Ref. #	Desc.	Mfr.	Part #
3.3VLED	Green	Kingbright	APTL3216CGCK
C0	10 uF, 16V Capacitor (Ceramic)	Samsung Electro-Mechanics	CL31B106MOHNN
C1	0.1 uF Capacitor (Ceramic)	Samsung Electro-Mechanics	CL31B104KBCNN
C100	0.1 uF Capacitor (Ceramic)	Samsung Electro-Mechanics	CL31B104KBCNN
C101	0.1 uF Capacitor (Ceramic)	Samsung Electro-Mechanics	CL31B104KBCNN
C102	0.1 uF Capacitor (Ceramic)	Samsung Electro-Mechanics	CL31B104KBCNN
C103	10 uF, 16V Capacitor (Ceramic)	Samsung Electro-Mechanics	CL31B106MOHNN
C12	0.1 uF Capacitor (Ceramic)	Samsung Electro-Mechanics	CL31B104KBCNN
C14	0.1 uF Capacitor (Ceramic)	Samsung Electro-Mechanics	CL31B104KBCNN
C15	0.1 uF Capacitor (Ceramic)	Samsung Electro-Mechanics	CL31B104KBCNN
C16	0.1 uF Capacitor (Ceramic)	Samsung Electro-Mechanics	CL31B104KBCNN
C2	0.1 uF Capacitor (Ceramic)	Samsung Electro-Mechanics	CL31B104KBCNN
C20	0.1 uF Capacitor (Ceramic)	Samsung Electro-Mechanics	CL31B104KBCNN
C2000	0.1 uF Capacitor (Ceramic)	Samsung Electro-Mechanics	CL31B104KBCNN
C21	0.1 uF Capacitor (Ceramic)	Samsung Electro-Mechanics	CL31B104KBCNN
C3	0.1 uF Capacitor (Ceramic)	Samsung Electro-Mechanics	CL31B104KBCNN
C4	0.1 uF Capacitor (Ceramic)	Samsung Electro-Mechanics	CL31B104KBCNN

C5	0.1 uF Capacitor (Ceramic)	Samsung Electro-Mechanics	CL31B104KBCNN
C6	0.1 uF Capacitor (Ceramic)	Samsung Electro-Mechanics	CL31B104KBCNN
C7	22 uF, 50V Capacitor (Electrolytic)	Nichicon	UPW1H220MDD
C8	0.1 uF Capacitor (Ceramic)	Samsung Electro-Mechanics	CL31B104KBCNN
C9	0.1 uF Capacitor (Ceramic)	Samsung Electro-Mechanics	CL31B104KBCNN
IC1	Temperature Sensor	Texas Instruments	LM60
IC2	Voltage Reference	Texas Instruments	LM4128
IC3	Voltage Regulator	Texas Instruments	LM2937
LED1	Red	Kingbright	APTL3216SURCK
LED2	Yellow	Kingbright	APTL3216SYCK
LED3	Green	Kingbright	APTL3216CGCK
R0	10 kΩ Resistor	Stackpole Electronics Inc.	RMCF0805FT10K0
R1	1.5 kΩ Resistor	Stackpole Electronics Inc.	RNCP0805FTD1K5
R10	1.5 kΩ Resistor	Stackpole Electronics Inc.	RNCP0805FTD1K5
R2	1.5 kΩ Resistor	Stackpole Electronics Inc.	RNCP0805FTD1K5
R3	1.5 kΩ Resistor	Stackpole Electronics Inc.	RNCP0805FTD1K5
R4	1.5 kΩ Resistor	Stackpole Electronics Inc.	RNCP0805FTD1K5

