



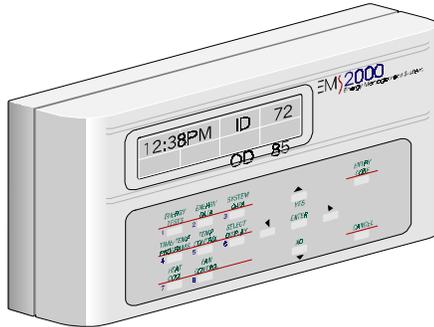
EMS 2000 Energy Management System Operation Manual for the 43025 Master Control Unit

Version 1.2



Wm Energy Controls, Inc.

Section	Description	Page
1.0	Equipment Description and Programming Guide	
	System Components	1 - 01
	Master Control Unit	1 - 02
	HVAC Control Module	1 - 03
	Room Temperature Sensor	1 - 04
	EnergyPro PC Computer Software	1 - 05
	Keyboard Operation	1 - 06
	Function Quick Finder	1 - 07
	Setting the Time of Day and Date	1 - 12
	Selecting the Default Display	1 - 13
	Selecting the HVAC Unit Availability	1 - 14
	Selecting the Indoor Fan Operating Mode	1 - 16
	Selecting the Method of Temperature Control	1 - 18
	Changing the Time / Temperature Programs	1 - 20
	Changing the Comfort Setpoint Temperature	1 - 22
	Changing the Economy Setpoint Temperature	1 - 23
	Clear a Holiday or Vacation Schedule	1 - 24
	Program a Holiday or Vacation Schedule	1 - 25
	Performing and Monitoring Energy Tests	1 - 26
2.0	Program and Control Settings	
	Building HVAC Weekly Time/Temperature Setpoint Schedule Worksheet	2 - 01
	EMS2000 Program and Control Setpoint Worksheets	
3.0	Troubleshooting Guide	
	Using the Master Control Unit's Displayed Data to Troubleshoot	3 - 01
	Displaying Room Temperature	3 - 02
	RS232 Communications from the Master Control Unit	3 - 04
	Heating System	3 - 06
4.0	Warranty Registration Card	



Master Control Unit (MCU)

The Master Control Unit (MCU) provides a means of controlling up to eight different HVAC systems from a single location without the use of a computer. The MCU operates similarly to an electronic thermostat and can be operated by the plant, office or maintenance personnel.

The MCU provides a means of programming the Control Module at each HVAC system and displaying current operating status and conditions as well as energy consumption and savings at each HVAC system.

Each of the eight HVAC systems can be defined from the MCU, operating parameters and operating modes can be entered, energy tests can be initiated, test results and energy consumption displayed.

For those users that want to use a computer on site or located remotely, an RS232 connector is provided at the bottom of the MCU for a serial computer port or a modem for communicating with a remote computer.



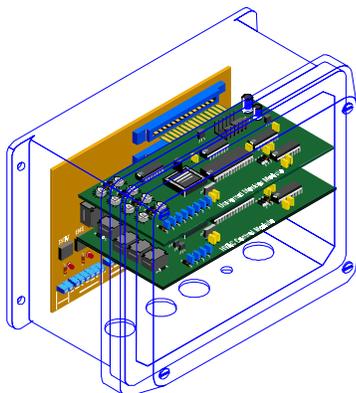
Room Temperature Sensor (RTS)

The Room Temperature Sensor (RTS) consists of a thermistor temperature sensor for monitoring room temperature, a Warmer and Cooler key provides limited adjustment of the current setpoint temperature and an optional temperature display.

The Warmer and Cooler keys provide an additional function of overriding the programmed night setback should an occupant work past normal closing hours. Pressing either key returns the setpoint to the comfort temperature for a two hour time period.

The Master Control Unit can limit the amount of temperature override that can be obtained by pressing the Warmer or Cooler keys. This prevents excessive settings and yet provides occupants with some control over comfort. The duration of the night time override is also programmed from the MCU and is set to two hours.

