S20-D3C

TEMPERATURE CONTROLLER

OPERATING INSTRUCTIONS

Please read these instructions thoroughly before using this instrument.

S20-D3C
TEMPERATURE CONTROL MODULE
Installation, Operation, & Maintenance Manual

ELECTRICAL LOCKOUT:

THE ELECTRICAL POWER SOURCE MUST BE LOCKED OUT WHENEVER ANYONE IS WORKING ON THE EQUIPMENT.

Each maintenance person should have a personal padlock, with only one key. When working on any equipment this person should use the padlock to lock out the electrical controls. It is most important that the only available key for the lock be in the pocket of the person who is working on the temperature control equipment. If other persons work on the same equipment, each should use their own different lock at a separate lockout station for the controls of the equipment. Accidental start up of the equipment, may have tragic results.

In no case should the removal of or work be performed on the temperature control modules or main frames without following proper electrical lockout procedures.

LIFTING APPARATUS:

Temperature control equipment, like any other type of equipment, requires normal periodic maintenance or relocation if the user is to get the most for the investment in the equipment. One of the most flagrant of safety violations is the use of inadequate and unsafe lifting equipment. The temperature control equipment or parts thereof should be assembled, disassembled and moved with lifting facilities that have the capability of gently and slowly lifting and lowering the equipment or various parts.

WHEN USING A CRANE OR FORK LIFT, OPERATE WITHIN ITS RATED CAPACITY, THE SAFE RATED CAPACITY INCLUDES WEIGHT OF HOOKS, BLOCKS, AND ANY OTHER HANDLING DEVICES, SUCH AS CABLES, SLINGS, SPREADER BARS, ETC. CONSIDER THE WEIGHT OF ALL THESE AS PART OF THE LOAD TO BE LIFTED.

WARNING:
When inserting or removing a control module from the main frame, power must be turned off on both the module and main frame. If the module is inserted or removed while under a load, severe damage will result to both the control module and the main frame. Before replacing the module, the main frame must be inspected for damage by a qualified technician. Damage caused to control module and main frame as a result of improper insertion or removal, will not be covered under warranty.

PLANT SAFETY:
The safety procedures mentioned here do not eliminate all safety hazards found in the area of operation. However, they do highlight some procedures that have been found through long experience to improve safety conditions around temperature control systems. International Temperature Control Inc. Welcomes' inquiries about other suggested safety procedures for use around their equipment.

OUT OF SERVICE:
When the system is out of service, both the control module and main frame must be turned off.

INSTALLATION OF MODULE INTO MAIN FRAME:

1. Lockout and tag out power to main frame. Module must be turned off. If module is installed or removed under load, damage to both the main frame and module can result.

2. Slide module into housing zone slot. Make sure it slides into card guides and seats properly into edge card connector on the back of the main frame.

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MODULE DESCRIPTION:

- The S20-D3C Temperature Control Module utilizes microprocessor based circuitry. It has been designed to function in either our standard 15 amp or high power 30 amp main frames
- Working in conjunction with type-J or type-K thermocouples, in either Fahrenheit or Centigrade ranges, the module automatically controls temperature within the mold zone, by comparing actual temperature with power usage and regulating power to maintain a set point temperature.
- The S20-D3C module has a digital LED readout which allows the operator to monitor temperatures, amperage and error codes. The module is also equipped with individual LED displays which indicate current mold operating functions.
- The module can be used as a fully automatic closed loop temperature controller, or as a manual power controller.
- The S20-D3C module incorporates a wide range of diagnostic and protective features.
- The S20-D3C module is noted for its ease of operation and reliable features.
- The S20-D3C is compatible with "G" series main frames.

AUTOMATIC OPERATION:

When used with type-J or type-K thermocouple feedback the S20-D3C module is a fully automatic temperature control instrument. You need only to enter the desired zone operating temperature and turn on the power switch. When power is switched on the module will:

- Automatically switch to the soft start cycle if the zone temperature is below 212 degrees Fahrenheit (100 degrees Celsius) and below set point.
- After approximately 5 minutes or when the mold zone temperature reaches 212 degrees Fahrenheit (100 degrees Celsius), or when the set point is reached, whichever occurs first, the unit will automatically switch to normal operation and begin to bring the temperature to the selected set point temperature.

