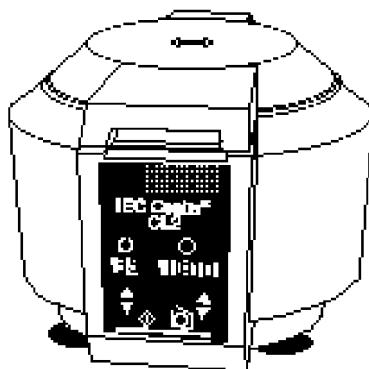


Thermo IEC

**INSTRUCTION
MANUAL
IM-426**

Revision 6



Centra-CL2

Centrifuge

Cat. No. 426 -- For 120 VAC, 50/60 Hz

Cat. No. 427 -- For 240 VAC, 50/60 Hz

Thermo IEC

300 Second Ave.

Needham Heights, MA 02494

Tel. (781) 449-8060 Toll Free: (800) 843-1113 Fax (781) 444-6743

Website: www.labcentrifuge.com email: info@iec-centrifuge.com

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IMPORTANT

This manual may not contain information on all changes that have occurred to the subject instrument since the manual issue date. It was prepared for use by IEC authorized factory-trained service or dealer personnel who are kept current through a program of service letters and bulletins and training seminars.

This manual contains *warnings* against operating procedures which could result in an accident and/or personal injury. It also contains *cautions* against procedures which could result in damage to your centrifuge or accessory equipment. Read this manual thoroughly before operating or servicing this centrifuge.

1 INTRODUCTION

The IEC Centra-CL2 is a compact benchtop centrifuge designed for multipurpose use in medical, industrial, and scientific laboratories.

There are two models:

- Cat. No. 426 for 120 V, 50/60 Hz
- Cat. No. 427 for 240 V, 50/60 Hz

The Centra-CL2 accommodates a wide variety of rotors, including fixed angle and horizontal (swinging bucket). IEC AeroCarriers™ provide aerosol containment along with autoclaveability. The CL2 can handle up to 300 ml (801 rotor), and reach maximum speeds of up to 8500 rpm (841 fixed angle rotor) and 3900 rpm (236 horizontal rotor).

Other important features of the CL2 are a cover interlock for safety, and a 'glove-friendly' membrane control panel with digital speed and time displays. An 'At Speed' timer mode allowing for accurate separations, and a continuous 'hold' mode are also featured.

2 INSTALLATION

After unpacking, place the unit on a clean, level surface. The surface must be level to ensure quiet, vibration-free operation. A rigid, stable location is important since an improperly loaded unit can vibrate or even move. Allow a space of 3 in. (7.6 cm) on each side and 4 in. (10.2 cm) in the rear of the unit for ventilation. Ensure that the suction cup feet grip the surface firmly.

Using a voltmeter, measure the line voltage to ensure it is within the limits for your model. For Cat. No. 426 the line voltage should be between 108 and 132 VAC. For Cat. No. 427 the line voltage should be between 216 and 264 VAC. Variations in line voltage or frequency will affect the unit's speed and acceleration.

Before moving, unplug the centrifuge and remove all accessories and the rotor.

Clearance Envelope

International Electrotechnical Commission standard 1010 part 2-20 limits the permitted movement of a laboratory centrifuge to 300mm in the event of a disruption. The user should therefore mark the clearance envelope boundary around the centrifuge, or laboratory management procedures should require that no person or any hazardous materials are within such a boundary while the centrifuge is operating.

3 OPERATION

3.1 Warnings and Cautions

Warnings To Avoid Electric Shock:

- Plug the power cord into a grounded outlet.
- Never remove the grounding prong from the power plug, or use any adapter which does not complete the grounding circuit.
- Always unplug the power cord before attempting to clean or service the centrifuge.

Cautions

- DO NOT exceed maximum rated speed for each rotor/accessory combination. Maximum speeds can be found in Section 4.1 Speed And Force Tables. All IEC rotors and accessories are stamped with their cat. no. for easy identification.
- Samples of specific gravity higher than 1.2 require the maximum speed to be derated.
- Ensure that loads are properly balanced around the rotor to minimize vibration. All IEC accessories are stamped with their weight for easy balancing.
- Do not block the vents, otherwise, airflow will be restricted.
- Be sure the rotor and accessories are properly installed before attempting to start a run.

3.2 Opening The Cover



Once the red light over the STOP button is steadily illuminated (no longer flashing) pressing the COVER OPEN button on the control panel will release the interlock, allowing the cover to be opened.

3.3 Rotor Installation

When the unit has power, the red light over the STOP button is illuminated. This is also an indication that the rotor is stopped and the cover can be opened. Push the COVER OPEN lever to the right and lift the cover. Lower the rotor straight onto the shaft. Screw the knurled metal locking nut (clockwise) onto the shaft to hold the rotor down (on some rotors, you must remove any sample tubes first.). Tighten the nut with your fingers; do not use a tool.

Rotors with or without a keyway can be used on the Centra-CL2 since there is no key on the shaft.

3.4 Starting And Stopping A Run



To start a run, use the ARROW buttons to set the desired run time (0 to 60 minutes) in the TIME display, and the desired rpm in the SPEED display. Press the START button. The green light under the START button will illuminate, and the time display will begin counting down. The actual speed is displayed in the SPEED display. The centrifuge will run for the set duration and decelerate to a stop. To terminate a run before time expires, press the STOP button. The red light over the STOP button illuminates when STOP is pressed or time expires, and it flashes until the rotor comes to a stop.

Note: The cover may be opened when the rotor speed is below 20 RPM.

The time and speed settings cannot be changed during a run. A new run cannot be started until the rotor has come to a complete stop.

For infinite spins (hold mode), use the arrow keys to scroll up past 30 minutes. The word 'HOLD' appears in the display. Pressing the START button will begin a run which can only be terminated by pressing the STOP button. In the hold mode, the timer counts up.

To select the timing mode, use the arrow buttons to scroll down past 0 seconds. The letters 'Spd' or 'Acc' will appear. Press the arrow buttons to toggle between the two timing modes. 'Spd' is the 'At Speed' timing mode where the timer starts counting down when rotor reaches 95% of set speed. 'Acc' is the normal timing mode where the timer begins to count down as soon as the run button is pressed.

3.5 Rotor Removal

To remove a rotor, first remove any sample tubes, shields, and other accessories from the rotor. Next, unscrew (counterclockwise) approximately one full turn the knurled locking nut. Then place both thumbs on the knurled locking nut and grip the rotor with the fingers. Push your thumbs down and at the same time pull the rotor up with your fingers. This should dislodge the rotor from the shaft. If unsuccessful, **lightly tap** the knurled metal locking nut with a rubber/plastic mallet or other similar object. The nut and the rotor can now be removed from the shaft.

3.6 Balance

A balanced load is essential with all centrifuges. An unbalanced load produces vibration and can damage the unit. A 2-gram load imbalance, at a speed of 4600 rpm, imparts force equivalent to 9.1 kg at rest (20 pounds). Therefore, always ensure that the rotor is loaded symmetrically and with a full (or paired) set of tubes. Tube adapters should also be installed symmetrically.

IEC rotors are dynamically balanced at the factory. IEC matches removable parts (trunnion rings, shields, cups and carriers) to within 1 gram and stamps the weight on each piece. Check these markings whenever you interchange parts, to ensure that opposite parts are matched. Ensure that the total weight of samples and removable parts loaded in opposing positions are equal in weight to within 1 gram. The position numbers, present on many rotors and adapters, identify opposing tube positions.

To obtain good dynamic balance, the opposite loads must not only be equal in mass, but must also have the same center of gravity. Opposing containers must be alike in shape, thickness, and distribution of glass or plastic. This is especially important for large containers.

Tubes loaded into swinging bucket rotors must likewise be symmetric around the axis of rotation. Verify this by rotating the entire rotor 180° by hand: the loads should be in the same apparent positions (not in the mirror image). In addition, the loads within each bucket must also be symmetric around the bucket's pivot axis. Verify this by ensuring that each bucket is loaded so that it does not tilt from the vertical when the rotor is at rest. Maintaining balance within each bucket ensures that the bucket and the tubes swing out to horizontal when the rotor reaches operating speed, applying centrifugal force toward the bottom of the tubes. Failure to achieve full swing-out causes vibration and premature wear.

Samples of different specific gravities can be processed in the same run, provided that the samples of a given type are balanced around the rotor as though they were the only ones in the rotor.

For example, load tubes in the following manner:

1. Load four tubes.
Positions 3, 6, 10, 13
or 2,5,9,12
or 1,4,8,11
2. Load six tubes.
Positions 6,7,3,13,14,10
or 5,7,2,12,14,9
or 1,7,4,8,14,11
3. Load an odd number of tubes.
Not recommended (unless a dummy tube is used for balance.)

4 APPLICATIONS

This section describes the use of specific rotors and accessories. More detailed information is often shipped with the rotor or accessory itself. This section contains four reference tables:

- 4.1 Speed And Force Table
- 4.2 Derating Table for Dense Samples
- 4.3 Chemical Resistance Table
- 4.4 Decontamination Table
- 4.5 Nomograph

Relative centrifugal force (RCF or G-force) at a given speed varies with the rotor, and with the length of the sample tube, because the distance of the tube's tip from the center of rotation is different. The Speed and Force Table indicates the maximum speed and RCF the Centra-CL2 can achieve with various rotor/accessory combinations.

The Derating Table specifies reductions in rpm when spinning samples with specific gravity above 1.2.

Misapplication of any tube can cause tube rupture. To avoid this, compare the G forces specified in the Speed and Force Table with the ratings for the tubes you are using. If the tubes are not rated for the force the centrifuge will apply, reduce the speed to the G force limit of your tubes.

Your IEC centrifuge is made of materials designed to resist attack from most laboratory chemicals. The interior of the rotor chamber is Painted steel. Rotors and accessories placed in the chamber are made of a variety of materials, including aluminum and polypropylene. The Chemical Resistance Table shows the suitability of each material with different classes of reagents.

The Decontamination Table lists compatible methods of decontamination which may be used on the IEC Centra-CL2 centrifuge.

The Nomograph provides an easy method of converting RPM to RCF (or xg).

Section 5.1 describes how to clean and remove corrosion from the chamber, rotors, and accessories. Follow these instructions, and clean spills promptly, to minimize the effects of corrosive chemicals, before any resulting chemical attack requires more expensive repair. Replace metal locking nut, rotors, or accessories if they become cracked, deformed, or gouged.

4.1 Speed And Force Tables

Rotor 215 4-Place Swinging Bucket Rotor								
Tube No. x Vol. (ml)	Tube	Maximum RPM / RCF		Radius	Tr Ring	Shield or Carrier	Adapter	Cushion
8x50ml	Falcon/Corning conical plastic	3100	1510	14.1	4x326	8x320	-	8x315
8x50ml	Corning 8300-50 conical glass	3100	1510	14.1	4x326	8x320	-	571
8x15ml	Falcon/Corning conical plastic	3100	1510	14.1	4x326	8x320	8x1106	570
4x50ml	Falcon/Corning conical plastic	3350	1750	13.9	4x325	4x320	-	4x315
4x50ml	Corning 8300-50 conical glass	3350	1750	13.9	4x325	4x320	-	571
4x15ml	Falcon/Corning conical plastic	3350	1750	13.9	4x325	4x320	4x1106	570
4x50ml sealed	Falcon/Corning conical plastic	3175	1750	15.4	4x350	4x323		315
4x15ml sealed	Falcon/Corning conical plastic	3350	1750	13.9	4x325	4x320	4x1106	4x668
4x15ml sealed	Falcon/Corning	3175	1710	15.2	4x350	4x7323	1106	4x571
4x10-15ml sealed	Vacutainer 16x100-125mm	3175	1710	15.2	4x350	4x7323	1106	4x668
4x7ml sealed	Vacutainer 13x100mm	3175	1710	15.2	4x350	4x7323	4x1105	4x571
12x10ml	16x100mm	3450	1725	12.9	4x366	4x1013	-	570
12x7ml	16x75mm	3450	1725	12.9	4x366	4x1013	-	570
16x7ml	13x100mm	3450	1700	12.8	4x366	4x1018	-	667
16x5ml	13x75mm	3450	1700	12.8	4x366	4x1018	-	667
20x5ml	12x75mm	4000	1975	11.1	4x366	4x369	-	567
20x3ml	10x75mm	4000	1975	11.1	4x366	4x369	-	567

Rotor 221 6-place Fixed Trunnion Swinging Bucket								
Tube No. x Vol. (ml)	Tube	Maximum RPM / RCF		Radius	Tr Ring	Shield or Carrier	Adapter	Cushion
6x15ml	Falcon/Corning	3100	1650	15.4	fixed	6x303	-	668
6x12.5ml	Kimble 45170-125	3100	1650	15.4	fixed	6x303	-	668
6x12ml	IEC 1629, 1649	3100	1570	14.6	fixed	6x303	-	570
6x10ml	Corning 8080-10	3500	1890	13.8	fixed	6x356	-	668
6x10ml	IEC 2046, 2067	3500	1780	13.0	fixed	6x356	-	570

Rotor 236 4-place Aerocarrier Horizontal Swing-Out Rotor								
Tube No. x Vol. (ml)	Tube	Maximum RPM / RCF		Radius	Tr Ring	Aero carrier	Adapter	Cushion
4x50ml	Falcon/Corning	3400	1950	15.0	fixed	4x2091S	-	-
8x15ml	Falcon/Corning	3400	2000	15.5	fixed	4x2092S	-	-
8x10ml	Kova/UriSystem	3400	2000	15.5	fixed	4x2092S	-	-
16x10ml	Vacutainer 16x100mm	3700	2200	14.3	fixed	4x2093S	-	-
16x7ml	Vacutainer 13x100mm	3700	2200	14.3	fixed	4x2093s	-	-
16x7ml	Hemogard Vacutainer 13x100mm	3700	2200	14.3	fixed	4x2093s	-	-
28x7ml	Vacutainer 16x75mm	3900	2150	12.7	fixed	4x2094S	-	-
28x5ml	Vacutainer 13x75mm	3900	2150	12.7	fixed	4x2094s	-	-
28x5ml	Hemogard Vacutainer 13x75mm	3900	2150	12.7	fixed	4x2094s	-	-

Rotor 801 6-Place 45 degree Fixed Angle Rotor

Tube No. x Vol. (ml)	Tube	Maximum RPM / RCF	Radius	Shield	Adapter	Cushion
6x50ml	Falcon/Corning conical plastic	3900 2050	12.1	6x305	-	6x315
6x50ml	Corning 8300-50 conical glass	3900 2050	12.1	6x305	-	571
6x15ml	Falcon/Corning conical plastic	3900 2050	12.1	6x305	6x1106	570
6x50ml	Falcon/Corning conical plastic	4500 2450	10.8	6x320	-	6x315
6x50ml	Corning 8300-50 conical glass	4500 2450	10.8	6x320	-	571
6x15ml	Falcon/Corning conical plastic	4500 2450	10.8	6x320	6x1106	570

Rotor 804S 4-Place 40 degree Fixed Angle Rotor

Complete with 4 x 323 Sealed Buckets

Tube No. x Vol. (ml)	Tube	Maximum RPM / RCF	Radius	Shield	Adapter	Cushion
4x50ml	Falcon/Corning conical plastic	4200 2270	11.5	323	-	315
4x50ml	Corning 8300-50 conical glass	4200 2270	11.5	323	-	571
4x15ml	Falcon/Corning conical plastic	4200 2270	11.5	323	6x1106	570
4x60ml	Corning 8540-60	2500 1000	14.3	4x341	-	572

Rotor 809 12-Place 45 degree Fixed Angle Rotor

Tube No. x Vol. (ml)	Tube	Maximum RPM / RCF	Radius	Shield	Adapter	Cushion
12x15ml	Falcon/Corning conical plastic	3800 2150	13.3	302	-	668
12x15ml	Corning 8080-15 conical glass	3800 2050	12.7	302	-	570
126xDevice	Amicon Filtration Device	3900 2050	13.4	302	-	-
12x10ml	Corning 8080-10	4500 2310	10.2	12x356	-	570
12xDevice	Filtron or Millipore Devices	4500 2490	11.0	12x356	-	-
12x10ml	Corning 8080-10	4100 2270	12.1	12x303	-	12x668
12x10ml	17x102mm	4100 2120	11.3	12x303	-	570

Rotor 841 12-Place 45 degree Fixed Angle Rotor

Tube No. x Vol. (ml)	Tube	Maximum RPM / RCF	Radius	Use Adapter
12x1.5-2.0ml	microtubes	8500 4680	5.8	-
12x0.7ml	microtubes	8500 4770	5.9	5763
12x0.5ml	microtubes	8500 3960	4.9	5763
12x0.4ml	microtubes	8500 4680	5.8	5764
12x0.25ml	microtubes	8500 3630	4.5	5764

4.2 Derating Table for Dense Samples

The Speed and Force Table lists the Maximum speed for each rotor/ accessory combination in the Centra-CL2. IEC guarantees that the units can achieve these speeds when used at nominal voltage.

