MCS-6 HEAT PUMP

Hardware Revision 1.2
Manual Revision 2.5
May 28, 2003

The MCS Commitment

Our commitment is to provide practical solutions for the industries needs and to be both a leader and partner in the effective use of microprocessor controls.

Micro Control Systems, Inc.
5400-1 Division Drive
Fort Myers, Florida 33905
(239) 694-0089
FAX: (239) 694-0031

1. Revision Page

Date	Author	Description of Changes
10/11/00	John G. Walterick	Updated to Revision 2.3. Modified following: -Added Revision page -Layout of section 2.2 -Layout & content section 3.1
11/02/00	John G. Walterick	Updated to Revision 2.4. Modified following: -Brian Walterick changes -Added Communicating Thermostat operations -Added Zone Sensor operations
05/28/03	Brian Walterick	Change area code from 941 to 239

Table of Contents

2. INTRODUCTION

2.1 THE MCS-6

The MCS-6 is a dedicated stand-alone unitary direct digital controller that provides total control for geothermal heat pumps. The standard heat pump control unit consists of the following:

MCS-6 micro plus sensor inputs

MCS-STAT or MCS-ZONE temperature

The MCS-6 micro is factory mounted on the heat pump unit. The MCS-STAT or MCS-ZONE sensor is field installed in the room/zone that the heat pump is conditioning. A field installed shielded cable connects the MCS-6 micro and either the MCS-STAT or MCS-ZONE

2.2 Geothermal unit configuration

The MCS-6 geothermal heatpump is designed to have the following inputs and outputs:

OUTPUTS		INPUTS	(Analog or Digital)
1 Evaporator Fan		1 Suction 1	(A or D)
2 Compressor 1		2 Discharge 1	(A or D)
3 Reverse valve		3 Supply temperature	(A)
4 Optional		4 Water In temperature	(A)
5 Optional		5 Water Out temperature	(A)
6 Optional		6 Zone temperature or	(A)
		Condenser over flow	(D)
7 Analog Output (0 to 10 VDC)		7 Suction 2 (if opt. G selected)	(A or D)
Option A= Compressor 2		8 Discharge 2 (if opt. G selected)	(A or D)
Option B= Auxiliary Heat			
Option C= Emergency Heat			
Option D= Economizer			
Option E= Hot Gas Reheat			
Option F= Heat Reclaim Pump			
Option G= Outside Damper			

3. MCS-6 unit layout
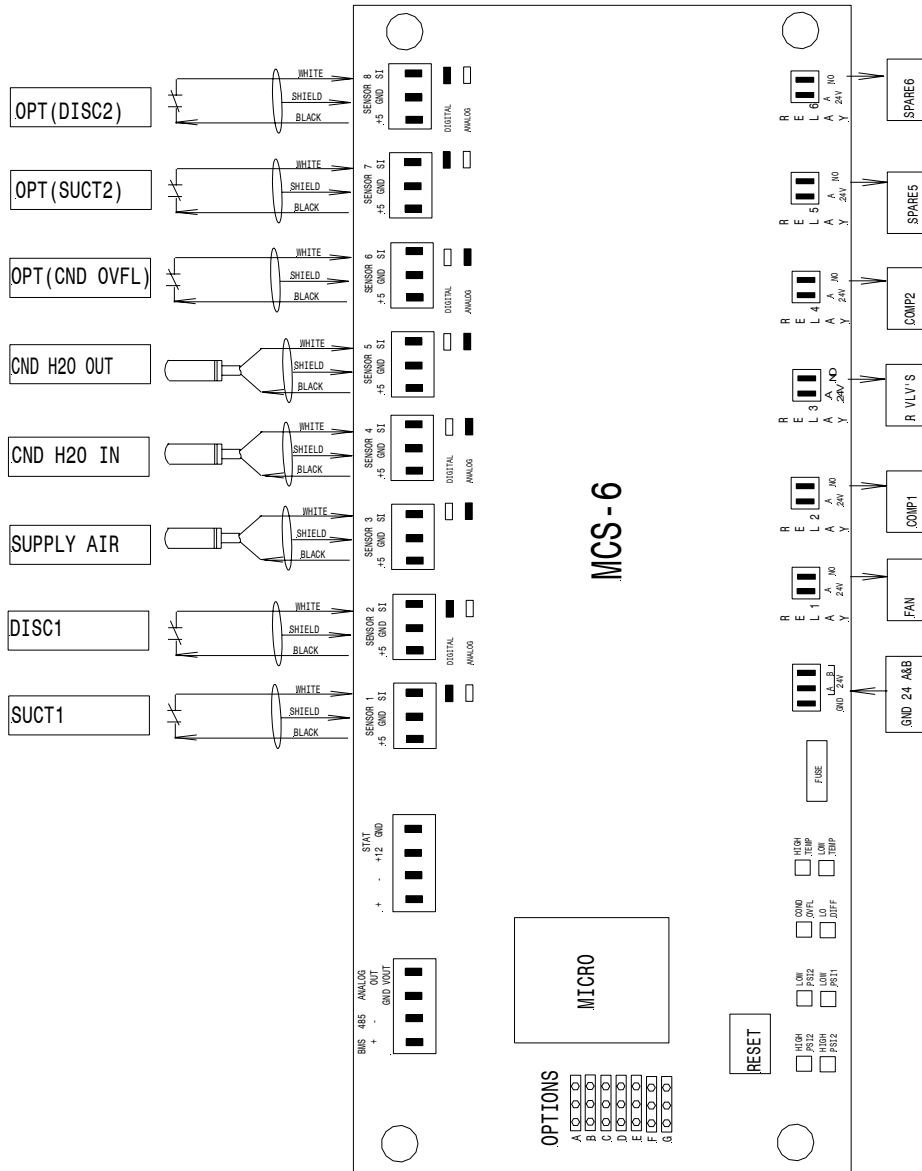
3.1 MCS-6 and Devices Hardware Features

3.1.1 Standard hardware features MCS-6

24 VAC input power (user supplied)
>   2 amp 5 x 20 mm fuse

Four layer printed circuit board
>   .093 thickness printed circuit board
>   Power & ground planes
>   Surface mount parts
>   4" X 8 7/8" board with 4 mounting holes and a lexan cover
>   Connectors and options are clearly labeled
>   Connectors for communication to thermostat
>   Real time clock with battery

TOSHIBA micro controller
>   16 MHz, 1K of RAM, 32K ROM
>   10 bit A/D converter
>   Watch dog timer

6 Relay Outputs (RO)
>   Individually fused at 5 AMP
>   Individual 24 VAC common & Normally open terminals
>   Individual green LED for each RO to indicate when the RO is on
>   All ROs are tied to one common
>   Individual relay output connectors

8 Sensor Inputs (SI)
>   Individual +5 VDC, ground & sensor inputs for each sensor
>   All are tied to a self resetting Poly Fuse
>   Digital or analog pressure sensors are supported
>   Analog temperature sensors are supported
>   Zone or communicating thermostat is supported
>   Individual sensor input connectors
>   Override switch on Zone or communicating thermostat