AUTOMATIC MODE OPERATING PROCEDURE:

- Module must be properly installed in the housing. Heater and thermocouple must be properly connected. (**NOTE:** NEVER REMOVE A MODULE WHILE THE MAIN FRAME IS UNDER POWER).
- Turn on the main frame power switch.
- Turn the **"MANUAL % KNOB"** to the "off" position for automatic operation.
- Turn "on" the **"POWER ON/OFF"** switch located at the bottom of the module.
- If the zone temperature is below 212° F (100° C) and below the set point, the module will automatically go into **"SOFT START"** mode for approximately 5 minutes, or until the mold zone temperature as determined by the thermocouple reaches 212 degrees F (100° C), or the set point temperature is reached. (**Soft Start** can be deactivated by turning the manual knob "on" then "off" within 1 to 1 ½ seconds)
- When the above Soft Start conditions are met, the Soft Start mode ends and the instrument goes into normal operation. Power is applied at a full rate while the temperature is well below set point. As the temperature nears the set point temperature, the control module will automatically begin to adjust the output power to the heater to smoothly bring the zone temperature to the set point temperature. Once the set point temperature is reached, the control module will continue to automatically adjust the output power to constantly maintain the set point temperature. The red load light on the front of the control module allows the operator to monitor power as it is being applied to the heater. When the light is lit, it indicates power is being applied to the heater. A blinking light indicates a modulating of power to the heater.

- To turn off the module, simply switch "off" the **"POWER ON/OFF"** switch.

MANUAL OPERATION:
If thermocouple feedback is not available, the S20-D3C may be operated as a manual power controller.

- Turn on the main frame power switch.
- Turn the **"MANUAL % KNOB"** to the "on" position. This will switch the instrument into the manual control mode.
  Note: When the module is switched from automatic to manual mode, the module will display & maintain the percent of power currently used for a period of two seconds. This bumpless transfer is a guide for setting the percent of power in the manual mode.
- The **"MANUAL"** LED light will be illuminated to indicate the control module is in the manual operating mode.
- The percentage of power to be applied can be set by simply rotating the knob "clockwise" to increase the output power and "counterclockwise" the reduce output power.
- The top window displays the percent of power being applied.
- The output power works on a basis of **"ON"** time versus **"OFF"** time. The red **"LOAD"** indicator LED will give you an indication of the amount of time power is being applied to the mold heater. The more the LED is **"ON"** the more power the module is applying to the heater.
- If you wish to resume automatic mode, simply turn the **"MANUAL % KNOB"** to the "off" position.
- To turn off the module, simply switch "off" the **"POWER ON/OFF"** switch.

GENERAL OPERATING FEATURES

SOFT START:

The automatic **"SOFT START"** function of the S20-D3C is designed to eliminate the adverse affect of full power being applied to a cold heater by slowly baking out moisture. If the zone temperature is below 212 degrees F (100° C) and or below the set point temperature when the control module is turned on, the **"SOFT START"** function will automatically be activated. If the zone temperature is above 212 degrees F (100° C) when the module is turned on, it will automatically switch to the normal operation mode. When the **"SOFT START"** cycle is active, the instruments output power is limited to approximately 25% of full power. The **"SOFT START"** cycle has been set to last for a time period of about 5 minutes, or until the mold zone temperature reaches 212 degrees F (100° C), or the set point temperature is reached, whichever occurs first. The **"SOFT START"** function can be disabled by turning the manual knob "on" then "off" within 1 to 1 ½ seconds.

If thermocouple feedback is not available, the **"SOFT START"** function will not be activated when the control module is turned **"ON"**. The module will go in thermocouple error mode.
NOTE: When the **"SOFT START"** cycle is active, the red **"SOFT START"** LED is lit.

