

## LCD Contrast Circuitry Revision for Chickadee

Effective with Chickadee SBC serial number 0028199723, the LCD contrast circuitry has been revised. No hardware changes by the user are required; the same display modules may be used. The only change required in software is the replacement of Timer 0 constants with new constants. The old constants, shown below, may be commented out of the CSFCLCD.C source file:

```
#if 0 // rev 7/20/96 (old constants)
static const UWORD contrast[24][2] = {
    { 12, 20 },
    { 13, 20 },
    { 14, 20 },
    { 15, 20 },
    { 16, 20 },
    { 17, 20 },
    { 18, 20 },
    { 19, 20 },

    { 20, 20 },
    { 20, 19 },
    { 20, 18 },
    { 20, 17 },
    { 20, 16 },
    { 20, 15 },
    { 20, 14 },
    { 20, 13 },
    { 20, 12 },
    { 20, 11 },
    { 20, 10 },
    { 20, 9 },
    { 20, 8 },
    { 20, 7 },
    { 20, 6 },
    { 20, 5 }
};
#endif
```

These new constants should be placed into the CSFCLCD.C source file:

```
// these contrast constants chosen to give fixed interval of 54925 when added
// formulas: cnta = ((Vee - 5) / -10) * 54925, cntb = 54925 - cnta
// where Vee is the LCD contrast voltage in Volts
static const UWORD contrast[51][2] = {
    { 15928, 38997 }, // 2.10 V
    { 16697, 38228 }, // 1.96 V
    { 17466, 37459 }, // 1.82 V
    { 18235, 36690 }, // 1.68 V
    { 19004, 35921 }, // 1.54 V
    { 19773, 35152 }, // 1.40 V
    { 20542, 34383 }, // 1.26 V
    { 21311, 33614 }, // 1.12 V
```

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```
{ 22080, 32845 }, // 0.98 V
{ 22849, 32076 }, // 0.84 V
{ 23618, 31307 }, // 0.70 V
{ 24387, 30538 }, // 0.56 V
{ 25156, 29769 }, // 0.42 V
{ 25925, 29000 }, // 0.28 V
{ 26694, 28231 }, // 0.14 V