The RTS replaces the thermostat and is wired to the HVAC Control Module using the existing thermostat wires. An RTS is required for each HVAC system.



HVAC Control Module

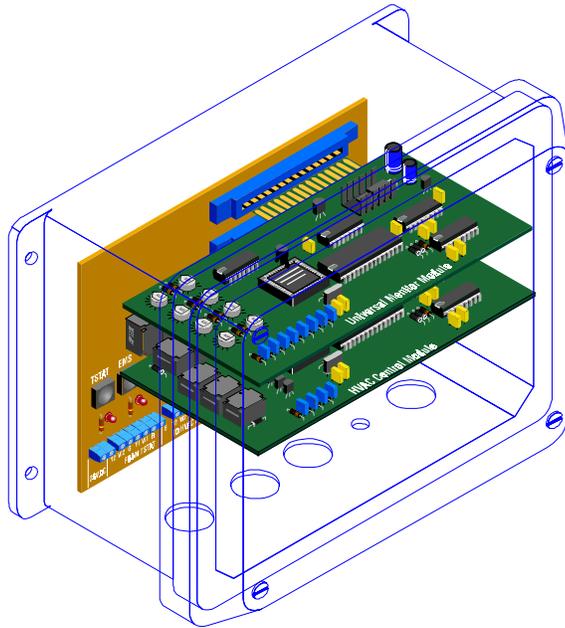
The HVAC Control Module operates the HVAC unit independent of the MCU. It is factory programmed although the system parameters can be easily changed using the MCU or from a remote PC computer. The control unit has non-volatile memory (unaffected by power loss) containing the system operating parameters, program schedules and the accumulated energy data.

The control module saves energy by improving the operating efficiency of the HVAC system by 20 to 35%, automatically setting the heating and cooling to more economical temperatures at night, on the weekends and during holidays when a facility may be vacant. This is accomplished without interfering with occupant comfort.

The Control Module is connected to the Room Temperature Sensor using the existing thermostat wiring. A 4-wire cable has to be installed to connect the first Control Module to the MCU. Multiple Control Modules are connected on the roof using a 3-wire cable.

The Control Module is compatible with a variety of HVAC systems including single or two-stage gas/electric systems, heat pumps with either O or B type reversing valves, economizers and systems with either single or two-speed fans.

A built-in test mode allows you to run a 2 to 28-day test to measure energy consumption, calculate savings in consumption, KW demand and both cooling and heating degree days.



An HVAC Control Module is required for each HVAC system. The Control Module can be programmed to operate with most heating and air conditioning systems. The Control Module is programmed from a Master Control Unit or a PC computer via an RS232 port.

Once programmed, the operating parameters are stored in non-volatile memory (unaffected by power outages) and controls the HVAC system independently. Energy usage data is stored in the Control Module and can be accessed via the Master Control Unit or a PC computer.

Compatible Systems

The Control Module can be programmed to operate with single and two-stage, packaged or split, gas/electric or heat pump systems. Optional outputs are provided for an economizer and a two speed indoor fan.

Temperature Sensors

The Control Module has temperature sensors for room, supply air and roof or outdoor temperature. The room temperature sensor is part of the Room Temperature Sensor. The supply air temperature sensor should be located in the the supply air duct or plenum. Be sure the sensor is not to close to the heat exchanger or indoor coil.

The outdoor or rooftop temperature sensor should be located in a shaded area so that it tracks the outdoor temperature. This sensor is used to determine when an economizer is activated and to compute the heating and cooling degree days.

Serial Communications

A serial RS232 port is provided for communications with a Master Control Unit or a PC computer. The first unit on the roof is wired to the Master Control Unit or PC computer and then wired to HVAC Control #2 which is wired to number #3 and so on. In this manner only the first unit is wired through the roof and the remaining units are connected on the roof.