ANTI-ARCHING FEATURE:

The S20-D3C module is equipped with our innovative **Anti-Arching** feature, which will help prevent damage to the control module and/or main frame in the event the module is inadvertently removed or inserted while under load. The **Anti-Arching** feature must not be considered a substitute for proper handling procedures, but rather a supplemental protection mechanism.

If this control module is inserted into a main frame not equipped for **Anti-Arching**, the instrument will not provide power to the heater. If this condition occurs, the Anti-Arching Jumper can be moved from the "bottom" enabled position to the "top" disabled position. By moving the jumper to the Anti-Arching disabled position, the module will function in main frames not equipped with the Anti-Arching feature.

NOTE: The **Anti-Arching** feature will only work with ITC's updated TC-2000 main frames.
NOTE: The **Anti-Arching** feature will not forestall damage if the jumper is not in the enabled position.
NOTE: The **Anti-Arching** feature of this module will not prevent damage if the module is used in a main frame not properly equipped for **Anti-Arching**.
NOTE: Older ITC main frames can be upgraded with the **Anti-Arching** feature. Please consult factory.
Reference enclosed Anti-Arching sheet for more information.

AMPERAGE DISPLAY FEATURE:

To display the amount of power the heater is using, press the black **"AMP"** button. While the button is held in, the top process temperature window will display "Average Amperage Draw" of the heater in question. Once the button is released, the display will revert back to displaying the process temperature.

FAHRENHEIT OR CENTIGRADE:

"F" or "C" ranges are field selectable by repositioning the appropriate dip switch on the circuit board. A decimal point after the third digit in the upper display window indicates if the module is operating in "C" range. The factory default setting is in Fahrenheit. Ref. section labeled "DIP SWITCH" for more information.

THERMOCOUPLE TYPE - J or K:

The S20-D3C module is engineered to operate with either type-J or type-K thermocouples. The thermocouple type is field selectable by repositioning the thermocouple dip switch on the circuit board. Factory default setting is for "J" type thermocouple. Two decimal points in the bottom of the upper display window indicate if the module is set for "K" type thermocouple. Ref. section labeled "DIP SWITCH" for more information.

CONTROL METHOD:

The S20-D3C temperature control module utilizes a highly efficient Adaptive-auto-tuning PID or Fuzzy Logic Power Output algorithm to control temperature. The time proven processes reliably hold temperature to a very close tolerance. The control method is selectable between "PID" and "Fuzzy" by changing the dip switch on the board. "PID" must be used when the module is used with our 30 amp high power main frames. Ref. section labeled "DIP SWITCH" for more information.

ERROR CODES

Error Code	Description
tCO	Open Thermocouple
tCr	Reversed Thermocouple
tCS	Shorted Thermocouple
tOh	Open Triac or Heater
tSh	Shorted Triac
HiC	Over Current

ERROR & WARNING INDICATORS

OPEN THERMOCOUPLE WARNING ERROR:

If thermocouple feedback is not available when the unit is turned on, or if it is lost during operation, the **"tCO"** error message will be displayed in the upper display window until "Manual" mode is selected.

REVERSED THERMOCOUPLE WARNING ERROR:

If the thermocouple wiring to the instrument is reversed, the control module will detect the problem. When a reversed thermocouple polarity is detected, the temperature display window will display **'tCr'** error. The output power to the heater will be disabled if the unit is in the **"AUTOMATIC"** control mode.

SHORTED THERMOCOUPLE WARNING ERROR:

In the event a thermocouple fails to detect a rise in temperature while power is being applied to the heater, or an instant 50 degree (27° C)drop in temperature is detected, the module will activate the **"tCS"** error code in the process temperature window. The module will automatically go into **"APO"** mode allowing the module to run for a period of time at the last average power condition until the controller is switched to **"MANUAL".**

OPEN TRIAC / OPEN HEATER ERROR:

The module will alert the operator in the event of an open Triac or heater, by displaying a **'tOh'** error message in the upper window. This condition is detected if the heater fails to maintain or rise to set point temperature and there is an absence of current flowing to the heater. The output power to the heater is disabled.

