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This product was distributed by the DME Company in the early 1990's.

DME does not offer any support or repairs for this product. The following pages contains the documentation which was provided when the DME Company distributed this product.

Contact American MSI Corporation directly for assistance with this product.

MTC-System

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Operations Manual

D-M-E Company

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Introduction

Welcome to the world of advanced digital control for your runnerless molding application. The MTC-System you have purchased is one of the most advanced control systems in the world for runnerless molding. As you learn to use the MTC-System the problems that have confronted you for years may be corrected simply and effectively. The MTC-System is a tool not just a temperature control. The capabilities in diagnostics, information gathering, flexible thermocouple software, all provide you with the ability to more effectively perform your job.

We take great pride in the technology of our MTC-System. However, without your continued support and ideas we will not be able to make the next "quantum leap" in technology. If you have a suggestion, complaint or idea please do not hesitate to contact us immediately. We do want to hear from you. Our dedication to superior workmanship and technology are not merely marketing buzz words. This is one company that believes in quality, customer support and continued long range development.

Thank you for purchasing the MTC-System and we will do everything in our power to continue to provide you with the best in runnerless molding controls.

D-M-E Company

Safety Reminder (Disclaimer)

This operation manual has been developed to offer written instruction to factory personnel in the operation of the MTC-System during normal installation, use, and maintenance conditions. It includes general WARNINGS and CAUTIONS to prevent damage to the system, mold, or personal injury to the individual operating the MTC-System.

These WARNINGS and CAUTIONS are not intended to be nor are they all inclusive to every condition or application that may occur during individual usage. Maintenance and safety procedures when using the MTC-System remain the sole responsibility of the user and his or her company. The MTC-System MUST be installed by a licensed electrician and operated only by those who have a thorough knowledge of its operation and capabilities.

D-M-E Company strongly urges you to enforce upon all of your fellow employees and your company the necessity for following all instructions to avoid damage to the equipment, mold, or causing personal injury.

IF ANY QUESTION ARISES AT ANY TIME, DO NOT HESITATE TO CALL D-M-E COMPANY AND ASK FOR TECHNICAL ASSISTANCE. IT IS BETTER TO ASK FIRST BEFORE MAKING A MISTAKE!

REMEMBER SAFETY IS FIRST, SECOND, THIRD, FOURTH AND LAST!!!

CAUTIONS:

01. NEVER connect power to the MTC-System without a proper ground and connectors on the cables.
02. NEVER start the MTC-System if there are any water or liquids of any nature around the system.
03. NEVER place any liquids on or around the MTC-System. If the MTC-System becomes wet IMMEDIATELY disconnect all power from the system.

WARNING: Possible electric shock could result if you touch the system if it is wet and not grounded. This could result in serious injury or death!

04. NEVER permit anyone unfamiliar with the MTC-System to operate it.

Pre-Start Instructions

WARNING: Prior to every start up of the MTC-System the following procedures are to be followed to prevent the possibility of electric shock to any person(s). These should always be carried out with **ALL POWER DISCONNECTED FROM THE SYSTEM!**

01. Be sure the MTC-System is completely disconnected from power.
02. Clean up any water, oil, dirt, cleaning liquids etc. that may have spilled during a mold change or since the last production run.
03. Check all the cable connections to the controller and to the mold for loose, split, pinched, mashed or general wearing evidence. Repair any damage prior to restarting the system.
04. Be sure the Main Breaker is in the OFF position prior to reconnecting power.
- 05.* **Verify the GROUND is connected and in good condition. Check to see that the controller and the mold have the same ground reference. This will eliminate any ground loops. If they do not, simply connect a small wire from the mold to the controller.**
06. Connect the power to the MTC-System and turn ON the Main Breaker located on the panel.
07. Begin your desired setup.

How To Operate The MTC

The MTC-System is simple and very easy to use. It can guide you quickly through its capabilities without the aid of a manual. Every time the system is turned ON it always comes up on the SECURITY screen. There are two (2) levels of SECURITY on the MTC, LEVEL 0 and LEVEL 1. It always comes up in LEVEL 0. LEVEL 0 only permits the viewing of the setup and temperatures but does not permit the changing of anything. LEVEL 1 permits the changing of all information on the MTC.

