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Chapter 1 - Introduction

General

The CC-4500 Compressor & Condenser Controller was developed to provide a cost effective, easy to use electronic controller for all applications that require compressor and condenser control at a lower cost.

The CC-4500 controller was developed to be fully compatible with Com-Trol I/O boards, COM-5002 Communications Controller, and MCS-6000 Graphical user interface. While most systems will provide only the basic compressor and condenser control, they can be expanded to a fully integrated control system at anytime, if the customer so desires.

The CC-4500 can control up to two suction groups with up to 8 compressors (or compressors and unloaders) each. It can also control one air-cooled condenser with up to eight stages. Floating suction control with one case temperature sensor for each suction group is optional.

The control algorithms are the same as used in the Com-Trol MCS-4000, but the set-up and operational screens have been customized for the limited application, thus making it extremely easy to program and use.

The controller is based upon Com-Trol's MCS-4500, with a customized keypad/overlay and a 4 line by 20 character LCD display. Alarm indications are provided by flashing LED's and a buzzer. There are alarm outputs that can be used to drive remote relays for alarm lights and/or bells. The controller is mounted on a flat panel that fits nicely into a control panel mounting location.

Alarms are provided for suction pressure, head pressure, phase loss, oil failure, as well as hardware failure alarms.

Help is built into the controller. Pressing the Help key will bring up information to explain the particular screen/function you are on.

The Front Panel

The Front Panel contains the 4 line by 20 character display, the alarm LED's and the keypad.

Introduction (cont.)

The alarm LED's will flash in sequence anytime there is an active alarm. A buzzer will also be activated when an alarm occurs, but it can be silenced, until another alarm occurs, by pressing the **Cancel** key.

The keypad consists of twenty keys, the purpose of each key is as follows:

0 to 9 - entry of setpoints.

. - decimal point or : when entering delay times.

- - minus sign for temperature below zero.

Help - brings up the appropriate help information screen.

Cancel - silences the alarm buzzer or voids the entry of a setting prior to hitting Enter.

Escape - backs you up one screen/menu.

Enter - secures change/setting or selection and moves to next screen.

- - moves down one line or to next page, if at bottom.

- - moves up one line or to previous page, if at top.

Ⓜ - moves to another screen associated with the screen you are on giving more information.

↩ - returns you from a screen giving additional information.

Passwords

The CC-4500 contains two levels of passwords. The low level starts out as 8888. The high level starts out at 9999. They can be changed at any time (see Programming/Setup - Chapter 3). You will be automatically prompted for a password anytime you are performing a function or entering into an area where changes can be made. The low level password lets you make setpoint changes. The high level password is required for the Setup function, to change passwords, and to Clear the alarm History Log.

Chapter 2 - Installation

The installation of the CC-4500 is very simple. The controller is pre-mounted on a flat panel (part number [45TD270G01](#)). This panel has six (6) #10 screw studs at each corner for mounting to the control cabinet door. Drills holes and place the panel/controller assembly into position and secure into place with nuts and star washers provided (Chapter 7-1).

Next, mount the power transformer and cable assembly (part number 45TB001G01) on the back plane. Wire the primary side of the transformer to the appropriate terminals. This transformer/cable assembly will power the controller and up to two I/O boards. If more boards are needed, use transformer/cable assembly for controller and use another 5 board transformer for board power.

Mount the input and output boards, as required for the particular job, to the back plane. Most jobs will require one to three relay boards, and one input board (AI-8). (Chapter 7-2).

Connect the transformer, I/O boards, and CC-4500 controller together with the pre-wired cable harness (Chapter 7-2,3).

Set the address switches on the I/O boards as follows:

1st RO-8 = **0**, 2nd RO-8 = **1**, etc. as required.

AI-8 or AI-16 = **0**.

The control wiring of the compressors and fans to the relay boards, and the input wiring for the pressures, temperature, and monitors, will be determined by the set-up of the CC-4500 controller for each application. The controller automatically makes the board and point assignments, however it will follow the same format each time as follows:

Relays

1. Compressor #1 - Suction group #1
2. Compressor # 2 or unloader for Compressor #1 - Suction group #1
3. Compressor #3 or Compressor #2, if unloader on #1-Suction grp #1 etc.
4. Suction group #2 follows in same manner, if present.
Condenser Stage 1 to 8

Digital Inputs

1. Phase Loss
2. Oil Failure #1 (Rack Alarm)
3. Oil Failure #2, if second suction group.
4. Low Refrigerant (optional – DI or AI)
5. Hot Gas DI (optional)

Installation (cont.)

Analog Inputs

1. Head Pressure
2. Suction pressure #1
3. Suction pressure #2, if second suction group, or Float #1
4. Float #1
5. Float #2

Example: Single Suction Rack, w/ 3 compressors, 4 fan stages; Use one RO-8, & one AI-8.

RO-8

1. Compressor 1
2. Compressor 2
3. Compressor 3
4. Condenser Fan Stage 1
5. Condenser Fan Stage 2
6. Condenser Fan Stage 3
7. Condenser Fan Stage 4
8. spare

AI-8

1. Phase Loss*
2. Oil Failure #1*
3. N/A (would be Oil Fail #2 if used)*
4. Low Refrigerant (optional)*
5. Hot Gas DI (optional)*
6. Head Pressure*
7. Suction Pressure #1*
8. Float#1(optional)

Note: For the digital inputs on the AI-8 board, the dip switches must be set to 1=ON, 2=OFF. For temp sensors and Pressure Transducers, both are ON. Also, the jumper at the top of the board must be set to AI/DI any time you have both digital and analog inputs on the same board.

Example: Dual Suction Rack, w/ 3 compressors each w/ unloader on first compressor, 5 fan stages; Use two RO-8, & one AI-16.

RO-8

1. Compressor 1-1
2. Unloader 1-1
3. Compressor 2-1
4. Compressor 3-1
5. Compressor 1-2
6. Unloader 1-2
7. Compressor 2-2
8. Compressor 3-2

R0-8

1. Condenser Fan Stage 1
2. Condenser Fan Stage 2
3. Condenser Fan Stage 3
4. Condenser Fan Stage 4
5. Condenser Fan Stage 5
6. Spare
7. Spare
8. Spare

AI-16

1. Phase Loss*
2. Oil Failure #1*
3. Oil Failure #2*
4. Low Ref-option*
5. HotGasDI-option*
6. Head Press*
7. SuctionPress #1*
8. SuctionPress #2
- 9.Float #1
10. Float #2
- 11-16 Spare

* Denotes input board points that are "fixed" to those particular features listed. If feature is not used, do not wire that input point on the board.

