CONVAQUIP IND., INC.

5500VB-W
Scale Kit

Operating Manual

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SECTION I

5500VB-W
SYSTEM DESCRIPTION and SPECIFICATIONS

The low power microprocessor circuitry allows the 5500VB-W Scale Kit to derive it's power from the system's DC battery supply. This eliminates the need for an external battery charger or the danger of an A.C. power supply. **SYSTEM DESCRIPTION -** The 5500VB-W Scale Kit is specifically designed as a precision scale system retrofit for the Gendron line of bariatric beds. The 5500VB-W Scale Kit Scale System employs the latest in microprocessor and load cell technology to provide accurate and repeatable weight data. Four (4) identically matched transducers are strategically placed to ensure an accurate representation of the patient's weight regardless of weight distribution.

The Patient's weight is displayed on a 16 character dot matrix liquid crystal display with L.E.D. backlighting. Patient weight may be viewed in both POUNDS and KILOGRAMS with the push of a button with a displayed resolution of 0.1 #/Kg (100 grams). The 5500VB-W Scale Kit also features a WEIGHT CHANGE mode which makes it convenient to monitor the patient's weight relative to ZERO in order to observe variations in weight. A FREEZE feature is provided to give the added convenience of being able to adjust the patient's comfort by adding or removing a pillow, blanket, or adjusting the chair without effecting the patient's displayed weight.

1.0

The patient's weight is displayed on a 16 character dot matrix L.C.D. With the push of a button, weight data may be viewed in either POUNDS or KILOGRAMS with a displayed resolution of 0.1 Lb or .1Kg.

1.1   **INTENDED USE** The 5500VB-W Scale Kit is designed for use as a patient weighing system integrated within a bed frame.

1.2   **SPECIFICATIONS**

1.2.01   **Maximum Weight Capacity -** The 5500VB-W Scale Kit has a maximum weight capacity of 1000Lbs. / 454Kgs. DON NOT exceed the rated weight capacity of the bed.

1.2.02   **Display Type** - The display is a large 16 Character Dot Matrix L.C.D. with green L.E.D. back lighting. Highly visible in all light conditions,

1.2.03   **Display Resolution** – The 5500VB-W Scale Kit will display weight data in both POUNDS and KILOGRAMS with a resolution of 0.1 Lb. or 0.1 Kg.

1.2.04   **Accuracy** - The accuracy of the displayed weight is 0.2% +/- 1 digit of the displayed resolution for calibrated range (Refer to the Calibration Certificate supplied with the scale for the calibrated range).

1.2.05   **Zero** - One button Auto-Zero

1.2.06   **Auto Power Down (APD)** – The system will automatically power down in 60 seconds to conserve battery life.

1.2.07   **Averaging** – An Automatic Digital Filter samples the weight data to filter motion.

1.2.08   **Power Supply** - 24v DC.

1.2.09   **Warranty 1 YEAR LIMITED WARRANTY** - Each **S** scale system is manufactured with high quality components. SR Instruments, Inc. warrants that all new equipment will be free from defects in material or workmanship, under normal use and service, for a period of one year from the date of purchase by the original purchaser. Normal wear and tear, injury by natural forces, user neglect and purposeful destruction are not covered by this warranty. Warranty service must be performed by the factory or an authorized repair station. Service provided on equipment returned to the factory or authorized repair station includes labor to replace defective parts. Goods returned must be shipped with transportation and/or broker charges prepaid. SR Instruments obligation is limited to replacement of parts which have been so returned and are disclosed to SR Instruments satisfaction to be defective. The provisions of this warranty clause are in lieu of all other warranties, expressed or implied, and of all other obligations or liabilities on SR Instruments part and it neither assumes or authorizes any other person to assume for SR Instruments any other liabilities in connection with the sale of said articles. In no event shall SR Instruments be liable for any subsequent or special damages. Any misuse, improper installation or tampering, shall void this warranty.

1.2.10   **Calibration** - Calibration is traceable to NIST Standards.

1.2.11   **Operating Conditions** – Care has been taken in the design of this product to provide accurate and reliable information under normal operating conditions. When proper care is exercised, your scale will provide many years of reliable service. Normal conditions for this product would be : **Temperature Range: 20^oC to 30^oC (68° to 85^of) Humidity Range: 0%-95% (non-condensing).** Avoid exposure to high pressure water or steam.