Wiring to the Room Temperature Sensor

Each HVAC Control module is connected to a Room Temperature Sensor (RTS) using the existing thermostat wiring. The RTS contains a temperature sensor, an optional temperature display and two keys for adjusting the setpoint temperature.

The RTS provides limited adjustment over the setpoint temperature. The amount of adjustment is programmed into the HVAC Control Module and is typically three degrees.

Control Wiring

The detailed wiring of the HVAC Control module and the HVAC system are shown in the detailed wiring diagrams in Section 2.0 of this manual.

Mechanical Installation

The HVAC Control module is installed on the outside or within the HVAC system enclosure using four sheet metal screws. The module should be positioned high enough so that it is not subject to water from plugged drains or rain damage.



The Room Temperature Sensor (RTS) consists of a thermistor temperature sensor for monitoring room temperature, a Warmer and Cooler key provides limited adjustment of the setpoint temperature during normal occupied or comfort temperature setpoints.

The Warmer and Cooler keys also provide an additional function of overriding the programmed night setback should an occupant work past normal closing hours. Pressing either key returns the heating and cooling setpoints to the programmed comfort temperatures for a two hour time period. The RTS is available in two models, one with an LCD display of the room temperature and a second with no display.

The user can limit the amount of temperature override that can be obtained by pressing the Warmer or Cooler keys. This prevents excessive settings and yet provides occupants with some control over comfort.

The RTS replaces the thermostat and is wired to the HVAC Control Module using the existing thermostat wiring. An RTS is required for each HVAC system.

Adjusting the Setpoint Temperatures Using the WARMER and COOLER keys.

The occupant can make limited adjustment of the setpoint temperature for heating or cooling by pressing the WARMER key to raise the temperature or the COOLER key to lower the temperature.

Each time the key is pressed and held for one second, the setpoint temperature is raised or lowered by one degree from the programmed setpoint.

The total number of degrees of offset is set using the Master Control Unit. It is factory set at three degrees so the occupant can raise or lower the setpoint up to three degrees.

Pressing the WARMER or COOLER Keys Override the Night Time or Weekend Setpoint Temperature.

Whenever the HVAC Control Module is in a setback mode, with the heating or cooling temperatures set to more economical settings, pressing either the WARMER or COOLER key will return the setpoint temperature to the comfort temperature for a predefined time.

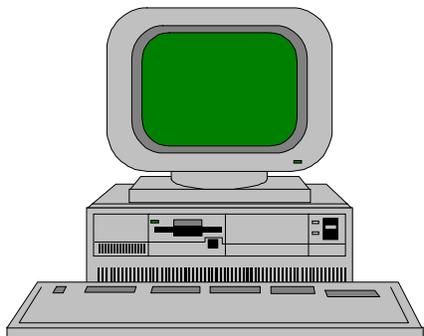
The factory default override time period is set to 2 hours and the comfort setpoint temperatures are set at 68° for heating and 72° for cooling. A setback period is defined as a programmed change of 5° or more in the setpoint temperature. The default comfort and economy temperatures can be changed from the Master Control Unit using the #4 Time/Temp Programs key.

Installing the Room Temperature Sensor. Wiring the Room Temperature Sensor.

The Room Temperature Sensor is installed in place of the existing thermostat used to control the HVAC system. On a new installation, the location of the Room Temperature Sensor should be installed using the same guidelines as a conventional thermostat.

The Room Temperature Sensor is wired directly to the HVAC Control Module. The five terminals on the RTS are wired to the corresponding terminals on the HVAC Control Module.

