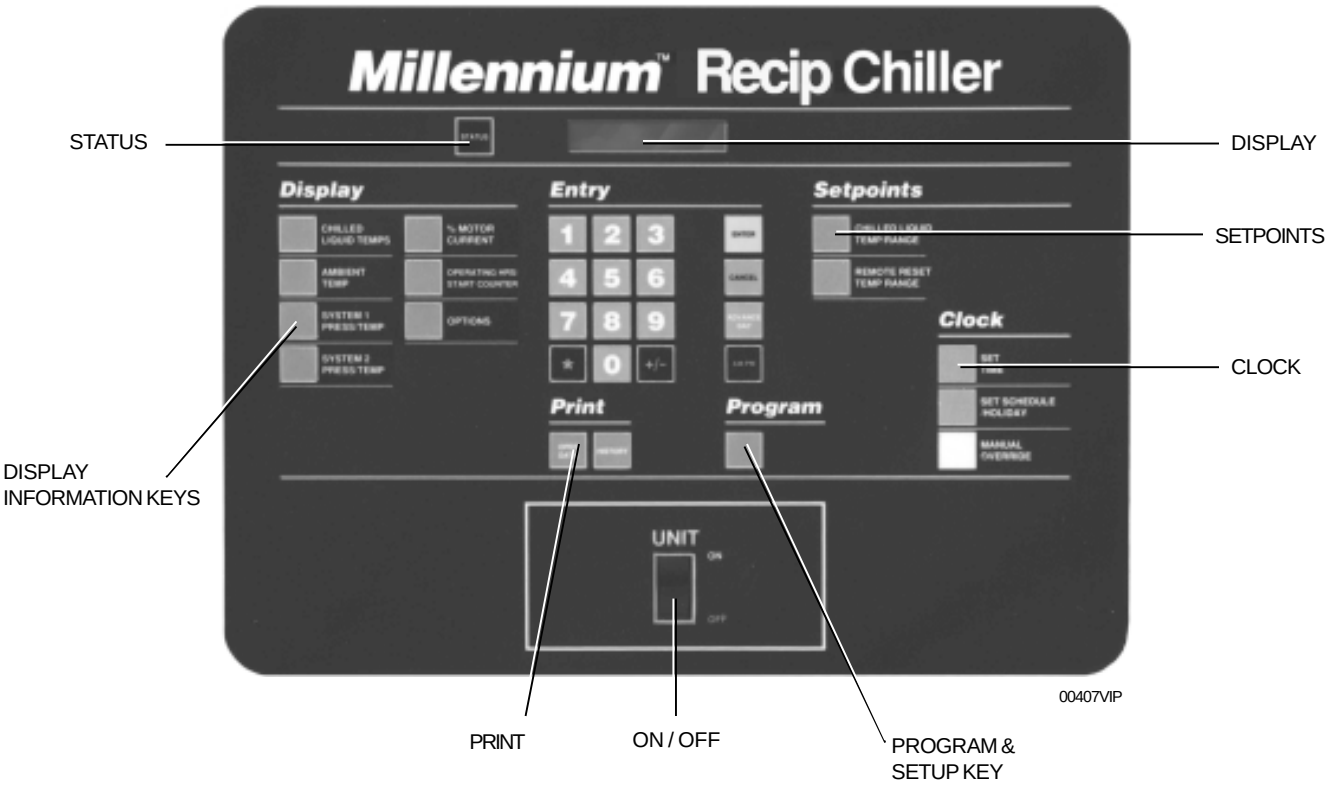
CHILLER CONTROL PANEL
PROGRAMMING AND DATA ACCESS



DISPLAY AND STATUS INFORMATION KEYS

Status Key - see Section 2

This key provides a display of the current operational and/or fault status of the chiller or individual refrigerant systems.

Display Keys - see Section 3

Each key provides a real time display of commonly required information about the chiller and individual system operating conditions and settings.

Print Keys - see Section 4

These keys allow control panel display or remote printout of both current real-time operating and programmed data as well as fault history data from recent safety shutdowns.

ON / OFF ROCKER SWITCH

This switch shuts down the entire chiller when placed in the OFF position. The switch must be ON for the chiller to operate.

PROGRAM & SETUP KEYS

Entry Keys - see Section 5

The numeric and associated keys are used for entering data required for programming the chiller. The ENTER and ↑ ↓ keys are also used for scrolling through information available after pressing certain keys.

Setpoints Keys - see Section 6

These keys are used for display and programming of the local and remote offset chilled liquid temperature setpoints.

Clock Keys - see Section 7

These keys are used for display and programming of the clock and operating schedule for the chiller.

Program Key - see Section 8

This key is used for display and programming of the chiller operational settings and limits.

1. INTRODUCTION & PHYSICAL DESCRIPTION

00407VIP

1.1 GENERAL

The YORK *Millennium* Reciprocating Chiller Control Panel is a microprocessor-based control system fitted to YCAR liquid chillers. It is capable of multi-refrigerant system control to maintain chilled liquid temperature within programmed limits and to provide safety control of the chiller. The microprocessor monitors leaving chilled liquid temperature deviation from setpoint and the rate of change of this temperature to start, stop, load and unload compressors as required.

User interface is via a touch keypad and a liquid crystal display allowing access to operating and programmed data. Information can be displayed in English (Imperial) units or S.I. (Metric) units (Section 8.1). Conversion tables are provided at the back of this manual.

A master ON/OFF rocker switch is provided on the chiller control panel to activate or deactivate the complete chiller, while switches to activate or deactivate individual refrigerant systems are provided on the Microprocessor Board(s).

External interface is available for control of the chiller via a YORK ISN System or YORK Remote Control Center. In addition, EMS/BAS System connections are provided for remote cycling, current limiting, remote temperature setpoint reset and alarm annunciation.

YCAR chillers each have a single split circuit evaporator serving either 2, 3, or 4 independent refrigerant systems. YCAR 2 and 3-system chillers are configured as a single self-contained section with a single control panel controlling the two refrigerant systems. YCAR 4-system chillers are divided into 2 sections.

1.2 KEYPAD & DISPLAY

An operator keypad allows complete control of the chiller from a central location. The keypad offers a multitude of commands available to access displays, program setpoints, and initiate system commands. Keys are grouped and color coded for clarity and ease of use.

A 40 Character Liquid Crystal Display (2 lines of 20 characters) is used for displaying system parameters and operator messages. The display has a lighted background for night viewing as well as a special feature which intensifies the display for viewing in direct sunlight.

Displays will be updated every two seconds by the microprocessor.

1.3 UNIT (CHILLER) ON / OFF SWITCH

A master UNIT (Chiller) ON / OFF switch is located just below the keypad. This switch allows the operator to turn the entire chiller OFF, if desired. The switch must be placed in the ON position for the chiller to operate. Any time the switch is in the OFF position, a Status message indication will be displayed. See Page 108 for the location of this switch.

1.4 MICROPROCESSOR BOARD

The Microprocessor Board(s) controls and makes decisions for the chiller. Information inputs from trans-

ducers, and sensors around the chiller, are either connected directly to the Microprocessor Board or are connected to the I/O Expansion Board and multiplexed before being sent to the Microprocessor Board. The Microprocessor Board circuitry multiplexes all of these analog inputs, digitizes them, and constantly scans them to monitor chiller operating conditions. Based on this information, the Microprocessor issues commands to the Relay Boards to activate and deactivate contactors, solenoids, etc. for chilled liquid, operating control, and safety control.

Keypad commands are acted upon by the micro to change setpoints, cutouts, scheduling, operating requirements, and to provide displays.

A +12VDC REG supply voltage from the Power Supply Board is converted to +5V REG by a voltage regulator located on the Microprocessor Board. This voltage is used to operate the integrated circuitry on the board.

System Switches 1 - 4

System Switches for each system are located on the Microprocessor Board (Section 9 [1.11, Item 5]). These switches allow the operator to selectively turn a given system on or off as desired.

Internal Clock & Memory Backup Battery

The Microprocessor Board contains a Real Time Clock integrated circuit chip (Section 9 [1.11, Item 2]) with an internal battery backup. The battery backup assures that any programmed values (setpoints, clock, cutouts, etc.) are not lost during a power failure or shutdown period regardless of the time involved.

The battery is a 10 year lithium type, but life will depend upon whether the Real Time Clock's internal clock circuit is energized. With the clock OFF, a rated life of approximately 10 years can be expected. With the clock ON, approximately 5 years. The clock is enabled and disabled using a jumper on the microprocessor board.

If the chiller is shut down or power failure is expected for extended periods, it may be desirable to disable the clock to save battery life. The clock can then be reactivated and reprogrammed when the chiller is returned to service. This will not affect the maintenance of programmed values and stored data by the backup battery.

While a chiller is operating, the clock must be ON (Section 9 [1.11, Item 1]) or the internal clock on the microprocessor will not be active and the micro cannot keep track of time, although all other functions will operate normally. Failure to turn the Clock ON could result in the chiller not starting due to the time "frozen" on the clock falling outside the Start/Stop time programmed in the Daily Schedule. See Section 9 (7.3).

1.5 ANCILLARY CIRCUIT BOARDS

Power Supply Board

The on-board switching power supply is fuse protected and converts 24VAC from the logic transformer 2T to +12V REG which is supplied to the Microprocessor Board, Relay Output Boards, and the 40 character display to operate the integrated circuitry.

24VAC is filtered, but not regulated, to provide unregulated +24VDC to supply the flow switch, PWM remote temperature reset, PWM remote current reset and remote print circuitry which may be utilized with user supplied contacts.

24VAC is also filtered and regulated to +24VDC to be used by the optional EMS/BAS Circuit Boards for remote temperature or remote current reset.

Individual rectifier and filtering circuits are present which receive the Current Transformer signals for each phase of motor current on each compressor. These circuits rectify and filter the signals to variable DC. A phase rotation circuit for each compressor is also present to assure that the screw compressors do not run in the wrong direction. All of these signals are sent to the I/O Expansion Board which multiplexes them and then feeds them to the Microprocessor Board.

I/O Expansion Board

The I/O Expansion Board provides multiplexing to allow additional inputs to be connected to the Microprocessor Board, via a single data line. The additional inputs are multiplexed according to the selection made by the Microprocessor through address lines.

Signals routed through the I/O Expansion Board include Cooler Inlet Temperature, Current Transformer outputs (motor current signals), and Oil Temperature.

Relay Output Boards

One Relay Output Board per system operates the motor contactors / starters, solenoid valves, and heaters which control system operation.

The relay boards are located in the logic section of the control panel(s). The boards convert 0 - 12VDC logic levels outputs from the Microprocessor Board to 115VAC levels used by the contactors, valves, etc.

The common side of all relays on the Relay Output Board is connected to +12VDC REG. The open collector outputs of the Microprocessor Board energize the DC relays or triacs by pulling the other side of the relay coil to 0VDC. When not energized, both sides of the relay coils or triacs will be at +12VDC potential.

1.6 CIRCUIT BREAKERS

Three Circuit Breakers are provided for the 115VAC controls.

CB1 allows removal of control power from System 1 for control system circuitry servicing. Specifically, the 115VAC feed to Relay Output Board 1 which energizes contactors and solenoids.

CB2 allows removal of control power from System 2 for control system circuitry servicing. Specifically, the 115VAC feed to Relay output Board 2 which energizes contactors and solenoids.

CB3 allows removal of control power to the Microprocessor Board, Power Supply board, I/O Expansion Board and Evaporator Heater.

The Circuit Breakers remove 115VAC control power only. High voltage circuitry will still be energized from the high voltage supply.

Removing 115VAC power to CB3 or opening CB3, removes power from the evaporator heaters. This could cause evaporator freeze-up in low ambient temperatures.

1.7 CURRENT TRANSFORMERS (C.T.)

C.T.'s located internally in the Motor Protector Modules on each of the 3 phases of the power wiring of each compressor motor send AC signals proportional to motor current to the Power Supply Board, which rectifies and filters the signals to variable DC Voltage (analog). These analog levels are then fed to the Microprocessor Board via the I/O Expansion Board, allowing the microprocessor to monitor motor currents for low current, high current, unbalanced current, and single phasing.

1.8 TRANSFORMERS

2 Transformers (2T and 3T) are located in the Control Panel. These transformers convert the 115VAC Control Power Input to 24VAC to operate the microprocessor circuitry.

2T: This 75VA transformer supplies the Microprocessor power supply.

3T: Supplies power to the Motor Protector Modules.

1.9 MOTOR PROTECTOR MODULES

A Motor Protector Module for each compressor is located in the Control Panel. These modules supply motor over-temperature protection, 3-phase current protection, phase imbalance, phase rotation, and a programming and troubleshooting 7-segment display.

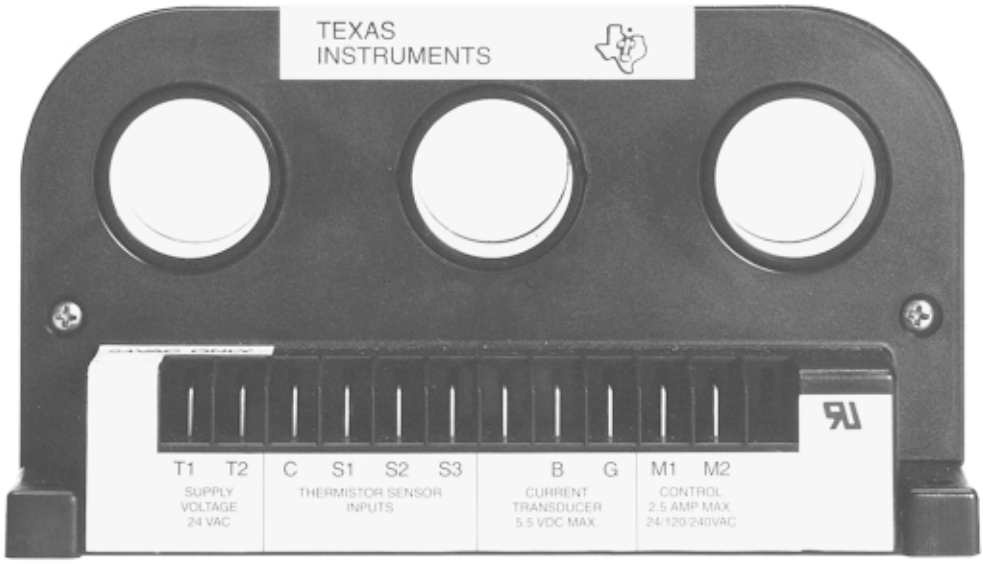
The motor over-temperature protection is supplied by 3 temperature sensors embedded in the motor windings 120 degrees apart. The module monitors these sensors allowing it to sense a hot winding and shut down the compressor if motor cooling is inadequate.

The on-board C.T.'s provide 3-phase current protection which look at 3 of the 6 motor legs and send an analog signal proportional to average motor current to I/O Expansion board and on to the microprocessor board for microprocessor low/high current protection and current display. This allows the micro to monitor current and shut a system down if low or high motor current is sensed. This is a non-adjustable protection circuit electronically sized to a system's motor specifications.

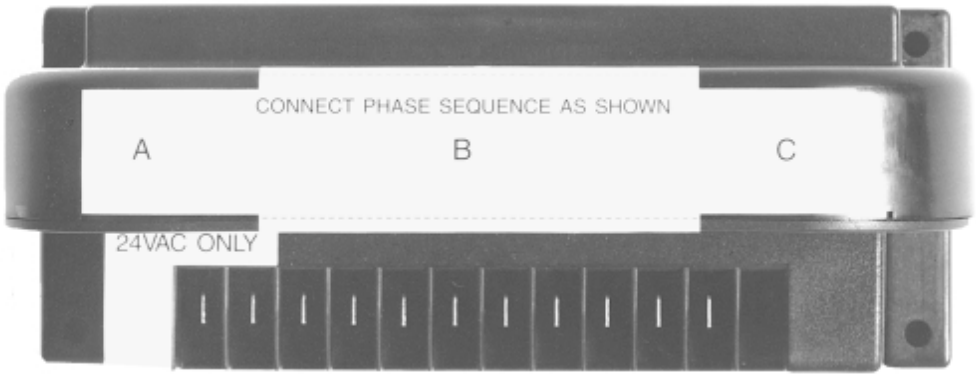
Internally, the on-board 3 C.T.s and internal circuitry allow the Motor Protector Module to protect against high motor current as programmed on the Motor Protector dip switches. These switches are set at the factory according to motor specifications.

The module also provides phase rotation protection to assure the screw compressor does not rotate backwards.

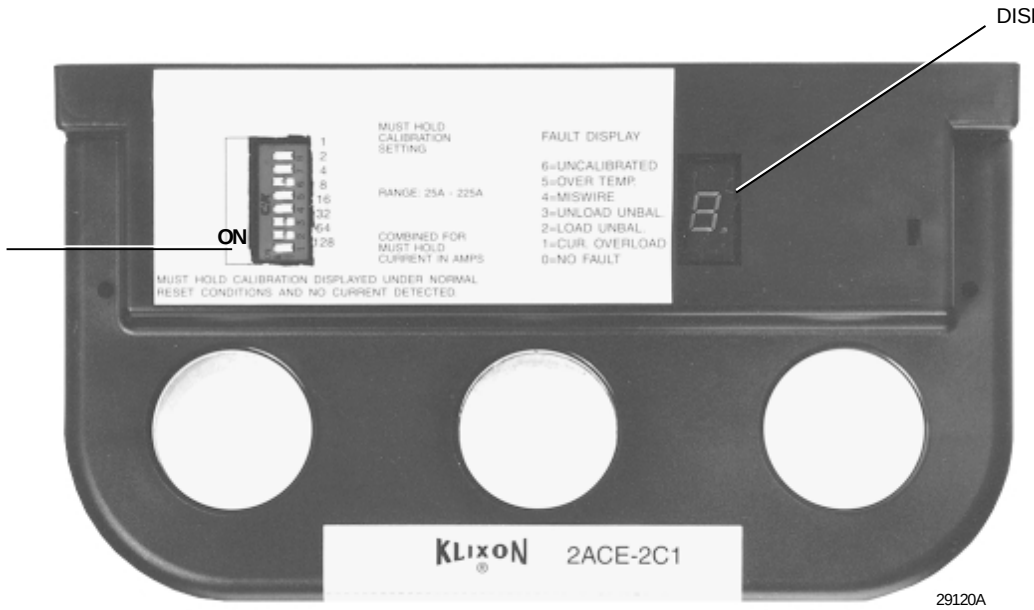
A single phase protection circuit located in the module also monitors for a phase imbalance. If current imbalance exceeds 17% of the average motor current in one of the phases, the Motor Protector will recognize it and shut the system down.