These speeds are guaranteed only with samples whose specific gravity is not greater than:

- 1.2 for swinging bucket rotors
- 1.5 for angle rotors

For denser samples, the maximum guaranteed speed is reduced (derated) by a factor from the table below:

Derating Factor for:

<u>Specific Gravity</u>	<u>Swinging Bucket</u>	<u>Fixed Angle</u>
1.2	1	1
1.3	.960	1
1.4	.925	1
1.5	.894	1
1.6	.866	.967
1.7	.839	.939
1.8	.816	.912
1.9	.794	.888
2.0	.774	.866
2.1	.755	.844
2.2	.738	.825
2.3	.721	.807
2.4	.707	.790
2.5	.692	.774
2.6	.678	.758
2.7	.666	.744
2.8	.654	.731
2.9	.642	.719
3.0	.632	.707

Example. An angle rotor rated for 5,000 rpm, used with samples with a specific gravity of 1.6, should not be spun faster than $(5,000 \times .967 =) 4,835$ rpm.

Specific gravities greater than 3.0. This table is based on the formula:

$$\sqrt{(s_0/s_a)}$$

...where s_0 is the maximum specific gravity allowed before derating (1.2 or 1.5, depending on the type of rotor), and s_a is the actual specific gravity of the sample in question. You can use the same formula to compute derating factors for specific gravities greater than 3.0.

4.3 Chemical Resistance Table

	Plastic										Metal					Other			
	PA	PC	PE	PP	PU	NL	DN	CN	NN	PS	TI	SS	AL	MB	MG	RR	BN	VN	PF
Acids, dilute or weak	E	E	E	E	G	E	F	N	F	E	G	G	F	F	N	F	E	E	E
Acids*, strong or conc.	E	N	E	E	F	N	N	N	N	F	N	N	N	N	N	N	F	G	N
Alcohols, aliphatic	E	G	E	E	F	E	E	E	N	E	E	E	E	E	F	E	E	G	E
Aldehydes	G	F	G	G	G	G	G	F	N	E	E	E	E	E	E	E	N	E	E
Bases	E	N	E	E	N	G	N	G	F	E	E	E	E	E	E	G	G	N	N
Esters	G	N	G	G	N	E	G	G	E	N	E	E	E	E	E	N	N	N	E
Hydrocarbons, aliphatic	G	F	G	G	E	N	E	E	E	N	E	E	E	E	E	N	E	E	E
Hydrocarbons, aromatic	F	N	G	F	N	N	E	E	E	N	E	E	E	E	E	N	N	E	E
Hydrocarbons, halogenated	F	N	F	F	N	N	G	E	G	N	E	E	E	E	N	N	N	F	E
Ketones	G	N	G	G	N	N	E	E	E	N	E	G	G	G	E	N	N	N	E
Oxidizing Agents, strong	F	N	F	F	N	N	N	N	N	N	E	F	N	N	N	N	F	E	E
Salts	E	E	E	E	E	E	E	E	E	E	E	F	F	F	N	E	E	E	E

*For Oxidizing Acids, see "Oxidizing Agents, strong".

PA - POLYALLOMER

PC - POLYCARBONATE

PE - POLYETHYLENE

PP - POLYPROPYLENE

PU - POLYURETHANE

NL - MODIFIED PHENYLENE OXIDE (NORYL)

DN - ACETAL HOMOPOLYMER (DELTRIN)

CN - ACETAL COPOLYMER (CELCON)

NN - NYLON

PS - POLYSTYRENE

TI - TITANIUM

SS - STAINLESS STEEL

AL - ALUMINUM

MB - MANGANESE BRONZE

MG - MAGNESIUM

RR - RUBBER

BN - BUNA-N

VN - VITON

PF - PHENOLIC FIBER

Classification of Resistance

E= Excellent

G= Good

F= Fair

N= Not Recommended

4.4 Compatible Processes For Decontamination

Compatible Processes For Decontamination																				
Sterilization Methods	Plastic										Metal					Other				
	PA	PC	PE	PP	PU	NL	DN	CN	NN	PS	TI	SS	AL	MB	MG	RR	BN	VN	PF	PT
Mechanical																				
Autoclave*	S	M	U	S	M	U	S	S	S	U	S	S	S	S	S	S	S	M	S	M
Ethylene Oxide Gas	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	U	U	S	S	S
Dry Heat 160°C@2Hrs.	U	U	U	U	U	U	U	U	U	U	S	S	U	S	S	U	U	U	U	U
Chemical																				
Ethanol	S	S	S	S	U	S	S	S	U	M	S	S	S	S	S	S	S	S	S	S
40% Formalin	S	S	S	S	U	S	S	S	S	U	S	S	S	S	S	S	U	S	S	S
Methanol	S	M	S	S	M	S	S	S	U	M	S	S	S	S	S	S	S	U	S	S
2-Propanol	S	S	S	S	M	S	S	S	U	S	S	S	S	S	M	S	S	S	S	S
5% Sodium Hypochlorite**	S	S	S	S	U	S	U	U	U	S	S	M	U	U	U	S	U	S	S	M
3% Hydrogen Peroxide	S	S	S	S	S	S	M	S	U	S	S	S	S	S	U	S	S	S	S	M
100% Hydrogen Peroxide	S	S	S	S	S	U	U	U	U	S	S	S	S	S	S	U	U	S	S	U
5% Phenol Solution	M	U	U	S	U	U	M	U	M	M	M	M	M	M	M	U	S	S	U	

*For Oxidizing Acids, see "Oxidizing Agents, strong".

PA - POLYALLOMER

PC - POLYCARBONATE

PE - POLYETHYLENE

PP - POLYPROPYLENE

PU - POLYURETHANE

NL - MODIFIED PHENYLENE OXIDE (NORYL)

DN - ACETAL HOMOPOLYMER (DELFIN)

CN - ACETAL COPOLYMER (CELCON)

NN - NYLON

PS - POLYSTYRENE

TI - TITANIUM

SS - STAINLESS STEEL

AL - ALUMINUM

MB - MANGANESE BRONZE

MG - MAGNESIUM

RR - RUBBER

BN - BUNA-N

VN - VITON

PF - PHENOLIC FIBER

PT - PAINTED SURFACES

*Autoclaving

12°C 20 min. @

2 ATM (15 PSIG)

**Household Bleach

(1:10 Dilution)

S = SATISFACTORY

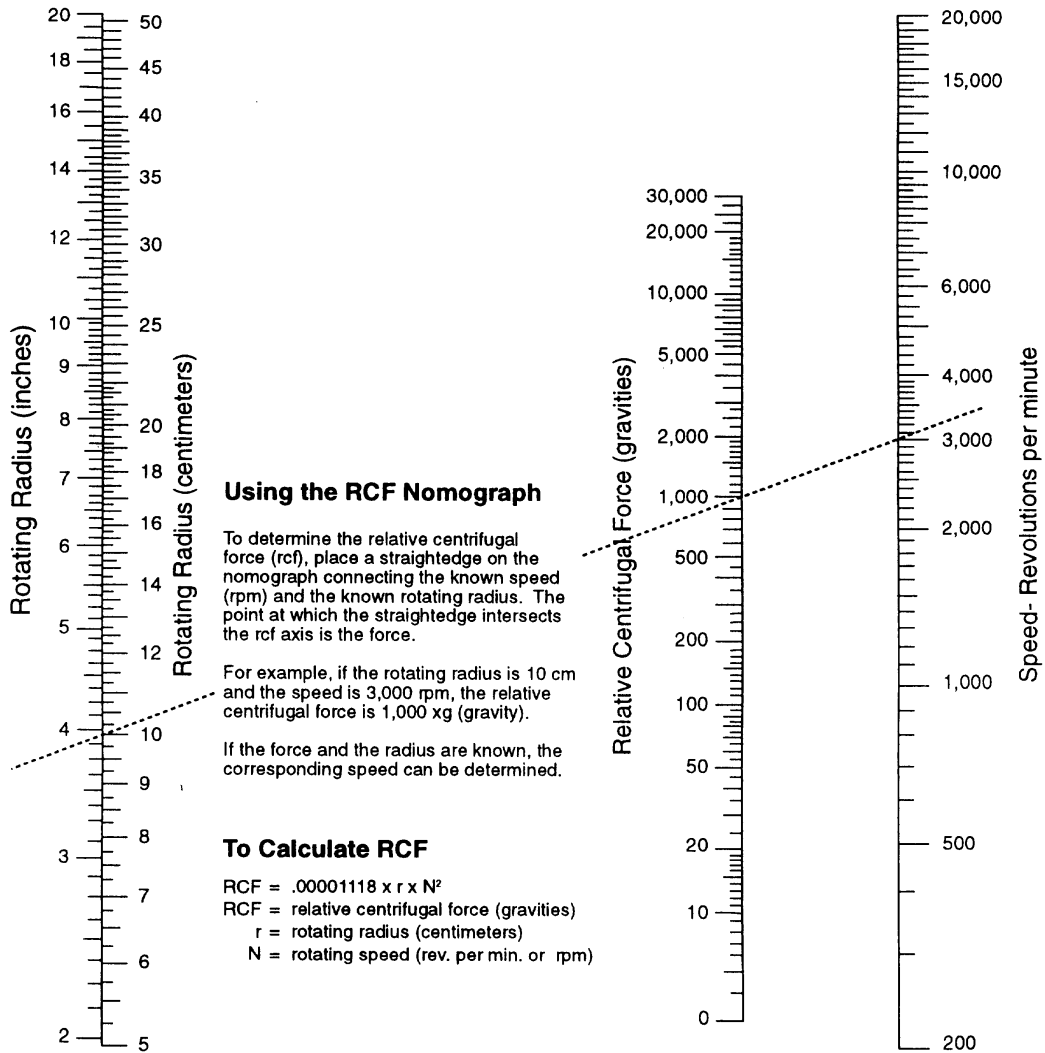
M = MARGINAL

U = UNSATISFACTORY

WARNING:

This chart describes the material compatibility of various sterilization methods. It does not specify the adequacy of sterilization. Refer to section 4.3 Chemical Resistance Table for material compatibility during centrifugation.

4.5 RCF Nomograph



5 MAINTENANCE

5.1 Cleaning

Keep your centrifuge clean to ensure good operation and to extend its life. Clean the entire sample chamber, rotor, and lid at the end of each workday, and also right after any spill.

To clean the sample chamber, use a damp sponge, warm water, and a mild liquid detergent suitable for washing dishes by hand, such as Ivory® liquid. Do not use caustic detergents or detergents that contain chlorine ions, since these attack metals. Remove stubborn stains with a plastic scrub pad. Do not use steel wool, wire brushes, abrasives, or sandpaper, since they create corrosion sites. Never pour water directly into the sample chamber. Scrub the rotor's tube cavities with a stiff test-tube brush that has end bristles and a nonmetallic tip. After cleaning any part, dry it properly, preferably using a clean, absorbent towel.

Corrosion IEC manufactures and finishes rotors and structural accessories to give maximum resistance to corrosion. However, maximum equipment life requires that you continually inspect the rotor cavities for corrosion, especially after using chloride ion solutions, such as sodium chloride (saline), and sodium hypochlorite (household bleach). These solutions attack most metals. Clean the rotor, rotor chamber, and accessories (particularly the sample compartments and bucket cups) thoroughly after each such use. Inspect all surfaces under bright light for corrosion; small crevices will grow deeper and cause failure.

If you see any corrosion, remove it immediately as follows:

1. Follow the cleaning procedure at the start of this section. Soak the part in the mild hand-dishwashing detergent. Scrub the part thoroughly with a stiff test-tube brush having end bristles and a non-metallic tip.
2. Soak the part again in clear warm water for at least an hour.
3. Rinse the part thoroughly in warm water first, then in distilled water.
4. Dry the part thoroughly with a clean, absorbent cloth.
5. If this procedure does not remove the corrosion, **discontinue use of the part.**

Storage Store parts on a soft surface to avoid damaging finished surfaces. Rotors and other parts should be clean and dry for storage. Store them open to the atmosphere, not in a plastic bag, so that any residual moisture will evaporate. The parts should face downward to avoid retaining moisture in the cavities.

Decontamination Decontamination is called for if tube breakage occurs and infectious, pathogenic, or radioactive material is released into the unit. Some rotors or accessories totally contain the sample tubes. In this case, spillage is usually confined, and it may be sufficient to decontaminate only the rotor or accessory.

The Decontamination Table lists the sensitivity of various materials to common sterilization procedures. When using a 1-to-10 dilution of household bleach (sodium hypochlorite) to decontaminate metal rotors or accessories, follow decontamination by the corrosion cleaning procedure given earlier, since chloride ions attack most metals.

Always decontaminate for the minimum recommended time. If you observe corrosion, remove it as described earlier, discontinue use of the sterilization method, and use an alternate decontamination procedure.

Sterilization of polypropylene rotors can be done by autoclaving. Remove any sample tubes before autoclaving, unless they are completely full of sample, or remove caps, stoppers, and other tube closures, before autoclaving to keep the tubes from collapsing under pressure. Autoclave the rotor and accessories at 121° C @ 15 psig for 20 minutes. Do not stack polypropylene rotors during autoclaving. After the rotor is cool to the touch, do a normal cleaning operation as described above.

Repeated autoclaving will seriously degrade the performance of polycarbonate materials.

5.2 Brush Replacement

Refer servicing to qualified personnel only. Brush replacement is required when the length of the brush not including the spring is less than 1/4 inch long. **Order additional sets as IEC Part Number 1780A.**

WARNING DISCONNECT POWER CORD BEFORE REMOVING THE BRUSHES.

First, remove all rotor and accessories from the chamber. Gently tilt the unit onto its side and remove the four screws which secure the baseplate. The brush caps are located on either side of the motor housing. Unscrew each cap with your fingers (or use a small flat screwdriver) and remove the brushes. There are two black caps which can be removed from the housing to allow use of a large screwdriver. Measure the length of the brushes and replace both brushes if either one is less than 1/4 of an inch long. Be sure to reinstall all parts removed.

It is important to check the brushes periodically since damage to the motor can occur if the brush is allowed to wear down to the spring.

CAUTION: WHEN REINSTALLING INSPECTED BRUSHES

When brush replacement is not required, it is important that the brush be inserted in the same position as it was removed. The trailing edge of the brush must be positioned properly. The trailing edge may be identified by the presence of a dark deposit of carbon along that side.

Note: New brushes may require a burn-in period of up to a half hour.

5.3 Fuse Replacement

Refer servicing to qualified personnel only. First, remove all rotor and accessories from the chamber. Gently tilt the unit onto its side and remove the four hex head screws which secure the baseplate. Unscrew and remove the four rubber feet and lift the baseplate off. The fuse(s) is mounted to the cabinet housing. Replace fuse(s) with:

For 100/120 VAC	1 - 4A, .25 x 1.25 in.	IEC part no. 40340
For 220/240 VAC	2 - 2A, .25 x 1.25 in.	IEC part no. 40794

5.4 Cover Interlock Bypass

The Centra-CL2 has an interlock bypass for easy sample retrieval in the event of a power failure. To bypass the safety interlock, unplug the centrifuge and pry off the plastic plug located on the bottom of the control panel. Pull downward on the cord to release the interlock. Do not perform this bypass routinely. The cover interlock provides user safety and allows the cover to be opened promptly whenever rotation has stopped.

5.5 Calibration

The speed sensor used in the Centra-CL2 requires no calibration. IEC recommends verifying its speed once every 24 months. This can be done easily using an optical tachometer through the clear plastic viewport in the lid. If this measurement indicates instrument failure, please notify IEC Technical Service.

5.6 Power Cord Replacement

Inspect the power cord every four months for signs of wear. Refer servicing to qualified personnel only. Replace power cord with IEC part number 44392 only.

5.7 Warranty

IEC wants you to be satisfied with the quality of your Centra-CL2 centrifuge. We warrantee your IEC centrifuge for one year and IEC rotors for seven years. We will repair or replace a product that fails, within this period from the date of its delivery, due to defects in material and workmanship, and we will ship you the repaired product or its replacement at our expense. You must use IEC approved accessories and genuine IEC spare parts. This warranty does not apply to any instrument that has been abused or repaired without authorization.