1 Analog output
>   0 to 10 VDC

3.1.2 Communicating thermostat (Optional)

Provides: Temperature sensor (standard)
>   Humidity sensor   (optional)
>   Alarm output codes displayed and Alarm horn alert
>   Adjustable cool and heat targets
>   System switch with 'OFF, AUTO, SCHED'
>   Fan switch with 'AUTO, ON'
>   Override button (Allows ALARM reset and SCHED override)

4. MCS-6 Sensor Inputs

4.1 Sensor Inputs that are wired directly to the MCS-6 micro

There are eight inputs that can be wired directly to the MCS-6 micro. Of these eight, five are standard, with the other three being specified via the PC-Conn program. All wired inputs have fixed connector locations that are located on the bottom left of the board and are identified as follows:

Suction 1 pressure   (analog or digital)

Discharge 1 pressure   (analog or digital)

Supply temperature   (analog)

Water In temperature   (analog)

Water Out temperature   (analog)

Zone temperature   (analog) (optional COND OVL FLOW, if Communicating Stat used)

Suction 2 pressure   (Analog or digital)   (if option G selected)

Discharge 2 pressure   (Analog or digital)   (if option G selected)

4.1.1 Suction for compressor 1   (standard)

Low Pressure Switch -Digital Input (standard)

This is a normally closed switch input that will signal a low suction pressure fault when open. Refer to the safety LOW PSI COMPRESSOR1 for details on this fault condition.

Pressure Transducer - Analog Input (optional)

The unit supports a 0-500 PSI transducer in place of the standard Low Pressure Switch. This not only provides a low pressure safety but also will give the user the actual suction pressure. Refer to the safety LOW PSI COMPRESSOR1 for details on this fault condition.

This option is only selectable via the PC-Connection program with a factory authorization level.

4.1.2 Discharge for compressor 1   (standard)

High Pressure Switch -Digital Input (standard)

This is a normally closed switch input that will signal a high discharge pressure fault when open. Refer to the safety HIGH PSI COMPRESSOR1 for details on this fault condition.

Pressure Transducer - Analog Input (optional)

The unit supports a 0-500 PSI transducer in place of the standard High Pressure Switch. This not only provides a high pressure safety but also will give the user the actual discharge pressure. Refer to the safety HIGH PSI COMPRESSOR1 for details on this fault condition.

This option is only selectable via the PC-Connection program with a factory authorization level.

4.1.3 Supply Air Temperature   (standard)

This is an MCS-SAIR temperature sensor with accuracy of $\pm$ 0.3 °F; it provides the supply air temperature.

4.1.4 Water In Temperature   (standard)

This is an MCS-T100 temperature sensor with accuracy of $\pm$ 0.3 $^\circ$F; it provides the water temperature entering the condenser.

4.1.5 Water Out Temperature   (standard)

This is an MCS-T100 temperature sensor with accuracy of $\pm$ 0.3 $^\circ$F; it provides the water temperature leaving the condenser.

4.1.6 Zone Temperature Sensor   (standard)

This is an MCS-ZONE temperature sensor with accuracy of $\pm$ 0.3 $^\circ$F; it provides the zone temperature. This is the default item; it can be replaced with a MCS-STAT communicating thermostat.

The MCS-6 software will inquiry the network to determine if the MCS-STAT is present.

When Override switch is pressed the micro will switch into OVERRIDE mode.

4.1.7 Condensation Overflow   (optional)

This is a normally closed switch input that will signal a condensation overflow fault condition when open.

This option is only selectable via the PC-Connection program with a factory authorization level.

This option can only be selected when the zone temperature sensor has been replaced with an MCS-STAT communicating thermostat.

4.1.8 Suction for compressor 2   (optional)

This input must be used when the compressor 2 option has been selected via the on board jumper.

Low Pressure Switch -Digital Input (standard)

This is a normally closed switch input that will signal a low suction pressure fault when open. Refer to the safety LOW PSI COMPRESSOR2 for details on this fault condition.

Pressure Transducer - Analog Input (optional)

The unit supports a 0-500 PSI transducer in place of the standard Low Pressure Switch. This not only provides a low pressure safety but also will give the user the actual suction pressure. Refer to the safety LOW PSI COMPRESSOR2 for details on this fault condition.

This option is only selectable via the PC-Connection program with a factory authorization level.

4.1.9 Discharge for compressor 2   (optional)

This input must be used when the compressor 2 option has been selected via the on board jumper.

High Pressure Switch -Digital Input   (standard)

This is a normally closed switch input that will signal a high discharge pressure fault when open. Refer to the safety HIGH PSI COMPRESSOR2 for details on this fault condition.

Pressure Transducer - Analog Input   (optional)

The unit supports a 0-500 PSI transducer in place of the standard High Pressure Switch. This not only provides a high pressure safety but also will give the user the actual discharge pressure. Refer to the safety HIGH PSI COMPRESSOR2 for details on this fault condition.

This option is only selectable via the PC-Connection program with a factory authorization level.

4.2 Network Inputs provided by the MCS-STAT communicating thermostat

The communicating thermostat provides information that is critical to the MCS-6 micro. The communicating thermostat can be replaced with the MCS-ZONE temperature sensor to capture the temperature reading.

Communications between the micro and the communicating thermostat is provided via a four wire shielded cable. This will provide the power and the RS485 communications.

4.2.1 Zone temperature sensor.

This is temperature sensor with accuracy of $\pm 0.3°F$; it will provide the zone temperature.

4.2.2 Fan switch

The fan switch indicates if the fan is to be on continuously or if the fan is to be on only when the unit is in either a heating or cooling schedule.

4.2.3 Off/AUTO/SCHEDULED switch

This switch indicates if the unit is in an auto, schedule or off mode.

4.2.4 Override button

This enables the unit to use occupied setpoints for a given period of time regardless of the time of day schedule. (Also used to clear alarm.)

4.2.5 Humidity sensor   (optional)

This is required if the Hot Gas Reheat option has been selected for dehumidification control. It can also be used for information only purposes.

5. MCS-6 outputs

There are six Relay outputs that can be wired directly to the MCS-6 micro. The on board relays are rated for 5 amps with a life cycle of 1,000,000 @ 25°C.

Of these six, three are standard, with the other three being specified with jumper settings on the micro board. The standard wired outputs have fixed locations and are identified as follows:

FAN

COMP (compressor 1)

REV.V (reversing valve for both compressor 1 and 2 if it is present)

The other outputs are identified as RELAY 4, 5 & 6. The options are selected via on board jumpers. The options are identified with the letters A through G.

5.1 Standard Relay Outputs

5.1.1 Fan   (standard)

The fan will be turned on whenever the micro is in a heating or cooling mode, unit is in either a pre or post delay or the fan switch on the communicating thermostat is in the ON position.

5.1.2 Compressor   (standard)

The compressor 1 will be turned on when not locked out and whenever the micro is in a heating or cooling mode and the stage is not in an economize stage.

5.1.3 Reversing Valve   (standard)

The reversing valve will be turned on whenever the micro is in a heating mode and not in the economizer stage.