SIDE VIEW 29119A



TOP VIEW 29121A



SIDE VIEW 29120A

FIG. 36 – MOTOR PROTECTOR

The Motor Protector Module is equipped with a hexadecimal display to use as a guide to determine the exact nature of a shutdown. See page 18 for details.

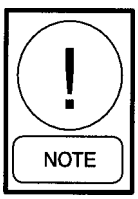
Whenever the Motor Protector Module senses a fault, internal contacts will open and shut the system down. These contacts are wired in series with the compressor motor contactor. When the contact opens, the micro will attempt to start the system 2 more times. Since the motor contactor signal path from the Relay Output Board to the motor contactor is broken by the Motor Protector Module contacts, it will lock the system out after 3 faults. The Motor Protector Module must then be reset by removing 115VAC power from the Control Panel. After the Motor Protector is reset, the individual system SYS switch must be switched OFF and then ON to reset the microprocessor to allow restart of the system. NOTE: Anytime the module faults, a thorough investigation of the problem should be performed before attempting to return the system to operation. Failure to perform this investigation could lead to motor or compressor failure. Additional details on the Motor Protector Module can be found on page 18.

1.10 EMS/BAS CONTROLS

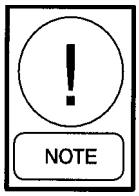
The microprocessor system can accept remote signals to Start/Stop the chiller, to adjust maximum allowable running current for each compressor, and to adjust the chilled liquid leaving temperature setpoint. These functions can easily be controlled by connecting user supplied “dry” contacts to the customer terminals in the control panel. In addition, Alarm Contacts are provided to remotely signal a fault with the chiller.

Remote Start/Stop

Remote Start/Stop can be accomplished using a time clock, manual contact or other “dry” contact in series with the flow switch (Terminals 13 & 14 of TB4) connected to terminals in the logic section of the control panel. The contact must be closed to allow the chiller to run. Any time the contact opens, the chiller will shut down and the NO RUN PERM message will be displayed. The location of the flow switch connection is shown in Section 9 (1.12).



Never bypass a flow switch. This will cause damage to the chiller and void any warranties.



Wiring from remote "dry" contacts (for stop/start reset functions) should not exceed 25 ft. (8 m) and should be run in grounded conduit that does not carry any wiring other than control wiring or in shielded cable. If an inductive device (relay, contactor) is supplying these contacts, the coil of the device must be suppressed with a standard RC suppressor (50Hz models) across the inductive coil.

Remote Current Reset

The maximum allowable running current for each compressor can be adjusted remotely to a lower value using repeated timed closure of "dry" contacts connected to Terminals 13 & 16 at the bottom center of the Microprocessor Panel (See Section 9 [1.12]) in the logic section of the control panel. The duration of the contact closure will determine the amount of adjustment. Generally, this input is used for purposes of demand limit and operates as follows:

Closing the input contact for a defined period of time allows reset of the % Current Limit downward. Contact closure of 1 - 11 seconds will allow % Current Limiting to be adjusted downward from 105% by a maximum of 75%, i.e. to a minimum value of 30% FLA. EMS Current Limiting operates independently of the High Average Current Unload (See Section 9 [8.2]). The micro will always look at the two Current Limit Setpoints and choose the lower as the controlling value, whenever Remote Current Limiting is utilized. Contact closures of less than 1 second will be ignored. A closure of 11 seconds is the maximum allowable closure and provides a Current Limit reduction of 75%. The remote reset current can be calculated as follows:

$$\text{REMOTE RESET CURRENT} = 105\%\ \text{FLA} - \left\{\frac{(\text{Contact Closed Time} - 1\text{sec}) \times (75\%\ \text{FLA})}{10\ \text{sec}}\right\}$$

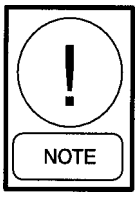
For example, after a 4 second pulse, the offset would equal:

$$\text{Remote Reset Curr} = 105\%\ \text{FLA} - \left\{\frac{(4\text{sec} - 1\ \text{sec}) \times (75\%\text{FLA})}{10\ \text{sec}}\right\}$$

$$= 105\% - \frac{225\%\text{FLA sec}}{10\ \text{sec}}$$

$$= 82.5\%\ \text{FLA}$$

To maintain a given offset, the contact closure signal must be repeated every 30 seconds - 30 minutes. The refresh is not accepted sooner than 30 seconds from the end of the last PWM signal, but it must be refreshed before 30 minutes has elapsed. After 30 minutes, if no refresh is provided, the setpoint will change back to its original value.



Wiring from remote "dry" contact (for reset functions) should not exceed 25 ft. (8 m) and should be run in grounded conduit that does not carry any wiring other than control wiring or in shielded cable. If an inductive device (relay, contactor) is supplying these contacts, the coil of the device must be suppressed with a standard RC suppressor (50Hz models) across the inductive coil.

Remote Setpoint Reset

The chilled liquid leaving temperature setpoint programmed into the micro can be remotely adjusted to a higher value using repeated timed closure of "dry" contacts connected to Terminals 13 & 17 of TB4 in the logic section of the control panel (See Section 9 [1.12]). The duration of the contact closure will decide the amount of adjustment. This is achieved as follows :

The maximum allowable reset value can be programmed from 2ºF - 40ºF (1°C - 22°C), as appropriate to the application - see Section 6.4. Once the maximum reset is programmed, an input contact closure of 11 seconds provides the maximum reset. Closure for less than 11 seconds will provide a smaller reset. For noise immunity, the micro will ignore closures of less than 1 second. To compute the necessary contact closure time to provide a required Reset, use the following steps:

$$\text{Reset Temp} = \left\{ \frac{(\text{Contact Closure} - 1\text{sec}) \times \text{Programmed Max Reset}}{10\text{ sec}} \right\} \text{Offset}$$

For example, with a programmed setpoint of 44ºF (7°C), after a 4 second pulse and a programmed maximum offset of 40ºF (22°C), the temperature offset would equal:

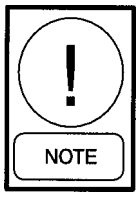
$$\text{Reset Temp} = \frac{(4\text{ sec} - 1\text{ sec}) \times 40^{\circ}\text{F}}{10\text{ sec}}$$

$$\text{Reset Temp} = \frac{120^{\circ}\text{F sec}}{10\text{ sec}}$$

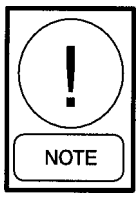
$$= 12^{\circ}\text{F } (6^{\circ}\text{C})$$

To determine the new setpoint, add the reset to the setpoint programmed into memory. In the example preceding, if the programmed setpoint = 44°F (7°C), **the new setpoint after the 4 second contact closure would be 44°F (7ºC) + 12°F (6ºC) = 56°F (13ºC).** This new setpoint can be viewed on the display by Pressing the Remote Reset Temperature/Range key.

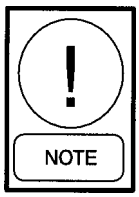
To maintain a given offset, the contact closure signal must be repeated every 30 seconds - 30 minutes. The refresh is not accepted sooner than 30 seconds from the end of the last PWM signal, but must be refreshed before 30 minutes has elapsed. After 30 minutes, if no refresh is provided, the setpoint will change back to its original value.



After an offset signal, the new Remote Setpoint may be viewed on the Remote Reset Temperature Range display. However, if this display is being viewed when the reset pulse occurs, the setpoint will not change on the display. To view the new offset, first press any other display key on the keypad and then press the Remote Reset Temperature Range key. The new setpoint will then appear.

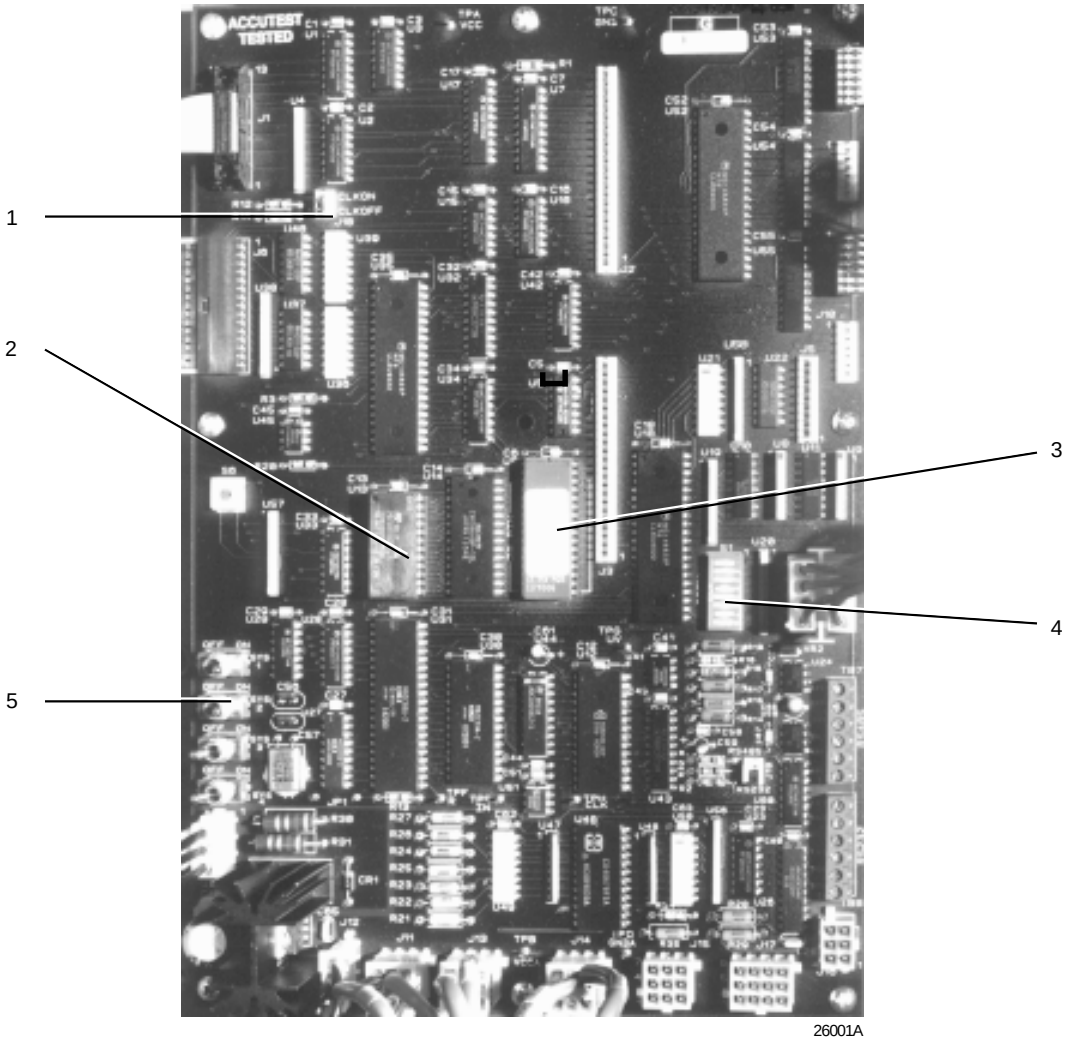


Remote Setpoint Reset will not operate when a Remote Control Center Option Kit is connected to the Micro. The Remote Control Center will always determine the setpoint.



Wiring from remote "dry" contact (for reset functions) should not exceed 25 ft. (8m) and should be run in grounded conduit that does not carry any wiring other than control wiring or in shielded cable. If an inductive device (relay, contactor) is supplying these contacts, the coil of the device must be suppressed with a standard RC suppressor (50Hz models) across the inductive coil.

1.11 MICROPROCESSOR BOARD LAYOUT

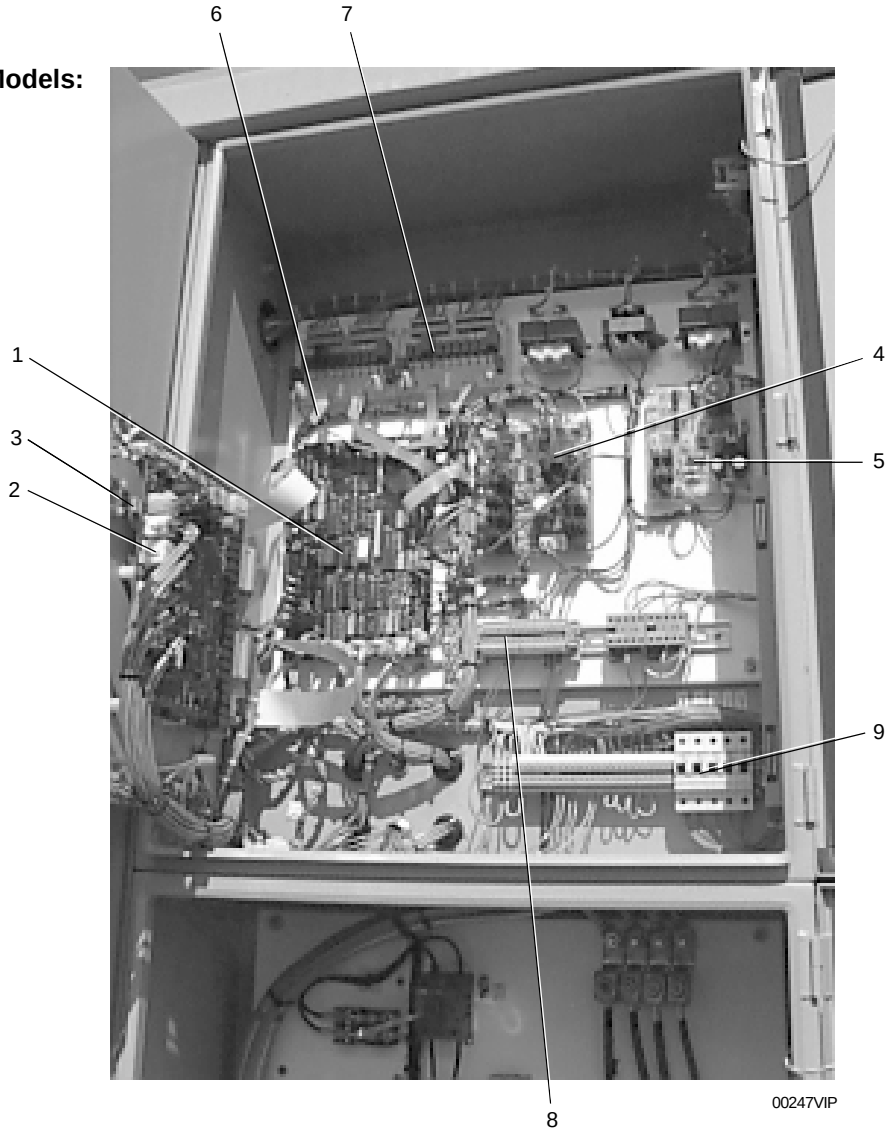


ITEM	DESIGNATION	DESCRIPTION
1	J18	Clock Enable/Disable Jump Contact
2	RTC (U13)	Real Time Clock and Battery Backup I.C.
3	EPROM	Microprocessor I.C. (label shows version) *NOTE : Dimple is positioned at top edge*
4	S1	Dip Switch Set (8 switches)
5	S2 to S5	System Switches S2 = System 1 S3 = System 2 S4 = System 3 S5 = System 4

FIG. 37 – COMPONENT LAYOUT

1.12 LOGIC SECTION LAYOUT

60 Hz Models:



ITEM	DESCRIPTION
1	Microprocessor Board
2	Back of Keypad
3	Back of Display
4	I/O Expansion Board #1
5	Power Supply Board
6	Relay Output Board #1
7	Relay Output Board #2
8	Flow Switch & Customer Connection Terminals
9	Circuit Breakers

FIG. 38 – LOGIC SECTION LAYOUT

1.13 ANTI-RECYCLE TIMER

The programmable Anti-Recycle Timer allows the user to select the compressor anti-recycle time to best suit their needs. Motor heating is a result of inrush current when the motor is started. This heat must be dissipated before another start takes place or motor damage may result. The anti-recycle timer assures that the motor has sufficient time to cool before it is restarted.

An adjustable timer allows for the motor cooling, but gives the user the ability to extend the anti-recycle timer to cut down on cycling. In some applications, faster compressor start response is necessary and shorter anti-recycle times are required. These needs should be kept in mind but, whenever possible, the timer should be adjusted for the longest period of time tolerable. 600 seconds is recommended, although 300 seconds provides adequate motor cooling time. Longer periods will allow more heat dissipation, reduce cycling, and possibly increase motor life. See Section 9 (8.2), page 151 for programming of the anti-recycle timer.

1.14 ANTI-COINCIDENCE TIMER

The Anti-Coincidence Timer assures that 2 systems do not start simultaneously. This assures that inrush current is kept to a minimum. A 60-second time delay will always separate motor starts. This timer is not programmable.

1.15 EVAPORATOR PUMP CONTROL

Dry contacts (Terminals 25 & 26, see Fig. 9 for location) are provided, which transition (close) when the Daily Schedule is calling for chiller operation and power has been applied to the micropanel for 30 seconds. If for some reason the evaporator pump contacts have been closed to run the pump and a power loss or Daily Schedule shuts the pump down (contacts open), the contacts will not reclose for any reason until 30 seconds have elapsed after power re-application, or 30 seconds have elapsed between a Daily Schedule shutdown and restart.

The contacts will also close if a Low Water Temp Fault occurs.

1.16 COMPRESSOR HEATER CONTROL

Each compressor has its own heater. The heater will be off whenever the compressor is running.

