# CPC

# INTELLIGENT PRESSURE CONTROL
## Installation and Operation Manual

**Model: IPC  Part Numbers: 800-0004  800-1004  800-1005  800-3004**

# IPC USERS MANUAL

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## PREFACE

### 1. General Description.

*The IPC (Intelligent Pressure Control) is a rack mounted solid state suction pressure controller that controls two, three, or four compressors connected in parallel.*

The IPC functionally replaces mechanical controls that have traditionally been used to control suction pressure. When installed with a temperature sensor in the "lead" fixture, the IPC incorporates a floating pressure set point strategy which adjusts cut-in and cut-out pressure settings when temperature conditions permit. In addition, the IPC also monitors system parameters and indicates alarms for high and low suction pressure, high discharge pressure (optional transducer), and pump down condition. Other features are included and are detailed in this manual.

### 2. Contents.

This manual consists of the following sections:

### 3. Use Of This Manual.

The table of contents indicates sections, paragraphs, and titles to facilitate location of information. Illustrations, tables, and diagrams, when applicable, are placed throughout the publication to supplement the text material. Lists of illustrations and tables indicate the numbers and titles. Abbreviations, phrases, and words are set forth in the text exactly as they appear on the equipment. A glossary in APPENDIX C gives definitions of certain terms unique to this product and its application.

# STUDY THIS MANUAL CAREFULLY PRIOR TO INSTALLING AND OPERATING THIS SYSTEM

# Section I
# General Information

## 1.1 Introduction.

*This manual contains information necessary to install, operate, and maintain the following Computer Process Controls IPC Intelligent Pressure Control Part Numbers:*

| | |
|---|---|
| 800-0004 - | Standard CPC 120V/208V/240V IPC |
| 800-1004 - | CPC U.L. 24VAC Version IPC |
| 800-1005 - | U.L. 24VAC IPC (Special Configuration) |
| 800-3004 - | U.K. (United Kingdom) Version. |

Each IPC will control two, three, or four compressors plus, if desired, one satellite compressor using a temperature sensor in the satellite line-up.

## 1.2 General Description.

*The IPC is a stand alone unit containing necessary terminals for pressure and temperature sensor inputs and output connections to compressor control circuit relays.*

In addition, each IPC controller also has an alarm terminal and connections for a communications bus that facilitates connection to other IPC controllers, the CPC 1601, 1602, RMC, and Remote Monitor Control Unit, the CPC IEC and SEC Intelligent Environmental Control panel. Instructions and Installation Information for the communications feature is described in Appendix F.

When installed with a temperature sensor in the "lead" fixture, the IPC incorporates a floating pressure setpoint strategy which adjusts cut-in and cut-out pressure settings when temperature conditions permit. In addition to control, the IPC also monitors system parameters and indicates alarms for high and low suction pressure, high discharge pressure (optional transducer), and pump down condition. Other features include:

-Temperature logging

-Accumulated run times of compressors

-Controller bypass switches for each compressor

-Hot Gas Defrost status for rack

-Compressor on/off status indication

-High discharge pressure cut-out

-Low suction pressure cut-out

The operator of the IPC has valuable information about a refrigeration system's present and past performance at his fingertips.

## 1.3 Theory of Operation.

*The Intelligent Pressure Control continuously monitors the value of the refrigerant pressure in the suction manifold and compares it to a cut-in pressure setting and a cut-out pressure setting.*

When the actual suction pressure is outside of the cut-in and cut-out settings, the IPC adjusts refrigeration capacity by changing the combination of compressors running. The unit incorporates time delays to prevent short cycling, and when installed with the optional temperature sensor, will automatically adjust cut-in and cut-out settings if the temperature stays above or below the temperature setpoint for extended periods of time.

This manual will introduce you to all of the features of the IPC and how you can make use of them.

## 1.4 WIRING.

All sensor input and control output wires are connected to the terminal blocks supplied in the IPC enclosure. These terminal blocks may be removed without disconnecting the wires. See Section III for details.

## 1.5 Optional Equipment.

The IPC may be enhanced with the following optional equipment.

a. Temperature sensor for the control of a satellite compressor unit.

b. Temperature sensor for control of the floating cut-in and cut-out suction pressure set points.

c. Discharge pressure transducer for detecting high pressures and to allow compressor shut down and alarm notification.

d. 1200 or 2400 Baud telephone modem to permit the communication feature.

Contact CPC for any additional information on IPC options.

## 1-6 Technical Characteristics.

Technical Characteristics of the IPC are shown in Table 1-1.

### TABLE 1-1.

### Technical Characteristics

| Components | Characteristics |
|---|---|
| Front Panel Display | L.E.D. indicator for power<br>Operation status: Increase, Decrease,<br>    Pump Down, Alarm, By-Pass,<br>    Defrost;<br>Display/Setpoint status:<br>    Air Temperature, Suction<br>    Pressure, Discharge Pressure,<br>    Timing. |
| Field Outputs | Alarm:    Dry contacts 24V, max. 1 amp.<br>Relay Board Dry Contacts: (for compressor consttrol)<br>    24V-240V, max. 3 amps. |
| Pressure Transducer | 1 to +6 VDC input.<br>Suction:    0-100 psig.(0-6.89 bars)<br>Discharge:    0-500 psig.(0-34.5 bars) |
| Temperature Sensor | Thermistor, -40°F(-40°C) to +99°F(38°C). |
| Power Supply | 120 VAC, 208 VAC, OR 230 VAC<br>Factory preset at 208VAC.<br>UL Version P.N. 800-1005 is<br>24 VAC, 1 amp. , Factory Fixed. |
| Physical Dimensions | Controller:    10 1/4"(2604mm) wide X 12 1/4"(3112mm) high<br>    x 4 1/8"(1048mm) deep,<br>Weight: Approx. 15 lbs.(33kg) |
| | Relay Board:    3 1/2"(889mm) wide X 5 1/2"(1397mm) long<br>    X 1 3/8"(349mm) high,<br>Weight:   Approx. 5 oz(0.7kg). |
| Communications | RS-232 Interface. (See Appendix F) |
| Operating Temperature | 40°F(04°C)  to 120°F(49°C). |
| Operarting %RH | 0 to 95%  Non Condensing. |
| Overrides | Individual override switches for<br>each compressor. |

# SECTION II

# Installation

## 2.1 General.

*This section contains suggestions and factors to consider during the installation phase of the IPC.*

Close adherence to the suggestions will assure satisfactory performance from the equipment. In general, the installation procedure includes:

- Mounting
- Installing pressure transducer(s)
- Installing temperature sensor(s) (optional)
- Field wiring and terminations

This manual will describe each of these. For reference, Figure 2-1 below indicates the major components of the IPC.

Drawing Fig. 2-1 Inserts:

1. CPU Board
2. Dip Selection Switches #1 and #2
3. Compressor Control Bypass Switches
4. Power Interface Board (PIB)
5. "JU1" Input Power Jumper.
   *Do Not Change For 24Volt*
   *UL Version P.N.s 800-1004 & 800-1005*
6. Power Switch
7. Field Wire Terminal Blocks
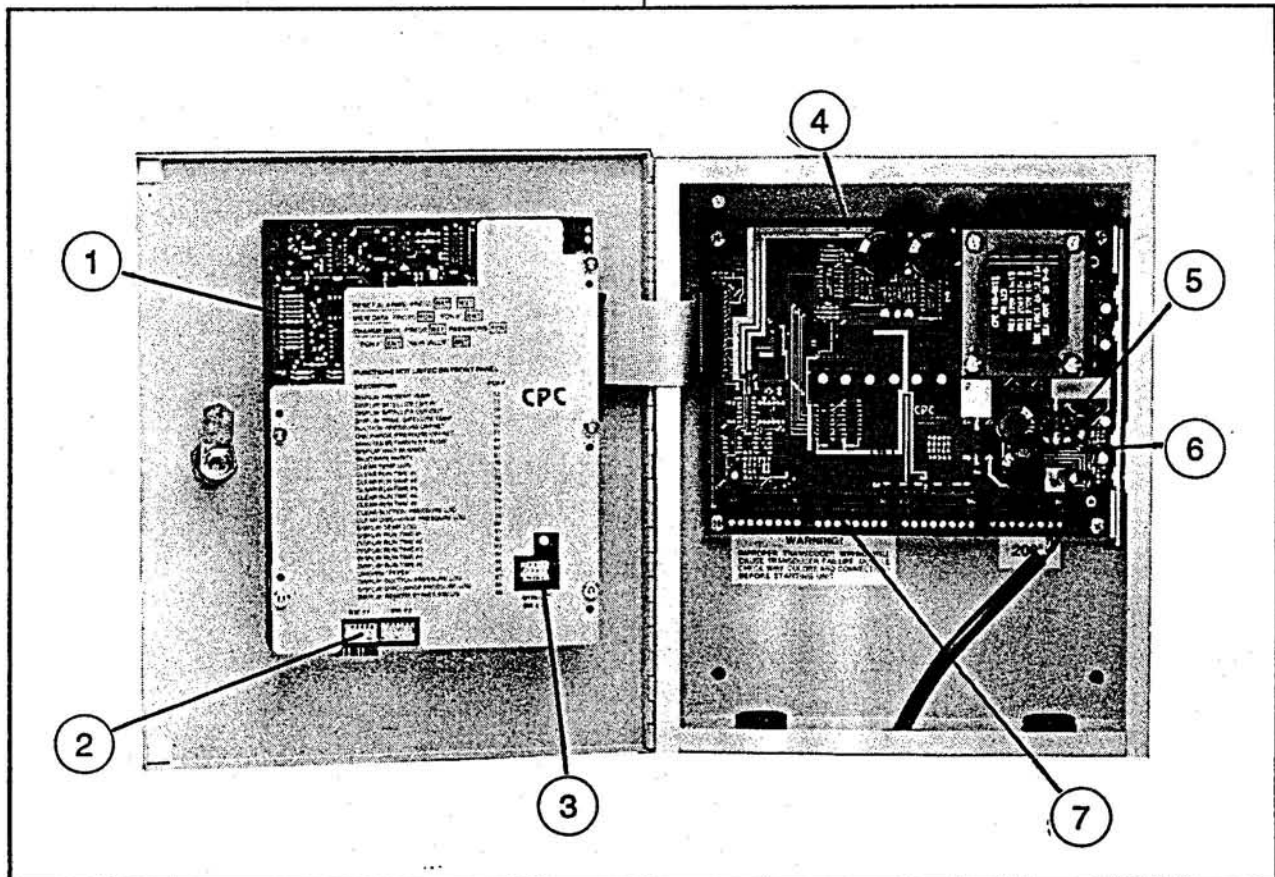


**FIGURE 2-1**
**IPC Major Components**

## 2.2 Mounting the Controller.

*The Intelligent Pressure Controller has been designed to mount directly on the refrigeration unit's control panel. It may also be mounted on an adjacent wall, if desired.*

Disconnect power supply to the rack before beginning. Only trained service personnel should install this unit.

Mounting holes are provided on the rear of the IPC enclosure.

The mounting method used must provide adequate isolation from extreme vibration and moisture. Locate the unit where wiring to the compressor control circuits and supply voltage is most convenient.

The relay output board is to be mounted in the compressor control panel in a convenient location for interfacing with compressor start circuits. A mounting bracket (track) has been supplied for this purpose. The relay board should be mounted with output terminal strip TB2 down.

## 2.3 Installing the Pressure Transducer(s)

*All IPC installations require a suction manifold pressure transducer.*

At the customers option, a discharge manifold transducer may also be required. The suction transducer is a CPC Part No. 801-0101. The discharge transducer is a CPC Part No. 801-0501.

Each pressure transducer must be mounted in a vertical position so as to allow natural protection from oil damage. in addition, it must be mounted above crank case oil level.

CAUTION: Do not pressure test system with transducers installed.

Both suction and discharge pressure transducers will thread into a 1/8" female pipe thread fitting. Use adequate pipe thread compound to insure proper fit. CPC recommends the use of a shut-off valve between the transducer and the manifold so as to make transducer replacement more convenient.

See Figures 2-2 and 2-3 for transducer mounting details.
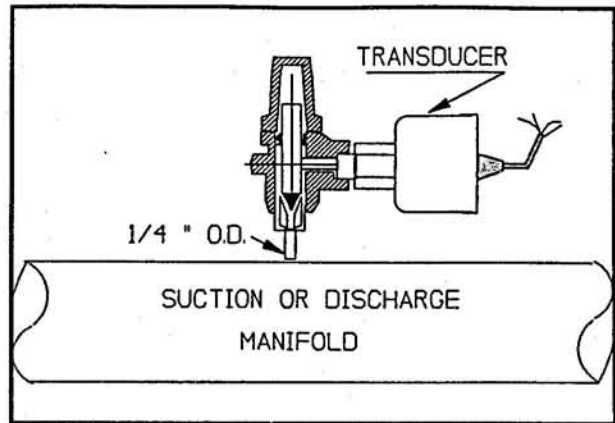


**FIGURE 2-2**

**Transducer Mounting**

**With Valve**
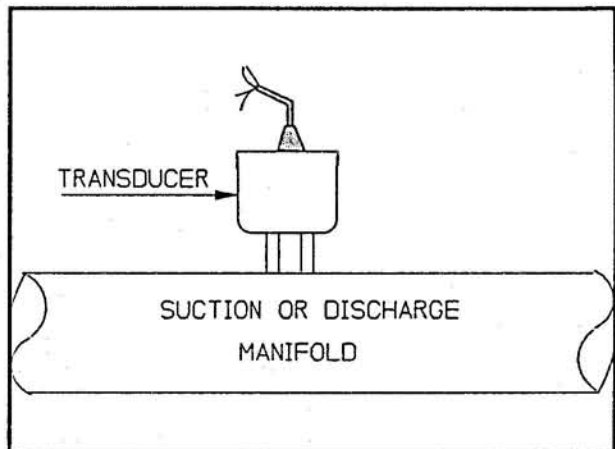


**FIGURE 2-3**

**Transducer Mounting**

**Without Valve**

## 2.4 Installing the Temperature Sensor(s)

*(optional)*

*The temperature sensor is an extremely accurate measuring device used in the refrigerated fixture to increase the operating efficiency of the compressor system.*

**Floating Sensor:**

Choosing the mounting location is critical to proper operation of the unit. Locate the temperature sensor in the fixture that operates at the lowest suction pressure. This fixture's temperature will be directly controlled by the IPC, therefore any control device, such as an EPR, should be adjusted to a lower pressure setting, or manually opened. Make sure that this does not interfere with defrost operation or other system requirements.

The temperature sensor should be located in the discharge air stream of the refrigerated case as shown in Figures 2-4 through 2-7. Make sure that it is accessible so that verification and or replacement can be made without disassembling the fixture.

**Satellite Sensor:**

A second optional temperature sensor may be required for use in controlling the satellite compressor. Locate this sensor in the refrigerated fixture which is refrigerated by the satellite compressor. It should be located as described above

Each temperature sensor is CPC Part No. 501-1121.

**Do not run sensor wire with line voltage wiring.** Sensors should be wired using shielded cable or placed in conduit with no other wiring. If shielded, connect the shield at IPC panel end only.

# FIGURE 2-4

## Meat Case Temperature Sensor Locations
## Operating Temperatures
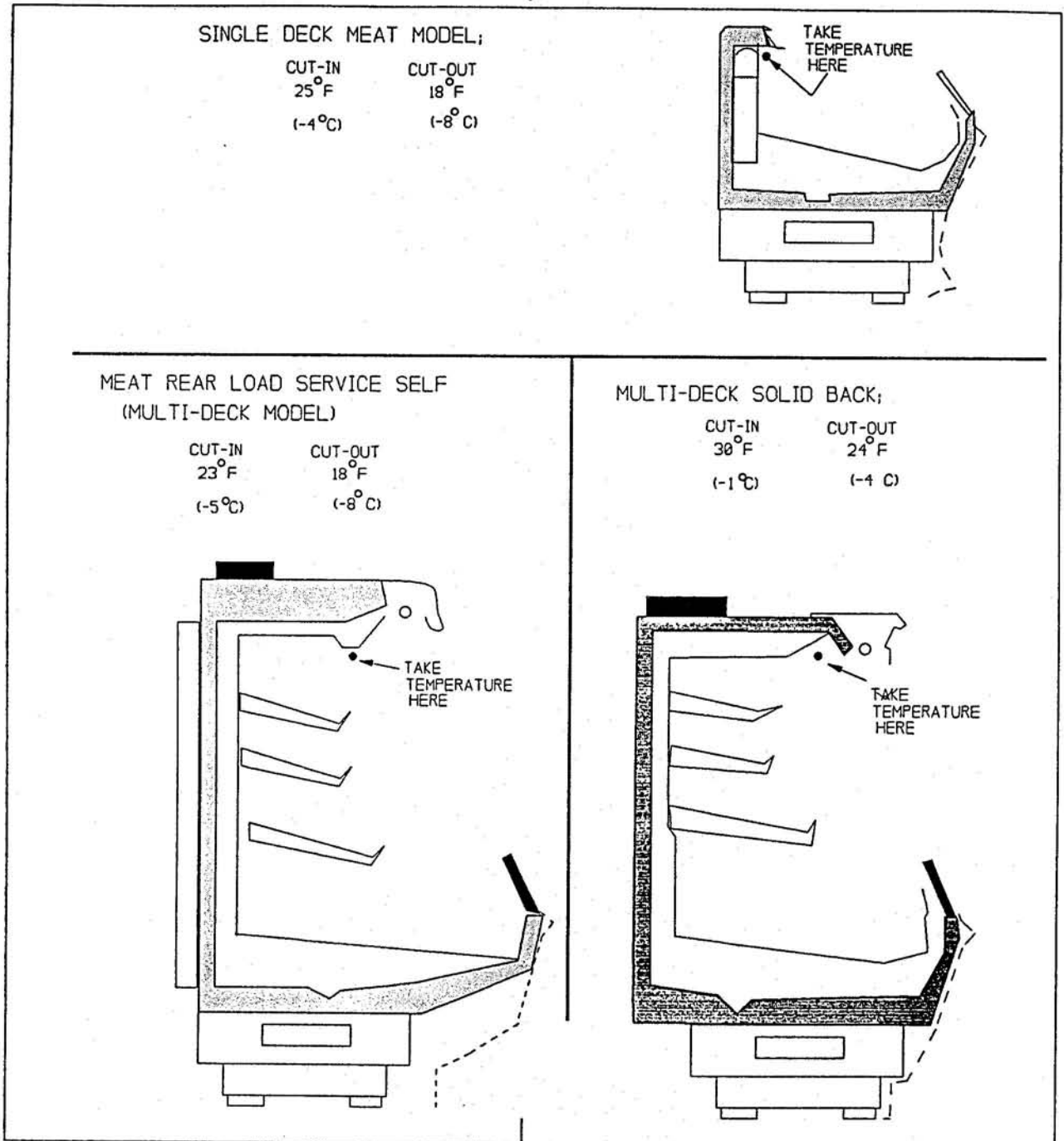
SINGLE DECK MEAT MODEL;

| CUT-IN | CUT-OUT |
|--------|---------|
| 25°F | 18°F |
| (-4°C) | (-8°C) |

TAKE TEMPERATURE HERE

MEAT REAR LOAD SERVICE SELF
(MULTI-DECK MODEL)

| CUT-IN | CUT-OUT |
|--------|---------|
| 23°F | 18°F |
| (-5°C) | (-8°C) |

TAKE TEMPERATURE HERE

MULTI-DECK SOLID BACK;

| CUT-IN | CUT-OUT |
|--------|---------|
| 30°F | 24°F |
| (-1°C) | (-4 C) |

TAKE TEMPERATURE HERE

Note: Temperature of case will vary due to compressor cycling, but should fall within the cut-in and cut-out temperature range. Temperature reading should be taken at a point near the discharge air grill opening, inside duct or just outside grill as shown by small circle on cross section. A label should be placed on the case to indicate this location for future use. **Be sure case is not on defrost when verifying proper IPC operation.**