1.2.12   **Transport and Storage** – To maintain proper operation of this instrumentation transport and storage conditions should not vary outside the following conditions: **Humidity:** 0% to 99% **(non-condensing).**, **Ambient Temp:**-20^0C to +50^0C

1.2.13   **Patient Applied Part Classification** – TYPE B

SECTION I

5500VB-W Scale Kit Theory of Operation

1.3   The 5500VB-W Scale Kit patient weighing system is a digital weigh scale. 4 strain-gauge force cells convert the force of a patient's weight into an analog signal. This signal is amplified by a chopper-stabilized operational amplifier and converted to a digital signal by a quad slope analog to digital converter. The digital signal is transferred to a micro-controller where it is filtered, converted to appropriate units and displayed on a dot-matrix liquid crystal display.

The transducer of the 5500VB-W Scale Kit patient weighing system contains 4 strain gauge based force cells (Analog board J1..4). Each cell contains four strain gauges mounted in a full Whetstone-bridge configuration (Figure 1.) These bridges convert the physical bending of the force cell (Figure 2.), due to the patient's mass on the system, into minute changes in electrical resistance. These changes in resistance produce a voltage difference across the Whetstone Bridge, which is amplified by the chopper-stabilized operational amplifier (Analog board U1). The amplifier is configured to current sum the output of each cell, with potentiometers serving to adjust the sensitivity (voltage out per unit of weight applied) of each bridge. The offset potentiometer (Analog board R3) produces a small current, which nulls the output of the amplifier for an unloaded system.
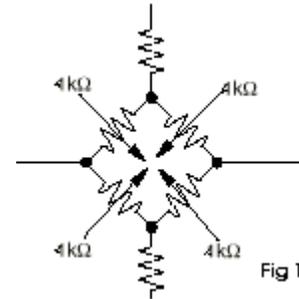
Fig 1

The output of the operational amplifier is digitized by the quad slope analog to digital converter (Analog board U5). The converter integrates the analog signal onto the integrating capacitor (Analog board C9) over a short interval. The integrating capacitor is then discharged at a rate proportional to the reference voltage applied to the converter The residual voltage on the integrating capacitor (Analog board C9) is then multiplied by a factor of eight and again discharged at a rate proportional to the reference voltage (Figure 3.). The residual voltage from this discharge is again multiplied by eight and again discharged. The time taken to discharge the capacitor is proportional to the voltage from the operational amplifier, which is proportional to the weight on the force cells. The time is stored as a binary number in the analog to digital converter and is transferred to the micro-controller when the conversion is complete.
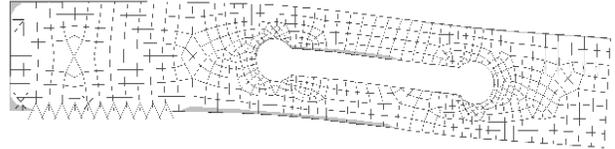
Figure 2. Force Cell bending with applied weight (displacement exaggerated for clarity)

The micro-controller averages and filters the digital output of the analog to digital converter, subtracts the value saved during the system tare operation and scales the filtered output to the appropriate units (Kg or Lb.) then displays the result on the dot-matrix liquid crystal display. The micro-controller performs a rolling average of two seconds of data for continuous weigh and, for AutoHold,

Figure 3. Analog to digital converter timing diagram (from Maxim MAX132 data sheet).