NOTE: All passwords are shipped in a sealed envelope with the unit.

To enter the password PRESS F1, then sequentially press each button in your password, then press E. The security level will then change from 0 to 1.

On successful entering of the password the MTC will display one of two screens, the SETPOINTS or the GRAPHS.

From here you may select any of the other screens in the MTC's program and begin your setup or if the system has already been set up you may simply press the GREEN 1 or START key.

If this is your first time setting up the MTC follow these simple instructions below.

FIRST TIME STARTUP - USING NO SPECIAL FEATURES

The display looks like this... (For a 8 zone system as an example.)

MTC - Set Points								READY
ZN	SET	ACT	PWR	ALM	REG	SLV	ON/OFF	
01	300	300	025	010	A	NO	OK	
02	300	299	027	010	A	NO	OK	
03	300	301	030	010	A	NO	OK	
04	300	300	040	010	A	NO	OK	
05	300	300	022	010	A	NO	OK	
06	300	301	010	010	A	NO	OK	
07	300	299	055	010	A	NO	OK	
08	300	300	050	010	A	NO	OK	

F1-Graphs F2-Limits F3-Setup F4-Copy

There will be a BLACK or REVERSED area over Zone 01 SET. Using the UP-DOWN-RIGHT-LEFT arrows on the keypad you may move this cursor to the appropriate area and make your desired changes on this page.

First Time Startup Continued...

To make a change to a **TEMPERATURE** or **value** simply press the + or - key. You will see when you first press either key the **REVERSED** area will move from covering all of the numbers to just covering the **ONES** column. This allows you to change 1 degree up or down at a time, 10 degrees up or down at a time or 100 degrees up or down at a time, depending which column (one, ten, hundred) is reversed. The same applies if a particular zone is in **MANUAL**. You will be changing a percentage instead of a temperature.

To turn a zone **ON** or **OFF** move the **REVERSED** cursor using the **UP-DOWN-RIGHT-LEFT** arrows to the desired zone under the **ON/OFF** column and press + or - to change the value from **ON** to **OFF** or from **OFF** to **ON**.

To change **REG** (Regulation Control - **[A]** Automatic, with a thermocouple connected or **[M]** Manual for use without a thermocouple) move the **REVERSED** cursor using the **UP-DOWN-RIGHT-LEFT** arrows to the desired zone under the **REG** column and press + or - to change the value from **A** to **M** or **M** to **A**.

To change the **ALARM (ALM)** limits move the **REVERSED** cursor using the **UP-DOWN-RIGHT-LEFT** arrows to the desired zone under the **ALM** column and press + or - to increase or decrease the temperature. Again you may change one digit at a time using the left and right arrows to move the reversed cursor to the proper column, (ones, tens, or hundreds). This temperature is + and - whatever the setpoint is under the **SET** column for that same zone. **Example:** Zone 01 SET=300, ALM is set to 10, the MTC will alarm if the actual temperature reaches 311 or falls below 290.

Use common sense when setting this value. Too close of a value may create nuisance alarming when no error is actually occurring and too wide a value will not give you early enough warning that something is wrong. **D-M-E recommends a value of 10 to 15.**