MS Windows Compatible Software



EMS2000 EnergyPro Software Product Features

- ▶ *IBM PC Hardware Compatible*
- ▶ *Microsoft Windows 95 or
Windows 3.1 Required*
- ▶ *Direct EMS2000 System Control or
Remote Control Using Modems*
- ▶ *All Control and Monitoring Done
Using Menus and Mouse Selections*
- ▶ *HVAC Unit Programming and Control
Done Individually, in Groups or All
Simultaneously*
- ▶ *On-Line Help and Instructions*
- ▶ *EMS2000 EnergyPro Software can be
Customized for Large Projects
or Unique Applications Upon
Request*

The EMS2000 Energy Management System can be locally or remotely controlled with an IBM compatible Personal Computer (PC) using the EnergyPro software. The EnergyPro software must be used with the Microsoft Windows 95, 98, NT and 2000 operating systems.

The EnergyPro software is an MS Windows Icon driven program providing for complete EMS2000 System control, programming, monitoring and data logging.

Communication Configuration Alternatives

A PC can communicate with the EMS2000 System either through the Master Control Unit or directly with the Control Modules without a Master Control Unit. The PC can be hardwired to the EMS2000 System through a standard PC Serial Communication Port. Alternatively the PC can communicate with the System through telephone lines using standard computer modems.

PC Control Capability

The PC EnergyPro software has the ability to control all HVAC equipment under EMS2000 System control. All HVAC equipment control can be done on an individual unit basis, multiple units or all units simultaneously by simple selection using the computer mouse and clicking on the appropriate HVAC unit's box shown on each screen. All HVAC system control parameters, such as time and temperature setpoint programming, holiday scheduling, manual or override unit operation, etc. can be performed.

Equipment Monitoring

The PC EnergyPro software can monitor all HVAC equipment either sequentially or individually. The HVAC equipment status such as cooling on/off, heating on/off, indoor fan on/off, Stage 2 On, or Heat and Cool setpoints can be monitored. System parameters and HVAC equipment performance such as room temperatures, outdoor temperature and HVAC unit supply temperatures can all be monitored, displayed and updated.

Energy Data Logging and Trending

The PC EnergyPro software can access all the EMS2000 System's energy and test data. The software can obtain and display the monthly and yearly operational data from each HVAC unit. Results from the EMS2000 System's energy test can also be displayed for each HVAC unit.

Displaying the Test Status for each HVAC System.

Start With	ENERGY TESTS 1	TEST STATUS ?Y/N
Factory Setting	NA	SELECT SYSTEM 01
For More Information	See Page 1-26	TEST DAY 01 TEST DAYS 14

Display Heating Hours.

Start With	ENERGY DATA 2	HEATING HOURS ?Y/N
Factory Setting	NA	WITH ER 0032. NORMAL 0034.
For More Information		

Start an Energy Test.

Start With	ENERGY TESTS 1	START TEST ?Y/N
Factory Setting	NA	LENGTH OF TEST 14 DAYS
For More Information	See Page 1-26	ALL SYSTEMS ?Y/N NO NO NO NO NO NO NO NO

Display Indoor Fan Hours.

Start With	ENERGY DATA 2	INDOORFAN HOURS ?Y/N
Factory Setting	NA	WITH ER 0032. NORMAL 0034.
For More Information		

Cancel an Energy Test.

Start With	ENERGY TESTS 1	CANCEL TEST ?Y/N
Factory Setting	NA	ALL SYSTEMS ?Y/N
For More Information	See Page 1-26	NO NO NO NO NO NO NO NO

Display Demand Minutes.

Start With	ENERGY DATA 2	DEMAND MINUTES ?Y/N
Factory Setting	NA	WITH ER 0008. NORMAL 0009.
For More Information		

Retrieve Energy Test Data.

Start With	ENERGY DATA 2	RETRIEVE TEST DATA ?Y/N
Factory Setting	NA	SELECT SYSTEM 01
For More Information	See Page 1-26	

Display Cooling Degree Days.

Start With	ENERGY DATA 2	COOLING DEGREE DAYS ?Y/N
Factory Setting	NA	WITH ER 0067. NORMAL 0072.
For More Information		

Display Cooling Hours.