Chapter 3 - Programming/Setup

Programming or Setup of the CC-4500 has been greatly simplified. The user only has to specify the type of refrigerant being used; then for each suction group, the suction temperature or target pressure desired, and the horsepower of each compressor/unloader. For the Condenser specify, the condensing temperature or target pressure desired and the number of fans/stages. The set-up is then complete. The controller does the rest of the work: assigns all the inputs and outputs required, sets-up the appropriate alarms, and provides standardized names to all the inputs & outputs.

The Menu Tree and screens for each operation are show below:

```
MAIN MENU
→ Status
  Setpoints
  Alarms
```

Pressing the **←** key 3 times brings you to the *Setup* selection.

```
MAIN MENU
  Setpoints
  Alarms
→ Setup
```

Press **Enter**, to bring up the Setup Menu.

```
SETUP MENU
→ Refrigerant Type
  Suction #1
  Suction #2
```

Setting the Refrigerant Type

Pressing **Enter** with the **Ⓢ** pointing to *Refrigerant Type* allows you to select the refrigerant that is being used on this Rack.

```
REFRIGERANT TYPE
  R-404A
Enter 1 to 9
Press Help for List
```

Press the **Help** key to get to a list of refrigerants to choose from. The current or default selection is shown at the upper right, i.e.R404A. The Help screen gives a list of the refrigerants to choose from as shown below:

```
1 = R-22
2 = R-409A
3 = R-134A
page 1 of 3    ↓↑
```

Programming/Setup (cont.)

Pressing the **→** key brings up the next page of the Help Screen, etc. until all Help screens are viewed. You can back up through the Help screens with the **←** key. These prompts are shown at the lower right hand corner.

```
4 = R-404A (HP62)
5 = R-507 (AZ50)
6 = R-402A (HP80)
page 2 of 3      ↓↑
```

```
7 = R-401B
8 = G-125
9 = R-408A
page 3 of 3      ↓↑
```

To return to the screen you came from, press the **Escape** key. Then type the number, **1** to **9**, of the refrigerant that will be used for this Rack. Press the **Enter** key to make the selection.

Press the **Escape** key to return to the *Setup Menu*.

```
SETUP MENU
→ Refrigerant Type
Suction #1
Suction #2
```

Setup Suction #1 & #2

From the Setup Menu, press the **→** once to move to *Suction #1*,

```
SETUP MENU
Refrigerant Type
→ Suction #1
Suction #2
```

then press **Enter** to make the selection.

```
SETUP SUCTION #1
→ Suct Temp -25.0 f
Target PSI 15.0 PSI
Enter value or ↓
```

You may now type in the desired Suction Temperature, *Suct Temp*, or press the **→** key once, and type in the desired Target Pressure, *Target PSI*. These two values are linked by the selected refrigerant type, so if you change one, the other will change accordingly when you press the **Enter** key.

Programming/Setup (cont.)

Press the $\bar{_}$ until you get to the next screen. The optional liquid level is entered next.

```
SETUP SUCTION #1
Liq Lvl Input
→    2
Enter 0 or 1 or 2
```

“0” provides no liquid level input; “1” provides a DI input (Float switch); and “2” provides an analog (AI) input (Hansen). Type in the desired entry, then press Enter. Press the $\bar{_}$ until you get to the next screen. The HP of each compressor and unloader is entered next.

```
SETUP SUCTION #1
→Compr 1 HP    0.0
  Unldr 1 HP    0.0
Enter HP;    0=none
```

Type in the HP of compressor 1, then press *Enter*. Make it as accurate as possible. (Note: you can also enter the MBH capacity, e.g. 36,500 BTU = 36.5 MBH.) If compressor 1 has an unloader, press the $\bar{_}$ key to select the unloader, Unldr. Type in its HP (the amount of capacity it has control of, i.e. 10HP compressor with 50% unloader, unloader HP = 5). If no unloader is present, leave HP at 0.0. Press the $\bar{_}$ key until the Compr 2 screen appears. Enter its HP (or MBH) as indicated previously.

```
SETUP SUCTION #1
→Compr 2 HP    0.0
  Unldr 2 HP    0.0
Enter HP;    0=none
```

Continue, until all compressors and unloaders present have their HP entered. Then by pressing either **Enter** with a 0.0 value for HP on a compressor, or pressing the $\bar{_}$ key with 0.0 as the compressor HP value, will terminate the set-up process; i.e. these actions indicate that there are no more compressors. If you make a mistake, simply begin the set-up again, and correct the mistake when you get to that part of the set-up.

If a second suction group, Suction #2, is present, repeat the steps as stated for Suction #1.

Programming/Setup (cont.)

Setup Condenser

From the *SETUP MENU*, press the \leftarrow until it aligns with Condenser,

```
SETUP MENU
Suction #1
Suction #2
→Condenser
```

then press **Enter**.

```
SETUP CONDENSER
→Conden. Tmp 80.0f
Target PSI 150.0p
Enter Value or ↓
```

You may now type in the desired Condensing Temperature, *Conden. Tmp*, or press the \leftarrow key once, and type in the desired Target Pressure, *Target PSI*. These two values are linked by the selected refrigerant type, so if you change one, the other will change accordingly when you press the **Enter** key.

Press the \leftarrow key until the next screen appears.

```
SETUP CONDENSER
Total Fans/Stages → 0
Enter Value 0 to 8 ↓
```

Enter the number of control stages required, 0 to 8, and press **Enter**.

Press the \leftarrow key until the next screen appears.

```
SETUP CONDENSER
I/O Pack Tight
→ 1
Enter 1 or 2 ↑↓
```

This option determines how the I/O (relays) are assigned for the Condenser Fans. If “1”, the pack tight function is disabled – this means that the relays for the condenser will be assigned to a separate relay board to enable remote location. If “2” the pack tight function is enabled, placing the condenser relays immediately following the compressor relays.

Press the \leftarrow key to return to the *SETUP MENU*.

Programming/Setup (cont.)