1.17 EVAPORATOR HEATER CONTROL

The evaporator heater is controlled by ambient temperature. When the ambient temperature drops below 40°F (4ºC), the heater is turned on when the compressors are turned off. When the temperature rises above 45°F (7ºC), the heater is turned off. An undervoltage condition will keep the heater off until full voltage is restored to the system. The heater will provide freeze protection to -20°F (-29ºC).

115VAC power must remain "ON" through CB1 and CB3 for freeze protection. Otherwise, the evaporator must be drained.

1.18 PUMPDOWN CONTROLS

Pumpdown control will pump down a system to the suction pressure cutout whenever the compressor shuts down on a normal shutdown. Additionally, a recycling pumpdown is employed on an as-needed basis to assure that liquid does not accumulate in the evaporator on an OFF system while cold chilled liquid is flowing through the evaporator. Since pumpdown at startup is not employed, the liquid line solenoid valve will open immediately when a compressor starts.

"Pumpdown on shutdown" will pump a system down whenever a system shuts down, except in two circumstances: a pumpdown will not occur whenever a fault causes a shutdown, or when unit rocker switch is turned "OFF". Pumpdown will continue until the suction pressure falls below the suction pressure cut-out. If the pressure never drops below the cut-out, pumpdown will continue until a three-minute pumpdown timer has expired.

During pumpdown, the following STATUS message will be displayed:

```
SYS#1   PUMPING DOWN
SYS#2   PUMPING DOWN
```

The "Pumping Down" message indicates that the respective compressor is unloaded, the liquid line solenoid valve is closed, and is presently in the process of pumping the system down. The compressor will either be in a recycling pumpdown or in a pumpdown prior to shutdown when this message is displayed. The message will disappear when the compressor shuts off.

"Recycling pumpdown" is initiated while a compressor is off, able to run, and is in a "No Cooling Load" state. It can be initiated 45 minutes after either of the following two conditions are met:

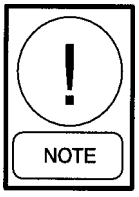
1. Sat Suction Temperature > LCHWT - 1.5°F (0.8°C)
   – and –
   Ambient Temp > LCHWT - 6°F (3.3°C)
2. The compressor has been idle for 2 hours and Suction Pressure is greater than the cut-out.

The 45-minute timer assures that excessive pumpdowns do not occur.

After 120 pumpdowns, uninterrupted by a cooling start, the system will cease to pump down. Pumpdowns will begin again after a cooling start occurs. This is to prevent oil loss in the system. However, if one system reaches 120 pumpdowns while the other system is running for cooling, the running (lead) compressor will be shut off if the off (lag) compressor is available for start. At this point, the lead compressor will pump down and shut off while the lag compressor starts and assumes the lead. The previously running compressor will now have 120 pumpdowns available.

A pumpdown failure fault will occur if a system performs three unsuccessful pumpdowns in a row. "Unsuccessful" assumes that the system was not able to pump down to the suction pressure cutout in three minutes. The system will require a manual reset to restart. The following is an example of this safety message:

```
SYS#1   PUMPDOWN   FAIL
SYS#2   PUMPDOWN   FAIL
```



Under some circumstances, a pumpdown may occur when a compressor is called to come on for cooling. If this occurs, the compressor will restart to provide cooling after the pumpdown is complete and the anti-recycle timer times out.

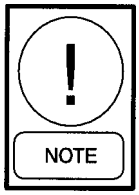
Recycling pumpdown will increase the number of starts logged in the micropanel; however, it will have no effect upon the life of compressors.

1.19 ALARMS

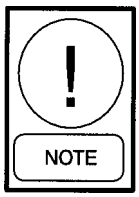
Internal contacts are provided in the Power Panel (See Section 9 [1.12]) which can be used to remotely signal a warning whenever a fault lockout occurs on any system, or if power is lost to the control panel. The internal contacts are normally open (N.O.) and will close when control power is applied to the panel, if no fault conditions are present. When a system fault occurs which locks out a system, the respective contacts open. If chiller power is lost or a unit fault occurs, such as a Low Water Temp fault, contacts for all systems will open.

Contacts for SYS 1 are located on the bottom right of the microprocessor panel, terminals 23 and 24. SYS 2 contacts are located on terminals 27 and 28. See Fig. 9, Page 42 for the location of these terminals.

A 28VDC or 120VAC (60 Hz models) or up to 240VAC (50 Hz models) external alarm circuit (supplied by others) may be connected to the alarm contacts. The contacts are rated at 125VA.



If any inductive load devices (relay or contactor) supplied by the user are in the electrical circuit connected to the dry alarm contacts, the device must be suppressed at the load with an RC suppressor (YORK Part Number 031-00808-000) across the inductive coil. (Typically, several are supplied loose with the panel). Failure to install suppressors will result in nuisance faults and possible damage to the chiller.



If the alarm circuit is applied in an application used for critical duty (such as process duty or cooling other critical equipment) and the alarm circuit should fail to function, YORK will not be liable for damages.

1.20 RUN STATUS (CHILLER)

Chiller Run Status contacts between Terminal 29 and 30 close whenever one of the systems is running. These contacts are located on the bottom right of the Microprocessor Board and are rated (voltage and current) the same as the alarm contacts (Section 9 [1.19]). Also use a suppressor, same as alarm contacts (Section 9 [1.19]). Individual system "Run Status" is not available.

1.21 LEAD / LAG COMPRESSOR SELECTION

The chiller may be set up for AUTO or MANUAL Lead / Lag. This is accomplished by programming the option under the Program Key. Details for programming the Manual/Auto Lead/Lag Selection are discussed in Program Key Section 9, page 152.

When AUTO Lead/Lag is utilized, the micro attempts to balance run time between the two compressors. A number of conditions can occur which will prevent this from happening. Factors determining lead/lag selection and the resulting lead/lag determination are:

1. The micro automatically defaults the lead to SYS 1 and the lag to SYS 2 if both compressors are ready to start (Anti-recycle Timers timed out) and compressors have equal run time.
2. Individual system run status is not available.
3. If all compressors are ready to start (Anti-recycle timers timed out), the compressor with the lowest run hours will start first.
4. If all compressors are waiting to start (Anti-recycle timers have not timed out), the micro will assign the lead to the compressor with the shortest anti-recycle time in an effort to provide cooling quickly.
5. If the lead compressor is locked out, faulted and waiting to restart, SYS switch on the microboard is off, or a run permissive is keeping an individual system from running, the lag (first lag in YCAR 3-compressor models) compressor is swapped to the lead. This is true regardless of whether the lag compressor is ON or OFF.

MANUAL Lead/Lag selection will be automatically overridden by the micro to allow the lag compressor to automatically become the lead anytime the selected lead compressor shuts down due to a lock-out, lead system faults and is waiting to restart, lead switch on the micro board is in the OFF position, or if a run permissive is keeping the lead of the system off. Automatic switchover in MANUAL mode is provided to try to maintain chilled liquid temperature as close to setpoint as possible.

1.22 COMPRESSOR HEATER

The compressor heater will be on whenever the respective compressor is off.

2. STATUS KEY: GENERAL STATUS MESSAGES & FAULT WARNINGS

2.1 GENERAL

Pressing the Status key displays the current chiller or individual system operational status. The messages displayed include running status, cooling demand, fault status, external cycling device status, load limiting, and anti-recycle timer status. The display will show one message relating to the "highest priority" information as determined by the microprocessor.

For individual system status or fault messages, the display shows information for up to two refrigerant systems. For models with three or four systems, pressing the Status key again will show messages for Systems 3 and 4.

The main categories of messages available using the Status key are:

2.2 General Status Messages

2.3 Unit Warnings

2.4 Anticipation Control Status Messages

2.5 Chiller Fault Status Messages

2.6 System Fault Status Messages

These messages are described in detail in this section, with examples of each display. In each example "#" is used as applicable to represent the system number where messages apply to individual systems.

2.2 GENERAL STATUS MESSAGES

Unit Switch OFF:

```
UNIT SWITCH OFF
SHUTDOWN
```

This message indicates that the Chiller ON / OFF Switch on the Control Panel is in the OFF position which will not allow the chiller to run.

Schedule Shutdown:

```
DAILY SCHEDULE
SHUTDOWN
```

This message indicates that the that the chiller has been shut down by the daily schedule programmed into the Clock - Set Schedule / Holiday system (Section 9 [7.3]).

Remote Controlled Shutdown:

```
REMOTE CONTROLLED
SHUTDOWN
```

This message indicates that either an ISN or RCC (Remote Control Center) has turned the unit OFF through the RS-485 port.

Compressors Running:

```
SYS # COMP RUNNING
SYS # COMP RUNNING
```

This message indicates that the respective compressor is running due to demand.

System Switches OFF:

```
SYS # SYS SWITCH OFF
SYS # SYS SWITCH OFF
```

This message indicates that the system switch on the Microprocessor Board for the respective system is in the OFF position. A system can only run if the system switch is in the ON position. The switch for System 1 and System 2 should normally be in the ON position for all models. Switches for System 3 and 4 should only be in the ON position for three and four compressor chillers respectively. See Section 9 (1.11), Figure 37 for the location of the system switches.

Anti-Recycle Timers:

```
SYS # AR TIMER 0 S
SYS # AR TIMER 120 S
```

The anti-recycle timer message shows the amount of time remaining before a compressor can be called to restart. These 300 - 600 sec. timers begin timing when a compressor starts, although a minimum of two minutes must always elapse after a compressor shuts down, before it may again restart. If a power failure occurs, the anti-recycle timers will reset to 120 seconds after power is restored. The purpose of the timer is to allow for motor cooling to dissipate the heat generated by inrush current at start-up.

Anti-Coincidence Timers:

```
SYS # AC TIMER 60 S
SYS # AC TIMER 60 S
```

The anti-coincident timer guards against two or more compressors starting simultaneously. This avoids excessive instantaneous starting currents. A minimum of 60 seconds between compressor starts is maintained even if demand is present and the anti-recycle timers are timed out. The display shows the time before the respective compressor can start. This display will only appear after the anti-recycle timers have timed out.

Run Permissive Contacts OPEN:

```
SYS # NO RUN PERM
SYS # NO RUN PERM
```

This display indicates that an external cycling contact and/or the flow switch connected to terminals 13 & 14 in the Logic Section(s) of the control panel(s) is/are open. Whenever the contact(s) is /are open, the No Run Permissive message will be displayed and the indicated system will not run.

System No Cool Load:

```
SYS # NO COOL LOAD
SYS # NO COOL LOAD
```

This message indicates that chilled liquid temperature is below the point where the microprocessor will bring the lead system on and/or that the loading sequence has not loaded the chiller far enough to bring the lag system on. The lag system will display this message until the loading sequence is ready for the lag system to start.

Pump Down:

```
SYS 1 PUMPING DOWN
SYS 2 PUMPING DOWN
```

This message indicates that the respective system is in a pumpdown cycle. Pumpdown display messages occur on shutdowns where the cooling load has been met, when a system switch is turned off, or on recycling pumpdown. Note that only one compressor could be pumping down, as shown in the following display:

```
SYS 1 PUMPING DOWN
SYS 2 COMP RUNNING
```

See Section 1.18 (page 117) for details of pumpdown control and recycling pumpdown.

Manual Override:

```
MANUAL
OVERRIDE
```

This message indicates that the “Override” key has been pressed and the daily schedule programmed into the chiller is being ignored, and the chiller will start up when water temperature is above the high limit of the Control Range, the Chiller ON/OFF switch is ON, remote cycling devices are closed, and system switches permit.

Normally, this key is only used for servicing when the chiller is required to run, but the daily schedule is in an OFF period. This key avoids the need to reprogram the daily schedule. Once activated, Manual Override automatically disables itself after 30 minutes.

Additional information regarding Manual Override is outlined in Section 9, page 147.

2.3 UNIT WARNINGS

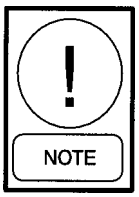
Unit Warnings are often caused by conditions which require operator intervention to start the unit, or extreme operating conditions. All setpoints and programmable values should be checked, if a chiller shutdown occurred, before restarting the chiller. Unit Warnings are not logged into the HISTORY BUFFER.

Low Battery Warning:

```
!! LOW BATTERY !!
CHECK PROG/SETP/TIME
```

On power-up, the microprocessor will check the RTC (Real Time Clock) memory back-up battery to make sure it is still operational. Provided the battery checks out, operation will continue normally. If a check is made and the battery has failed, the microprocessor will not allow the chiller to run and the above Status message will appear.

If a low battery condition exists, the micro will restore programmed cutouts, setpoints, and schedules to their default values.



Once a low battery condition is detected, the only way to run the chiller is to use the Manual Override key - see Section 9 (7.4). This allows reprogramming of setpoints, cutouts, and schedule.

The U13 RTC chip on the Microprocessor Board should be replaced as soon as possible with YORK part # 031-00955-000. Otherwise, the chiller will shutdown and lose all programmed points, and require a MANUAL OVERRIDE restart, if a power failure occurs.

Incorrect Refrigerant Warning:

```
REPROGRAM TYPE OF
REFRIGERANT TO RUN
```

The Incorrect Refrigerant Warning will occur if the DIP Switch setting for refrigerant type and the type programmed into the micro "at the factory" are not the same. This message will be displayed until the non-programmable "factory" programmed refrigerant type and DIP Switch setting agree.

Power Failure Warning:

The Power Failure Warning will only be displayed on "power restoration" after a "power loss", if manual restart on power failure is selected under the PROGRAM key (Page 152). If manual restart on power failure has been selected, the following warning message is displayed indefinitely on power restoration, and the chiller will not run until the UNIT Switch is cycled OFF-and-ON to restart the unit. This safety is available for users who desire a chiller lock-out on power failure. NOTE: This is typically not a desirable feature.

```
!! POWER FAILURE !!
CYCLE UNIT SWITCH
```

When this message appears, the chiller will not run and the Unit Switch must be cycled OFF and ON to start the unit. This display will only appear if “Manual Restart On Power Failure” is programmed under the Program Key.

2.4 LIMIT / ANTICIPATION CONTROL STATUS MESSAGES

Limit / anticipation controls are built into the software to prevent safety shutdowns by automatically overriding the temperature controls, if system conditions approach safety thresholds. This avoids total loss of cooling resulting from a lockout by a safety control.

Anticipation controls monitor discharge pressure, motor current and suction temperature for each compressor and, if programmed limits are exceeded, the affected compressor’s load stage will be reduced one step, even if requested to load by the leaving chilled liquid temperature control routine. The micro will display a “Lim-

iting" message if a limit is exceeded. To prevent the controls from ever requiring a forced unload, the micro anticipatory control will prevent a system from loading when a limit exceeds 90% of the programmed unload point. No display will indicate anticipatory loading prevention. Loading will resume when the temperature/pressure limit drops below 90% of the programmed limit.

Displays of anticipation safety control messages and their meanings are as follows:

Discharge Pressure Limiting:

```
SYS # DSCH LIMITING
SYS # DSCH LIMITING
```

Discharge Pressure Limiting takes effect when compressor discharge pressure nears the point at which the high pressure cutout would shut the system down. When the above message appears, discharge pressure has exceeded the programmable threshold and the compressor loading is inhibited or is being unloaded in an effort to prevent shutdown on the high pressure cutout. The operation of this safety is important if condenser coils become dirty, if there is a problem with the condenser fan operation, or if extreme ambient or load conditions occur (see Section 9 [8.2] / High Discharge Pressure Unload Point [page 149] for more details).

Loading will take place when pressure drops below 90% of the programmed unload point.

Compressor Motor Current Limiting:

```
SYS # CURR LIMITING
SYS # CURR LIMITING
```

The Motor Current Limiting message indicates that a compressor motor current has reached a programmable limit and the system loading is inhibited or is being unloaded to ensure that motor current does not become excessively high, causing a fault (see also Section 9 [8.2]/ High Motor Current Unload Point, page 151; Section 9 [3.5]/, Motor Current Key, page129; Section 9 [1.10], page 113).

Loading will take place when current drops below 90% of the unload point.

Suction Temperature Limiting:

```
SYS # SUCT LIMITING
SYS # SUCT LIMITING
```

The Suction Temperature Limiting message indicates that saturated suction temperature on a system has dropped to 24°F (-4.4ºC), and that any further temperature reduction could cause some icing of the evaporator tubes. Saturated suction temperature is computed by the micro by converting suction pressure to temperature.

When this threshold is exceeded, the micro will unload the respective system. Reloading will take place when temperature rises above the unload point plus 10%.

ISN Motor Current Limiting:

```
SYS # ISN LIMITING
SYS # ISN LIMITING
```

The ISN Motor Current Limiting message indicates that a compressor motor current has reached a BAS limit and the system is being unloaded according to a Building Automation System demand limit from the RS-485 input.

EMS-PWM Motor Current Limiting:

```
SYS # EMS LIMITING
SYS # EMS LIMITING
```

The EMS-PWM Motor Current Limiting message indicates that a compressor motor current has reached a programmable, BAS or Remote limit and the system is being unloaded according to a demand limit signal provided from the PWM input or BAS board in the micropanel.

2.5 UNIT FAULT STATUS MESSAGES (AUTO RESET)

A Unit Fault will shut the entire chiller down when a preset safety threshold is exceeded. The chiller will automatically restart after the condition causing the shutdown clears. Restart will occur only after anti-recycle timers are satisfied and cooling demand requires additional cooling. A reset hysteresis is built into each safety so repetitive faulting and clearing will not occur in a short time period.

Continuous monitoring by the microprocessor assures that instantaneous reactions result. When the chiller is shut down on one of these safeties, a message will appear on the Status display informing the operator of the problem as shown in the text that follows.

Any time that a Unit Fault occurs, the shutdown will be logged into the HISTORY BUFFER.

Low Ambient Temperature Cutout:

```
UNIT FAULT
LOW AMBIENT TEMP
```

The Low Ambient Temperature Safety protects the chiller from running in very low temperatures which could cause damage due to low system pressures. This feature is programmable and can also be used to shut down the chiller at a temperature where continued running of the chiller is not economical compared to the use of "free" cooling techniques (see also Section 9 [8.2]/ Low Ambient Temperature Cutout [page 150]). The fault will clear when ambient temperature rises 2°F (1ºC) above the cut-out.