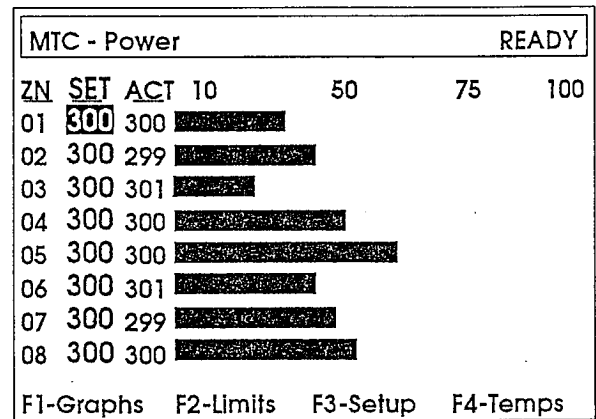
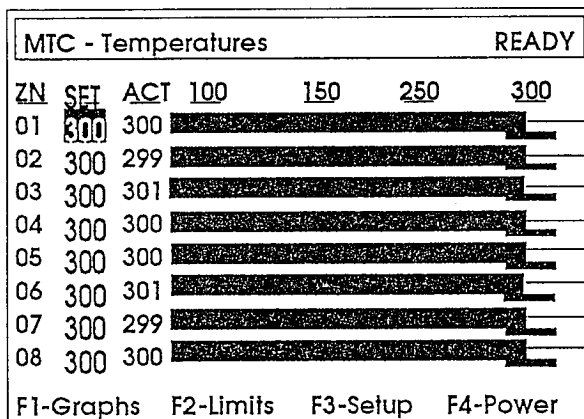
Slave SLV - In the event you have a thermocouple become defective during molding the MTC gives you the ability to **SLAVE** one zone to another. Example: Zone 1 thermocouple is damaged but Zone 2 is very similar. You may enter a 2 in the **SLV** column and now Zone one will mirror Zone 2. This permits you to keep running in automatic and eliminate the need to find a manual setting that works. At the same time as temperatures change or material or process conditions change the thermocouple in Zone 2 will automatically regulate the power up or down and that in turn happens to Zone 1. Move the **REVERSED** cursor using the **UP-DOWN-RIGHT-LEFT** arrows to the desired zone under the **SLV** column and press + or - to change the value.

First Time Startup Continued...

The MTC also permits you to COPY a setting from zone to another to speed up the setup process. Notice the COPY key F4. To use this feature set the temperature on ZONE 01 to your desired temperature. Press F4, you will see ZONE 01 highlighted in reversed mode and a cursor will be located on ZONE 02. Move the cursor using the up or down arrows to the zone you wish to be the same as ZONE 01 and press F1. You will immediately see that the zones settings are the same. Move the cursor to the next zone you wish to copy to and press F1. When you are finished copying press the E key to exit the copy mode.

You are now ready to press **START**, the **GREEN 1** and the MTC will automatically begin to regulate your mold. At the factory a standard soft start and bake out are set for each start up if you wish to modify these settings you should read further on in the manual.

If you wish to view your zones in a GRAPHIC display with bar charts simply press F1 and the MTC will display the **TEMPERATURES** graph. Press F4 and the MTC will display the **POWER** graph.



To return to the setpoints page simply press F1 again and the MTC will return the display to the previous one.

How To Setup Limits

From the Set Points or Graphics page press **F2** and the display will read...

MTC - Zone Setup Page 1								READY
ZN	ALM	REG	SLV	AMC	PMC	T/C	ON/OFF	
01	010	A	NO	YES	Sys	1	OK	
02	010	A	NO	YES	Sys	2	OK	
03	010	A	NO	YES	Sys	3	OK	
04	010	A	NO	YES	Sys	4	OK	
05	010	A	NO	YES	Sys	5	OK	
06	010	A	NO	YES	Sys	6	OK	
07	010	A	NO	YES	Sys	7	OK	
08	010	A	NO	YES	Sys	8	OK	

F1-Page 2 F2-PID Setup F3-Security F4-Copy

Your REVERSED cursor is located in the **ALM** column at Zone 01.

How to Setup Limits Continued...

To change the **ALARM (ALM)** limits move the REVERSED cursor using the UP-DOWN-RIGHT-LEFT arrows to the desired zone under the **ALM** column and press + or - to increase or decrease the temperature. This temperature is + and - what ever the setpoint is under the SET column for that same zone. **Example:** Zone 01 SET=300, ALM is set to 10, the MTC will alarm if the actual temperature reaches 311 or falls below 290. Use common sense when setting this value. Too close of a value may create nuisance alarming when no error is actually occurring and too wide a value will not give you early enough warning that something is wrong. **D-M-E recommends a value of 10 to 15.** You may also do this from the Setpoints page.

