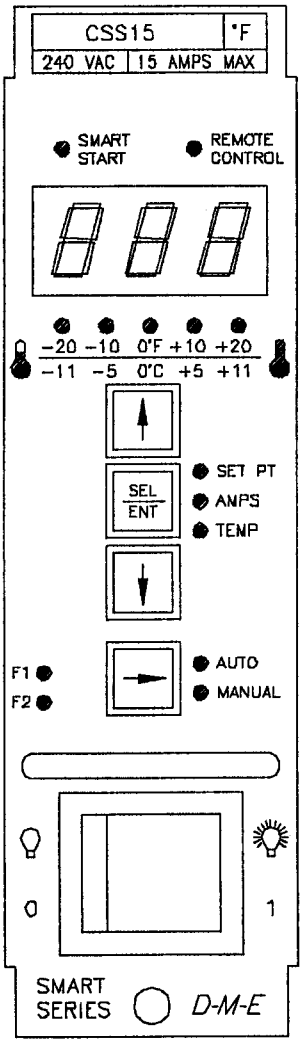
Smart Series®
CSS-15 & CSS-30



Microprocessor-Based Temperature Control Module With Digital Display

User's Manual

D-M-E Company

D-M-E Standard Smart Series® Microprocessor-Based Temperature Control Modules with Digital Display CSS-15 (15 AMP) & CSS-30 (30 AMP)

GENERAL DESCRIPTION

The CSS-15 Communications Smart Series® module provides the molder with the first fully comprehensive temperature control module. This microprocessor based unit incorporates the most complete list of control features while providing full communications capability with a D-M-E® CIM (Computer Interface Module).

The CSS® module is compatible with D-M-E's previous G-Series® Systems.* While the CSS module was designed with computer integrated manufacturing in mind it also provides the highest level of performance as a stand-alone module. When operating independently the CSS offers these features: A multi-function display, advanced diagnostics, improved control and a new patented interactive Smart Start®. A set-point memory feature also allow the user to power up the module with the same setpoint as the day before.

*Main Frames only.

The advanced diagnostics will automatically alert the user to unusual fault conditions. This is done by multiplexing the following fault codes with the normal display in three second intervals: Shorted Thermocouple: Shi , Open Triac: oPO, Reversed Thermocouple: bci, Shorted Triac: ShO, Open Thermocouple: oPi, Ground Fault: GFI, Over and under temperature warnings are indicated by flashing LED's directly under the display.

With its unique Smart Start® function, the CSS® has the ability to dry out a heater which may have acquired moisture inside its case. Smart Start automatically applies low voltage to the heater after initial start-up. If a ground leakage is sensed, the module will go into a bake-out procedure which drives moisture from the heater.

When the Smart Start® bake-out function is in operation, the unit is monitored for leakage current. If the ground fault current becomes excessive, the module inhibits output power to the heater and signals a ground fault interrupt. When necessary, the module automatically repeats the bake-out procedure for a maximum of ten minutes. If at any time during the bake-out procedure the leakage current falls within acceptable limits, the module will automatically switch to normal operation.

OPERATION:

Automatic Mode: The microprocessor maintains temperature using a closed loop PID control method. Closed loop means the unit continuously looks at the process temperature to determine whether or not to adjust the power delivered to the heater. With PID control, it anticipates the system characteristics to make accurate adjustments and correct for errors.

Manual Mode: For open thermocouple or thermocouple failure, open loop-percent power is used. In manual mode, the microprocessor maintains a power level using an open loop power control method. Open loop means the process temperature is not used to determine whether or not adjustments should be made. This enables the user to continue production and override thermocouple wire breaks, short circuits, or lead reversal until the problem has been resolved. Manual mode overrides thermocouple break protection, reversed thermocouple, and any normal modes.

Smart Start®: Smart Start is automatic on start-up in the auto mode, and provides the application of low voltage for heater bake out. Smart Start® is completed upon detecting that the heater is dried out, to a maximum of nine minutes.