THE FOREGOING OBLIGATIONS ARE IN LIEU OF ALL OTHER OBLIGATIONS AND LIABILITIES INCLUDING NEGLIGENCE, AND ALL WARRANTIES, OF MERCHANTABILITY OR OTHERWISE, EXPRESSED OR IMPLIED IN FACT OR BY LAW. THE FOREGOING STATES OUR ENTIRE AND EXCLUSIVE LIABILITY, AND BUYER'S EXCLUSIVE REMEDY, FOR ANY CLAIM OR DAMAGES IN CONNECTION WITH THE SALE OR FURNISHING OF GOODS OR PARTS, THEIR DESIGN, SUITABILITY FOR USE, INSTALLATION, OR OPERATION. IEC WILL IN NO EVENT BE LIABLE FOR ANY SPECIAL OR CONSEQUENTIAL DAMAGES WHATSOEVER, AND OUR LIABILITY UNDER NO CIRCUMSTANCES WILL EXCEED THE PURCHASE PRICE FOR THE GOODS FOR WHICH LIABILITY IS CLAIMED. IN SOME INSTANCES, UNITS MAY CONTAIN RECONDITIONED (AS NEW) PARTS.

5.8 Condition of Returned Equipment

Before returning equipment to IEC, you must contact IEC or your dealer and receive a return goods authorization (RGA). **All returned units must be decontaminated, free of radioactivity, and free of hazardous and infectious materials.** The RGA paperwork includes a Certificate of Decontamination for you to sign indicating that you have performed these steps. IEC will not accept the shipment until this signed certificate is received.

You must prepay transportation to the service depot.

6 SPECIFICATIONS

Rotation Speed	8500 rpm (Angle Rotor No. 841) 3900 rpm (Horizontal Rotor No. 236)
Maximum RCF	4775 xg (Angle Rotor No. 841) 2200 xg (Horizontal Rotor No. 236)
Maximum Volume	400 mL (8 x 50 mL)
Timer	
Range	0 to 30 minutes
Increments	0 to 1 minute by 5 seconds 1 to 5 minutes by 15 seconds 5 to 30 minutes by 1 minute HOLD mode up to 99 min., 99 sec. 'At Speed' Timing Mode
Accuracy	±1.0 %
Speed	
Range	1000 to 8500 rpm by 100 rpm
Accuracy	±100 rpm
Power Requirement	120 VAC ± 10%, 60 Hz (Cat. No. 426) 240 VAC ± 10%, 50 Hz (Cat. No. 427)
Heat Output (typical)	175 Watts (600 Btu/hr.)
Sound Level	52 dB(A)
Height	
Cover Closed:	11 in. (28 cm)
Cover Opened:	24 in. (61 cm)
Width	13 in. (34 cm)
Depth	16 in. (40 cm)
Net Weight	11 kg (24 lbs.)
Shipping Weight	13 kg (29 lbs.)

Specifications Subject To Change Without Notice

7.1 Warning Messages and Error Codes

The following Warning Messages and Error Codes can appear in the display of the Centra-CL2. A Warning Message indicates improper operation, and may be cleared by opening the lid, correcting the problem, and then using the centrifuge. Error Codes indicate a malfunction of the centrifuge. They are cleared by disconnecting and reconnecting power to the centrifuge. If an Error Code or Warning Message persists, service may be required.

Warning Messages:

Lid: The cover was not properly closed when the start button was pressed, or the cover was opened during a run.

PFL: Power to the centrifuge was lost during a run.

Error Codes:

Er 1: Tachometer signal not present during a run.

Er 2: Speed is 500 RPM over set speed and not decelerating for more than 2 seconds, or speed is over 9000 RPM at any time.

Er 10: The motor voltage was detected to be over the maximum limit (94 volts).

7.2 General

Trouble Shooting If the centrifuge won't start, check the following in order to isolate a problem:

If the rotor stopped indicator (red LED) is lit, there is power to the centrifuge. If not, unplug the centrifuge and check the fuse(s) per Section 5.3.

Spin the rotor by hand to see that the rotor stopped indicator begins flashing, and listen for the latch to engage. This will verify the function of the tachometer and latch.

Warnings: The following hazards exist in servicing the Centra-CL2:

The unit uses AC power, and some of the service procedures require operation with panels removed, exposing power lines. This introduces the risk of electric shocks. Service should be performed by qualified personnel only. Do not touch exposed wires without first unplugging the unit.

Cautions: An additional hazard to the equipment is as follows:

The circuit boards contain electronics that can be damaged by static electricity. Persons doing extensive maintenance on the circuit boards, or removing individual components from the circuit boards, should be grounded (such as by wearing a wrist strap.) When shipping a circuit board, always enclose it in a static-protective bag.

7.3 Disassembly For Service

First, open the cover and unplug the centrifuge. To access the electrical components, remove the rotor and accessories from the chamber. Gently tilt the unit onto its side and remove the four hex head screws which secure the baseplate. Unscrew and remove the four rubber feet and lift the baseplate off.

With the cover open, remove the four screws (two on each side) from the control tower. Gently pull the tower outward without removing it completely (there are wires connecting it to the chamber).

To remove the guard bowl, locate and remove the 9 Phillips head screws at the base of the centrifuge chamber. To remove the cover from the guard bowl, pry off one end cap from the hinge pin. Slide the pin out.

7.4 Interlock

The IEC Centra-CL2 has a safety interlock which prevents the cover from being opened unless the rotor is turning 20 RPM or less. There is a switch in the interlock assembly which senses that the cover is closed and locked. It is a normally open switch and closes when the solenoid is in the locked position. When pressed, the STOP/COVER OPEN button releases the safety interlock by powering the solenoid through the Interlock PC board.

The solenoid coil has a resistance of approximately 80 Ω . Power to the solenoid should be approximately 170 VDC. Voltage is provided by the Interlock PCB when the STOP/COVER OPEN button is pressed.

Note: The following procedure involves operating the unit with panels removed. Refer to Section 7.1 Warnings.

To measure the voltage, disconnect the solenoid at JP4 and read across the

BRN and YEL leads. Verify the function of the switch using an ohmmeter.

To replace the interlock, remove the four screws which secure the latch assembly to the cabinet. Snip the wire ties in order to disconnect all leads to the latch assembly. Make note of wiring before disconnecting. Reconnect wires as noted, or using the diagram provided at the end of this manual.

The slots in the latch assembly mounting bracket are for proper positioning. Raise or lower the height of the assembly so that when the cover is closed completely switch SW1 (WHT and WHT/BLK leads) is engaged by the roll pin of the solenoid plunger. A run may not be started until the switch is engaged.

7.5 Timer PCB

The IEC Centra-CL2 has a Timer/Display PCB mounted behind the membrane control panel. The timer PCB contains the EPROM and delivers power to the motor. To replace it, the tower must first be removed (see Section 7.2). The PCB is secured to the tower by four screws

Note: To prevent damage to the PC board, always use a static protective device (such as wriststrap) when handling or servicing.

7.6 Motor

The IEC Centra-CL2 uses an AC series wound drive motor. The motor is not a singular replaceable component, as the base housing of the centrifuge serves as the motor housing. The motor is made up of an armature (includes bearings), field, brushes, brush holders, brush caps, brush leads, and a magnetic rotor. All of these parts are available separately (as well as motor bearings) for repair purposes.

When isolated, the armature resistance should be approximately 6.3 Ω . This can be measured by disconnecting the RED and WHT motor leads and measuring the resistance across them. When isolated, the field resistance should be approximately 10 Ω . It can be measured by disconnecting the Red and BLK motor leads (BLK at BR1).

To access the motor, remove the baseplate (see Section 7.2) and then the top cap located in the guard bowl. Two Phillips head screws secure the top cap. When removing the top cap, take care not to lose the pre-load washer which rests on top of the upper bearing.

To replace the armature, the brushes must be removed (see Section 5.2), and the magnetic rotor taken off of the motor shaft. Magnetic rotor removal requires that the Interlock PCB be removed (see Section 7.6). It is secured with Loctite® 454. Use care not to break the magnetic rotor. Once brushes and the magnetic rotor have been removed, the armature simply lifts out of the housing.

The field rests inside the housing. To remove it, simply disconnect the three

motor leads (RED, WHT, BLK) and lift it out.

Located below the field are the two set screws which secure the brush holders in place. To replace or adjust a brush holder, loosen the set screw. This allows the brush holder to be moved or removed. The set screw may be accessed through the two holes in the field through which the top cap mounting screws secure the top cap to the base.

7.7 Interlock PC Board

The Interlock PCB in the IEC Centra-CL2 disables power to the interlock during rotation. This PC board is mounted below the motor. To sense rotation, it uses a Hall effect sensor to pickup pulses from a magnetic disk mounted on the motor shaft.

To replace the PCB, disconnect the wiring harness and remove the four mounting screws which secure the PCB to the base housing. Take care not to damage the speed sensor when lifting the PCB off of the housing.

Note: To prevent damage to the PC board, always use a static protective device (such as wriststrap) when handling or servicing.

8 DRAWINGS

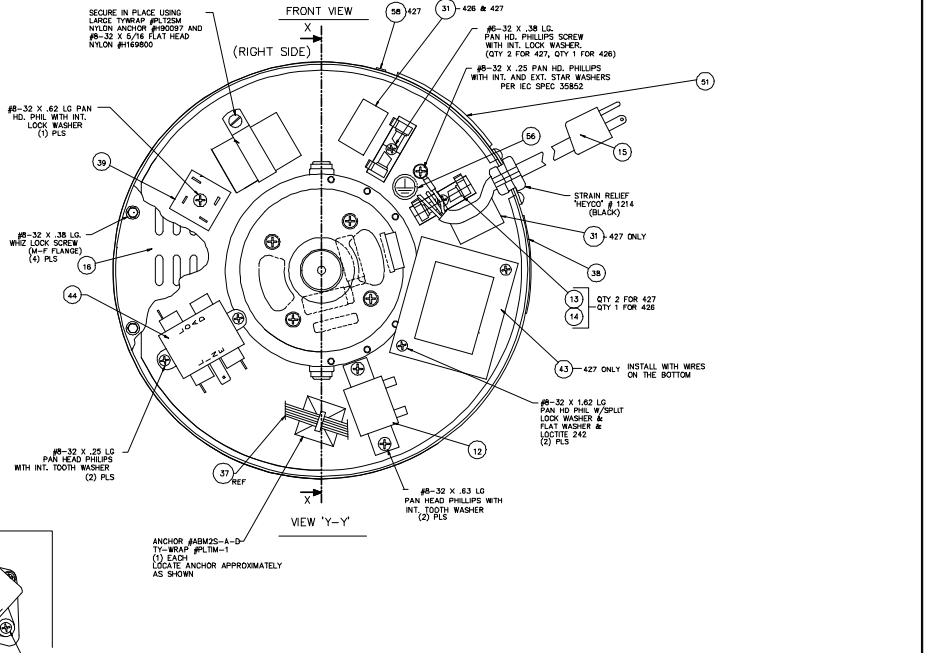
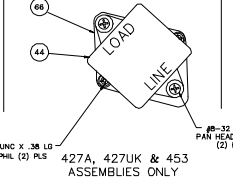
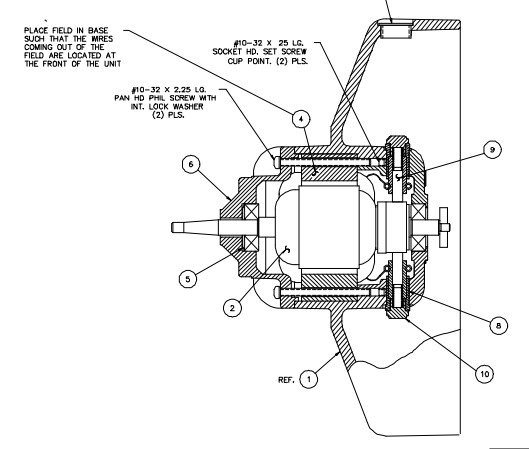
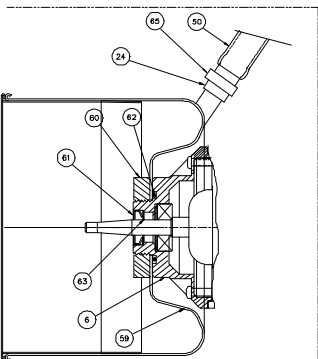
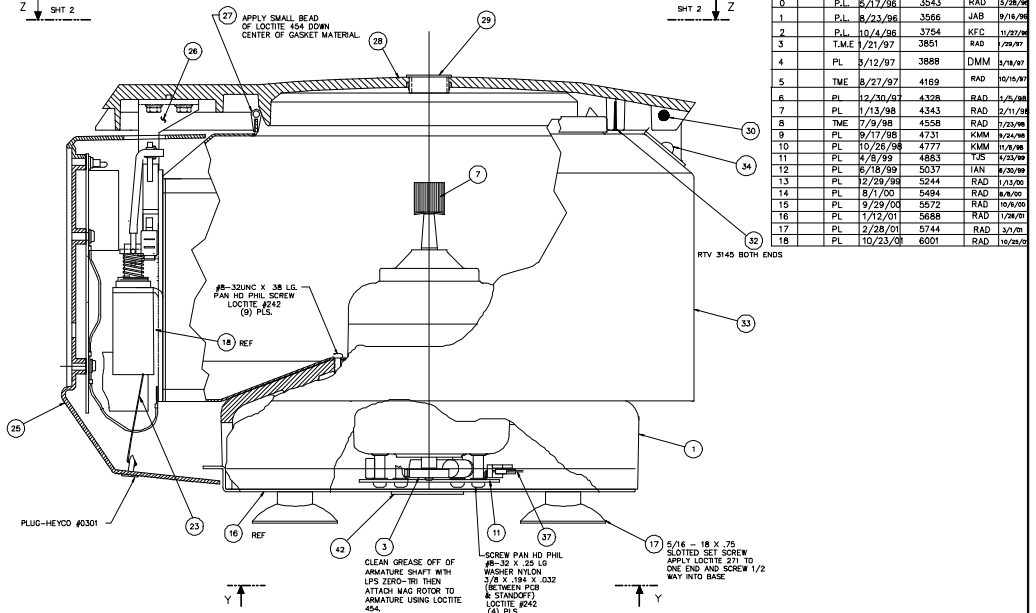
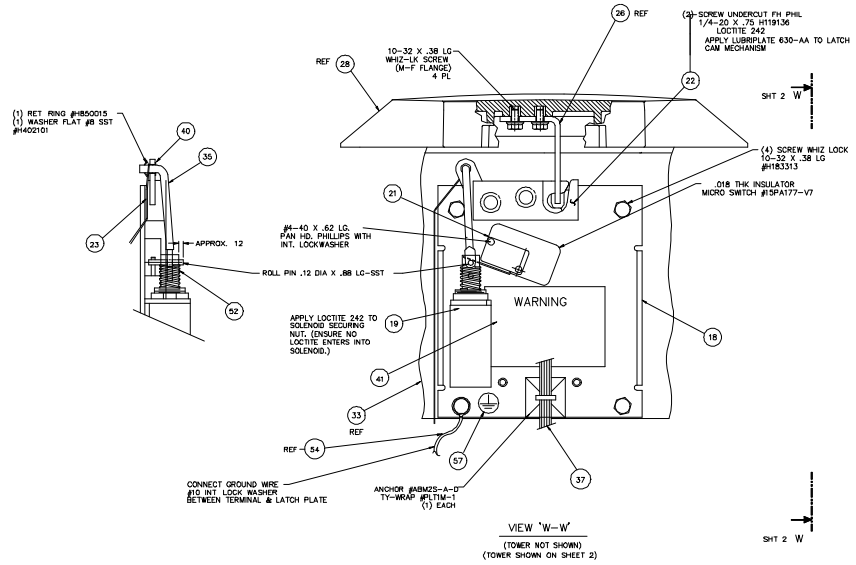
The following drawing are included in this manual.

<u>Dwg. No.</u>	<u>Description</u>
426	CL2 Assembly
PL-426	CL2 Parts List (120 VAC)
PL-427	CL2 Parts List (240 VAC)
10857	Wiring Diagram
10895	Timer/Display PCB Schematic
44416	Timer/Display PCB Layout
PL-44416	Timer/Display PCB Parts List
10875	Interlock PCB Schematic
44418	Interlock PCB Layout
PL-44418	Interlock PCB Parts List

These drawings were accurate at the time of publication. Changes do occur. If you have any questions regarding these drawings, please contact IEC Technical Support at (800) 843-1113.