SHORTED TRIAC ERROR:

The S20-D3C control module can detect a shorted Triac condition. This condition will be detected, if power is being applied to the heater when the temperature is well above the set point. This condition is indicated when the **'tSh'** error is displayed in the upper window and all LED's start flashing. The output power to the heater is disabled.
(WARNING: IF THIS CONDITION OCCURS, SHUT THE MODULE OFF IMMEDIATELY AS DAMAGE TO THE HEATER AND MOLD CAN RESULT)

HIGH TEMPERATURE WARNING INDICATOR:

The red **"HIGH"** warning LED is factory set to illuminate when the process temperature is more than 30 degrees Fahrenheit (16°C) above the set point temperature.

LOW TEMPERATURE WARNING INDICATOR:

The red **"LOW"** warning LED is factory set to illuminate when the process temperature is more than 30 degrees Fahrenheit (16°C) below the set point temperature.

OVER CURRENT WARNING ERROR:

If the module detects a current draw to the heater in excess of the factory set value of 16 amps, the top window will display the **"HiC"** warning and power to the heater is disabled.

BLOWN FUSE INDICATOR:

In the event one or both of the module power fuses blow, the red LED's labeled "FI" or "F2" will come on indicating which fuse has blown. CAUTION: only the proper fuses must be used in order to prevent module damage and voiding the warranty. Fuses are available from ITC.

DIP SWITCH SETTINGS:

The circuit board mounted dip switch allows for various operational and diagnostic choices. To change the dip switch setting for a particular parameter, locate the switch which corresponds to the number of the parameter you wish to change, then slide the switch to the desired setting.

1	PID	FUZZY
2	J	K
3	DIAGNOSTICS	NORMAL
4	CALIBRATE	NORMAL
5	CELSIUS	FAHRENHEIT
	UP is ON	DOWN is OFF

SETING #	DESCRIPTION	FACTORY DEFAULT SETTING
#1	Control Method	"FUZZY"
#2	Thermocouple Type	"J"
#3	Diagnostics – Checks Set point & LED operation	"NORMAL"
#4	Calibrate – Calibration mode	"NORMAL"
#5	Temperature Range	"FAHRENHEIT"

TROUBLESHOOTING GUIDE

Module will not turn on:	1. Check input power. 2. Check power cord connection. 3. Check that main frame power is on. 4. Check module fuses. If blown, check for a short in the wiring
Temperature won't settle on set point:	1. Give module more time to settle on the set point. 2. Does molding process have a wide temperature variation? Check to see if changes in display temperature are in the same cycle as the molding process.
Lights dim:	1. Is actual voltage input into housing equal to rating of module?
Display shows temp is low and not rising: LOW TEMP light on.	1. Give module more time to settle on the set point. 2. Set point may not be functioning properly.
Display shows temp is low and rising slowly: LOW TEMP light on	1. Check for poor connections between heater and heater wires and connectors. 2. Half-open triac or triac driver could cause this problem. 3. Try module in a known good heater zone.
Display shows temp is low and not rising: LO TEMP light on & LOAD light on	1. Check for open heater. 2. Check for open wire or connector. 3. Open triac or triac driver. 4. Try module in a known good heater zone. 5. If no current, triac or triac driver failure.
Display erratic: LO TEMP light on tCr Error Code	1. Thermocouple wires may be reversed. White (iron) is positive Red (constantan) is negative
Display shows temperature is high and rising: HI TEMP light on LOAD light on	1. Shorted triac or triac driver. NOTE: Triac or triac driver can be half shorted.
Module appears to operate properly, but no power is being applied to the heater:	1. Main frame is not set up for Anti-Arching. 2. Move Jumper from lower (enabled) to upper (disabled) position.
Module blows fuses:	1. Make sure heater size does not exceed module rating. 2. Make sure this is not the result of a shorted heater or a short in the tool wiring. Do not replace fuses until problem is corrected as damage may result.
HiC – Over Current – Error Code:	1. The heater is drawing current beyond the limit set. Replace heater.
tCr – Reversed Thermocouple – Error Code:	1. Thermocouple wiring is reversed. Re-wire the thermocouple.

