless of whether the yellow input has been activated. The red inputs have the highest priority over other inputs.

If the yellow input is activated and no red inputs are activated then the yellow light is turned on. As an additional feature a time delay of 1 second has been enabled on the yellow input so that as long as a yellow input is received within a second the yellow output will stay on (unless a red signal is activated). This is useful when tapping a yellow signal from a buzzer that buzzes every

0.5 seconds for example. Without this delay the external lights would flash orange then green repeatedly.

Setting input Polarities

Using the input polarity dip switches (see Fig 1) it is possible to select whether an input will be active high (Low to high transition eg 0V to 24V transition will trigger the input) or active low (High to low transition eg 24V to 0V transition will trigger the input).

The dipswitches are as follows:

Dip switch 1 – input polarity for input 1 (activates red and buzzer outputs)
Dip switch 2 – input polarity for input 2 (activates red and buzzer outputs)
Dip switch 3 – input polarity for input 3 (activates yellow output)
Dip switch 4 – input polarity for input 4 (activates red and buzzer outputs)
Dip switch 5 – input polarity for input 5 (activates red and buzzer outputs)
Dip switch 6 – input polarity for input 6 (activates red and buzzer outputs). Input 6 has a pullup resistor built in which means that with no connection to input 6 5V will be present at the input. This is useful for input signals that supply a GND signal such as in some Tadano systems.
Note: If input 6 is not used then leave dip switch 6 in the "on" position.

If the dip switch for an input is turned "On" then the input is active low.

If the dip switch for an input is turned "Off" then the input is active high.

Inputs can be independently set as active high or active low.

Programming flashing outputs and input thresholds

In programming mode the outputs can be individually set to flash or stay on and the sensitivities of the input thresholds can be reprogrammed.

Flashing output overview

The ability to be able to program outputs to flash or just stay on is useful if using normal globes or LEDs that do not have flashing circuits built in and you wish to set them to flash without the need of an additional flasher can. Alternatively, if you wish to connect a light with a rotating beacon you do not want the light to start and stop rotating due to the output being strobed. In this case you would program the output to stay on when activated instead of flash.

Input threshold overview

Being able to reprogram the input sensitivity is useful due to the wide range of signals that may be encountered on a crane for triggering an input that will then activate an output. For example, an input taken from the switched side of the LED may change from 0.6V to 2.5V. In this case a threshold level with a sensitivity of 1V would be sufficient to determine if the LED had been turned on or off allowing the control module to determine if the input had been activated. An input taken from a solenoid may change from 0V to 24V. A threshold level with a lower sensitivity of 3V would

be sufficient to detect if the solenoid had been turned on or off allowing the control module to determine if the input had been activated.

Program the flashing outputs and input thresholds as follows:

1. Enter programming mode:
   To enter programming mode press and hold the programming switch (see Fig. 1) then turn the power on. Release the programming switch when the LED (see Fig. 1) starts flashing.
2. Set the dip switches on the output polarity and input level switches as follows:
   In programming mode the output polarity dip switches and the input level dip switches take on different functions.

   The output polarity dip switches become the flashing output selection dip switches as follows:

   Dip switch 1 – Flashing output selection for red light output
   Dip switch 2 – Flashing output selection for yellow light output
   Dip switch 3 – Flashing output selection for green light output
   Dip switch 4 – Flashing output selection for buzzer output.

   If the dip switch for a given output is turned “on” during programming mode then the corresponding output will flash when activated.

   If the dip switch for a given output is turned “off” during programming mode then the corresponding output will have a constant output when activated.

   The input polarity dip switches become the input threshold sensitivity setting dip switches as follows:

   Dip switch 1 – input threshold sensitivity setting for input 1
   Dip switch 2 – input threshold sensitivity setting for input 2
   Dip switch 3 – input threshold sensitivity setting for input 3
   Dip switch 4 – input threshold sensitivity setting for input 4
   Dip switch 5 – input threshold sensitivity setting for input 5
   Dip switch 6 – input threshold sensitivity setting for input 6 (input 6 has a resistor built in which means that with no connection to input 6 there will be 5V present at the input terminal)

   If the dip switch for a given input is turned “on” during programming mode then the corresponding input threshold will be set to a lower sensitivity of 3V.

   If the dip switch for a given input is turned “off” during programming mode then the corresponding input threshold will be set to a higher sensitivity of 1V.

   Determine which outputs you want to flash. Set the flashing output dip switches appropriately.

   Determine the input threshold sensitivity required for each input. Voltmeter readings of the input signals will be required to determine this. For the majority of cases a lower sensitivity

of 3V is suitable (ie input threshold switch turned on). Set the input threshold sensitivity dip switches appropriately.

3. After the flashing output dip switches and the input threshold sensitivity dip switches have been correctly set press the programming switch again. When the LED stops flashing the settings have been written to EEPROM and the programming switch can be released.
4. Set the input polarity dip switches and the output polarity dip switches to their appropriate settings.