The Setup is now complete. There are two other items in the Setup area; *Passwords* and *Time Set*. They can be changed at any time, but we will cover them now.

Change Passwords

From the *SETUP MENU* press the \leftarrow key until the \rightarrow is pointing to *Passwords*.

```
SETUP MENU
Suction #2
Condenser
→Password
```

Pressing the **Enter** key brings up the following screen:

```
Password Required
Enter Password
→ XXXX
Press Enter
```

A Level 2 password is required before the passwords can be viewed/changed. The initial Level 2 password is 9999. Type in the password, and press **Enter**. If the password was incorrect, it will indicate so:

```
Incorrect Password
Enter Password
→ XXXX
Press Enter
```

Once correctly entered, the following screen will appear:

```
Change Code Required
Enter Change Code
→ XXXX
Press Enter
```

The change code is **1843**.

If correctly entered, the following screen will appear:

```
PASSWORDS
→Level 1      8888
Level 2      9999
```

Select Level 1 or 2 with the \leftarrow - keys, type in the new password (numbers), press **Enter**. Press **Escape** to return to the *Setup Menu*.

Programming/Setup (cont.)

Note: If you forget the passwords, the only way to get them back is to clear the controller and do the set-up over again. To clear the controller Dip switches 7 & 8 are used in combination with each other.

Set Date & Time

To set the date & time, from the *Setup Menu*, press the $\bar{_}$ until you get to the *Time Set* selection,

```
SETUP MENU
Condenser
Passwords
→Time Set
```

then press **Enter**.

```
TIME SET
→02/28/97 15:00:00
← → to select
Enter when done
```

To set the date, have the selection arrow, \rightarrow pointing to the date, use the \rightarrow to move the underline cursor to the desired item to change, type in the value as appropriate, then press **Enter**.

To return to the *MAIN MENU* press **Escape** twice.

Calibration

This selection allows an offset to be entered for each transducer for calibration.

To Calibrate the transducers, from the *Setup Menu*, press the $\bar{_}$ until you get to the *Calibrate* selection,

```
SETUP MENU
Passwords
Time Set
→Calibration
```

then press **Enter**. The following screen will appear:

```
SENSOR CALIBRATION
→Head Pressure 0.0
Suction #1 0.0
Suction #2 0.0
```

Programming/Setup (cont.)

Use the $\bar{}$ - keys to select the desired transducer input, then enter the required offset/calibration amount, and press **Enter**. For example, if the transducer reading is 3 PSI high, you would enter a - 3.0; 3 PSI would be subtracted from the transducer reading before it was used by the controller. Likewise, if the transducer was reading 2 PSI high, you would enter 2.0 for the offset so that the controller would add 2 PSI before it used the reading.

NOTE: Make sure your reference gauge is accurate/calibrated before you make any adjustments to the transducer calibration.

Chapter 4 - Viewing Status

The **Status** selection on the MAIN MENU leads to screens that show the current operating status and set points; e.g. what the current suction pressure(s), head pressure, and float temperatures are (updated every 6 seconds.); which compressors/fan stages are ON/OFF, etc.

```
MAIN MENU
→ Status
Setpoints
Alarms
```

Pressing **Enter** with the → pointing to *Status* brings up the following screen:

```
STATUS MENU
→ Suction #1 Norm Run
Suction #2 Norm Run
Condenser Norm Run
```

The *Mode* is shown after the name. It indicates the operating status. The possible conditions indicated here are:

- Norm Run** - Everything OK.
- Hi Head** - The compressors have been staged off because the head pressure rose above the high head setting.
- LoSafety** - compressors have been cycled off because the suction pressure dropped below the Low Safety setting.
- PhasLoss** - the phase loss digital input was closed indicating a phase loss condition and all compressors are shutdown.
- LockRecv** - compressors are held off for 60 seconds following a phase loss.

All Off - All compressors or fans are shut-off under normal control.

To view the *Status* of any item, move the selection arrow, →, with the ← - keys to the desired item, then press the **Enter** key.

Status of Suction #1 / #2

Pressing **Enter** with the → pointing to *Suction #1 (or #2)* brings up the following screen:

```
STATUS SUCT #1
Suction      20.0 PSI
Sat. Suct    -15.0 f
Connected to 1-1 ↓↑
```

Viewing Status (cont.)

The current suction pressure and its equivalent saturated suction temp are given here, and updated every 6 seconds. The bottom line shows what board and analog point address the suction pressure transducer should be connected to, i.e. board 1 - point 1.

Pressing the $\bar{\quad}$ key once will take you to the next status screen for the selected Suction group.

```
STATUS SUCT #1
Target PSI  18.0 PSI
Sat Tgt Tmp -17.0 f
             ↓↑
```

The current Target pressure and it's equivalent saturated suction temperature are shown here.

Note: The Target pressure may be different from the target set point, if floating suction is being used. The float up is limited to 5 PSI, and the float down is limited to 3 PSI.

Pressing the $\bar{\quad}$ key once will take you to the next status screen for the selected Suction group.

```
STATUS SUCT #1
Head PSI    150.0 PSI
Sat Cnd Tmp 85.0 f
Connected to 1-2 ↓↑
```

The current head pressure and the equivalent saturated condensing temperature are shown here, along with the board and analog point assignment for the head pressure transducer.

Pressing the $\bar{\quad}$ key once will take you to the next status screen for the selected Suction group.

```
STATUS SUCT #1
Float Temp  -10.5 f
Float Target -10.0 f
Connected to 1-3 ↓↑
```

The current float temperature and float target temperature are shown here, along with the board and analog point assignment for the float temperature sensor.

Note: If the Float Target is set above 75 f, the floating feature is disabled (refer to Setpoints Chapter 5).

Viewing Status (cont.)

Pressing the $\bar{_}$ key once will take you to the next status screen for the selected Suction group.

```
STATUS SUCT #1
Load          89.0%
Reaction Speed 5
              ↓↑
```

Pressing the $\bar{_}$ key once will take you to the next status screen for the selected Suction group.

```
STATUS SUCT #1
Liq Level     25.0
Connected to  1-4
              ↓↑
```

The Liquid Level monitor status is shown here, along with its board and point assignment address. This can either be an analog or digital value (On/Off) depending upon the Setup Option selected.