Start With	ENERGY DATA 2	COOLING HOURS ?Y/N
Factory Setting	NA	WITH ER 0032.7 NORMAL 0034.1
For More Information		

Display Heating Degree Days.

Start With	ENERGY DATA 2	HEATING DEGREE DAYS ?Y/N
Factory Setting	NA	WITH ER 0067. NORMAL 0072.
For More Information	See Page 4-14	

Retrieve Monthly Energy Data.

Start With	ENERGY DATA 2	RETRIEVE TEST DATA ?Y/N
Factory Setting	NA	RETRIEVE MONTHLY DATA ?Y/N
For More Information	See Page 1-26	ENTER MONTH 01
		SELECT SYSTEM 01

Retrieve Monthly Energy Data.

Start With	ENERGY DATA 2	RETRIEVE TEST DATA ?Y/N
Factory Setting	NA	RETRIEVE MONTHLY DATA ?Y/N
For More Information	See Page 1-26	RETRIEVE YEARLY DATA ?Y/N
		ENTER MONTH 01
		SELECT SYSTEM 01

Display Cooling Hours.

Start With	ENERGY DATA 2	COOLING HOURS ?Y/N
Factory Setting	NA	COOL1 0027. COOL2 0004.
For More Information		

Display Heating Hours.

Start With	ENERGY DATA 2	HEATING HOURS ?Y/N
Factory Setting	NA	HEAT1 0032. HEAT2 0003.
For More Information		

Display Energy Recovery Hours.

Start With	ENERGY DATA 2	ER HOURS ?Y/N
Factory Setting	NA	HEAT ER 0027. COOL ER 0075.
For More Information		

Display Indoor Fan Operating Hours.

Start With	ENERGY DATA 2	INDOOR FAN HOURS ?Y/N
Factory Setting	NA	FAN 0327.
For More Information		

Display Demand Minutes.

Start With	ENERGY DATA 2	DEMAND MINUTES ?Y/N
Factory Setting	NA	TIME 0008.
For More Information		

Display Cooling and Heating Degree Days.

Start With	ENERGY DATA 2	DEGREE DAYS ?Y/N
Factory Setting	NA	COOL 0000. HEAT 0000.
For More Information		

Setting the Cooling Anticipation.

Start With	SYSTEM DATA 3	COOLING ON/OFF TEMP DIFF ?Y/N
Factory Setting	On 1° above setpoint Off 2° below setpoint	COOLING ON +01 COOLING OFF -02
For More Information		

Setting the Heating Anticipation.

Start With	SYSTEM DATA 3	HEATING ON/OFF TEMP DIFF ?Y/N
Factory Setting	On 1° below setpoint Off 2° above setpoint	HEATING ON +01 HEATING OFF -02
For More Information		

Setting the Minimum Temperature Differential to Start Energy Recovery.

Start With	SYSTEM DATA 3	MINIMUM START ER TEMP DIFF ?Y/N
Factory Setting	+20° for Heating -12° for Cooling	HEAT ER DIFF 20 COOL ER DIFF 12
For More Information		<i>Differential temperature is the temperature across the heat exchanger or indoor coil.</i>

Setting the Minimum Temperature Differential to Stop Energy Recovery.

Start With	SYSTEM DATA 3	MINIMUM STOP ER TEMP DIFF ?Y/N
Factory Setting	+12° for Heating -06° for Cooling	HEAT ER DIFF 12 COOL ER DIFF 06
For More Information		<i>Differential temperature is the temperature across the heat exchanger or indoor coil.</i>

Setting the Minimum Run Times.

Start With	SYSTEM DATA 3	MINIMUM RUN TIME ?Y/N
Factory Setting	5.0 Minutes for Heat 4.0 Minutes for Cool	HEAT MINUTES 05 COOL MINUTES 04
For More Information		

Setting the Minimum Off Times.

Start With	SYSTEM DATA 3	MINIMUM OFF TIME ?Y/N
Factory Setting	3.0 Minutes for Heat 3.0 Minutes for Cool	HEAT MINUTES 03 COOL MINUTES 03
For More Information		

Setting the Number of HVAC Systems.