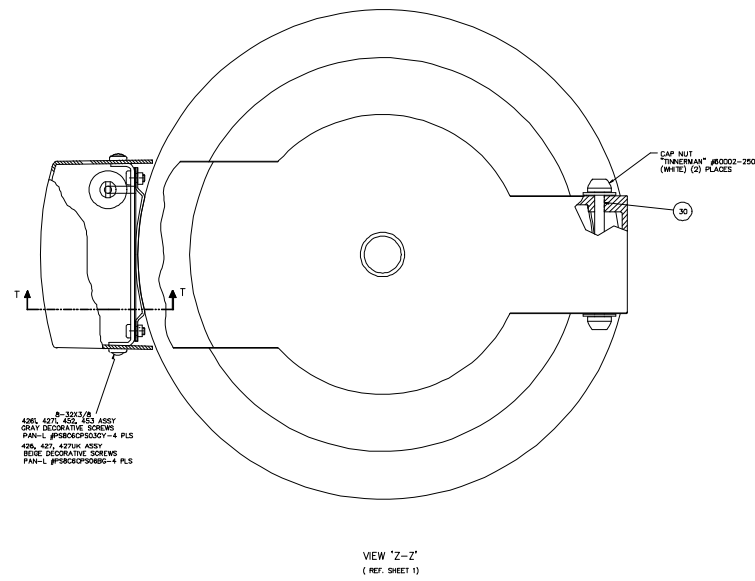
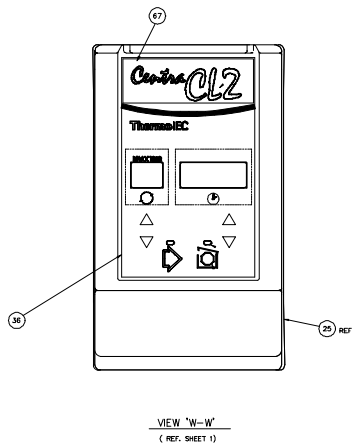
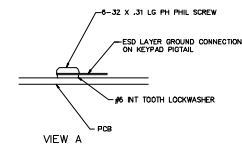
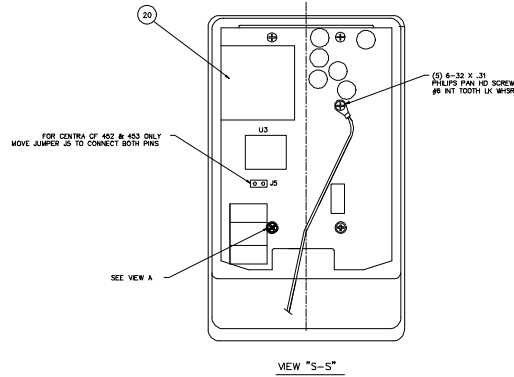
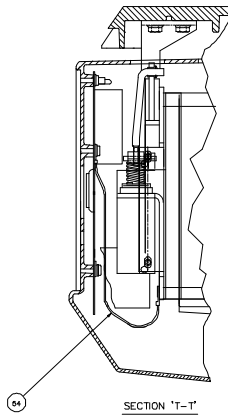
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REVISIONS					
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8		P.L.	1/28/96	3378	RAD 1/28/96
C		P.L.	1/6/96	3371	JAB 5/9/96
0		P.L.	5/17/96	3543	RAD 5/28/96
1		P.L.	8/23/96	3566	JAB 9/15/96
2		P.L.	10/4/96	3754	KFC 10/22/96
3		T.M.E.	1/21/97	3851	RAD 1/29/97
4		PL	3/12/97	3888	DMM 3/18/97
5		T.M.E.	8/27/97	4169	RAD 10/15/97
6		PL	12/30/97	4328	RAD 1/5/98
7		PL	1/13/98	4343	RAD 2/11/98
8		T.M.E.	7/9/98	4558	RAD 7/23/98
9		PL	9/17/98	4731	KMM 10/22/98
10		PL	10/26/98	4777	KMM 11/19/98
11		PL	4/8/99	4883	TJS 4/23/99
12		PL	8/18/99	5037	IAN 8/26/99
13		PL	12/29/98	5244	RAD 1/13/00
14		PL	8/1/00	5494	RAD 8/16/00
15		PL	9/29/00	5572	RAD 10/16/00
16		PL	1/12/01	5688	RAD 1/28/01
17		PL	12/28/01	5744	RAD 3/3/02
18		PL	10/23/03	6001	RAD 12/29/03



MATERIAL:	PARTS LIST SEE PL-		
FINISH:	INTERNATIONAL EQUIP. CO.		
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES DIMENSIONS ARE AFTER FINISH REMOVE ALL BURRS & SHARP EDGES SURFACE QUALITY		TITLE: CENTRA CL2 ASSEMBLY	
NEXT ASSY USED ON:		SIZE: CODE ID. NO. DRAWING NO. REV.	
APPLICATION:		E 426A 18	
BY:	DATE:	SCALE: 1=1	
1/16/96		SHEET 1 OF 3	
CHECKED HJR	DATE DEC 10/6/00	PLA DEC 1 PLACE DEC 3 PLACE DEC 4	
APPROVED RAD	DATE 1/18/96	SCALE: 1=1	

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INTERNATIONAL EQUIP. CO.			
TITLE: CENTRA CL2 ASSEMBLY			
SIZE:	CODE ID. NO.	DRAWING NO.	REV.
E		426A	18
SCALE: NONE			SHEET: 2 OF 3

4

3

2

1

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REVISIONS						
REV	ZONE	BY	DATE	ECO	APP'D	DATE

ASSY CL2 & CF			
ITEM QTY	PART NO.	DESCRIPTION	REMARKS
1			
2	48411	ARMATURE, MOTOR	
3	50344	ROTOR, MAGNETIC (6 POLE PAIR)	
4	2782	FIELD, MOTOR	
5	41778	WASHER, SPRING	ASSOCIATED SPRING # 31164-209
6			
7	65637	NUT, ROTOR	
8	3037	BRUSH HOLDER	
9	1780A	BRUSH/SPRING	
10	9056	CAP, BRUSH	
11	44418	ASSEMBLY, PC. BOARD CL2 INTERLOCK	
12			
13	55125	FUSE HOLDER	BUSS #2499
14			
15			
16	65610	PANEL, BASE	
17	50148	SUCTION FOOT	
18	65617A	BRACKET, CONTROL	
19	50634B	SOLENOID	
20	44416	DIGITAL TIMER/PWM MOTOR DRIVE PCB, CL2	
21	43754	SWITCH	V3L-1108-D8
22	65721	LATCH	
23	1.67	COML POLYESTER 50LB. TEST FISHING LINE	
24			
25			
26	65614	STRIKER, LATCH	
27	50778	GASKET, COVER	
28			
29			
30	65613	PIN, HINGE	
31			
32	65622	SCREEN, COVER	
33	65606	GUARD BOWL	
34	43782	OROMMET, RUBBER	MINOR RUBBER, #2B-3053
35	50635	LINK ARM	
36			
37	65616-A	WIRING HARNESS, MAIN	
38			AC
39	61534	BRIDGE DIODE	
40	COML	NYLINER	THOMPSON NYLINER 3L2-FF
41	65598	LABEL, WARNING	
42	45996	LABEL, WARNING	
43			
44			
45	1M426	OPERATION MANUAL	
46	P0600	CL2 TOP PACK	
47	P0601	CL2 BOTTOM PACK	
48	P0312	CARTON	
49	PC180	POLYBAG	
50			
51	41170	LABEL, CAUTION - HIGH LEAKAGE	
52	50787	SOLENOID SPRING	CE LABEL FOR CARTON
53			
54	50605D	GROUND WIRE	
55	COML	NYLON WASHER #10 3/8 X 1.94 X .032	H401003
56	50127	LABEL, PROTECTIVE EARTH GROUND SYMBOL	
57	50128	LABEL, SECONDARY CHASSIS GROUND SYMBOL	
REF	10857	SCHEMATIC WIRING DIAG. CL2	

ASSY CL2		CATALOG NUMBER	
ITEM QTY	PART NO.	DESCRIPTION	REMARKS
1	65605A	BASE MACHINED	
6	42470A	TOP CAP (MACHINED)	
12	60076	RESISTOR 30W 1000 OHMS	
14	40340	FUSE, SLO-BLO 4A	
15	47415	POWER CORD	
25	65711A	TOWER, CONTROL CL2	
28	65604A	COVER	
29	48116	PLUG, WINDOW	
31	40346B	LABEL, FUSE 4A	
36	50788A	MEMBRANE PANEL	
38	COML	DATA PLATE	REF DWG 66001AC
44	62608	LINE FILTER	SAE #GA1A-8

ASSY CL2 INT		CATALOG NUMBER	
ITEM QTY	PART NO.	DESCRIPTION	REMARKS
1	65605A	BASE MACHINED	
6	42470A	TOP CAP (MACHINED)	
12	60076	RESISTOR 30W 1000 OHMS	
14	42517	LITTLE FUSE 1.25A 3AG SLO-BLO	#3131.25 OR EQUIV
15	44392	POWER CORD	
25	65711A	TOWER, CONTROL CL2	
28	65604A	COVER	
29	48116	PLUG, WINDOW	
31	40346B	LABEL, FUSE 4A	
36	50788A	MEMBRANE PANEL	
38	COML	DATA PLATE	REF DWG 66003AH
43	61265B	TRANSFORMER	
44	62617	LINE FILTER SF3	
66	51086	PLATE LINE FILTER	

ASSY CL2		CATALOG NUMBER	
ITEM QTY	PART NO.	DESCRIPTION	REMARKS
1	65605B	BASE MACHINED	
6	42470A	TOP CAP (MACHINED)	
14	40340	FUSE, SLO-BLO 4A	
15	47415	POWER CORD	
25	65711B	TOWER, CONTROL CL2	
28	65604B	COVER	
29	48116	PLUG, WINDOW	
31	40346H	LABEL, FUSE 4A	
36	50788C	MEMBRANE PANEL	
38	COML	DATA PLATE	REF DWG 66001AC
44	62608	LINE FILTER	SAE #GA1A-8
67	50166	LABEL, OVERLAY, 3I	

ASSY CL2 INT		CATALOG NUMBER	
ITEM QTY	PART NO.	DESCRIPTION	REMARKS
1	65605B	BASE MACHINED	
6	42470A	TOP CAP (MACHINED)	
14	42517	LITTLE FUSE 1.25A 3AG SLO-BLO	#3131.25 OR EQUIV
15	44392	POWER CORD	
25	65711B	TOWER, CONTROL CL2	
28	65604B	COVER	
29	48116	PLUG, WINDOW	
31	40346B	LABEL, FUSE	
36	50788C	MEMBRANE PANEL	
38	COML	DATA PLATE	REF DWG 66003AH
43	61265B	TRANSFORMER	
44	62608	LINE FILTER	
67	50166	LABEL, OVERLAY, 3I	

ASSY CL2 INT		CATALOG NUMBER	
ITEM QTY	PART NO.	DESCRIPTION	REMARKS
1	65605A	BASE MACHINED	
6	42470A	TOP CAP (MACHINED)	
12	60076	RESISTOR 30W 1000 OHMS	
14	42517	LITTLE FUSE 1.25A 3AG SLO-BLO	#3131.25 OR EQUIV
15	65694	POWER CORD	
25	65711A	TOWER, CONTROL CL2	
28	65604A	COVER	
29	48116	PLUG, WINDOW	
31	40346B	LABEL, FUSE	
36	50788A	MEMBRANE PANEL	
38	COML	DATA PLATE	REF DWG 66003BS
43	61265B	TRANSFORMER	
44	62617	LINE FILTER SF3	
66	51086	PLATE LINE FILTER	

ASSY CF 120V		CATALOG NUMBER	
ITEM QTY	PART NO.	DESCRIPTION	REMARKS
1	65605B	BASE MACHINED	
6	45301	TOP CAP (MACHINED)	
12	60076	RESISTOR 30W 1000 OHMS	
14	40340	FUSE, SLO-BLO 4A	
15	47415	POWER CORD	
24	36"	TUBING 1/2 O.D. X 3/32 WALL	TYGON B-44-4X
25	65711B	TOWER, CONTROL CL2	
28	65604B	COVER	
31	40346H	LABEL, FUSE 4A	
36	50788B	MEMBRANE PANEL	
38	COML	DATA PLATE	REF DWG 66003BN
44	62608	LINE FILTER	SAE #GA1A-8
50	18"	43346 TUBING FLEX VINYL 1" O.D. X 3/4 I.D.	
59	1420	ASSY DRAINING CHAMBER	
60	50796	HOLD DOWN NUT	
61	65719	SEAL BEARING	
62	48381	O-RING 2-221	
63	AR	2086 GREASE SYNTHETIC TEFLON	
65	COML	CLAMP HOSE 11/16-13/16	RICHCO SHC-44
66	51086	PLATE LINE FILTER	

ASSY CF 240V		CATALOG NUMBER	
ITEM QTY	PART NO.	DESCRIPTION	REMARKS
1	65605B	BASE MACHINED	
6	45301	TOP CAP (MACHINED)	
12	60076	RESISTOR 30W 1000 OHMS	
14	42517	LITTLE FUSE 1.25A 3AG SLO-BLO	#3131.25 OR EQUIV
15	44392	POWER CORD	
24	36"	TUBING 1/2 O.D. X 3/32 WALL	TYGON B-44-4X
25	65711B	TOWER, CONTROL CL2	
28	65604B	COVER	
31	40346B	LABEL, FUSE	
36	50788B	MEMBRANE PANEL	
38	COML	DATA PLATE	REF DWG 66003BL
43	18"	61265B TRANSFORMER	
44	1	62617 LINE FILTER SF3	
50	18"	43346 TUBING FLEX VINYL 1" O.D. X 3/4 I.D.	
59	1	1420 ASSY DRAINING CHAMBER	
60	1	50796 HOLD DOWN NUT	
61	1	65719 SEAL BEARING	
62	1	48381 O-RING 2-221	
63	AR	2086 GREASE SYNTHETIC TEFLON	
65	1	COML CLAMP HOSE 11/16-13/16	RICHCO SHC-44
66	1	51086 PLATE LINE FILTER	

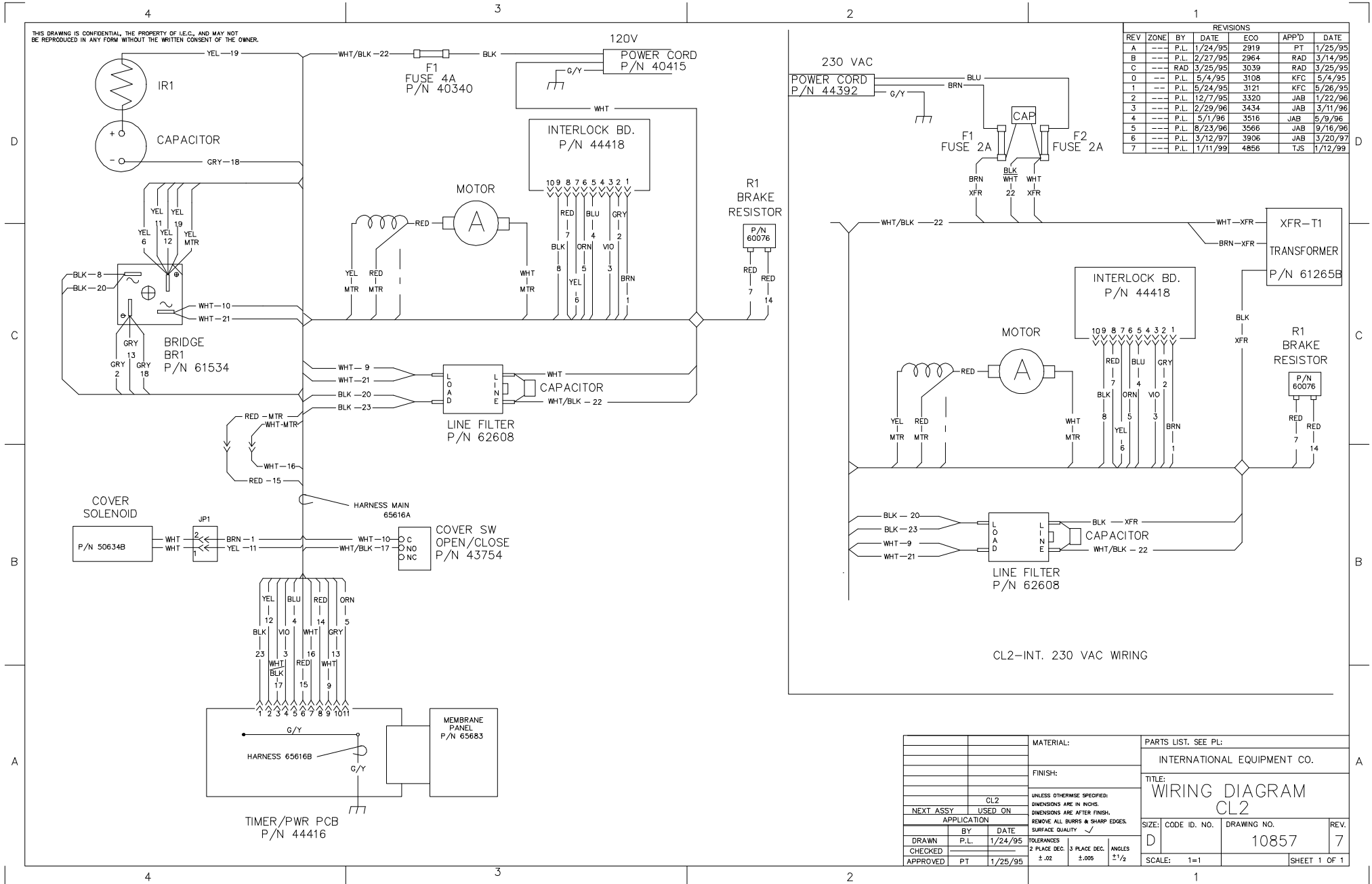
MATERIAL:	PARTS LIST. SEE PL:
FINISH:	INTERNATIONAL EQUIPMENT CO.
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. DIMENSIONS ARE AFTER FINISH. REMOVE ALL BURRS & SHARP EDGES. SURFACE QUALITY ✓	TITLE: ASSY. CL2
NEXT ASSY USED ON APPLICATION	SIZE: CODE ID. NO. DRAWING NO. REV.
BY DATE	D 426A 18
PL 4/21/99	SCALE:
CHECKED	TOLERANCES: 2 PLACE DEC. 3 PLACE DEC. ANGLES ±.02 ±.005 ±1/2
APPROVED	SHEET 3 OF 3