Pressing the $\bar{_}$ key once will take you to the next status screen for the selected Suction group.

```
STATUS SUCT #1
Compr #1      ON
Connected to  1-1
              ↓↑→
```

The requested control status, ON/OFF of the first compressor is shown here, along with its board and relay point assignment address.

Pressing a \textcircled{R} key allows you to view the runtime information for this relay (compressor #1):

```
Compr #1      ON
Runtime & Cycles
13:00 95 23:10 154
              ↓↑←
```

The runtime and cycle count for today, starting from midnight, and the runtime and cycle count for yesterday are shown here.

Pressing the \rightarrow key will return you to the screen you came from. Then press the $\bar{_}$ key, to move on to the status of the next compressor, or unloader if the compressor is equipped with one.

Viewing Status (cont.)

If the compressor was programmed with an unloader, it's status will be shown next.

Note: If an unloader is ON, it means that the compressor has its full capacity available; if the unloader is OFF, the compressor is running unloaded.

Once you reach the last compressor/unloader screen, you will return to Status Menu by pressing the $\bar{_}$ key, or press **Escape** at anytime.

Status of Condenser

To view the Status of the Condenser, press the $\bar{_}$ key until it points to *Condenser*.

```
STATUS MENU
Suction #1
Suction #2
→Condenser
```

Press **Enter** to go to its first status screen.

```
STATUS CONDENSER
Head PSI    150.0PSI
Sat Cnd Tmp 85.0f
Connected to 1-2 ↓↑
```

The current Head pressure and the equivalent saturated condensing temperature for the programmed refrigerant are shown here, along with the board and analog point assignment for the head pressure transducer.

Pressing the $\bar{_}$ key once will take you to the next status screen for the Condenser.

```
STATUS CONDENSER
Target PSI  105.0 PSI
Sat Tgt Tmp 60.0 f
Stage Diff. 5.0 PSI↓↑
```

The current Target pressure and it's equivalent saturated discharge/head temperature, and the staging differential are shown here.

Pressing the $\bar{_}$ key once will take you to the next status screen for the Condenser.

```
STATUS CONDENSER
Fan/Stage #1    ON
Connected to 2-1
                ↓↑→
```

Viewing Status (cont.)

The requested control status, ON/OFF of the first Fan/Stage is shown here, along with its board and relay point assignment address.

Pressing a **®** key allows you to view the runtime information for this relay (Fan/Stage #1):

Fan/Stage #1	ON
Runtime & Cycles	
13:00 95	23:10 154
↓↑←	

The runtime and cycle count for today, starting from midnight, and the runtime and cycle count for yesterday are shown here.

Pressing the **→** key will return you to the screen you came from. Then press the **←** key, to move on to the status of the next Condenser Fan/Stage.

When you have viewed all Fan stages you will return to Status Menu by pressing the **←** key, or press **Enter** at this screen.

Chapter 5 - Changing Setpoints

The Setpoints selection from the MAIN allows you to access all the control settings for fine tuning. Once the ERC is SETUP and tuned, the need for Setpoint changes should be minimal, and you should always make sure that something else is not the problem before you change any setpoint.

From the Main /menu use the **←** key to move to the Setpoints selection,

```
MAIN MENU
Status
→Setpoints
Alarms
```

then press **Enter** to bring up the *SETPOINTS MENU*.

```
SETPOINTS MENU
→Suction #1
Suction #2
Condenser
```

Use the **←** - **→** keys to select the desired item and then press **Enter**.

Suction #1 Setpoints

The Suction temperature or Target pressure may be altered on the first screen.

```
Setpoints Suction #1
→Suct Temp -25.0f
Target PSI 18.0PSI
Enter new value ↓
Condenser
```

Use the **←** - **→** keys to select the desired entry, type in the new value, and press **Enter**.

Note: The Suction temp and the Target PSI are linked by the refrigerant type selected. Thus, if you change one, the other will change accordingly.

Press the **←** to move on to the next setpoint screen, or press **Escape** to return to the *Setpoints Menu*.

```
Setpoints Suction #1
→Low Safety 1.0PSI
Head Safety 325.0PSI
Enter new value ↓↑
Condenser
```

Use the **←** - **→** keys to select the desired entry, type in the new value, and press **Enter**.

Changing Setpoints (cont.)

The *Low Safety* sets a suction pressure level below which compressors will be staged off at 6 second intervals, to try and bring the suction pressure back above this level; it overrides the normal control algorithm.

The *Head Safety* sets a pressure above which the compressors will be staged off to try and drop the head pressure below the setting; it overrides the normal control algorithm.

Press the \leftarrow to move on to the next setpoint screen, or press **Escape** to return to the *Setpoints Menu*.

```
Setpoints Suction #1
→Reaction Speed 5
Fast-123456789-Slow
Enter 1 to 9      ↓↑
Condenser
```

This screen allows you to change the *Reaction Speed*. This number determines how fast or slow the controller reacts to pressure changes, and thus has an effect on the cycling rate of the compressors to maintain the Target. Entering a larger number slows down the reaction speed. Review the Runtime and Cycles data (See Viewing Status - Chapter 4) to determine if this number needs adjusting; normally you want to try and keep your daily cycle rate below 200.

Type in the reaction speed number desired and press **Enter**.

Press the \leftarrow to move on to the next setpoint screen, or press **Escape** to return to the *Setpoints Menu*.

```
Setpoints Suction #1
→Float Temp 80.0f
75 or more disables
Enter new value ↓↑
Condenser
```

If floating suction is desired, type in the desired Float temperature and press **Enter**. Note: any value entered that is greater than 75 will disable the floating suction feature.

This completes the Setpoints for Suction #1 and Suction #2.

Press the \leftarrow or **Escape** to return to the *Setpoints Menu*.

Condenser Setpoints

Use the \leftarrow - keys to select the Condenser and then press **Enter**.

```
SETPOINTS MENU
Suction #1
Suction #2
→Condenser
```

Changing Setpoints (cont.)

The Condensing temperature or Target pressure may be altered on the first screen.

```
Setpoints Condenser
→Cond. Temp  60.0f
  Target PSI  105.0PSI
Enter new value Condenser
```

Use the `-` keys to select the desired entry, type in the new value, and press **Enter**.

Note: The Condensing temp and the Target PSI are linked by the refrigerant type selected. Thus, if you change one, the other will change accordingly.