Power-Up: Upon power-up, the unit retains the same set point and operation mode as when the unit was turned off.

Input Fault: Thermocouple break protection, and shorted or reversed thermocouple all override Smart Start® and normal modes. Output is inhibited.

CSS® COMMUNICATIONS:

The DME® CSS® module has the capability to communicate with a DME® CIM module. The CIM module enhances the product from a manufacturing, quality control and management perspective. This combination of CSS/CIM association allows the user a platform designed specifically for runnerless molding systems. Any DME® mainframe that has a communications strip installed can utilize the extra built-in features of a CSS module. When the CSS module is used in conjunction with a DME CIM module communication between modules and a personal computer (IBM or compatible) or molding machine are made possible. This combination of state-of-the-art temperature controllers enables the user to remotely monitor and control up to 8 CSS/CIM systems each containing up to 63 CSS modules each. Using the software provided, the user can set setpoint temperatures and monitor on-line conditions of any system at any time all from a single remote location. It can also remotely alarm the user of certain diagnostic fault conditions that may exist while on-line. For example: open or shorted or reversed thermocouple, ground-fault detection, open or shorted triac (output device). It can also monitor the % power, current, process temperature and setpoint temperature of any CSS module

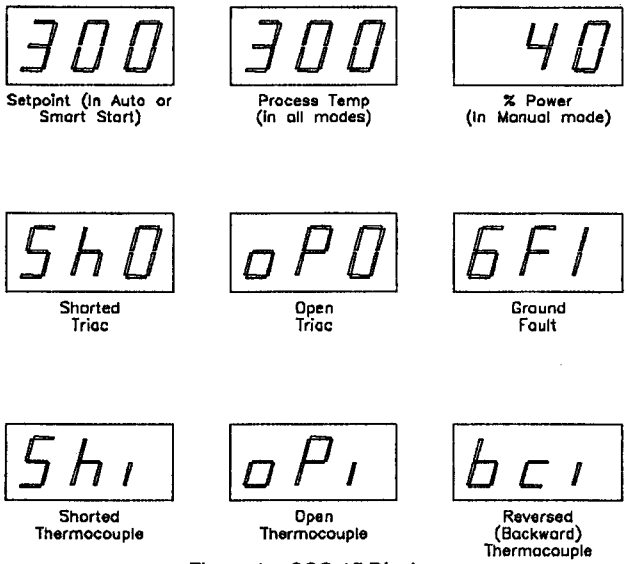


Figure 1. - CSS-15 Display

in any given system. The CIM communicates to a molding machine via a software protocol called SPI-3.01, which has been adopted by the Society of Plastic Industry and is now considered the standard protocol for the plastic molding industry in the USA.

The CSS® controller modules can control temperatures without any communications or CIM module preset. The CSS has its own microprocessor, which tunes the PID control algorithm with parameters designed for the characteristics of plastics processing. It also has the ability to run diagnostics on the heater, which includes our Smart Start® heater moisture dry-out routine. The diagnostics also places the heater output in the safest mode, as well as alerting the molder to the problem. This module plugs into a DME® mainframe that has a communication strip installed and enables the CSS modules to communicate with a DME CIM module. The CIM module then communicates with a personal computer or molding machine in one of three different communications methods; RS-232, RS-422, or RS-485. DME recommends the use of RS-485 as the most secure method for communication.

The CSS/CIM communicates on a DME® mainframe equipped with a communications strip (e.g., part number MFPC-XX-G... the "C" stands for communications strip installed). You will also need one CIM-10-G module for each main frame. If the main frame is a stack frame, such as MFPC-24-G, it has two frame units wired together as one, then only one CIM module is required.

DIAGNOSTICS: (See figure 1)

The CSS® diagnostics automatically alert the user to a fault condition.

- Shorted thermocouple displays flashing **Shi** in the auto mode (output inhibited), or is on steady in the manual mode.