# FIGURE 2-5
## Produce Case Temperature Sensor Locations
## Operating Temperatures
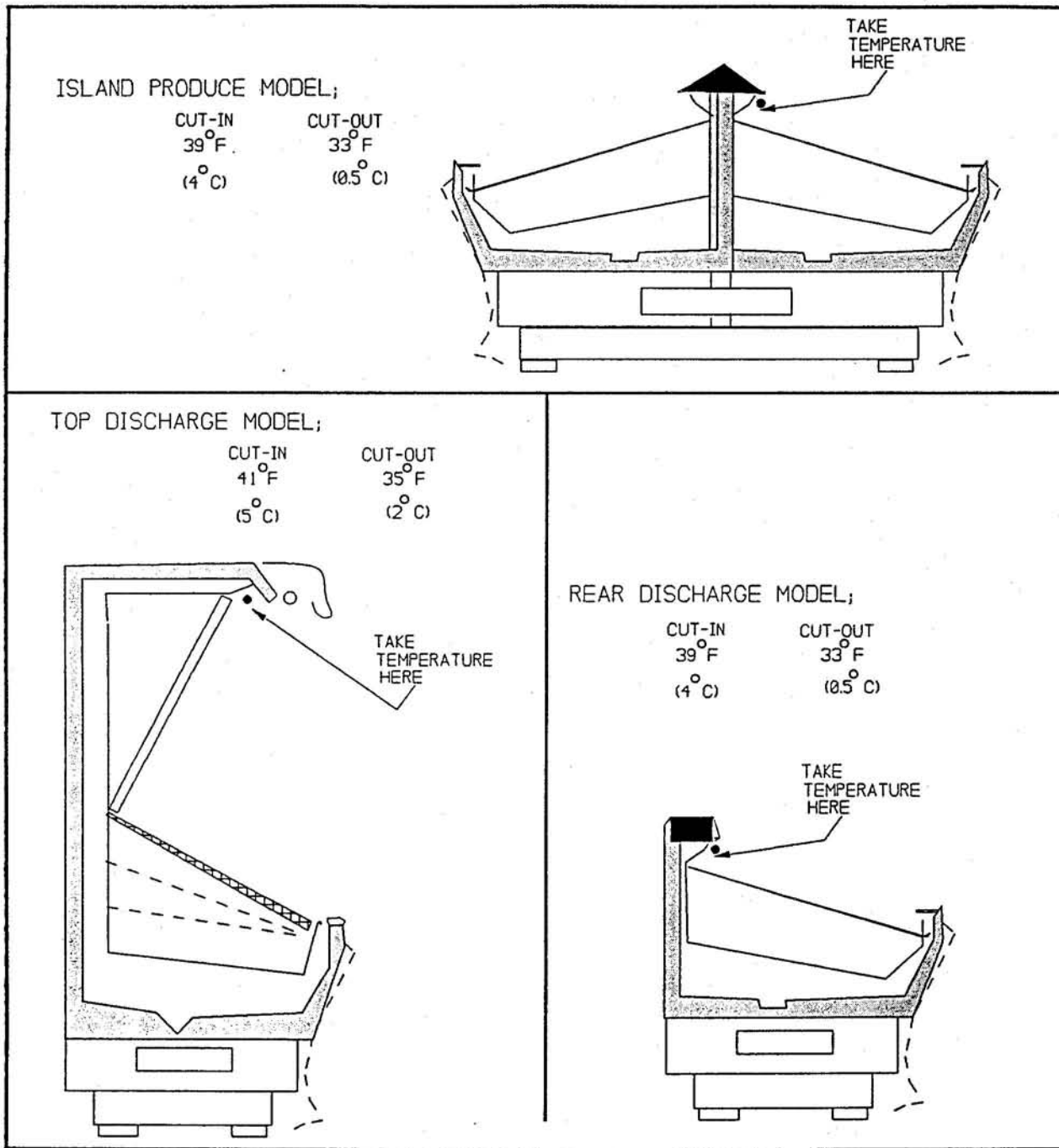
ISLAND PRODUCE MODEL;

CUT-IN
39°F.

CUT-OUT
33°F

(4°C)

(0.5°C)

TAKE
TEMPERATURE
HERE

TOP DISCHARGE MODEL;

CUT-IN
41°F

CUT-OUT
35°F

(5°C)

(2°C)

TAKE
TEMPERATURE
HERE

REAR DISCHARGE MODEL;

CUT-IN
39°F

CUT-OUT
33°F

(4°C)

(0.5°C)

TAKE
TEMPERATURE
HERE

Note: Temperature of case will vary due to compressor cycling, but should fall within the cut-in and cut-out temperature range. Temperature reading should be taken at a point near the discharge air grill opening, inside duct or just outside grill as shown by small circle on cross section. A label should be placed on the case to indicate this location for future use. **Be sure case is not on defrost when verifying proper IPC operation.**

## FIGURE 2-6
## Deli and Dairy Case Temperature Sensor
## Locations & Operating Temperatures
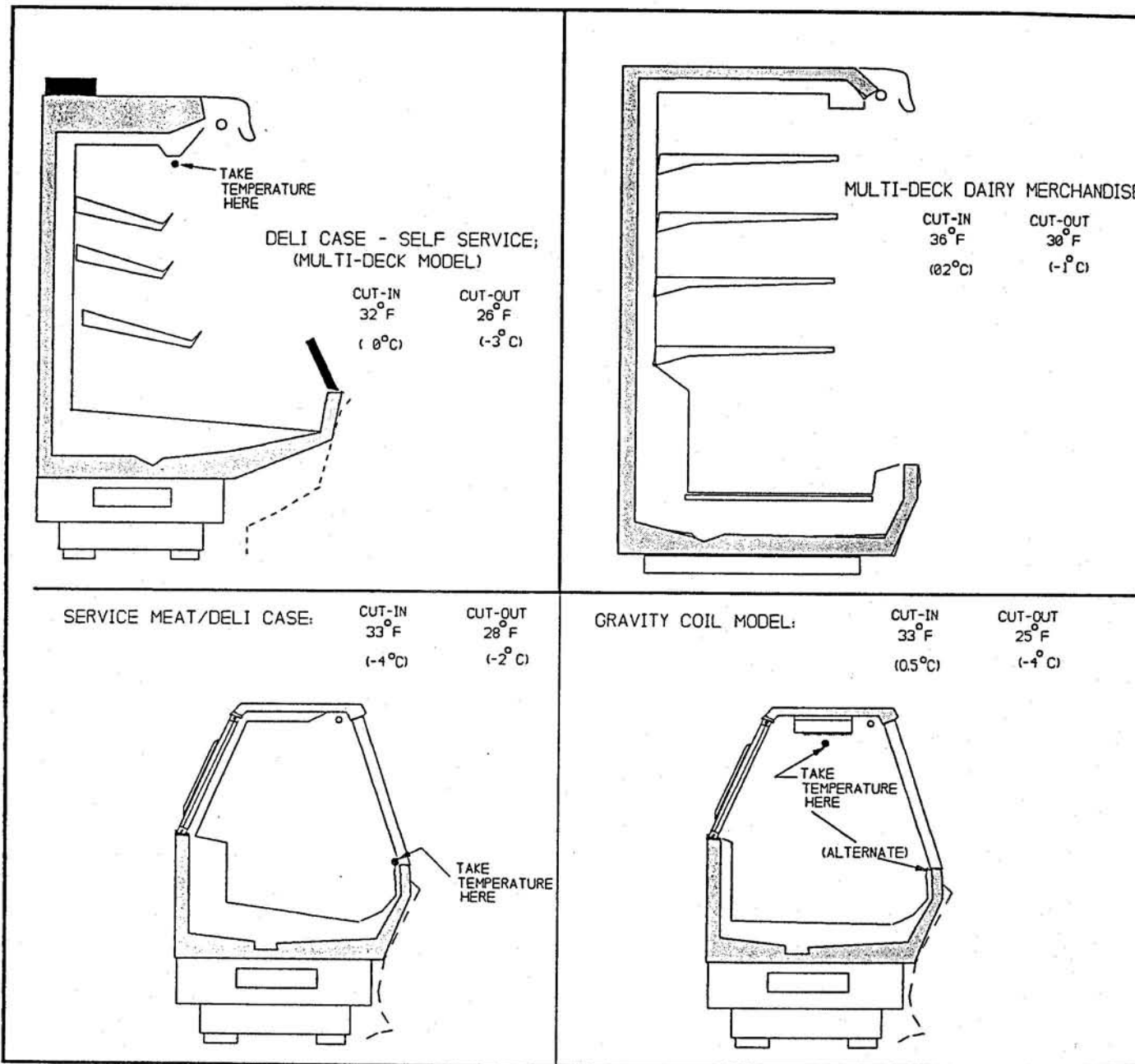


DELI CASE - SELF SERVICE;
(MULTI-DECK MODEL)

TAKE TEMPERATURE HERE

| CUT-IN | CUT-OUT |
|--------|---------|
| 32°F | 26°F |
| (0°C) | (-3°C) |

MULTI-DECK DAIRY MERCHANDISE

| CUT-IN | CUT-OUT |
|--------|---------|
| 36°F | 30°F |
| (02°C) | (-1°C) |

SERVICE MEAT/DELI CASE:

| CUT-IN | CUT-OUT |
|--------|---------|
| 33°F | 28°F |
| (-4°C) | (-2°C) |

TAKE TEMPERATURE HERE

GRAVITY COIL MODEL:

| CUT-IN | CUT-OUT |
|--------|---------|
| 33°F | 25°F |
| (0.5°C) | (-4°C) |

TAKE TEMPERATURE HERE

(ALTERNATE)

Note: Temperature of case will vary due to compressor cycling, but should fall within the cut-in and cut-out temperature range. Temperature reading should be taken at a point near the discharge air grill opening, inside duct or just outside grill as shown by small circle on cross section. A label should be placed on the case to indicate this location for future use. **Be sure case is not on defrost when verifying proper IPC operation.**

# FIGURE 2-7

## Frozen Food and Ice Cream Case Temperature
## Sensor Locations & Operating Temperatures
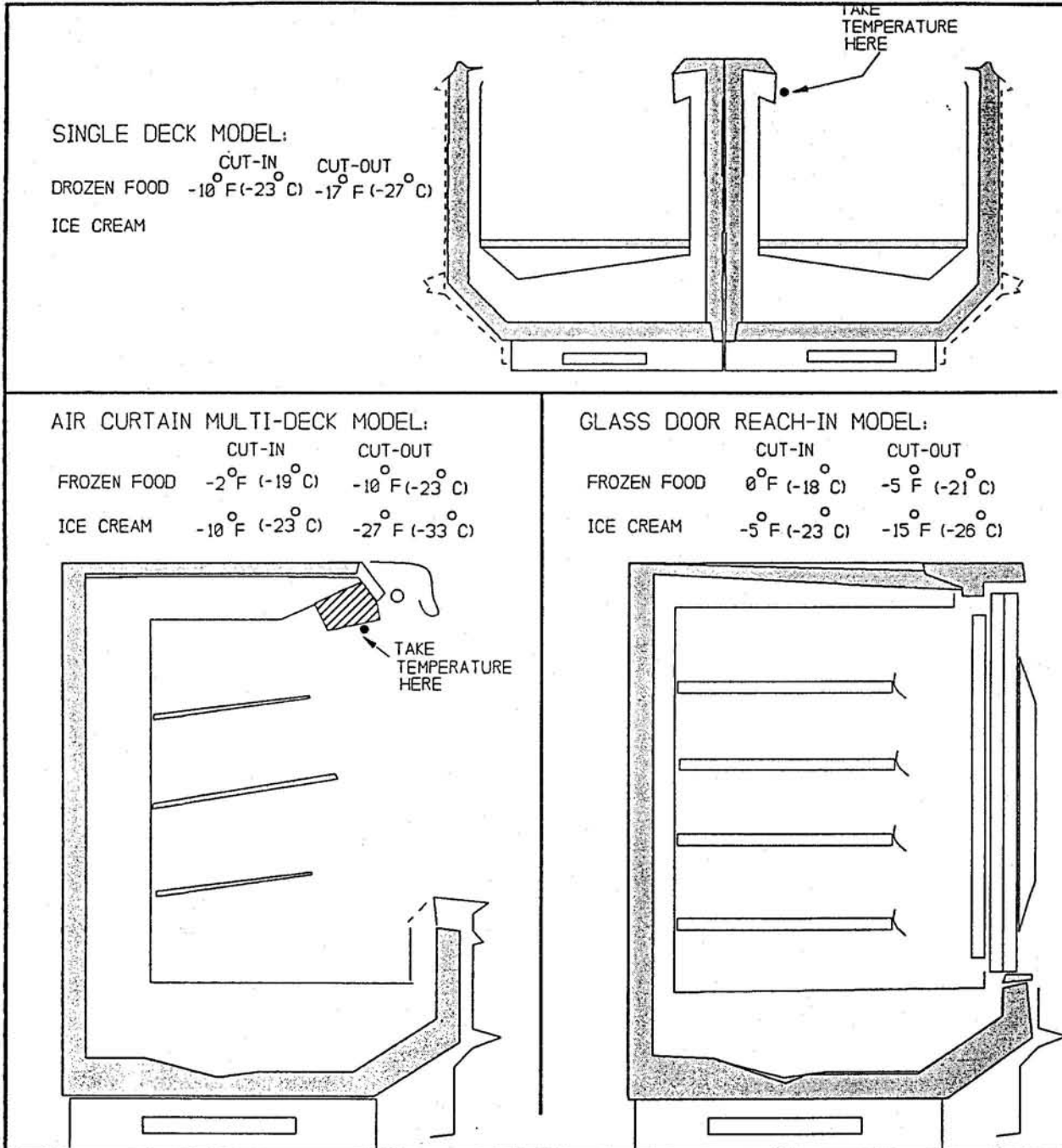
SINGLE DECK MODEL:

|  | CUT-IN | CUT-OUT |
|---|---|---|
| DROZEN FOOD | -10°F (-23°C) | -17°F (-27°C) |
| ICE CREAM | | |

TAKE TEMPERATURE HERE

AIR CURTAIN MULTI-DECK MODEL:

|  | CUT-IN | CUT-OUT |
|---|---|---|
| FROZEN FOOD | -2°F (-19°C) | -10°F (-23°C) |
| ICE CREAM | -10°F (-23°C) | -27°F (-33°C) |

TAKE TEMPERATURE HERE

GLASS DOOR REACH-IN MODEL:

|  | CUT-IN | CUT-OUT |
|---|---|---|
| FROZEN FOOD | 0°F (-18°C) | -5°F (-21°C) |
| ICE CREAM | -5°F (-23°C) | -15°F (-26°C) |

Note: Temperature of case will vary due to compressor cycling, but should fall within the cut-in and cut-out temperature range. Temperature reading should be taken at a point near the discharge air grill opening, inside duct or just outside grill as shown by small circle on cross section. A label should be placed on the case to indicate this location for future use. **Be sure case is not on defrost when verifying proper IPC operation.**

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# SECTION III

# FIELD WIRING/TERMINATION

## 3.1 Wiring

**3.1.1 Wiring Procedures.** *Table 3-1 gives suggested wire gauge and approved CPC part numbers for each*

*terminal in the IPC along with the use of each.. Shields are grounded only at the IPC control unit.*

For other than the shielded wire, for best results use only stranded type TFF wire, #18 awg or smaller. Larger wires will not fit properly into the terminal blocks of the IPC.

### TABLE 3-1

### Terminal Designation and Recommended Wire

| Terminal # | Function | Recommended Wire |
|---|---|---|
| 1 | Communications Shield | |
| 2 | Communications Transmit | 3 conductor with shield. (See Appendix F) |
| 3 | Communications Receive | (#20-3shielded) |
| 4 | Spare Input +12 Volt | Not Used |
| 5 | Input Satellite Sensor (option) | Belden #8762 |
| 6 | Input Satellite Sensor (option) | (#20-2shielded) |
| 7 | Fixture Temp.Sensor | Belden #8762 |
| 8 | Fixture Temp. Sensor | (#20-2shielded) |
| 9 | Suction Xducer +12V (red) | |
| 10 | Suction Xducer +Signal (clear) | Belden #8772 |
| 11 | Suction Xducer Common (black) | (#20-3shielded) |
| 12 | Discharge Xducer +12V (red) | |
| 13 | Discharge Xducer +Signal (clear) | Belden #8772 |
| 14 | Discharge Xducer Common (black) | (#20-3shielded) |
| 15 | Defrost Status | Belden #8762 |
| 16 | Defrost Status | (#20-2shielded) |
| 17 | Common to relay board TB6-8 | 18 awg. stranded, per code |
| 18 | Comp.#1 Out to relay board TB6-1 | 18 awg. stranded, per code |
| 19 | 0V Term. Out to relay board TB6-7 | 18 awg. stranded per code (UL 24V only.) |
| 20 | Comp.#2 Out to relay board TB6-2 | 18 awg. stranded per code |
| 21 | NOT USED | |
| 22 | Comp.#3 Out to relay board TB6-3 | 18 awg. stranded, per code |
| 23 | NOT USED | |
| 24 | Comp.#4 Out to relay board TB6-4 | 18 awg. stranded, per code |
| 25 | NOT USED | |
| 26 | Satellite Out to relay board TB6-5 | 18 awg. stranded, per code |
| 27 | Alarm Output--Line | |
| 28 | Alarm Output--Load | PER CODE |
| 29 | Ground (All Transducer/Sensor Shields) | |
| 30 | Ground (Earth) | |
| 31 | Neutral | See Fig. 3-1. (Check jumper.) |
| 32 | 24, 120, 208, or 240 VAC | PER CODE |

### 3.1.2 Field Terminals.

*The terminals for field wiring connections are located across the bottom edge of the Power Interface Board.*

'There are 32 terminals divided into four groups of eight on plug-in connectors.

The terminals are numbered sequentially from left to right with numbers 1 to 32. Terminal 29 is for grounding transducer cable shields.

The terminal blocks may be removed from the Power Interface Board without disconnecting field wiring by pulling straight down on each terminal block.

Table 3-1 list all terminals, their functions, and recommended wire. Figure 3-2, TYPICAL WIRING, shows graphically the over-all wiring. Figure 3-3 illustrates the compressor control circuit wiring. Refer to these two wiring diagrams for field wiring.

### 3.1.3 Power Input Voltage Jumper.

*Before power is applied to the controller, verify that the Line Voltage Jumper "JU1" is in the correct position. Failure to verify may cause damage to the unit!.................and void warranty.* "JU1" is located just below and to the right of the power transformer on the Power Interface Board. The Jumper Configuration is shown below.

## FIGURE 3-1

### Voltage Jumper Configuration



```
              208
              ⊙

 120                        240*
 ⊙                          ⊙
                ⊙
               JU1
            LINE VOLTS
*THIS JUMPER POINT BECOMES
 FIXED AT 24VAC FOR THE
 UL VERSION.
```
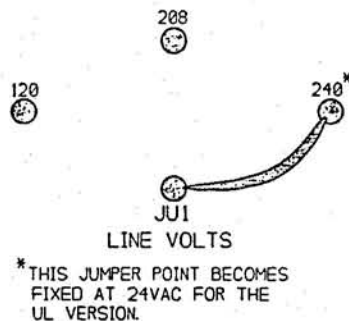
For U.L. 24 Volt U.L. version the jumper is fixed. Disregard any indication shown on the printed circuit board. *Do not change this version.*

### 3.1.4 FIELD WIRING DIAGRAMS.

Figures 3-2 and 3-3 depict graphically and schematically the typical wiring respectively. The following paragraphs are important in achieving a satisfactory installation.

Please observe the following:

a. Transducer and sensor wire shields are connected only at the IPC controller. Only connect shields at IPC controller terminal #29. Never run transducer or sensor wire with line voltage wire.

b. The defrost status inputs accept dry contacts only. Do not apply voltage to these terminals. When other than hot gas defrost is being used on the circuit with the floating set point temperature sensor, its defrost must be monitored in addition to the master liquid line solenoid valve. This is accomplished by wiring the two devices in parallel across a relay coil which will indicate status to the IPC.

c. Compressor output contacts on the relay board (mounted in the compressor control panel) are rated at 24v-240VAC, 3 Amps. They are normally closed contacts. That is, when power is removed from the IPC, or a compressor is put in controller bypass, the contacts close, allowing the compressor to run on other controls that are wired in series with the IPC.

d. Uneven compressor systems must be wired such that the compressor horsepowers are increasing from output #1 to output #4.

e. Existing time delay relays should be adjusted to minimum setting, or if necessary, disconnected from the control circuit.

f. Professional installation standards should be maintained. The warranty of this product will be valid only if installation is done per the directions given in this manual.