Press the `-` to move on to the next setpoint screen, or press **Escape** to return to the *Setpoints Menu*.

```
Setpoints Condenser
→Stage Diff  10.0 PSI
  Hi Safety  325.0 PSI
Enter new value ↓↑
Condenser
```

Use the `-` keys to select the desired entry, type in the new value, and press **Enter**.

The *Stage Diff.* sets the differential between stages. If the Target PSI is 105 PSI, with the Stage Diff. Set to 10 PSI, the first fan would turn On at 105 and Off at 95, the second fan stage would turn on at 115 PSI and off at 105 PSI, etc.

The *High Safety* sets the pressure at which the fans will be staged on at 6 second intervals to try and lower the head pressure back the setting; this overrides the normal control algorithm/strategy.

This completes the Setpoints for the Condenser.

Press the `-` press **Escape** to return to the *Setpoints Menu*.

Chapter 6 - Alarms

The Alarms section of the controller provides the user with a list of the last 40 occurrences and provides access to change the alarm setpoints and to clear the alarm log.

From the Main /menu use the $\bar{_}$ key to move to the Alarms selection,

```
MAIN MENU
Status
Setpoints
→Alarms      ↓↑
```

then press **Enter** to bring up the *ALARMS MENU*.

```
ALARMS MENU
→History Log
Change Settings
Clear Log     ↓↑
```

Use the $\bar{_}$ - keys to select the desired item and then press **Enter**.

Alarm History Log

The History Log contains a list of the last 40 alarms. The newest alarm is the first viewed. The oldest/40th alarm is pushed off the list when the next alarm comes in.

Pressing **Enter** with the selection arrow, \rightarrow , pointing to *History Log* brings up the following screen.

```
Compr LT #01      1
Suctn           In Alm
High Suct       50.0
02/28/97 11:46  ↓↑→
```

The control task that the alarm is associated with is given on the 1st line. This could be Compr LT #01 (Suction #1), or Compr MT #02 (Suction #2), or Fan Group #01 (Condenser). The number of the alarm, 1 to 40, is shown at the upper right.

The point/input associated with the alarm (Suct) and alarm status (In Alarm, Timing, Clear) is shown on the second line.

The alarm type (High Suct) and value (50.0) when the alarm occurred is shown on the third line.

The date and time stamp when the alarm occurred is given on the bottom line.

Alarms (cont.)

By pressing the **®** key, you can view a screen which shows when this alarm cleared; see example below.

Compr LT #01	1
High Suct	
Cleared at	
02/28/97 11:50	←

Press the **→** key to return to the viewed alarm. Then press the **←** key to view the next alarm, or press **Escape** to return to the *ALARM MENU*. Pressing the period, “.”, will return you to the number 1, newest, alarm.

The alarm shown will depend on the last one that has occurred. The possible alarms are:

High Suct - the suction pressure has been above the high suction alarm setting for the delay time.

Low Suct - the suction pressure has been below the low suction alarm setting for the delay time

High Head - the head pressure has been above the high head alarm setting for the delay time.

Low Head - the head pressure has been below the low head alarm setting for the delay time.

Oil Fail - the digital input for the oil failure alarm has been closed for the delay time.

Phase Loss - the digital input for the phase loss alarm has been closed for the delay time; compressors will be shutdown.

Lost Relay - a relay board is not communicating with the controller.

Lost Analog - an analog input board is not communicating with the controller.

Lost Digitl - a digital input board is not communicating with the controller.

Low Gas - indicates low refrigerant charge.

Alarms (cont.)

Open - a pressure transducer or temp sensor has gone open.

Short - a pressure transducer or temperature sensor has been shorted.

Power Up - the controller has regained power.

Power Down - the controller lost power.

Change Alarm Settings

Each alarm is given default setting when the controller is setup. Some fine tuning may be required for the specific installation. The *Change Settings* selection on the *ALARM MENU* provides access to all the alarm settings.

```
ALARMS MENU
History Log
→Change Settings
Clear Log      ↓↑
```

Select *Change Settings* and press **Enter**.

The first alarm will be displayed. All the alarms are structured the same and are listed one after the other. Use the `←` - `→` keys to get to the alarm you want and to select the setting you want to change. An example alarm is shown below.

```
Compr LT #01
High Suct  Value
→ Setting  50.0
Delay      00:10↓↑
```

The control task that the alarm is associated with is given on the 1st line. This could be Compr LT #01 (Suction #1), or Compr MT #02 (Suction #2), or Fan Group #01 (Condenser).

The alarm type (High Suct) is shown on the second line.

The setting (50.0) and delay time (00:10 - hours: minutes) is shown on the third line and fourth lines respectively. The delay time is the amount of time you want to wait after the alarm setting has been reached before the alarm is activated.

To change the setting or delay time, select it by using the `←` - `→` keys to place the `→` on the item line, type in the new value (use the `.` for the `:`), and press **Enter**. Use the `←` - `→` keys to select another alarm or press **Escape** to return to the *ALARMS MENU*.

Alarms (cont.)

Clear Alarm History Log

The alarm History Log may be cleared at anytime. The high level password is required. The alarm history log can provide diagnostic information, so it should not be cleared casually.

Select the *Clear Log* item on the *ALARMS MENU*,

```
ALARMS MENU
History Log
Change Settings
→Clear Log      ↓↑
```