  - **Troubleshooting-** Check for damage to the thermocouple lead wire. Also, check for bare, twisted or pinched leads. Excessive distance between heaters and thermocouples or excessive interaction between neighboring manifold zones may trigger this diagnostic also, as could undersized heaters.

- Open thermocouple indicated by **oPi** flashing while in the auto mode (output inhibited), or on steady in the manual mode.

  - **Troubleshooting-** Check the thermocouple connections and wires for broken leads or check for damage to the sensor.

- Reversed thermocouple displays flashing **bci** while in the auto mode (output inhibited), or on steady in the manual mode.

  - **Troubleshooting-** Check thermocouple wiring for reversed leads.

- Shorted triac warning is indicated by **ShO** flashing while in auto mode.

  - **Troubleshooting-** Check triac for short or replace.

- Open output is indicated by **oPO** flashing while in auto mode.

  - **Troubleshooting-** Check heater wiring for open connections. Check for defective heater. Check for defective triac (open) device.

- Excessive heater current flowing to ground is indicated by **GFI** flashing in auto mode.

  - **Troubleshooting-** Replace damp heater. Check for possible problems with deteriorating wire insulation or moisture in wire channels.

- Over/Under temperature. The red deviation LED on the left, flashes when the process temperature is below set point by 40°F or more. The red deviation LED on the right flashes when the process is above set point by 40°F or more.

  - **Troubleshooting-** Check for:

    Under temperature;
    heater failure, low line voltage, t/c problem.
    Over temperature;
    output failure, shorted triac, interacting zones.

FEATURES:

- Fully self-tuning, microprocessor-based PID control
- Selective cycle® power drive for reliable and precise control
- Zero crossing triac triggering for minimum RFI
- Patented, closed loop low voltage Smart Start® to prolong heater life
- Process temperature readout operational even in manual mode as long as thermocouple (T/C) is intact
- Automatic T/C break protection and cold junction compensation
- High impedance potentiometric input allows long distance T/C wiring
- 100% solid state circuitry, no mechanical relays
- Completely self contained, no external output devices or power supplies required
- Fast acting fuses, or circuit breaker in the CSS-30, are provided on both sides of the AC line
- Electrically isolated with grounded front panel for operator safety
- Plug in design for module interchangeability
- Compatible with all 10 and 15 amp G-Series® and Smart Start® Main Frames. The CSS-30 is compatible with G-Series® and Smart Series® High Power Mainframes.

FRONT PANEL CONTROLS AND INDICATORS: (See figure 2)

1. DIGITAL LED DISPLAY: Indicates setpoint temp, percent power, process temp, load current, and fault conditions.

2. TEMPERATURE DEVIATION INDICATORS: Show deviation from setpoint.

3. SMART START® LIGHT: Indicates Smart Start® is on.

4. REMOTE CONTROL LIGHT: Indicates control is from a remote computer or molding machine.

5. UP ARROW KEY: Increases the desired setpoint value.

6. DOWN ARROW KEY: Decreases the desired setpoint value.

7. SELECT/ENTER KEY: Selects either Setpoint (temperature/percent power), Amps (load current) or Process Temperature. After a change has been made in the setpoint value, this key must be depressed to store new value in memory. If not pressed within 10 seconds of changing a value, previous value will be used and new value will be discarded.

8. SETPOINT LIGHT: Indicates Setpoint is on display. Setpoint has been changed but not entered if flashing.

9. AMPS LIGHT: Indicates load current is on display.

10. TEMP LIGHT: Indicates process temperature is on display.

11. SIDE ARROW KEY: Auto/manual select. To disable Smart Start®, depress side arrow key while simultaneously turning the power on. When power to the CSS® is turned off then on, Smart Start® will automatically be reactivated.