the micro-controller averages two seconds of data, minimum, before locking in on the reading. If the data variance is greater than 0.1% in the AutoHold mode, the micro-controller will reset the filter and start a new averaging period.
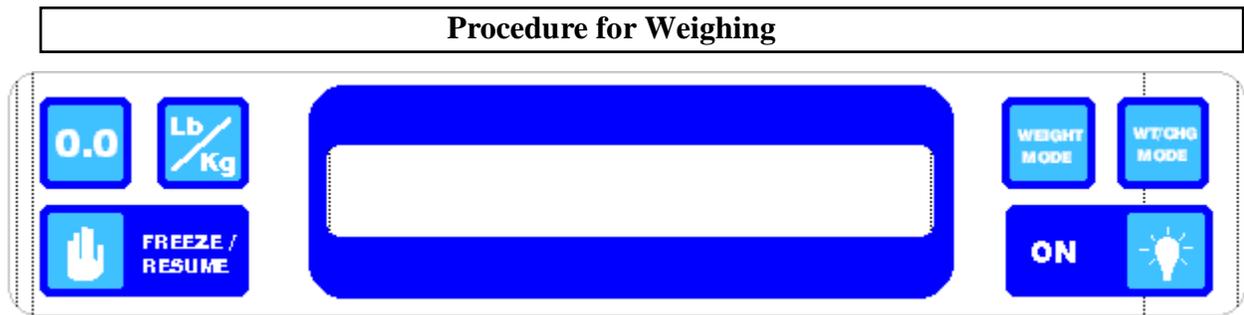
The micro-controller can be placed in a calibration mode where the system can be re-calibrated. In the calibration mode, the result of the weigh operation is scaled to match the value entered by the decimal keypad. This new calibration factor is then stored in the non-volatile memory.
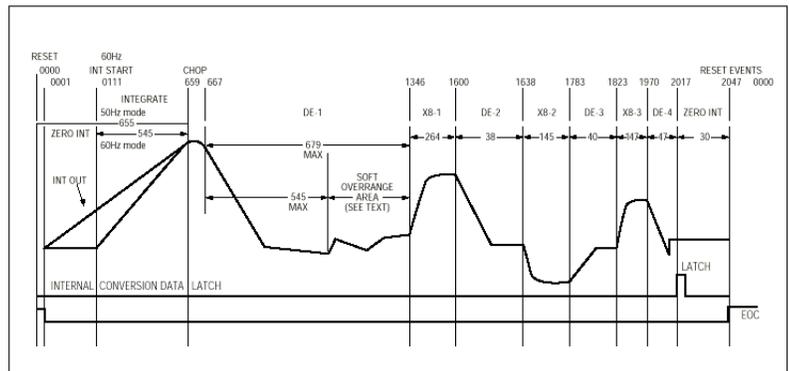
SECTION II

2.0   BUTTON FUNCTIONS and BASIC OPERATION

Procedure for Weighing

2.0.2   **ZERO –**
With all linens in place, press the **"ZERO"** button. The displayed message will read **" PLEASE WAIT - HANDS OFF ".** Be sure nothing comes in contact with the of the weight sensitive portion of the integrated scale system while zeroing. In a few seconds the display will indicate **"WEIGHT = 0.0 LB "**.

2.0.3   **WEIGH -** If the display shuts off before you are able to view the weight data, simply press the **"WEIGH"** button to wake the display and view the patient's weight. The display will **indicate "WEIGHT = XXX.X LB"** (or KG).

2.0.4   **DELTA** - The WEIGHT CHANGE mode is used to monitor the patient's weight relative to ZERO.

         1.   Press the **" WT CHG "** button. The display will read **" WT CHG=(patient weight)"**.

Any variation in weight will now be viewed as a "+" or "-" figure relative to ZERO. Pressing the **"WEIGHT"** button will switch back to the WEIGHT MODE allowing you to view the patient's total weight again.

NOTE: When you reset the **SYSTEM ZERO** in the **WEIGH** mode, **DELTA ZERO** will also be reset.

2.0.5   **FREEZE / RESUME** - This feature will allow you to make adjustments to the bed without effecting the displayed patient weight.

         1.   Press the **"FREEZE"** button. The display will read **" FREEZE = (patient weight) "**.
         2.   Make all necessary adjustments to bed or patient.
         3.   When done, press the **"RESUME"** button to resume normal
                 weighing.

While in the FREEZE mode, the **"WEIGHT"** and **"WT/CHG"**   keys will allow you to manually adjust the displayed weight reading in the event of a known error. Simply press the **"WEIGHT"** and **"WT/CHG"** keys to make the proper corrections.

IMPORTANT: If the correct patient weight is not known, the patient must be removed from the bed and the scale must be re-zeroed.

NOTE: If FREEZE Mode is left unattended for more than 3 minutes, display will read **" LEFT IN FREEZE - REFER TO MANUAL"**. You must press the **"RESUME"** button to exit this mode.

2.0.6   **MODE -**Weight data may be viewed in either POUNDS or KILOGRAMS. Pressing the button allows you to switch between display modes quickly and easily.
Both modes will display patient weight with 0.1 units of resolution. (0.1 Lb. or   0.1 Kg.)

2.0.7   **IMPORTANT –** Be sure not to touch the patient or the bed during the zeroing and weighing process. By design, these components are weight sensitive and any interference will affect the accuracy of the weight data.