5.2 Optional Relay Outputs

5.2.1 Compressor 2   (optional #1)   Jumper A

This option indicates that there are two compressors in this unit. This will add an additional heating and cooling stage.

The CMP2 CL DIFF, CMP2 HT DIFF and the HUMD COMP2 setpoints will be used with this option.

5.2.2 Auxiliary Heat   (optional #2)   Jumper B

If the auxiliary heat option is selected, the auxiliary heat will provide an additional heating stage. This stage will be activated when the zone temperature is less than the calculated auxiliary heat setpoint.

An option that can be selected via the PC-Connection program will control the auxiliary heat based upon the supply air being less than the setpoint S-AIR AUX HT.

The AUX HT DIFF setpoint must be active unless the supply air option is selected.

5.2.3 Emergency Heat   (optional #3)   Jumper C

This option will supply emergency electric heating coils.

This relay will be turned on when the micro is in the heating mode and a mechanical stage of heating is out on a safety.

5.2.4 Economizer   (optional #4)   Jumper D

This is a water economizer that when selected, will enable the water to provide cooling and/or heating if the water temperature is within range (setpoint) prior to the compressor being turned on.

This will provide the first stage of heating or cooling.

This relay will be turned on when the micro is in either a heating or cooling mode and the water temperature is with in the range of the associated setpoint.

The COOL'G WATER and HEAT'G WATER setpoints must be active.

When this option is selected, the factory setting will be economize cooling only. This change can be made to both cooling and heating or heating only via the PC-Connection program with a factory authorization level.

5.2.5 Hot Gas Reheat   (optional #5)   Jumper E

This option is used to perform dehumidification. The MCS-STAT must be specified with a humidity sensor.

The dehumidification mode will not be entered or the micro will not remain in this mode unless the zone temperature is being maintained.

The micro will enter the dehumidification mode when the zone temperature is being maintained and the zone humidity is above the associated setpoint. In this mode, the compressor(s), reversing valve(s) and the hot gas reheat relays will be turned on. The micro will move through the various stages of dehumidification until the humidity has been reduced to below the setpoint or the zone temperature is no longer being satisfied.

All of the humidity setpoints must be active.

5.2.6 Heat Reclaim Pump   (optional #6)   Jumper F

This option will use an auxiliary water loop/condenser loop for heat recovery in place of the main water loop/condenser loop.

This relay will be turned on when the micro has turned on either of the compressor relay outputs. (in cooling mode only)

5.2.7 Outside Damper   (optional #7)   Jumper G

If the outside damper option is selected, the damper will be opened; the relay will turn on after a given time (setpoint) when the unit is powered up, reset or cycles from unoccupied to occupied.

The damper will be closed (off) during the unoccupied mode.

The DAMPER DELY setpoint must be active.

Selected by setting a jumper to "ON" for this option.

Options selected are wired in order selected. As an example, if Jumpers A, B & E are selected, then

Option A = *Compressor 2 will be wired to Relay Output 4*

Option B = *Auxiliary Heat will be wired to Relay Output 5*

Option E = *Hot Gas Reheat will be wired to Relay Output 6*

6. Setpoints

6.1 General Description

Setpoints consist of the following:
Name
Setpoint value
The minimum that the value can be set
The maximum that the value can be set

Only the setpoint values of the occupied and unoccupied base setpoints for cooling, heating and dehumidification can be changed from the MCS-STAT. No authorization is required.

All setpoint values can be changed via the PC-Connection program with a service level authorization.

The setpoint minimum and maximum values cannot be changed. To change these values please contact the factory.

6.2 Cooling & Heating setpoints

The COOL / HEAT OCCUPIED and COOL / HEAT UNOCCUPIED setpoints are the only cooling setpoints that contains temperature values, all other COOLING / HEATING setpoints are differential values. These differential setpoints are used to calculate the cut in setpoint values of the various stages. Therefore, by changing the base setpoint, COOL / HEAT OCCUPIED; all related setpoints that effect OCCUPIED setpoints are adjusted. The same is true of the UNOCCUPIED setpoints.

CARE MUST BE TAKEN TO ENSURE THE BASE COOL SETPOINTS MUST NOT OVERLAP WITH THE BASE HEAT SETPOINTS!

Setpoint #	Setpoint Name	Setpoint Value	Minimum Setting	Maximum Setting
1	COOL OCCUPY	77.0F	70.0F	85.0F
2	COOL UNOCCUP	82.0F	75.0F	90.0F
3	COOL 1 DIFF	0.5F	0.2F	5.0F
4	COOL 2 DIFF	0.5F	0.2F	5.0F
5	COOL 3 DIFF	0.5F	0.2F	5.0F

Setpoint #	Setpoint Name	Setpoint Value	Minimum Setting	Maximum Setting
6	HEAT OCCUPY	70.0F	65.0F	75.0F
7	HEAT UNOCCUP	65.0F	60.0F	70.0F
8	HEAT 1 DIFF	0.5F	0.2F	5.0F
9	HEAT 2 DIFF	0.5F	0.2F	5.0F
10	HEAT 3 DIFF	0.5F	0.2F	5.0F
11	HEAT 4 DIFF	0.5F	0.2F	5.0F

6.3 Humidity Setpoints

The HUMD IN OCCUPIED and HUMD IN UNOCCUPIED setpoints are the only humidity setpoints that contains a humidity value, all other setpoints are a differential value that are added to these setpoints. Therefore, by changing the base setpoint, HUMD IN OCCUPIED, all related setpoints that are needed in the OCCUPIED mode are adjusted. The same is true of the UNOCCUPIED setpoints. The humidity sensor and the hot gas reheat option are required if dehumidification control is to be used. Dehumidification will only be entered if the zone temperature is being satisfied.

Setpoint #	Setpoint Name	Setpoint Value	Minimum Setting	Maximum Setting
13	HUMD OCCUPY	55.0%	45.0%	65.0%
14	HUMD UNOCCUP	60.0%	50.0%	70.0%
15	HUMD 1 DIFF	2.0%	1.0%	10.0%
16	HUMD 2 DIFF	2.0%	1.0%	10.0%
17	HUMD 3 DIFF	2.0%	1.0%	10.0%

6.4 Entering Water In Setpoints

These setpoints are relate to the water in temperature and are used to determine if the economizer can be used for heating or cooling, if this option is available in the unit. These setpoints are required if the economizer option has been selected.

Setpoint #	Setpoint Name	Setpoint Value	Minimum Setting	Maximum Setting
18	COOL WATER	55.0F	38.0F	60.0F
19	HEAT WATER	85.0F	75.0F	90.0F

6.5 Timers

These setpoints provide timing values for various functions.

> START UP DELAY - Time delay expressed in seconds that the micro will wait following a power up or a reset before the heat pump will be allowed to run.

> MINIMUM STAGE TIME - This the minimum time that the micro will remain in each cooling/heating stage before making a decision to change stages unless a safety or lockout condition has occurred.

> ANTI CYCLE TIMER - Time delay expressed in minutes that the associated compressor must be off before it can be restarted. Also the time that an output will be off, before retrying, while in a safety.