NOTE: You may use the copy function here to your advantage in the same manner as described on the previous page.

To change **REG** (Regulation Control - [**A**] Automatic, with a thermocouple connected or [**M**] Manual for use without a thermocouple) move the REVERSED cursor using the UP-DOWN-RIGHT-LEFT arrows to the desired zone under the **REG** column and press + or - to change the value from A to M or M to A. You may also do this from the Setpoints page.

Slave SLV - In the event you have a thermocouple become defective during molding the MTC gives you the ability to SLAVE one zone to another. Example: Zone 1 thermocouple is damaged but Zone 2 is very similar. You may enter a 2 in the SLV column and now Zone one will mirror Zone 2. This permits you to keep running in automatic and eliminate the need to find a manual setting that works. At the same time as temperatures change or material or process conditions change the thermocouple in Zone 2 will automatically regulate the power up or down and that in turn happens to Zone 1. Move the REVERSED cursor using the UP-DOWN-RIGHT-LEFT arrows to the desired zone under the **SLV** column and press + or - to change the value. It is possible to SLAVE from the SETPOINTS screen as well.

AMC Automatic Manual Control - The MTC also has the ability to select a power output to the heater at the time a thermocouple may fail. This prevents the need for someone to be available to make changes to manual or slave if there is no one around. The MTC constantly monitors the power level and in the event a TC fails it outputs to the heater an average of the past 8 readings it has stored to memory. Move the REVERSED cursor using the UP-DOWN-RIGHT-LEFT arrows to the desired zone under the **AMC** column and press + or - to change the value to YES or NO.

PCM Priority Control Mode - The MTC permits you to select how you want an alarm condition to be handled. You may select **ZONE** and the control will only shutdown the single problem zone. If you select **SYS** the MTC will turn **OFF** the complete system or you may select **NO** and nothing will happen except for an audible alarm. You may optionally purchase a machine shutdown output that will stop the press in the event of a problem in the mold. Move the REVERSED cursor using the UP-DOWN-RIGHT-LEFT arrows to the desired zone under the **PCM** column and press + or - to change the value.

How to Setup Limits Continued...

TC Thermocouple Wiring - The MTC permits you to completely rewire the mold in the event there has been a mis-wiring in the mold. Example: Zone 2 TC has been wired by mistake to heater 4 and Zone 4 TC has been wired to heater 2. First the MTC will alarm and show you this problem. Second you may then change the number by Zone 2 to a 4 and in Zone 4 to a 2. Now your mold is rewired. Move the REVERSED cursor using the UP-DOWN-RIGHT-LEFT arrows to the desired zone under the **TC** column and press + or - to change the value to the correct zone.

Caution: If you set this up wrong you are in effect miswiring your mold. Use good judgement.

PID Control Action - The MTC permits you to select one of 8 different control actions for any of your heaters. In the event one zone reacts different you may select a control action to suit that zone. In normal applications probes will run on PID 1 [P=0015/I=0010/D=0002] and manifolds will run on PID 7 [P=0100/I=0003/D=0000]. Move the REVERSED cursor using the UP-DOWN-RIGHT-LEFT arrows to the desired zone under the **PID** column and press + or - to change the value to 1 thru 8.

To turn a Zone ON or OFF move the REVERSED cursor using the UP-DOWN-RIGHT-LEFT arrows to the desired zone under the **ON/OFF** column and press + or - to change the value from ON to OFF or from OFF to ON. You may also do this from the Setpoints page.

Special Functions

Looking at the ZONE SETUP screen...

MTC - Zone Setup Page 2				READY
ZN	SET	PWR	M-BOOST	M-STDBY
01	300	10	450	150
02	300	23	450	150
03	300	45	450	150
04	300	33	450	150
05	300	34	---	150
06	300	56	---	150
07	300	68	---	150
08	300	12	---	150

F1-Page 1 F2-PID Setup F3-Security F4-Copy

Your REVERSED cursor is located in the **SET** column at Zone 01.

On the keypad of the MTC you will see two keys, one is **BLUE** with an **S** and the other is **YELLOW** with a **B**. These two keys are **BOOST** and **STANDBY**.