## 3.2  Wire  Terminations.

Control, sensor, and power wiring is terminated at the terminal blocks located along the bottom edge of the Power Interface Board. Connections are made by loosening the retaining screws, inserting wire with 1/4" insulation removed, and tightening the retaining screw. Use caution not to leave bare wire exposed under the terminal connections.

Wire connections may be made with the terminal blocks connected to the Power Interface Board, or removed.

Power wiring must be separate from sensor and control wiring. Use the knockout on the far right side for bringing power wiring into the IPC.

# FIGURE 3-2

## IPC Typical Wiring
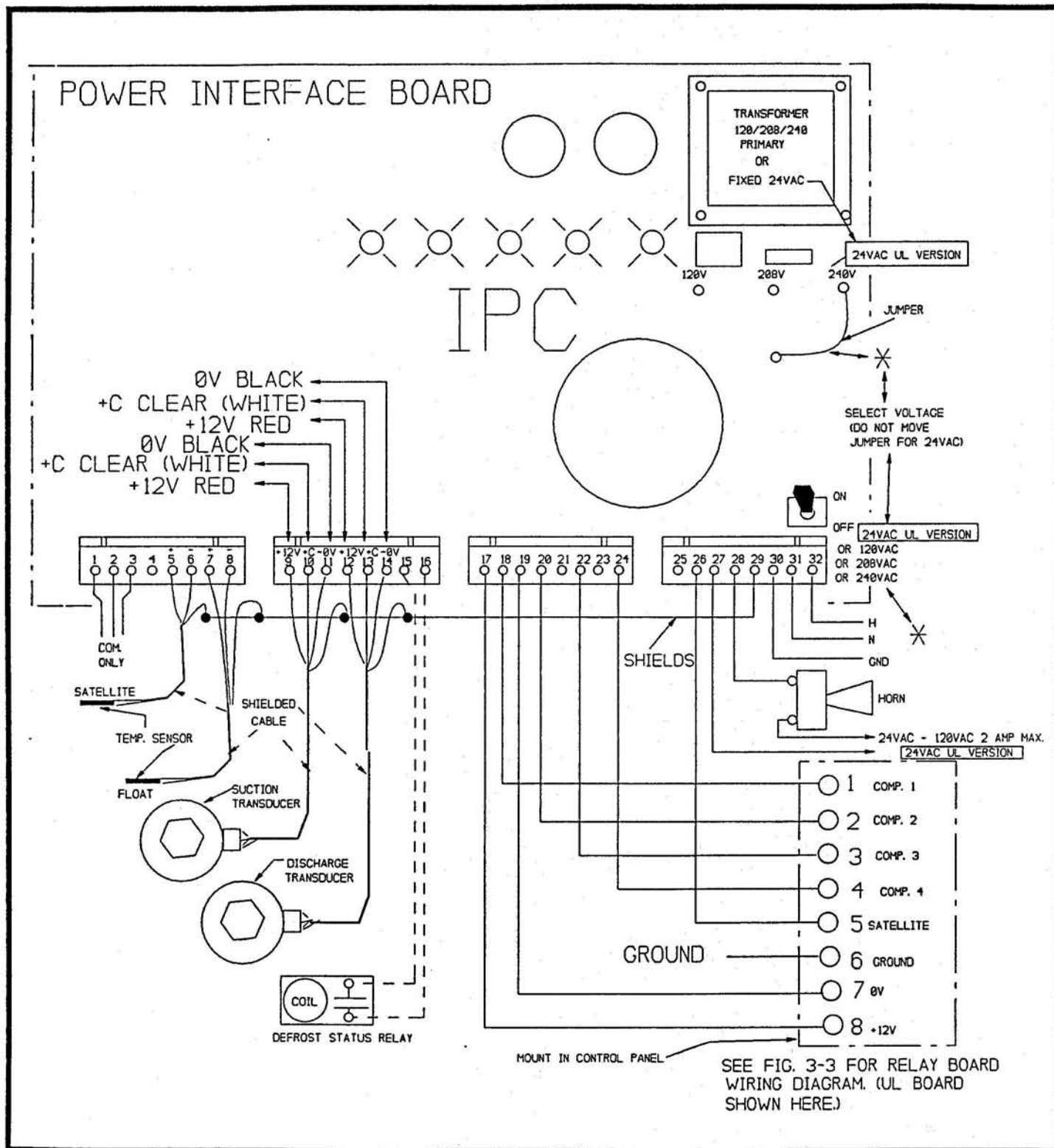
# FIGURE 3-3

## Compressor Control Wiring



COMPRESSOR CONTROL CIRCUIT
USING STANDARD RELAY BOARD

COMPRESSOR CONTROL CIRCUIT
USING UL VERSION RELAY BOARD
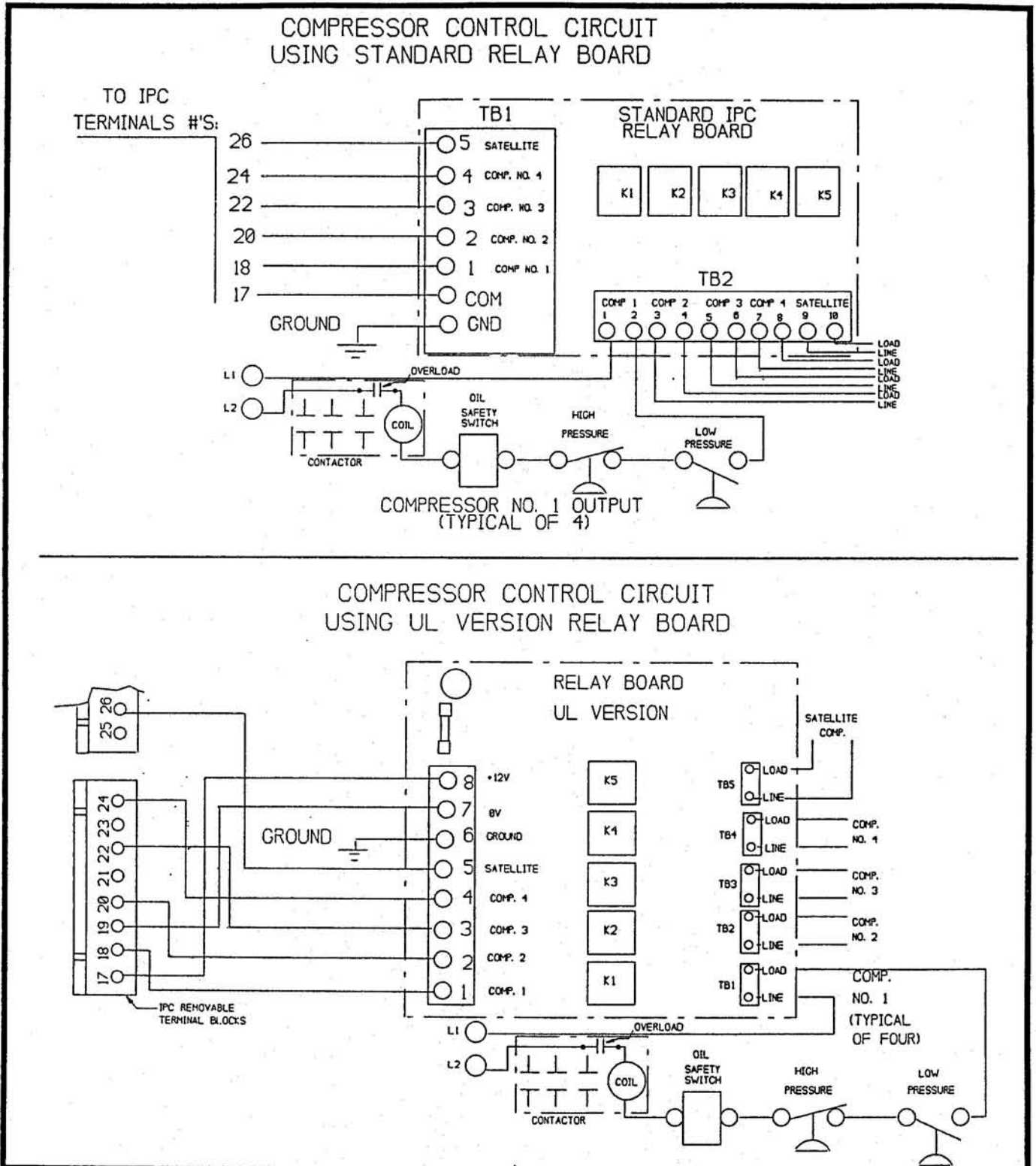
**NOTE:** Use only the knockouts provided. Any drilling or cutting of holes in the enclosure can cause serious operational problems and even failures to the controller.

Before powering up the IPC controller, read Section IV for dip switch settings. These must be properly set before applying power to the unit. Check all connections and verify that the supply voltage jumpers are in the proper position.

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# SECTION IV
# Powering Up the Unit

## 4.1 Controller Set-Up.

*Before powering up the IPC, the dip switches on the inside of the door must be set for the proper compressor configuration and application to be controlled.*

There are three sets of dip switches on the CPU board which is mounted on the inside of the door. See Figure 4-1 for their location.

These switches set the following:

Switch 1 - Control Strategy Options.
Switch 2 - High Pressure Options and Floating Suction Pressure Option. (
Switch 3. - Bypass.

The power switch is on the inside of the panel as shown in Figure 2-1. It should be in the down (off) position now.
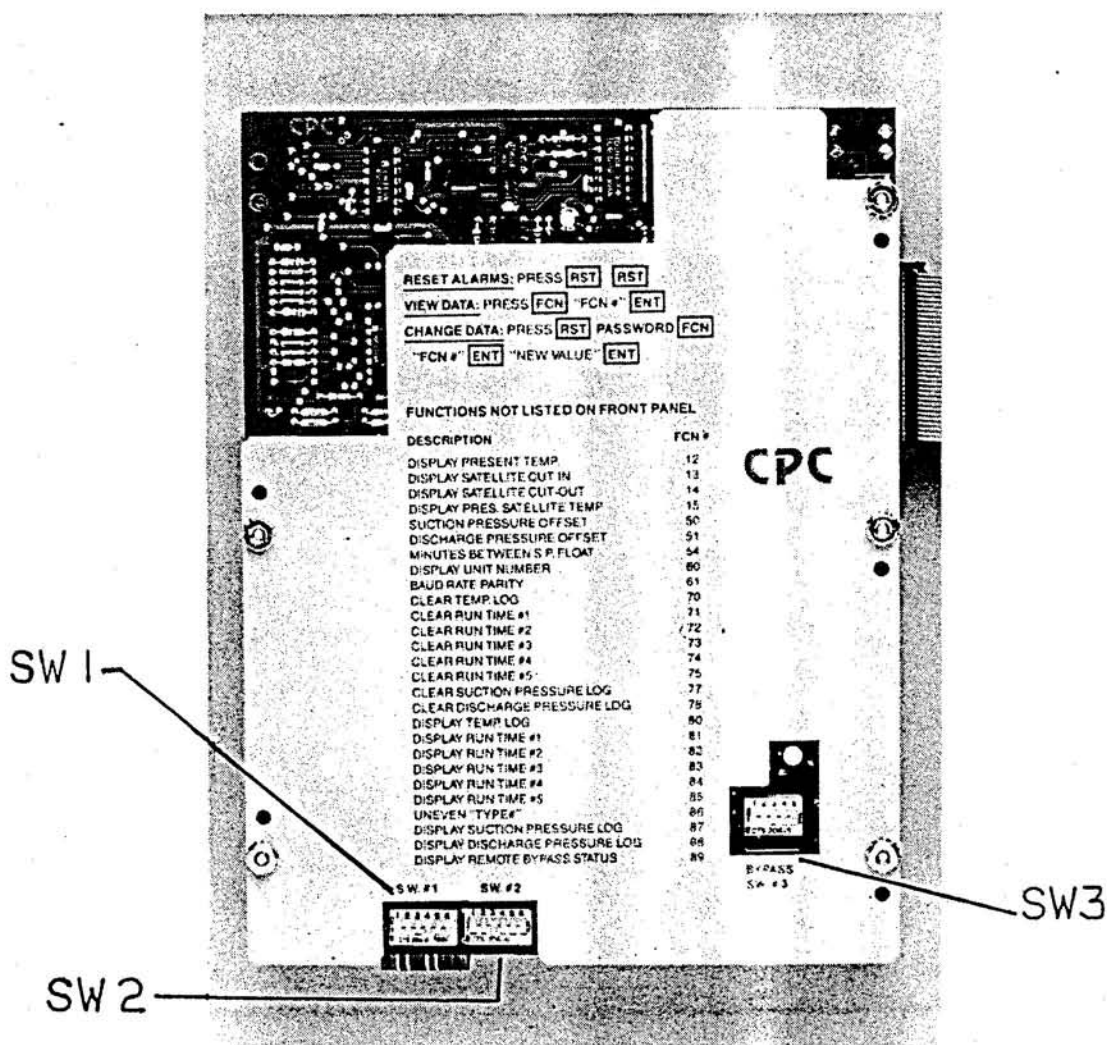


**FIGURE 4-1**

**Switch Locations**

### 4.1.1 Dip Switch Settings

## SWITCH 1
## Control Strategy Options

1&2 Determines the number of compressors under control. Set as follows for the appropriate # of compressors:

| # of Comp. | Pos. 1 | Pos. 2 |
|------------|--------|--------|
| 1 | ON | ON |
| 2 | OFF | ON |
| 3 | ON | OFF |
| 4 | OFF | OFF |

| POSITION | DESCRIPTION |
|----------|-------------|
| 3 | OFF = Uneven compressor control<br>. ON = Even compressor control |
| 4 | OFF = If in even compressor control, then the first compressor on will be the first compressor off.<br>ON = If in even compressor control, then the first compressor oin will be the last compressor off. |
| 5 | OFF = Insures that one compressor will remain on at all times except for pump down and high discharge cutout.<br>ON = Allows all compressors to turnoff when suction pressure stays below cut-out for an extended period, except when hot gas defrost is monitored. |
| 6 | NOT USED |

## SWITCH 2
## High Discharge Pressure Cut-Out Options and Floating Suction
### Pressure Control Option

| POSITION | DESCRIPTION |
|----------|-------------|
| 1 | OFF = Floating suction pressure control off. This switch must be set off if you have not installed the optional temperature sensor.<br><br>ON = Floating suction pressure control on. This switch must be set on if you have installed the optional temperature sensor. |
| 2 | OFF = High discharge cut-out, manual reset. If discharge pressure rises above setpoint, all compressors will go off until an operator pushes the "RST" key on the front panel twice. |

ON = High discharge cut-out, Auo Reset. If discharge pressure rises above setpoint, all compressors will go off until the discharge pressure falls below the setpoint by 25 or 50 psi, depending on switch position # 4's state.

| POSITION | DESCRIPTION |
|----------|-------------|
| 3 | OFF = Omits high discharge pressure alarm. Cut-out still occurs.<br>ON = Causes alarm to occur whenever discharge pressure is above cut-out setting. |
| 4 | OFF = Deadband of 25 psi(1.7 bars) below the high discharge pressure setting before auto reset occurs.<br>ON = Deadband of 50 psi(3.4 bars) below the high auto reset occurs. |
| 5 | OFF = Satellite control disabled. |
| 6 | OFF = Pump down alarm disabled.<br>ON = Pump down alarm enabled. |

## SWITCH 3
## BYPASS SWITCHES

*Note: before applying power to the unit, place all bypass switches in the "ON" position. (IPC control is bypassed)*

| POSITION | DESCRIPTION |
|----------|-------------|
| 1 | ON = Bypasses IPC control of compressor #1. This closes the output contacts connected to the compressor control circuit.<br>OFF = Computer control of compressor #1 |
| 2 | ON = Bypasses IPC control of compressor #2.<br>OFF = Computer control of compressor #2. |
| 3 | ON = Bypasses IPC control of compressor #3.<br>OFF = Computer control of compressor #3. |
| 4 | ON = Bypasses IPC control of compressor #4.<br>OFF = Computer control of compressor #4. |
| 5 | ON = Bypasses IPC control of Satellite Compressor.<br>OFF = Computer control of Satellite Compressor. |

**4.1.2 Standard Factory Switch Positions.** The IPC is shipped from the factory with the switches set in the positions shown in Figure 4-2. To change a switch setting, use a pointed object such as a ball point pen, push in on the top of the switch for "ON", and the bottom of the switch for "OFF."

## FIGURE 4-2

## Standard Factory Switch

## Settings
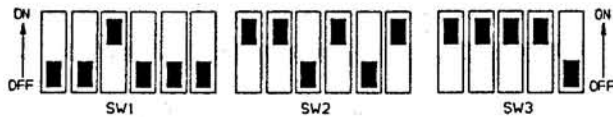


In general, the unit is shipped set up to control four even parallel compressors. The first compressor on will be the first compressor off so as to equalize run times of all compressors on the rack. High discharge pressure alarm is inactive, with an automatic reset after discharge pressures fall 50 psig(3.4 bars) below the high discharge pressure cut-out.

All bypass switches are in the "ON" position, so that the IPC will not have control over the compressors until these switches are changed to the "OFF" position, usually after programming is completed.

## 4.2. Start Up.

Once you are sure that the switch settings are in the desired position, apply power to the unit, and switch on the power supply switch located in the lower right hand corner of the power interface board, next to the green power indicator light.

The display should read "IPC". If so, the unit is ready for data entry. Information describing the programming and operation of the unit follows in the next section of this manual.

If "IPC" does not display, check power connections, and voltage supply. If the unit does not respond, call Computer Process Controls, customer service, at (404) 425-2724.

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# SECTION V
# Programming the IPC

## 5.1 Front Panel Indication

**5.1.1 General.**

*The front panel of the IPC gives information regarding the compressor system's status and the operation of the controller itself. Figure 5-1 shows the front panel of the IPC.*

The following pages give a description of each portion of the display.
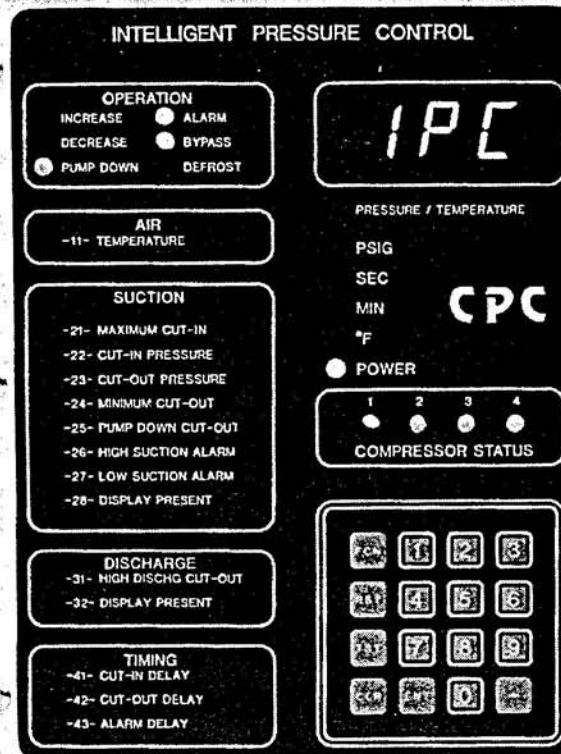


**FIGURE 5-1**

**Front Panel Display**

**5.1.2 Operation section.** *Operation indicator lights on the front panel give information about the refrigeration system and the controller.*

INCREASE LIGHT - When illuminated, the value of the present suction pressure is above the current cut-in pressure setting. Note that the increase light must remain on for the "increase time" before the IPC actually increases capacity.

DECREASE LIGHT - When illuminated, the value of the present suction pressure is below the current cut-out setting. Note that the decrease light must remain on for the "decrease time" before the IPC actually decreases compressor capacity.

PUMP DOWN LIGHT - When illuminated, the value of the suction pressure is or has been below the pump down cut-out setting. In addition, the alarm light will be on and the external alarm contacts will close. If the condition presently exists, the compressors will be off.

ALARM LIGHT - When illuminated, the alarm light indicates that any system alarm has occurred. The associated function light will also be illuminated, such as high suction alarm. The alarm light is latched, so that even if the problem corrects itself, the light will remain on until reset. (Pressing the "RST" key twice.) In addition, when this light is illuminated, the alarm output contacts will be closed, initiating a remote alarm, if so connected.