R5	470 Ω Resistor	Panasonic Electronic Compor	ERJ-6GEYJ471V
R6	30 kΩ Resistor	TE Connectivity	CRG0805F30K
R7	470 Ω Resistor	Panasonic Electronic Compor	ERJ-6GEYJ471V
R8	120 Ω Resistor	Stackpole Electronics Inc.	RNCP0603FTD180
R9	1.5 kΩ Resistor	Stackpole Electronics Inc.	RNCP0805FTD1K5
U1	16-bit Microcontroller	Microchip Inc.	dsPIC33EP512GP8
SV1	Pin Header	Sullins Connector Solutions	NRPN401PAEN-RC
FTDI	Pin Header	Sullins Connector Solutions	NRPN401PAEN-RC
JP1	Jumper Housing	Uxcell	N/A
JP3	Jumper Housing	Uxcell	N/A
JP4	Jumper Housing	Uxcell	N/A
U5	LCD Char Module	Newhaven Display Internatio	NHD0208AZ
POT	Rotary potentiometer	Alps	RK09K
U4	DAC	Microchip	MCP4922-E/SL
U3	Can Transciever	Maxim Integrated	MAX3051
CAN1	RJ11 Connector	Molex, LLC.	WM5575-ND
CAN2	RJ11 Connector	Molex, LLC.	WM5575-ND
H1	Pin Header	Sullins Connector Solutions	NRPN401PAEN-RC
H2	Pin Header	Sullins Connector Solutions	NRPN401PAEN-RC
H3	Pin Header	Sullins Connector Solutions	NRPN401PAEN-RC
S0	Rotary Encoder W/ Push Button	SparkFun	COM-09117
SW1	SPST Switch	RS Components	DTS61KV

SW2	SPST Switch	RS Components	DTS61KV
RESET	SPST Switch	RS Components	DTS61KV
PWRCONN1_3M	Power Barrel Connector Jack 1.3mm ID 3.5mm OD	CUI Inc.	PJ-007
XTAL	???	???	???

Purpose	Justification
Power Indication	Used for power indication. The PIC μC runs at 3.3V therefore the LED needed for power is rated at 3.3 forward voltage.
CPU Logic Filter Capacitor (	A 10 uF, 16V capacitor is recommended by the dsPIC33EP512GP806 datasheet section 2.3: CPU Logic Filter Capacitor Connection (Vcap) to stabilize the voltage regulator ouput. The capacitor should be ceramic or tantalum.
Bypass Capacitor	Used to reduce digital noise in the 3.3V power rails. Recommended by dsPIC33EP512GP806 datasheet under section 2.2: Decoupling Capacitors.
Bypass Capacitor	Smooths any voltage ripples going into the mcp49x2-sl
Bypass Capacitor	Smooths any voltage ripples coming from the DACA output of the mcp49x2-sl
Bypass Capacitor	Smooths any voltage ripples coming from the DACB output of the mcp49x2-sl
Bypass Capacitor	Smooths any voltage ripples going into the mcp49x2-sl
Bypass Capacitor	Bypass capacitor to regulate voltage for the VDD pin on the LCD display
Bypass Capacitor	Smooths out the vpot coming out of the pot
Bypass Capacitor	Used to reduce digital noise in the Output rail from the temperature sensor.
Bypass Capacitor	smooth out vref + voltage coming out of the voltage referencehurr durr
Bypass Capacitor	Used to reduce digital noise in the 3.3V power rails. Recommended by dsPIC33EP512GP806 datasheet under section 2.2: Decoupling Capacitors.
Bypass Capacitor	Used to smooth out the votlage going into the LM60M
Bypass Capacitor	Smooths out the input voltage for the voltage divider for LCD V0 contrast setting
Bypass Capacitor	Smooths out the input voltage going into the voltage reference
Bypass Capacitor	Used to reduce digital noise in the 3.3V power rails. Recommended by dsPIC33EP512GP806 datasheet under section 2.2: Decoupling Capacitors.
Bypass Capacitor	Used to reduce digital noise in the 3.3V power rails. Recommended by dsPIC33EP512GP806 datasheet under section 2.2: Decoupling Capacitors.