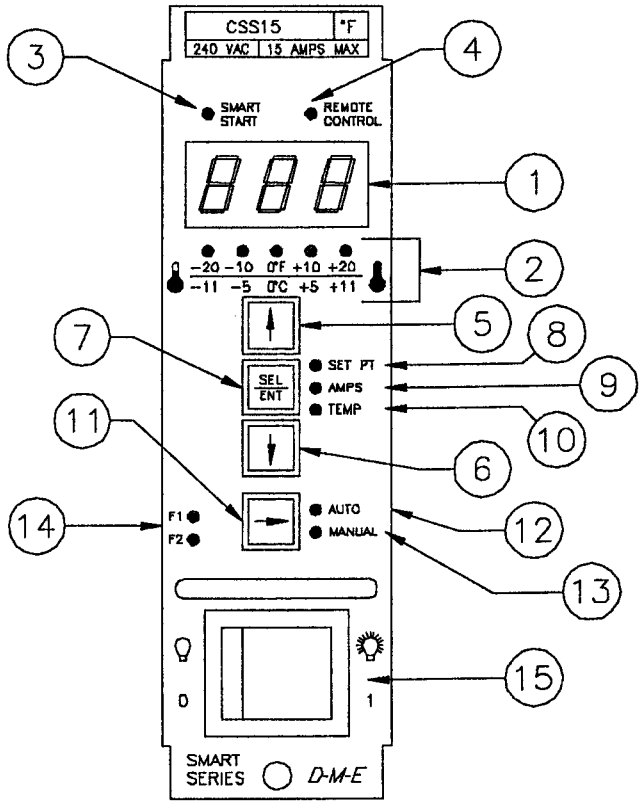


Figure 2. - CSS-15 Module

NOTE: CSS-30 is twice as wide as above; has circuit breaker instead of items 14 and 15.

12. AUTO LIGHT: Auto mode selected.

13. MANUAL LIGHT: Manual mode selected.

14. F1/F2 LIGHTS: Illuminate when fuse has blown.

15. POWER ON/OFF SWITCH.

PERFORMANCE SPECIFICATIONS:

Auto and Manual Control Modes: Time proportioning/Selective Cycle®

Temperature Range: Ambient to 999°F (537°C)

Control Accuracy: +/-0.5°F (0.5°C) dependent on the total thermal system

Temperature Stability: +/-0.5% of full scale over the ambient range of 32 to 120°F (0 to 50°C)

Calibration Accuracy: Better than 0.2% of full scale

Cycle Time: 0.33 seconds

Power Response Time: 0.010 seconds at 50 Hz 0.083 seconds at 60 Hz

Reset: Automatically corrects reset to no more than + /-2°F (1°C) at all settings

Manual Control: Adjustable from 0-99%. Maintains output power to within 1% of setting using the Selective Cycle® power drive

Advanced Diagnostics Indicators: LEDs and 3-digit, 7-segment display

Smart Start® (SS): Variable voltage steps from 0 to 240 volts repeatable over a 9 minute period. Will escape from this mode if leakage falls below 120 mA limit. If dry out is not required then a fast pass check of voltage is implemented over 30 seconds.

SS Duration: 30 seconds to 9 1/2 minutes

SS Override Temperature: 200°F (93°C)

Operational Mode Priority:

- Ground fault overrides all modes
- SS precedes auto mode
- Shorted output overrides SS and Auto mode
- Thermocouple (T/C) break overrides SS and Auto modes
- Reversed or shorted T/C overrides SS and Auto modes
- Open output overrides SS and Auto modes
- Manual control overrides T/C break, reversed T/C and Auto modes
- The output is inhibited during all fault conditions in the auto mode
- Remote control overrides local control

INPUT SPECIFICATIONS:

Thermocouple (T/C) Sensor: Type "J", grounded or ungrounded

External T/C Resistance: High impedance potentiometric input allows long distance T/C wiring

T/C Isolation: Isolated by control circuit power supply.