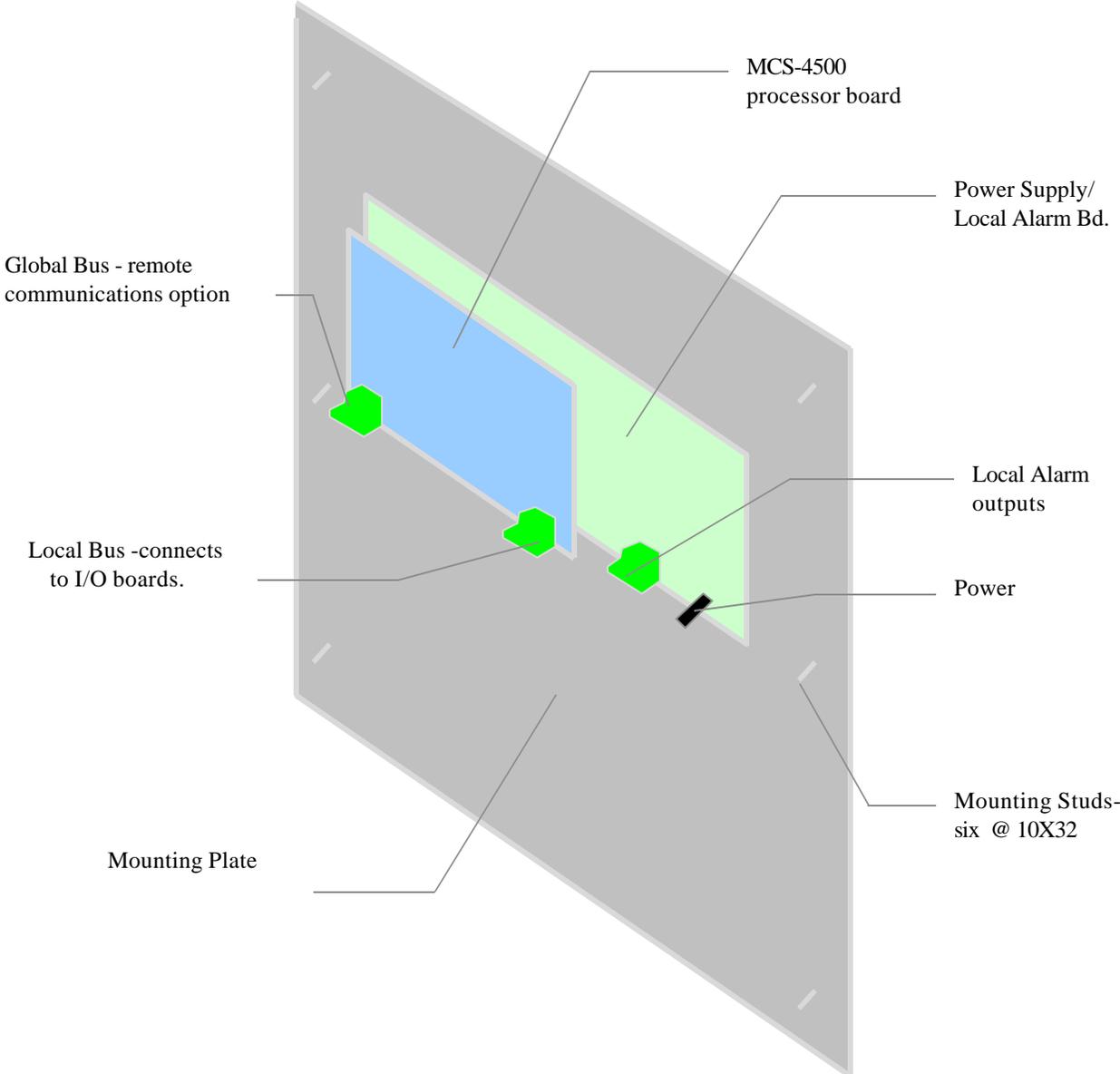
then press **Enter**. The password entry screen will pop-up.

```
Password Required
Enter Password
XXXX
Press Enter
```

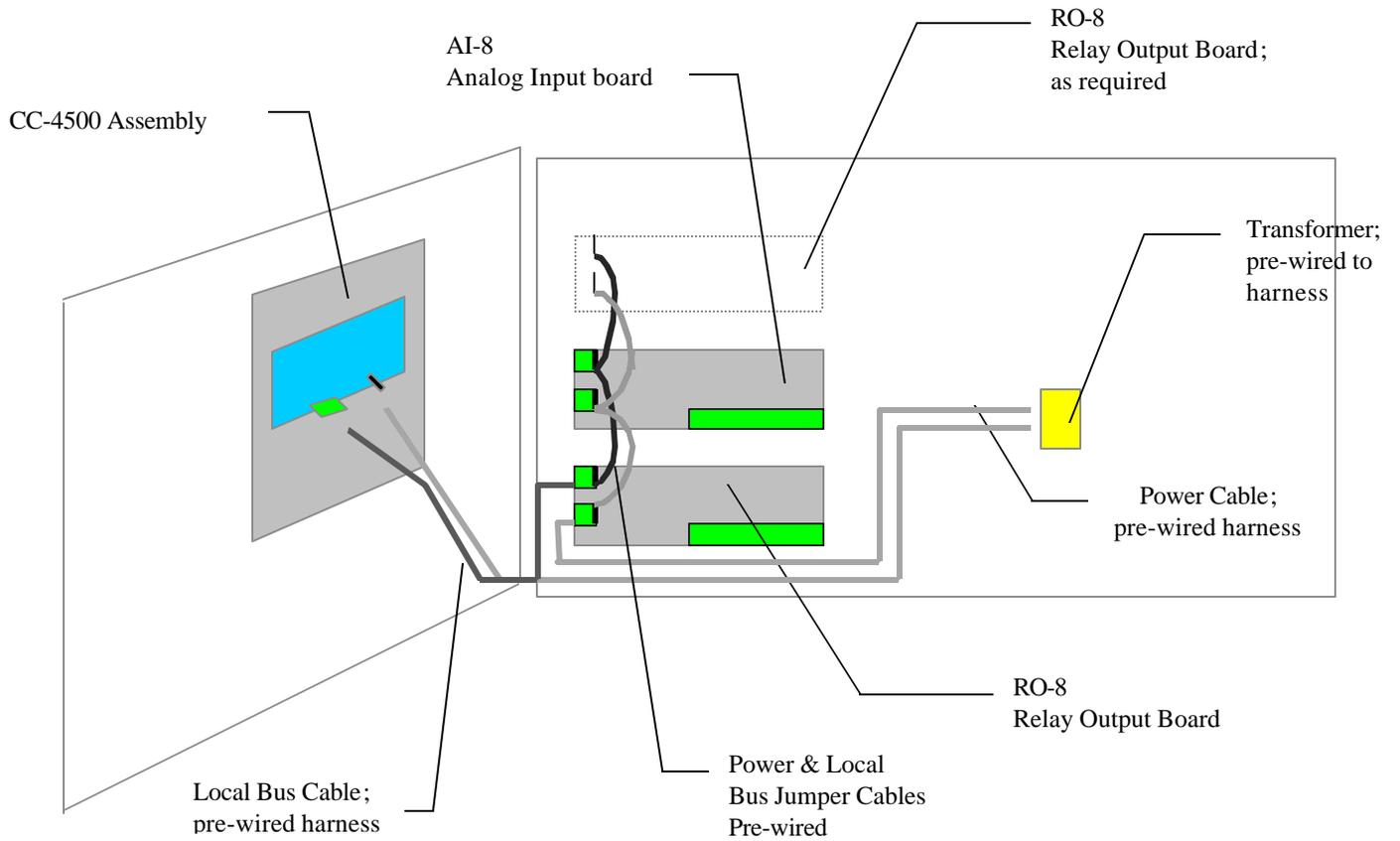
Type in the high level password, and press Enter. If a correct password is entered, the log will be cleared. If an incorrect password is entered, you will be re-prompted to try and enter it again. If unsuccessful, you will be returned to the ALARM MENU, and the log will not have been cleared.