High Ambient Temperature Cutout:

```
UNIT FAULT
HIGH AMBIENT TEMP
```

The High Ambient Temperature Safety protects the chiller from running in ambients above 130°F (54ºC) where potential malfunction of system mechanical and electrical components may result. The High Ambient Cutout is programmable and can be set for lower limit values if required (see also Section 9 [8.2]/ High Ambient Temperature Cutout [page 150]). The fault will clear when ambient temperature drops 2°F (1ºC) below the cut-out.

Low Leaving Chilled Liquid Temperature Cutout:

```
UNIT FAULT
LOW LIQUID TEMP
```

The Low Water Temperature Safety assures that the evaporator is not damaged from freezing due to improperly set control points. It also attempts to protect the chiller from freezing, if the flow switch should fail. Whenever the chilled liquid temperature drops below the programmable cutout, the chiller will shut down (see also Section 9 [8.2] / Leaving Water Temperature Cutout, page 151). The chiller fault will clear when temperature rises 4°F (2ºC) above the cut-out, and cooling demand exists.

115VAC Under Voltage Cut-Out:

```
UNIT FAULT
115VAC UNDER VOLTAGE
```

The Under Voltage Safety assures that the system is not operated at voltages where malfunction of the microprocessor could result in system damage. Whenever the microprocessor senses an on-board control power supply failure while a compressor is running, the chiller is shut down. The microprocessor circuitry is capable of operating at voltages 10% below the nominal 115VAC supply to the panel. Auto-restart of the chiller occurs after a 2 minute start-up timer has elapsed from the time when power is re-applied, if the AUTO RESTART ON POWER FAILURE is enabled. Otherwise, the chiller must be manually reset. See Section 9 (8.2, page 152).

Flow Switch Open (No Run Permissive):

```
SYS # NO RUN PERM
SYS # NO RUN PERM
```

Closure of the flow switch(es) is monitored to check that flow is present in the evaporator when a compressor is running. Any external cycling devices fitted by the customer should be connected in series with the flow switch. If the flow switch opens, all systems controlled by the panel it is connected to will shut down and a NO RUN PERM (Permissive) message will be displayed. Closing of the flow switch, when flow is present, will cause the message to disappear and auto-restart to occur.

Never bypass a flow switch. This will cause damage to the chiller and void any warranties.

2.6 INDIVIDUAL START INHIBIT SAFETIES

System start inhibits prevent a system from starting if the inhibit value is exceeded. This prevents damage to the compressor, which should not start under the given conditions. Inhibits can only prevent a system from operating and cannot shut a system off. Inhibits are not logged in the History buffer.

When the chiller is shut down on one of these safeties, a message will appear on the STATUS display informing the operator of the problem. This is accessible by pressing the STATUS key.

Low Oil Temperature Inhibit:

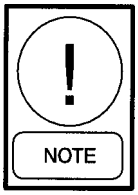
```
SYS 1 LOW OIL TEMP
SYS 2 LOW OIL TEMP
```

The Low Oil Temperature Inhibit prevents the compressor from starting if its oil temperature is too low due to heater failure or insufficient time for the heater to remove refrigerant from the oil. This prevents damage to the compressor. The oil temperature must be greater than or equal to ambient temperature plus 15°F (8°C) to allow a compressor to start. If the oil temperature is less than ambient plus 15°F (8°C), the affected system's compressor will not be allowed to start.

The low oil temperature inhibit can only prevent a compressor start. It is not a safety and will not shut down a compressor that is running. The inhibit is not logged to the History buffer.

2.7 SYSTEM FAULT (SAFETY) STATUS MESSAGES (MANUAL RESET)

A System fault will shut the affected system down whenever a preset safety threshold is exceeded for 3 seconds. Automatic restart will occur after the first 2 shutdowns when the anti-recycle timer times out and temperature demand exists. After any combination of 3 Manual Reset Safeties in a 90-minute time period, the affected system will shut down and lock out on the last fault. When one or more systems are shut down on one of these safeties, a message will appear on the Status display informing the operator of the problem.



The High Motor Current Safety is a unique safety which will lock out a system after only a single fault.

To reset a locked-out system, turn the System Switch for the affected system to the OFF position, then back to the ON position (see Section 1.11, Fig. 37 for switch locations).

Before returning a locked-out system to service, a thorough investigation of the cause of the fault should be made. Failure to repair the cause of the fault while manually allowing repetitive restarts may cause further expensive damage to the system.

High Discharge Pressure Cutout:

```
SYS # HIGH DSCH PRES
SYS # HIGH DSCH PRES
```

The Discharge Pressure Safety prevents system pressure from exceeding safe working limits. This safety is a backup for the mechanical High Pressure Cutout in each system. The Discharge Pressure Safety is programmable for a range of values below the system upper limit (see Section 9 [8.2] / Page 149, High Discharge Pressure Cutout for more details).

Low Oil Pressure Cutout:

```
SYS # LOW OIL PRESS
SYS # LOW OIL PRESS
```

The Low Oil Pressure Safety ensures that the compressor receives proper lubrication by monitoring the differential between oil pressure and suction pressure (Oil – Suction = Differential).

The oil pressure cutout is linearly ramped from 0PSID to 25PSID in 60 seconds. The cutout is totally ignored for the first 4 seconds of operations. The cutout can be calculated as follows:

$$\text{Cutout} = \frac{25}{(60/\text{Run Time})}$$

High Oil Temperature Cutout:

```
SYS # HIGH OIL TEMP
SYS # HIGH OIL TEMP
```

This safety assures oil temperature does not exceed a safe operating temperature which affects compressor lubrication. Typical oil temperature during normal operation will be approximately 120 - 140°F (48.9 - 60°C).

A system will not start up, or will shut down, when its oil temperature rises above 180°F during the first minute of run time, or 160°F after the first minute of run time.

Low Suction Pressure Cutout:

```
SYS # LOW SUCT PRESS
SYS # LOW SUCT PRESS
```

The Low Suction Pressure Cutout aids in protecting the evaporator from damage due to ice build up caused by operation at low refrigerant charge or restricted re-

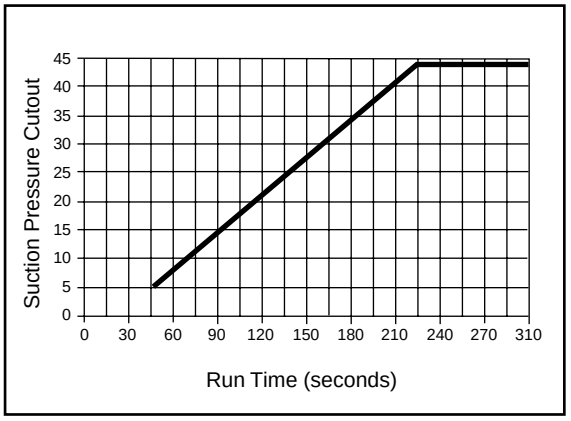
frigerant flow. A number of transient timer features prevent nuisance trips during start-up, compressor loading, etc. The Low Suction Pressure Safety is programmable (see Section 9 [8.2] / Page 144, Low Suction Pressure Cutout for more details).

The suction pressure cut-out is ignored for the first 45 seconds of operation. During the next 180 seconds of running , suction pressure may be lower than the cutout, but must be greater than:

$$\text{SP Cutout} = \frac{\text{Programmed Cutout} * (\text{Run Time} - 25)}{200}$$

This cutout value increases with time until after 225 seconds it equals the programmed cutout value. If suction pressure falls below the calculated cutout value before 225 seconds of run time, the system will be shut down.

The following graph shows a typical programmed suction pressure cutout of 44 PSIG (3 bar) and its change from time = 0 sec of compressor run time to 225 seconds of compressor run time.



Suction Pressure Cutout With 44 PSIG Programmed Cutout

FIG. 39 – SUCTION PRESSURE CUTOUT

After 225 seconds of operation with suction pressure operating above the cut-out, a 30-second transient timer prevents short term fluctuations in suction pressure due to loading or fan cycling from causing shutdown. If suction pressure drops below the cutout point after 225 seconds of operation, the transient timer is activated. While the transient timer is active, suction pressure must not drop below 10% of the cut-out initially programmed and must be greater than:

$$\text{New C.O.} = \text{Programmed C.O.} \times \frac{(33.3 - \text{Time Remaining})}{33.3}$$

This transient cutout value increases with time until after 30 seconds it equals the programmed cutout value. If the suction pressure falls below the value as calculated by the formula relative to time, the system will shut down on a low suction pressure fault. If the suction pressure rises above the programmed cutout value, the 30-second timer will be reset.

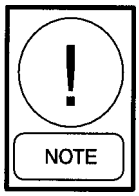
If the Dip Switch on the microprocessor board is set for "Water Cooling" (see page 131), the cutout is programmable between 44-70 PSIG (3-5 bar) for both R-22 and R-407C models. In this mode, settings of 44 PSIG (3 bar) for R22 and R-407C are recommended. If the Switch is set for "Brine Cooling" (glycol) the cutout is programmable between 5-70 PSIG (0.3-5 bar) for R-22 and R-407C models. In this mode, the cutout should typically be set to the saturated refrigerant pressure equivalent to 18ºF (10ºC) below the temperature of the chilled liquid. **The sludge point of the glycol MUST be at least another 20ºF (11ºC) below the equivalent cutout temperature. This programmable value is password protected.**

High Compressor Motor Current Cutout:

```
SYS # HIGH MTR CURR
SYS # HIGH MTR CURR
```

The High Motor Current Safety protects against excessively high motor current and shuts a system down and locks it out after only a single occurrence of a rise in average motor current above the cutout point. Motor current is monitored through the 3 Current Transformers (CTs) per motor, one on each phase, in the motor protection module.

Average motor current is monitored after 4 seconds of compressor operation. The system will be shut down if average motor current exceeds 115% FLA.



FLA (full load amps) is approximately 1.2 x RLA (rated load amps). RLA is specified on the motor / chiller nameplate and is typical current demand under rated operating conditions in a fully loaded system. When a system is fully loaded, typical motor currents may be at 60 - 85% FLA depending on operating conditions.

Low Motor Current Cutout / Motor Protector (Hi Motor Winding Temp Cutout) / Mechanical High Pressure Cutout / External Motor Overload:

```
SYS  #  LOW  CURR / MP / HP
SYS  #  LOW  CURR / MP / HP
```

The **Low Motor Current Safety** prevents a compressor motor running with less current than would normally be expected. This may result from loss of refrigerant, contactor, or power problems, as well as from a compressor that is not pumping due to a mechanical malfunction. Motor current is monitored using 3 Current Transformers (CTs) per motor, one on each phase.

Average motor current is monitored after 3 seconds of compressor operation. From this time the system will be shut down if average motor current is less than 10% of FLA.

Compressor Motor Protection Modules and **Mechanical High Pressure Cutouts** are fitted to each system. Both of these devices stop the compressor by removing power from its motor contactor coils. This causes the CT's to obviously sense a zero current draw by the compressor motor and causes a Low Motor Current Fault to be displayed. These devices operate as follows :

The **Motor Protection Module** protects against excessive motor winding temperature by monitoring 3 or 6 sensors built into the motor windings. If the temperature becomes excessive, the module will cause power to be removed from the compressor contactors shutting down the compressor. Auto restart will not occur since manual reset is required. A fault lockout will automatically occur after the micro attempts 2 more starts with the MP contacts open. Manual reset is accomplished by removing 115VAC control power from the micro panel after the motor sensors have sufficient time to cool. Details relating to operation of the Motor Protector Module can be found on page 18.

The **Mechanical High Pressure Cutout** protects against excessive refrigerant discharge pressure and is set to 405 PSIG (28 bar). Auto-restart will be permitted after shutdown on discharge pressure, when the pressure drops below 230 PSIG (23 bar) and the cutout contacts close. A fault lockout will result if safety thresholds are exceeded three times in a 90 minute period.

Pumpdown Safety:

```
SYS  1  PUMPDOWN  FAIL
SYS  2  PUMPDOWN  FAIL
```

The Pumpdown Safety ensures that a compressor does not run unless it completes a proper pumpdown. This prevents operation of a refrigerant system which has a leaking liquid line solenoid valve.

On shutdown, the system must pump down to the suction pressure cutout within 300 seconds, or the system will shut down. If the system performs 3 unsuccessful pumpdowns in a row, the system will fault and lock out.

Low Evaporator Temperature Cutout (R-407C Only):

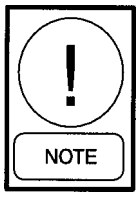
```
SYS  1  LOW  EVAP  TEMP
SYS  2  LOW  EVAP  TEMP
```

The Low Evaporator Temperature Cutout is to protect the evaporator from freeze-up with R-407C. This safety uses the Cooler Inlet Refrigerant Temp Sensors to monitor evaporator inlet refrigerant temperature on each system. These sensors are only installed on R-407C units. If the refrigerant temperature falls below 21ºF (11.5°C) in water cooling mode, the system will be shut down. If the refrigerant temp falls 19°F (11ºC) below the leaving chilled liquid temp in glycol cooling mode, the system will shut down. Also, if the cooler inlet refrigerant temp sensor reads out of range low, the system will also shut down.

2.8 PRINTOUT ON FAULT SHUTDOWN

If an optional printer is installed, the contents of History Buffer 1 will be sent to the printer any time a fault shutdown occurs. This will allow record keeping of individual faults, even if they do not cause a lockout of the system. This information may be useful to identify developing problems and troubleshooting.

The No Run Permissive fault messages will not be stored in the History Buffer and will not cause an auto printout.



Due to extreme operating conditions or systems where control deficiencies are present, occasional faults may occur with the corresponding automatic printout. This is not a cause for concern, unless oil pressure faults, liquid slugging, or motor overheating continuously occur.

3. DISPLAY KEYS & OPTION SWITCHES

3.1 GENERAL

The Display keys provide direct access to retrieve commonly required data about the operation of the chiller. This is particularly useful during commissioning, monitoring the operation of the chiller, diagnosing potential future problems and service troubleshooting.

When a Display key is pressed, the corresponding message will be displayed and will remain on the display until another key is pressed.

Displayed data is in "real-time" and is updated approximately every 2 seconds. If updating of one of the messages is required faster than every 2 seconds, the appropriate key for the desired display can be pushed and held to provide updating every 0.4 seconds.

Display Messages may show characters indicating “greater than” (>) or “less than” (<). These characters indicate the actual values are greater than or less than the values which are being displayed, but are outside the ability of the micro to give an actual reading. This is unlikely to occur unless a problem exists in the measuring sensors or during extreme conditions.

The Display keys and the data available from each is as follows:

3.2 CHILLED LIQUID TEMPS KEY

When the Chilled Liquid Temperatures key is pressed, a display of chilled liquid temperatures leaving the chiller (LCHLT) and returning to the chiller (RCHLT) is provided as follows:

```
LCHLT = 42.1 °F
RCHLT = 47.9 °F
```

If the key is pressed again, the following message will appear if an optional mixed chilled leaving temp sensor is installed for multi-unit sequencing. If a sensor is not installed, pressing the key will have no effect.

```
MCHLT = 42.3 °F
```

3.3 SYSTEM # DATA KEYS

Pressing one of the four System # Data keys a number of times scrolls through displays of differential oil pressure (OIL), suction pressure (SP) and discharge pressure (DP), oil temperature, suction temperature (ST), saturated suction temperature, suction superheat, load stage, and cooler inlet refrigerant temp.

Examples of these displays are as follows, where # is the appropriate system number.

```
SYS # OIL=   72 PSID
SP= 60  DP= 229 PSIG
```

```
SYS # OIL =130.1 °F
          ST = 46.8 °F
```

```
S# SAT SUCT = 31.6°F
 SUCT SHEAT = 15.2°F
```

```
SYS # LOAD STAGE=2
```

```
* SYS # COOLER INLET
REFRIG TEMP = 31.9°F
```

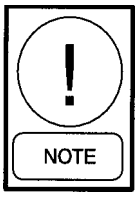
* This display will only appear in the R-407C mode.

Temperatures and pressures are measured either directly by transducers and temperature sensors, or computed from these measurements as follows:

- Differential oil pressure is the difference between oil pump output pressure and suction pressure, as measured by the transducers.
- Saturated suction temperature is computed by converting measured pressure to temperature.
- Superheats are the difference between the respective saturated temperature (converted from pressure) and actual temperature.
- Load stage increments from 0-2, according to the loading step of each compressor as loaded by the micro. Stage O = Compressor OFF. Stage U = Compressor ON and unloaded. Stage = Number of solenoids on the compressor de-energized and loaded.

Display limits for the System Pressures and Temperatures displays are as follows:

	MIN. LIMIT	MAX. LIMIT
Oil Pressure	208 PSID (14 bar)	0 PSID (0 bar)
Suction Pressure	0 PSIG (0 bar)	199 PSIG (14 bar)
Discharge Pressure	0 PSIG (0 bar)	399 PSIG (28 bar)
Oil Temp.	7°F (-14°C)	202.1°F (94.5°C)
Suction Temp.	9°F (-13°C)	132.8°F (56°C)
Sat. Suction Temp.	-41°F (-41.0°C)	101.3°F (39°C)
Suction Superheat	-81.5°F (-63°C)	60.9°F (16°C)
Load Stage	0	2



Minimum and maximum values may change as software (EPROM) revisions are made.

3.4 AMBIENT TEMP KEY

When the Ambient Temperature Key is pressed, ambient air temperature, as measured surrounding the chiller, is displayed.

```
AMBIENT AIR TEMP
     = 86.8°F
```

Display Limits: Minimum = -4.6°F (-20.3°C)
Maximum = 137.9°F (58.8°C)

3.5 MOTOR CURRENT KEY

Pressing the Motor Current Key displays compressor current for each system:

```
COMP# 240 AMP 82%FLA
COMP# 176 AMP 43%FLA
```

This display shows the average motor current in amps and average compressor motor current as a percentage of FLA. % FLA values are approximate. Keep in mind that current in amps is also an “approximate” value.

```
ISN CRNT LIMIT: NONE
EMS CRNT LIMIT: NONE
```

On the second press of the of the Motor Current Key, the current limit values as set by the ISN (Remote BAS System) and EMS-PWM current limiting input are displayed, if they are active. See Section 9 (1.10, 2.4 and 3.5) for more details.