BOOST- What is it?

The MTC-System is equipped with a special feature that permits you to automatically increase the temperature of a particular zone or zones by Touching the BOOST key on the keypad. This is the MANUAL BOOST key.

The MTC has available (at additional cost) an **AUTOMATIC BOOST** that can be generated by the molding machine. Both work and set up identical. The only difference is the Manual is started by a person and the Automatic comes from the machine signal. The Auto Boost includes an Auto Delay Time. This delays the start of the Boost from the time the signal is given to the unit until this timer times out. All timers are set in the SYSTEM SETUP page.

If one of your cavities were not filling properly and the operator determined that some "unmelt" was located in the gate area. He or she may wish to increase the temperature of that zone for a period of time. The operator may increase the temperature to a higher setpoint for a set time.

If the normal setpoint were 350 degrees and the M-BOOST were set to 400 degrees and the M-TIMER were set to 3:00 minutes, when the Manual Boost key was Touched the temperature would attempt to rise to 400 degrees and hold there until the three minutes had elapsed. At this point the temperature would return to normal. If during the boost time the operator wants to stop the boost he or she simply presses the button again and the boost is eliminated at that point.

The advantage to this feature is that it eliminates the chance of the operator forgetting and leaving a zone or zones elevated in temperature for too long.

If no temperature is selected for a zone or zones they will ignore the signal to boost and maintain the normal setting.

STANDBY - What is it?

The MTC-System STANDBY works in the opposite manner of the BOOST. If a problem were to occur and the operator needed to lower the mold temperatures for a short or extended period he may enter the desired setpoints here and then simply press the STANDBY key.

If a STANDBY time is entered the MTC-System will lower the temperatures for the set time and then return the temperatures to normal. If no time is set the MTC will stay indefinitely at the lower temperature until the operator presses the STANDBY key again.

During a timed STANDBY if the operator presses the STANDBY key a second time the temperatures will return to normal and the remaining STANDBY time will be eliminated.

EXAMPLE: Your normal set temperatures are 350 degrees. The molding machine stops for an unknown reason. You need to lower all zones to 180 degrees until the machine is fixed and you don't know how long this will take.

STANDBY - What is it? Continued...

Set all zones in the MANUAL STANDBY column to 180 degrees. Press BLUE STANDBY key, all temperatures will go to 180 degrees.

Any zones may have any setting. This is fully operator selectable. Once the machine is fixed press the STANDBY key again and the temperatures will return to your normal setpoint of 350.

Any zones with a STANDBY temperature of 0 will be unaffected by the STANDBY function.

Changing BOOST and STANDBY

There are 3 columns on this page and the data is somewhat crowded but don't let this confuse you. It is very simple to understand.

Column one (SET/PWR) is the setpoint you entered on the setpoints screen for automatically or manually controlled Zones.

Column two (M-BOOST) is the MANUAL BOOST setting for any zones running with a thermocouple and for any zones running without a thermocouple, 000=with TC, 000=without.

Column three (M-STBY) is the MANUAL STANDBY setting for any zones running with a thermocouple and for any zones running without a thermocouple, 000=with TC, 000=without.

Your REVERSED cursor is located in the **SET** column at Zone 01.

To change any of the setpoints to a temperature or percentage you must move the cursor using the UP-DOWN-RIGHT-LEFT arrows to the Zone you wish to give a BOOST or STANDBY. Once the cursor is over your desired Zone press the + or - key and increase or decrease the setpoint to the proper value.

PID SETUP

From the LIMITS (Zone Setup) page you may press the F2 key and enter the PID control action information.

MTC - PID SETUP				READY		
RATE	-P-	-I-	-D-	ZN SET	PWR	PID
01	0015	0010	0002	01	300F10	1
02	0050	0020	0002	02	300F23	1
03	0020	0010	0000	03	300F45	1
04	0015	0015	0002	04	300F33	1
05	0020	0003	0100	05	300F34	7
06	0020	0003	0200	06	300F56	7
07	0100	0003	0000	07	300F68	7
08	0075	0003	0000	08	300F12	7

The MTC-System is equipped with a very sophisticated controlling system that permits fine tuning of any given zone to achieve the optimum in control accuracy.