Start With	SYSTEM DATA 3	NUMBER OF HVAC SYSTEMS ?Y/N
Factory Setting	1 System	TOTAL SYSTEMS 1
For More Information		

Setting the Type of HVAC Equipment.

Start With	SYSTEM DATA 3	TYPE OF SYSTEM ?Y/N
Factory Setting	Gas/Electric	GAS/ELECTRIC ?Y/N
For More Information		HEAT PUMP ?Y/N
		O-TYPE VALVE ?Y/N
		B-TYPE VALVE ?Y/N

Setting the HVAC System Address.

Start With	SYSTEM DATA 6	SET ADDRESS ?Y/N
Factory Setting	Set to 01	ADDRESS 0
For More Information		

Calibrating the Room Temperature Sensor.

Start With	SYSTEM DATA 3	CALIBRATE ROOM TEMP ?Y/N
Factory Setting	Set to 0 offset	ROOM TEMP 72
For More Information		-

Setting the Maximum Room Temperature Sensor Override Temperature.

Start With	SYSTEM DATA 3	MAX TEMP OVERRIDE ?Y/N
Factory Setting	Set to 03	MAX OVERRIDE 03
For More Information		-

Entering a Time/Temperature Schedule.

Start With	<i>TIME TEMP</i> 4	ENTER TIME/TEMP PROGRAM ?Y/N																
Factory Setting	See Below	SELECT PROGRAM NUMBER 01																
For More Information	See Page 1-20	6:00AM COOL 74 HEAT 68																
Program Time	<table border="1"> <tr> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td>6:00AM</td> <td>9:00AM</td> <td>5:00PM</td> <td>6:00PM</td> </tr> <tr> <td>72°F</td> <td>72°F</td> <td>72°F</td> <td>82°F</td> </tr> <tr> <td>68°F</td> <td>68°F</td> <td>68°F</td> <td>58°F</td> </tr> </table>	1	2	3	4	6:00AM	9:00AM	5:00PM	6:00PM	72°F	72°F	72°F	82°F	68°F	68°F	68°F	58°F	ALL DAYS ?Y/N
1	2	3	4															
6:00AM	9:00AM	5:00PM	6:00PM															
72°F	72°F	72°F	82°F															
68°F	68°F	68°F	58°F															
		MON TUE WED THU FRI SAT SUN																
		ALL SYSTEMS ?Y/N																
		NO NO NO NO NO NO NO NO																

Clear the Holiday or Vacation Schedules.

Start With	<i>TIME TEMP</i> 4	CLEAR HOLIDAYS ?Y/N
Factory Setting	None set.	SELECT HOLIDAY NUMBER 0
For More Information	See Page 1-24	SELECT SYSTEM 01

Setting the Holiday or Vacation Schedules.

Start With	<i>TIME TEMP</i> 4	SET HOLIDAYS ?Y/N
Factory Setting	None set.	SELECT HOLIDAY NUMBER 0
For More Information	See Page 1-25	START 12-25 STOP 12-27

Setting the Time and Date.

Start With	<i>TIME TEMP</i> 4	SET TIME OF DAY ?Y/N
Factory Setting	Same as shown	01-01-95 MON 12:00PM
For More Information	See Page 1-12	

Setting the Keyboard Entry Code.

Start With	<i>ENTRY CODE</i> 4	ENTER 3-NUMBER CODE TO LOCK
Factory Setting	NA	
For More Information		

Setting the Economy Temperature (Temperature used during Holidays).

Start With	<i>TIME TEMP</i> 4	SET ECONOMY TEMP ?Y/N
Factory Setting	Cooling set to 85°F Heating set to 58°F	COOLING 85 HEATING 58
For More Information	See Page 1-23	

Unlocking the Keyboard with the Entry Code.