SECTION III

3.0   **CALIBRATION**

3.1   **Periodic Calibration Check - IMPORTANT :**   The following calibration procedure should only be performed by qualified service personnel. The 5500VB-W Scale Kit load cell, itself, has no user serviceable components and should not be tampered with for any reason.   Re-calibration is generally not required, but should be verified periodically to ensure accuracy. Our recommendation for calibration check is at least once every 12 months or as your maintenance policy requires.

3.2   **ESD –** The integrated circuits and semiconductors on the printed circuit boards may be damaged by electrostatic discharge (ESD). Be sure to use proper handling precautions at all times.

3.3   **CALIBRATION PROCEDURE** - NOTE: Make sure that nothing is in contact with the scale system during this procedure. Be sure to remove your hands from the system when noting the displayed calibration results.

1. **Press** and the **"FREEZE"** button.
2. When the display indicates **"FREEZE = (weight)"**, press and hold the **"LB/KG"** button. The display will read **"CAL"** as the right hand digit counts down to enter the **CAL MODE.**
3. When in the **CAL MODE**, press the **"ZERO"** button to zero the display.
4. Place a known calibrated weight on to the weighing surface and compare it to the displayed reading.
5. Use the **"WEIGHT"** button to make **"+"** corrections and the **"DELTA WEIGHT"** button to make **"-"** corrections to the displayed weight. The displayed value should be within 0.2% of the calibrated weight plus or minus 1 digit of reading.
6. Remove weight and re-zero. Repeat steps 5 and 6 until results are satisfactory.
7. When adjustments are completed:
a). Press the **"ON"** button to **ABORT** your changes and exit the CAL mode **(or)**
b). Press the **"FREEZE"** button to **SAVE** all changes and exit the CAL mode.

**3.4**   **CALIBRATION TOLERANCE TABLE**

LOW LIMIT	APPLIED LOAD	HIGH LIMIT
99.9	100.0	100.1
199.8	200.0	200.2
299.7	300.0	300.3
399.6	400.0	400.4
499.5	500.0	500.5
599.4	600.0	600.6
699.3	700.0	700.7
799.2	800.0	800.8
899.1	900.0	900.9
999.0	1000.0	1001.0

3.5   **MAINTENANCE, CARE and CLEANING** - The transducer housing for the 5500VB-W Scale Kit Scale System is made of powder-coated steel tube. You need only exercise caution when cleaning the display window of the electronics as this is made of clear polyester . We recommend mild soap and water for general cleaning and disinfecting.

3.5.01   **WARNING: DO NOT** use pressurized water or steam. The scale system contains microprocessor circuitry and strain gage sensors that may be adversely affected by exposure to such an environment.

3.5.02   **STORAGE –** If storing this equipment for periods longer than 3 months remove the batteries. Observe storage conditions in section 1.2.12.

3.5.03   **BATTERY REPLACEMENT –** When battery replacement is needed the display will indicate "CHANGE BATTERIES". Remove ALL SIX BATTERIES and replace with new. Upon restoring the power, the display will indicate "POWER INTERRUPTED / PRESS FREEZE TO RESUME". Press "FREEZE" to resume normal weighing.

3.5.04   **REPLACE BATTERIES WITH PATIENT IN BED –**
               BEFORE YOU BEGIN, RECORD THE CURRENT PATIENT WEIGHT! You may change the batteries while the patient is in the bed without any loss of data. Follow directions in section 3.5.04. If , after the power is restored, you find the patient weight to be incorrect take an inventory of the bed to make sure nothing has changed (items added or subtracted from the weighing surface..). If the patient weight is still incorrect you may follow the steps in section 2.0.5 to make manual correction to the displayed weight. If you do not know the correct patient weight you must remove the patient from the bed, re-zero the bed scale, then place the patient back onto the bed.