BYPASS LIGHT - The bypass light, when illuminated, indicates that at least one of the compressors has been bypassed from control using the manual bypass switch. (Dip switch #3)

DEFROST LIGHT - When illuminated, the defrost monitor contacts are closed, and the IPC goes into the defrost run mode, which stops the floating setpoint operation, and keeps one compressor running.

**5.1.3 Air Temperature.** (Function 11) - When illuminated, the operator is displaying either the temperature setpoint, or the present temperature. When displaying present temperature, the "display present" light under the " suction" section will also be illuminated.

**5.1.4 Suction Section.** *The suction section indicator lights illuminate to show suction conditions and to* indicate what is presently being displayed on the LED readout.

MAXIMUM CUT-IN PRESSURE (Function 21) - When illuminated, the LED display is showing the upper limit to which the cut-in pressure can reach when the IPC is in the floating setpoint control mode.

CUT-IN PRESSURE (Function 22) - When illuminated, the LED display is showing the current cut-in suction pressure setting. This light will also illuminate when programing this value.

CUT-OUT PRESSURE (Function 23) - When illuminated, the LED display is showing the current cut-out suction pressure setting. This light will also illuminate when programing this value.

MINIMUM CUT-OUT PRESSURE (Function 24) - When illuminated, the LED display is showing the lower limit to which the floating strategy can adjust the cut-out pressure setting. This light will also illuminate when programing this value.

PUMP DOWN PRESSURE (Function 25) - When illuminated, the LED display is showing the pressure at which the IPC will turn off compressors due to an excessive low pressure condition. This light will also illuminate when programing this value, and when a pump down occurs.

HI SUCTION ALARM (Function 26) - When illuminated, the suction pressure has reached the high suction alarm value and has stayed above it for the alarm delay time (Function 43). This is a latched alarm, so that if the condition is corrected, the light will remain on until the "RST" key is pushed twice. The present suction pressure will automatically be displayed. In addition, during any alarm, the alarm output contacts will close, initiating a remote alarm, if so connected. The Hi Suction Alarm light will also illuminate when displaying or programing this value.

LO SUCTION ALARM (Function 27) - When illuminated, the tion pressure has reached the low suction alarm valued has stayed there for the alarm delay time (Function 43). The present suction pressure is automatically displayed, and the alarm output contacts close. This is a latched alarm that will stay until the "RST" key is pressed twice. This light will also illuminate when displaying or programing this value.

**DISPLAY PRESENT** (Function 28) - When illuminated, the LED display is showing either the present suction pressure, or the present reading of the temperature sensor. When showing the temperature sensor, the "air temperature" indicator light will also be illuminated.

**5.1.5 Discharge Section.** *The discharge section indicators give information about the discharge pressure settings and the LED display.*

**HI DISCHARGE CUT-OUT** (Function 31) - When illuminated, the discharge pressure reading has reached the high discharge cut-out value. This turns off all compressors. An alarm will be indicated if the discharge cut-out alarm option is selected with the proper dip switch. Reset may be manual or automatic, depending on the setting of the dip switches. To manual reset, press "RST" key twice.

**DISPLAY PRESENT** (Function 32) - When illuminated, the LED display is showing the present discharge pressure. (If the optional transducer is installed.)

**5.1.6 Timing Section.** *The timing section indicates, when displaying or programming, which time parameter is being shown on the LED readout.*

**INCREASE TIME** (Function 41) - When illuminated, indicates that the LED display is showing the time in seconds that the IPC will wait before adding capacity if the suction pressure is above the present cut-in setting.

**DECREASE TIME** (Function 42) - When illuminated, indicates that the LED display is showing the time in seconds that the IPC will wait before reducing capacity, if the suction pressure is below the present cut-out setting.

**ALARM DELAY** (Function 43) - When illuminated, indicates that the LED display is showing the time in minutes that alarm condition except pump down and high discharge must remain before the IPC turns on the alarm output and displays an alarm. Pump Down and High Discharge alarms occur immediately.

**5.1.7 Display Section.** The LED display screen is where all setpoint values and current pressure or temperature readings are displayed.

**5.1.8 Engineering Units.** When the LED display is showing any value, the respective engineering units light will be illuminated.

**5.1.9 Power Light.** Indicates if the IPC is being supplied with power.

**5.1.10 Compressor Status.** Indicates the on-off status of each set of compressor output contacts. When the light is on, the IPC contacts are closed, attempting to run the compressor.

**5.1.11 Key Pad.** The membrane keypad is used to enter data into the IPC and interrogate it for information. DO NOT USE SHARP OBJECTS TO PRESS KEYS. THIS MAY RESULT IN DAMAGE TO THE UNIT. Besides the normal numbered keys, there are six special keys as described below.

**FCN - FUNCTION.** This key is used to select a command (function) by its number, e.g. . FCN 22 = Cut-In pressure setting.

**RST - RESET KEY.** This key is used for resetting alarms and exiting and entering the programming mode.

**TST - TEST KEY.** This key is used to test the indicator lights on the front panel. You must be in the programing mode to use it. When pressed, all indication except the bypass and defrost lights should illuminate. Each light and LED segment will light in sequence. **Caution: Compressors will shut off and on during this test. Disconnect relay board at third terminal block to avoid this.**

**CLR - CLEAR KEY.** This key is used to clear an incorrect entry.

**ENT - ENTER KEY.** Before the IPC will actually respond to an entry, the operator must "enter" his command by pressing the "ENT" key.

**MINUS KEY.** The minus key allows you to enter negative numbers such as frozen food temperature setpoints.

A complete description of all of the "functions" that the IPC offers and their appropriate numbers may be found in Appendix B. There are many functions built in to the IPC, but not shown on the front panel.

## 5.2 Modes Of Operation.

*There are three basic modes of operation for the IPC:*

**5.2.1 Run Mode.** Normal operation. The controller is monitoring suction pressure and making control decisions. In the run mode, the IPC will display one of the following at the LED display:
1. "IPC"
2. Present Suction Pressure
3. Present Discharge Pressure
4. Present Temperature

While in the run mode (also program mode), the IPC is monitoring suction pressure, discharge pressure (option), and temperature (option). If the bypass switches are in the off position, the IPC will have control of the compressors, and will operate them based on the settings that have been entered into the unit's memory. If the bypass switches are in the "on" position, the outputs of the IPC are forced on, and the IPC can not control.

**5.2.2 Read Only Mode.** When the operator pushes the "FCN" key while the IPC is in the run mode, it automatically goes to the read mode, waiting for a function number.

The read only mode allows the operator to access the IPC's memory, but not change it.

Essentially, the IPC is in the read only mode anytime the "FCN" key is pressed when the controller is in the run mode. When the operator presses the "FCN" key followed by the function number and the "ENT" key, the IPC will show the requested data on the LED display screen for two seconds, and then return to the run mode. The exception to this is when the operator selects one of the run mode displays such as present temperature or present pressures. In this case, the IPC will continue to display the requested data continuously, while internally it will return to the run (control) mode after two seconds.

**5.2.3 Program Mode.** The operator can view and change all setpoints. You must know the three digit password to enter the program mode.

The programming mode allows you to view and or change any IPC settings.

To make changes to the IPC settings, the operator must be in the "programming mode." To enter the programming mode, the operator must know the three digit password for the particular unit he is using. See the Section 5.9 for details on entering the programming mode.

If left unattended in the programming mode, the IPC will automatically revert to the run mode after one minute.

## 5.3 Initial Programming.

The Intelligent Pressure Controller is simple to program.

*Once you have set the dip switches to match the application as described in Section 4.1.1 you are ready to begin.*

This programming section of the operator's manual is designed to take you step by step through the initial programming of the controller, and help you to determine control settings for different applications. If you are somewhat familiar with the IPC, or just need to view or change one or more settings, you may want to look at the quick reference guide that is in Appendix A and the functions listed in Appendix B.

Before actually entering the setpoints, it is convenient to determine ahead of time, what each of the settings will be.

Use the IPC programming form that is supplied with this manual. Extras may be found at the end of the booklet.

Starting on the left side of the form, there is a column entitled "FUNCTION." This column shows the function number for each of the pertinent entries as shown under the "DESCRIPTION" column.

The "VALUE" column is where you write in the actual setting that will be entered during programming. The engineering units are shown next to the value.

On the right of the page, the key sequence for each entry is found. The actual setting is inserted where words in "quotes" are shown. Sample forms with recommended settings for different application may be found in the Appendix.

The entries required are described beginning with Section 5.4.

## 5.4 Programming Step I - Determine the System Type.

*This step is only required if the compressors or steps are of uneven horsepowers or BTUHs*

**5.4.1 Standard Types.** The various compressor combinations and the "Type #" for most of the common types are shown in Table 5-1. These have been pre-programmed. Select the type for your applications and place the appropriate number on the programming form. For custom types see paragraph 5.4.2.

**5.4.2 Custom Types/Programmable Strategy.** This program was implemented on all units manufactured after Dec. 10, 1987.

*The Programmable Strategy feature allows users with uneven compressor horsepowers or with unloading type compressors, not covered by the Standard Types listed below, to program a custom strategy for their particular application.*

A step-by-step description of how to program and utilize a custom strategy follows:

### TABLE 5-1

### Uneven Compressor Types For Entry Into Function #86

| COMPRESSOR COMBINATION | STANDARD TYPE NUMBER |
|---|---|
| **TWO COMPRESSORS:** | |
| #1 smaller than #2. | 1 |
| **THREE COMPRESSORS:** | |
| #1 smaller than #2, #2 smaller than #3. | 2 |
| #1 equal #2, #2 smaller than #3. | 4 |
| #1 smaller than #2, #2 equals #3. | 5 |
| #3 twice #2, #2 twice #1 (binary). | 10 |
| **FOUR COMPRESSORS:** | |
| #1 smaller than #2, #2 smaller than #3, and #3 smaller than #4. | 3 |
| #1 equals #2, #2 smaller than #3, and #3 smaller than #4. | 6 |
| #1 smaller than #2, #2 equals #3, and #3 smaller than #4. | 7 |
| #1 smaller than #2, #2 smaller than #3, and #3 equals #4. | 8 |
| #1 equals #2, #2 smaller than #3, and #3 equals #4. | 9 |
| #1 smaller than #2, #2 equals #3, #3 equals #4. | 11 |

NOTE: Compressors should be wired to the IPC such that:

#1 is smaller or equal #2,   #2 is smaller or equal #3,   and #3 is smaller or equal #4.

NOTE: A reminder to be sure to disconnect the compressor wiring from the IPC before programming or reviewing a strategy.

First, enter the password mode by pressing the "RST" key and entering the password. A 'C' will appear in the display. Press the "FCN" key to show an "F" in the display; then enter "55" followed by the "ENT" key. The number that appears in the display at this time is the number of steps (including the ALL OFF step) in the programmed strategy. A value of "000" means there is no strategy programmed. A sample strategy is described here.

SAMPLE STRATEGY:

| OUTPUT NO. | 1 | 2 | 3 | 4 | |
|---|---|---|---|---|---|
| Step #1 - | 0 | 0 | 0 | 0 | (All Off) |
| #2 - | 0 | 0 | 1 | 0 | |
| #3 - | 1 | 0 | 0 | 0 | |
| #4 - | 0 | 0 | 1 | 1 | |
| #5 - | 1 | 0 | 1 | 0 | |
| #6 - | 0 | 1 | 1 | 1 | |
| #7 - | 1 | 0 | 0 | 1 | |

Note: 1 = On; 0 = Off.

For this example, after entering the "FCN" "55" you would enter a "7" followed by "ENT" key to tell the IPC that there will be 7 steps in the strategy. When you do this the display will show "001" and the compressor status LED's will show how the outputs are to be for step #1. Once you are in this mode, press the numbers "1", "2", "3" and/or "4" of the output you want to change (1 thru 4). Each time you press one of these numbers the corresponding status LED will toggle. For the above example, we want all outputs off in step #1. so press "ENT". This registers step #1 into (temporary) memory and moves to the next step. The display now should show 002, ready for step #2. In the example we want output #3 to be on, so press key "3" to toggle that output on. Now press "ENT" key to place into (temporary) memory and to move to step #3. In step #3 we want output #1 to be on so press key "1" and then "ENT" to move on to step #4. In step #4 we want outputs #3 and #4 to be on so press keys "3" and "4" and then "ENT". Continue this procedure for steps 5, 6, and 7. When you press "ENT" after setting up the last step #7, the display and output status LED's will go to step #1.

You may now review your strategy by pressing "ENT" to move to the succeeding step or "_" to move to the preceding step.

IMPORTANT: *To actually write the strategy in to memory you must press the "TST" key. So when you are satisfied with the strategy, press the "TST" key. Pressing the "FCN" or "RST" keys will discard any changes you made during this session.*

When you have finished programming the strategy, you must set "FCN" "86" to "0" to tell the IPC that you want to run the programmable strategy.

## 5.5 Programming Step II - Determine the Target Temperature.

*This step is only required if the optional temperature sensor was installed in the "lead" fixture for controlling a floating suction pressure set point based on refrigerator temperature.*

This is the temperature at which you want to control the Discharge Air Stream of the case that has the sensor installed. Make sure that EPR's, or liquid line solenoid valves on this circuit are set substantially below the target temperature so that they do not interfere with the IPC controller during normal operation.

A list of fixture types and suggested target temperatures are shown in Table 5-2.

Place the appropriate target temperature in the space provided on the programming form.

## TABLE 5.2

## Recommended Target
### Temperatures

| APPLICATION | TARGET TEMP.-°F(°C) |
|---|---|
| Fresh Meat Self Service | +22(-05) |
| Multideck Meat (Rear Service) | +21(-06) |
| Multideck Fresh Meat (Solid Back) | +27(-03) |
| Multideck Deli (rear coil) | +29(-02) |
| Multideck Dairy | +33(0.5) |
| Island Produce | +32(0.0) |
| Single Deck Top Discharge Prod. | +38(03) |
| Single Deck Rear Discharge Prod. | +32(0.0) |
| Single Deck Frozen Food | -13(-25) |
| Single Deck Ice Cream | -23(-30) |
| MultiDeck Frozen Food | -06(-21) |
| Multideck Ice Cream | -14(-26) |
| Glass Door Reach In Frozen Food | -02(-19) |
| Glass Door Reach In Ice Cream | -10(-23) |
| Ice Cream Walk In | -15(-27) |
| Frozen Food Walk In | -05 TO -10(-20 TO -23) |
| Meat Walk In | +30(-01) |
| Deli Walk In | +30(-01) |
| Dairy Walk In | +35(02) |
| Produce Walk In | +36(03) |

## 5.6 Programming Step III - Determine The Pressure Settings.

**5.6.1 Suction Cut-in And Cut-out Pressure Settings.** Table 5-3 gives suggested settings for different applications. Keep in mind, that if you are using the optional temperature sensor, the floating strategy will search for the appropriate cut-in and cut-out settings. The most important consideration then is the differential that you determine when you choose your starting cut-in and cut-out values. The differential will remain constant, even during the floating operation.

**5.6.2 Suction Minimum Cut-In and Maximum Cut-In.** (Only used when the temperature sensor is used.) Once you have determined the starting cut-in and cut-out pressure settings, you can determine the Upper and Lower limit pressure settings. These are the limits for the cut-in and cut-out settings during the floating setpoint strategy.

**5.6.3 High and Low Suction Alarm** Settings. High and Low suction alarm settings should be set 3 to 5 pai above and below your starting cut-in and cut-out. Enter these in the appropriate space on the programming form.

**5.6.4 Pump Down Pressure Setting.** The pump Down pressure setting is to protect the system from pumping quickly to a vacuum. Set the pump down setting at 2 or 3 psi. Enter this value on your programming form.

**5.6 .5 Summary Suction Pressure Strategy.** Figure 5-2 gives a graphic representation of the suction pressure settings strategy that need to be entered into the IPC.

NOTE: *When the optional temperature sensor is installed and the floating strategy dip switch is on, the IPC will adjust the cut-in and cut-out settings up and down to satisfy the temperature setpoint that is entered. The cut-in upperlimit*

### TABLE 5-3

### Suction Pressure Settings
### (Approximate)

REFRIGERANT

| APPLICATION | R-12 | | R-22 | | R-502 | |
|---|---|---|---|---|---|---|
| | CUT-IN | CUT-OUT | CUT-IN | CUT-OUT | CUT-IN | CUTOUT |
| | | | (# = psig, b = bars) | | | |
| Ice Cream(open) | -- -- | -- -- | -- -- | -- -- | 15#(1.0b) | 05#(0.4b) |
| MultiDeck Frozen | -- -- | -- -- | 25#(1.8b) | 15#(1.0b) | 30#(2.1b) | 20#(1.4b) |
| Glass Door Frozen | - -- | -- -- | 28#(2.0b) | 13#(0.9b) | 30#(2.1b) | 15#(1.0b) |
| Glass Door I.C. | -- -- | -- -- | -- -- | -- -- | 23#(1.6b) | 10#(0.7b) |
| Glass Dr. Med. | 20#(1.4b) | 10#(0.7b) | 40#(2.8b) | 30#(2.1b) | 50#(3.4b | )34#(2.4b) |
| Meat Cases M | 20#(1.4b) | 10#(0.7b) | 40#(2.8b) | 30#(2.1b) | 50#(3.4b) | 34#(2.4b) |
| D Dairy/Deli | 26#(1.8b) | 16#(1.1b) | 55#(3.8b) | 45#(3.1b) | 60#(4.2b) | 48#(3.4b) |
| Rear Serv. Dairy | 26#(1.8b) | 16#(1.1b) | 55#(3.8b) | 45#(3.1b) | 60#(4.2b) | 48#(3.4b) |
| Closed Serv. Mt. | 36#(2.5b) | 20#(1.4b) | 40#(2.8b) | 28#(2.0b) | 75#(5.2b) | 55#(3.8b) |
| Produce | 40#(2.8b) | 30#(2.1b) | -- | -- | -- -- | -- -- |

The MAXIMUM CUT-IN should be set at the highest cut-in pressure that the system should ever float to.

The Minimum Cut-Out should be set at the lowest cut-out pressure that the system should ever float to.

Typically, these values are 5-10 psi above and below your starting cut-in and cut-outs respectively. Enter these on your programm form.

*and the cut-out lower limit are the limits between which this adjustment can occur. The differential remains fixed at all times.*

**5.6.6. High Discharge Cut-Out Setting** *(Option). Where the IPC is installed with a discharge pressure transducer, you must enter a high discharge cut-out setting. Table 5-4 gives recommended settings for different refrigerants.*

## TABLE 5-4

## High Discharge Cut-Out Settings (approxmate)

| REFRIGERANT | SETTING |
|---|---|
| R-502 | 325-350 psi (22.4-24.1 bars) |
| R-22 | 325-350 psi (22.4-24.1 bars) |
| R-12 | 200-225 psi (13.8-15.5) bars) |

## 5.7 Step IV Determine Timing Parameters.

There are three time parameters which must be entered: *Cut-In Delay Time, Cut-Out Delay Time, and the Alarm Delay Time.*

**5.7.1 Cut-In Delay Time.** *Cut-In delay is the time, in seconds, that the IPC will wait before adding capacity if the suction pressure is above the cut-in pressure setting.* It is adjustable from 0 to 240 seconds. After a power failure, this is also the delay between compressor start-ups. Recommended setting is 120 to 180 seconds. Place this value on the programming form.

**5.7.2 Cut-Out Delay Time.** *Cut-Out Delay is the time in seconds that the IPC will wait before decreasing capacity if the suction pressure falls below the cut-out setting.* Recommended setting is between 10 and 20 seconds. Enter this on the programming form.

**5.7.3 ALARM DELAY.** *The Alarm Delay is the time in minutes that the IPC will wait before generating an alarm.* An alarm causes the alarm indicators to illuminate and the external alarm contacts to close. Alarm delay is associated only with high and low suction alarms.

The delay insures that nuisance alarms will not occur because of defrost cycles or temporary conditions. Recommended setting is 60 minutes.

## 5.8 Step V Determine The Satellite temperature Settings.

*(Optional)*

Using Table 5-2, determine a satisfactory temperature for the satellite circuit. Enter a cut-in temperature and a cut-out temperature on the programming form that will maintain the desired temperature, yet assure that short cycling will not occur.

HIGH-SUCTION-ALARM

When the pressure is above this settingfor the alarm delay time, the high suction alarm is initiated.

MAXIMUM-CUT-IN------------------------------------------------*UPPER LIMIT*-------------------------------------------------

When the pressure is above cut-in for the increase delay time, the IPC increases compressor capacity.

