These boards have loads of features including several options that are selectable by including or omitting certain components. Here is a rundown, assuming a pair of boards are installed; one at each end of the engine: An option selection matrix is included on page 2.

1. Standard headlight function is front headlights lit only when in forward, and rear headlights lit in reverse. You can use 1 or 2 white leds depending on the engine. When using one you must jumper the mating pattern pads to complete the circuit.
2. Another standard function is front bi-color markers that are green in forward while rear markers are red. This switches in reverse to front markers red and rear markers green. You can tell at a glance which direction the engine will start. Optionally you can have all 4 go green in forward, and all 4 go red in reverse. See user notes.
3. Say you want instead only green markers out front in forward, and only green out back in reverse. Simply omit the R3 resistors on both boards. If you want only red out back in reverse, omit R2 & R3 and jumper pads R2-pad1 to R3-pad2 on the rear board with a 2.2K resistor. Many other variations are possible.
4. Front & rear cab lights are supported and are lit when the engine is stopped, and optionally extinguish when moving. The front cab light can be selected to light in both forward and reverse, or only in forward (omit D9). The rear cab light is lit only when stopped in reverse; there is no option for it to be lit in forward (no D9 diode). Both will support one or two offboard series cab light leds connected to J3.
5. Cab light outputs can optionally be used for running board lights, or work lights, which will then extinguish in motion. See user notes.
6. Number board lights are supported by both boards, and can be selected to light in both forward and reverse, or only in the respective direction of motion (omit both D7's). For leds use R4=680 ohm as shown. If equipped with OEM GOW number board lights, omit and jumper the R4 pads.
7. Ditch lights leds are supported by both boards, and by default light only in the respective direction of motion. Both support two series offboard white leds connected to J5. Use resistor R1 = 680R when ditch light leds are installed, otherwise R1=1K for headlights only. If the engine has OEM GOR ditch lights this is a good time to switch them to leds.
8. There are two pairs of onboard headlight led pads. One set D3-D4 are vertical mount, the other D11-D12 are horizontal, since some diesel headlights are mounted this way. Only one set of white leds should be used for headlights; leave the other pads unpopulated.

All the above functionality is done with only 3 wires (#26-28) connected between the engine mobo and the F-R-G pads on *one* of the new boards. (Boards are inter-connected in the shell via the F-R-G pads, again using #26-28 wire) A 3 pin header such as Dupont or JST-EH is suggested at the board, with the female connector pigtail wires connected to the respective engine mobo pins that supply the R2LC/R4LC front and rear lighting outputs, and ground.

Use light gauge wires (#26-28) connected from each board J4 header to the power wires connected to the respective motor, to enable the boards to sense engine motion. The OEM motor wires are often colored yellow and blue, and are easily identified regardless. A 2 pin header such as Dupont or JST-EH can be used at the board, with the female connector pigtail soldered directly to the motor connections. This allows easy shell removal when needed. For a single motor engine, connect both board J4's in parallel to the motor connections. J4 polarity is not important.

Component Matrix: (For each board)

√	For Front Functional:	Install These Components:	Comments:
	Headlights (1-2) (directional)	D3, D4, (or D11/D12) and R1(680=4 or 1K=2)	Onboard leds (1 or 2) (1 is OK if no ditch lights)
	R-G Markers (2) (directional)	D1, D2, R2=680, R3=2.2K	Onboard leds (2)
	Ditch Lights (2) (directional)	R1 (680=4 or 1K=2)	Off-board leds in series (2)
	Nbr Brd Lights (2) (directional)	R4=680, D6 (plus D7 to light in both directions)	Off-board leds in series (2)
	Cab Lights (1-2) (directional and off-in-motion)	R5=1.5K, R6=1K, C3=1uF, VO1, D8, (plus D9 to light in both directions)	Off-board leds in series (1 or 2)

√	For Rear Functional:	Install These Components:	Comments:
	Headlights (1-2) (directional)	D3, D4, (or D11/D12) and R1(680=4 or 1K=2)	Onboard leds (1 or 2) (1 is OK if no ditch lights)
	R-G Markers (2) (directional)	D1, D2, R2=680, R3=2.2K	Onboard leds (2)
	Ditch Lights (2) (directional)	R1 (680=4 or 1K=2)	Off-board leds in series (2)
	Nbr Brd Lights (2) (directional)	R4=680, D6 (plus D7 to light in both directions)	Off-board leds in series (2)
	Cab Lights (1-2) (directional and off-in-motion)	R5=1.5K, R6=1K, C3=1uF, VO1, D8	Off-board leds in series (1 or 2)

NOTES:

1. All boards require D5 and C1 installed in addition to above options. See user notes.
2. To make the marker leds go all 4 green in forward, and all 4 red in reverse, reverse the D1/D2 Red-Green leads, and swap R2 & R3, on **the rear board only.**
3. Rear cab lights are only used for double-ended engines such as a GG1, or an A-A diesel engine pair.
4. R1 handles both headlights and ditch lights. Change resistor as shown for either 2 or 4 leds total. When ditch lights are used both ditch and headlights must be pairs of 2 leds in series. If using only one headlight mount the other flush to the pcb so it won't be seen.
5. Cab light outputs can optionally be used for operating running board lights or work lights, which will then extinguish on motion. See user notes.
6. Rear ditch lights are not commonly used, but provided for on the rear board anyway. Outputs can optionally be used for any other lighting that will be lit only in reverse.
7. All off-board sets of 2 leds are assumed to be wired in series.
8. All diodes are small glass 1N4148 DO-25 size.
9. All resistors are small 1/4W 7.62/4x1.5 size.
10. Pin headers are recommended for headlight led and marker led mounting on both boards.