4

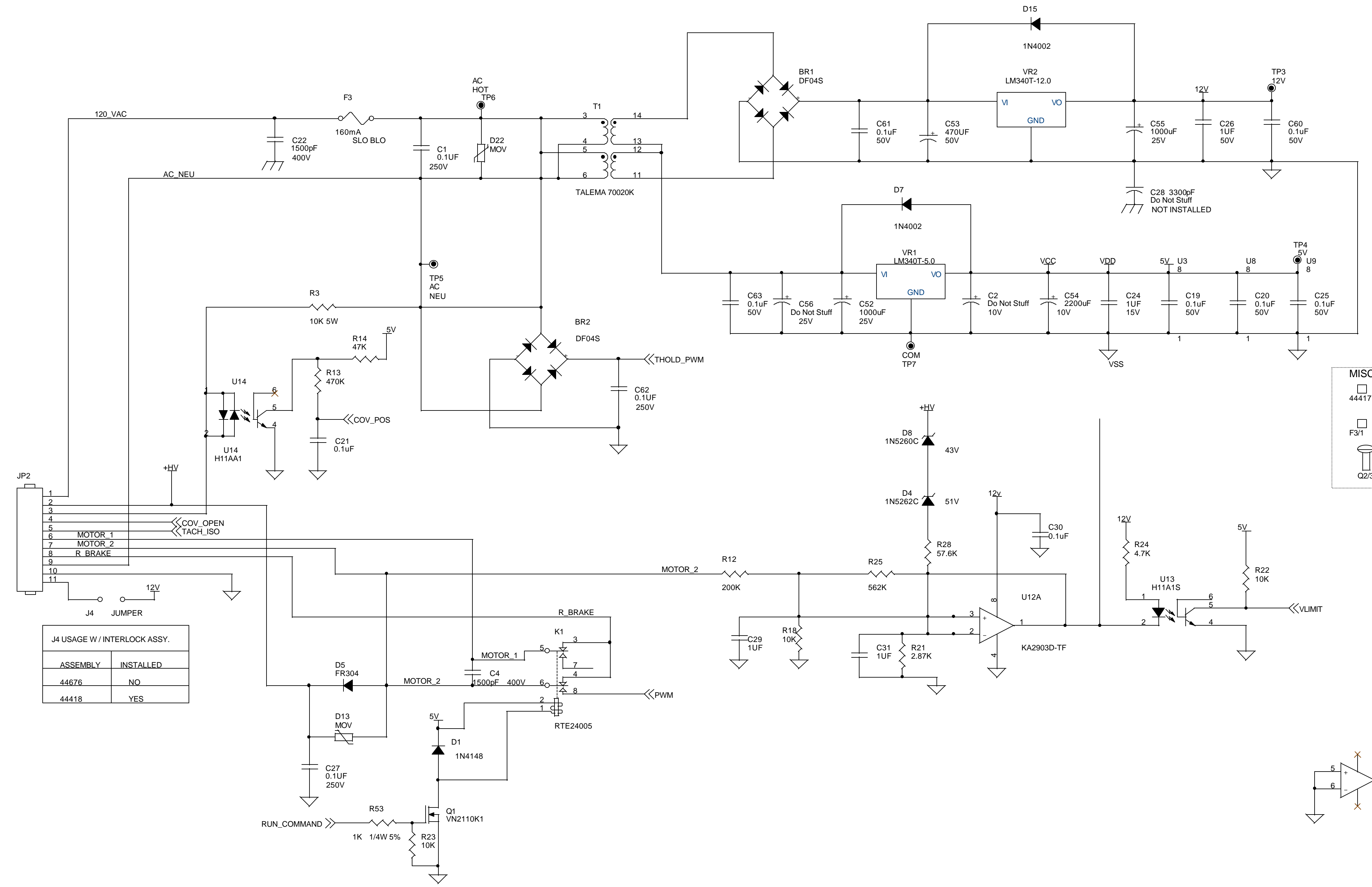
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2

1

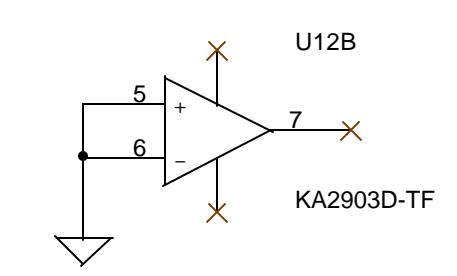


REVISIONS					
REV	BY	DATE	ECO	APP'D	DATE
D	TJS	8/27/98	4451		
0	TJS	01/12/99	4867	TJS	01/12/99
1	TJS	1/26/99	4883	TJS	04/23/99
2	TJS	7/29/99	5103	DMM	08/12/99
3	RAE	02/14/01	5719	RAE	02/22/01
4	HJR	06/12/01	5867	DMM	06/19/01



MISC HARDWARE					
44417	10895	35616	Q2/1	Q2/2	VR1/1
F3/1	Q2/6	U4/1	U4/2	U10/1	
Q2/3	Q2/4	Q2/5	U10/2		

J4 USAGE W / INTERLOCK ASSY.	
ASSEMBLY	INSTALLED
44676	NO
44418	YES



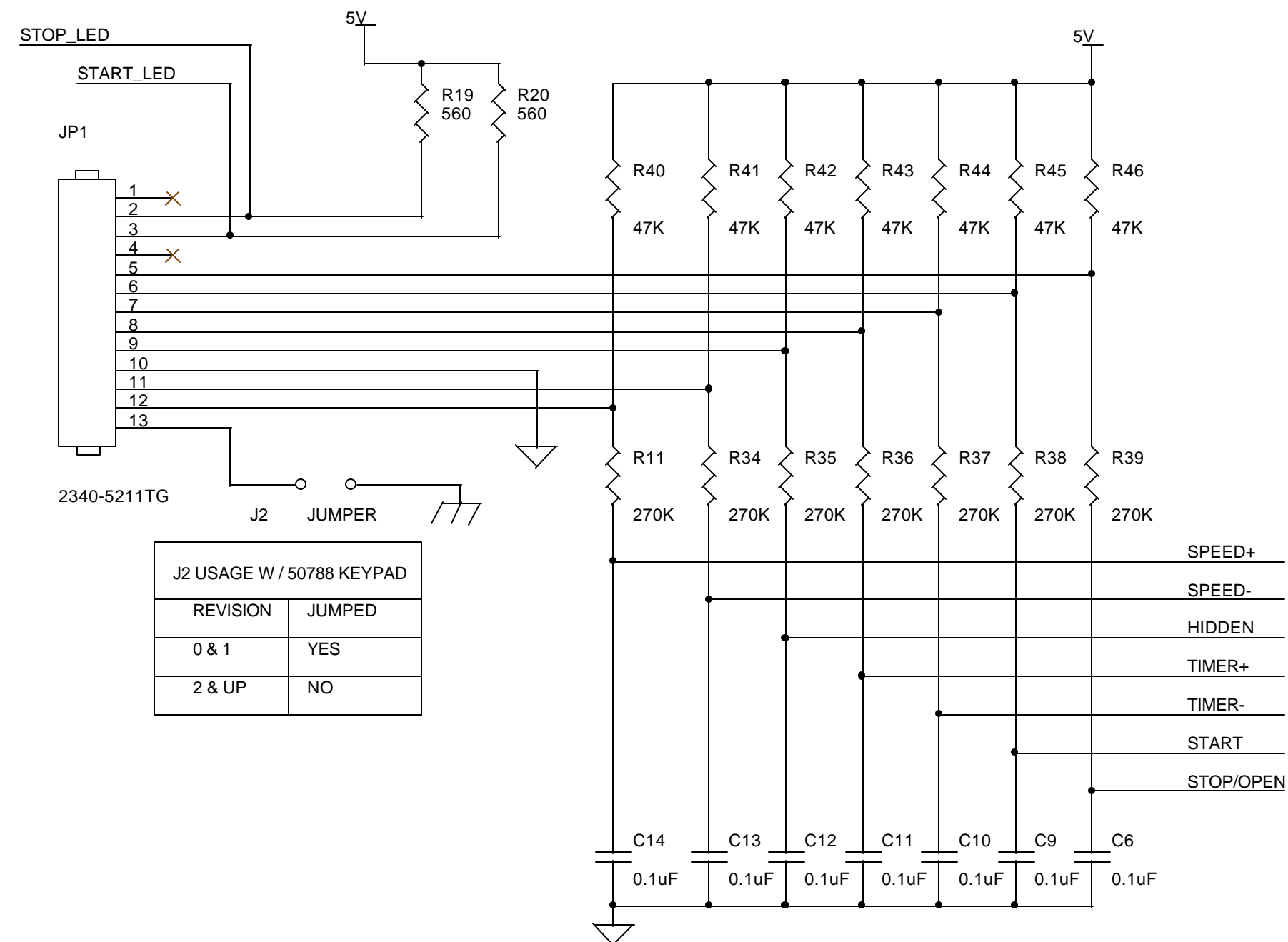
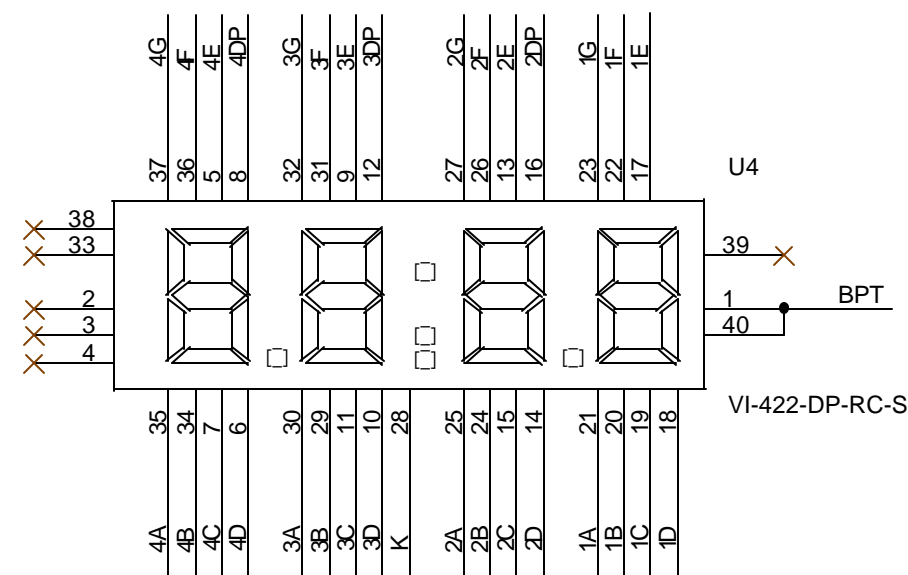
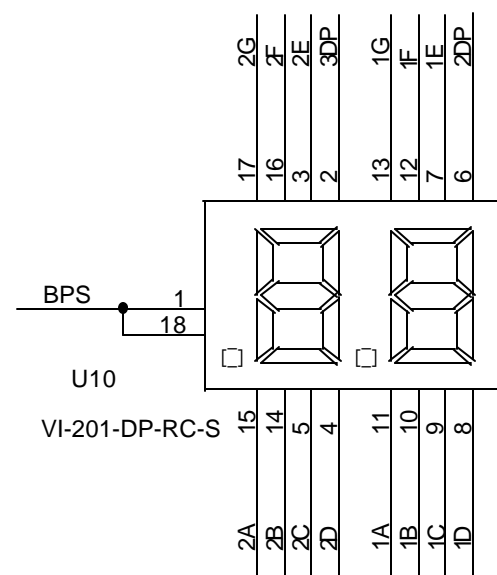
44416

Thermo IEC
 300 SECOND AVE
 Needham Heights, MA 02494.

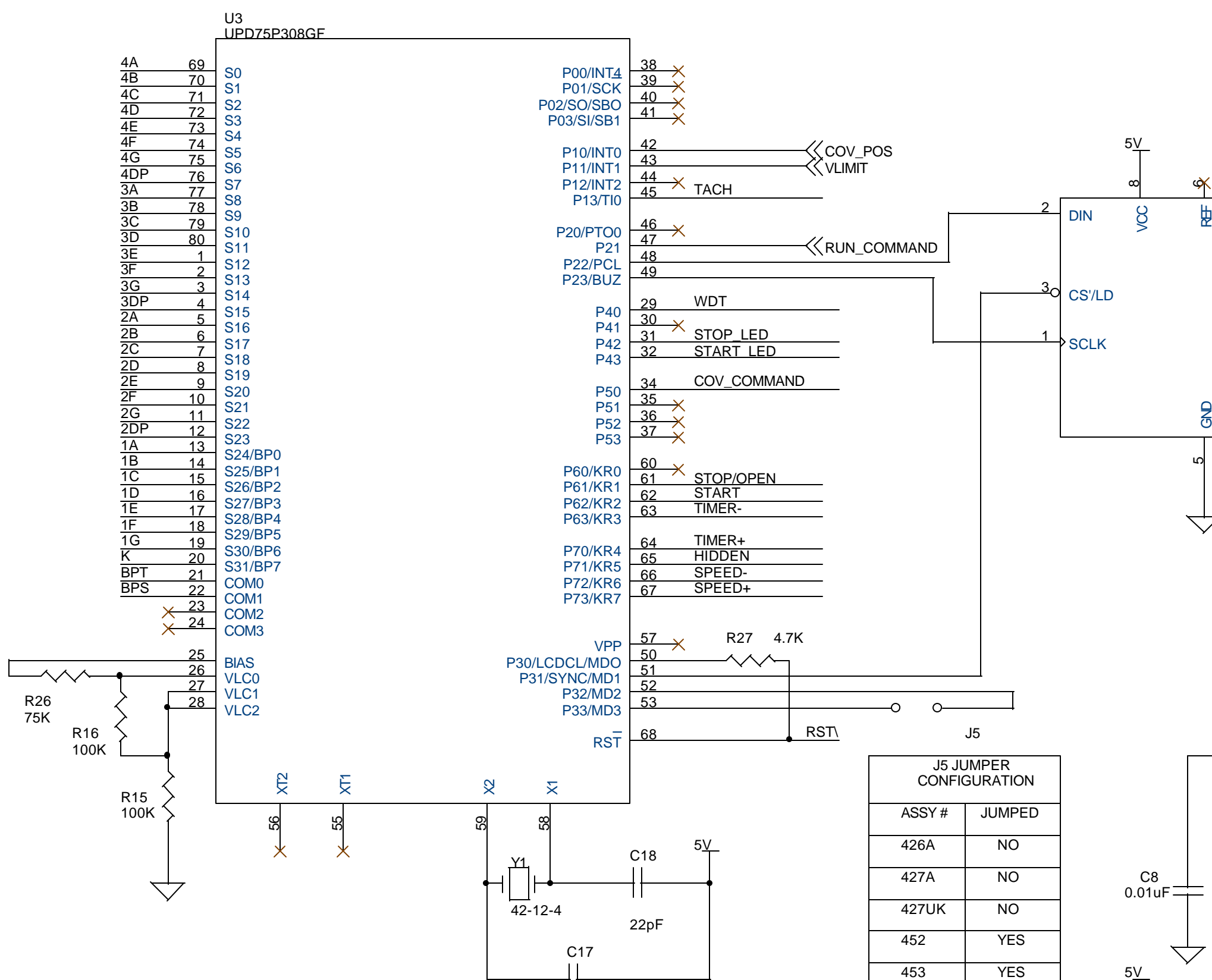
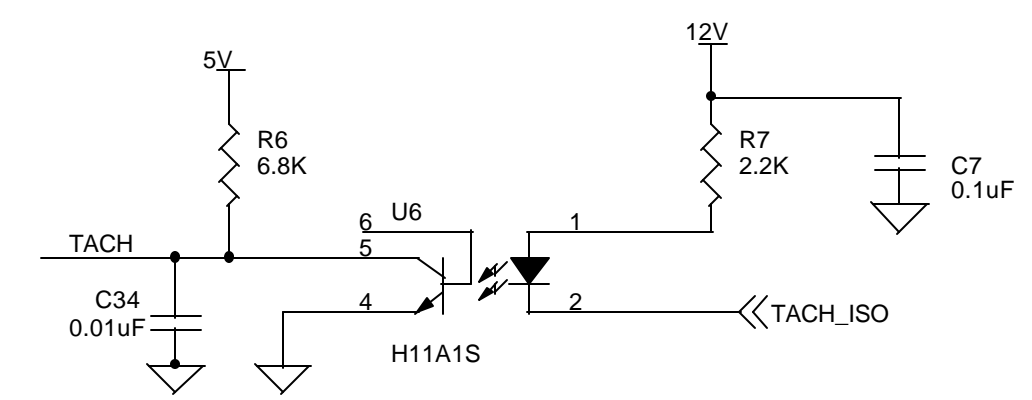
Title: CL2 Digital Timer/PWM Motor Drive

