

KC0JFQ TACHOMETER FEATURES

- 1 REVERSE POLARITY PROTECTION (SMD FUSE)
- 2 SWITCHMODE REGULATOR
- 3 PROGRAMMING CONNECTION VIA POGO-PINS CONNECTION TO PADS
(DOES NOT REQUIRES PROGRAMMING CONNECTOR)
- 4 ICOM CI-V SERIAL INTERFACE (FULL DUPLEX)
- 5 NON VOLATILE MEMORY (128kb)
- 6 ANALOG CONFIGURATION CHANNEL
- 7 INPUTS:
TACHOMETER PULSE
SUPPLY VOLTAGE MONITOR
ENGINE ANALOG CHANNEL (W/PULL-UP)
- 8 TACHOMETER CHANNEL IS LIMITED AND BUFFERED
- 9 SUPPLY VOLTAGE CHANNEL HAS 10V OFFSET (EXPANDED RANGE)
- 10 ANALOG CHANNEL IS BUFFERED AND HAS GAIN
- 11 4 DIGIT NUMERIC DISPLAY
- 12 4 LED STATUS INDICATORS
- 13 PROGRAMMING & DEBUG CONNECTIONS THROUGH POGO-PINS
ON 2ND. BOARD INCARNATION (REDUCE PARTS ON PRODUCTION BOARD)

CHANGE LIST

- 2020-11-23 MOVE "TEST" TO PA0 (FROM I2C-CLK)
- 2020-12-04 MOVE CURRENT LIMIT RESISTORS FOR LEDs TO
ALLOW MOUNTING ON EITHER SIDE OF BOARD
(LTS-6760P IS SYMMETRICAL, BUT SEGMENT
ASSIGNMENTS CHANGE)
UPDATE BIT PATTERN PAGE
- 2020-12-10 FLASH DEVICE IS PART OF BASE BUILD
HOUR METER DATA AREA