SECTION III
SCHEMATIC DIAGRAM

3.6
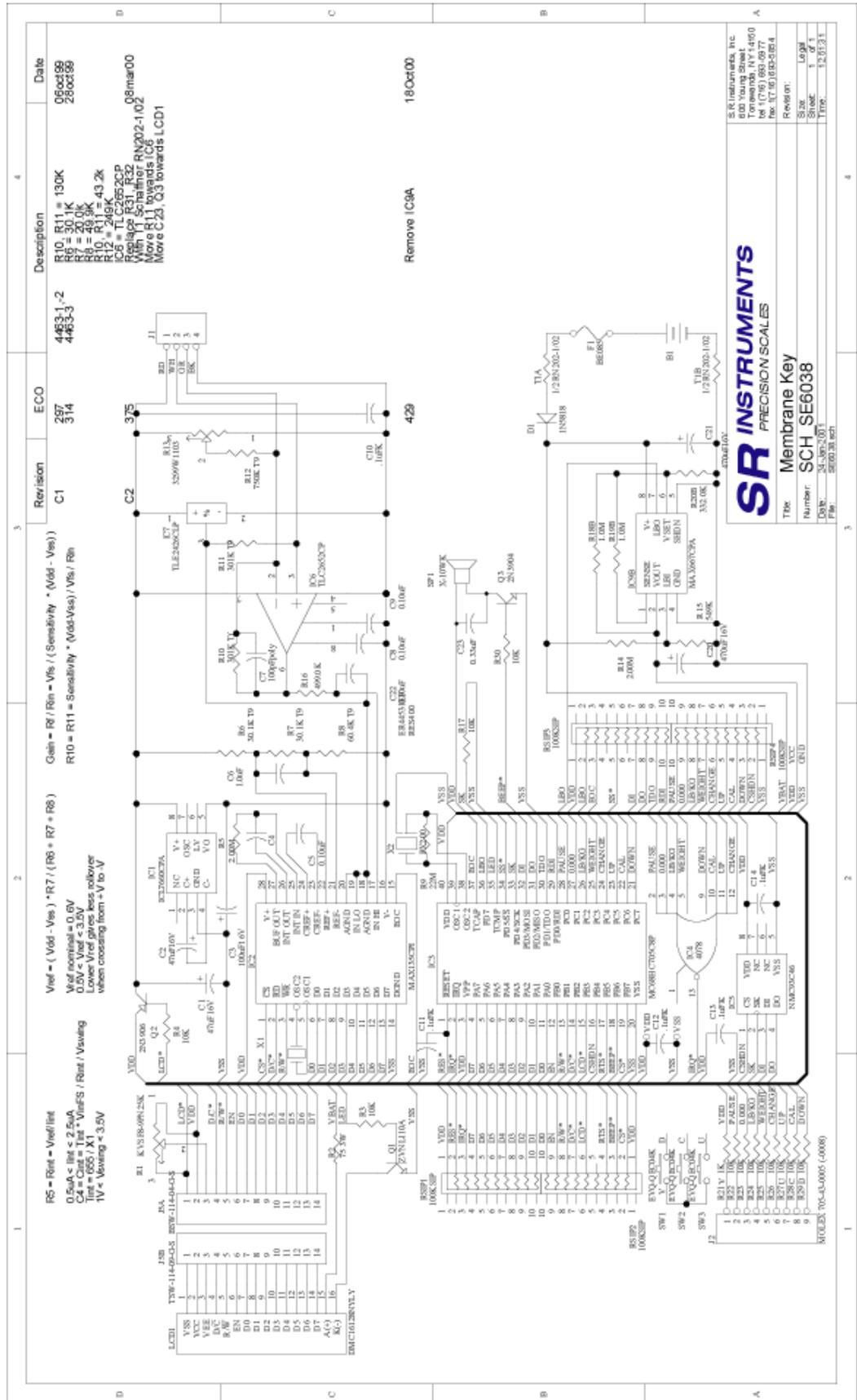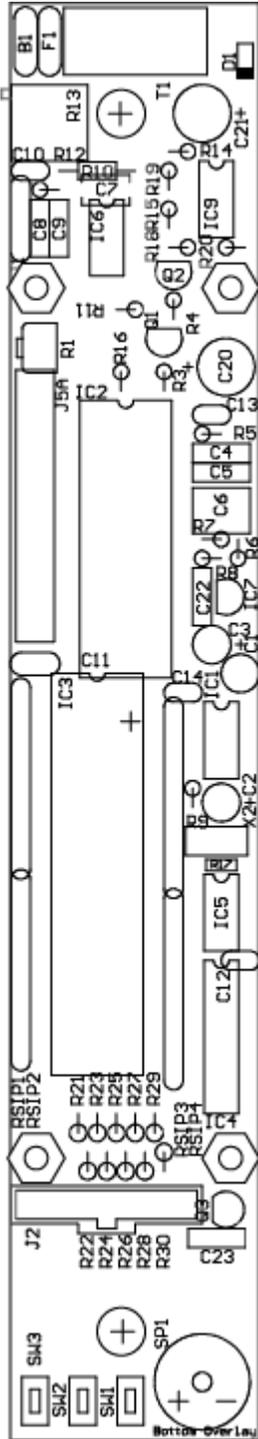
SECTION III
PARTS LIST
5500VB-W