Size C	Document Number 10895	Rev 4
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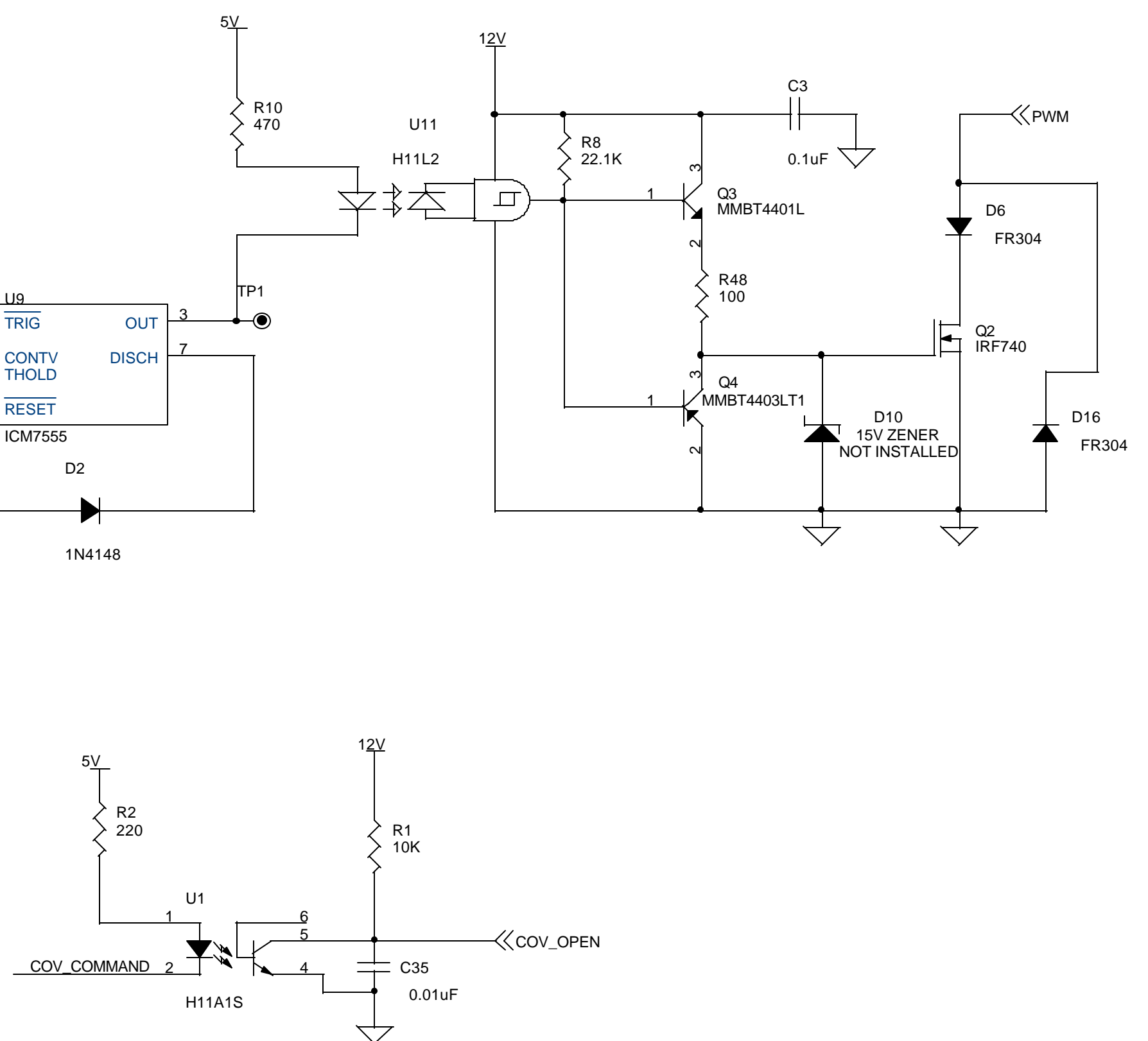
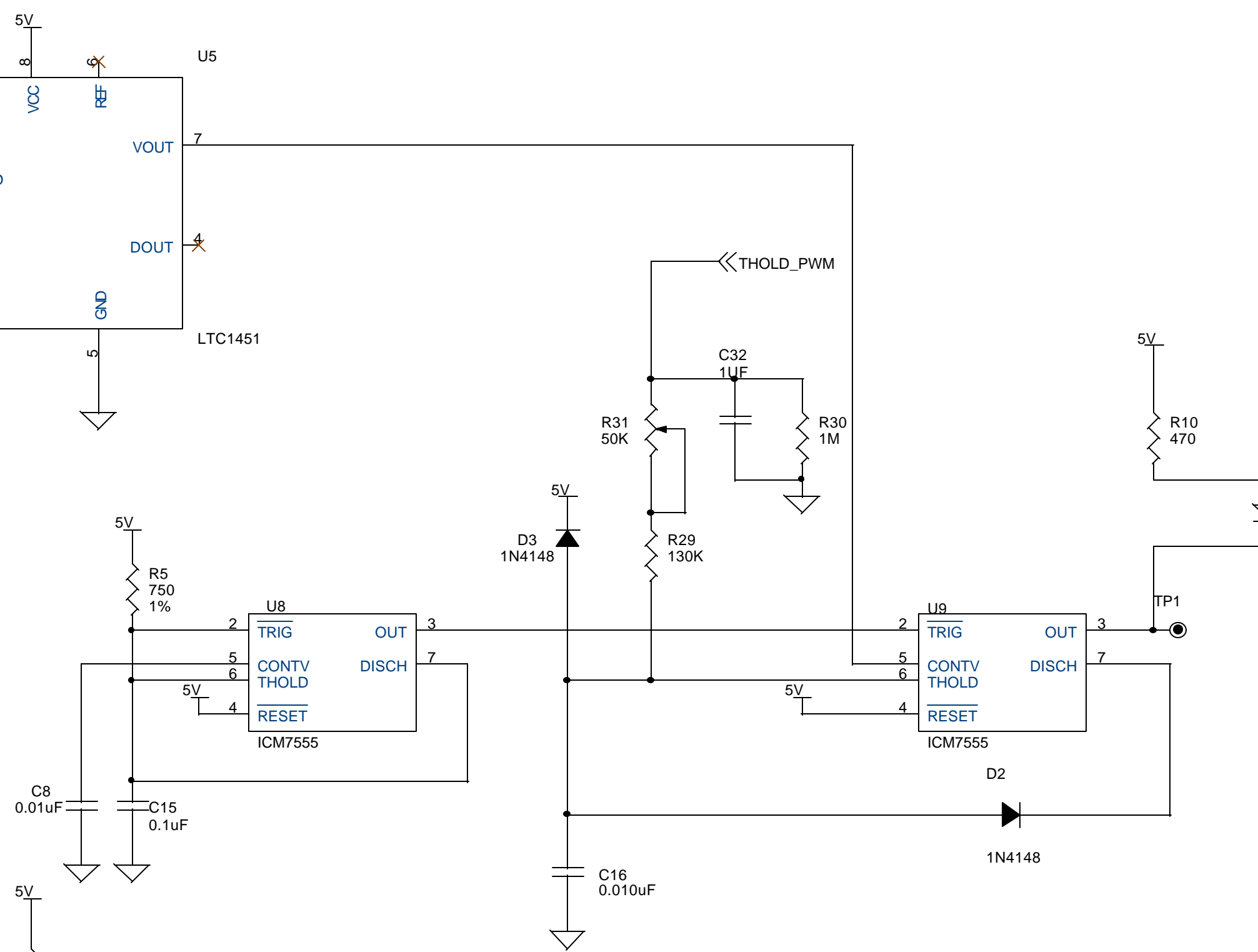
Date: Tuesday, June 19, 2001 Sheet 1 of 2



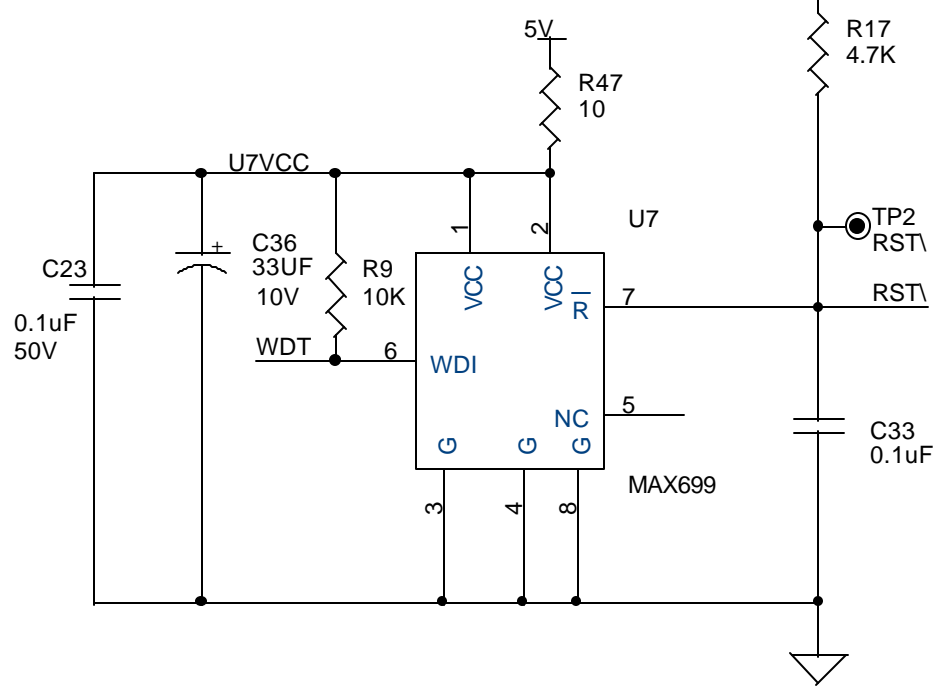
J2 USAGE W / 50788 KEYPAD	
REVISION	JUMPED
0 & 1	YES
2 & UP	NO



J5 JUMPER CONFIGURATION	
ASSY #	JUMPED
426A	NO
427A	NO
427UK	NO
452	YES
453	YES



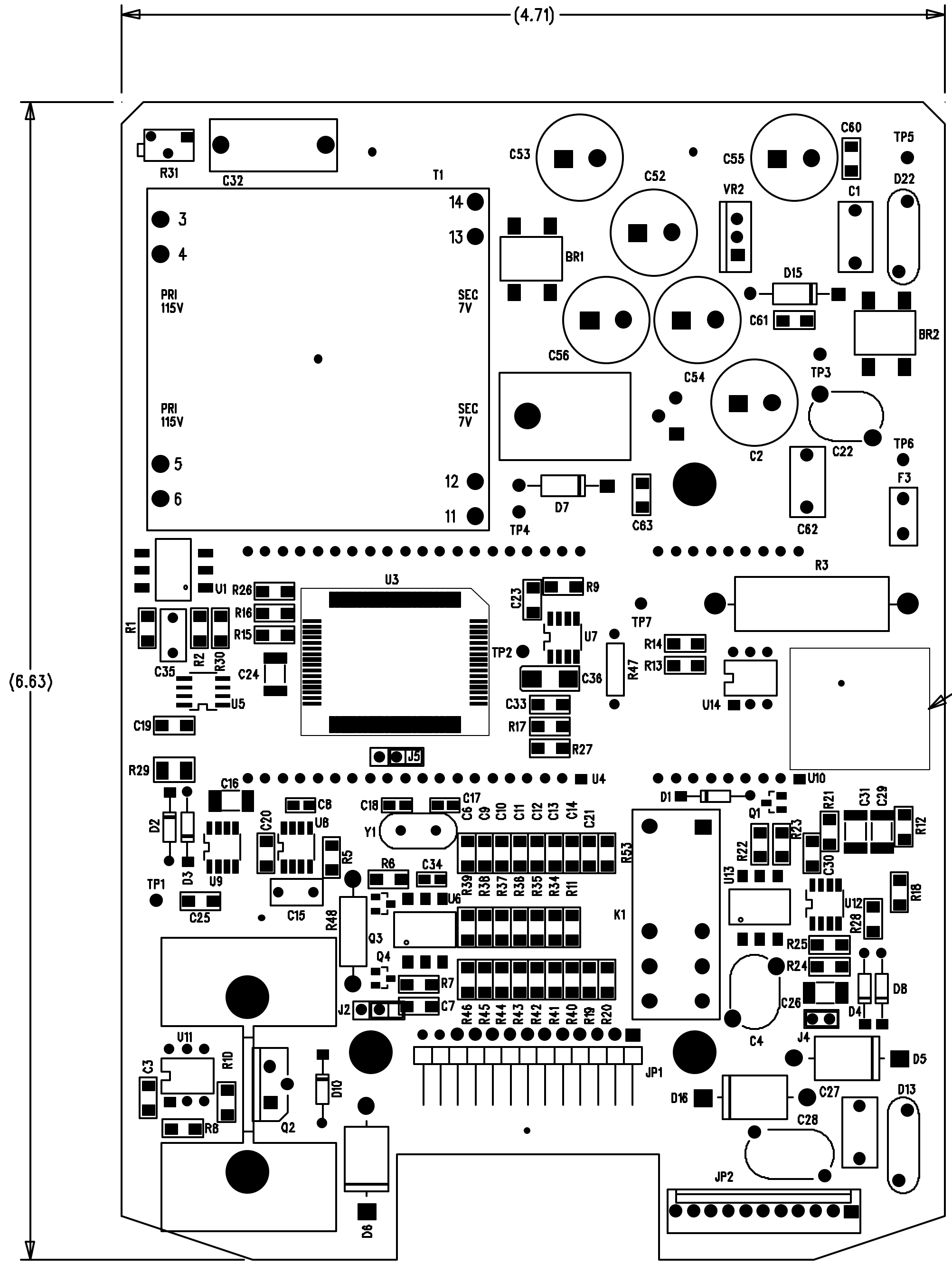
LAST USED REFERENCES	
C63	
D22	
JF2	
K1	
Q4	
R53	
U14	
Y1	



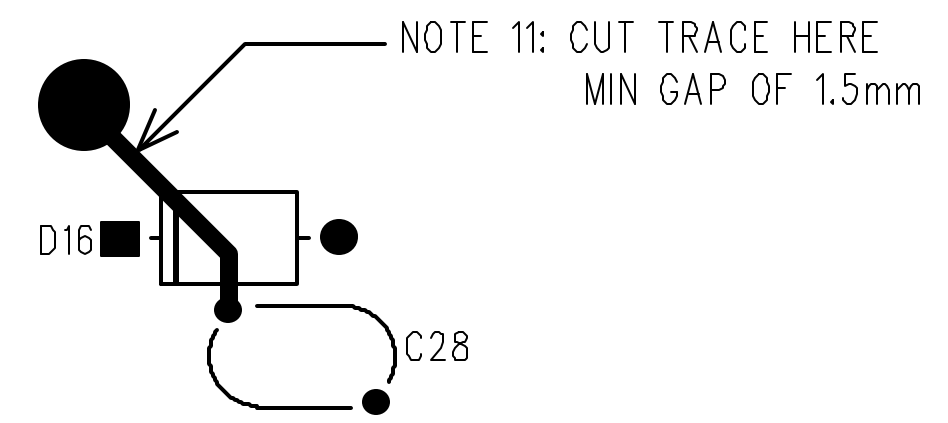
REVISIONS						
REV	BY	DATE	ECO	DESCRIPTION	DATE	APPROVED
C	TJS	09-02-98	4451			TJS
0	TJS	11-02-98	4785	RELEASE TO PRODUCTION	11-04-98	TJS
1	TJS	04-23-99	4883		04-23-99	TJS
2	TJS	08-10-99	5103		08-12-99	DMM
3	RAE	02-14-01	5719		02-22-01	RAE
4	AWD	06-08-01	5867	CUT TRACE AS PER NOTE 11	06-08-01	DMM