tCO – Open Thermocouple – Error Code:	1, A break in wiring. Determine if break is in wiring or in T/C. Repair wiring or replace thermocouple as necessary.
tOh – Open Triac – Error Code:	1. Replace Heater. 2. Check mold wiring to see if heaters & thermocouples are wired correctly. 3. Replace triac. Return module for repair. 4. If the system uses solid state relays, and the temperature rise is very slow, the tOh feature may activate. In these instances, the module may need to be reprogrammed for the application.
tSh – Shorted Triac – Error Code:	1. Replace triac. Return module for repair. "**SWITCH MODULE OFF IMMEDIATELY"**
tCS – Shorted Thermocouple – Error Code:	1. Short in wiring. Determine if short is in wiring or thermocouple. Repair wiring or replace thermocouple.
Temperature Oscillation:	1. This is usually caused by the location of the thermocouple being too far from the heater it is controlling. Proper procedures dictate that the heater & thermocouple should be within 1/2" of each other 2. Oscillation can also be caused when the melt temperature is significantly above or below the set point.
Temperature too high:	1. Normally this is caused by heat from adjacent zones. 2. The melt temperature of the plastic is above the set point for the zone. 3. Thermocouple may not be wired to the same control module as the heater.
No heat indication:	1. Heaters not connected. 2. Heaters too small. 3. Heaters burned out. 4. Heaters too far from thermocouple.

It is also possible something has occurred electrically to upset the microprocessor in the control module. It indicates that there is more interference in the power line to the control system than the filtering in the power supply can accommodate. A random occurrence is not cause for concern. The solution usually is to connect the controller as close to the electrical service supply as possible, and not to the molding machine, where motors, solenoids, etc can cause interference.

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SPECIFICATIONS:

Voltage	208 to 240 VAC, single phase
Current	15 amps
Frequency	50/60 Hz
Wattage	3600
Module Power Usage	Less than 3 watts, excluding load
Thermocouple Isolation	Isolated from ground and supply voltage
Control Method	Adaptive-Auto-Tuning PID with zero crossfire or FUZZY logic – Dip switch selectable
Physical Configuration	Plugs in for easy interchangeability
Compatibility	Compatible with any "G" Series housing
Size	2" wide, 7" high, 7 ½ " deep
Weight	1 ½ pounds
Temperature Range	Fahrenheit or Centigrade – Dip switch selectable
Set point	0 - 999° F (537° C)
Control Accuracy	+/- 1° F (in 200° to 800° F range) (93° to 428° C)
Calibration Accuracy	Better than 0.2% of full scale
Thermocouple	Type- J or K grounded or Ungrounded – Dip switch selectable
Display	Single LED display, 3-digit, 7 segment
Output Switch	Internal solid state Triac, triggered by AC zero crossing pulses
Overload Protection	Triac and load use high speed fuses Both sides of AC line are fused
Soft Start Duration	5 Minutes
Soft Start Override Temperature	212° F (100° C)
Set point Control	Precision 3 digit push-button switch direct reading resolution 1° F
Manual Power Control	Single turn On/Off potentiometer calibrated scale range: 0-100%
Anti-Arching Setting Method	Jumper selectable
Low Temperature Indicator	Red **"LOW"** temperature light
High Temperature Indicator	Red **"HIGH"** temperature light
Blown Fuse Indicator	Red **"F1"** and **"F2"** LED's
Thermocouple Reversed Indicator	Display '**tCr'**
Thermocouple Open Indicator	Display '**tCO'**
Manual Mode Indicator	Red **"MANUAL"** light
Soft Start Indicator	Red **"SOFT START"** light
Heater Load Indicator	Red **"LOAD"** light
Shorted Triac Indicator	Display **'tSh'** and all LED's Blink
Open Heater or Triac Indicator	Display **'t0h'** and LED' blink
Automatic/Manual Select	Turn On/Off potentiometer
Cold Junction Compensation	Automatic, better then 0.02° F/F (0.01° C/C)