Bypass Capacitor	Used to reduce digital noise in the 3.3V power rails. Recommended by dsPIC33EP512GP806 datasheet under section 2.2: Decoupling Capacitors.
Ripple Filter for Regulator	Smooths out any ripple from Vraw going into the LM2937 voltage regulator
Ripple Filter for Regulator	Smooths out any ripple coming from the 3.3V output of the LM2937 voltage regulator
Shunt Capacitor	This capacitor is used to help shunt the load capacitance of the Crystal. It's capacitance is chosen along with another capacitor to match this load capacitance.
Shunt Capacitor	This capacitor is used to help shunt the load capacitance of the Crystal. It's capacitance is chosen along with another capacitor to match this load capacitance.
Sense Ambient Air Temperat	Required for measuring the air temperature at the surface of the board.
Reference Voltage	provide a clean 3.3v reference voltage
Voltage Regulator	voltage regulator to provde 3.3v from the vrap
Programmable Indication	Used for program indication. Since schematic shows the cathode connected to ground and the annode connected to the IO the IO will be pulled to high when the LED is to be turned on.
Programmable Indication	Used for program indication. Since schematic shows the cathode connected to ground and the annode connected to the IO the IO will be pulled to high when the LED is to be turned on.
Programmable Indication	Used for program indication. Since schematic shows the cathode connected to IO and the annode connected to the 3.3v the IO will be pulled to low when the LED is to be turned on. It will be important the the reverse voltage is larger than what the LED3_HB pin can supply to prevent destroying the LED
MCLR Pin Pull-up	MCLR Pin is active-low external reset pin and requires an external pull-up resistor to prevent spontaneous reset. This resistor value was selected via the dsPIC33EP512GP806 datasheet section 2.4: Master Clear (MCLR) Pin.
Current Limiter	Limits the current going through the 3.3VLED from the 3.3V rail.
Pull-up Resistor	Current pull-up resistor required for I2C operation, specifically on the SCL line
Current Limiter	Limits the current going through the LED1
Current Limiter	Limits the current going through the LED2
Current Limiter	Limits the current going through the LED3

Current Limiter	Limits current going through dsPIC33EP512GP806 GPIO pins from LM60 Temperature meter
Voltage Divider	Voltage divider for LCD-CHAR-MODULE-NHD0208AZ contra
Voltage Divider	Voltage divider for LCD-CHAR-MODULE-NHD0208AZ contra
Current Limiter	Limits the current going through pin 4 on CAN2
Pull-up Resistor	Current pull-up resistor required for I2C operation, specifically on the SDA line
Microcontroller	Allows for running of user programs
Blank Flash Header	Used with MPLAB X to program to flash the Bully Bootloader to the MCU.
Program Flash Header / Seri	Used with BullyCPP to load custom programs to the device through Bully Bootloader.
Jumper Selector	Used to allow the use of a jumper to select vraw between the barrel jack and the USB 5v supply voltages
Jumper Selector	Allows the use of a jumper to connect CANL to CANH through a 120ohm resisor (R8)
Jumper Selector	Allows the use of a jumper to connect VICP to 3.3v directly
LCD Display	Allows for feedback display of user input from the microcontroler
Variable Resistor	Allows for user input of variable resistance
Digital to Analog Converter	Allows for conversion of digital input signals to analog signals
CAN Interface	Allows for communication through the CAN standard to other CAN devices
Connector	Interface that allows for the connection of a RJ11 standardized connection
Connector	Interface that allows for the connection of a RJ11 standardized connection
Pinouts	Allows the user to connect directly to certain pin inputs and outputs. One of these pins, for example, allows the user to input an external VREF-
Pinouts	Allows the user to connect directly to certain pin inputs and outputs. One of these pins, for example, allows the user to input an external VREF-
Pinouts	Allows the user to connect directly to certain pin inputs and outputs. One of these pins, for example, allows the user to input an external VREF-
Rotary Encoder	This rotary encoder allows the user to rotate to change the output bits, this allows the user to change settings based on rotation. Another inclusion of this rotary encoder is a pushbutton switch.
Switch Input	Used for user input to the MCU

Switch Input	Used for user input to the MCU
Switch Input	This switch pulls MCLR to ground. This will be needed reset the MCU
Power Input	Allows for system power input to the board
Crystal	Allows for accurate timing of microcontroller operation

ast setting V0
ast setting V0