J2/JH2 RECONFIGURED FOR POGO PINS
- 2020-12-12 **REVISION 1**

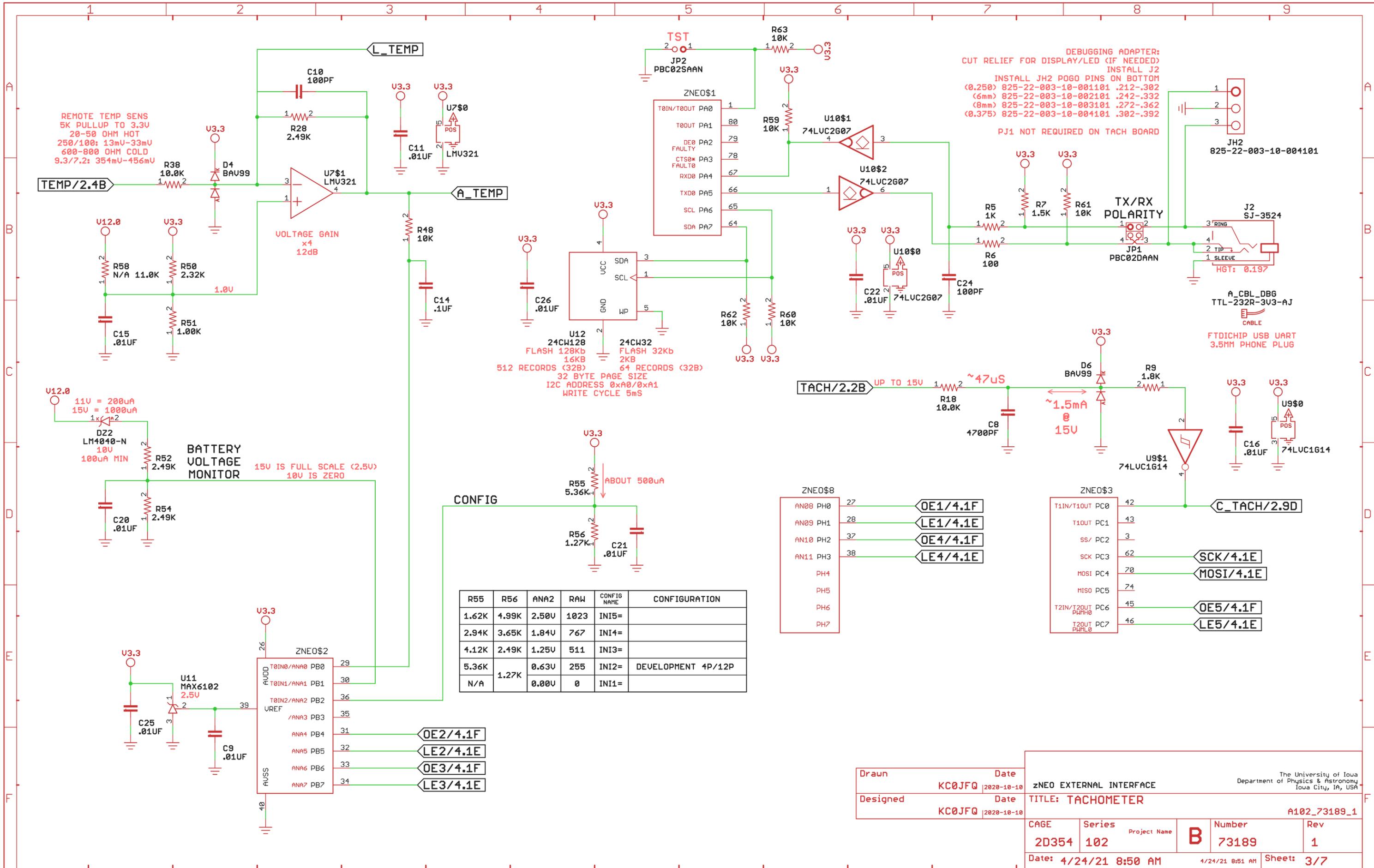
ADD HAYWIRE TO CONNECT PWML2(61)
TO PD4(72)/PD5(71)/PG0(60)
ALLOW PWML2 TO GENERATE INTERRUPT
ON PD4 TO MANAGE DISPLAY BRIGHTNESS
NO CHANGE TO ARTWORK
- 2020-12-25 ADD EXTERNAL PARTS
(i.e. NOT ON CIRCUIT BOARD)
- 2020-12-26 ADD MORE EXTERNAL PARTS
REALLOCATE SOME REFERENCE DESIGNATORS
- 2021-01-13 RE-LABEL U10 TO BE NON-INVERTING
74LVC2G07
- 2021-04-22 CHANGE DRIVE TO LEDs TO INCREASE BRIGHTNESS

non_flt_cap_common,non_flt_cap_0805,non_flt_cap_0603,non_flt_cap_0805,non_flt_cap_1206,non_flt_cap_tant,non_flt_misc,gse_001,gse_002

| | | | | | |
|--|------------|-------------|-----------------------|-------------------|--------------|
| TOP_FULL | BOARD ASSY | BOT_COMPACT | BOARD-ID | | |
| DRAWING FRAME SHOWN ON CIRCUIT BOARD | | | | | |
| Drawn | KC0JFQ | Date | 2020-10-10 | TITLE PAGE | |
| Designed | KC0JFQ | Date | 2020-10-10 | TITLE: TACHOMETER | |
| MARK ZERO POINT FOR PICK & PLACE FILE ON PRINTED CIRCUIT BOARD | | | CAGE | Series | Project Name |
| | | | 2D354 | 102 | B |
| | | | Number | Rev | |
| | | | 73189 | 1 | |
| | | | Date: 4/24/21 8:50 AM | 4/24/21 8:51 AM | Sheet: 1/7 |

The University of Iowa
Department of Physics & Astronomy
Iowa City, IA, USA

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Drawn
 KC0JFQ
 Date
 2020-10-10

