Introduction

Assuming we want to connect several probes to one datalogger, we need to consider the maximum length we can run I2C and what the power losses to the heater probe would be. This document contains some information relating to the transmission line properties of Ethernet, and to help develop a plan for making long sensor cables.

Proposed Connections

Blue	SCL
Blue/White	GND
Green	SDA
Green/White	GND
Orange	5V
Orange/White	GND
Brown	12V
Brown/White	Switch

Transmission Line Properties

These are for 24 AWG Cat5e. The resistance of 28 AWG will be higher, but other properties should be similar

Characteristic Impedance	100 ohms
DC loop resistance	.188 ohms / meter
Capacitance at 800Hz	52 pF/m
Inductance	525 nH/m
Conductance	Not listed (probably near zero?) One source says it's dielectric losses that appear at high frequencies
Corner Frequency	57 Khz
Max Current	577 mA
Propagation Speed	0.64 c = 192*10^6 m/s
Propagation Delay	4.5 - 5.3 ns/m

From these values, it appears we can use a lumped element model up to 200m, since we're only operating at 100kHz, which has a wavelength of 1.9km.

I2C limitations

2C isn't meant to run very far. It relies on the timing between SCL and SDA, and can only handle so much skew. Maybe we should use some differential pair drivers. Several people mention the PCA9615, which run about $2.50 each. I haven't found any other similar parts - this seems to be the only chip that does this function.
https://www.nxp.com/docs/en/data-sheet/PCA9615.pdf