3.6 OPERATING HRS / START COUNTER KEY

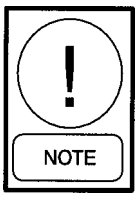
When the Operating Hours / Starts Counter key is pressed, the accumulated running hours and starts for System 1 and 2 compressors are displayed. Where applicable, pressing the key again displays the values for Systems 3 and 4 on larger models:

```
HRS  1=  1143,2  =  1382
STR  1=   285,2  =   322
```

```
HRS  3=  1255,4  =  1095
STR  3=   365,4  =   455
```

Display Limits : Maximum run hours 99,999
Maximum starts 99,999

Values roll over to zero, if the maximum limit is exceeded.



These counters are zeroed at the factory, but may indicate run time and number of starts logged during factory testing prior to shipment.

3.7 OPTIONS KEY & DIP SWITCH SETTINGS

The Options key provides a display of the unit set-up options which are programmed by the positions of the S1 Dip Switches (Fig. 40) on the Microprocessor Board. Proper programming of the switches is important during the commissioning of the chiller. The Options key can be used to verify the Dip Switch positions without looking at or handling the Microprocessor Board.

Each press of the key will scroll to the next option/dip switch setting.

Three Option Switch Messages (S1-1 to S1-3) will then be displayed in sequence. At the end of the sequence, the display will automatically revert to the first Option Switch message.

The following is a detailed guide to programming the Dip Switches together with the associated display message provided for each selection when the Options key is pressed:

SWITCH 1 : Water / Brine Cooling

Open:

```
S1-1 CHILLED LIQUID
       WATER
```

Water Cooling Mode is for water cooling applications and allows the chilled liquid leaving temperature setpoint to be programmed from 40 to 52 ºF (4.4 to 11.1°C). Selecting this mode also auto-programs the Low Chilled Liquid Cut-Out at 36°F (2°C) and the Suction Pressure Cut-Out at 44 PSIG (3 bar).

Closed:

```
S1-1 CHILLED LIQUID
       GLYCOL
```

Brine Cooling Mode is for brine/glycol applications with setpoints below 40°F (4ºC) and allows the chilled liquid leaving temperature setpoint to be programmed from 10 to 52°F (-12 - 11.1°C). In this mode, the Low Chilled Liquid Cut-Out can be programmed from 8 to 36ºF (-13 to 2°C) and the Suction Pressure Cut-Out programmed from 20 to 70 PSIG (1 to 5 bar) for R-22 models and 5 to 70 PSIG (0.3 to 5 bar) for R-407C models.

SWITCH 2 : Ambient Temp. Low Limit

Open:

```
S1-2 AMBIENT CONTROL
       STANDARD
```

Standard Ambient Mode auto-programs the Low Ambient Cutout setting at 25ºF (-4°C) and is not adjustable.

Closed:

```
S1-2 AMBIENT CONTROL
       LOW AMBIENT
```

Low Ambient Mode allows the Low Ambient Cut-Out to be programmed from 0 to 50 ºF (-18 to 10ºC). Values above 25ºF (-4°C) can be used to automatically shut down the chiller when direct cooling methods become operational.

SWITCH 3 : Refrigerant

Open:

```
S1-3 REFRIGERANT
       R-407C
```

The R-407C Mode MUST be selected for models using refrigerant R-407C. Incorrect selection of this switch may cause serious damage to the chiller.

Closed:

```
S1-3 REFRIGERANT
       R-22
```

The R-22 Mode MUST be selected for models using refrigerant type R-22. Incorrect selection of this switch may cause serious damage to the chiller.

SUMMARY OF SETTINGS

The following table provides a summary of Modes (displayed messages) which can be selected using the Open and Closed positions for each of the eight SW1 Dip Switches.

SWITCH	SWITCH "OPEN" SETTING	SWITCH "CLOSED" SETTING
1	Water Cooling	Brine Cooling
2	Standard Ambient Control	Low Ambient Control
3	Refrigerant R-407C	Refrigerant R-22
4	Spare	Spare
5	Spare	Spare
6	Spare	Spare
7	Spare	Spare
8	Spare	Spare

3.8 FUNCTION KEY

Pressing the Function key only displays the same message as pressing the Status key. Pressing the Function key followed by another display key will scroll through all the data available under that key once. E.g., pressing the Function key followed by the System 1 Data key will result in scrolling through the 5 displays shown in Section 9 (3.3) without the need to press the System 1 Data key to scroll to the next display. After scrolling through the data, the display returns to the status message.

The following keys can be scrolled using the Function Key: Chilled Liquid Temps, System # Data, Motor Current and Options.

Dip Switch Physical Location and Setting:

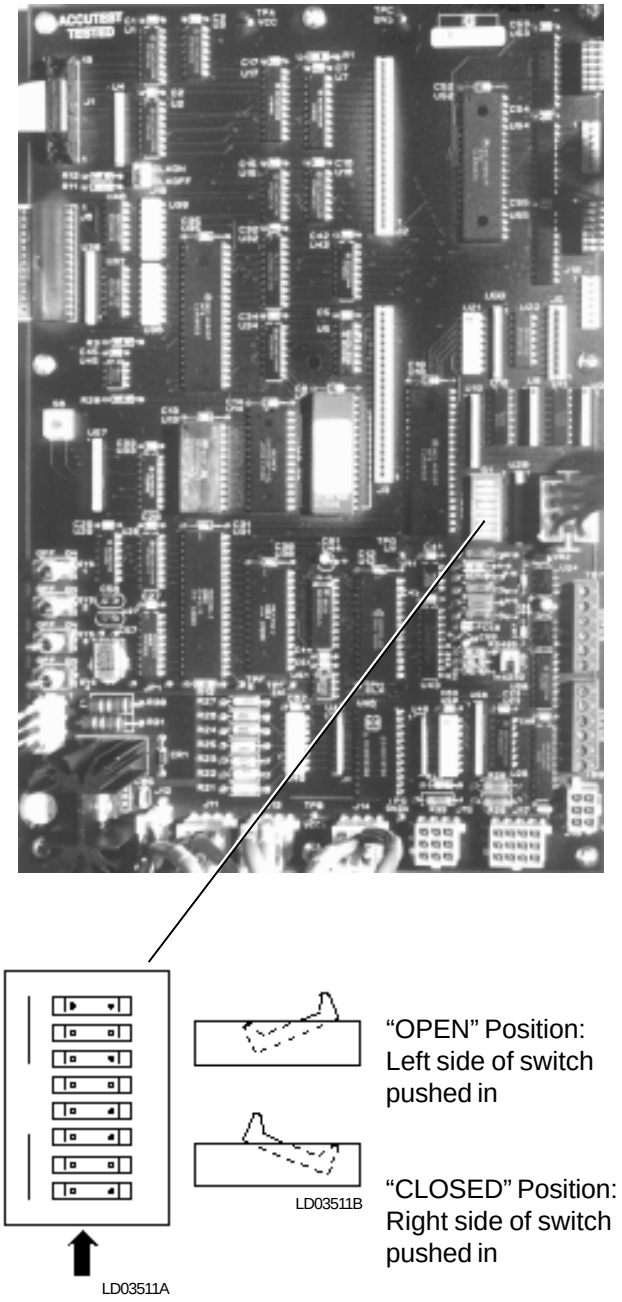


FIG. 40 – ENLARGED PHOTOGRAPH OF DIP SWITCHES ON MICROPROCESSOR BOARD

4. PRINT KEYS

4.1 GENERAL

The Print keys provide access to two sets of information either locally on the panel display or, if an optional printer is connected, remotely as hard copy printouts.

The Operating Data (Oper Data) key provides a real-time list of system operating data and programmed settings. The History key provides a comprehensive list of operating data and programmed settings "at the instant of fault" on each of the last six faults (local display) or three faults (remote printout) which occurred on the chiller.

4.2 OPER DATA KEY

If a remote printer is not connected, pressing the Operating Data key allows the user to scroll through information, on the 40 character display, which is not directly available from the Display keys on the panel.

If a remote printer is connected, pressing the Operating Data key causes a snapshot to be taken of system operating conditions and of the user programming selections. The data is stored in temporary memory, then transmitted from the microprocessor to the remote printer. As the data is transmitted it is erased from the memory.

Information available using the Operating Data key is described in the following sections. In example displays " # " is used to indicate system number where appropriate.

4.3 OPERATING DATA - LOCAL DISPLAY MESSAGES

YCAR 2-System Models:

When the Operating Data key is pressed, the following message appears:

```
OPERATING DATA
DISPLAYS
```

Repetitively pressing the ↑↓ keys will scroll through the following Common (whole chiller) Data and individual System Data information displays.

Common Data:

```
   LOAD TIMER   10 SEC
UNLOAD TIMER    0 SEC
```

This message shows the time remaining on the Load Timer and the Unload Timer. These Timers constantly recycle and are used in conjunction with "rate control" and "temperature deviation from setpoint" to determine when loading should occur.

```
TEMP ERROR   00.5 °F
TEMP RATE -  0.9 °F/M
```

The upper message gives the difference (error) between actual leaving chilled liquid temperature and the programmed Target temperature. The lower message gives the rate of change of the chilled liquid leaving temperature in degrees per minute. A minus sign (-) indicates falling temperature. No sign indicates rising temperature.

```
LEAD SYSTEM IS
SYSTEM NUMBER          #
```

This message advises which system is programmed as the lead.

```
EVAP PUMP IS          OFF
EVAP HEATER IS         ON
```

This message indicates the position of the optional auxiliary contacts for the evaporator water pump and the status of the evaporator heater.

For the evaporator pump contacts, ON = contacts closed, OFF = contacts open.

The Evaporator Heater status is controlled on ambient temperature as follows: If measured ambient falls below 40ºF (4°C), the Evaporator Heater is switched ON. If measured ambient then rises above 45ºF (7°C) the heater is switched OFF. The evaporator heater prevents water standing in the evaporator from freezing.

```
ACTIVE REMOTE CTRL
        NONE
```

This message indicates that a remote device such as a Remote Control Center, an ISN controller, or another device sending a PWM signal for temperature; or current reset is overriding control points programmed through the keypad or default microprocessor setpoints. The following displays may be encountered:

NONE –	No remote control active. Remote monitoring may be active.
ISN –	YorkTalk via ISN or Remote Control Center (remote mode).
PWM CURR –	EMS PWM Current Limiting Enabled
PWM TEMP –	EMS PWM Temp. Reset Enabled
CUR/TEMP –	EMS PWM Current Limiting & Temperature Reset Enabled

System Data:

The following sequence of three displays are provided first for System 1, then for System 2, and then for Systems 3 and 4 as applicable.

```
SYS # RUN TIME
   1-3-48-17   D-H-M-S
```

This message displays the accumulated Run Time since the last start in Days (D), Hours (H), Minutes (M), and Seconds (S).

```
SYS # LLSV IS          ON
HOT GAS SOL IS         ON
```

This message indicates the Liquid Line Solenoid Valve and the Hot Gas Solenoid valve position: ON = Energized/Open, OFF = De-energized/Closed.

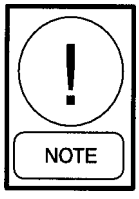
```
SYS # FAN STAGE        3
```

This message advises the stage of condenser fan operation on this system and the status of the compressor heater. See Section 9 (8.4) for details of fan staging.

Once the System Data sequence has been repeated for the second system, pressing the ↑ or ↓ key again will loop back to the beginning to the Load/Unload Timer display. To leave the sequence at any point, press a key from another section of the keypad.

YCAR 3- and 4-System Models

The Local and System Data display messages for the YCAR 3- and 4-System models follow the same format as the YCAR 2-System Model messages as given in the preceding paragraphs. The only difference is that after the System 2 data is completed, pressing the ↑ key displays System 3 data before looping back to the Load/Unload Timer Display.



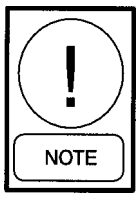
Pressing the "OPER DATA" key and then pressing the "*" key displays the EPROM software version being used, as shown below:

```
SOFTWARE VERSION
C.R09.23.01
```

4.4 OPERATING DATA - REMOTE PRINTOUT

The follow text shows a typical example printout obtained by pressing the Operating Data (OPER DATA) key with an optional printer attached. In this case an example is shown for a YCAR 2-system Chiller. YCAR 3-system models and YCAR 4-system models provide similar printouts for the appropriate number of systems:

```
      YORK INTERNATIONAL CORPORATION
         MILLENNIUM RECIP CHILLER

              UNIT STATUS
            2:04PM 25 AUG 00

SYS 1                NO COOLING LOAD
SYS 2             COMPRESSOR RUNNING

                 OPTIONS

CHILLED LIQUID                  WATER
AMBIENT CONTROL              STANDARD
REFRIGERANT TYPE                R-22

              PROGRAM VALUES

DSCH PRESS CUTOUT            399 PSIG
DSCH PRESS UNLOAD            375 PSIG
SUCT PRESS CUTOUT             44 PSIG
HIGH AMBIENT CUTOUT         130.0 ºF
LOW AMBIENT CUTOUT           25.0 ºF
LEAVING LIQUID CUTOUT        36.0 ºF
MOTOR CURRENT UNLOAD         100 %FLA
ANTI RECYCLE TIME            600 SECS
LOCAL/REMOTE MODE             REMOTE
LEAD/LAG CONTROL            AUTOMATIC

                 UNIT DATA

LEAVING LIQUID TEMP           49.0 ºF
RETURN LIQUID TEMP            58.2 ºF
MIXED LIQUID TEMP             51.3 ºF
COOLING RANGE       42.0 +/-  2.0 ºF
AMBIENT AIR TEMP              74.8 ºF
LEAD SYSTEM                    SYS 2
EVAPORATOR PUMP                  ON
EVAPORATOR HEATER               OFF
ACTIVE REMOTE CONTROL          NONE
SOFTWARE VERSION       C.RCP.09.00

              SYSTEM 1 DATA

COMPRESSORS STATUS               OFF
RUN TIME            0-0-0-0 D-H-M-S
MOTOR CURRENT        0 AMPS   0 %FLA
SUCTION PRESSURE            125 PSIG
DISCHARGE PRESSURE          131 PSIG
OIL PRESSURE                130 PSID
SUCTION TEMPERATURE          68.4 ºF
OIL TEMPERATURE              68.8 ºF
SAT SUCTION TEMP             71.8 ºF
SUCTION SUPERHEAT             3.4 ºF
COMPRESSOR LOAD STAGE               0
COOLER INLET REFRIG          44.6 ºF
LIQUID LINE SOLENOID             OFF
HOT GAS BYPASS SOLENOID          OFF
CONDENSER FAN STAGE              OFF

              SYSTEM 2 DATA

COMPRESSORS STATUS               ON
RUN TIME          0-0-15-26 D-H-M-S
MOTOR CURRENT      104 AMPS  87 %FLA
SUCTION PRESSURE             57 PSIG
DISCHARGE PRESSURE          233 PSIG
OIL PRESSURE                218 PSIG
SUCTION TEMPERATURE          42.9 ºF
OIL TEMPERATURE             102.8 ºF
SAT SUCTION TEMP             31.7 ºF
SUCTION SUPERHEAT            11.2 ºF
COMPRESSOR LOAD STAGE               2
COOLER INLET REFRIG          23.6 ºF
LIQUID LINE SOLENOID             ON
HOT GAS BYPASS SOLENOID          ON
CONDENSER FAN STAGE               3

              DAILY SCHEDULE

S M T W T F S             * = HOLIDAY
MON     START=00:00AM   STOP=00:00AM
TUE     START=00:00AM   STOP=00:00AM
WED     START=00:00AM   STOP=00:00AM
THU     START=00:00AM   STOP=00:00AM
FRI     START=00:00AM   STOP=00:00AM
SAT     START=00:00AM   STOP=00:00AM
HOL     START=00:00AM   STOP=00:00AM
```



The System Cooler Inlet Refrigerant Temperature will be printed if the unit is in R-407C mode.

4.5 HISTORY KEY

If a safety shutdown occurs on the chiller, a comprehensive list of operating and programmed settings data is stored by the microprocessor. The information is stored at the instant of the fault, regardless of whether the fault caused a lockout to occur. This information is not affected by power failures or manual resetting of a fault lockout.

The microprocessor stores data for up to 6 safety shutdowns on 2-System units and 4 safety shutdowns on 3- or 4-compressor units. Once this limit is reached, a further shutdown will cause the oldest set of data to be discarded in favor of storing the new shutdown data. The Safety Shutdowns are numbered from 1 to 6 with number 1 always being the most recent.

If a remote printer is not connected, pressing the History key allows the operator to locally scroll through information relating to the stored safety shutdowns on the control panel display.

If a remote printer is connected, pressing the History key will cause data from the last 6 shutdowns on a 2-compressor chiller or 4 shutdowns on a 3- or 4-compressor chiller to be transmitted from the microprocessor to the remote printer. The printout will begin with the most recent fault which occurred. This does not affect the stored data and as many prints as desired may be taken. See Section 9 (4.7) for a HISTORY printout sample.

Information contained in the SAFETY SHUTDOWN buffers is very important when attempting to troubleshoot a system problem. This data reflects the system conditions at the instant the fault occurred and often reveals other system conditions which actually caused the safety threshold to be exceeded.