> DAMPER OPEN DELAY - Time delay expressed in minutes that the micro will wait after the initial start up or after coming out of an unoccupied mode before the outside damper will be opened.

COOL DELAY - Time delay expressed in minutes that the micro will wait after the fan has been turned on before turning on the first stage of cooling.

HEAT DELAY - Time delay expressed in seconds that the micro will wait before turning on the fan after the first stage of heating has been turned on.

FAN POST DELAY - Time delay expressed in minutes that the micro will wait before turning off the fan after cooling, heating or dehumidification.

OVERIDE TIME - Time expressed in minutes that the micro will stay in the OCCUPPIED mode when the override switch has been activated. (If the setpoint value is 0, the micro will stay in the OCCUPPIED mode until the next scheduled UNOCCUPPIED mode.

Setpoint #	Setpoint Name	Setpoint Value	Minimum Setting	Maximum Setting
20	START DELAY	30s	15s	180s
21	STAGE DELAY	120s	15s	180s
22	ANTI CYCLE	5m	1m	10m
23	DAMPER DELAY	2m	1m	10m
24	COOL DELAY	2m	1m	10m
25	HEAT DELAY	15s	15s	30s
26	FAN POSTDLY	3m	1m	6m
27	OVERIDE TIME	120m	0m	144m

6.6 Control Safety Alarms

6.6.1 Introduction to Safeties

These setpoints are used to insure that the unit is functioning properly. When a condition is encountered that has existed for longer than the time contained in the associated safety setpoint, a safety occurs. Certain times are extended 90 seconds during compressor start. The unit will generate an error message, light the appropriate red LED, and turn off associated points, these will be marked as either in a safety or lockout state. The unit will enable the associated output point to return to normal when the safety condition returns to normal. If the same safety condition is encountered with in an hour, the unit will enter a lock out condition that requires a manual reset.

Setpoint #	Setpoint Name	Setpoint Value	Minimum Setting	Maximum Setting	Time
28	HI WATER IN	100.0F	90.0F	120.0F	1m
29	LOW DIFF TEMP	6.0F	5.0F	15.0F	5m
30	LOW WATER OUT	35.0F	5.0F	50.0F	5m
31	SPARE 31				
32	COND OVERFLW	0.0	40.0	95.0	10s
33	HI PSI CMP1	380.0P	360.0P	420.0P	2s
34	LO PSI CMP1	40.0P	35.0P	50.0P	2s
35	HI PSI CMP2	380.0P	360.0P	420.0P	2s
36	LO PSI CMP2	40.0P	35.0P	50.0P	2s

7. Events, Alarms and Safeties

7.1 Introduction

There are three types of control information generated by the MCS-6 control logic:

- Information only events,

- MCS-6 system alarms and

- Control safety alarms (these alarms will also turn on their respective red LED alarm lights).

All of the control information / alarm has the same format. The information / alarm is identified and is date / time stamped when the information message is generated. The information / alarm can be viewed from the PC-Connection program.

7.2 Information Only Events

INFORMATION EVENTS	DESCRITPION
DAYLITE SAVINGS	This alarm message is generated whenever the system changes the clock due to Day Light Savings time change.
CONFIG DOWNLOAD	This alarm message is generated whenever a configuration file has been down loaded from the PC-Connection program.
ALARMS CLEARED	This alarm message is generated whenever the alarm history has been cleared from the PC-Connection program.
POINTS CLEARED	This alarm message is generated whenever the point information has been cleared from the PC-Connection program.

7.3 MCS-6 System Alarms

MCS-6 SYSTEM ALARM	DESCRITPION
POWER UP/RESET	Message is generated when power has been returned to the system or the reset button on the MCS-6 has been pressed.
LOST STAT COMM	Message is generated when the MCS-STAT communications has been lost between it and the MCS-6 controller. This will result in the system entering the LOCKOUT FAULT state.
INVALID CONFIG	This alarm message is generated when the MCS-6 controller finds the configuration file is corrupted. The system will restore all settings to their factory default values. The system will run with these values.
INVALID CLOCK	This alarm message is generated when the MCS-6 controller's real time clock is not functioning properly. The system will be forced into the occupied mode until the clock has been corrected. The system will run in this mode.
BAD SENSOR-#	Message is generated when the MCS-6 controller has an analog sensor that is reading either opened or shorted. This results in the system entering the LOCKOUT FAULT state. The following sensor failures cause this: (SUCT1, DISC1, SUPPLY TEMP, ZONE TEMP, SUCT2, DISC2)

7.4 MCS-6 System Safeties / Lockouts

MCS-6 SYSTEM Safeties / Lockouts	DESCRITPION
HI WATER IN	Safety is generated when the unit is in cooling & the condenser water in temperature exceeds the value in setpoint 28. Factory default is 100 F.
LOW DIFF TMP	Safety is generated when the unit is in either cooling or heating mode and the difference between zone temperature minus supply temperature is less than the value in setpoint 29. Factory default is 6 F.
LOW WATER OUT	Safety is generated when the unit is in heating mode and the condenser water out is less than the value in setpoint 30.
COND OVERFLOW	This alarm message is generated when the optional condenser overflow input is available and is on; indicating the condenser is not draining correctly.
HI PSI CMP1	This safety is generated when either compressor 1 high psi digital in is on or the optional psi sensor value is greater than setpoint 33's value.
LO PSI CMP1	This safety is generated when either compressor 1 low psi digital in is on or the optional psi sensor value is lower than setpoint 34's value.
HI PSI CMP2	This safety is generated when either compressor 2 high psi digital in is on or the optional psi sensor value is greater than setpoint 35's value.
HI PSI CMP1	This safety is generated when either compressor 2 low psi digital in is on or the optional psi sensor value is greater than setpoint 36's value.

8. Control Logic Sequence

8.1 Modes and States

8.1.1 Heat Pump Mode

The Heatpump mode determines whether the occupied or unoccupied base setpoints are active for the cooling, heating or dehumidification states.

The Heatpump mode is either:
- OCCUPIED
- UNOCCUPIED
- VACATION
- OVERRIDE

The mode is determined by:
- The system switch setting on the MCS-STAT,
- The system schedules or
- Pressing the override button on either the MCS-STAT or the MCS-ZONE sensor.

The current mode and the elapsed time are displayed in the PC-Connection status screen under **Heat Pump Status**. The current active base setpoints are also displayed in this section.

8.1.2 Heat Pump State

The Heatpump state indicates the action that the system is taking, e.g. 'COOLING' indicates that the zone temperature is too high; therefore, bringing on stages of cooling.

The Heatpump states are:
- SAFETY FAULT
- SENSOR FAULT
- SCHEDULED OFF
- UNIT DISABLED
- STARTUP DELAY
- UNIT OFF
- FAN ONLY
- FAN PREDELAY
- COOLING
- HEATING
- DEHUMIDIFY
- FAN POSTDELAY

The current state and the elapsed time are displayed in the PC-Connection status screen under **Heat Pump Status**. The delay between stages and the number of stages wanted and actual on are also displayed in this section.

8.1.3 Compressor State

The Compressor State indicates the status of that compressor.