Chapter 7 - Drawings

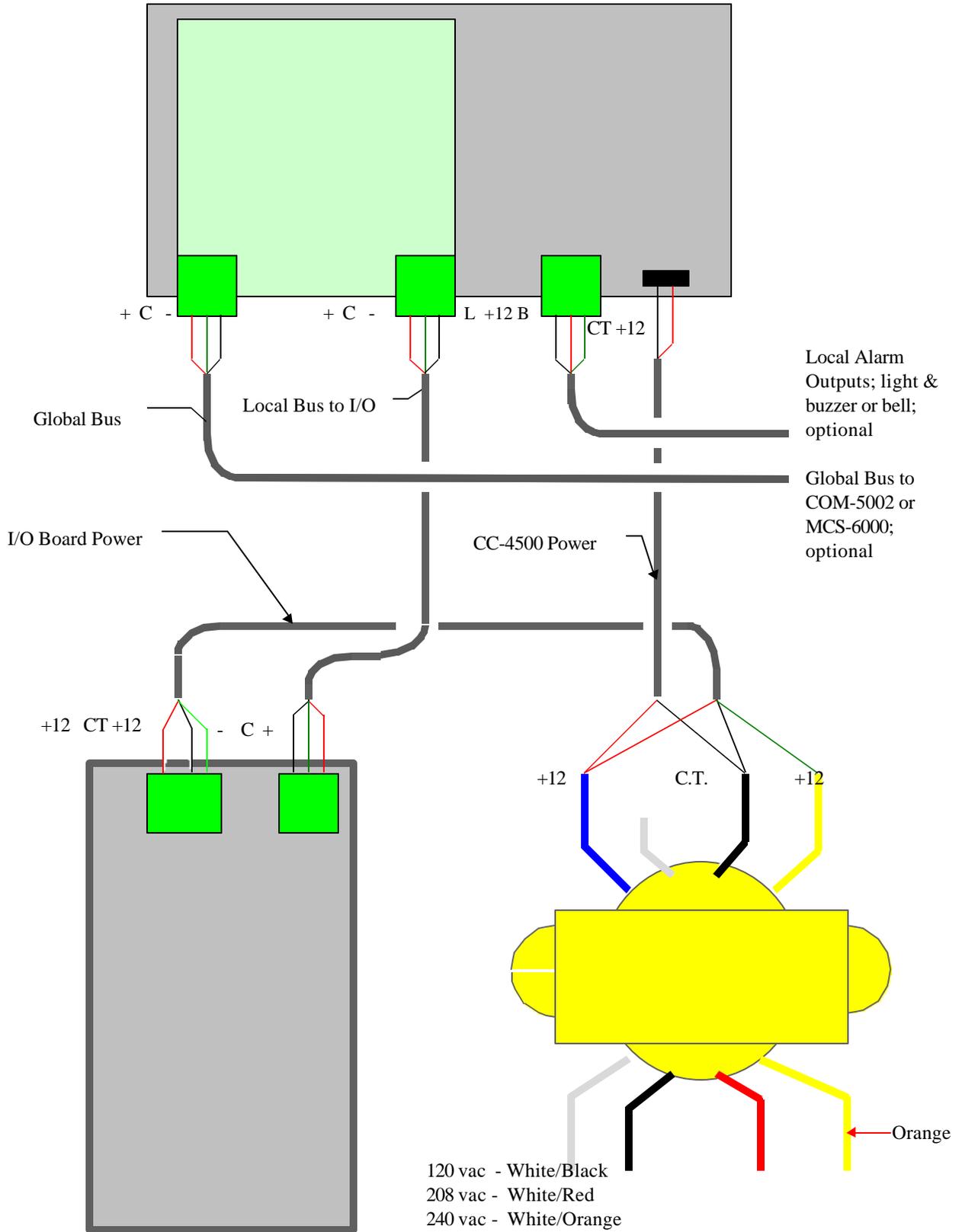
CC-4500 COMPRESSOR CONDENSER CONTROLLER CONTROLLER ASSEMBLY



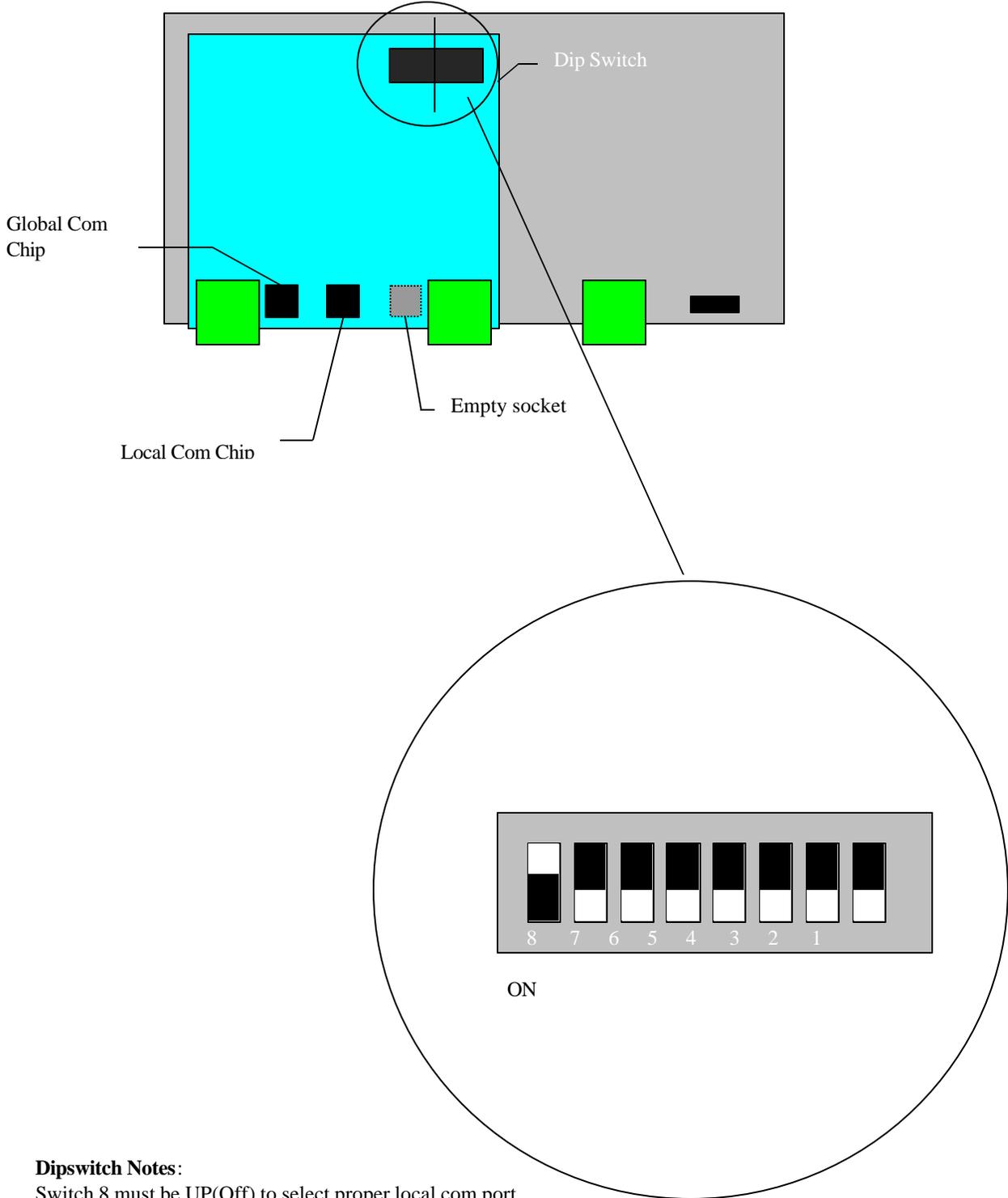
CC-4500 CONTROLLER TYPICAL SYSTEM LAYOUT



CC-4500 CONTROLLER WIRING DETAILS



CC-4500 CONTROLLER HARDWARE DETAILS



Dipswitch Notes:

- Switch 8 must be UP(Off) to select proper local com port.
- Switches 1 thru 5 are only used if remote communications are present to set the address of the controller.
- Switch 6 is only used if remote communications are present - ON for Com-5002, Off for MCS-6000.
- Switch 7 is used in combination with switch 8 to clear the memory of the controller.

Chapter 8 - Control Algorithms

Compressor Control

The compressors are controlled with a PID algorithm. When initially set-up, the HP or MBtuh capacity of each compressor/unloader is entered. The system then assembles all possible combinations of capacity and stores them in a table. Combinations with a difference of less than 2% between them are eliminated.

The suction pressure is compared to the current Target pressure every six seconds. The Target pressure can float up or down between specified limits (+5 & -3 PSI), based upon the float temperature being above or below target. The difference from target is multiplied by a proportional constant, KP and the differences over the last 5 periods (30 seconds) are multiplied by the integral constant, KI, and averaged. These results are added together and divided by the change in suction pressure from one period to the next multiplied by the derivative constant, KD. The net result of these three factors represents the current *Load* and is expressed in percent. The algorithm compares this value to the steps of capacity available (in percentage) and moves up or down in the capacity table accordingly. When a change in capacity is required, the algorithm only allows a change of one step every 18 seconds to reduce hunting/overshoot.

The 3 constants (KP, KI, KD) are contained in a table, with each group of three being represented by a single number called *Reaction Speed* (1 - 9); the response of the algorithm can be slowed down by increasing the *Reaction Speed* setting or speeded up by reducing it.