CUT-IN-PRESSURE-------------------------------------------------------------------------------------------------------------

When the pressure is in this rea the IPC does not change compressor capacity.

CUT-OUT-PRESSURE------------------------------------------------------------------------------------------------------------

The decrease delay time, the IPC decreases compressor capacity.

MINIMUM-CUT-OUT------------------------------------------*LOWER LIMIT*-----------------------------------------------
LOW-PRESS.-ALARM

When the pressure is below the low pressure alarm setting for the alarm delay time, the low suction alarm is initiated.

PUMP-DOWN-PRESSURE----------------------------------------------------------------------------------------------------

Whenever the pressure falls below this setting, all compressors are turned off and an alarm is initiated.

## Figure 5-2

## Suction Pressure Strategy.

## 5.9 Entering Parameters.

To enter data, you must have the three digit password for your system. The password is set to "123" when the units are shipped from the factory.

**5.9.1 Entering The Password.** To begin, enter the password as follows:

Press [RST] - The display will show "P", prompting you for the password.

Enter the Password _ _ _ - The display will show "C" if your password was valid, indicating the IPC is ready for a command.

**5.9.2 Entering Commands.** The commands are defined by the function numbers that are next to the appropriate indicator lights on the front panel and on the inside of the door on the metal shield and, under the function column on the programming form. Refer to Paragraph 5.10 and Appendix B for description of the Function Numbers.

*To enter or change a value, use the following key sequence. If you make an error, use the "CLR" key to clear the present display so that you can re-enter the correct value.*

| STEP | PRESS | DISPLAY WILL SHOW |
|------|-------|-------------------|
| 1 | FCN | "F" |
| 2 | "FUNCTION #" | "FUNCTION #" |
| 3 | ENT | CURRENT VALUE IN MEMORY |
| 4 | "NEW VALUE" | "NEW VALUE" |
| 5 | ENT | "NEW VALUE" |

The new value is now stored in memory. Follow this sequence for all of the items on the programming form if it is a new installation. To return to the "run mode", press the "RST" key three times, or until the display shows either present pressure, present temperature, or "IPC."

To display any of your entries, simply push the "FCN" key followed by the appropriate function number, and then "ENT." When in the programming mode, the display will continue to show the parameter for 60 seconds, or until you enter a new command. If you do not make an entry for 60 seconds, the IPC will revert to the run mode.

When reviewing data while the IPC is in the run mode, the display will show the requested data for two seconds and then return to the run mode.



**FIGURE 5-3**

**Front Panel Functions**
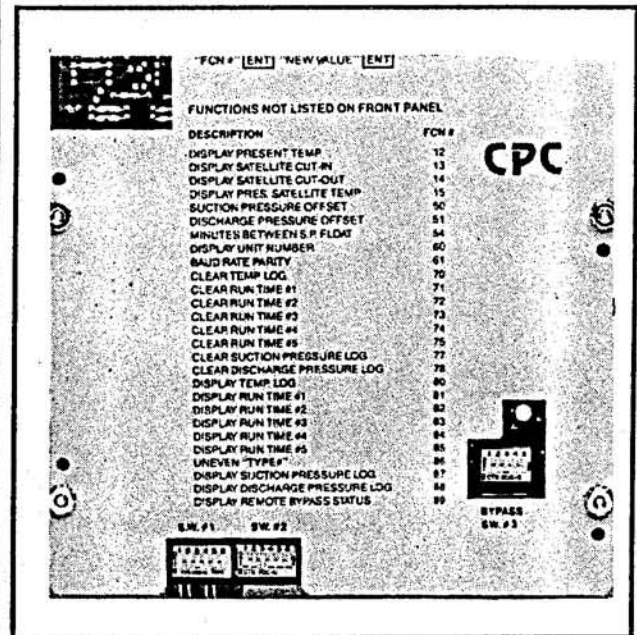


**FIGURE 5-4**

**Inside Door Functions**

## FRONT PANEL FUNCTIONS

FUNCTION NO.                                  DESCRIPTION

11          Display or change temperature setpoint

21          Display or change maximum cut-in. This is the upper limit that the cut-in pressure will float to if using the temperature sensor to float pressure set points.

22          Display or change cut-in pressure. this is the value of suction pressure at which the IPC will start adding compressor capacity.

23          Display or change cut-out pressure. This is the value of suction pressure at which the IPC will start decreasing compressor capacity.

24          Display or change minimum cut-out. This is the lower limit that the cut-out setting will float to when using the temperature sensor to float pressure setpoints.

25          Display or change pump down pressure. This is the suction pressure at which the IPC will turn off all compressors and generate a system alarm.

26          Display or change hi suction alarm setting. if he suction pressure is above this setting for the alarm delay time, the IPC initiates an alarm.

27          Display or change lo suction alarm setting if the suction pressure is below this setting for he delay time. The IPC Initiates an alarm.

28          Display present suction pressure.

31          Display or change high discharge cut-out setting. if the discharge pressure is above this setting, All compressors go off. depending on the dip switch B settings (see par.4.1.1), the IPC will either auto reset or may need manual reset, and system alarms may or may not occur.

32          Display present discharge pressure.

41          Display or change the cut-in time. This is the time in seconds that the IPC will wait before adding capacity if the suction pressure is above the cut-in setting.

42          Display or change the decrease time. This is the time in seconds that the IPC will wait before reducing capacity if the suction pressure is below the cut-out setting.

43          Display or change the alarm delay time. This is the time in minutes that the IPC will wait after first indications of a system alarm before actually initiating indicators and the alarm output relay.

## 5.10 Functions.

*The Intelligent Pressure Control has the functions that are shown on the front panel and as shown on the shield just inside the door.*

See Figure 5-3 and 5-4. In addition there are some added functions not listed on the shield inside the door, depending upon the version you may have. A list of all functions is shown here. A comprehensive list of all IPC functions, by category, may be found in Appendix B.

**5.10.1 Front Panel Functions.** Figure 5-3 depicts the functions as printed on the front panel and which are listed above.

**5.10.2 Inside Door Shield Functions.** *Additional functions are printed just inside the door on the metal shield as depicted in Figure 5-4. These are shown on the next page. (Page 5-11)*

**5.10.3 Additional Functions.** The added functions listed here may or may not be included in your IPC Version. All units manufactured after December 10, 1987 will include Functions #52 and #55.

FUNCTION NO.                  DESCRIPTION

52          Disables pump down feature.
            "1" = disable
            "0" = enable

55          Uneven compressor strategy program

# INSIDE DOOR FUNCTIONS

| FUNCTION NO. | DESCRIPTION |
|---|---|
| 12 | Displays present temperature reading. |
| 13 | Display or change satellite cut-in temperature. |
| 14 | Display or change satellite cut-out temperature. |
| 15 | Display present satellite temperature. |
| 50 | Display or change suction pressure offset. |
| 51 | Display or change discharge pressure offset. |
| 54 | Time between floating setpoint adjustments. |
| 60 | Unit I.D. # -used only with remote communications. |
| 61 | Baud rate, parity, data bits -used only with remote communications. |
| 70 | Clear the temperature log. |
| 71 | Clear the run time for compressor #1. |
| 72 | Clear the run time for compressor #2. |
| 73 | Clear the run time for compressor #3. |
| 74 | Clear the run time for compressor #4. |
| 75 | Clear the run time for compressor #5. |
| 80 | Display the temperature log. Displays one reading for each 15 minute period for the four previous hours. The display will flash 16 readings from most recent to the oldest. |
| 81 | Displays the run time for compressor #1 since last cleared with function #71. the run time is shown in two parts. The display will flash once with the Ten Thousands/Thousands and again with the Hundreds/Tens/Ones. For example: |

<div align="center">

Run time = 3516 hrs.
..Display flashes...003
..............................then...516.
Another example:
Run Time = 29042 hrs.
...Display flashes...029
.............................then...042.

</div>

Note: *Run times will automatically clear after 32,000 hours and will start over at zero.*

| | |
|---|---|
| 82 | Display the run time for compressor #2. |
| 83 | Display the run time for compressor #3. |
| 84 | Display the run time for compressor #4. |
| 85 | Display the run time for compressor #5. |
| 86 | Display or change the system "type" for uneven compressors. |
| 87 | Display suction pressure log. Displays one reading for each 15 minute period for the four previous hours. The display will flash 16 readings from most recent to the oldest. |
| 88 | Display discharge pressure log. |
| 89 | Display remote bypass status. |

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# SECTION VI

# Operating The IPC

## 6.1 Putting IPC Under Control.

Before putting the IPC under control, the mechanical pressure controls, if left in the circuit, must be set so that they will not interfere under normal IPC operation, yet offer protection in the event the IPC fails.

*To accomplish this, set each mechanical pressure control so that the cut-out is just below the "minimum cut-out" setting of the IPC, and the cut-in where it will supply proper refrigeration control if the IPC fails.*

In general, if the mechanical cut-outs are below the cut-outs of the IPC, they will not open unless there is a failure in the computer. For this reason, the cut-in settings will not interfere with the IPC during normal operation. i.e. during normal IPC operation, the mechanical controls are always "on."

After the mechanical pressure settings are adjusted you may put the IPC under control. Remove the bypasses by switching the selectors on dip switch #3 (under the power light on the inside of the door) to the off (down) position. This permits control by the IPC.

Once you are sure that the switch settings are in the desired position, apply power to the unit, and switch on the power supply switch located in the lower right hand corner of the power interface board, next to the green power indicator light.

The display will now read "IPC" and is operational and ready for data entry if desired.

## 6.2 Principle Of Operation.

6.2.1 SUCTION PRESSURE CONTROL. The Intelligent Pressure Control continuously measures the value of the refrigerant pressure in the suction manifold and compares it to a cut-in pressure setting and cut-out pressure setting.

If the actual suction pressure is greater than the present cut-in pressure setting for the time delay specified by the program, the refrigeration capacity is increased by adding a compressor, or in the case of uneven strategies, changing the combination of compressors that are running.

If the actual suction pressure is less than the present cut-out pressure setting for the time delay specified by the program, the controller reduces capacity by turning off a compressor or changing the combination of compressors that are running.

*When the actual suction pressure is between the current cut-in and cut-out pressure settings, no action takes place. That is, the capacity that is being supplied is not changed.*

CONTROL WITH FLOATING SETPOINT STRATEGY:

The customer, at his option, may install a temperature sensor in the discharge air stream of the coldest circuit on the system and connect it to input terminals on the Intelligent Pressure Control. Dip switch #2 position #1 must be in the "on" position to make this feature operational. (See Paragraph 4.1.1).

When this is done, the controller automatically compares the actual temperature in the refrigerated space to a target temperature selected by the customer.

If the actual temperature is one degree or more above the target temperature for the programmed time between floating set point adjustment (see Function 54 Section 5.10.2), the IPC subtracts one psi from the current cut-in pressure setting, and one psi from the current cut-out pressure setting, as long as preset limits are not exceeded.

If the actual temperature is one degree or more below the target temperature for the programmed time, the IPC adds one psi to the current cut-in pressure setting and one psi to the current cut-out setting, as long as preset limits are not exceeded.

If the actual temperature is within target plus one degree and target minus one degree, the IPC makes no changes to the current cut-in and cut-out pressures.

The time between pressure adjustments may be changed using the key pad of the IPC (Function 54). For most refrigerated cases the preset 10 minute delay is appropriate

The floating strategy allows the IPC to automatically adjust for seasonal and day/night changes in store conditions.

SUCTION PRESSURE CONTROL - EVEN COMPRESSORS:

In the above principle of operation, if the system consist of even compressors the sequence of operation will call for the next compressor in accordance to the setting of Dip Switch #1 Position 4. See Section 4.1.1. If this switch is off then the first compressor on will be the first compressor off. This selection will result in equalized compressor run time.

If the switch is on then the first compressor on will be the last compressor off. This selection does not provide equalized compressor run time.

SUCTION PRESSURE CONTROL - UNEVEN COMPRESSORS:

In the above principle of operation, if the system consist of uneven compressors, the sequence of operation will call for the next compressor in accordance with the System Type programmed. See Section 5.4. The sequence for each type is as shown in Table 6-1.

## TABLE 6-1

## Uneven Compressor Sequence For Each Type

| TYPE | STEP | COMPRESSOR STATUS | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| 1 | 1 | ON | OFF | NA | NA |
| | 2 | OFF | ON | NA | NA |
| | 3 | ON | ON | NA | NA |
| 2 | 1 | ON | OFF | OFF | NA |
| | 2 | OFF | ON | OFF | NA |
| | 3 | OFF | OFF | ON | NA |
| | 4 | ON | OFF | ON | NA |
| | 5 | OFF | ON | ON | NA |
| 3 | 1 | ON | OFF | OFF | OFF |
| | 2 | OFF | ON | OFF | OFF |
| | 3 | ON | ON | OFF | OFF |
| | 4 | ON | OFF | ON | OFF |
| | 5 | ON | OFF | OFF | ON |
| | 6 | OFF | ON | OFF | ON |
| | 7 | OFF | OFF | ON | ON |
| | 8 | ON | OFF | ON | ON |
| | 9 | OFF | ON | ON | ON |
| | 10 | ON | ON | ON | ON |
| 4 | 1 | ON | OFF | OFF | NA |
| | 2 | OFF | OFF | ON | NA |
| | 3 | OFF | ON | ON | NA |
| | 4 | ON | ON | ON | NA |
| 5 | 1 | ON | OFF | OFF | NA |
| | 2 | OFF | ON | OFF | NA |
| | 3 | ON | ON | OFF | NA |
| | 4 | OFF | ON | ON | NA |
| | 5 | ON | ON | ON | NA |
| 6 | 1 | ON | OFF | OFF | OFF |
| | 2 | ON | ON | OFF | OFF |
| | 3 | OFF | ON | ON | OFF |
| | 4 | OFF | OFF | ON | ON |
| | 5 | OFF | ON | ON | ON |
| | 6 | ON | ON | ON | ON |

## TABLE 6-1 CONT'D.

## Uneven Compressor Sequence For Each Type

| TYPE | STEP | COMPRESSOR STATUS | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| 7 | 1 | ON | OFF | OFF | OFF |
| | 2 | OFF | OFF | ON | OFF |
| | 3 | ON | OFF | ON | OFF |
| | 4 | ON | OFF | OFF | ON |
| | 5 | OFF | OFF | ON | ON |
| | 6 | ON | OFF | ON | ON |
| | 7 | OFF | ON | ON | ON |
| | 8 | ON | ON | ON | ON |
| 8 | 1 | ON | OFF | OFF | OFF |
| | 2 | OFF | ON | OFF | OFF |
| | 3 | ON | ON | OFF | OFF |
| | 4 | ON | OFF | OFF | ON |
| | 5 | OFF | OFF | ON | ON |
| | 6 | OFF | ON | ON | ON |
| | 7 | ON | ON | ON | ON |
| 9 | 1 | ON | OFF | OFF | OFF |
| | 2 | ON | ON | OFF | OFF |
| | 3 | ON | OFF | ON | OFF |
| | 4 | ON | ON | ON | OFF |
| | 5 | OFF | ON | ON | ON |
| | 6 | ON | ON | ON | ON |
| 10 | 1 | ON | OFF | OFF | NA |
| | 2 | OFF | ON | OFF | NA |
| | 3 | ON | ON | OFF | NA |
| | 4 | OFF | OFF | ON | NA |
| | 5 | ON | OFF | ON | NA |
| | 6 | OFF | ON | ON | NA |
| | 7 | ON | ON | ON | NA |
| 11 | 1 | ON | OFF | OFF | OFF |
| | 2 | OFF | ON | OFF | OFF |
| | 3 | ON | ON | OFF | OFF |
| | 4 | OFF | ON | ON | OFF |
| | 5 | ON | ON | ON | OFF |
| | 6 | OFF | ON | ON | ON |
| | 7 | ON | ON | ON | ON |

For Custom Uneven Compressor Types refer to Section 5.4.2 for the sequence

**6.2.2 Discharge Pressure Cut-Out.** The discharge pressure option, when used, protects the compressors from high pressures and provides alarm notices. As the discharge pressure rises above the set point it will automatically shut down all compressors. An alarm is indicated if the dip switch #2 position 3 "on" cut-out alarm has been selected. Reset is manual or automatic, depending on the setting of dip switch #2 position 2. If manual is selected, to reset, press "RST" key twice. If automatic is selected, the compressor will stage on one at the time after the discharge pressure has dropped either 50 psi or 25 psi below the cut-out setting as selected by the setting of dip switch #2 position 4.

**6.2.3 Pump Down Cut-out.** The pump down feature may be used to shut down all compressors instantly should the suction pressure go below the pump down setting. If dip switch #2 position 6 is in the "on" position an alarm is indicated. When the suction pressure rises above the pump down setting, the compressors will restart in time delayed stages.

**6.2.4 Satellite Compressor Control.** This option may be used by the use of a temperature sensor. The satellite compressor will cycle in accordance with the satellite cut-in and cut-out temperature setting.

**6.2.5 Defrost Interaction.** For systems using hot gas type defrost, it is important that one or more compressors be operating during a hot gas defrost period. The IPC Intelligent Pressure Control is designed to provide this important control feature. To signal the IPC and let it know when a circuit is in hot gas defrost, terminal numbers 15 and 16 must be wired to an electrical contact (relay or clock) to show a closed contact to #15 and #16 indicating the defrost status. The Master Liquid Line Solenoid used on most systems can be used with a relay to provide this status function.

When terminals #15 and #16 see a closed condition, indicating a hot gas defrost "ON" status, the IPC will allow the compressors to cycle on and off as normal except that one compressor will remain on for the duration of the defrost period. This assures that hot gas is being pumped into the circuit being defrosted.

At the defrost termination, the contacts to terminals #15 and #16 open indicating to the IPC that defrost status is now "OFF". For all controls manufactured after Dec. 10, 1987, at defrost termination, the Cut-Out Delay Time is reset. This permits the system to balance during the Cut-Out Delay Time without allowing a compressor to cut off.

# SECTION VII

# Trouble Shooting

## 7.1 General.

The IPC is designed to operate without the need for regular maintenance or adjustments. This trouble shooting guide is provided in the event that a problem may appear at start up or develop in the use of the IPC.