The compressor states are:
- LOCKOUT
- SAFETY
- SENSOR FLT
- ANTI-CYCLE
- OFF
- COOLING
- HEATING
- REHEATING

The Compressor State and the elapsed time are displayed in the PC-Connection status screen under **Compressor Status**. The suction and discharge status is also displayed in this section.

8.1.4 Economizer State

The Economizer State indicates the status of the economizer if it exists.

The economizer states are:
- BYPASSED
- OFF
- COOLING
- HEATING

The Economizer State and the elapsed time are displayed in the PC-Connection status screen under **Compressor Status**. If the economizer is not active, the state display contains 'NOT USED'.

8.2 Staging

The unit develops the cut in and cut out points for the various stages with in the cooling, heating or dehumidification mode and moves to those stages based upon the zone temperature and humidity.

8.2.1 Stages of cooling

The various cooling stages will be the same for the occupied, override and unoccupied modes. The base setpoint COOL OCCUPIED will be used when in the OCCUPIED or OVERRIDE modes and the COOL UNOCCUPIED will be used when in the UNOCCUPIED mode. There are three stages of cooling that are available: Economizer, compressor1 and compressor2.

8.2.2 Stages of heating

The various heating stages will be the same for the occupied, override and unoccupied modes. The base setpoint HEAT OCCUPIED will be used when in the OCCUPIED or OVERRIDE and the HEAT UNOCCUPIED will be used when the UNOCCUPIED mode. There are four stages of heating that are available: Economizer, compressor1, compressor2 and auxiliary heat. (Emergency heat is only used if a mechanical stage is locked out)

8.2.3 Stages of dehumidification

The various dehumidification stages will be the same for both the occupied and unoccupied modes. The base setpoint HUMD IN OCCUPIED will be used when in the OCCUPIED or OVERRIDE modes and the HUMD IN UNOCCUPIED will be used when in the UNOCCUPIED mode. There are two stages of dehumidification that are available: compressor1 and compressor2.

9. PC-Connection AVAILABLE INFORMATION

The MCS-6 micro stores various information that can be accessed by a 'Windows' based system, PC-Connection. With the addition of a MCS-GATEWAY card and a RS232 cable the user can communicate and receive update information every second from the MCS-6. In the appendix are some print outs of PC-Connection screens.

9.1 Screen Information

Upper portion of the screen provides the following
- Screen identification
- Authorization level
- Network address
- Date / Time information
- Manufacturer information
- Unit name

9.2 Zone Thermostat Status

The next portion of the screen provides the following
- Current Zone temperature
- Cooling & Heating targets   (setpoint information for the current mode)
- Zone humidity and target
- Thermostat switch setting

9.3 Evaporator Status

The next portion of the screen provides the following
- Supply fan on/off status
- Current Supply temperature
- Overflow on/off status
- Damper on/off status
- Auxiliary heat on/off status
- Emergency heat on/off status

9.4 Compressor Status

The next portion of the screen provides the following
- Compressor 1 on/off status
- Compressor 2 on/off status
- Economizer on/off status
- Reversing valve on/off status

In additional to the above, number of cycles, current state, time in state, suction psi and discharge psi status, are provided.

9.5 Alarm Status

The bottom left portion of the screen provides the following
- The five most current five alarms or events with their time of occurrence.

9.6 Heat Pump Status

The upper right portion of the screen provides the following
- The current state of the unit
- The time the unit has been in this state.
- The current mode of the unit
- The time the unit has been in this mode
- The time in seconds before the next change will occur
- The number of stages wanted on
- The number of stages actually on

9.7 Condenser Status

The next portion on the right of the screen provides the following
- Current condenser water in temperature
- Current condenser water out temperature
- Hot gas reheat temperature
- Heat reclaim pump status

9.8 Clear / Change Buttons

The bottom right portion of the screen provides select buttons which will provide the following
- Setpoint information & change ability
- Date & Time information & change ability
- Manual (Auto) relay output / sensor input listing & change ability
- Clear alarms ability
- Clear point information ability
- Lockout reset ability
- Default setup screen ability
- Change setup ability

10. SUMMARY OF OPTIONS

10.1 Board Selectable Options

These are the Relay Output options that are selected by moving the jumper to the ON position for that option. The options are located on the top right hand corner of the MCS-6 board. A maximum of three of the seven options may be active. They must be wired to relay output connectors identified as OPT1, OPT2 and OPT3. The options selected via the jumper settings are numbered. The output associated with the option with the lowest letter must be wired to the connector marked as OPT1, the option with the next highest number must be wired to the connector marked OPT2 and the option with the highest number must be wired to OPT3.

For example, if the COMP 2 (Option A), ECONOMIZER (Option D) and the HOT GAS REHEAT (Option E) and are selected, the compressor 2 output will be wired to Relay Output #4, the economizer output will be wired to Relay Output #5 and the hot gas reheat will be wired to Relay Output #6.

Three of following options can be selected:

1. *Jumper A-* COMP2, this is selected if there are two compressors in this system. The second compressor will provide an addition stage of cooling, heating and dehumidification.

2. *Jumper B-* AUXILIARY HEAT, auxiliary heat will provide an addition heating stage.

3. *Jumper C-* EMERGENCY HEAT, emergency heat is used when the unit is not generating the accepted heating capacity.

4. *Jumper D-* ECONOMIZER, this option will provide the first stage of cooling, heating and dehumidification. This stage is used before the compressor(s) is turned on.

5. *Jumper E-* HOT GAS REHEAT, this option is required if dehumidification is required.

6. *Jumper F-* HEAT RECLAIM PUMP, this option enables an auxiliary loop to be used for heat recovery.

7. *Jumper G-* OUTSIDE DAMPER, this option will provide out side air.

10.2 Options & Changes that can and cannot be made form the PC-Connection Program

1. Changes to the setpoint values, requires a service authorization level.

2. Changing the sensor input of the high and low pressure inputs from digital to analog (pressure transducers), requires a factory authorization level.

3. To change the factory default temperature sensor from a zone temperature to a MCS-STAT. This requires a factory authorization level. This will free sensor input #5 to be used as a condenser overflow indicator.

4. Change the date/time settings, no authorization is required.

5. The network address of the MCS-6 can be changed with a service authorization level.

6. The following unit information can be change with a service authorization:

    -   Installation Date
    -   Unit Name
    -   Model Name
    -   Company Name
    -   Serial Number

7. Change the optional condenser overflow sensor to indicate that the sensor is present. This can only be used if the MCS-STAT is present; otherwise that input is allocated to the zone temperature sensor.