Cold Junction Compensation: Automatic, better than 0.02°F/°F(0.01°C/°C)

T/C Break Protection: Automatically inhibits power to heater

Reversed T/C Protection: Automatically inhibits power to heater

Shorted T/C Protection: Automatically inhibits power to heater

Input Type: Potentiometric

Input Impedance: 22 Megohms

Input Protection: Diode clamp, RC filter

Input Amplifier Stability: 0.02°F/°F(0.01°C/°C)

Input Dynamic Range: 1000°F (550°C)

Common Mode Rejection Ratio: Greater than 100 db

Power Supply Rejection Ration: Greater than 90 db

Communication Inputs: Data alliance is optically coupled at 2500 volts isolation

OUTPUT SPECIFICATIONS:

Voltage/Power Capability:
15 AMP: 240 VAC nominal, single phase. 120 VAC available, 3600 watts @240 VAC (1800 watts @120 VAC)
30 AMP: 240 VAC nominal, single phase. 7200 watts @240VAC

Output Drive: Internal solid state triac, triggered by zero AC crossing pulses
Overload Protection:
15 AMP: Fuses are provided on both sides of AC line
30 AMP: Fast acting circuit breaker.

Transient Protection: dv/dt and transient pulse suppression included

Power Line Isolation: Optically and transformer isolated from AC lines. Isolation voltage is greater that 2500 volts

CONTROLS AND INDICATORS:

Auto/Manual Selection: Pushbutton switch toggles mode.

Setpoint Control:
Two buttons up and down, one button used to enter setpoint
Range: 0 to 999°F (0 to 537°C)
Resolution: 1°F (1°C)

Manual (% Power) Control: Two buttons up and down, one button used to enter setpoint Digital display indication Range: 0 to 99%

Auto/Manual Selection: Push button switches with the indicator LED

Power On-Off: 16 amp rocker switch, UL, CSA, VDE approved. On the CSS-30 a 30 amp circuit breaker that is UL, CSA, VDE approved is used.

Process Temp Selection: One push button with one LED indicator. Selected by select/enter push button.

Load Current Selection: One push button with one LED indicator. Selected by select/enter push button.

Multi-function Display: (3) 7-segment LEDs, 0.6 inch digital displays with decimal point used in load current display. Alarm characters also display.

Smart Start® Indicator: LED above display window illuminates

Blown Fuse Indicator: 2 neon indicators.

Shorted Thermocouple (T/C): Digital display (Shi) alternates with normal display

Shorted Output (Triac): Digital display (Shi) alternates with normal display

Open T/C: Digital display (oPi) alternates with normal display

Open Output (Triac): Digital display (oPO) alternates with normal display

Ground Fault: Digital display (6Fi) alternates with normal display

Remote Control Indicator: LED above display window illuminates

Temperature Deviation Indicators: Five separate LEDs:
+/-20°F/11°C=(Red),
+/-10°F/5°C=(Yellow),
0°F/0°C=(Green)

ELECTRICAL POWER SPECIFICATIONS:

Input Voltage: 240/120 VAC +10% -20%

Frequency: 50/60 Hz

DC Power Supplies: Internally generated, regulated and compensated

Module power usage: Less than 5 watts, excluding load

Dimensions:
15 AMP: 2"W x 7"H x 7 1/2"D (5.08 x 17.78 x 19.05cm)
30 AMP: 4"W x 7"H x 7 1/2"D (10.06 x 17.78 x 19.05cm)

NOTE: Standard (240 VAC) modules are compatible with main frames wired for either 240 VAC three phase (standard or 240 VAC single phase)

FUSE REQUIREMENTS: (2) ABC-15 fuses (Note: (2) spare fuses included with module, applies to CSS-15 only)