## TABLE 7-1

### Trouble Shooting Guide

| SYMPTOM | POSSIBLE CAUSE | CORRECTIVE ACTION |
|---|---|---|
| **1.** No lights on Front Panel and IPC not controlling compressors. | No A.C. power supplied to IPC. | Check voltage at power input terminals . |
| | Voltage Selection Jumper not correct. | Check to see that it is in place and correct. |
| | Four green LED's on PIB Board not "ON". | Check and replace power supply fuse. Fuse OK, replace PIB Board. |
| | Ribbon connector cable between CPU and PIB is loose or defective. | Check to be sure it is firmly connected or replace if necessary. |
| | Display Board is defective. | Replace. |
| **2.** No Lights on Front Panel but IPC is controlling com- | Four Green LEDs on PIB are not "ON". | Replace PIB Board. |
| | Four Green LEDs on PIB are "ON". | Replace Display Board. |
| **3.** Suction Pressure Reading Zero. | Transducer Connector is loose (older type). | Check and secure. |
| | Improper Transducer Wiring. | Check for proper wiring at PIB terminals. |
| | No +12 VDC at PIB terminal #9. | Set voltmeter to +DC and measure between Ter.#11 (common) and #9 (positive) for12 VDC. If none, Disconnect Transducer and measure again. If still none, replace PIB and reconnect the Suction Transducer. |
| | No 1 V to 6 V at PIB terminal #10. | Read Voltage as above for terminal #10. If no reading between 1 and 6 volts, replace the Suction Transducer. |

## TABLE 7-1 CON'T.

### Trouble Shooting Guide

| SYMPTOM | POSSIBLE CAUSE | CORRECTVE ACTION |
|---|---|---|
| **4.** Suction Pressure less than Nine PSI Off. | Calibration off. | Use Function 50 to set the Suct. Pressure Offset Pressure Offset to the difference between your accurate gauge and the IPC Display. |
| **5.** Suction Pressure more than Nine PSI Off. | Calibration off. | Measure the Voltage between terminals #10 and #11 at PIB Board. Compare that to the Pressure /Voltage as listed in Table 7-2. If not correct, replace the Suction Transducer. <br><br> If correct, replace the CPU Bd. |
| **6.** Discharge Press-ure reading Zero. | Transducer Connector is loose (older type). | Check and secure. |
| | Improper Transducer wiring. | Check for proper wiring at PIB |
| | No +12 VDC at PIB Terminal #12. | Set voltmeter to +DC and measure between Ter. #14 (common) and #12 (positive) for 12 VDC. If none, Disconnect Transucer and measure again. |
| **7.** Discharge Pressure less than 50 PSI Off. | Calibration off. | Use Function 51 to set the Disch. Pressure Offse t to the differerence between your accurate gauge and the IPC Display. |
| **8.** Discharge Pressure more than 50 PSI Off. | Calibration off. | Measure the Voltage between terminals #13 and#14 at PIB Board. Compare that to the Pressure /Voltageas listed in Table 7-3. If not correct, replace the Discharge Transducer. If correct replace the CPU Bd. |
| **9.** Lead Case Temp. Reading Minus 40°F or "OPE". | Temp. Sensor or wires to temp. sensor have an open circuit. | Check and replace or repair. |
| **10.** Lead Case Tem Reading Plus 99°F or "SHO". | Temp. Sensor or wires to temp. sensor have shorted circuit. | Check and replace or repair. |
| **11.** Lead Case Temp. Reading Incorrect. | Bad Sensor | Remove temperature Sensor wires from PIB terminals #7 & #8. With Ohmmeter measure the resistance of the Sensor. Compare the measured value to that shown in Table 7-4. If it does not match the Table's value, replace the Sensor. |
| | No shielding of wires | Check and replace or if shielded, ground at panel only. |

## TABLE 7-1 CON'T.

## Trouble Shooting Guide

| SYMPTOM | POSSIBLE CAUSE | CORRECTVE ACTION |
|---|---|---|
| **12.** IPC not Floating the Cut-IN and Cut-Out. | Dip Switch not set. | Set Switch 2 Position 1 to "ON". Turn the IPC Power off and back on. |
| | Lead Case Temp. is above set point for more than the Float Time. | Use Function 12 to read the present and compare to the Set Point using Function 11. If so, IPC will not Float. Float Time of 10 minutes is normal.hange the Float time, if desired to a longer period. |
| | Maximum Limits of Cut-In and Cut-Out Set Points, too close. | Adjust as desired using Functionm 21 and 24. |
| **13.** IPC not Control- of compres- ing correct num- sors. | Dip switch not set. | Set Switch 1 Pos.1 and 2 for number |
| | Incorrect System Type. | For uneven operation, use Function 86 to set correct System Type. |
| **14.** Satellite not con- trolled Properly. | Bad Sensor or wires to Sensor. | Remove temperature Sensor wires from PIB terminals #5 & #6. With Ohmmeter measure the resistance across the sensor. #6. With Ohmmeter measure the resitance across the Sensor. Compare the measured value to that shown in Table 7-4. If it does not match the Table's value, replace the Sensor. |
| | Shorted Sensor | If Function 15 reads minus 40°, repair short or replace sensor. |
| | Open circuit in sen- sor or sensor wires. | If Function15* reads plus 99°F(37°C) repair open or replace sensor. |
| | Cut-In and Cut-Out not set properly. | Re-set using Func. 13 and 14. |
| | Dip Switch not Set. | Set Switch 2 Position 5 to "ON". |
| **15.** Compressor stays on all the time. | Bypass switch not set. | Set Switch 3 Pos. 1, 2, 3, 4, and/or 5 to "OFF" to allow IPC control. |
| | Remote Bypass (Communication OptionOnly) | Use Function 89 to check for Bypass. |
| | Relay Board | If the compressor is to be turned off, there should be 12 volts from the IPC to the Relay Board . If so replace the Relay Board. |

* Present satellite temperature.

## 7.3 Transducer Voltage and Sensor Resistance Charts.

| TABLE 7-2 | | TABLE 7-3 | |
|---|---|---|---|
| **Suction Transducer** | | **Disacharge Transducer** | |
| **Pressure/Voltage Chart** | | **Pressure/Voltage Chart** | |
| Pressure | Voltage(D.C.) | Pressure | Voltage(D.C.) |
| 0(0 bars) | 1.0 | 0(0 bars) | 1.0 |
| 10(0.69 bars | 1.5 | 50(3.45 bars) | 1.5 |
| 20(1.38 bars) | 2.0 | 100(6.89 bars) | 2.0 |
| 30(2.07 bars) | 2.5 | 150(10.34 bars) | 2.5 |
| 40(2.76 bars) | 3.0 | 200(13.79 bars) | 3.0 |
| 50(3.45 bars) | 3.5 | 250(17.24 bars) | 3.5 |
| 60(4.14 bars) | 4.0 | 300(20.68 bars) | 4.0 |
| 70(4.83 bars) | 4.5 | 350(24.13 bars) | 4.5 |
| 80(5.52 bars | 5.0 | 400(27.58 bars) | 5.0 |
| 90(6.21 bars) | 5.5 | 450(31.03 bars) | 5.5 |
| 100(6.89 bars) | 6.0 | 500(34.47 bars) | 6.0 |

### TABLE 7-4
### Temperature Sensor Resistance/$^o$F ($^o$C) Chart

| RESISTANCE | TEMPERATURE | | RESISTANCE | TEMPERATURE | |
|---|---|---|---|---|---|
| (ohms) | ($^o$F) | ($^o$C) | (ohms) | ($^o$F) | ($^o$C) |
| 336,450 | -40 | -40 | 34,565 | 30 | -01 |
| 234,170 | -30 | -34 | 26,100 | 40 | 04 |
| 165.210 | -20 | -29 | 19.899 | 50 | 10 |
| 118,060 | -10 | -23 | 15,311 | 60 | 16 |
| 85,399 | 0 | -18 | 11,883 | 70 | 21 |
| 62,493 | 10 | -12 | 9,299 | 80 | 27 |
| 46,235 | 20 | -07 | 7,334 | 90 | 32 |

# SECTION VIII

# Parts List

## 8.1 General.

This section lists the components that are shipped standard with each CPC IPC Intelligent Pressure Control. Figure 8-1 shows the layout of the circuit boards in the IPC. It is to be used as a guide should the replacement of circuit boards ever become necessary.

## 8.2 List Of Parts.

### TABLE 8-1

### Parts List

| Quantity | Part # | Description |
|----------|--------|-------------|
| 1 | 113-0093 | Door Lock and Key |
| 1 | 135-3406 | Ribbon Cable 34 Pin x 6 |
| 1 | 143-1234 | Front Panel/Key Pad |
| 1 | 144-0059 | MSTB8 Connector Terminal |
| 1 (Option) | 501-1121 | Temperature Sensor |
| 1 | 537-4212 | PIB Power Interface Board |
| 1 | 537-4124 | Relay Board |
| 1 | 537-4121 | Display Board |
| 1 | 537-4130 | CPU Processor Board Complete |
| | 800-1004 | IPC With Suction Transducer |
| 1 | 800-0101 | 100psi(6.89 bars) Suction Transduer |
| 1(Option) | 800-0501 | 500psi{34.48bars) Discharge Transducer |

### FIGURE 8-1

### Layout Of

### Boards
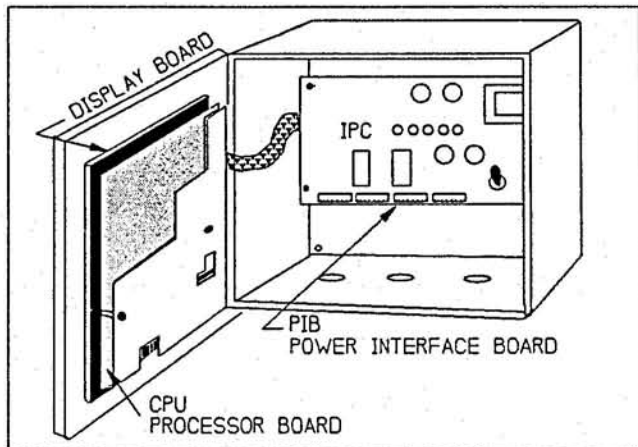
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# APPENDIX A

# Quick Reference Operator's Guide

## RESET ALARMS:

To reset any alarms press **RST RST**

## VIEW DATA ONLY (NO CHANGES TO MAKE):

*To view setpoints, current pressures and temperatures, and other stored information:*

1. Find the appropriate function number (either on the front panel or inside the panel or *APPENDIX B.*)

2. Press FCN "Function #" ENT

The display will show the current value for two seconds. If you request present temperature or pressures, the display will remain until your next entry.

Use the "CLR" key if you make an entry error and want to re-enter your function #.

## CHANGE SET POINTS AND CLEAR LOGS:

*To change setpoints or clear logs, the operator must know the three digit password. New IPC units are shipped with "123" as the password.*

To change any values, press:

RST the display will show **"P"**

Enter the password __ __ __.

If the display shows "C", you have entered a valid password. If the display shows "ERR", your password is not valid.

With the display showing "C", then press:

**FCN "Function #" ENT "New value" ENT**

The new entry is then completed. By repeating the above sequence, you may change all required data before exiting the programming mode.

When you are through changing values, press "RST" three times to put the IPC back in the run mode.

# APPENDIX B
# List Of All IPC "Functions"

*At this printing the following Function Numbers have been assigned for publication:*

    11,12,13,14,15.

    21,23,24,25,26,27,28.·

    31,32.

    41,42,43.

    50,51,52,54,55.

    60,61.

    70,71,72,73,74,75,

    80,81,82,83,84,85,86,87,88,89.

A listing in alphabetical order for the categories describing each Function Number is shown below for:

COMMUNICATIONS

LOGGING

PUMP DOWN FEATURE

PRESSURE, DISCHARGE

PRESSURE, SUCTION

TIMING

UNEVEN COMPRESSOR STRATEGY

## FUNCTION #                            DESCRIPTION

### COMMUNICATIONS (option)

| | |
|---|---|
| 60 | Unit I.D. # -used only with remote communications. |
| 61 | Baud Rate, Parity, Data Bits -used only with remote communications. |
| 89 | Display remote bypass status. |

### LOGGING

| | |
|---|---|
| 70 | Clear the temperature log. |
| 71 | Clear the run time for compressor #1. |
| 72 | Clear the run time for compressor #2. |
| 73 | Clear the run time for compressor #3. |
| 74 | Clear the run time for compressor #4. |
| 75 | Clear the run time for compressor #5. |
| 80 | Display the temperature log. displays one reading for each 15 minute period for the four previous hours. The display will flash 16 readings from most recent to the oldest. |
| 81 | Displays the run time for compressor #1 since last cleared with function #71. the run time is shown in two parts. The display will flash once with the ten thousands/thousands and again with the hundreds /tens/ones. |

FOR EXAMPLE:
RUN TIME = 3516 HRS
....DISPLAY FLASHES...003
..............THEN...516.

ANOTHER EXAMPLE:
RUN TIME = 29042 HRS
....DISPLAY FLASHES...029
..............THEN...042.

Note: *Run times will automatically reset at
32,000 hours and start over at zero.*

| | |
|---|---|
| 82 | DISPLAY THE RUN TIME FOR COMPRESSOR #2. |
| 83 | DISPLAY THE RUN TIME FOR COMPRESSOR #3. |
| 84 | DISPLAY THE RUN TIME FOR COMPRESSOR #4. |
| 85 | DISPLAY THE RUN TIME FOR COMPRESSOR #5. |
| 86 | DISPLAY OR CHANGE THE SYSTEM "TYPE" FOR UNEVEN COMPRESSORS. |
| 87 | DISPLAY SUCTION PRESSURE LOG. DISPLAYS ONE READING FOR EACH 15 MINUTE PERIOD FOR THE FOUR PREVIOUS HOURS. THE DISPLAY WILL FLASH 16 READINGS FROM MOST RECENT TO THE OLDEST. |
| 88 | DISPLAY DISCHARGE PRESSURE LOG. |

## PUMP DOWN FEATURE

52      Disables pump down feature.
"1" = disable
"0" = enable

## PRESSURE, DISCHARGE

31      Display or change high discharge cut-out setting. If the discharge pressure is above this setting, all compressors go off. depending on the dip switch settings (see paragraph 4.1.1), The IPC will either auto reset or may need manual reset, and system alarms may or may not occur.

32      Display present discharge pressure.

51      Display or change discharge pressure offset.

## PRESSURE, SUCTION

21      Display or change maximum cut-in this is the upper limit that the cut-in pressure will float to if using the temperature sensor to float pressure setpoints.

22      Display or change cut-in pressure. this is the value of suction pressure at which the IPC will start adding compressor capacity.

23      Display or change cut-out pressure. This is the value of suction pressure at which the IPC will start decreasing compressor capacity.

24      Display or change minimum cut-out. this is the lower limit that the cut-out setting will float to when using the temperature sensor to float pressure setpoints.

| | |
|---|---|
| 25 | Display or change pump down pressure. This is the suction pressure at which the IPC will turn off all compressors and generate a system alarm. |
| 26 | Display or change hi suction alarm setting. If the suction pressure is above this setting for he alarm delay time, The IPC initiates an alarm. |
| 27 | Display or change lo suction alarm setting. if the suction pressure is below this setting for the delay time. The IPC initiates an alarm. |
| 28 | Display present suction pressure. |
| 50 | display or change suction pressure offset. |

## TEMPERATURE

| | |
|---|---|
| 11 | Display or change temperature setpoint. |
| 12 | Display present temperature reading. |
| 13 | display or change satellite cut-in temp. |
| 14 | Display or change satellite cut-out temp. |
| 15 | Display present satellite temperature. |

## TIMING

| | |
|---|---|
| 41 | Display or change the cut-in time. this is the time in seconds that the ipc will wait before adding capacity if the suction pressure is above the cut-in setting. |
| 42 | Display or change the decrease time. this is the time in seconds that the IPC will wait before reducing capacity if the suction pressure is below the cut-out setting. |
| 43 | Dis play or change the alarm delay time. this is the time in minutes that the IPC will wait after first indications of a system alarm before actually initiating indicators and the alarm output relay. |
| 54 | Time between floating setpoint adjustments. |

## UNEVEN COMPRESSOR STRATEGY

| | |
|---|---|
| 55 | Custom uneven compressor strategy program |
| 86 | Display or change the standard system "type". This defines the uneven compressor combination the IPC is controlling. |

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# APPENDIX C

# Glossary

**ACCUMULATED RUN TIMES -**
A record of the total run time for which the IPC has told the compressor to run. The IPC maintains this accumulated time for each compressor in increments of one hour. The run time can be reset at any time desired. It will accumulate up to 32,000 hours before automatically resetting to zero again.

**ALARM DELAY -**
The time in minutes the IPC will wait before closing the alarm contacts once an alarm status is indicated by the alarm light.

**ALARM LIGHT -**
Display light on front panel indicating that a system alarm has occured.

**BYPASS LIGHT -**
Display light on front panel indicating that at least one of the compressors have been bypassed.

**BYPASS SWITCHES -**
A switch is provided in the IPC for bypassing the computer control for each compressor. When in bypass the compressor will cycle only on it's mechanical controls.

**BYPASS, REMOTE -**
With Communication Option the bypass of each compressor can be accomplished by the remote computer terminal. Use Function 89 to check for Bypass. Refer to the IPC Communications Manual.

**CLEAR KEY -**
(CLR) This key is used to clear an incorrect entry.

**COMPRESSOR STATUS LIGHT -**
Display lights on front panel and on PIB Board indicating when a compressor is on or off.

**CPU BOARD -**
Sometimes called processor board, this is the board containing the microprocessor and is mounted on the inside of the door. It is the Central Processing Unit.

**CUT-IN -**
The pressure (or temperature) at which the compressor is to turn on.

**CUT-IN DELAY TIME -**
The time in seconds the IPC will wait before turning on a compressor once it has an increase capacity status.

**CUT-OUT -**
The pressure (or temperature) at which the compressor is to turn off.

**CUT-OUT DELAY TIME -**
The time in seconds the IPC will wait before turning off a compressor once it has a decrease capacity status.

**DEADBAND -**
A band of pressure or temperature in which no action is taken to turn on or off a device being controlled. For example, when the discharge pressure cut-out optional feature is use on the IPC and is set for auto reset, the deadband during which the compressors are shut off due to high pressure is adjustable at either 25 psi or 50 psi. In other words, if the discharge pressure reached the cut-out point and shut down the compressors, the compressors would not come back on until the discharge pressure dropped either 25 or 50 psi.

**DECREASE LIGHT-**
Display light on front panel indicating when present suction pressure is below the current cut-out pressure setting.

**DEFROST LIGHT -**
Display light on front panel indicating that the defrost relay or clock terminals have closed indicating a hot gas defrost status on.

**DEFROST STATUS -**
The IPC has input terminals to let it know when a refrigerant circuit is in hot gas defrost. Wiring from a contact closure at the defrost clock or relay or master liquid line solenoid can be used to give the defrost status to the IPC. During hot gas defrost the IPC will maintain the operation of at least one compressor.

**DEFROST TERMINATION -**
The end of the defrost period as caused by defrost terminating thermostat (or sensor) the defrost clock.

**DIP SWITCH -**
Small switches mounted on the printed circuit board and usually in groups of four or five.

**DISCHARGE -**
The refrigerant port leaving the compressor. The refrigerant line at this port is called the discharge line. The pressure at this port is called the discharge pressure (also head pressure). The discharge pressure, except for pressure losses, is the same as the condensing pressure.

**DISCHARGE AIR STREAM -**
The refrigerated air leaving the evaporator cooling coils and discharging into the refrigerated case.

**DISCHARGE MANIFOLD -**
A central pipe to which all compressors feed to and from which the hot gas is fed to the condenser.

**DISCHARGE PRESSURE OFFSET -**
The number written on the discharge pressure transducer to allow for field calibration for replacement transducers. New IPC units are factory calibrated. This number may be positive or negative.

**DISPLAY BOARD -**
The printed circuit board mounted inside the door behind the front panel.

**ENGINEERING UNITS -**
The unit of measure for pressure, temperature, etc. Pressure is PSI. Temperature is °F.

**ENTER KEY -**
(ENT) This key is used to enter commands.

**EPR VALVE -**
Evaporator pressure regulator valve located in the suction line between refrigerator and suction manifold, usually at the rack. This valve maintains pressure in the suction line for each circuit.

**EVEN COMPRESSOR CONTROL -**
Compressor rack with all compressors the same and controlled by the IPC. The IPC can be set to control both even and uneven systems.

**FIELD TERMINALS -**
The wiring terminal screws located in the IPC for wiring into the field components, such as, the compressor control circuits and field mounted temperature and pressure sensors. Incoming power wiring is also wired into these field terminals.

**FLOATING SETPOINT STRATEGY -**
A strategy to allow the suction pressure to float up or down between minimum and maximum limits to satisfy the temperature setpoint for the lead case.

**FUNCTION KEY -**
(FCN) This key is used to select a command (or function).

**HOT GAS DEFROST -**
A defrost method using the compressed refrigerant gas to flow in reverse into the evaporator coils for the purpose of melting the accumulated frost. This compressed refrigerant gas may or may not be desuperheated, depending upon the system used by the rack manufacturer.

**INCREASE LIGHT -**
Display light on front panel indicating when present suction pressure is above the current cut-in pressure setting.

**INPUT CONNECTION -**
Electrical input terminals for the pressure transducers and temperature sensors wiring.

**KEYPAD -**
The alpha/numeric pad on the front panel.

**LEAD FIXTURE -**
Where multiple refrigerant circuits are supplied from one parallel compressor rack and the floating set point feature is used, the lead fixture is the circuit which requires the lowest suction pressure. This is normally the coldest refrigerator.

**LED -**
Light Emitting Display. The display indicating lights on the display board.

**LOGGING -**
A "history" of the past four hours of temperatures, pressures, and compressor run times.

**MANUAL RESET -**
Requires that a person be at the sight to reset the alarm or system manually. The high discharge cut-out optional feature in the IPC can be set for manual reset or for auto reset.

**MASTER LIQUID LINE SOLENOID -**
The main liquid line solenoid used in a parallel compressor system to close during a hot gas defrost to create a pressure differential between the hot gas manifold and liquid manifold. This closing can be a source for obtaining the defrost status for the IPC by the use of a parallel relay.

**MECHANICAL PRESSURE CONTROL -**
The electro-mechanical bellows type control used in the system prior to the use of the IPC. This control is normally left in the control circuit as a backup.