Example

It has been noticed that there are no outputs specifically for an external warning light. A Light Control Module will be fitted to control the lights.

An LED style light is to be fitted to a crane. The red, orange and green LED light modules are to have a common 24V supply with each light module being activated by supplying a ground signal. The light does not have a buzzer so it has been decided that the buzzer will have a permanent earth connection and the buzzer will be activated by sending 24V to the buzzer. The customer wants the red light to flash when activated but wants the green and yellow light to turn on without flashing. The customer also wants the buzzer to beep continuously instead of buzzing on and off.

The job site requires the red light to activate if the override switch is activated or if the crane goes into alarm condition.

By experimentation it has been determined that the yellow output can be triggered by sensing the activation of a buzzer that beeps every 0.5 seconds when the crane is at between 90% and 99%. The buzzer is receiving a signal that measures 24V when the buzzer is activated and 0V when the buzzer is off. The override switch has a terminal that switches from 24V to 0V when the override switch is activated. There is also an LED that has been observed to turn on when the crane limit is reached or when an alarm condition is triggered. This LED can be used to activate the red light and buzzer when the crane is in an overload or alarm condition. The LED has 3V permanently on one terminal. The other terminal has 2.5V when the LED is off and 0.7 V when the LED is activated.

The Light Control Module is wired up as shown in Fig. 2.

The module is then put into programming mode. From the above information the dip switch settings will be:

1. Only the red output is to flash. Therefore flashing output dip switch 1 (Output polarity dip switch 1) is turned “on”. Dip switches 2, 3 and 4 are turned off so that outputs for orange, green and buzzer respectively do not flash.
2. From the information given previously only three inputs are being used. The input thresholds required will be:
    a) Buzzer input to activate yellow: buzzer is reported to have a signal that goes from 0V to 24V. A threshold level of 3V will be selected so that noise does not cause the orange output to accidentally be activated. Input threshold sensitivity dip switch 3 (Input polarity dip switch 3) will be turned “on”.
    b) Override switch signal to activate red light: The override signal goes from 24V to 0V. Again a threshold sensitivity of 3V will be selected. This signal is being fed into input

1 therefore input threshold sensitivity dip switch 1 (Input polarity dip switch 1) will be turned ”on”.

c) Crane limit and alarm condition LED to activate red light: A signal of 2.5V to 0.7 V was measured. A threshold level of 3V will not work since the signal is always under 3V. A higher sensitivity level of 1V will be needed. The input from the LED is being fed into input 2 therefore input threshold sensitivity dip switch 2 (input polarity dip switch 2) will be turned “off”.
d) Inputs 4, 5 and 6 are not being used. Therefore the sensitivity levels of these inputs don’t matter since no inputs are being fed into these inputs. Good practice is to set these unused inputs to a low sensitivity of 3V. Therefore dip switches 4, 5 and 6 will be turned “on”.

In summary the input threshold sensitivity dip switches will be set as follows:

- dip switches 1, 3, 4, 5 and 6 will be turned “on” to select an input threshold of 3V.
- dip switch 2 will be turned “off” to select an input threshold of 1V.

After setting the dip switches to program the desired input and output settings the program switch is pressed to write the settings to EEPROM and exit programming mode.

In normal operating mode the following dip switch settings will be required:

1. Output polarity settings:
    a) The LED modules are turned on by a ground signal. Therefore output polarity dip switches 1, 2 and 3 for red, orange and green outputs respectively will be turned “off”. These outputs will be activated by supplying a ground signal to the light modules.
    b) The buzzer is turned on by supplying 24V. Output polarity dip switch 4 will be turned “on” so that the buzzer output supplies 24V when activated.
2. Input polarity settings:
    a) The buzzer signal goes from 0V when the buzzer is not activated to 24V when the buzzer is activated. This is a low to high transition when the buzzer is activated meaning it is an active high signal so dip switch 3 (yellow activating signal is wired into input 3) is turned “off” to select an active high input.
    b) The override signal goes from 24V when the override switch is not activated to 0V when the override switch is activated. This is a high to low transition when the switch is activated meaning it is an active low signal so dip switch 1 (signal is wired into input 1) is turned “on” to select an active low input.
    c) The LED signal goes from 2.5V when the LED is not activated to 0.7V when the LED is turned on. This is a high to low transition when the LED is activated meaning it is an active low signal so dip switch 2 (signal is wired into input 1) is turned “on” to select an active low input.
    d) Inputs 4,5 and 6 are not used. Inputs 4 and 5 will have a low signal at their inputs all the time (no pullup resistors on these inputs) so dip switches 4 and 5 will be turned “off”. Input 6 is special in that it is the only input to have a pull up resistor. Therefore even with no input 5V will be measured at the input terminal. When input 6 is not used dip switch 6 is always turned “on”.

That completes the set up of the Light Control Module.

Figure 2. Example switch settings and connections