CALIBRATION PROCEDURE

1. Insert controller into the calibration jig and turn power on.

2. Set the simulation temperature to 200 degrees F.

3. Press the CSS "SEL/ENT" key to select "TEMP".

4. Adjust the OFFSET trimpot, R48, to get 200 degrees on the display.

5. Set the simulation temperature to 800 degrees F.

6. Adjust the GAIN trimpot, R24, to get 800 degrees on the display.

7. Repeat steps 2 thru 6 until no further trimpot adjustment is needed.

8. Turn power off. Thread a # 16 insulated stranded wire through the GFI transformer, T3.

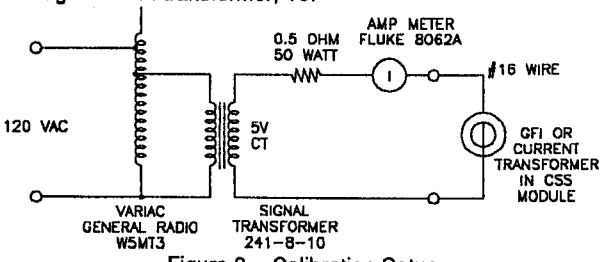


Figure 3. - Calibration Setup

9. Turn power on.

10. Send a variable AC GFI current through the # 16 wire. The CSS should display GFI for a GFI current within the range of 1.5 amp + /-20% (1.2 - 1.8 A). See test current setup diagram below. If GFI is not activated, reduce R14; If GFI is activated below 1.2 A, reduce R15.

11. Turn power off.

12. Thread #16 wire through the current transformer, T2

13. Turn power on. Press "SEL/ENT" key to select "AMPS" display. Adjust simulation temperature to 800 degrees F then to 0 degrees.

14. Send 10 Amps through the # 16 wire. The CSS should display 10.0 + /-0.5 Amp. If the displayed current is too low, reduce R20; if the current is too high, reduce R19.

15. Turn power off and remove from calibration fixture.

RETURN POLICY:

The D-M-E® CSS® modules are warranted for 1 year parts and labor, excluding fuses.

Contact D-M-E Customer Service for return authorization for repairs or warranties. Replacement parts are also available through the Customer Service Department.

D-M-E Customer Service

In U.S., West Coast:	1-213-263-9261
Elsewhere in U.S.:	1-800-626-6653
In Canada:	1-416-677-6370

COMMUNICATION CONNECTOR COMPATIBILITY:

The Communication Connector strip in your mainframe communicates to all the other modules in the rack. If the communications connector in your mainframe has pins 3 & 4 missing, you must order a new communication strip from D-M-E to allow the alarm feature in this module to communicate properly with the TAS-05-02 module. It will not work without these pins installed. This does not affect communication with the CIM module.

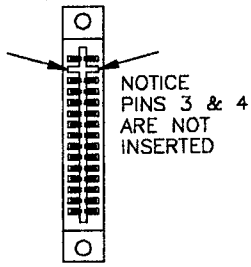


Figure 4. - Communication Connector Not Compatible

SERVICE CENTER U.S.A

D-M-E WORLD HEADQUARTERS
29111STEPHENSONHIGHWAY
MADISON HEIGHTS, MICHIGAN 48071
TELEFAX(313)398-6174

REPLACEMENT PARTS LIST

To meet warranty requirements, use only DME® parts.

Q10, Triac, 40 Amp, 600 Volt, Q6040P	RPM0023
S1, Power Rocker Switch, 16 Amp, 250 VAC	RPM0008
T1, Transformer, 240/120 Volt, DST-4-16	RPM0009
F1, F2, Fuse, 15 Amp, 250 Volt	ABC15
U14, Triac Driver, MCP3021Z	RPM0011
U1, Microprocessor for **15 AMP** modules (DME proprietary software)	CSS0001
U1, Microprocessor for **30 AMP** modules (DME proprietary software)	CSS0002
U9, U10, U11, Optocoupler, 4N26	RPM0012
U8, U13, Operational Amplifier, LM324	RPM0013
U3, Operational Amplifier, OP07	RPM0014