8. Indicate that the fan speed will be controlled via the analog output. (Phase II)

9. Enable D.L.S.T. If yes, Day Light Savings Time adjustment will automatically be made.

10. Indicate if auxiliary heat is to be controlled on supply temperature. (Phase II)

11. APPENDIX

11.1 Setpoint Summary

(Values from Factory Settings are shown)

#	SETPOINT NAME	SETPOINT VALUE	MINIMUM SETTING	MAXIMUM SETTING	TIME
1	COOL OCCUPY	75.0F	70.0F	85.0F	0
2	COOL UNOCCUP	85.0F	75.0F	90.0F	0
3	COOL 1 DIFF	0.5F	0.4F	5.0F	0
4	COOL 2 DIFF	0.5F	0.4F	5.0F	0
5	COOL 3 DIFF	0.5F	0.4F	5.0F	0
6	HEAT OCCUPY	68.0F	65.0F	80.0F	0
7	HEAT UNOCCUP	55.0F	60.0F	70.0F	0
8	HEAT 1 DIFF	0.5F	0.4F	5.0F	0
9	HEAT 2 DIFF	0.5F	0.4F	5.0F	0
10	HEAT 3 DIFF	0.5F	0.4F	5.0F	0
11	HEAT 4 DIFF	0.5F	0.4F	5.0F	0
12	SUPPLY AUX	95.0	85.0	110.0	0
13	HUMD OCCUPY	55.0%	40.0%	70.0%	0
14	HUMD UNOCCUP	60.0%	50.0%	70.0%	0
15	HUMD 1 DIFF	2.0%	1.0%	10.0%	0
16	HUMD 2 DIFF	2.0%	1.0%	10.0%	0
17	HUMD 3 DIFF	2.0%	1.0%	10.0%	0
18	COOL WATER	65.0F	38.0F	60.0F	0
19	HEAT WATER	75.0F	70.0F	90.0F	0
20	START DELAY	30s	15s	180s	0
21	STAGE DELAY	120s	15s	180s	0
22	ANTI-CYCLE	5m	1m	10m	0
23	DAMPER DELAY	2m	1m	10m	0
24	COOL DELAY	1m	0m	10m	0
25	HEAT DELAY	15s	15s	30s	0
26	FAN POSTDLY	1m	0m	6m	0
27	OVERRIDE	120m	0m	1440m	0
28	HI WATER IN	100.0F	90.0F	120.0F	1m
29	LO DIFF TEMP	6.0F	2.0F	15.0F	5m
30	LO WATER OUT	35.0F	5.0F	50.0F	1m
31	SPARE 31				
32	COND OVERFLW	0.0	40.0	95.0	10s
33	HI PSI CMP1	380.0P	360.0P	420.0P	2s
34	LO PSI CMP1	40.0P	35.0P	50.0P	2s
35	HI PSI CMP2	380.0P	360.0P	420.0P	2s
36	LO PSI CMP2	40.0P	35.0P	50.0P	2s

11.2 Communicating Thermostat Alarm Codes

(Note: All alarms are displayed under *'ALARM STATUS'* and can be viewed with 'PC-Connection')

ALARM NAME	DESCRIPTION	DISPLAY on the MCS-STAT
POWER FAIL ALARM	POWER OFF	NONE
POWER RETURN ALARM	POWER ON	NONE
LOST STAT ALARM	NO STAT COMM.	NONE
DAYLIGHT SAVINGS ALARM	DAYLIGHT SAVINGS CHG	NONE
CFG DOWNLOAD ALARM	CONFIGURATOR LOADED	NONE
INVALID CFG ALARM	CONFIGURATOR INVALID	YES '5.0'
INVALID RTC ALARM	REAL TIME CLOCK INVALID	YES '6.0'
ALARMS CLEARED ALARM	CLEARED ALARMS	NONE
HI WATER IN ALARM	HIGH WATER TEMP IN	YES '8.0'
LO DIFFERENTIAL ALARM	SUPPLY TO ZONE TEMP LOW	YES '9.0'
LO WATER OUT ALARM	LOW WATER TEMP OUT	YES '10.0'
LOCKOUT RESET ALARM	LOCKOUT'S CLEARED	NONE
COND OVERFLOW ALARM	CONDENSER DRAIN CLOGGED	YES '12.0'
HI PSI COMP1 ALARM	COMP 1 HIGH DISCHARGE PSI	YES '13.0'
LO PSI COMP1 ALARM	COMP1 LOW SUCTION PSI	YES '14.0'
HI PSI COMP2 ALARM	COMP2 HIGH DISCHARGE PSI	YES '15.0'
LO PSI COMP2 ALARM	COMP2 LOW SUCTION PSI	YES '16.0'
POINTS CLEARED ALARM	POINTS DATA CLEARED	NONE
SUCT1 SENSOR ERROR CODE	COMP 1 SUCTION SENSOR ERR	YES '18.0'
DISC1 SENSOR ERROR CODE	COMP 1 DISCHARGE SENSOR ERR	YES '19.0'
SUPPLY AIR SENSOR ERROR CODE	SUPPLY AIR TEMP SENSOR ERR	YES '20.0'
WATER IN SENSOR ERROR CODE	WATER IN TEMP SENSPOR ERR	YES '21.0'
WATER OUT SENSOR ERROR CODE	WATER OUT TEMP SENSOR ERR	YES '22.0'
ZONE TEMP SENSOR ERROR CODE	ZONE TEMP SENSOR ERR	YES '23.0'
SUCT2 SENSOR ERROR CODE	COMP 2 SUCTION SENSOR ERR	YES '24.0'
DISC2 SENSOR ERROR CODE	COMP 2 DISCHARGE SENSOR ERR	YES '25.0'

11.3 Communicating Thermostat Operation

Displays:
  -Current zone temperature
  -Current zone humidity (optional)
  -Current cooling setpoint
  -Current heating setpoint

Keys:
  -SET key, allows selection of
      Actual temperature,
      Cooling setpoint,
      Heating setpoint.
  -UP or DOWN key, when display is in Actual,
      shifts the display between actual temperature &
      actual humidity (if available).
  -UP or DOWN key, when display is in Heat or Cool,
      allows changing setpoint value.
  -SET and DOWN key, when pressed together,
      provides the software version of the thermostat.

System Switch:
  -Allows for the selection of 'OFF', 'AUTO' and 'SCHED'.
      OFF moves the system to off where it will remain until another selection is made.
      AUTO will allow the system to automatically select Heating or Cooling mode as required.
      SCHED will put the system in occupied or unoccupied mode based on the schedule.

Fan Switch:
  -Allows the fan to operator in auto mode on be on continuously.
      Note- The fan can be in auto and have the MCS-6 operate the fan continuously while
              in occupied mode.

Alarm on (LED & Horn):
  -Refer to the table 'Communicating Thermostat Alarm Codes' for messages that will be
    displayed and cause the alarm LED and horn to be activated. The horn will be on for 3
    seconds and off for three seconds.

Alarm Reset (LED & Horn) & Override:
  -When in Alarm
        -Horn reset is accomplished by pressing the reset button on the lower right 1 time when
        the horn is active.
         -LED reset is accomplished be pressing the reset button a second time. This also clears
        all lockout conditions.
  -When not in Alarm
        -Override is accomplished by pressing the reset button 1 time. The system will be put into
        'occupied' mode for the time specified in the override setpoint.

11.4 Zone Sensor Operation

The ZONE sensor provides the current temperature to the unit. It also provides an override button when a schedule is provided. When the override button is pressed the system will be put into 'occupied' mode for the time specified in the override setpoint.