4.6 FAULT HISTORY DATA - LOCAL DISPLAY MESSAGES

When the History key is pressed, the following message will appear:

```
DISPLAY SAFETY SHUT-
DOWN NO.1 (1 TO 6)
```

To select a Safety Shutdown, press the appropriate key on the numeric keypad then press Enter. Remember that the most recent fault information is stored as shutdown No. 1. After the ENTER Key is pressed, a message indicating the time and date of the Fault Shutdown will appear:

```
  SHUTDOWN OCCURRED
 9:55 P.M. 28 AUG 00
```

Repetitively pressing the ↑↓ Keys allows scrolling through the information available in the Safety Shutdown buffer. This is divided into Common (Whole Chiller) Data and Individual System Data displays as follows:

Common Data:

```
SYS 1 NO FAULTS
SYS 2 HIGH MTR CURR
```

This message indicates the fault that caused the shutdown; in this case, a high motor current in System 2 was the cause of the shutdown.

```
S1-1 CHILLED LIQUID
      WATER
```

This message displays the type of chilled liquid selected (water or glycol) at the time of the fault.

```
S1-2 AMBIENT CONTROL
     LOW AMBIENT
```

This display indicates whether standard or low ambient operation was selected at the time of the fault.

```
S1-3 REFRIGERANT
       R-22
```

This message indicates the type of refrigerant that was programmed at the time of the fault (R-22 or R-407C).

```
DISCHARGE PRESSURE
CUTOUT = 375.0 PSIG
```

This message indicates the discharge pressure cut-out programmed at the time of the fault.

```
DISCHARGE PRESSURE
UNLOAD = 360.0 PSIG
```

This display provides the discharge pressure unload point, programmed at the time of the fault.

```
SUCTION PRESSURE
CUTOUT = 44.0 PSIG
```

This message displays the suction pressure cut-out programmed at the time of the fault.

```
HIGH AMBIENT TEMP
CUTOUT = 115.0 °F
```

This message indicates the High Ambient Temperature Cutout at the time of the fault.

```
LOW AMBIENT TEMP
CUTOUT = 25.0°F
```

This display shows the Low Ambient Cutout programmed at the time of the fault.

```
LEAVING LIQUID TEMP
CUTOUT =   34.0°F
```

This display shows the Low Leaving Chilled Liquid Cutout programmed at the time of the fault.

```
HIGH MOTOR CURRENT
UNLOAD - 100% FLA
```

This message shows the programmed %FLA Motor Current Unload at the time of the fault.

```
LOCAL/REMOTE MODE
        LOCAL
```

This message shows whether remote or local communications was selected at the time of the fault.

```
LEAD/LAG CONTROL
      AUTOMATIC
```

This message displays the lead/lag selection programmed at the time of the fault.

```
LCHLT = 42.3 °F
RCHLT = 48.9 °F
```

This message indicates the leaving and return chilled liquid temperature at the time of the fault.

```
MCHLT = 43.0 °F
```

This message indicates the mixed water temperature at the time of the fault. A mixed water sensor may be present when multi-unit sequencing is utilized. If no mixed water temperature sensor is installed, the display will not appear.

```
SETPOINT   = 42.0°F
 RANGE = +/- 2.0°F
```

This message displays the programmed chilled liquid setpoint and deviation (control range) programmed at the time of the fault.

```
   AMBIENT AIR TEMP
      = 72.6°F
```

This message indicates the outdoor Ambient Air Temperature at the time of the fault.

```
LEAD SYSTEM IS
SYSTEM NUMBER      1
```

This message indicates which system was in the lead at the time of the fault.

```
EVAP PUMP IS       ON
EVAP HEATER IS    OFF
```

This message indicates the status of both the evaporator pump signal from the microprocessor and the evaporator heater.

```
  ACTIVE REMOTE CTRL
        NONE
```

This message indicates that a remote device such as a Remote Control Center, an ISN controller, or another device sending a PWM signal for temperature or current temperature or current reset is overriding control points programmed through the keypad or default microprocessor setpoints.

System Data:

Following the Common Data is a sequence of twenty information displays which are given twice, first for System 1, then for System 2. In each example, "#" is used to indicate System number.

```
  SYS # COMPRESSOR
       IS ON
```

This message indicates whether the compressor on this system was ON or OFF at the time of the fault.

```
SYS # RUN TIME
  1-3-48-17  D-H-M-S
```

This message shows the Run Time logged on the system since the last compressor start, in Days (D), Hours (H), Minutes (M), and Seconds (S).

```
SYS # MOTOR CURRENT
255 AMPS =   82% FLA
```

This message indicates the compressor motor current in as a percentage of Full Load Amps.

```
SYS # OIL= 70 PSID
SP= 59 DP=227 PSIG
```

This message shows the system differential oil pressure at the time of the fault.

```
SYS # OIL= 116.2 °F
      ST=  46.5 °F
```

This message indicates the system oil line temperature at the time of the fault.

```
S# SAT SUCT= 31.7 °F
SUCT SHEAT = 14.8 °F
```

These messages indicate compressor suction gas saturation temperature and superheat at the time of the fault.

```
SYS # COOLER INLET
REFRIG TEMP = 30.4 °F
```

This message, which is only displayed if the unit is in R-407C mode, indicates the refrigerant temperature at the inlet of the cooler.

```
SYS # LLSV IS      ON
HOT GAS SOL IS    OFF
```

This message indicates the Liquid Line Solenoid Valve and the economizer Hot Gas Solenoid Valve position: ON = Energized / OFF = De-Energized (OFF) at the time of the fault.

```
SYS # FAN STAGE    3
```

This message indicates the stage of condenser fan operation on the system. See Section 8.4 for details of fan staging.

History Key:

When the History key is pressed, the following message will appear:

```
DISPLAY SAFETY SHUT-
DOWN NO.1 (1 TO 4)
```

To select a Safety Shutdown, press the appropriate key on the numeric keypad, then press ENTER. Remember that the most recent fault information is stored as shutdown Number 1. Repetitively pressing the ENTER key now scrolls through the information available in the Safety Shutdown buffer.

4.7 FAULT HISTORY DATA - REMOTE PRINTOUT

A printout history of unit and system operating conditions, at the time of the fault, can be obtained by pressing the HISTORY Key with an optional printer installed. 2-compressor chillers will provide a history printout on the last 6 faults and 3 & 4-compressor chillers will provide printouts on the last 4 faults. Printouts for 2, 3 and 4-compressor models will be similar. The most recent fault will always be stored as Safety Shutdown No. 1.

An example of the HISTORY Printout is shown on the following page.

SAMPLE PRINTOUT OF FAULT HISTORY DATA

YORK INTERNATIONAL CORPORATION
MILLENNIUM SCREW CHILLER

SAFETY SHUTDOWN NUMBER 1
SHUTDOWN @ 3:56 PM 28 AUG 00

SYS 1 HIGH DSCH PRESS SHUTDOWN
SYS 2
NO FAULTS

OPTIONS

CHILLED LIQUID	WATER
AMBIENT CONTROL	STANDARD
REFRIGERANT TYPE	R-22

PROGRAM VALUES

DSCH PRESS CUTOUT	399 PSIG
DSCH PRESS UNLOAD	375 PSIG
SUCT PRESS CUTOUT	44 PSIG
HIGH AMBIENT CUTOUT	130.0 ºF
LOW AMBIENT CUTOUT	25.0 ºF
LEAVING LIQUID CUTOUT	36.0 ºF
MOTOR CURRENT UNLOAD	100 %FLA
ANTI RECYCLE TIME	600 SECS
LOCAL/REMOTE MODE	REMOTE
LEAD /LAG CONTROL	AUTOMATIC

UNIT DATA

LEAVING LIQUID TEMP	49.0 ºF
RETURN LIQUID TEMP	58.2 ºF
MIXED LIQUID TEMP	51.3 ºF
COOLING RANGE	42.0 +/-2.0 ºF
AMBIENT AIR TEMP	74.8 ºF
LEAD SYSTEM	SYS 2
EVAPORATOR PUMP	ON
EVAPORATOR HEATER	OFF
ACTIVE REMOTE CONTROL	NONE
SOFTWARE VERSION	C.RCP.09.00

SYSTEM 1 DATA

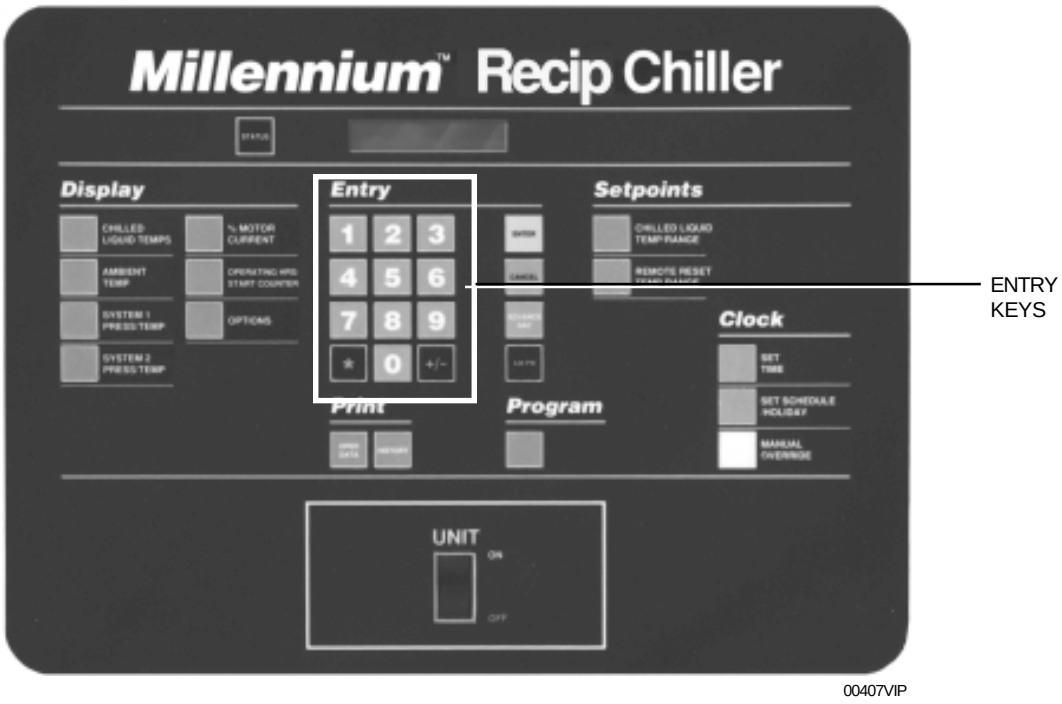
COMPRESSORS STATUS	OFF
RUN TIME	0- 0- 0- 0 D-H-M-S
MOTOR CURRENT	0 AMPS 0 %FLA
SUCTION PRESSURE	125 PSIG
DISCHARGE PRESSURE	131 PSIG
OIL PRESSURE	130 PSID
SUCTION TEMPERATURE	68.4 ºF
OIL TEMPERATURE	68.8 ºF
SAT SUCTION TEMP	71.8 ºF
SUCTION SUPERHEAT	3.4 ºF
COMPRESSOR LOAD STAGE	0
COOLER INLET REFRIG	44.6 ºF
LIQUID LINE SOLENOID	OFF
HOT GAS BYPASS SOLENOID	OFF
CONDENSER FAN STAGE	OFF

SYSTEM 2 DATA

COMPRESSORS STATUS	ON
RUN TIME	0- 0-15-26 D-H-M-S
MOTOR CURRENT	104 AMPS 87 %FLA
SUCTION PRESSURE	57 PSIG
DISCHARGE PRESSURE	233 PSIG
OIL PRESSURE	218 PSIG
SUCTION TEMPERATURE	42.9 ºF
OIL TEMPERATURE	102.8 ºF
SAT SUCTION TEMP	31.7 ºF
SUCTION SUPERHEAT	11.2 ºF
COMPRESSOR LOAD STAGE	2
COOLER INLET REFRIG	23.6 ºF
LIQUID LINE SOLENOID	ON
HOT GAS BYPASS SOLENOID	ON
CONDENSER FAN STAGE	3

DAILY SCHEDULE
S M T W T F S *=HOLIDAY

5. ENTRY KEYS



5.1 GENERAL

The Entry keys allow the user to change numerical values programmed in as chiller setpoints, cutouts, clock, etc.

5.2 NUMERICAL KEYPAD

The Numerical keypad provides all keys necessary to program numerical values into the micropanel.

The " * " key is used to designate holidays when programming special start/stop times for designated holidays in the SET SCHEDULE/HOLIDAY program mode.

The "+/-" key allows programming -C setpoints and cutouts in the metric display mode.

5.3 ENTER KEY

The Enter key must be pushed after any change is made to setpoints, cutouts, or system clock. Pressing this key tells the micro to accept new values into memory. If this is not done, the new values entered will be lost and the original values will be returned.

The Enter key is also used to scroll through available data when using the Program or Set Schedule/Holiday keys.

5.4 CANCEL KEY

When the Cancel key is pressed, the cursor will always return to the first character to be programmed in the display message. This allows the operator to begin re-programming, if an error is made. When the Cancel key is pressed, the values already keyed in will be erased and the original or internally programmed default values will appear. In other instances the display will remain the same and the only reaction will be the cursor returning to the first character.

5.5 ↑ ↓ KEYS

The ↑ ↓ keys allow the user to scroll through data under the OPER DATA and HISTORY Key and to select the correct day of the week and the correct month when programming the micro with the correct time and date. The ↓ key also operates as a toggle AM/PM key if the cursor is over “AM” or “PM” on the display. For example, pressing the ↓ key when the cursor is on “PM” changes it to “AM”.

6. SETPOINTS KEYS & CHILLED LIQUID CONTROL

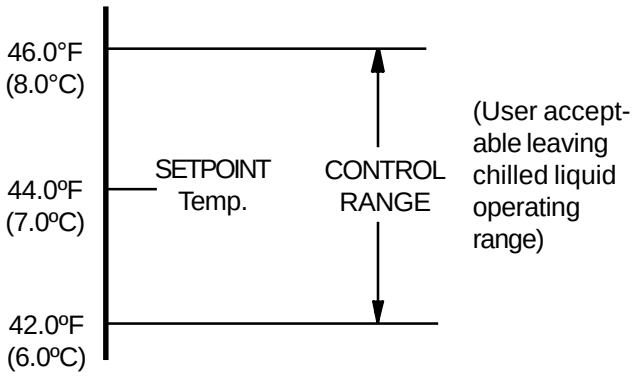
6.1 GENERAL

The microprocessor monitors leaving chilled liquid temperature and adjusts the chiller cooling capacity to maintain this temperature within a programmed range. The capacity is controlled by switching compressors on or off, by varying the number of cylinders loaded on each compressor, and by controlling the hot gas valve. The microprocessor controls chilled liquid temperature through a combination of Fuzzy Logic control and internal timers. Fuzzy Logic enables the micro to analyze the deviation from setpoint and the rate of change and determine whether compressors need to be started or stopped, increase/decrease compressor load stages, or whether to turn the hot gas bypass on or off to control chilled liquid temperature to the desired setpoint. The micro also attempts to minimize cycling. This method of control is suitable for both water and brine cooling. Control setpoints can be programmed into the chiller to establish the desired range of leaving chilled liquid operating temperatures. A description of the operation and programming follows.

6.2 CHILLED LIQUID TEMPERATURE CONTROL

The Setpoints keys are used to program the required chilled water liquid temperature for the application. This is accomplished by programming the "Setpoint" and the acceptable deviation (+ or - Range) This deviation is simply called the "Range" and is best described as the maximum acceptable + and - deviation from Setpoint.

The minimum acceptable temperature is the Lower Range and is calculated by subtracting the "-" Range from the Setpoint. The Lower Range is the lowest acceptable leaving temperature. The highest acceptable temperature is referred to as the Upper Range and is calculated by adding the "+" Range to the Setpoint. The Upper Range is the highest acceptable leaving temperature. For example, if the desired Setpoint temperature is 44.0ºF (7°C) and the allowable deviation (+ / - Range) from this temperature is +/- 2°F (1.0ºC), then the micro will attempt to control leaving chilled liquid temperatures to 42.0ºF (6°C) to 46.0ºF (8°C). This total temperature range is called the Control Range and can be viewed pictorially as follows:



6.3 LOCAL COOLING SETPOINTS KEY

The Local Cooling Setpoints key is used to program the required Leaving Chilled Liquid control temperatures for the application. When the key is pressed, the following message will be displayed:

```
SETPOINT =   44.0  °F
  RANGE  = +/-  2.0  °F
```

Key in the desired Chilled Liquid Setpoint and the allowable deviation (Range). The micro will accept values from 10.0 - 52.0ºF (-12 to 11ºC). For values below 40ºF (4°C), Dip Switch S1, Switch #1 on the Microprocessor Board must be properly programmed for Brine Cooling (see Section 9 [3.7]). If unacceptable values are entered, or the switch is incorrectly selected when setpoints below 40ºF (4°C) are entered, the following message will be displayed before returning to the Control Range message :

```
OUT OF RANGE-
TRY AGAIN!
```

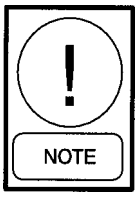
After the Setpoint is keyed in, the cursor will automatically advance to the first digit of the Range as shown :

```
SETPOINT =   44.0  °F
  RANGE  = +/-  2.0  °F
```

This value should be programmed for the maximum allowable positive and negative chilled liquid temperature deviation that is acceptable from setpoint in the system application. A typical value would be +/- 2°F (1ºC). The micro will accept a range from 1.5-2.5 ºF (0.8-1.4°C).

After the Setpoint and Range is keyed in, press the ENTER Key to store the data in memory.

The default values for both water and glycol cooling are: Setpoint = 44.0°F (6.7°C)
Range = 2.0°F (1.1°C)



Failure to press the Enter key will cause the newly programmed values to be ignored and not entered into memory.

After pressing the Enter key, the display will continue to show the message until another key is pressed.

6.4 REMOTE COOLING SETPOINTS KEY

Remote Cooling Setpoints key allows resetting the setpoint upward from the programmed value in memory from a remote device. This feature is typically used for demand limiting or ice storage applications. Reset is accomplished by timed closure of external contacts for a defined period of time and allows reset of the setpoint upward by up to 40ºF (22°C) above the setpoint programmed in memory - see Section 9 (1.10).