{ 27463, 27462 }, // 0 V
{ 28231, 26694 }, // -0.14 V
{ 29000, 25925 }, // -0.28 V
{ 29769, 25156 }, // -0.42 V
{ 30538, 24387 }, // -0.56 V
{ 31307, 23618 }, // -0.70 V
{ 32076, 22849 }, // -0.84 V
{ 32845, 22080 }, // -0.98 V
{ 33614, 21311 }, // -1.12 V
{ 34383, 20542 }, // -1.26 V
{ 35152, 19773 }, // -1.40 V
{ 35921, 19004 }, // -1.54 V
{ 36690, 18235 }, // -1.68 V
{ 37459, 17466 }, // -1.82 V
{ 38228, 16697 }, // -1.96 V
{ 38997, 15928 }, // -2.10 V
{ 39766, 15159 }, // -2.24 V
{ 40535, 14390 }, // -2.38 V
{ 41304, 13621 }, // -2.52 V
{ 42073, 12852 }, // -2.66 V
{ 42842, 12083 }, // -2.80 V
{ 43610, 11315 }, // -2.94 V
{ 44379, 10546 }, // -3.08 V
{ 45148, 9777 }, // -3.22 V
{ 45917, 9008 }, // -3.36 V
{ 46686, 8239 }, // -3.50 V
{ 47455, 7470 }, // -3.64 V
{ 48224, 6701 }, // -3.78 V
{ 48993, 5932 }, // -3.92 V
{ 49762, 5163 }, // -4.06 V
{ 50531, 4394 }, // -4.20 V
{ 51300, 3625 }, // -4.34 V
{ 52069, 2856 }, // -4.48 V
{ 52838, 2087 }, // -4.62 V
{ 53607, 1318 }, // -4.76 V
{ 54376, 549 } // -4.90 V
};
```

## LCD Contrast Circuitry Revision for Chickadee

/\*\*\*\*\*\*  
LCDinit(): turns on LCD and initializes it to the default mode

arguments: the LCD type  
returns: nothing  
resources used: LCD, 16C452 parallel port, timer 0  
comments:  
verified: 7/20/96

\*\*\*\*\*  
void LCDinit (UBYTE type) {

LCDtype = type;  
LCDmode = LCD\_DISPLAY\_ON | LCD\_CURSOR\_ON; /\* default mode \*/  
/\* Wait at least 15 ms because the CPU may have gotten here before then,  
which would not give the LCD enough time to power up. Optrex manual  
says wait >= 15 ms after power-up for 4-bit interface.

\*/

CHKdelay (DLY (1500000));  
LCDwrite (0x28, COMMAND, 0); /\* 4 bit \*/  
CHKdelay (DLY (4100000)); /\* delay 4.1 ms \*/  
LCDwrite (0x28, COMMAND, 0);  
CHKdelay (DLY (4100000)); /\* delay 4.1 ms \*/  
LCDwrite (0x28, COMMAND, 0);  
CHKdelay (DLY (4100000)); /\* delay 4.1 ms \*/  
LCDwrite (0x0f, COMMAND, 0); /\* on, cursor on, blink \*/  
LCDwrite (0x06, COMMAND, 0); /\* shift cursor, increment \*/  
LCDwrite (0x01, COMMAND, 0); /\* clear display \*/  
/\* if 4x40, do 2nd controller \*/

if (LCDtype == LCD40X4) {  
LCDwrite (0x28, COMMAND, 1); /\* 4 bit \*/  
CHKdelay (DLY (4100000)); /\* delay 4.1 ms \*/  
LCDwrite (0x28, COMMAND, 1);  
CHKdelay (DLY (4100000)); /\* delay 4.1 ms \*/  
LCDwrite (0x28, COMMAND, 1);  
CHKdelay (DLY (4100000)); /\* delay 4.1 ms \*/  
LCDwrite (0x0f, COMMAND, 1); /\* on, cursor on, blink \*/  
LCDwrite (0x06, COMMAND, 1); /\* shift cursor, increment \*/  
LCDwrite (0x01, COMMAND, 1); /\* clear display \*/  
}

LCDsetcontrast (8); /\* set contrast to default (about 0 V) \*/

**#if 0 // took this out for DOS usage (BIOS programs timer 0)**

/\* Timer 0 control register  
\* Enable = (1) Enabled  
\* Inhibit = (1) Enable Change Allowed  
\* Interrupt = (0) No Interrupt  
\* Retrigger = (0) Disabled  
\* Prescaler = (0) Disabled  
\* External Clock = (0) Internal Clock

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```
* Alternate Compare Register = (1) Enabled
* Continuous Mode = (1) Enabled
*/
outport(TOCON , 0xC003);
#endif

/* initialize screen position */
LCDgotoxy (1, 1);
}
```

Alternatively, the CSFCLCD.C rev. 7/20/96 source file may be replaced by the CSFCLCD.C rev. 3/16/97 source file. If this is done, either '#if 0' out the Timer 0 initialization in LCDinit() if using BIOS, or '#if 1' it in if not using BIOS. Then run the makefile to regenerate your application. Note that older Chickadees still require the old constants.

The reason for this revision is to make the Chickadee compatible with BIOS software which requires the use of Timer 0 as the BIOS timer. Typically, BIOS uses a 18.206507365 Hz timer tick. Since standard BIOS uses the same interrupt vector as Timer 0, it is natural to use Timer 0 for this purpose. In order to also use Timer 0 for LCD contrast, it is necessary to program it with constants that generate the same period but produce a variable duty cycle (ratio of on-time to off-time during a period). With this technique, it is possible to use Timer 0 for two purposes at the same time: BIOS timer interrupt, and LCD contrast.

The actual hardware change implemented on the Chickadee was the change of C19 from 0.01uF to 47uF. This allows a much longer period from Timer 0.

If an old revision Chickadee is used with new constants, the LCD will flicker. This will not harm the LCD but it will be annoying to the user. If a new revision Chickadee is used with old constants, the LCD will appear normal, but contrast adjustments will take as much as a minute to take effect.