There are 8 separate loops available and any loop may be used on any zone. In page F2 of the LIMITS (Zone Setup) you may select 1 thru 8 for any zone under PID. That 1 thru 8 corresponds to the values for each loop listed below. These are the factory settings:

Use these settings for faster reacting zones : Probes, Heaters with internal located thermocouples.

RATE	PROP	INT	DEV
01	0015	0010	0002
02	0050	0020	0002
03	0020	0010	0000
04	0015	0015	0002

Use these settings for medium reacting zones : Probes, Heaters with internal located thermocouples but with a larger mass.

RATE	PROP	INT	DEV
05	0020	0003	0100
06	0020	0003	0200

PIDD Setup Continued...

Use these settings for slower reacting zones: Manifolds, Heaters with the thermocouple located externally.

RATE	PROP	INT	DEV
07	0100	0003	0000
08	0075	0003	0000

To return to Zone Setup press **E (EXIT)**.

Your REVERSED cursor is located in the P column at Rate 1.

To change any of the RATE's you must move the cursor using the UP-DOWN-RIGHT-LEFT arrows to the RATE P-I-D you wish to modify and press the + or - key to increase or decrease the P-I-D to the proper value.

Each of the PID values are fully adjustable to permit the fine tuning sometimes required to acheive the best possible control action.

It should be noted that you may also change the setpoint of any zone(s) from this page by using the arrows, UP/DOWN/RIGHT/LEFT.

SYSTEM SETUP

MTC - SYSTEM SETUP	READY
UNITS: F	
SOFTSTART: YES 0:00:00 Level: 030%	
BAKEOUT: YES 0:00:00 Power: 020%	
MAN-BOOST: 0:00.0	
MAN-STANDBY: 0:00.0	
PRINT: Baud 9600 Data 8 Stop 1 Par N Ctl D	
F1-Print Setup	

Units - You may select F Fahrenheit or C Celcius display of your temperatures. Move the REVERSED cursor using the UP-DOWN-RIGHT-LEFT arrows to UNITS and press + or - to change the value.

System Setup Continued...

Softstart - The MTC has the unique feature of heating up all zones at the same rate. This helps to eliminate thermal stress in the mold by stopping the heat up of the manifold first then turning on the probes. The MTC makes all zones (probes and manifolds) reach setpoint together. To set the softstart you must enter a time. This time should be equal to the slowest zone or zones in the system. Normally the manifold is the slowest part of the mold. Example: Manifold takes 30 minutes to heat up - set the Softstart at 35 minutes. This allows the mold to not only reach temperature but soak for a few minutes after reaching setpoint. Move the REVERSED cursor using the UP-DOWN-RIGHT-LEFT arrows to SOFTSTART and press + or - to increase or decrease the time.

LEVEL - The MTC permits you to select the point where all zones should begin controlling together. By entering a percentage you effectively are telling the control how to start up. Example: Your zones are all at 300F you set a LEVEL of 30%. This 30% is equal to 30% of setpoint which is 300 degrees or 90 degrees F. Your mold will heat to 90 degrees and then begin regulating all zones together. Move the REVERSED cursor using the UP-DOWN-RIGHT-LEFT arrows to LEVEL and press + or - to increase or decrease the percentage. D-M-E recommends 30%.

PRINTER - The MTC comes as a standard with a serial printer port. This port may be used in conjunction with a printer to produce hard copy reports of setup, setpoints vs actual temperatures and printouts when ever an alarm occurs. From the SYSTEM SETUP screen Press F1 (Print Setup). Here you may select YES or NO to print errors. Use the Up/Down/Right/Left arrows to goto your desired selection. To Print press F1.

BAKEOUT - To remove the moisture from the heating elements prior to running the mold you may wish to bake them out. To do this move the REVERSED cursor using the UP-DOWN-RIGHT-LEFT arrows to LEVEL and press + or - to set a time for the bakeout to run.

