

<b>Team #:</b>	P19345	<b>Team Name:</b>	Unstoppable
<b>Date:</b>	12/5/2019 8:49	<b>Document Owner:</b>	Rui
<b>Revision #:</b>	4		

### Customer Requirements: MSD Team P19345

Category	Customer Rqmt. #	Importance	Description	Comments/Status	Requirement Met?
Technical	T1	9	Support physical control via local control panels	Push a button and it throws a switch, control routing via a button board	Yes
Technical	T2	9	Support indication via local control panels	Support for LED outputs of switch positions, blocked occupancy (if a train is there), and signal aspect. More complicated traffic lights.	Yes
Technical	T3	9	Integration with existing layout control systems	Works with existing NCE systems	Yes
Technical	T4	3	Prototypical signal operations	Specific to lights on actual layout. More complicated traffic lights (which way going, which speed allowed to go, etc.) Provide outputs for LEDs and inputs for someone to decide what those outputs need to do.	RG LEDs Functional- Partial Yes
Technical	T5	9	Proof of concept installation and functionality	Want prototype to work with full functionality	Yes
Technical	T6	3	Support for remote control via network or web interface	Need ethernet interface and some API. Have Java Model Railroad Interface (JMRI TV preview) communicate with new 'brain' (command station) and current systems.	No
Technical	T7	3	Support for indication via network or web interface	Need ethernet interface and some API. Have Java Model Railroad Interface (JMRI TV preview) communicate with new 'brain' (command station) and current systems.	No
Functional	F1	3	Modular design	Not a custom solution for one particular instance. Expandable to any model railroad and layouts. Ex/ same board could switch between areas in a model railroad layout	Yes
Functional	F2	3	Safe for daily use		Yes
Functional	F3	3	User friendly	Need to be able to use boards as well as program track locations, inputs, and outputs. Someone with a mild technical background, ex/ mechanical engineer, should be able to use it	Yes
Cost	C1	3	Low-cost hardware design	No hard number on 'low cost'. Focus on creating a sustainable solution. Many different options for hardware design. Don't have to buy a part that costs \$100 to run for one instance.	Yes
Want	W1	1	Realistic signal lighting effects	Different styles of signals. Fancy lighting used in real-life railroad systems. If can be applied, do it	Yes

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Engineering Requirements: MSD Team P19345

Category	rqmt. #	Importance	Source	Function	Engr. Requirement (metric)	Unit of Measure	Ideal Value	Direction of Improvement	Comments/Status	Requirement Met?
Cost	C1	3	C1	Cost per line of i/o	Less than \$10 per line	\$	<\$10	minimize	Waiting for baseline of current cost of systems from customers. Subject to change	Yes- \$0.60 per line of I/O
Technical	T1	9	T1	Support for multiple signalling rulesets	Does it have this support?	Yes/No	Yes	maximize		No
Technical	T2	3	T5	Support for time-based logic	Does it have this support?	Yes/No	Yes	maximize		Yes
Technical	T3	9	T1,T5	Support for automatic or dispatcher-controlled signal operations	Does it have this support?	Yes/No	Yes	maximize		No
Technical	T4	9	T1,T2,T5	Support for logical lock out of local control panels	Does it have this support?	Yes/No	Yes	maximize		Yes
Technical	T5	3	T5,T6	Support for full interaction via HTTP REST API	Does it have this support?	Yes/No	Yes	maximize		No
Technical	T6	9	T6,T7	Ability to "talk to" hardware	Interface on relevant boards	Yes/No	Yes	maximize		Yes
Functional	F1	3	T3,T6,F1,F2	Number of NCE interface commands supported	How many does it support?	Number	-	maximize	Team needs to determine which commands are relevant and necessary. Further research will determine the ideal value.	Yes- direct support of 5 main NCE commands. All commands have functionality to be supported.
Functional	F2	3	T4,F1,F3,W1	Support for realistic signal lighting	Green/red/yellow lighting and control	Yes/No	Yes	maximize		Yes
Functional	F3	3	T6,T7	Improved "block occupancy" detection	Train wheels have resistors that draw current, sending a signal that there is a train there	Yes/No	Yes	maximize		Yes
Functional	F4	9	T4	Track occupancy lights work without needing computer	Track occupancy lights always functional, not just when computer software is running	Yes/No	Yes	maximize		No