The maximum allowable reset must be programmed into memory and can be a value of 2 to 40ºF (1 to 22°C) depending on user requirements. To program the reset, press the Remote Reset Temperature Range key. The following message will appear:

```
REM SETP =   44.0  °F
  RANGE  = +/-  2.0  °F
```

The display indicates the Remote Setpoint which is always equal to the chilled liquid setpoint programmed by the Chilled Liquid Temperature / Range key plus the offset from the remote reset signal. The display will also show the Range which is the programmed maximum deviation allowed for the application. This display is not programmable, and will change the setpoint only through a signal from a remote device.

```
MAX EMS-PWM REMOTE
TEMP RESET = +40°F
```

Pressing the REM RESET TEMP RANGE Key again scrolls the display to the MAX EMS-PWM REMOTE TEMP RESET which is programmable. This should be programmed to the maximum offset which is required for the application. The maximum programmable value is 40º F (22ºC), while the minimum programmable value is 2ºF (1°C).

The cursor will stop beneath the first digit of the maximum reset. Key in the maximum reset allowed for the application, remembering to use a leading "0" for values less than 10ºF (or 10ºC). Press the ENTER Key to store the new value in memory.

6.5 CHILLED LIQUID TEMPERATURE CONTROL

The Microprocessor controls the chiller loading and unloading to maintain the leaving chilled liquid within the programmed control range. A 60-second load timer and 30-second unload timer determines when the micro may adjust the chiller capacity to keep the chilled liquid tem-

perature within the control range. A fuzzy logic loading/unloading control algorithm allows the micro additional anticipatory loading and unloading capabilities within the control range, based on the rate of chilled liquid temperature change and the approach of safety thresholds.

Control by "return" chilled liquid temperature is not an option on this chiller.

6.6 COMPRESSOR CAPACITY LOADING SEQUENCE

Each compressor will be cycled through three stages of loading regardless of the number of cylinders (4, 6 or 8). These stages are designated as Stage 0, 1 and 2. Compressor capacity will be staged according to the table below:

CMPR CYLINDER	STAGE	NO. OF CYLINDERS	CAPACITY
4	0	2	50%
	1	4	100%
	2	4	100%
6	0	2	33%
	1	4	66%
	2	6	100%
8	0	4	50%
	1	6	75%
	2	8	100%

The microprocessor will attempt to control the leaving chilled liquid temperature to the setpoint +/- the Range, which defines the upper and lower limits of the Control Range. The Control Range specifies the desired temperature range that is acceptable for a specific chilled liquid application.

When power is first applied, the microprocessor will begin counting down a 2-minute "power-up" timer. This timer prevents repeat motor starts after a power failure and reduces the possibility of overheating the motor. After the 2-minute power-up timer times out, a start sequence will initiate when all run permissives are satisfied, no faults exist, the Daily Schedule is calling for chiller operation, and a cooling load exists.

When the start-up timer has counted to "0", if the leaving chilled liquid temperature is above the high end of the control range, the lead compressor will start at "Stage 0". In addition, the liquid line solenoid of the lead compressor will energize immediately on start. A 60-second anti-coincidence timer will always assure that another compressor will not start for a period of at least one minute. The Load Timer will reset to 60 seconds, and the Unload Timer to 30 seconds.

After one minute of operation and the load timer has counted down to "0", and if the chilled liquid temperature is above the high end of the control range, the micro will load the lead compressor. The lead compressor now loads to "Stage 1". The Load Timer will reset to 60 seconds and the Unload Timer to 30 seconds.

After 2 minutes of operation and the load timer has counted down to "0", and if the chilled liquid temperature is above the high end of the control range, the micro will load the lead compressor. The lead compressor now loads to "Stage 2". The Load Timer will reset to 60 seconds and the Unload Timer to 30 seconds.

After 5 minutes of operation and the load timer has counted down to "0", and if the chilled liquid temperature is above the high end of the Control Range, the lag compressor will start ("Stage 0") and the lead compressor will fully unload ("Stage 0"). The Load Timer will reset to 60 seconds and the Unload Timer to 30 seconds.

After 6 minutes of operation and the load timer has counted down to "0", and if the chilled liquid temperature is above the high end of the control range, the micro will load the lead compressor to "Stage 1". The lag compressor remains unloaded. The Load Timer will reset to 60 seconds and the Unload Timer to 30 seconds.

After 7 minutes of operation and the load timer has counted down to "0", and if the chilled liquid temperature is above the high end of the control range, the micro will load the lag compressor to "Stage 1". The lead compressor remains at "Stage 1". The Load Timer will reset to 60 seconds and the Unload Timer to 30 seconds.

After 8 minutes of operation and the load timer has counted down to "0", and if the chilled liquid temperature is above the high end of the control range, the micro will load the lead compressor to "Stage 2". The lead compressor remains at "Stage 1". The Load Timer will reset to 60 seconds and the Unload Timer to 30 seconds.

After 9 minutes of operation and the load timer has counted down to "0", and if the chilled liquid temperature remains above the high end of the control range and the load timer has counted down to "0", the lag compressor will load to "Stage 2". The lead compressor remains loaded to "Stage 2". The Load Timer will reset to 60 seconds and the Unload Timer to 30 seconds. **The chiller is now fully loaded.**

Once temperature is satisfied and the chiller is loaded to a capacity less than full load, the micro will load the compressor with the lowest stage of loading if temperature rises above the high end of the Control Range and

the Load Timer has counted down to "0". The micro will always pick the compressor with the lowest load stage as long as it is available. In the event that both compressors are on the same stage, priority will be chosen according to lead/lag assignments.

Conditions that would prevent a compressor from loading are:

- Compressor must not have loaded when the Load Timer last counted to "0".
- The compressor must not be pumping down.
- The compressor must not be inhibited from loading by anticipatory controls. Note: When a system is inhibited from loading due to control limit exceeding 90% of the load limit thresholds, the micro will not allow the respective system to load, or will force it to unload, regardless of the need for cooling.
- Compressor run time is <60 seconds.

6.7 "FUZZY LOGIC" "LOADING" ANTICIPATORY CONTROL

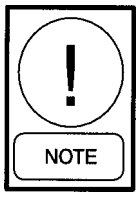
The fuzzy logic has the capability of decision-making based on the rate of change of chilled liquid temperature. When the chilled liquid is within the control range, the fuzzy logic may load the chiller, even though the temperature is within the desired control range. This ability allows the Micro to react to a rapid change in temperature rise and attempt to keep the chilled liquid temperature within the control range, rather than waiting until until the temperature rises above the control range before loading takes place.

6.8 "LOAD LIMITING" ANTICIPATORY CONTROL

Anticipatory Controls are intended to prevent a system from loading and reaching a point where a safety threshold may be exceeded or forced unloading is required. Anticipatory controls are checked by the micro each time a system is to be loaded.

Three factors affect Load Limiting Anticipatory Control: Motor Current, Saturated Suction Temperature, and Discharge Pressure. If any of the motor currents or discharge pressures are greater than 90 - 99% of the user programmed unload points, the micro will not load the respective system, even if cooling demand requires it. If saturated suction temperature is less than 110 - 101% of the internal limit of 24°F (4°C) for water chilling or setpoint – 11°F (6°C) for brine chilling – the respective system will not be allowed to load.

Loading is once again permitted to occur when system motor current or discharge pressure falls below 90% of the user programmed unload points. The same is true when saturated suction temperature rises above 110% of the internal limits mentioned above.



There will be no display message to inform the operator that a specific system is load limited by the microprocessor anticipatory control.

6.9 COMPRESSOR UNLOADING AND SHUTDOWN SEQUENCE

The micro will unload a compressor whenever the leaving chilled liquid temperature falls below the low end of the Control Range and the 30-second Unload Timer has timed to "0". At this point, the micro will unload the compressor with the highest stage of loading. If all compressors are at the same stage of loading, the micro will unload the lag compressor first.

If temperature remains below the low end of the Control Range, the micro will alternately unload the compressors each time the Unload Timer reaches "0". **Should the fuzzy logic algorithm sense a continuing trend toward unloading (temperature drops quickly), the micro may set the unload timer to 15 seconds rather than 30.** The decision to set the timer to 15 or 30 seconds is determined by the rate of chilled liquid temperature change.

If temperature remains below the low end of the Control Range and both compressors totally unload to Stage "0", the micro will shut down the lag compressor when the leaving chilled liquid temperature falls below the "Setpoint Range/2" When a compressor shuts down due to load, the micro will first close the liquid line solenoid valve and allow the compressor to pump down to the suction pressure cutout before stopping the compressor (pumpdown on shutdown).

If load continues to drop, the lag compressor will shut down after the chilled liquid temperature drops below "Setpoint – Range". Before the micro shuts down the lead compressor, it will turn the optional hot gas bypass off and pump down the compressor.

6.10 "FUZZY LOGIC" "UNLOADING" ANTICIPATORY CONTROL

The fuzzy logic has the capability of decision-making based on the rate of change of chilled liquid temperature. When the chilled liquid is within the control range, the fuzzy logic may unload the chiller, even though temperature is within the desired Control Range. This ability allows the micro to react to a rapid change in temperature fall and attempt to keep the chilled liquid temperature within the control range, rather than waiting until the temperature overshoots and falls below the control range before unloading takes place.

6.11 "UNLOADING LIMITING"

Unloading Limits are intended to unload a compressor before a safety limit is reached, which would shut a system down on a fault. Three factors affect load limiting: Motor Current, Saturated Suction Pressure, and Discharge Pressure. A "XXXXXX LIMITING" status message indicates that a compressor has been unloaded due to exceeding an unload threshold.

If %FLA Motor Current rises above the user-programmed Unload % FLA, the micro will unload the respective system by 1 stage. Once the limit is exceeded, the micro will check the motor current every 10 seconds to determine if further action is required. This safety assures an excessive load does not damage the motor.

If Saturated Suction temperature drops below 24°F (chilled liquid applications) or setpoint minus 11° (brine applications), the micro will unload the respective system by 1 stage. Once the limit is exceeded, the micro will check the saturated suction temperature every 10 seconds to determine if further action is required. This safety assures that the evaporator is not damaged by chilled liquid freezing in an area of the tube bundle.

If Discharge Pressure rises above the user-programmed Discharge Pressure Unload, the micro will unload the respective system by 1 stage. Once the limit is exceeded, the micro will check the discharge pressure every 10 seconds to determine if further action is required. This safety assures that the system does not fault due to high discharge pressure.

Loading will reoccurr, if demand requires, once the motor current or discharge pressure drops to 90% of the programmed unload point. A similar situation is true of the saturated suction temperature once the temperature rises to 110% of the safety threshold.

6.12 OPTIONAL HOT GAS BYPASS OPERATION

The optional hot gas bypass will be activated when the lead compressor is fully unloaded and the leaving chilled liquid temperature is within the Control Range. If the rate of fall of chilled liquid temperature causes the fuzzy logic to believe that significant temperature overshoot may occur, the hot gas will remain on until load increases or the lead compressor shuts down.

7. CLOCK KEYS

7.1 GENERAL

The microprocessor features a continuously running internal Clock and calendar and can display actual time as well as the day of the week and the date. An automatic schedule feature is provided for starting and stopping the chiller on individual days of the week, eliminating the need for an external time clock. Also provided are a Holiday feature, allowing special start/stop times to be set for designated holidays, and a Manual Override feature to aid servicing. If the automatic schedule feature is not required, the micro can be programmed to run the chiller on demand as long as the Chiller ON/OFF and System switches are in the ON position.

Programming of the internal clock/calendar and operating schedule are described below :

7.2 SET TIME/DATE KEY

When the Set Time/Date key is pressed, a message showing the day, time and date will be displayed with the cursor below the first digit of the time as shown:

```
TODAY IS MON 11:12AM
      28 AUG 2000
```

First, press the ↑ or ↓ key until the proper day appears. Press ENTER to move on to the hour part of the display. Next, key in the time (hours/minutes) using a leading “0” for times before 10 o’clock. e.g. 08:31. The cursor will then advance to the AM/PM designation. If necessary press the ↑ or ↓ key to change to the opposite time period. Press ENTER to advance to the day of the month.

Key in the day of the month. The cursor will then skip to the month. Press the ↑or↓ keys to select the month and press the ENTER key. Next, key in the year. (Always use two digits for the day and the year, using a leading “0” for days 1-9; e.g. 09 AUG 00. Once the desired information is keyed in, it must be stored into memory by pressing the ENTER key.

Any valid time or date will be accepted. If an out of range value is entered, the following message will be displayed for 3 seconds, then revert back to the Set Time display message for reprogramming:

```
OUT OF RANGE-
TRY AGAIN!
```

NOTE

Pressing the Set Time key once enters the "programming" mode in which the displayed time does not update. Pressing the Set Time key a second time enters "display" mode in which the cursor will disappear and the “live” clock will be displayed.

7.3 SET SCHEDULE / HOLIDAY KEY

Messages showing each week day and the holiday start/stop schedule, as shown below, can be displayed using the Set Schedule / Holiday key:

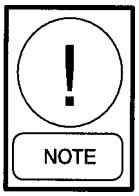
```
MON START = 06:00 AM
    STOP = 05:30 PM
```

9

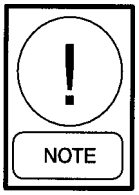
The displays for each day are scrolled through by repetitively pressing the SET SCHEDULE/HOLIDAY key. To reprogram any of the daily schedules, key in the new Start time; then, if necessary, change the associated AM/PM by pressing the ↑or↓ keys. Press the ENTER key to enter the new start time and advance to the stop time.

Next, key in the Stop Time and the AM/PM if necessary. Now press the ENTER key to store the new schedule. Press the SET SCHEDULE/HOLIDAY key to scroll to the next day. If an unacceptable time is entered, the following message will be displayed for 3 seconds then return to the schedule display:

```
OUT OF RANGE
TRY AGAIN!
```

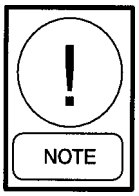


New start/stop times programmed for Monday are automatically used for all following days of the week.



Always use the Set Schedule/Holiday key to scroll through the schedule displays. Pressing the ENTER key after changing the Monday stop time schedule will change times programmed for the remainder of the week to the Monday schedule.

If the chiller is not cycled by the Daily Schedule, but is required to run whenever remote cycling devices, system switches, and main Chiller ON/OFF switch are in the ON position, all 00.00's should be programmed into the daily schedule. This can be done manually for individual days or for all days by pressing the CANCEL key once and the ENTER key four times while viewing the Monday Start / Stop schedule.



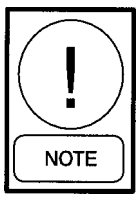
Programming the DAILY SCHEDULE will not affect on the holiday schedule.

If the chiller is not required to run on a given day, the Start time should be programmed for 00:00 AM and the Stop time programmed for 12:00 AM.

Continue to program each day as needed. After SUN has been entered, the Holiday message will be displayed:

```
HOL START = 08:30 AM
      STOP = 12:00 PM
```

The Holiday (HOL) Start / Stop allows a specific day(s) to be assigned for special requirements. This is provided so that a day(s) needing special start / stop requirements can be programmed without disturbing the normal working schedule. The start / stop times for the Holiday schedule are programmed just as any other day. Press ENTER to store the selected times.

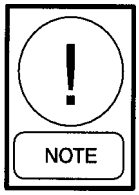


Only one start/stop time can be programmed, which will apply to each of the Holiday days selected.

Following the Holiday Start/Stop, pressing the Set Schedule/Holiday key displays a message designating which days of the week are holidays:

```
S * M T W T F S
HOLIDAY NOTED BY *
```

When the display appears, the cursor will first stop after Sunday as shown. To designate a day as a holiday, press the " * " key. If a day marked as a holiday is not to be a holiday, press the " * " key. When the " * " key is pressed, the cursor will advance to the next day. Use the ↑ or ↓ keys to move back and forth among days. After all the holiday days are programmed, press Enter to store the new data. The display will then return to the beginning of the Daily Schedule (MON).



The Holiday Schedule is only performed once, then erased from memory. This avoids the need for reprogramming after the holiday, as most special Holiday Schedule requirements occur only occasionally.

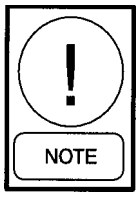
If an error is made while programming the holidays or a change is required, press Cancel. This will clear all programmed (*) "Holidays".

7.4 MANUAL OVERRIDE KEY

When the Manual Override key is pressed, the Daily Schedule programmed into the chiller is ignored and the chiller will start up when water temperature is above the high limit of the Control Range, the Chiller ON/OFF switch is ON, remote cycling devices are CLOSED, and system switches permit.

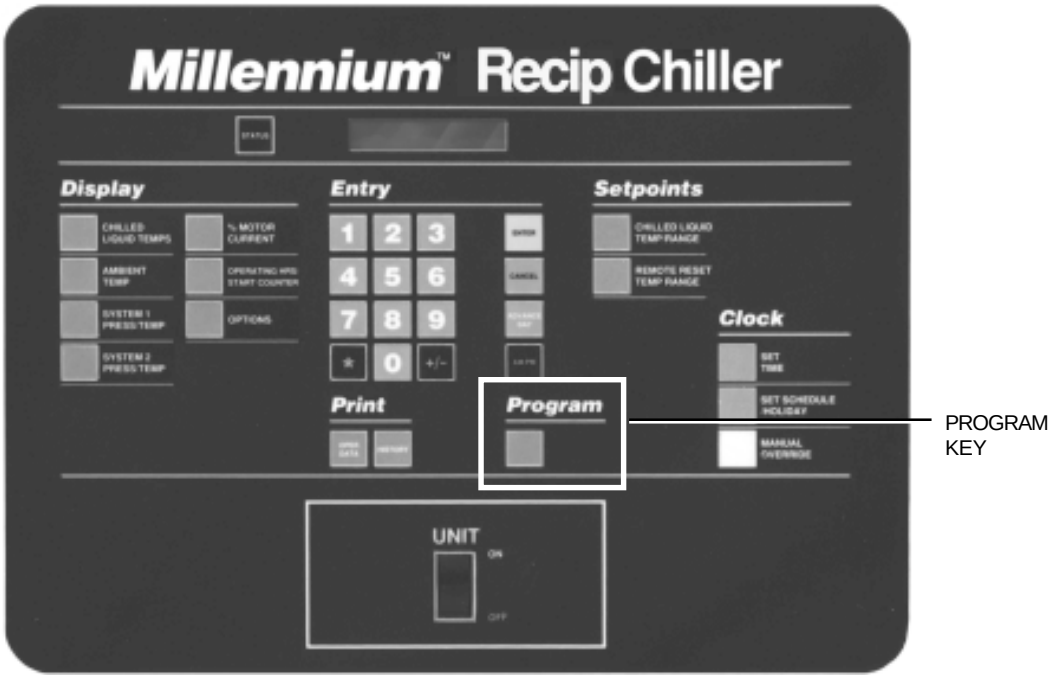
Normally this key is only used for servicing when the chiller is required to run but the Daily Schedule is in an OFF period. This key avoids the need to reprogram the Daily Schedule. Once activated, Manual Override is only active for a period of 30 minutes and will automatically disengage after 30 minutes. The following status message will be observed when in the Manual Override Mode:

```
MANUAL
OVERRIDE
```



If a "Warning - Low Battery" fault message appears on the display the internal clock, calendar and program settings cannot be relied on for accuracy. Default values are loaded into the microprocessor memory and the Manual Override key can be used to zero out the daily schedule and allow unlimited operation regardless of the time on the internal clock. Reprogramming of the setpoints and cutout values may also be necessary. When the MANUAL OVERRIDE key is pressed, the low battery message will disappear. If a power failure should again occur, the above process will need to be repeated to bring the chiller back on line. See also Section 9 (2.5).