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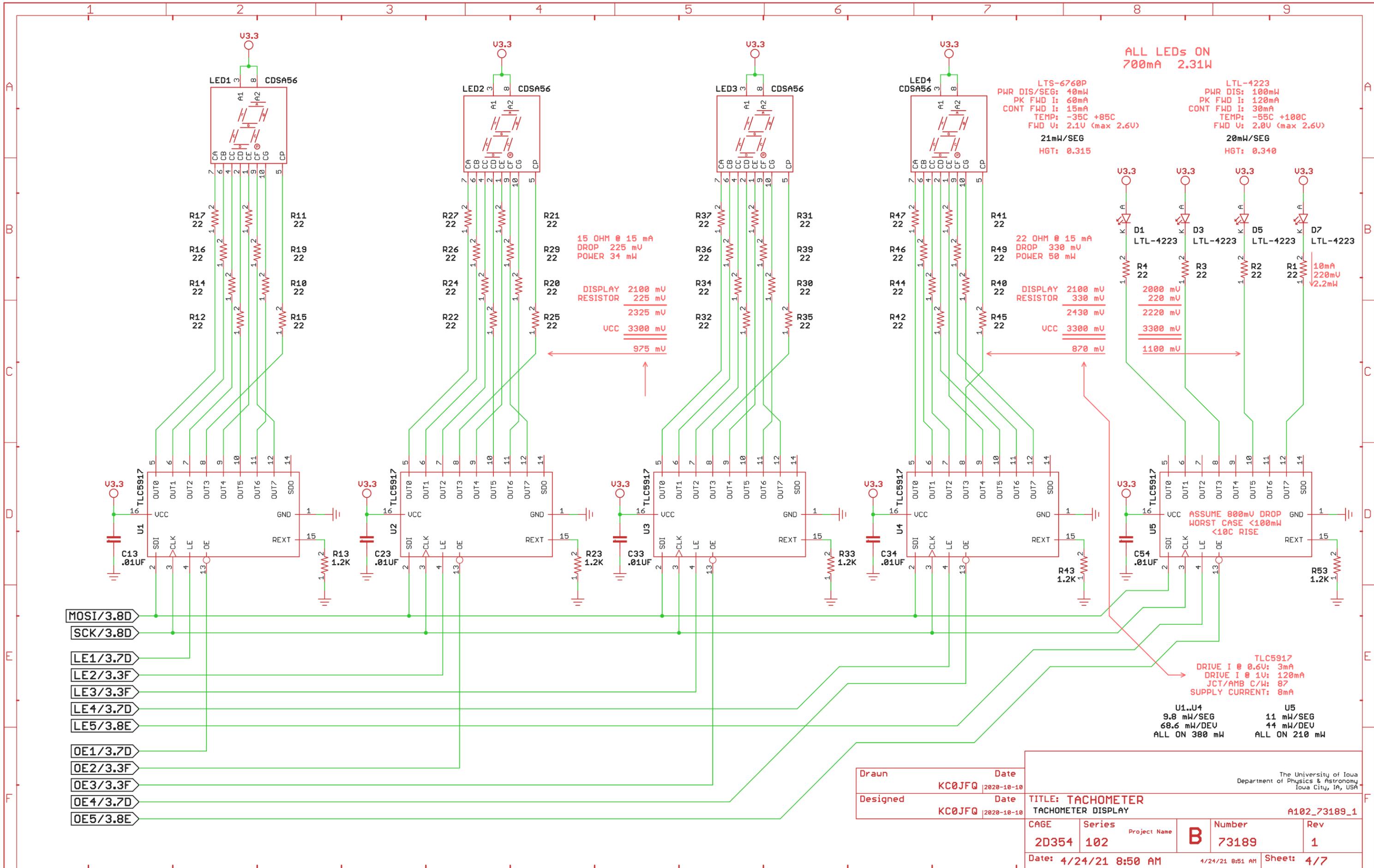
zNEO EXTERNAL INTERFACE

TITLE: TACHOMETER

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|-------|--------|--------------|--------|-----|
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KC0JFQ UNIVERSAL TACHOMETER