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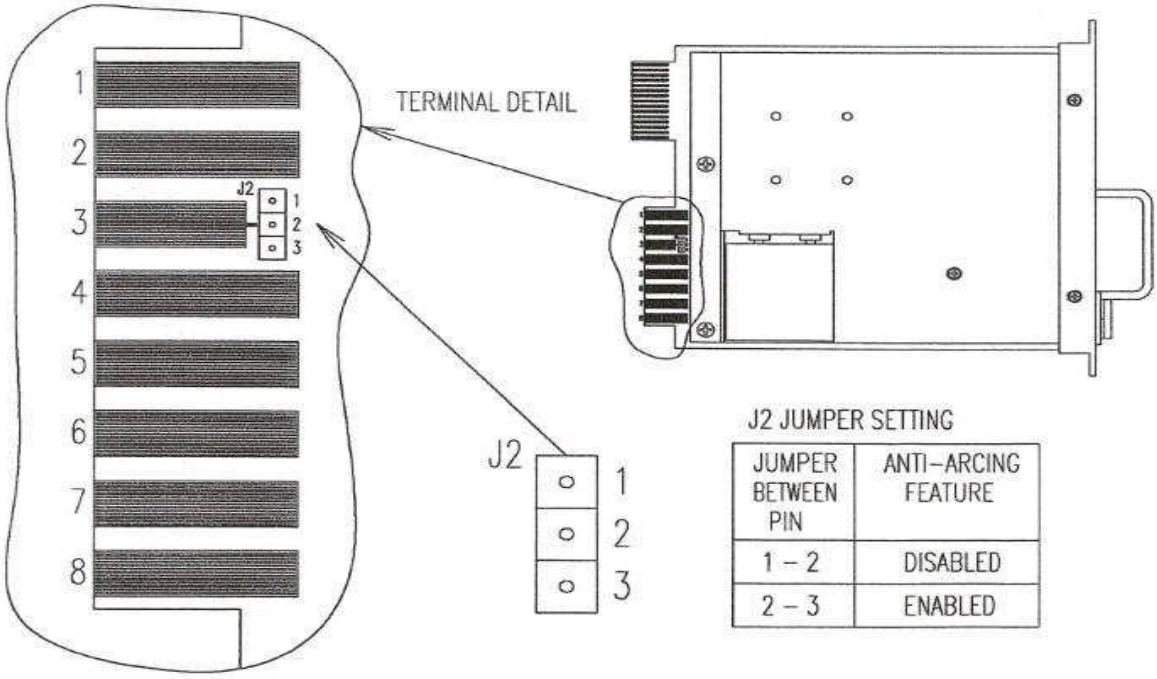
INTERNATIONAL TEMPERATURE CONTROL, Inc.

This temperature control system incorporates a special "Anti-Arcing" feature

The control modules that were shipped with this unit have a special "Anti-Arching" circuit that will help to prevent damage to the module and main frame in the event that the module is removed under load. This feature should not be considered a substitute for proper handling procedures, but rather as a suplimental protection device. If you wish to use these control modules in an older main frame, i.e. one that is not set up for this option, the anti-arcing feature must be disabled on the control module. This is very easily done by moving the illustrated jumper from the lower position to the upper position (see below). If this module is installed in a main frame that is not equipped for this feature, no damage will be caused as a result. The module will appear to operate normally, but no power will be put out to the heater.

This main frame will operate with all standard control modules regardless of the availability of this feature.



J2 JUMPER SETTING

JUMPER BETWEEN PIN	ANTI-ARCING FEATURE
1 – 2	DISABLED
2 – 3	ENABLED