**MINUS KEY -**
___ This key allows you to enter negative numbers such as below zero degrees.

**OUTPUT CONNECTION -**
Electrical output terminals for wiring to the relay board for controlling the compressors.

**PASSWORD -**
A three digit number assigned to enable programming of the IPC. Factory shipped IPC's have "123" assigned which may be changed by the user as desired. Further information may be obtained from Computer Process Controls, Inc.

**PIB (POWER INTERFACE BOARD) -**
This board is in the back of the IPC box. This is the board which has the field wiring terminals and also the ribbon cables going to other IPC components.

**PUMP DOWN -**
In the refrigeration system when the liquid refrigerant is stopped from flowing and the compressor continues to pump the refrigerant from the suction line and on into the system to the receiver., During the process the suction pressure is pumped down to a very low point. The pump down setpoint is the pressure at which the compressor shuts off. It is desirable for the pump down set point to be at just above 0 psi to avoid pumping foreign materials (such as air and moisture) into the system in case of a leak.

**PUMP DOWN LIGHT -**
Display light on front panel indicating that the suction pressure is or has been below the pump down pressure setting.

**RACK -**
A frame with one or more compressors mounted and manifolded together (If more than one) to form a single refrigeration compressor system.

**RELAY BOARD, OUTPUT -**
The separate relay board that is wired to the IPC and has output terminals to control the individual compressors.

**RESET KEY -**
(RST) This key is used for resetting alarms and exiting and entering the program mode.

**RIBBON CONNECTOR CABLE -**
The flat ribbon like cable between the PIB and the CPU.

**SATELLITE UNIT -**
On parallel compressor racks, sometimes one of the Compressor Units operates at a different suction pressure (and temperature) range than the others. This compressor is in parallel with the others on the discharge side but not on the suction side. The IPC has an optional temperature sensor for controlling this unit. This unit is sometimes called a "Satellite Unit".

**SETPOINT -**
The point at which a control is set to turn on and off the particular device being controlled. There are setpoints for: Alarms, Pressures, and Temperatures, etc.

**SHUT-OFF VALVE -**
A hand valve that closes to prevent refrigerant flow.

**SUCTION -**
The refrigerant port entering the compressor. The refrigerant line entering this port is called the suction line. The pressure at this port is called the suction pressure. Except for pressure losses, the suction pressure is the same as the evaporator pressure.

**SUCTION MANIFOLD -**
A central pipe to which all refrigeration circuits feed to and from which all of the compressors in parallel feed from.

**SUCTION PRESSURE OFFSET -**
The number written on the suction pressure transducer to allow for field calibration for replacement transducers. New IPC units are factory calibrated. This number may be positive or negative.

**SYSTEM -**
The entire refrigeration unit including compressors, evaporators, condensers, and all controls necessary to perform the refrigerating process.

**SYSTEM TYPE -**
The name for uneven compressor standard systems. There are 11 standard types. See Table 5-1.

**TARGET TEMPERATURE -**
The temperature set for the lead case for the floating set point feature.

**TEMPERATURE SENSOR -**
The probe located in the refrigerated discharge air to sense air temperature. Used with floating setpoint option and with satellite compressor control.

**TEST KEY -**
(TST) This key is used to test the indicator lights on the front panel.

**TIME BETWEEN FLOATING SETPOINT -**
The time the IPC takes before automatically changing the suction pressure cut-in and cut-out set points when the floating setpoint option is used. The condition for increasing or decreasing the setpoint must be in place for this time period before a change cam be made. The time period is adjustable.

**TIME DELAY -**
A delay period can be set to delay the compressor starting or stopping when it is first called to start or stop. Also a delay time period can be set to delay the alarm from signaling outside devices during the preset time delay.

**TRANSDUCER -**
The pressure sensor which transduces the pressure of the suction or discharge refrigerant into an electrical signal to allow the IPC to control.

**UNEVEN COMPRESSOR SYSTEMS -**
Any rack where the compressors or not identical is considered to be an uneven compressor system. Typically the compressors will be of different BTU capacities in an uneven compressor system.

# APPENDIX D
# Sample Programming Forms

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# IPC PROGRAMMING FORM

STORE: _SAMPLE_

SYSTEM: _LOW TEMP. R-502 3 COMP. EVEN_

APPLICATION: _DAIRY_

DATE INSTALLED: _____

INSTALLER: _____

| FUNCTION | DESCRIPTION | VALUE | UNITS | ENTRY SEQUENCE WITH DISPLAY SHOWING "C--" | | | | |
|---|---|---|---|---|---|---|---|---|
| 86 | SYSTEM TYPE (UNEVENS ONLY) | ___ | | FCN | 86 | ENT | "TYPE" | ENT |
| 11 | TARGET TEMPERATURE* | 33 | °F(°C) | FCN | 11 | ENT | "VALUE" | ENT |
| 22 | CUT-IN PRESSURE | 55 | psig (bars) | FCN | 22 | ENT | "VALUE" | ENT |
| 23 | CUT-OUT PRESSURE | 45 | psig (bars) | FCN | 23 | ENT | "VALUE" | ENT |
| 21 | CUT-IN UPPER LIMIT* | 60 | psig (bars) | FCN | 21 | ENT | "VALUE" | ENT |
| 24 | CUT-IN LOWER LIMIT* | 38 | psig (bars) | FCN | 24 | ENT | "VALUE" | ENT |
| 25 | PUMP DOWN PRESSURE | 03 | psig (bars) | FCN | 25 | ENT | "VALUE" | ENT |
| 26 | HIGH SUCTION ALARM | 62 | psig (bars) | FCN | 26 | ENT | "VALUE" | ENT |
| 27 | LOW SUCTION ALARM | 37 | psig (bars) | FCN | 27 | ENT | "VALUE" | ENT |
| 31 | HI DISCHARGE CUT-OUT | 325 | psig (bars) | FCN | 31 | ENT | "VALUE" | ENT |
| 41 | INCREASE TIME | 05 | sec. | FCN | 41 | ENT | "VALUE" | ENT |
| 42 | DECREASE TIME | 05 | sec. | FCN | 42 | ENT | "VALUE" | ENT |
| 43 | ALARM DELAY | 01 | min. | FCN | 43 | ENT | "VALUE" | ENT |
| 13 | SAT. CUT-IN TEMP | 10 | °F(°C) | FCN | 13 | ENT | "VALUE" | ENT |
| 14 | SAT. CUT-OUT TEMP | 05 | °F(°C) | FCN | 14 | ENT | "VALUE" | ENT |

* - ENTER ONLY WHEN USING FLOATING SETPOINT CONTROL

SAMPLE

D-3

*MECHANICAL PRESSURE SETTINGS*

## AFTER IPC INST.

| COMP. # | CUT-IN | CUT-OUT |
|---------|--------|---------|
| 1 | 53 | 38 |
| 2 | 55 | 38 |
| 3 | 58 | 38 |
| 4 | 60 | 38 |

## BEFORE IPC INST.

| COMP. # | CUT-IN | CUT-OUT |
|---------|--------|---------|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |

D-4

# IPC PROGRAMMING FORM

STORE: _SAMPLE_

SYSTEM: _MED. TEMP. 4 COMP. EVEN_

APPLICATION: _R-12 FRESH MEAT_

DATE INSTALLED: _____

INSTALLER: _____

| FUNCTION | DESCRIPTION | VALUE | UNITS | ENTRY SEQUENCE WITH DISPLAY SHOWING "C--" | | | | |
|---|---|---|---|---|---|---|---|---|
| 86 | SYSTEM TYPE (UNEVENS ONLY) | NA | | FCN | 86 | ENT | "TYPE" | ENT |
| 11 | TARGET TEMPERATURE* | 27 | °F(°C) | FCN | 11 | ENT | "VALUE" | ENT |
| 22 | CUT-IN PRESSURE | 20 | psig(bars) | FCN | 22 | ENT | "VALUE" | ENT |
| 23 | CUT-OUT PRESSURE | 10 | psig(bars) | FCN | 23 | ENT | "VALUE" | ENT |
| 21 | CUT-IN UPPER LIMIT* | 28 | psig(bars) | FCN | 21 | ENT | "VALUE" | ENT |
| 24 | CUT-IN LOWER LIMIT* | 06 | psig(bars) | FCN | 24 | ENT | "VALUE" | ENT |
| 25 | PUMP DOWN PRESSURE | 02 | psig(bars) | FCN | 25 | ENT | "VALUE" | ENT |
| 26 | HIGH SUCTION ALARM | 30 | psig(bars) | FCN | 26 | ENT | "VALUE" | ENT |
| 27 | LOW SUCTION ALARM | 05 | psig(bars) | FCN | 27 | ENT | "VALUE" | ENT |
| 31 | HI DISCHARGE CUT-OUT | 225 | psig(bars) | FCN | 31 | ENT | "VALUE" | ENT |
| 41 | INCREASE TIME | 120 | sec. | FCN | 41 | ENT | "VALUE" | ENT |
| 42 | DECREASE TIME | 60 | sec. | FCN | 42 | ENT | "VALUE" | ENT |
| 43 | ALARM DELAY | 60 | min. | FCN | 43 | ENT | "VALUE" | ENT |
| 13 | SAT. CUT-IN TEMP | 10 | °F(°C) | FCN | 13 | ENT | "VALUE" | ENT |
| 14 | SAT. CUT-OUT TEMP | 05 | °F(°C) | FCN | 14 | ENT | "VALUE" | ENT |

* - ENTER ONLY WHEN USING FLOATING SETPOINT CONTROL

SAMPLE

MECHANICAL PRESSURE SETTINGS

## BEFORE IPC INST.

| COMP. # | CUT-IN | CUT-OUT |
|---------|--------|---------|
| 1 | _____ | _____ |
| 2 | _____ | _____ |
| 3 | _____ | _____ |
| 4 | _____ | _____ |

## AFTER IPC INST.

| COMP. # | CUT-IN | CUT-OUT |
|---------|--------|---------|
| 1 | 28 | 1 |
| 2 | 30 | 09 |
| 3 | 32 | 08 |
| 4 | _____ | _____ |

# IPC PROGRAMMING FORM

STORE: _SAMPLE_

SYSTEM: _MED. TEMP. 4 COMP. EVEN_

APPLICATION: _R-12 FRESH MEAT_

DATE INSTALLED: _____

INSTALLER: _____

| FUNCTION | DESCRIPTION | VALUE | UNITS | ENTRY SEQUENCE WITH DISPLAY SHOWING "C-" | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 86 | SYSTEM TYPE (UNEVENS ONLY) | NA | | FCN | 86 | ENT | "TYPE" | ENT | |
| 11 | TARGET TEMPERATURE* | 27 | °F(°C) | FCN | 11 | ENT | "VALUE" | ENT | |
| 23 | CUT-OUT PRESSURE | 10 | psig (bars) | FCN | 22 | ENT | "VALUE" | ENT | |
| 21 | CUT-IN UPPER LIMIT* | 28 | psig (bars) | FCN | 23 | ENT | "VALUE" | ENT | |
| 24 | CUT-IN LOWER LIMIT* | 05 | psig (bars) | FCN | 21 | ENT | "VALUE" | ENT | |
| 25 | PUMP DOWN PRESSURE | 02 | psig (bars) | FCN | 24 | ENT | "VALUE" | ENT | |
| 26 | HIGH SUCTION ALARM | 30 | psig (bars) | FCN | 25 | ENT | "VALUE" | ENT | |
| 27 | LOW SUCTION ALARM | 05 | psig (bars) | FCN | 26 | ENT | "VALUE" | ENT | |
| 31 | HI DISCHARGE CUT-OUT | 225 | psig (bars) | FCN | 27 | ENT | "VALUE" | ENT | |
| 41 | INCREASE TIME | 120 | sec. | FCN | 31 | ENT | "VALUE" | ENT | |
| 42 | DECREASE TIME | 60 | sec. | FCN | 41 | ENT | "VALUE" | ENT | |
| 43 | ALARM DELAY | 60 | min. | FCN | 42 | ENT | "VALUE" | ENT | |
| 13 | SAT. CUT-IN TEMP | 10 | °F(°C) | FCN | 43 | ENT | "VALUE" | ENT | |
| 14 | SAT. CUT-OUT TEMP | 05 | °F(°C) | FCN | 13 | ENT | "VALUE" | ENT | |
| | | | | FCN | 14 | ENT | "VALUE" | ENT | |

* - ENTER ONLY WHEN USING FLOATING SETPOINT CONTROL

## SAMPLE

*MECHANICAL PRESSURE SETTINGS*

### BEFORE IPC INST.

| COMP. # | CUT-IN | CUT-OUT |
|---------|--------|---------|
| 1 | _____ | _____ |
| 2 | _____ | _____ |
| 3 | _____ | _____ |
| 4 | _____ | _____ |

### AFTER IPC INST.

| COMP. # | CUT-IN | CUT-OUT |
|---------|--------|---------|
| 1 | 18 | 05 |
| 2 | 19 | 04 |
| 3 | 21 | 03 |
| 4 | 23 | 03 |

# APPENDIX F

# Remote Communications System

# Operation and Set Up

## TABLE OF CONTENTS

## List Of Illustrations

## List of Tables

## PREFACE

*The model IPC Intelligent Pressure Control is designed to accurately control parallel compressor systems in supermarkets and refrigerated facilities. The communications feature of the IPC allow remote programming and monitoring over standard dial up telephone lines.*

The IPC Communications system (IPCCOM) also allows automatic dial out of two telephone numbers to indicate compressor system alarms such as high and low suction pressure, pump down, and high discharge pressure. Over a remote terminal, the operator may change set points, monitor current system status, compressor running times, and read logs of past pressures and temperatures.

## CONTENTS

## USE OF THIS MANUAL

A table of contents indicates sections and paragraph numbers to facilitate location of information. Illustrations are used throughout to supplement the text material. The list of illustrations shows the numbers, titles, and page numbers. The illustrations in themselves offer most of the information required to become familiar with the actual operation of the communications system. Where entries of your terminal are required, brackets have been used.

# SECTION F1

# General Information

## 1.1 Introduction.

*This manual contains information necessary to set up and operate the remote communications feature of the Model IPC. An understanding of the local (on site) operation and the theory of operation of the IPC is required to properly utilize the remote communications feature. This information may be obtained from the rest of this manual.*

## 1.2 General Description.

The IPC Communications (IPCCOM) is a feature of the IPC that allows the user to monitor and program IPC units over a standard dial up telephone line. With the installation of a modem (CPC part number 370-1200 or 370-2400, 1200 baud or 2400 baud respectively.) at the IPC site, and with proper electrical connection to the IPC's, this feature may be utilized. See Figure F1-1 for wiring instructions. The equipment necessary at the other end or at the remote monitoring site is a standard dial up telephone line, a modem, and a standard data terminal or a personal computer operating in the data terminal mode.

## 1.3 Technical Characteristics.

Technical characteristics of the system are shown in Table F1-1.

### TABLE F1-1

### Technical Characteristics

| Item | Characteristics |
|---|---|
| Communications Interface | RS-232, 7 or 8 bits/char., Even, Odd or No parity, 1 stop bit. |
| Baud Rate | 300 to 9600 baud. |
| Modem | Hayes software compatible, RS-232 connection, auto dial, auto answer. |
| Terminal/Keyboard | ASCII compatible, PC or Video display display, 80 column x 24 line. |
| Software | English prompting, Seven system commands including "HELP" command. Password entry required for access. |

## FIGURE F1-1

## IPCCOM Wiring Diagram



MSTB 1,5-8 TO IPC
P.I.B. BOARD

IPC P.I.B TERMINALS 1-8
1 2 3 4 5 6 7 8

CABLE ASSEMBLY:
CPC P.N. 535-1004

RED        2
BLACK      3
CLEAR      7

MALE DB-25 CONNECTOR
TO HAYES SMARTMODEM

7
3        TO ANY OTHER
         IPCCOM UNITS
2

NOTE:
COMMUNICATIONS CABLE IS
3 CONDUCTOR BELDEN W/SHIELD.
SHIELD IS TIED TO GROUND.

07/18/91
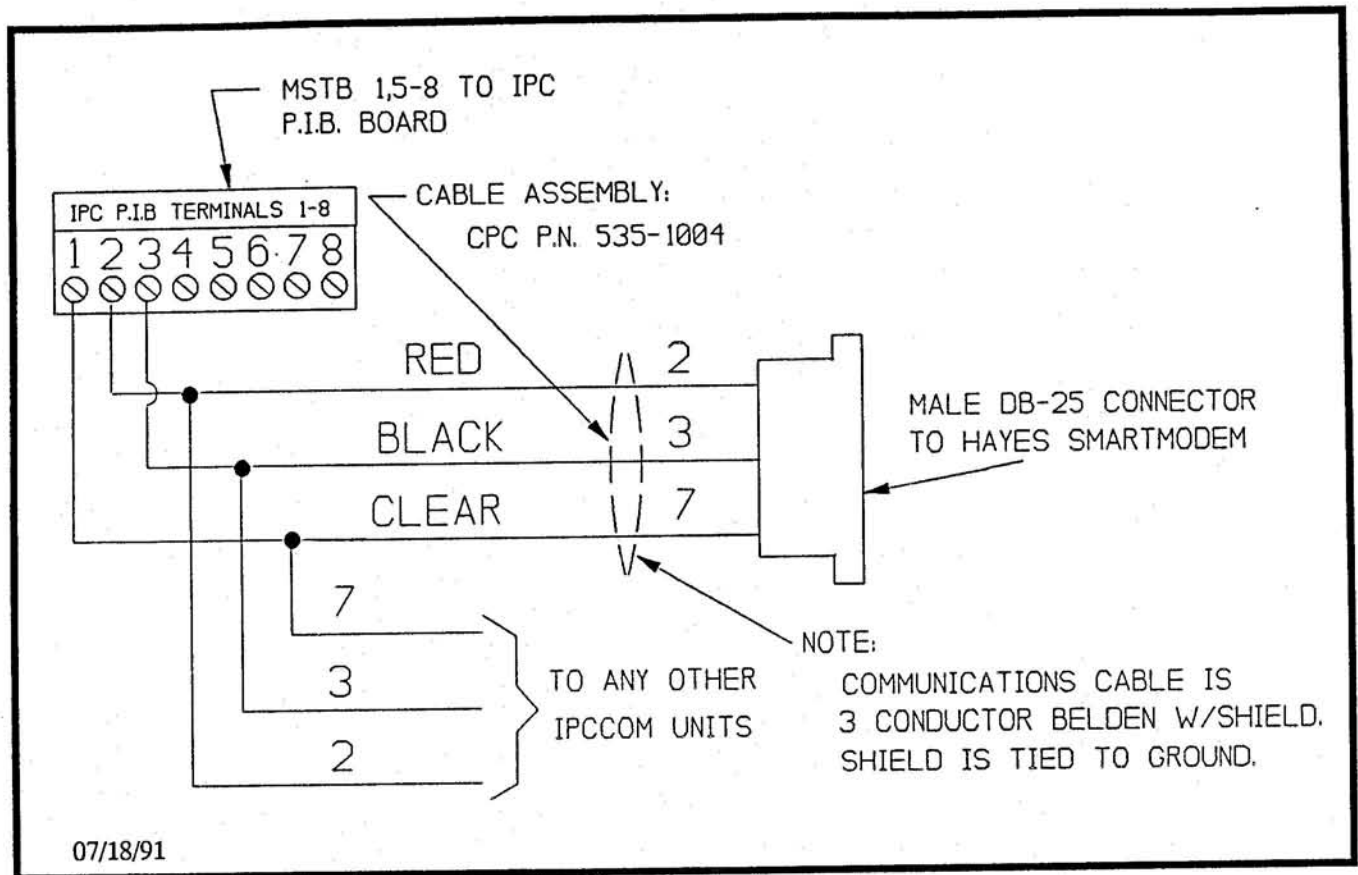
**NOTE:** *Where IPCs are connected with RMCs, SECs, LPMs, 1602s, TRCs, TECs, TLCs, etc. using the same RS232 communication line, swap terminals #2 and #3.*

# SECTION F2

# Terminal Selection and Set Up

## 2.1 General.

*This section contains suggestions on the selection and set up of a terminal for remote monitoring.*

As there are many different types of data terminals, it is impossible to cover all situations for all types in this Appendix. Therefore, please contact CPC for any questions you may have concerning the proper operation for your terminal.