11.5 PC-Connection

PC-Connection is a 'Windows' based communications system. Communications may be either local, through a RS232 cable, or remote, via a modem. The MCS-6 is accessed in the same matter as the MCS-8. Both may reside on the same network and be accessed via the MCS-8 GATEWAY. The MCS-6 will be selected from the SYSTEM INFORMATION SCREEN'S grid. The same authorization rules that apply to the MCS-8 apply to the MCS-6.

11.5.1 PC-Connection 'SYS INFO'

This screen is updated at approximately 10 addresses per second. The time is a function of how many units are connected on line. If 100 units are on line they will be updated about every 10 seconds. The screen below shows the base information plus MCS-6 Mode, Heatpump Status, Compressor 1 Status and Compressor 2 Status (if available). Safeties and Overrides will be highlighted in yellow and lockouts in red.

PC-Connection System Information Screen   Authorization is at View Only Level

Address	Config Name	Company Name	Model Name	Serial Number	Installed Date	Config Version	Software Version	MCS-6 Mode	HeatPump State	Compresspr 1 State	Compressor 2 State
1	DEMO	FLORIDA HEATPMP	1 COMP HEATPU	SERIAL #00000	7/22/ 0	1	FHP REV 1.16	OCCUPIED	UNIT OFF	OFF	OFF

SCAN NETWORK

EXIT	SYS INF	STATUS	GRAPH	TRANSMIT	RECEIVE	METER	SCHED	DIAG	AUTH

11.5.2 PC-Connection 'STATUS'

The screen is updated every second and provides access to all of the "*CLEAR / CHANGE'* buttons. Information is grouped in related sections and identified. Colors are use to identify abnormal conditions.

```
PC-Connection Status Screen                    Authorization is at Factory Level
Addr #2 MON MAY 22, 00 10:33:08    FLORIDA HEATPMP        MCS PLANT
```

Zone Thermostat Status

ZONE TEMP	78.6F	COOL TARGET	78.0F	HEAT TARGET	70.0F
ZONE HUMD	N/A	HUMD TARGET	N/A		
SYSTEM SW	SCHED	FAN SW	AUTO		

Heat Pump Status

STATE CURR	COOLING
STATE TIME	03:32:13
MODE CURR	OCCUPIED
MODE TIME	03:33:13
STAGE DELAY	0
STAGES WANTED	2
STAGES ON	2

Evaporator Status

| FAN | ON | SUPPLY TMP | 59.0F | OVERFLOW | N/A |
| DAMPER | OFF | AUX HEAT | ON | EMG HEAT | N/A |

Compressor Status

	STATUS	CYCLES	STATE	TIME	SUCT	DISC
COMP1	ON	270	COOLING	03:32:12	OFF	OFF
COMP2	ON	394	COOLING	00:34:28	OFF	OFF
ECON	OFF	7	NOT USED	00:00:00		
REV VLV	ON	375				

Condenser Status

WATER IN TEMP	76.7F
WATER OUT TEMP	82.2F
HOT GAS REHEAT	N/A
HEAT RECLAIM PUMP	N/A

Alarm Status

1	POWER UP/RESET	MAY 11 10:35:02
2	ALARMS CLEARED	MAY 11 10:13:13
3		
4		
5		

Clear / Change Buttons

SETPOINTS	CLEAR ALARMS	
DATE / TIME	CLEAR PT INFO	DEFAULT SETUP
MANUAL(AUTO)	LOCKOUT RESET	CHANGE SETUP

Informational Messages

| EXIT | SYS INF | PRINT | GRAPH | TRANSMIT | RECEIVE | METER | SCHED | DIAG | AUTH |

11.5.3 PC-Connection 'SETPOINTS'

Current setpoint values and ability to modify within upper / lower values set by factory.

MCS 6/8 Set Points

Select Value to Change by Double Clicking on the Cell

#	NAME	VALVE	TIME	MIN	MAX
1	COOL OCCUPY	78.0F	0	70.0F	80.0F
2	COOL UNOCCUP	83.0F	0	75.0F	95.0F
3	COOL1 DIFF	0.5F	0	0.4F	5.0F
4	COOL2 DIFF	0.5F	0	0.4F	5.0F
5	COOL3 DIFF	0.5F	0	0.4F	5.0F
6	HEAT OCCUPY	70.0F	0	65.0F	80.0F
7	HEAT UNOCCUP	60.0F	0	50.0F	70.0F
8	HEAT1 DIFF	0.5F	0	0.4F	5.0F
9	HEAT2 DIFF	0.5F	0	0.4F	5.0F
10	HEAT3 DIFF	0.5F	0	0.4F	5.0F
11	HEAT4 DIFF	0.5F	0	0.4F	5.0F
12	SUPPLY AUX	95.0F	0	85.0F	110.0F
13	HUMD OCCUPY	55.0%	0	40.0%	70.0%
14	HUMD UNOCCUP	60.0%	0	50.0%	70.0%
15	HUMD1 DIFF	2.0%	0	1.0%	10.0%
16	HUMD2 DIFF	2.0%	0	1.0%	10.0%
17	HUMD3 DIFF	2.0%	0	1.0%	10.0%
18	COOL WATER	65.0F	0	38.0F	60.0F
19	HEAT WATER	75.0F	0	70.0F	90.0F
20	START DELAY	30s	0	15s	180s
21	STAGE DELAY	120s	0	15s	180s

Authorized to make changes

RETURN to HP STATUS SCREEN

11.5.4 PC-Connection 'Date/Time'
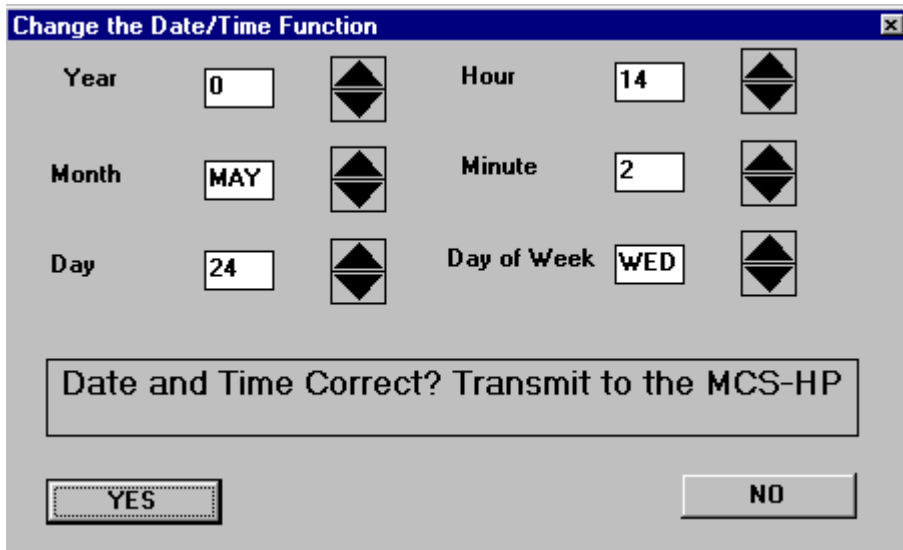
The date and time may be changed with out authorization. Use the scroll arrows to change the information. When all data is correct, the YES button will transmit the updated date and time to the MCS-6.