Start With	<i>ENTRY CODE</i> 4	LOCKED ENTER 3-NUMBER CODE
Factory Setting	NA	UNLOCKED ENTER 3-NUMBER CODE
For More Information		

Setting the Comfort Temperature (Temperature used for RTS Override from Setback).

Start With	<i>TIME TEMP</i> 4	SET COMFORT TEMP ?Y/N
Factory Setting	Cooling set to 72°F Heating set to 68°F	COOLING 72 HEATING 68
For More Information	See Page 1-22	

Locking the Keyboard with the Entry Code.

Start With	<i>ENTRY CODE</i> 4	UNLOCKED ENTER 3-NUMBER CODE
Factory Setting	NA	
For More Information		

Setting the Temperature Control Mode.

Start With	<i>TEMP CONTROL</i> 5	PROGRAM OPERATION ?Y/N
Factory Setting	Program Operation	MANUAL OPERATION ?Y/N
For More Information	See Page 1-18	HEATING 68 COOLING 72
		OVERVERRIDE OPERATION ?Y/N
		HEATING 68 COOLING 72

Setting the Heat/Cool Operating Mode.

Start With	<i>HEAT COOL</i> 7	AUTO HEAT/COOL CHANGEOVER ?Y/N
Factory Setting	Automatic Heat/Cool Changeover	HEAT ONLY ?Y/N
For More Information	See Page 1-14	COOL ONLY ?Y/N
		HEAT COOL BOTH OFF ?Y/N

Selecting the Default Display Mode.

Start With	<i>DISPLAY</i> 6	SELECT DISPLAY ROOM TEMP 01
Factory Setting	Room Temperatures Display 01	SELECT DISPLAY HVAC STATUS 02
For More Information	See Page 1-13	SELECT DISPLAY TIME/TEMP 03
		SELECT DISPLAY HEAT TEMP 04
		SELECT DISPLAY COOL TEMP 05
		SELECT DISPLAY SUPPLY TEMP 06

Setting the Fan Operating Mode.

Start With	<i>FAN CONTROL</i> 8	AUTO OPERATION ?Y/N
Factory Setting	Automatic Operation	CONTINUOUS OPERATION ?Y/N
For More Information	See Page 1-16	TIMED OPERATION ?Y/N
		ON TIME 6:00AM OFF TIME 10:00PM
		ALL DAYS ?Y/N
		MON TUE WED THU FRI SAT SUN
		DUTYCYCLE OPERATION ?Y/N
		MINUTES ON PER HOUR 3

To set the time of day and the date, start by pressing the TIME/TEMP PROGRAMS key. Answer No to the first option of "ENTER TIME/TEMP PROGRAM ?Y/N" by pressing the NO key. Answer Yes to the option "SET TIME OF DAY ?Y/N". The date, day of the week and the time of day will then be displayed.

<p>TIME/TEMP PROGRAMS <input type="checkbox"/></p>	ENTER TIME/TEMP PROGRAM ?Y/N	<p>NO <input type="checkbox"/></p>
	SET TIME OF DAY ?Y/N	<p>YES <input type="checkbox"/></p>
	01-01-95 MON 12:33PM	

Notice the cursor under the "01" (month). Use the right and left cursor keys to position the cursor under the number to be changed. After selecting the number to be changed, use the up and down keys to increase or decrease the number.

<p>▶ ◀ <input type="checkbox"/> <input type="checkbox"/></p>	01-01-95 MON 12:33PM
<p>YES NO ▲ ▼ <input type="checkbox"/> <input type="checkbox"/></p>	01-01-95 MON 12:33PM

After changing the date and time, press the ENTER key. The LCD will display "SYSTEM BUSY" while it resets the date and time in each of the HVAC systems connected to the Master Control. After updating each system, the display will return to the last selected default display.

<p>ENTER <input type="checkbox"/></p>	SYSTEM BUSY
	11:08AM ID 70 OD 85