PORT BIT ASSIGNMENTS

| | BIT 7 | BIT 6 | BIT 5 | BIT 4 | BIT 3 | BIT 2 | BIT 1 | BIT 0 | BASE |
|--------|----------|----------|--------------|--------------|-------------|----------------|---------------|----------------|------|
| PORT A | A I2C | A I2C | A(O) TXD0 | A(I) RXD0 | | | | I TEST* | |
| PORT B | O LE3 | O OE3 | O LE2 | O OE2 | | A(A) CONFIG | A(A) BAT_U | A(A) TEMP | |
| PORT C | O LE5 | O OE5 | | A(O) MOSI | A(O) SCK | | | A(C) C_TACH | |
| PORT D | | | | | | | | INT C_TACH | |
| PORT E | | | | | | | | | |
| PORT F | | | | | | | | | |
| PORT G | | | | | | | | | |
| PORT H | | | | | O LE4 | O OE4 | O LE1 | O OE1 | |

UART 0 DEBUG PORT (PORT A)
 SPI DISPLAY x 5 (PORT C)
 SCK SHIFT CLOCK
 MOSI SERIAL DATA
 TEST* TEST MODE
 CONFIG CONFIGURATION (5 LEVELS)
 BAT_U BATTERY VOLTAGE (EXTERNAL)
 TEMP WATER TEMPERATURE (EXTERNAL)
 I/A** READ JUMPER AT STARTUP, THEN I2C

I BIT INPUT
 O BIT OUTPUT
 A(I) ALTERNATE FUNCTION (INPUT)
 A(O) ALTERNATE FUNCTION (OUTPUT)
 A(A) ALTERNATE FUNCTION (ANALOG)
 A(C) ALTERNATE FUNCTION (COUNTER)
 INT INTERRUPT/WAKEUP

TLC5917 BIT PATTERNS

| | PIN | SEGMENT | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
|-----------------|------|---------|----|----|----|----|----|----|----|----|----|----|---|
| | OUT0 | 5 | CA | 1 | | 1 | 1 | | 1 | | 1 | 1 | 1 |
| | OUT1 | 6 | CB | 1 | 1 | 1 | 1 | 1 | | | 1 | 1 | 1 |
| | OUT2 | 7 | CC | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | OUT3 | 8 | CP | | | | | | | | | | |
| | OUT4 | 9 | CE | 1 | | 1 | | | | 1 | | 1 | |
| | OUT5 | 10 | CD | 1 | | 1 | 1 | | 1 | 1 | | 1 | |
| | OUT6 | 11 | CG | | | 1 | 1 | 1 | 1 | 1 | | 1 | 1 |
| OUT7 | 12 | CF | 1 | | | | 1 | 1 | 1 | | 1 | 1 | |
| TLC5917 PATTERN | | | B7 | 06 | 73 | 67 | C6 | E5 | F4 | 07 | F7 | C7 | |

LED DISPLAY ON BACK SIDE

| | PIN | SEGMENT | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
|-----------------|------|---------|----|----|----|----|----|----|----|----|----|----|---|
| | OUT0 | 5 | CF | 1 | | | 1 | 1 | 1 | | 1 | 1 | |
| | OUT1 | 6 | CG | | | 1 | 1 | 1 | 1 | 1 | | 1 | 1 |
| | OUT2 | 7 | CD | 1 | | 1 | 1 | | 1 | 1 | | 1 | |
| | OUT3 | 8 | CE | 1 | | 1 | | | | 1 | | 1 | |
| | OUT4 | 9 | CP | | | | | | | | | | |
| | OUT5 | 10 | CC | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | OUT6 | 11 | CB | 1 | 1 | 1 | 1 | 1 | | | 1 | 1 | 1 |
| OUT7 | 12 | CA | 1 | | 1 | 1 | | 1 | | 1 | 1 | 1 | |
| TLC5917 PATTERN | | | ED | 60 | CE | E6 | 63 | A7 | 2F | E0 | EF | E3 | |