<u>**3.7**</u>

Part	Qty	Ref	Ref	Ref
EPCB1857C2PC BOARD 1857 REV C2	1			
EC347RM50.0047MFD P3472-ND DIGI-KEY	1	C4		
EC510RF0.1MFD #SR205C104KAA (AVX)	5	C10,11,12,13,14	C12,C13,	C14
EC747RE01647MFD #UVX1V470MPA(NICHICON)	2	C1,C2		
EC810RE016100MFD 16V CAP #UVX1C101MPA	1	C3		
EC510RM050.1MFD #R68104J63B (NISSEI)	4	C5,8,9,22	C22	
EC610RM0501MFD 168105J50G(B32529-105-63J	1	C6		
EC210AP100PF POY CAP.#09WX7747	1	C7		
EC847RE016470MFD RADIAL (UVX1C471M)	2	C20,C21		
EC533RM.33MFD #B32529-C334J	1	C23		
ED1N5817DIODE 1N5817	1	D1		
ESRUE090SWITCH, POLY (RAYCHEM) #RUE090	1	F1		
EITC7660CPIC #TC7660CPA (TELCOM))	1	IC1		
EIMAX135CPIC #MAX135CPI (MAXIM)	1	IC2		
EICD4078BEIC #CD4078BE	1	IC4		
EINM93C46NIC #93LC46B-I/P (MICROCHIP)	1	IC5		
EITSC7652CIC #TC7652CPA	1	IC6		
EITLE2426CIC #TLE2426CLP (TEXAS INSTR.)	1	IC7		
EIMAX667CPIC #MAX667CPA (MAXIM)	1	IC9B		
FCBSW11404TERMINAL STRIP #BSW-114-04-G-S	1	J5A		
ETZVNL110ATRANSISTOR,VOLTAGE REF.ZVNL110	1	Q1		
ET2N3906TRANSISTOR 2N3906 (MATOROLA)	2	Q2,Q3		
EV25KKVSF825K POT (MOUSER) #32RM403	1	R1		
ER41005QF10K 1/4 WATT 5% RESISTOR	12	R3,4,17,R22..R30	R22,R23,	R24,R2,R29
ER62004EJ2M 1/8 WATT 1% J RESISTOR	2	R5		
ER57501EJ750K 1/8 WATT 1% J RESISTOR	1	R12		
ER43011EJ30.1K 1/8 WATT 1% RESISTOR	2	R6,R7		
ER46041EJ60.4K 1/8 WATT 1% J RESISTOR	1	R8		
ER72205QF22M 1/4 WATT 5% RESISTOR	1	R9		
ER53011EJ301K 1/8 WATT 1% J RESISTOR	2	R10,R11		
ER55491ED549K 1/8 WATT 1% RESISTOR	1	R15		
ER54991EJ499K 1/8 WATT 1% J RESISTOR	1	R16		
ER61001EJ1M 1/8 WATT 1% J RESISTOR	2	R18,R19		
ER53321EJ332K 1/8 WATT 1% J RESISTOR	1	R20		
ER31005QF1K 1/4 WATT 5% RESISTOR	1	R21		
ER770101RESISTOR NETWORK 100K #770-101	4	RSIP1,2,3,4	RSIP4	
EXSE3201CRYSTAL 32.768 KHZ (EPSON)	1	X1		
EXPX200CERAMIC RESONATOR #PX200	1	X2		
EIDIP8SOCKET 8 PIN (BURNDY)	4	IC1,IC5,IC6,IC9B	IC9B	
EIDIP14SOCKET,14 PIN #DILB-14P-223T	1	IC4		
EIDIP28SOCKET 28 PIN #DILB-28P-223T	1	IC2		
EIDIP40SOCKET 40 PIN #DILB-40P-223T	1	IC3		
FCHTSW10912TERMINAL STRIP (SAMTEC)	1	J2		
EXRN202-1.5CHOKE (SCHAFFNER)	1	T1		
EM16128NY(OPTREX)DOT MATRIX DMC-16128NY	1	LCD1		
FCTSW11409TERMINAL STRIP #TSW-114-09-G-S	1	J5B		
EW1551RWIRE 22AWG RED	0.0583	LCD1-15		
EW1551BWIRE 22AWG BLACK (ALPHA)	0.0583	LCD1-16		

CONVAQUIP IND., INC.

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