11.5.5 PC-Connection MANUAL (AUTO) button to Change Manual Status of RO's or SI's
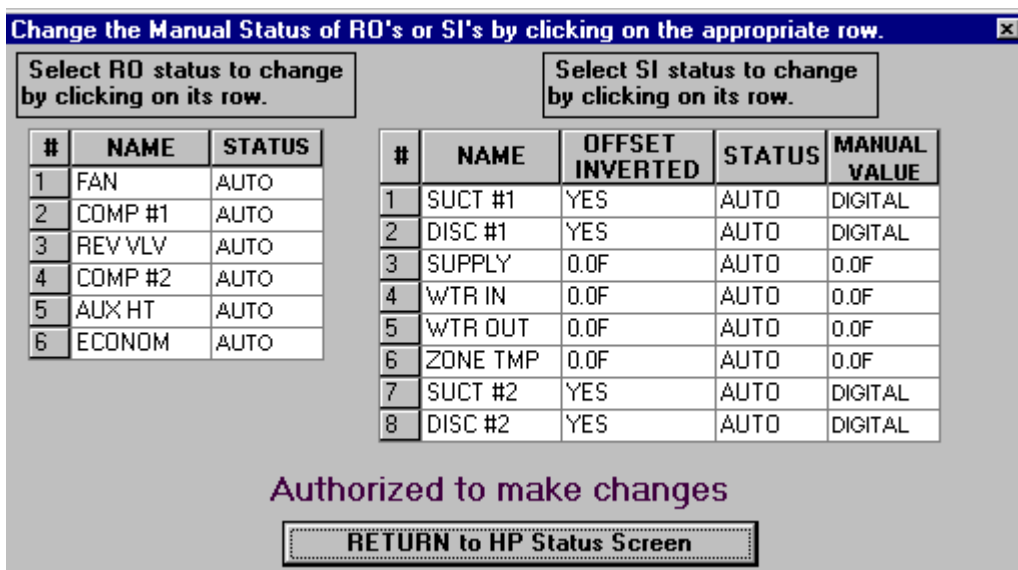

To change the status of an RO, click on the line and then selecting the correct status.
To Manual status, offset or whether the DI is wired inverted can be changed in the same matter.
After all changes have been made, return to the HP Status Screen.

11.5.6 PC-Connection 'Clear Alarms"
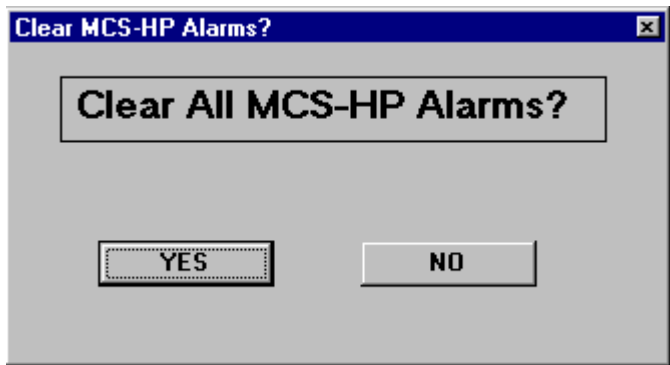
To clear alarms and record this action, select YES. If NO, then alarms have not been cleared. Control is then returned to the HP Status Screen.

11.5.7 PC-Connection 'Point Information"
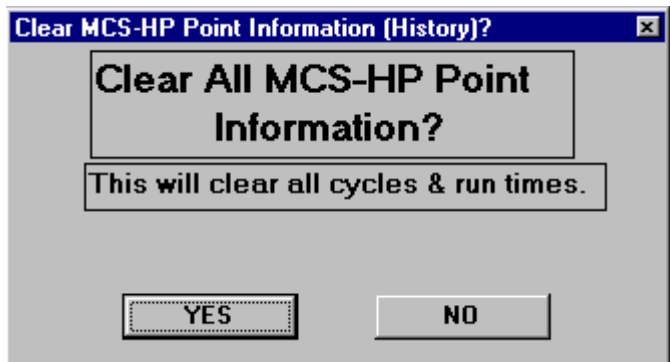
To clear point information and record this action, select YES. If NO, then alarms have not been cleared. Control is then returned to the HP Status Screen.
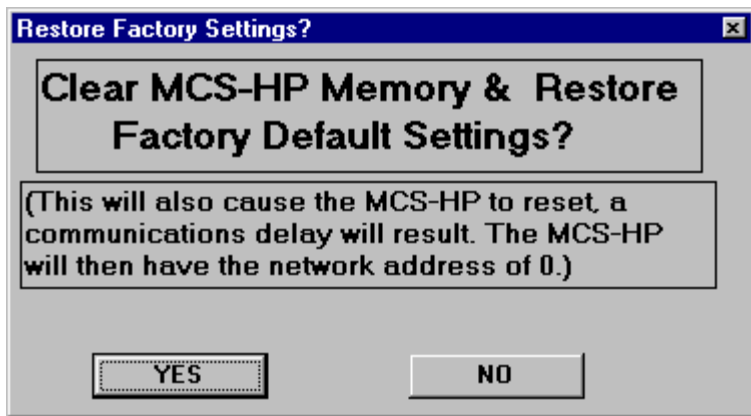
11.5.8 PC-Connection 'Lock out Reset"

Reset the MCS-HP?

Lockout Reset the MCS-HP?

YES   NO
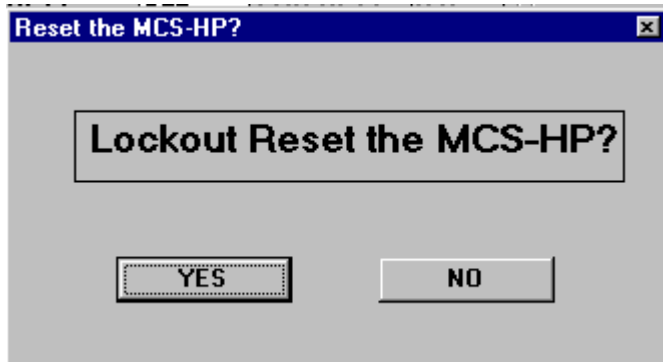
To reset an MCS-6, select YES. If NO, no action has been taken. Control is then returned to the HP Status Screen.

11.5.9 PC-Connection 'Restore Factory Defaults"

Restore Factory Settings?

Clear MCS-HP Memory & Restore Factory Default Settings?

(This will also cause the MCS-HP to reset, a communications delay will result. The MCS-HP will then have the network address of 0.)

YES   NO

To restore the factory settings to the MCS-6, select YES. If NO, no action has been taken. Control is then returned to the HP Status Screen. Note, if defaults have been restored; all alarms have been cleared; all point information has been reset and the network address is 0. This could create a problem is other MCS devices share this network and one of them has an address of 0.

11.5.10   PC-Connection 'CHANGE SETUP'

Change screen values screen at the MCS Plant.

Enter the correct data or use the spin arrows to make changes. Once all the data is correct, select YES. If NO, no action has been taken.