POWER - During bakeout it is necessary to tell the control at what percentage you wish to bakeout the zone.

Caution: Too high of a percentage may cause damage to your mold. Use good judgement.

D-M-E recommends values between 5 and 20 percent however this may be too much for some applications and not enough for others. To do this move the REVERSED cursor using the UP-DOWN-RIGHT-LEFT arrows to LEVEL and press + or - to set a percentage for the bakeout while it is running.

Errors

When an error condition occurs, no matter which screen you are on, the MTC automatically changes to the SETPOINTS screen so that you may see what the error is.

In the ON/OFF column of the SETPOINTS page you may view the status on any zone in the system. If the zone is ON it will read OK if there are no problems. If the zone is turned OFF it will read OFF.

In the event of a problem the MTC will indicate the problem by alarming and printing in the status column the error. The list of possible data in the status column follows :

ON	-	All Systems Working/Ready To Start
OFF	-	Zone Turned OFF
Over Temp	-	Zone Has Exceeded Set Limit
Under Temp	-	Zone Has Exceeded Set Limit
No Sensor	-	Thermocouple Disconnected Or Damaged
Fuse Blown	-	Fuse Damaged (See Changing Fuses)
No Heater	-	Heater Damaged Or Heater Disconnected Available Only As Option
AMC	-	Thermocouple Damaged While In Production System Automatically Entered Manual Control
PCM-Over	-	System Or Zone Shutdown Because Of Over Temperature
PCM-Under	-	System Or Zone Shutdown Because Of Under Temperature
PCM-Sensor	-	System Or Zone Shutdown Because Of Thermocouple Failure
PCM-Fuse	-	System Or Zone Shutdown Because Of Fuse Failure
PCM-Heater	-	System Or Zone Shutdown Because Of Heater Failure (Optional)
PCM-AMC	-	System Or Zone Shutdown Because Of Automatic Manual Control
REV T/C	-	Thermocouple Reversed In The Mold

REPLACING FUSES

If you receive a Fuse Blown message for a zone the following steps are necessary to follow to change the fuse.

01. Turn OFF breaker on controls right side.
02. **Disconnect all power from the control.**
03. Remove two screws in the front of the control door.
04. Locate the blown fuse in the control and replace it with the identical fuse only.

WARNING: If you replace the fuse with another fuse of a higher rating you will void your warranty and may cause a serious fire hazard or circuit hazard.

05. Replace the two screws and tighten them back to the original position.

WARNING: These screws must be return to the door and the door must be secure before you restore power to the control.

General Maintenance

The MTC is simple to maintain. You need only keep it clean and free of oil and or chemicals. Use a mild non-abrasive cleaner and do not spray anything directly onto the control.

If there are any questions or problems please call the factory immediately at 805-523-9593.

Check power and thermocouple cables every day and be sure to maintain clean good connections in your mold junction box. This will save you much trouble.

WARRANTY - Disclosure

D-M-E Company warrants that the control will at the time of shipment be free from defects due to faulty materials or bad workmanship. Provided that in the event of any breach by D-M-E of such warranty D-M-E's only responsibility or liability (subject to D-M-E's being satisfied that the control has been used for the application specified by D-M-E, properly operated, adequately maintained and that the defects have arisen solely through faulty workmanship or materials) shall be to replace or repair the defective part or parts free of charge at D-M-E's option, at D-M-E's factory within 1 year of the date of delivery of the control provided buyer bears the expense of returning the control to and from the factory.

D-M-E shall not be liable for nor will D-M-E accept any charge for labor or other expense incurred by the buyer in connection with any defective component by reason of any cause. The sole purpose of the stipulated exclusive remedy shall be to provide the buyer with free repair and replacement of defective parts in the manner provided herein. This exclusive remedy shall not be deemed to have failed any of its essential purpose so long as the seller is willing and able to repair or replace defective parts in the prescribed manner.

If the buyer makes, allows or causes to be made any alterations or repairs to the control without the written consent of D-M-E then the warranty will become void immediately and D-M-E shall be released from any responsibility or liability.