8. PROGRAM KEY



8.1 GENERAL

The Program key is used to program 12 system operating parameters, including cutout points for safeties, anticipatory unload points to avoid faults, and anti-recycle timer duration.

When the Program key is pressed, the following message will be displayed to indicate the display is in the Program Mode:

```
PROGRAM MODE
```

Pressing the ENTER Key causes the display to show the operator in what language the control panel message are displayed.

```
DISPLAY LANGUAGE
ENGLISH
```

The operator may select 5 display message languages. The options are English, Spanish, French, German and Italian. The ↑ or ↓ keys can be used to select the desired language.

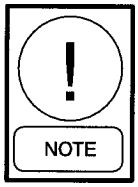
Pressing the Enter key repeatedly allows scrolling through the programmable displays.

As each value is displayed, it may be reprogrammed using the 12 Entry keys and ↑↓ Keys. New values will be programmed into memory when the Enter key is pressed and the display will scroll on to the next programmable value.

If an unacceptable value is entered at any stage, the following message is displayed for a few seconds and the entered value is ignored:

```
OUT OF RANGE
TRY AGAIN!
```

The following section shows examples of each programmable value display in the order in which they appear after pressing the Program key, together with guidance on programming each parameter.



The programmable values under the Program Key must be checked and properly programmed when commissioning the chiller. Failure to properly program these values may cause damage to the Chiller or operating problems.

8.2 PROGRAM KEY - USER PROGRAMMABLE VALUES

High Discharge Pressure Cut-Out:

```
DISCHARGE PRESSURE
CUTOUT = 395.0 PSIG
```

The Discharge Pressure Cutout is a microprocessor backup for the mechanical high pressure cutout located in each refrigerant circuit. This safety is bypassed for the first 5 seconds of operation, after which if the cutout point is exceeded for 3 seconds, the system will shut down.

Normally, air-cooled YCAR chillers should have the cut-out set at 395 PSIG (27 bar) for R-22 and R-407C models. The micro will, however, accept values between 200 - 399 PSIG (14 - 28 bar). For this cutout to be functional, the Discharge Pressure Read-out Option must be installed (fitted as standard on 50Hz models). This programmable value is password protected.

To program the Discharge Pressure Cutout, key in the desired value and press the Enter key to store the value into memory and scroll to the next display.

High Discharge Pressure Unload Point:

```
DISCHARGE PRESSURE
UNLOAD = 360.0 PSIG
```

The Discharge Pressure Unload point is used to avoid a high pressure cutout shutdown by unloading a compressor, if its discharge pressure approaches the cutout value. The chiller can then continue to run automatically at reduced capacity until the cause of the excessive pressure is attended to (e.g. dirty condenser coils), or ceases naturally (e.g. high ambient temperature).

For the first 60 seconds of operation, discharge pressure limiting is disabled. After this time, if discharge pressure exceeds the programmed limit, load limiting will occur with the affected system being unloaded by one stage until the discharge pressure drops below the programmed limit. The message will be removed and reloading will take place when discharge pressure has dropped 60 PSIG (4 bar) below the threshold.

Typically, the unload point should be set 20 - 25 PSIG (1.4 to 1.7 bar) below the discharge pressure cutout setting. The micro will accept a range of programmable values between 200 - 399 PSIG (14 - 28 bar). This programmable value is password protected.

To program the Discharge Pressure Unload, key in the required setting and press the Enter key to store the value into memory and scroll to the next display.

Low Suction Pressure Cutout:

```
SUCTION PRESSURE
CUTOUT = 44.0 PSIG
```

The Low Suction Pressure Cutout protects the evaporator from damage due to ice buildup caused by operation at low refrigerant suction pressure.

Forty-five seconds after the compressor starts, suction pressure is monitored as long as the compressor runs. For the first 225 seconds of running, suction pressure can be lower than the programmed cutout, but must be greater than:

$$\text{Programmed Cutout} \times \frac{(\text{Run Time} - 25)}{200}$$

Example: If Programmed Cutout = 44PSIG (3 bar) and Run Time = 150 seconds

$$\text{New Cutout} = 44 \times \frac{150 - 25}{200} = 27.5 \text{ PSIG (1.9 bar)}$$

This cutout value increases with time until, after 225 seconds, it equals the programmed cutout value. If suction pressure falls below the calculated cutout value before 225 seconds, the system will be shut down.

After 225 seconds, a transient timer system prevents short term fluctuations in suction pressure from causing shutdown as follows: If suction pressure drops below the cutout point, a 30-second transient timer starts. During the 30-second time period, the suction pressure must be greater than:

$$\text{Programmed Cutout} \times \frac{33.3 - \text{transient time remaining}}{33.3}$$

Example: If Programmed Cutout = 44PSIG (3 bar) and timer has run 10 seconds.

$$\text{New Cutout} = 44 \times \frac{33.3 - 20}{33.3} = 17.6 \text{ PSIG (1.2 bar)}$$

This cutout value increases with time, until after 30 seconds, it equals the programmed cutout value. If the suction pressure rises to above the programmed cutout value during the 30-second time period, the timer will be reset. If the suction pressure falls below the ramped cutout, the system will shut down on a low pressure fault.

If the Dip Switch on the microprocessor board is set for "Water Cooling" (see Section 9 [3.7]), the cutout is programmable between 44 - 70 PSIG (3-5 bar) for both R-22 and R-407C models. In this mode, settings of 44 PSIG (3 bar) for R-22 and R-407C are recommended. If the Switch is set for "Brine Cooling" (glycol) the cutout is programmable between 5 - 70 PSIG (0.3 - 5 bar) for R-22 and R-407C models. In this mode, the cutout should be set to the saturated refrigerant pressure equivalent to 18ºF (10°C) below the temperature of the chilled liquid.

To program the Suction Pressure Cutout, key in the required setting and press the Enter key to store the value into memory and scroll the next display.

High Ambient Temperature Cut-Out:

```
HIGH AMBIENT TEMP
CUTOUT = 115.0°F
```

The High Ambient Cutout is used to select the ambient temperature above which the chiller may not operate. If the ambient temperature rises 1ºF (1ºC) above this point, the chiller will shut down. Restart will occur automatically, when temperature falls more than 1ºC (1ºF) below the cutout and cooling demand is present.

This cutout is normally set at 130ºF (54ºC) to allow operation to the absolute maximum temperature capability of the electromechanical components; however, values between 100.0 - 130.0ºF (38 - 54ºC) are accepted. This programmable value is password protected.

To program the High Ambient Cutout, key in the required setting and press the Enter key to store the value into memory and scroll to the next display.

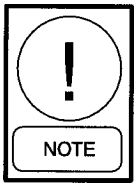
Low Ambient Temperature Cut-Out:

```
LOW AMBIENT TEMP
CUTOUT = 25.0°F
```

The Low Ambient Cutout is used to select the ambient temperature below which the chiller may not operate. If the ambient temperature falls 1ºF (1ºC) below this point, the chiller will shut down. Restart will occur automatically, when temperature rises more than 1ºF (1ºC) above the cutout and cooling demand is present (see also Section 9 [2.5] page 124). This programmable value is password protected.

If the SW1 Dip Switch on the Microprocessor Board is set for "Standard Ambient Control" (see Section 9 [3.7]) the low ambient cutout is set at 25ºF (-4°C) and is NOT programmable. If the Dip Switch is set for "Low Ambient Control", programming of the cutout between 0.0 - 50.0ºF (-18 - 10°C) is allowed. This allows values higher than 25º F (-4°C) to be programmed to shut down the chiller when other cooling methods become operational. Values below 25ºF (-4°C) can be used for applications requiring chiller operation at lower temperatures. If operation is occasionally needed below 1ºF (-17°C), the cutout should be set at 0.0ºF (-18°C). This will allow operation at any temperature, as the micro will only recognize temperatures above 1ºF (-17ºC). Temperatures below 1ºF (-17ºC) will not be displayed.

To program the Low Ambient Cutout, key in the required setting and press the Enter key to store the value into memory and scroll to the next display.



Operation below 1ºF (-17°C) may occasionally cause nuisance low pressure safety shutdowns. This will generally not cause a problem provided ambient temperature is not expected to be below 1ºF (-17ºC) for more than a short time.

Low Leaving Liquid Temperature Cut-Out:

```
LEAVING LIQUID TEMP
CUTOUT =  36.0°F
```

The Low Leaving Liquid Temperature Cutout protects the evaporator from damage due to ice build up caused by operation below the chilled liquid freezing point.

If the leaving chilled liquid temperature (water or glycol) drops below the cutout point, the chiller will shut down. The chiller will restart automatically when temperature rises more than 4ºF (2°C) above the cutout point and cooling demand exists.

If the Dip Switch on the microprocessor board is set for "Water Cooling" (see Section 9 [3.7], page 130) the cutout is automatically set at 36ºF (2°C) and cannot be reprogrammed. If the Switch is set for "Brine Cooling" (glycol) the cutout can be programmed between 8.0 - 36.0ºF (-13 to -2°C). The cutout should normally be set to 4ºF (2°C) below the setpoint minus the range, i.e. - 34ºF (setpoint) – 2ºF (range) – 4ºF = 28ºF (see Section 9 [6.3], page 141).

To program the Leaving Liquid Temperature Cutout, key in the required setting and press the Enter key to store the value into memory and scroll to the next display.

High Motor Current Unload Point:

```
HIGH MOTOR CURRENT
UNLOAD = 100% FLA
```

The Motor Current Unload point is used to avoid a high motor current safety shutdown by unloading a compressor, if current draw approaches the maximum limit cutout value. The chiller can then continue to run automatically at reduced capacity until the cause of the excessive current is attended to.

The micro will accept between 30 - 105% for the unload point. The motor current safety will shut the compressor down whenever current exceeds 115%.

If the programmable limit is set between 100% and 105% of full load current, this safety will protect against excessive current causing compressor shutdown due to extremely high ambient, high chilled liquid temperature, and condenser malfunction caused by dirt or fan problems.

If the programmable limit is set below 100% of full load current, this feature can be used for “demand limiting”. This is important when demand limiting is critical due to power requirements or limitations in the building. (See also Section 9 [1.10]).

For the first 60 seconds of operation, the unloading safety is disabled. After this time, if motor current exceeds the programmed limit, the SYS x CRNT LIMITING message will appear on the display and load limiting will occur with the affected compressor being unloaded by one stage until the motor current drops below the programmed limit. The message will be removed and additional loading will take place when motor current drops below 90% of the programmed threshold.

Typically, this setpoint should be set at 100%. For maximum motor protection, programming for 100% is advisable. When programming values below 100% use of a leading "0" is required, e.g. 085%.

To program the High Motor Current Unload, key in the required setting and press the Enter key to store the value into memory and scroll to the next display.

Anti-Recycle Timer:

```
ANTI RECYCLE TIMER
= 600 SECS
```

The Anti-Recycle Timer controls the minimum time between starts for each compressor. This is the time available for the heat build up caused by inrush current at start to be dissipated before the next start. Insufficient cooling time between starts can cause heat build up and motor damage. A fast compressor start response is needed in some applications and not in others. Although the minimum setting allowed on this timer will avoid excessive heat build up, adjusting the timer for the longest period acceptable in each application will reduce cycling and maximize motor life. **600 seconds is recommended.**

The micro will accept a range of programmable values between 300 - 600 seconds.

To program the Anti-Recycle Time, key in the required setting and press the Enter key to store the value into memory and scroll to the next display.

Local / Remote Communications

```
LOCAL / REMOTE MODE
LOCAL
```

The panel can be programmed for "Local" or "Remote" communications. "Local" mode allows monitoring through the RS-485 port only. "Remote", allows an external device such as an ISN or Remote Control Center to change setpoints and programming points.

The ↑↓ keys are used to change from Local to Remote. The ENTER Key must be pressed to save the selection in memory.

Imperial / SI Units Display

```
DISPLAY UNITS
IMPERIAL
```

This allows the operator to select the display messages to display SI (Scientific International, Bars, ºC, etc.); or Imperial Units (PSIG, ºF, etc.).

The ↑↓ keys are used to change from Imperial to SI units. The ENTER Key must be pressed to save the selection in memory.

Automatic / Manual "Lead / Lag"

```
LEAD / LAG CONTROL
AUTOMATIC
```

The chiller may be selected for manual lead/lag or automatic lead/lag. In some cases the operator may want to manually select the system that is desired to be the lead system. In most cases, automatic lead/lag is selected to allow the micro to attempt to balance run time between the system. Details of manual and automatic lead / lag operation are outlined in Section 9 (1.21).

The ↑↓ keys are used to change from Automatic to Manual lead/lag. The ENTER key must be pressed to save the selection in memory.

If manual control is desired, press the ↑ or ↓ key. One of the following messages will be displayed:

```
LEAD/LAG CONTROL
MANUAL SYS 1 LEAD
```

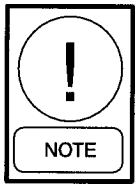
```
LEAD/LAG CONTROL
MANUAL SYS 2 LEAD
```

System 1, 2, 3 or 4 can be selected as the lead by pressing the ↑ or ↓ key. The ENTER key must be pressed to save the selection in memory.

Automatic / Manual Power Failure Restart

```
POWER FAIL RESTART
AUTOMATIC
```

The chiller may be selected for "Automatic" or "Manual" restart after a power failure. In most instances, "Automatic Restart" is preferred to allow the chiller to automatically restart when power is reapplied after a power failure. When "Manual" is selected, the chiller will not operate after re-application of power until the ON / OFF Rocker Switch on the keypad is cycled OFF and then ON.



In most applications, it is undesirable to use Manual Reset on power failure since chillers normally are required to auto-restart after a power failure.

The ↑ and ↓ keys are used to change from AUTOMATIC to MANUAL power failure restart. The ENTER key must be pressed to save the selection in memory.

8.3 PROGRAMMING "DEFAULT" VALUES

Programmable values may be individually programmed at start-up or any time thereafter. For ease of programming, once the type of refrigerant is programmed in under the Program key, a "defaults password" may be programmed to automatically program default values into memory. This will preset all programmable values under the Program key to values that will allow operation of the chiller under most operating conditions. This allows quick start-up programming for typical chilled water applications.

To program the default values into memory, first press the PROGRAM key followed by the ENTER key, to program the "refrigerant type". Press the Program key again, key in the numbers “6140”, then press Enter. As the code is being keyed in, the digits are not displayed but are shown as " * " as shown :

```
PROGRAM MODE
        * * * *
```

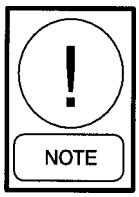
When the Enter key is pressed, the following message will appear:

```
DEFAULT SETPOINTS ?
1 = YES, 0 = NO,      1
```

Key in a “1” for if default setpoints are required, or a “0” for individually programmed values, then press Enter to store the selection into memory.

If individual programming is selected, the display will now return to the Status display. If a default setpoints have been selected, the display will momentarily display the message shown below before returning to the Status display :

```
PROGRAM OPTIONS SET
TO DEFAULT VALUES
```



It is often easier to select Default Setpoints and then reprogram a few that require changing rather than programming each individual value from scratch.

A list of the default values entered into memory, if this program option is selected, is shown below. Also included are minimum and maximum allowable programmed values.

PROGRAM VALUE	MODE	LOW LIMIT	HIGH LIMIT	DEFAULT
Display Language	–––	See Below	See Below	English
Discharge Pressure Cutout	–––	200 PSIG	399 PSIG	399 PSIG
		13.8 bar	27.5 bar	27.5 bar
Discharge Pressure Unload	–––	200 PSIG	399 PSIG	375 PSIG
		13.8 bar	27.5 bar	25.9 bar
Suction Pressure Cutout	Water Cooling	44.0 PSIG	70.0 PSIG	48.0 PSIG
		3.03 bar	4.83 bar	3.31 bar
	Glycol Cooling	5.0 PSIG	70.0 PSIG	48.0 PSIG
		0.34 bar	4.83 bar	3.31 bar
High Ambient Air Temp. Cutout	–––	100.0°F	130.0°F	130.0°F
		37.8°C	54.4°C	54.4°C
Low Ambient Air Temp. Cutout	Standard Ambient	–––	–––	25.0°F
		–––	–––	3.9°C
	Low Ambient	0°F	50.0°F	25.0°F
		-17.8°C	10.0°C	-3.9°C
Leaving Chilled Liquid Temperature Cutout	Water Cooling	–––	–––	36.0°F
		–––	–––	2.2°C
	Glycol Cooling	8.0°F	36.0°F	36.0°F
		-13.3°C	2.2°C	2.2°C

TABLE 2 – PROGRAM DEFAULTS AND LIMITS