NOTES: UNLESS OTHERWISE SPECIFIED:

1. WORKMANSHIP TO BE EQUAL TO AND COMPLIANT WITH THE REQUIREMENTS OF IPC-A-610.
2. MARK REVISION AND SERIAL NUMBER AND MANUFACTURER I.D. ON THE COMPONENT SIDE OF THE PCB IN AREA INDICATED.
3. THIS ASSEMBLY CONTAINS ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES; STATIC-FREE HANDLING IS REQUIRED.
4. DESIGNATIONS ARE FOR REFERENCE ONLY AND MAY NOT APPEAR AS SEEN ON ACTUAL ASSEMBLY.
5. DIMENSIONS SHOWN SPECIFY MAXIMUM ENVELOPE LIMITS FOR THE FINISHED ASSEMBLY.
6. ORIENTATION OF POLARIZED CAPACITORS IS DENOTED BY A PLUS (+) SIGN. POLARITY IS IDENTIFIED ON THE PART.
7. INSTALL U4 (ITEM #4) AND 2, 20 PIN SOCKETS (ITEM #92) ONTO THE SOLDER SIDE OF THE PCB.
8. INSTALL U10 (ITEM #7) AND 2, 9 PIN SOCKETS (ITEM #93) ONTO THE SOLDER SIDE OF THE PCB.
9. INSTALL JUMPERS J2 AND J5 ON SINGLE PIN OF HEADER AS SHOWN TO THE RIGHT.
10. INSTALL JUMPER J4 OVER BOTH PINS OF HEADER AS SHOWN TO THE RIGHT.
11. CUT EARTH GROUND TRACE LEADING TO C28 WHERE SHOWN



NOTE 2



COMPONENT SIDE (LAYER 1)

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ± .XX .XXX ±		CONTRACT NO.		CUSTOMER	
		APPROVALS		INTERNATIONAL EQUIPMENT COMPANY	
		DATE		TITLE	
		DRAWN CS # DESIGNNET INC. 09-02-98		ASSEMBLY DRAWING, CL2 DIGITAL TIMER/PWM MOTOR DRIVE	
		CHECKED		SIZE FSCM NO. DWG NO. REV.	
		ISSUED		D 44416 4	
DO NOT SCALE DRAWING				SCALE SHEET 1 OF 1	

BILL OF MATERIALS

Part Number: 44416

Revision Level: 4

Part Number: 44416

Revision Level: 4

<u>Part Number</u>	<u>Description</u>	<u>Part Reference</u>	<u>Qty</u>
ZNR0007-00	DIODE, ZENER, 51V Motorola 1N5260C	D8	1
ZNR0006-00	DIODE,ZENER, 43V Motorola 1N5262C	D4	1
XFR0007-00	TRANSFORMER 14VAC/7VAC CT,5VA TELEMA 70020K	T1	1
WSH0006-00	WASHER,SS,SPLIT LOCK,#4 GENERIC	Q2/5	1
UCN0002-01	MICROCONTROLLER, PROGRAMMED NEC UPD75P308GF	U3	1
TPT0000-00	Test Point Mill-max 2108-2-00-44-00-07-0	TP1 TP2 TP3 TP4 TP5 TP6 TP7	7
SCW0013-00	SCREW,SS,PAN HD,PHIL,#4-40,.38 L GENERIC	Q2/3	1
RLY0019-00	RELAY,DPDT SIEMENS RTE24005	K1	1
RES0143-01	RES,75K,1/8W,5% Dale CRCW1206753J	R26	1
RES0142-01	RES,750,1/8W,1% Dale CRCW12067500F	R5	1
RES0130-01	RES,6.8K,1/8W,5% Dale CRCW1206682J	R6	1
RES0126-01	RES,57.6K,1/8W,1% Dale CRCW12065762F	R28	1
RES0124-01	RES,562K,1/8W,1% Dale CRCW12065623F	R25	1

Part Number: 44416

Revision Level: 4

<u>Part Number</u>	<u>Description</u>	<u>Part Reference</u>	<u>Qty</u>
RES0121-01	RES,560,1/8W,5%	R19 R20	2
	Dale CRCW1206561J		
RES0110-01	RES,47K,1/8w,5%,1206	R14 R40 R41 R42 R43 R44 R45 R46	8
	AVX CRCW1206473J		
RES0108-01	RES,470K,1/8W,5%	R13	1
	Dale CRCW12064703J		
RES0105-00	RES,470,1/8W,5%,CF	R10	1
	AVX CRCW1206471J		
RES0098-01	RES,4.7K,1/8W,5%	R17 R24 R27	3
	Dale CRCW1206472J		
RES0078-01	RES,270K,1/8W,5%,1206	R11 R34 R35 R36 R37 R38 R39	7
	Dale CRCW1206274J		
RES0071-01	RES,220OHMS,1/8W, 5%	R2	1
	Dale CRCW1206221J		
RES0069-01	RES,22.1K,1/8W,1%	R8	1
	Dale CRCW12062212F		
RES0067-01	RES,200K,1/8W,1%, 1206	R12	1
	Dale CRCW12062003F		
RES0061-01	RES,2.87K,1/8W,1%	R21	1
	Dale CRCW12062871F		
RES0056-01	RES,2.2K,1/8W,5%	R7	1
	Dale CRCW1206222JRT1		
RES0053-01	RES,1M,1/8W,5%	R30	1
	Dale CRCW1206105J		
RES0049-01	RES,1K,1/8W,5%,1206	R53	1
	Dale CRCW1206102JRT1		

Part Number: 44416
Revision Level: 4

<u>Part Number</u>	<u>Description</u>	<u>Part Reference</u>	<u>Qty</u>
RES0032-01	RES,130K,1/4W,1% Dale CRCW12101303F	R29	1
RES0025-01	RES,10K,1/8W,1% Dale CRCW12061002F	R1 R9 R18 R22 R23	5
RES0020-00	RES,WIREWOUND,10K,5W,1% Clarostat SC5E-10K	R3	1
RES0014-01	RES,100K,1/8W,5% Dale CRCW1206104J	R15 R16	2
RES0012-00	RES,CC,100,1/4W,5% GENERIC	R48	1
RES0008-01	RES, 10, 1/4W, 5% Dale CRCW1210100JRT1	R47	1
REG0004-00	REGULATOR, 12V, 1A National LM340T-12.0	VR2	1
REG0000-00	VOLTAGE REGULATOR, 5V National LM340T-5.0	VR1	1
REF44417	PC BD, MACHINED	REF1	1
REF35616	TEST FIXTURE& PROCEDURE,PC BD	REF3	1
REF10895	SCHEMATIC, DIGITAL TIMER	REF2	1
RCT0011-00	DIODE,FAST RECOVERY,400V,3A Diodes Inc FR304	D5 D6 D16	3
RCT0001-01	DIODE BRIDGE, 1A, 400V Diodes Inc DF04S	BR1 BR2	2

Part Number: 44416

Revision Level: 4

<u>Part Number</u>	<u>Description</u>	<u>Part Reference</u>	<u>Qty</u>
POT0001-00	RES,POT,10 TURN,50K Bourns 3266X-1-503	R31	1
OPT0010-00	IC,OPTOCOUPLER,LOGIC OUT QT Opto H11L2	U11	1
OPT0009-00	IC,OPTOCOUPLER,TRANS OUT ISOCOM H11A1S	U1 U6 U13	3
OPT0005-00	IC,OPTO-ISOL,AC SWITCH Motorola H11AA1	U14	1
NUT0003-00	NUT,SS,#4-40 GENERIC	Q2/4	1
MOV0003-00	VARISTOR SUPPRESSOR, 150V EDAL 150LA5	D13 D22	2
LED0017-00	LCD DISPLAY,2 DIGIT VL Electronics VI-201-DP-RC-S	U10	1
LED0014-00	LCD DISPLAY,4 DIGIT VL Electronics VI-422-DP-RC-S	U4	1
ICD0028-01	IC,TIMER,CMOS,SURFACE MOUNT PHILIPS ICM7555CD	U8 U9	2
ICA0024-01	IC,D-to-A CONVERT W/V OUTPUT Linear Tech LTC1451CS8	U5	1
ICA0023-00	IC,DUAL COMPARATOR,SMT SAMSUNG KA2903D-TF	U12	1
ICA0021-00	IC,SUPPLY MONITOR W/WATCHDOG Maxim MAX699CPA	U7	1
HSK0011-00	HEAT SINK,1.0 IN,VERTICAL MNT THERMALLOY 6296B	Q2/6	1

Part Number: 44416

Revision Level: 4

<u>Part Number</u>	<u>Description</u>	<u>Part Reference</u>	<u>Qty</u>
HSK0006-00	HEATSINK, TO-220 CLIP-ON AAVID 576802 B03100	VR1/1	1
HDW0008-00	SIL PAD BERGQUIST 200-30MAC-54	Q2/2	1
HDW0007-00	BUSHING, NYLON RAF 5624-T-136-033-115	Q2/1	1
FUS0020-00	FUSE HOLDER, TE5 WICKMANN 19562	F3/1	1
FUS0019-00	FUSE, 160mA, 125V, SLO BLO, TE5 WICKMANN 396-0160-44	F3	1
FET0009-00	MOSFET, N CHANNEL, 100V SUPERTEX VN2110K1	Q1	1
FET0004-01	MOSFET, N CHANNEL Diodes Inc IRF740	Q2	1
DIO0011-00	DIODE, 1A, 200V GI 1N4002	D7 D15	2
DIO0005-00	DIODE, SIGNAL, 75V, 500mW Diodes Inc 1N4148	D1 D2 D3	3
CRY0003-00	CRYSTAL, 4.194304 MHz ECS, Inc. 42-12-4	Y1	1
CON0077-00	SOCKET, STRAIGHT MILLMAX 310-93-120-41-001	U4/1 U4/2	2
CON0049-00	SOCKET, STRAIGHT MILLMAX 310-93-109-41-001	U10/1 U10/2	2
CON0039-00	CONNECTOR, 2 PIN, 0.100". VERT. CENTURY C10B0021	J2 J4 J5	3

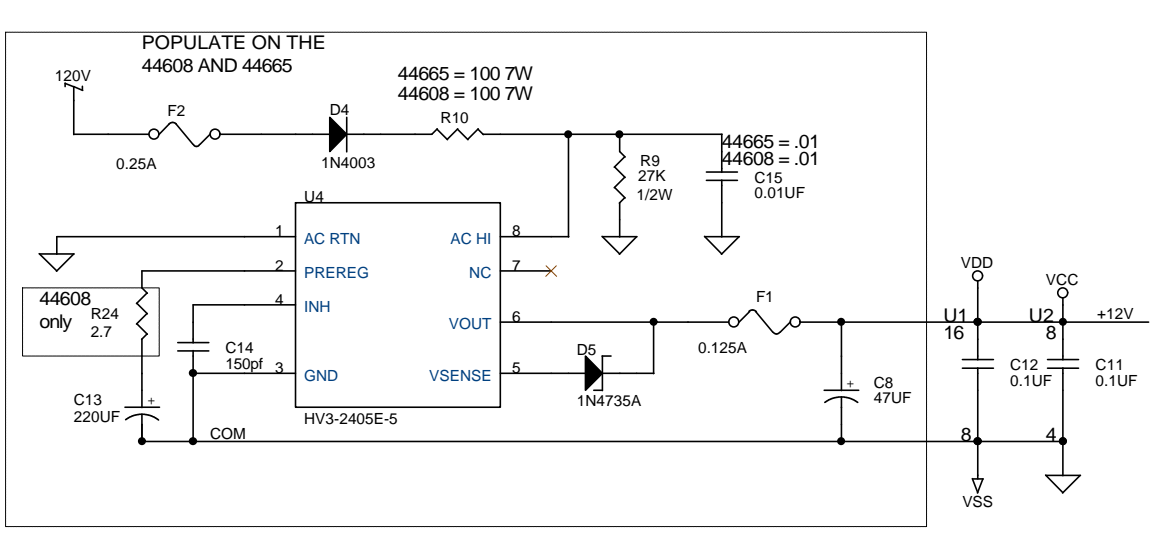
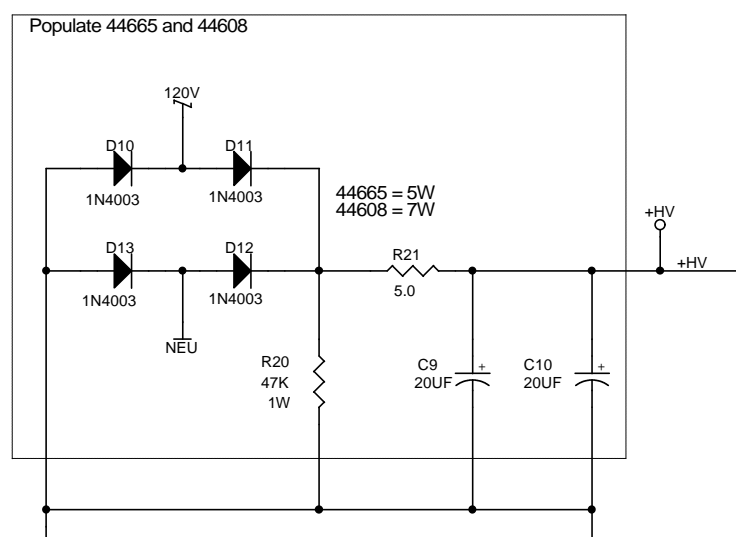
Part Number: 44416

Revision Level: 4

<u>Part Number</u>	<u>Description</u>	<u>Part Reference</u>	<u>Qty</u>
CON0038-00	HEADER,11 PIN,LOCKING Molex 22-23-2111	JP2	1
CON0037-00	HEADER,13 PIN 3M 2340-5211TG	JP1	1
CAP0115-00	TANT,33UF,10V,20% AVX CWR09FC336M	C36	1
CAP0114-00	CER. 0805 CHIP,0.01uF,50V Kemet CO805C103K5RAC	C8 C34	2
CAP0106-00	0.1uF,50V Kemet C1206C104K5RAC	C3 C6 C7 C9 C10 C11 C12 C13 C14 C19 C20 C21 C23 C25 C30 C33 C60 C61 C63	19
CAP0091-00	FLM,0.01uF, 50V, 5% Panasonic ECQ-V1H103JL	C35	1
CAP0090-00	FILM,0.1uF,5% Panasonic ECQ-V1H104JL	C15	1
CAP0088-00	FILM,1UF,250V Panasonic ECQ-E2105KF	C32	1
CAP0073-00	FILM, 0.1UF,250V Panasonic ECQ-E2104KF	C1 C27 C62	3
CAP0063-00	MONO-CER,1UF,50V NIC 1812Z5U105M50TR	C24 C26 C29 C31	4
CAP0062-00	MONO CER,22pF,50V Kemet C1206C220K5GAC	C17 C18	2
CAP0061-00	MONO, 0.010uF, 5%,50V NIC NMC1812NPO103J50	C16	1
CAP0030-00	ELECTROLYTIC,470UF,50V Panasonic ECE-A1HGE-471	C53	1

Part Number: 44416
Revision Level: 4

<u>Part Number</u>	<u>Description</u>	<u>Part Reference</u>	<u>Qty</u>
CAP0029-00	ELECT,2200uF,10V Panasonic ECE-A1AGE-222	C54	1
CAP0028-00	ELECT,1000uF,25V Panasonic ECE-A1EGE-102	C52 C55	2
CAP0004-00	'Y'TYPE,1500pF Panasonic ECK-DNS152ME	C4 C22	2
BJT0004-01	TRANSISTOR, NPN Motorola MMBT4401L	Q3	1
BJT0000-01	TRANSISTOR, PNP Diodes Inc MMBT4403LT1	Q4	1