LED DISPLAY INVERTED

| | PIN | SEGMENT | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
|-----------------|------|---------|----|----|----|----|----|----|----|----|----|----|---|
| | OUT0 | 5 | CA | 1 | | 1 | 1 | | 1 | 1 | | 1 | |
| | OUT1 | 6 | CB | 1 | | 1 | | | | 1 | | 1 | |
| | OUT2 | 7 | CC | 1 | | | | 1 | 1 | 1 | | 1 | |
| | OUT3 | 8 | CP | | | | | | | | | 1 | |
| | OUT4 | 9 | CE | 1 | 1 | 1 | 1 | 1 | | | 1 | 1 | 1 |
| | OUT5 | 10 | CD | 1 | | 1 | 1 | | 1 | | 1 | 1 | 1 |
| | OUT6 | 11 | CG | | | 1 | 1 | 1 | 1 | 1 | | 1 | 1 |
| OUT7 | 12 | CF | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| TLC5917 PATTERN | | | B7 | 90 | 73 | F1 | B4 | E5 | C7 | B0 | F7 | FC | |

zNEO ENABLES TO TLC5917

| | | PORT | |
|-----|-----------------|------|--|
| OE1 | THOUSANDS DIGIT | PH0 | |
| LE1 | | PH1 | |
| OE2 | HUNDREDS DIGIT | PB4 | |
| LE2 | | PB5 | |
| OE3 | TENS DIGIT | PB6 | |
| LE3 | | PB7 | |
| OE4 | UNITS DIGIT | PH2 | |
| LE4 | | PH3 | |
| OE5 | STATUS LEADS | PC6 | |
| LE5 | | PC7 | |

zNEO ANALOG CHANNELS

| CHANNEL | PORT | COEFFICIENTS |
|--|------|--------------|
| CONFIGURATION VOLTAGE (RESISTOR DIVIDER) | PB0 | |
| BATTERY VOLTAGE MONITOR (RESISTOR DIVIDER) | PB1 | |
| TEMPERATURE MONITOR (RESISTOR DIVIDER) | PB2 | |
| NOT USED | PB3 | |
| NOT USED | PB4 | |
| NOT USED | PB5 | |
| NOT USED | PB6 | |
| NOT USED | PB7 | |

Drawn **KC0JFQ** Date 2020-10-10
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COUNTER CONFIGURATION

| PULSE/REV | PULSE RATE (Hz) | | | | INTEG. PER. MULT. | | |
|--|---------------------------------------|---------|---------|---------|-------------------|-------|-------|
| | 500RPM | 1000RPM | 5000RPM | 6000RPM | 1000mS | 250mS | 100mS |
| 1 | 8.33 | 16.66 | 83.33 | 100 | 60.0 | 240.0 | 600. |
| 2 | 16.66 | 33.33 | 166.6 | 200 | 30.0 | 120.0 | 300. |
| 3 | 25.00 | 50.00 | 249.9 | 300 | 20.0 | 80.0 | 200. |
| 4 | 33.33 | 66.66 | 333.3 | 400 | 15.0 | 60.0 | 150. |
| 5 | 41.66 | 83.33 | 416.7 | 500 | 12.5 | 50.0 | 125. |
| 6 | 50.00 | 100.0 | 500.0 | 600 | 10.0 | 40.0 | 100. |
| 7 | 58.33 | 116.6 | 583.3 | 700 | 8.571 | 34.28 | 85.71 |
| 8 | 66.66 | 133.3 | 666.7 | 800 | 7.5 | 30.0 | 75. |
| 9 | 75.00 | 150.0 | 750.0 | 900 | 6.666 | 26.66 | 66.66 |
| 10 | 83.33 | 166.6 | 833.3 | 1000 | 6.0 | 24.0 | 60. |
| 11 | 91.66 | 183.3 | 916.6 | 1100 | 5.455 | 21.80 | 54.55 |
| 12 | 100.0 | 200.0 | 1000. | 1200 | 5.0 | 20.0 | 50. |
| LINE CALIBRATION 60 HZ 3600 PPM | RAW COUNT RATE FROM INTERRUPT ROUTINE | | | | | | |
| | CAL MODE: 10 Sec Int Per 600.00 | | | | 60.00 | 15.00 | 6.00 |

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