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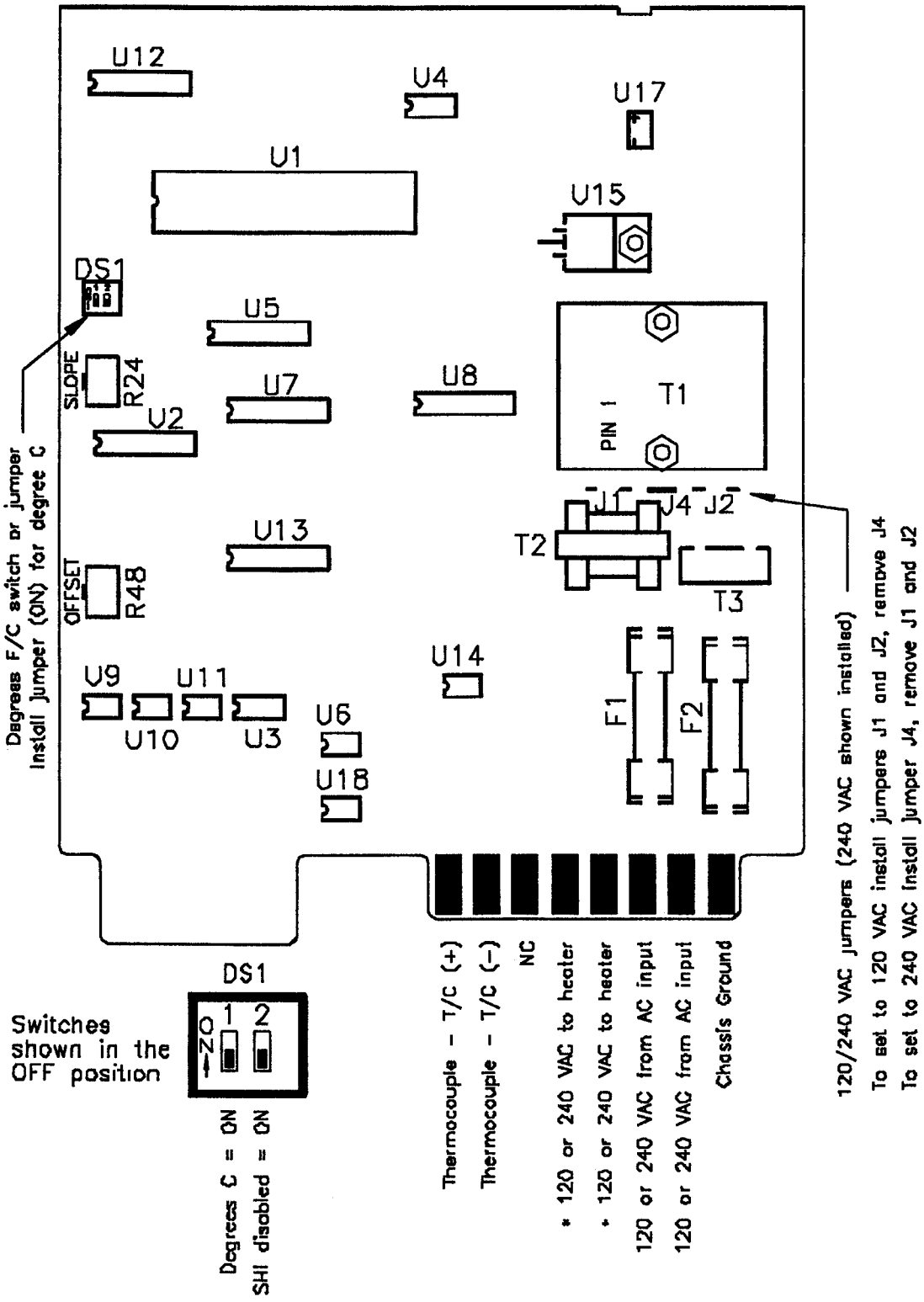