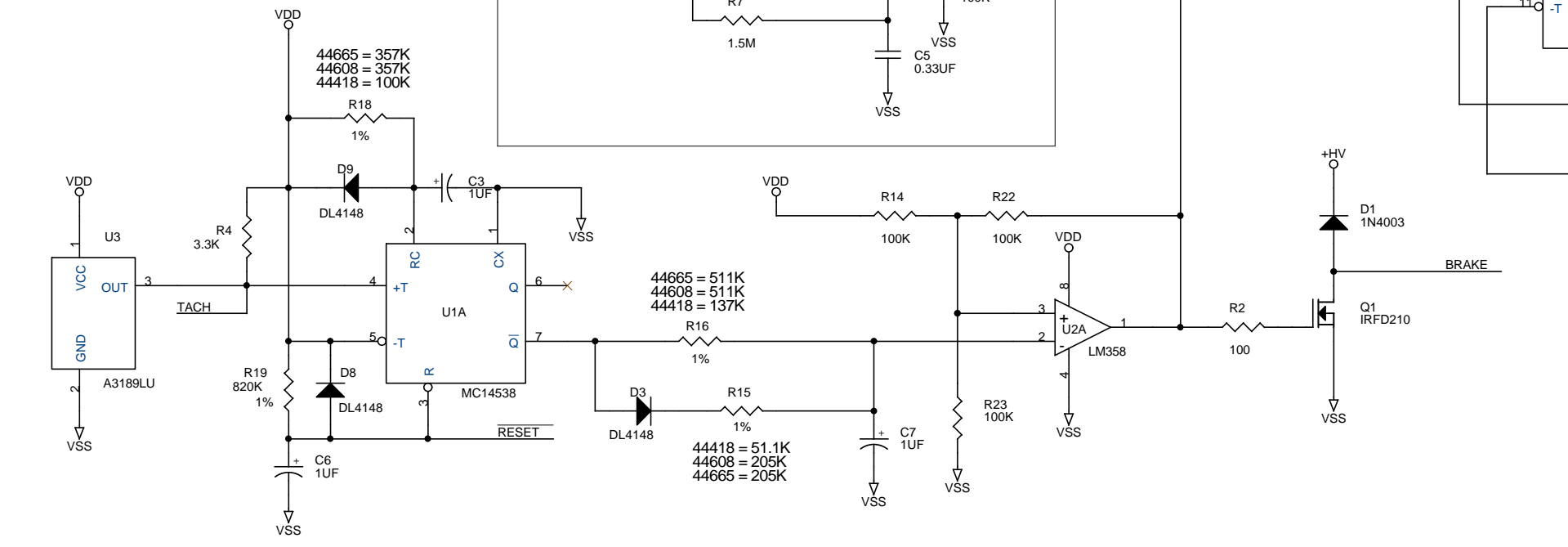
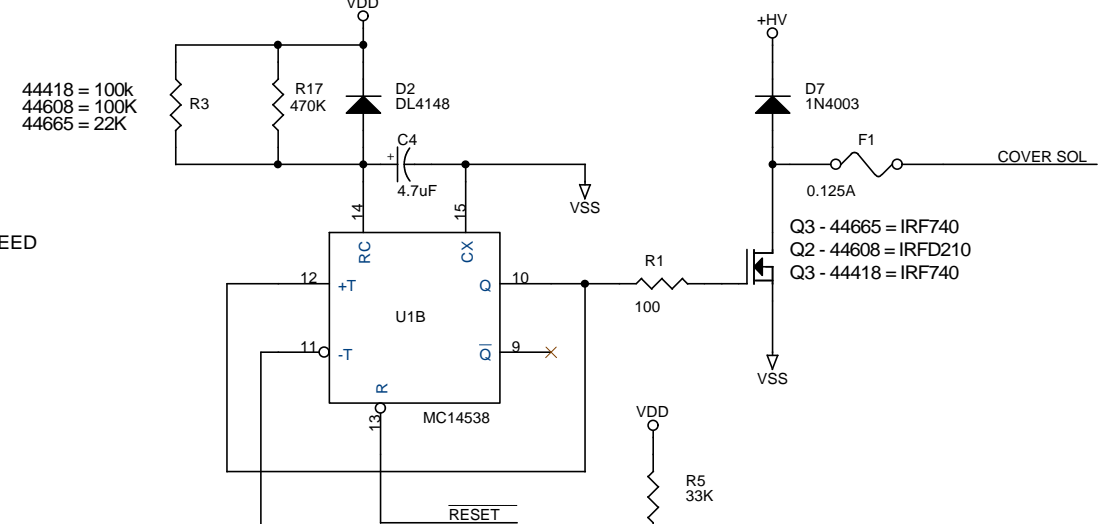
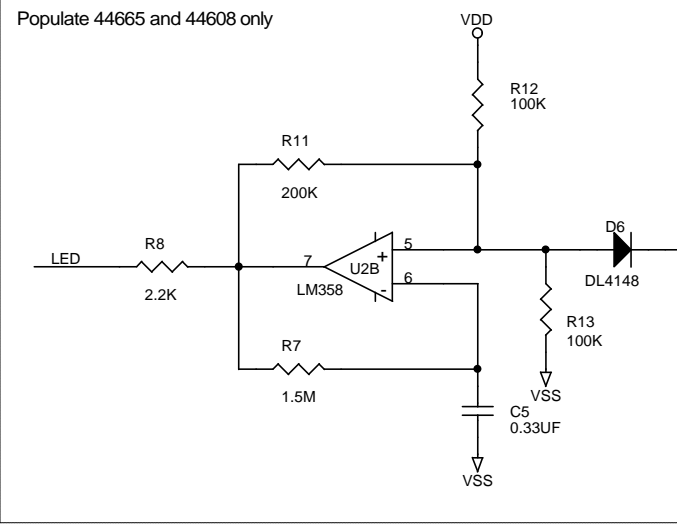
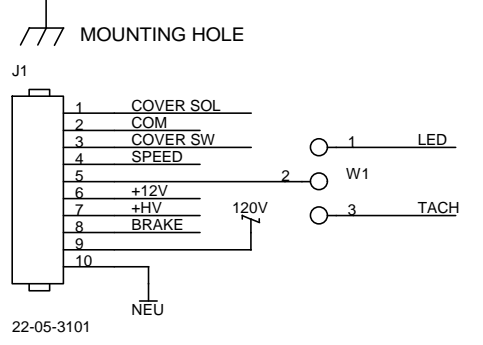


ASSY KEY

Model	ASSY
CL2	44418
Medispin	44608
Centra B+	44665

REVISIONS

REV	BY	ECO	APPD	DATE
0	JAB		JAB	11/29/95
1	DMM	3888	DMM	2/25/97
2	DMM	4103	DMM	7/7/97
3	DMM	4625	DMM/CM	10/08/98
4	TJS	4785	TJS	11/04/98
5	RAE	5236	DMM	1/10/00
6	RAE	5277	RAE	2/25/00
7	RAE	5316	RAE	3/13/00
8	RAE	5717	RAE	3/01/01



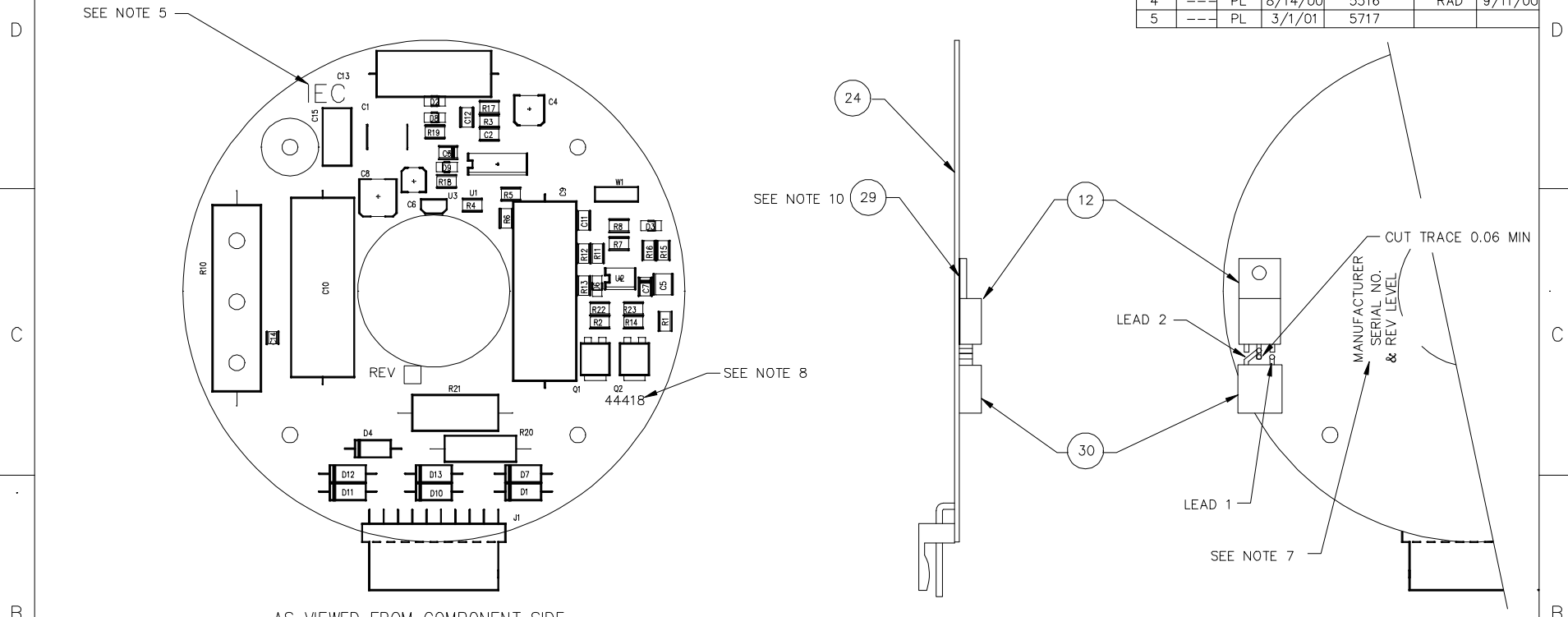
MISC HARDWARE

10875	44453
2 mils	50458

<Core Design>
ThermoIEC
 300 SECOND AVE
 Needham Heights, MA 02494.
 Title: SCHEMATIC, INTERLOCK CONTROL BD, NEW 12V
 Size: Document Number 10875 Rev 8
 Date: Tuesday, February 13, 2001 Sheet 1 of 1

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REVISIONS						
REV	ZONE	BY	DATE	ECO	APP'D	DATE
1	---	PL	10/29/99	5185	RE	12/14/99
2	---	PL	12/30/99	5236	DM	1/10/00
3	---	PL	2/15/00	5277	RAE	2/25/00
4	---	PL	8/14/00	5516	RAD	9/11/00
5	---	PL	3/1/01	5717		



AS VIEWED FROM COMPONENT SIDE

NOTES:

1. WORKMANSHIP TO BE EQUAL TO AND COMPLIANT WITH THE REQUIREMENTS OF IPC-A-600.
- 2.
3. THIS ASSEMBLY CONTAINS ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES; STATIC-FREE HANDLING IS REQUIRED.
4. DESIGNATIONS ARE FOR REFERENCE ONLY AND MAY NOT APPEAR AS SEEN ON ACTUAL ASSEMBLY.
5. IEC LOGO TO BE LOCATED AS SHOWN.
6. ORIENTATION OF POLARIZED CAPACITORS IS DENOTED BY A PLUS (+) SIGN. POLARITY IS IDENTIFIED ON THE PART.
7. PLACE MANUFACTURER AND SERIAL NUMBER AND REV LEVEL APPROX. WHERE SHOWN.
8. MARK BOARD PART NUMBER WHERE SHOWN.
9. ARTWORK NUMBER IS 44453.
10. ITEM 12 TO BE ASSEMBLED FLAT ON PCB (ITEM 24) WITH KAPTON TAPE (ITEM 29) TO COVER ENTIRE AREA OF ITEM 12 THAT IS IN CONTACT WITH PCB (ITEM 24).
11. PREFORM ITEM 30 LEADS AS INDICATED. CUT TRACE BETWEEN THRU HOLES AS INDICATED. LEAD #1 OF ITEM 30 PENETRATES THE THRU HOLE INDICATED. LEAD #2 CAN SOLDER DIRECTLY TO LEAD #2 OF ITEM 12.

		MATERIAL:	PARTS LIST. SEE PL:	
		SEE NOTE 9	INTERNATIONAL EQUIPMENT CO.	
		FINISH:	TITLE:	
		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHS. DIMENSIONS ARE AFTER FINISH. REMOVE ALL BURRS & SHARP EDGES. SURFACE QUALITY ✓	ASSY PCB INTERLOCK	
NEXT ASSY USED ON		SIZE:	CODE ID. NO.	DRAWING NO.
APPLICATION		C	44418	5
DRAWN	BY	DATE	REV.	
CHECKED	PL	11/3/98	44418 5	
APPROVED			SCALE: 2=1	
		TOLERANCES	SHEET 1 OF 1	
		2 PLACE DEC. 3 PLACE DEC. ANGLES		
		±.02 ±.005 ±1/2		

BILL OF MATERIALS

Part Number: 44418

Revision Level: 7

Part Number: 44418
Revision Level: 7

<u>Part Number</u>	<u>Description</u>	<u>Part Reference</u>	<u>Qty</u>
WIR0005-00	JUMPER,INSULATED	W1	1
RES0145-01	RES,CC,820K,1/4W,5% GENERIC	R19	1
RES0117-01	RES,CF,51.1K,1/4W,1% GENERIC	R15	1
RES0107-01	RES,CC,470K,1/4W,5% GENERIC	R17	1
RES0090-01	RES,CC,33K,1/4W,5% GENERIC	R5	1
RES0084-01	RES,CC,3.3K,1/4W,5% GENERIC	R4 R6	2
RES0034-00	RES,CF,137K,1/4W,1% GENERIC	R16	1
RES0022-01	RES 10K Dale CRCW1206103JRT1	R26	1
RES0015-01	RES,CC,100K,1/4W,5% GENERIC	R3 R13 R14 R22 R23	5
RES0015-00	RES,CF,100K,1/4W,1% GENERIC	R18	1
RES0012-01	RES,CC,100,1/4W,5% GENERIC	R1 R2	2
RES0007-01	RES,CC,1.5M,1/4W,5% GENERIC	R7	1
REF50458	TEST FIXTURE/PROCEDURE	REF2	1

Part Number: 44418

Revision Level: 7

<u>Part Number</u>	<u>Description</u>	<u>Part Reference</u>	<u>Qty</u>
REF10875	SCHEMATIC,PC BD	REF1	1
RCT0044-00	RECTIFIER, SMT 400V 1A FAST RECOVERY Vishay DL 4936-13	D7	1
RCT0043-00	RECTIFIER, SMT 200V 1A Vishay DL 4003-13	D1	1
ICD0063-00	IC,CMOS,DUAL,MULTIVIBRATOR,SMT NS PKG TI CD14538B NS	U1	1
ICA0018-01	IC,OP-AMP,DUAL,SINGLE SUPPLY National LM358AMX	U2	1
ICA0017-00	IC,HALL EFFECT,LATCHING ALLEGRO A3189LU	U3	1
HDW0003-00	CONFORMAL COATING CHEMTRONICS Konform SR 2000	MISC1	1
FUS0039-00	Fuse,1A,125V,TIME-LAG, 396 SERIES WICKMANN WK4448BK-ND	F2	1
FUS0037-00	FUSE HOLDER, TE5 SMT WICKMANN WK0010CT-ND	F1	1
FET0019-00	MOSFET, N-CHNL,5.2A,200V Vgs=5V IR IRL620S	Q1 Q3	2
FET0000-01	N-CHANNEL, 60V, 800mA Motorola 2N7002	Q4	1
DIO0012-00	DIODE,SIGNAL Motorola DL4148	D2 D3 D8 D9	4
CON0000-00	HEADER,PC MNT,10 PIN,RGHT ANG Molex 22-05-3101	J1	1

Part Number: 44418
Revision Level: 7

<u>Part Number</u>	<u>Description</u>	<u>Part Reference</u>	<u>Qty</u>
CAP0211-00	CAP TYPE-Y1,1000pF,250VAC Panasonic ECK-DNA102ME	C11	1
CAP0188-00	CAP 4.7uF,50V Nichicon UVX1H4R716B	C4	1
CAP0113-00	CAP TANT,1UF,16V Kemet T491A105K016	C3 C7	2
CAP0106-00	CAP 0.1uF,50V Kemet C1206C104K5RAC	C1 C17 C18	3
CAP0059-00	CAP MONO CER,0.1UF,50V AVX 12065C104KAT	C2	1
CAP0027-00	CAP ELECT,1UF,50V Calchip 6ACE1R0M50V4X5.5	C6	1
44461	ARTWORK,PC BD	PCB1	1