Safeties are built-in for *low suction* and *high head*. If the *low suction* setting is reached, compressors are sequenced off every 6 seconds, until all are off or the low suction condition no longer exists. If the *high head* setting is reached, compressors are sequenced off every 6 seconds, until the head pressure falls below the high head setting minus a specified differential, or all are off. Alarms are also created with these events.

If a *Phase Loss* condition occurs (phase loss digital input closes), all compressors are shutdown within 12 seconds. When normal power returns, the compressors are held off an additional 60 seconds, called *Lock Recovery*, to make sure the power is going to stay up, before they are sequenced back on.

The *Oil failure* or Rack Alarm, indicates that the contacts, that the digital input is connected to, have closed, and an alarm activated - no control actions are taken. The exact meaning of this alarm is determined by the OEM's wiring/design.

Control Algorithms (cont.)

Condenser Control

The *Condenser Control* is very similar to the compressor control. It also uses a PID algorithm. When the number of stages is specified, it is assumed that each stage has equal capacity, and the step table that is built is a straight sequence with each having a capacity of 100% divided by the number of stages.

The head pressure is compared to the current target pressure every six seconds. The difference from target is multiplied by a proportional constant, KP, and the differences over the last 5 periods (30 sec.) are multiplied by the integral constant, KI, and averaged. These results are *added* to the change in head pressure from one period to the next multiplied by the derivative constant, KD. The net result of these three factors represents the current *Load* and is expressed in percent. The algorithm compares this value to the steps of capacity available (in percentage) and moves up or down in the capacity table accordingly. When a change in capacity is required, the algorithm only allows a change of one step every 30 seconds to reduce hunting/overshoot.

The 3 constants (KP, KI, KD) are contained in a table, with each group of three being represented by a single number called *Reaction Speed* (1 - 9); the response of the algorithm can be slowed down by increasing the *Reaction Speed* setting or speeded up by reducing it.

Safeties are built-in for high head. If the *high safety* setting is reached, fans are staged ON every 6 seconds, overriding the PID algorithm, until all are ON or the head pressure drops below the high safety setting. Alarms are also created with these events.