Figure 5. - Component layout, CSS-8 main board

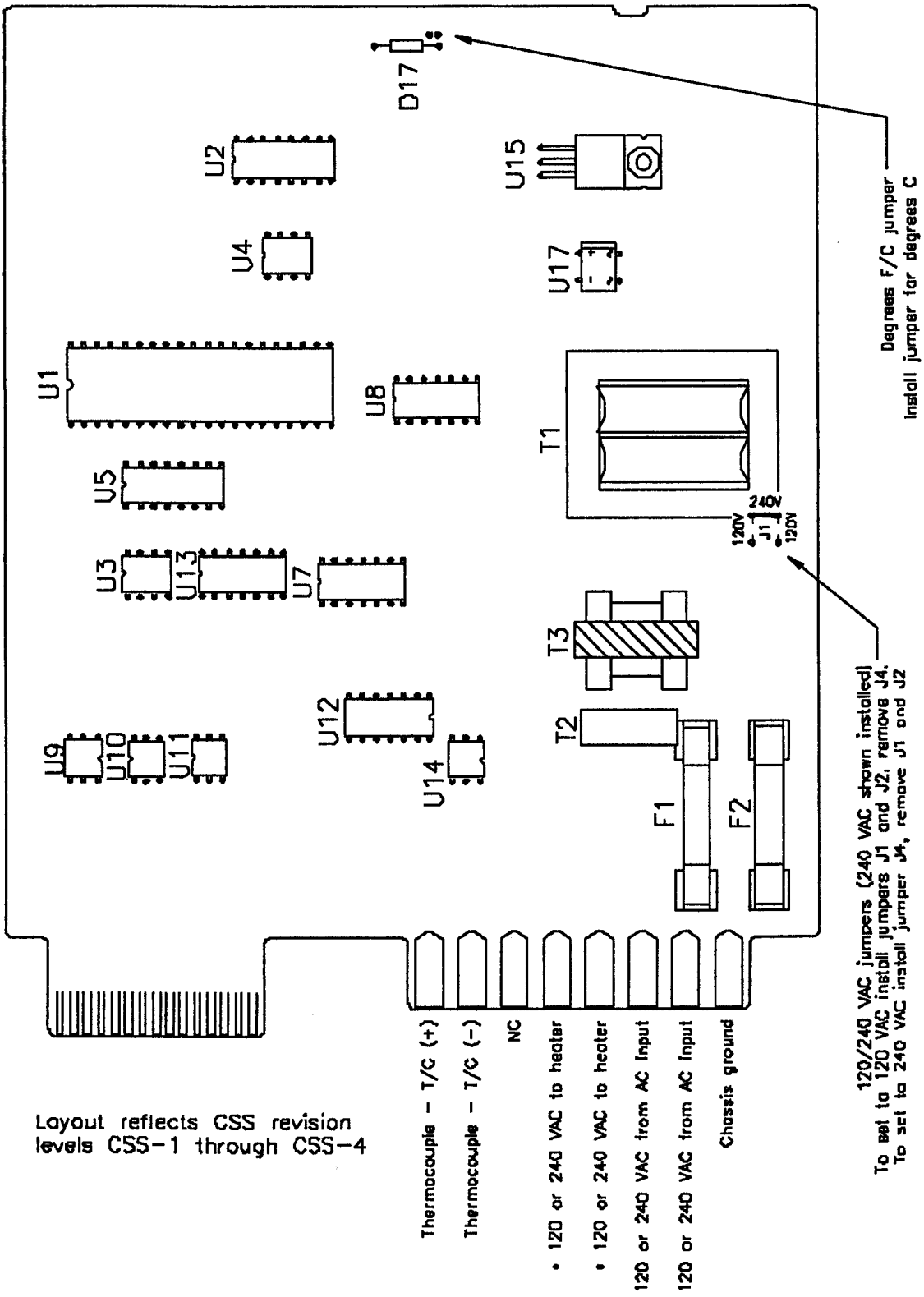

Figure 6. - Component layout, CSS1 - CSS4 main board