

# CANtactor Product Requirements

Target release	CANtactor v1
Epic	
Document status	DRAFT
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Designer	Jack Smith Rich Osman
Developers	
QA	


## Goals

- Provide a first pass PoC of a Contactor controlled by CAN bus

## Background and strategic fit

This will be used by the Interlock Solution

## References

Reference	Location
GitHub Repo	<a href="https://github.com/Dallas-Makerspace/Interlock-CANtactor">https://github.com/Dallas-Makerspace/Interlock-CANtactor</a>
CANopen-stack:	<a href="https://canopen-stack.org/v4.4/">https://canopen-stack.org/v4.4/</a> <a href="https://github.com/embedded-office/canopen-stack">https://github.com/embedded-office/canopen-stack</a>
CAN In Automation Web	<a href="https://www.can-cia.org/">https://www.can-cia.org/</a> <div><p>CANopen ...v4.2.pdf</p></div> <p>CiA 301 Spec:</p>
CAN Open Wiki	<a href="https://en.wikipedia.org/wiki/CANopen">https://en.wikipedia.org/wiki/CANopen</a>

## Requirements / HW

#	Title	User Story	Importance	Notes
1	CAN Bus enabled	Control of the node will be done over CAN-FD from the primary CANtroller of the interlock system.	Must Have	<ul style="list-style-type: none"><li>• Recommend also having side-band Digital I/O enabled on /off for testing</li></ul>

2	uController in node	a small uC will generally be required in order to handle the CAN bus and the desired sensors.  The uC should be relatively generic, such that if it needed to be changed it could be replaced with a different device.		
3	Safety	The device needs to be safe, and should exceed basic safety ratings.	Critical for Safety	<ul style="list-style-type: none"> <li>All circuits carrying &gt; 24V should be analyzed for safety. No Waivers.</li> <li>Creepage and Clearance requirements should specified and enforced.</li> <li>Reinforced insulation and Double Insulation should be considered.</li> <li>High-Pot testing should be performed before system is put in service</li> <li>Enclosure should require tool usage in order to access &gt;24v circuits</li> <li>Warning Signs should be evident</li> </ul>
4	Voltage Measurement		Nice to Have / Future	<ul style="list-style-type: none"> <li>Voltage ADC should be fairly generic such that it can be replaced.</li> <li>Voltage ADC should be isolated from uC via magnetic or optical isolation</li> <li>Some uC may already include an ADC that can be used.</li> </ul>
5	Current Measurement	Being able to determine if the machine is on/off by current measurement will be useful.	Nice to Have / Future	<ul style="list-style-type: none"> <li>Current ADC should be fairly generic such that it can be replaced.</li> <li>Current ADC should be isolated from uC via magnetic or optical isolation</li> <li>Some uC may already include an ADC that can be used.</li> </ul>
6	Wiring	Much of the wiring in the device will handle high currents and high loads, and will need to survive for years.	Critical for Safety	<ul style="list-style-type: none"> <li>Ensure that all wiring is properly insulated</li> <li>CAN Wiring will have twists (typically 40/meter for old CAN, TBD for CAN-FD)</li> </ul>
7	Indicators	A user should be able to see the status of the device easily when near it.	Must Have	<ul style="list-style-type: none"> <li>LED on input power indicating Powered / Unpowered</li> <li>LED on output power indicating Powered / Unpowered</li> <li>Consider LED on uC indicating node connected to CANtroller and blink for CAN activity vs node not connected to CANtroller.</li> </ul>
8	Termination	CAN bus needs termination	TBD	<ul style="list-style-type: none"> <li>Termination strategy is TBD</li> </ul>
9	Contactur Unit	The system should use a NEMA General Purpose Contactur.		<ul style="list-style-type: none"> <li>Previous interlock used a 50A "Definite Purpose" style contactur, which is good for cost</li> <li>Prefer NEMA style, 3 pole, 50A rated, with 120v activation circuit but cost is a factor</li> <li>Likley NEMA size 2 based on the above and wiki (<a href="https://en.wikipedia.org/wiki/NEMA_size">https://en.wikipedia.org/wiki/NEMA_size</a>)</li> <li>Benshaw has a good selection: <ul style="list-style-type: none"> <li><a href="https://benshaw.com/wp-content/uploads/2020/01/benshaw-contactors-brochure.pdf">https://benshaw.com/wp-content/uploads/2020/01/benshaw-contactors-brochure.pdf</a></li> <li>RC-50A-56AC120 or RC-50A-56AC200 depending upon the coil (120v vs 208v)</li> <li>Web pricing is approx \$200 on these</li> </ul> </li> <li>Grainger web pricing for NEMA size 2 magnetic general purpose is almost 10x that (crazy) <ul style="list-style-type: none"> <li>Mouser Option: <a href="#">CC40SA120</a> or <a href="#">CC50LA240</a></li> </ul> </li> </ul>
10	Transorb	Coil will need a transorb to catch the spikes  Applies to both the large contactur and the small relay		

## Requirements / SW

#	Title	User Story	Importance	Notes
1	GitHub based S/W	Future developers and maintainers will want access to the code.	Critical	<ul style="list-style-type: none"> <li>Code must be maintained on DMS GitHub</li> </ul>

2	CAN Library	CAN library should ideally be common between the CANtroller and CANTacter	Nice to Have	<ul style="list-style-type: none"> <li>Differences in uC may make this difficult</li> <li>Consider CANopen and CANopen-stack</li> </ul>
3	CAN Usage	The usage of the CAN bus should be very well defined and common between CANtroller and CANTacter	Must Have	<ul style="list-style-type: none"> <li>Keep the same RFC / APR for the usage of the CAN bus</li> </ul>
4	Node ID	Each node should have a unique ID and should be able to	Must Have	
5	Prevent_Off_when_running	Cutting power to a high powered device while it is in operation can be damaging.	Must Have	<ul style="list-style-type: none"> <li>CANTactor can Deny a CANtroller request to turn off</li> <li>TBD: should CANTactor shut down when safe, or should it wait for continued requests from CANtroller?</li> </ul>
6	11bit vs 29bit addressing?	TBD		
7			TBD	

## User interaction and design

## Questions

Below is a list of questions to be addressed as a result of this requirements document:

Question	Outcome
Brooks Przybylek: Out of curiosity, why not a web server with an api and just have the interlocks on the network? I'm not sure how reasonable a load that'd be for the network but if you're doing esp the hardware is there and no need to worry about wiring, power will be at the device anyway	Jack: a web server could always be added later... as a function of the controller. I wasn't planning to put one in the contactor box... as I'd rather not have power on/off to the machinery changed without the local controller being involved. (the CAN bus would be from the controller to the contactor)

## Not Doing