## 2.2 Terminal Selection.

Computer Process Controls has made every effort to make the IPCCOM system compatible with most data terminals, and personal computers operating in the "terminal mode". This is a very popular industry standard. We recommend the following two types of terminals. One is a video terminal, the other is a PC (personal computer).

*VIDEO*              *TELEVIDEO TV # 905*

*PC (IBM COMPATIBLE)*   *OPERATING AS A*
                      *DATA TERMINAL*

## 2.3 Terminal Set Up

Before setting up the terminal, it is first necessary to decide upon what communications protocol you wish to use for your particular situation. CPC recommends the following protocol:

**All capital letters**

**8 data bits per character**

**No parity**

**One stop bit**

**300, 1200, or 2400 baud. (Depending upon modem used.)**

Consult the terminal manufacturer's instruction manual for the procedure to set up the communications protocol.

If your terminal does not have a built-in modem, connect a Hayes Smartmodem or one that is compatible and follow the modem manufacturers suggestions. Set the modem up for the following parameters:

**Auto answer**

**Non-echo mode**

See Figure F2-1 for the switch settings for the Hayes Smartmodem.

Test the terminal/modem connection by following the instructions for dialing a number. Dial a know number so that you can audibly verify the dial out is working.

## FIGURE F2-1

### Hayes Smartmodem Switch

### Settings

NOTE:  1. 1200 baud modem shown.
       2. 300 baud modem has only 8 switches
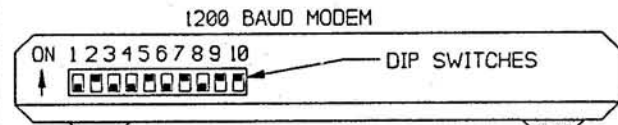


(Set same as 1 thru 8 on 1200 baud modem.)

| SWITCH # | POSITION |
|---|---|
| 1 | DOWN (Only if all are IPCs and IECs.)* |
| 2 | UP |
| 3 | DOWN |
| 4 | DOWN |
| 5 | UP |
| 6 | DOWN |
| 7 | UP |
| 8 | DOWN |
| 9 | UP |
| 10 | UP |

* - If connected with 1602s, TRCs, RMCs, TECS, TLCS, etc. leave switch 1 up.

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# SECTION F3

# Programming and Operating

# Procedures

## 3.1 General.

*This section describes the operating procedures necessary to properly use the IPCCOM system.*

Illustrations are used to assist in the understanding of the text. By following the text, studying the illustrations, and following along on your terminal, the operation of the system is straight-forward and easy to learn.

## 3-2 Before Calling Any IPCs.

Before calling an installation site, verify that the controls have been set up properly for communications. Insure that the following have been done:

Telephone modem has been connected to IPC's as shown in Figure F1-1.

Telephone modem is plugged into telephone line.

Modem is turned on.

Each IPC has been signed a unique "Unit Number" through Function 60 from the front key pad. The IPC's must each have a unique Unit Number from 1 to 49.

Each IPC has been set to the proper communications protocol. This is entered through Function 61 from the front key pad. Table F3-1 below shows the proper number to enter in Function 61.

### TABLE F3-1

### Communications Protocol

### (Function 61)

| DIGIT | MEANING |
|-------|---------|
| FIRST | Baud Rate |
| | 1 = 300 baud |
| | 2 = 1200 baud |
| | 3 = 2400 baud |
| | 4 = 4800 baud |
| | 5 = 9600 baud |
| SECOND | Parity |
| | 0 = No parity |
| | 1 = Odd parity |
| | 2 = Even parity |
| THIRD | Bits Per Character |
| | 7 = Seven Bits/Char. |
| | 8 = Eight Bits/Char. |

For example, If you want 1200 Baud, Even Parity and 8 data bits per character, then you would enter 228 in Function 61.

Note that the IPC's are shipped from the factory with 108 in function 61; 300 baud, no parity, 8 data bits per character.

## 3.3 Calling an IPC Installation.

Following the terminal modem manufacturer's instructions, dial the telephone number of an IPC installation.

If you have assigned an IPC to device number "1", when the calling modem is connected to the answering modem, the IPC will respond with a message that describes the software and revision number. You may then sign on to the individual IPC. However, if no IPC is assigned device number "1", then you will only see a "connect" message from the answering modem.

## 3.4 Signing on to an Individual IPC.

*To sign on to an individual IPC, you must send an ID code that identifies the IPC you wish to communicate with.*

To do this, enter the following at your terminal's keyboard:

[#] [$] [The I.D. Number] [RETURN]

Note: The I.D. Number is the Individual IPC unit number that you wish to communicate with.

The system header message for the IPC that you requested will be displayed. See Figure F3-1.

Note: *Do not request to sign on to another IPC until logging off of the current logged on unit. If this occurs, hang up the telephone and wait 5 minutes before re-dialing.*

Note that on initial sign on, the STORE ID, REFRIGERANT TYPE, and SYSTEM ID are blank. These are user defined and are entered using one of the IPCCOM commands as described below.

## 3.5 Entering Password.

A three digit password must be entered to gain access to the IPC. The initial password is [123]. The password will not be displayed on your terminal for security reasons. When the proper password is entered, press [RETURN]. The IPPCCOM will prompt you with:

COMMAND:

The IPC is now ready to display all available information that you request.

## 3.6 Entering Commands.

There are seven IPCCOM commands that may be entered at the "COMMAND:" prompt.

| | | |
|---|---|---|
| 1.HELP | 2.SYSTEM | 3.STATUS |
| 4.SET POINTS | 5.LOGS | 6.BYPASS |
| 7.BYE | | |

Only the first three letters of each command, as shown underlined above, need be entered for IPPCCOM to recognize them. A description of each command is shown below with reference to the illustrations that show examples.

Note: The [RETURN] key must be pressed after entering any command.

## 3.6.1 Help Command.

The HELP command, when entered, displays the list of available IPCCOM commands. See Figure F3-2. This is used if you forget a command and wish a reminder.

## 3.6.2 System Command.

The SYSTEM command is used to change or view a variety of system parameters such as the password and the uneven compressor system type. One of the items, the dip switch positions, is "read only" for the IPC you are presently logged on to. See Figure F3-3 for a list of the options under the system command.

The SYSTEM command requires that you make a selection from the list of options. The IPCCOM system prompts you to select an option. The request for the SYSTEM command are:

Select the option desired by pressing [The Number] of the selection and then [RETURN].

Press [0] [RETURN] to exit to the command: prompt.

Press [M] [RETURN] to redisplay the menu of options.

If the selection chosen is a "read only" option, the IPCCOM displays the information selected and prompts you to enter another option.

If the selection chosen is one that you may change, the IPCCOM displays the information stored for that option and request if you want to change the current value/name by pressing [Y] for yes or [N] for no.

If you choose [Y], the IPCCOM asks you to enter the new value/name. Press [RETURN] after entering the new value/name. The display then prompts you to enter another option.

If you choose [N], the IPCCOM prompts you to select another option (or exit, or redisplay menu).

You may enter up to 15 characters for the Store ID, System ID and the two telephone numbers for dial out alarm. You may use up to five characters for the refrigerant type.

### 3.6.3 Status Command.

The STATUS command is a "read only" command. When this command is entered, the IPCCOM displays a 'picture' of the refrigeration system's current status. This includes suction pressure, discharge pressure (if a discharge transducer is present), lead fixture temperature, etc. The STATUS command also shows the current compressor status; bypass, on. or off. See Figure F3-4 for a sample display.

### 3.5.4 Set Point Command.

The SET POINT command allows viewing or changing of all IPC set points. Entering the SET Point command displays a list of the current IPC set points numbered from one to 16. See Figure F3-5 for a sample of the SET POINT command.

The status of each compressor is displayed when you enter the BYPASS command. There are three possible states:

1. Normal - The IPC is in control of the compressor.

2. Remote - The compressor has been bypassed over the remote terminal.

3. Local - The compressor has been bypassed locally with the bypass switches.

See Figure F3-7 for a sample printout of the BYPASS command.

NOTE: *A remote terminal operator may not override a local bypass, and a local operator may not override a remote bypass.*

### 3.6.7 Bye Command.

The BYE command logs you off the current IPC and verifies that this has happened by displaying the message "LOGGED OFF". *You must LOG OFF one IPC before signing on to another.* See Figure F3-9 for a sample printout of the BYE command.

After logging off, you may select another IPC by entering:

> [#] [$] [UNIT ID NO.] [RETURN] where "UNIT ID NO." is the new IPC you wish to log on to.

If you wish to end the session completely, hang up the telephone.

## FIGURE F3-1

### Sample of the System Header

```
Computer Process Controls, Inc.
IPC COMMUNICATIONS SOFTWARE      REV.  CD.2

STORE ID   : SUPER MART #20 REFRIGERANT TYPE: R-502
SYSTEM ID : LO TEMP RACK A NUMBER OF  COMPRESSORS: 4 SATELLITE: NO

PASSWORD :
```

## FIGURE F3-2

### Sample of the HELP Command

```
COMMAND: HEL

VALID COMMANDS

BYE - LOG OFF
BYP - ALLOWS BYPASSING OF COMPRESSORS
HEL - LIST ALL VALID COMMANDS
LOG - DISPLAYS TEMPERATURE AND PRESSURE LOGS
SET - DISPLAY AND/OR CHANGE SYSTEM SET POINTS
STA - DISPLAY COMPLETE SYSTEM STATUS
SYS - DISPLAY AND/OR CHANGE SYSTEM PARAMETERS

COMMAND:
```

*See following page for additional display examples........*

## FIGURE F3-3

## Sample of the SYSTEM Command

```
COMMAND: SYS

STORE ID   : SUPER MART #20          REFRIGERANT TYPE: R-502
SYSTEM ID  : LO TEMP RACK A NUMBER OF COMPRESSORS: 4 SATELLITE: NO

   OPTION                    DESCRIPTION

    (1)          PASSWORD
    (2)          UNEVEN SYSTEM TYPE
    (3)          CLEAR COMPRESSOR RUN TIMES
    (4)          CLEAR TEMPERATURE LOG
    (5)          CLEAR SUCTION PRESSURE LOG
    (6)          CLEAR DISCHARGE PRESSURE LOG
    (7)          CLEAR SYSTEM ALARMS
    (8)          RESET PROCESSOR
    (9)          1ST PHONE NUMBER
   (10)          2ND PHONE NUMBER
   (11)          STORE ID
   (12)          SYSTEM ID
   (13)          DIP SWITCHES
   (14)          REFRIGERANT TYPE
   (15)          MINUTES BETWEEN FLOATING SETPOINT CHANGES

   OPTION (0 = EXIT, M = MENU) : 0

COMMAND :
```

## FIGURE F3-4

## Sample of the STATUS Command

```
COMMAND : STA

SUCTION PRESSURE.....        14.1 PSIG   DISCHARGE PRESSURE....170 PSIG
LEAD FIXTURE TEMPERATURE..41 F   SATELLITE TEMPERATURE..39 F
DEFROST STATUS..........     OFF   CURRENT SUCTION IS ABOVE CUT-IN
SYSTEM ALARMS...........     NONE SET

             COMPRESSOR STATUS AND RUN TIMES
    UNIT #1     UNIT #2     UNIT #3     UNIT #4     SATELLITE
      ON          ON          ON          ON          OFF
   10.2 HOURS 10.2 HOURS 10.2 HOURS 10.2 HOURS 0.0 HOURS

COMMAND :
```

## FIGURE F3-5

## Sample of the SET POINT Command

```
    COMMAND : SET

SET POINT            DESCRIPTION              CURRENT
   (1)        LEAD FIXTURE SET POINT           10°F
   (2)        SATELLITE CUT-IN TEMP            0°F
   (3)        SATELLITE CUT-OUT TEMP           -10°F
   (4)        MAXIMUM CUT-IN                   11°F
   (5)        CUT-IN PRESSURE                  12 PSIG
   (6)        CUT-OUT PRESSURE                 05 PSIG
   (7)        MINIMUM CUT-OUT                  04 PSIG
   (8)        PUMP DOWN CUT-OUT                0 PSIG
   (9)        HIGH SUCTION ALARM               15 PSIG
  (10)        LOW SUCTION ALARM                02 PSIG
  (11)        HIGH DISCHARGE CUT-OUT           350PSIG
  (12)        CUT-IN TIME DELAY                5 SECONDS
  (13)        CUT-OUT TIME DELAY               5 SECONDS
  (14)        ALARM DELAY                      1 MINUTE
  (15)        SUCTION PRESSURE OFFSET          0 PSIG
  (16)        DISCHARGE PRESSURE OFFSET        0 PSIG

   CHANGE SET POINT # (0 = EXIT, M = MENU) : 0

COMMAND :
```

## FIGURE F3-6

## Sample of the LOGS Command

```
COMMAND : LOG
         LEAD FIXTURE TEMPERATURE / PRESSURE LOGS

 MINUTES      TEMPERATURE       SUCTION        DISCHARGE
  AGO             (F)            (PSIG)          (PSIG)

   15             39              14.1            170
   30             39              14.1            170
   45             39              14.1            170
   60             39              14.1            170
   75             39              14.1            170
   90             39              14.1            170
  105             39              14.1            170
  120             39              14.1            170
  135             39              14.1            170
  150             39              14.1            170
  165             39              14.1            170
  180             39              14.1            170
  195             39              14.1            170
  210             39              14.1            170
  225             39              14.1            170
  240             39              14.1            170

COMMAND :
```

## FIGURE F3-7

## Sample of the BYPASS Command

```
COMMAND : BYP

CURRENT BYPASS STATUS

    UNIT         STATUS

     1           NORMAL
     2           NORMAL
     3           NORMAL
     4           NORMAL
     5           NORMAL

CHANGE UNIT # (0 = EXIT) : 0

COMMAND :
```

## FIGURE F3-8

## Sample of the BYE Command

```
COMMAND : BYE

LOGGED-OFF
```

**NOTE:** For metric measurements the temperatures are in "°C" and pressures are in "BARS".

# SECTION F4

# Dial Out Alarms

## 4.1 General.

*The IPCCOMs system allows the entry of two telephone numbers to dial out in the event of a system alarm.*

These numbers are entered under the SYSTEM command, and may be up to 15 digits in length.

## 4.2 Remote Alarm Receiver.

*CPC's ACCESS software package, Part Number 805-2000, should be used with your remote PC to receive all alarms from the field installed IPC's.*

Refer to the ACCESS Instruction Manual for details.

**NOTE:** *Your PC terminal cannot receive alarm messages during the time you are communicating with any other device. Therefore, if you desire to insure receipt of all alarms, it will be necessary to provide a dedicated PC with its own telephone line and number.*

## 4.3 IPC Dial Out Sequence.

The IPC, within six minutes of detecting an alarm, will begin dialing telephone number 1, as entered under the SYSTEM command.

### 4.3.1 If Answered.

The IPC will send the status display to the PC terminal. This will give the current readings and the alarm status. The IPC will then hang up the phone.

### 4.3.2 If No Answer Or Busy.

The IPC will dial telephone number 2. If answered, the status screen will be sent to this PC terminal. If no answer or busy, the IPC will wait six minutes and begin the dial out sequence again. This redial operation will be repeated five times (30 minutes total), before the IPC "gives up".

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# SECTION F5

# Quick Reference Operator

# Instructions

## 5.1 General.

*This section is a quick reference for operating the IPCCOM system.*

It is assumed that the remote terminal and IPCs have been set up properly for remote communications. [ ] brackets indicate entries made at your terminal.

## 5.2 Call The IPCs.

Following your terminal and modem manufacturers' instructions, dial the telephone number of the IPC site you wish to communicate with. Wait until the calling modem connects with the answering modem. With the Hayes Smartmodem, you will see a "CONNECT" message on your screen.

## 5.3 Enter The IPC ID No

Enter the ID code for the IPC that you are interested in as follows:

[#] [$] [UNIT ID NO.] [RETURN]

Where [ ] are keys on your terminal keyboard and "UNIT ID NO." is the IPC number defined by FUNCTION 60, When the IPCs were initially programmed at the site.

NOTE: *Do not enter an ID code for an IPC while signed on to another. You must log off with the BYE command before signing on top another IPC.*

## 5.4 Enter A Command.

Enter one of the seven system commands as described here. You only need to enter the first three characters.

HELP: [HEL] [RETURN] Lists all available commands with a description of each. Entering [?] will also list the commands.

SYSTEM: [SYS] [RETURN] Allows viewing and/or modifying general system functions such as the store and rack name, password, and dial out telephone numbers.

STATUS: [STA]   [RETURN] Lists the current status of the compressor system showing present readings, alarms, and compressor status.

SET POINTS: [SET] [RETURN] Lists the current set points and allows you to change each.

LOGs: [LOG] [RETURN] Displays a four hour history of suction pressure, discharge pressure, and lead case temperature. NOTE: *If no discharge pressure transducer is used the discharge will read 0.00 and if their is no temperature sensor the temperature will read -40 degrees.*

BYPASS: [BYP] [RETURN] Displays the current compressor bypass status and allows bypassing of individual compressors. Note that a remote operator may not change a local bypass, and a local operator may not change a remote bypass. Bypass forces the compressor to run, unless mechanical controls shut it off.

BYE: [BYE] [RETURN] Logs you off of the present IPC. You must log off before signing on to another IPC.

## 5.5 Ending The Session

*To end a session, log off of the current IPC and hang up the telephone or turn off the modem.*

# SECTION F6

# Trouble Shooting

## 6.1 General.

*Problems that arise with IPCCOM are most often related to set up.*

### TABLE F6-1

### Trouble Shooting Guide

| SYMPTOM | POSSIBLE SOLUTION |
|---|---|
| Terminal will not dial out | Verify that you have a "live" telephone line. |
| | Check terminal and modem connections against manufacturer's instructions. |
| IPCs will not answer. | Verify that IPC modem is turned on and connected to a "live" telephone line. |
| | Dial IPC number using a standard handset and listen for a high pitched tone. If the tone is present the IPC modem is working. Problem may be at terminal / modem set up or IPC / modem wiring. Check Figures F1-1 and F2-1 to make sure the proper wiring connections have been made. |
| | Check that you have assigned each IPC a unique Device Number and that the protocol set in Function 61 matches that of the terminal/modem you are using. |
| IPCs answer, but do not respond or "scrambled" information is being sent back. | Verify that each IPC has a unique Device Number set in Function 60. Make sure you have selected one of these units. |
| | Log off by entering [BYE] [RETURN] and then log back on. It is possible you have signed on to two IPCs |

Once you have the IPCs and your terminal set up properly, few if any, problems should occur. Table F6-1 describes some symptoms and possible solutions. If, after going through the items below, your problem persists: contact the Service Department at CPC,s telephone number (404) 425-2724.

# CPC

# WARRANTY

The warranty extended by **Computer Process Controls, Inc.** (CPC), as printed below, is a limited warranty to provide parts and factory labor necessary to remedy any material defects which appear during the first fifteen months from date of shipment of a CPC product. This warranty is subject to proper system installation and maintenance, as specified by CPC, and does not cover willful or accidential damage.

CPC (Seller) warrants to the Buyer of this CPC product (Buyer), that all tangible articles manufactured by Seller will be free of material defects in workmanship and material. Seller's sole obligation under this warranty shall be to provide, without charge, parts and factory labor necessary to remedy defects, if any, which appear during the first fifteen months from the date of shipment of such articles. Buyer's exclusive remedy and Seller's entire liability in contract, tort, or otherwise for breach of this warranty is Buyer's right to require Seller to repair or replace components, and any claim must be made to Seller in writing within sixteen months after such shipment date. This warranty is the sole and exclusive warranty given with respect to any articles delivered by Seller AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, ORAL OR WRITTEN, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. SELLER IS NOT RESPONSIBLE FOR LOSS OF PROFITS, ECONOMIC LOSS OR OTHER INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES. This warranty is subject to installation and maintenance of the articles in accordance with the specifications and directions supplied by Seller. To obtain warranty service the articles must be shipped or delivered to Seller. All postage, insurance and shipping charges are the responsibility of the Buyer. Seller makes no warranty whatsoever with respect to articles which are not manufactured by it; however, Seller will assign or make available to Buyer any warranty which has been extended ar assigned to Seller by the manufacturer and/or vendor of such articles and which Seller has the right to so assign or otherwise make available to the Buyer. Acceptances of articles covered hereby by Buyer from carrier on shipment thereof shall constitute a waiver of all claims based on delay in delivery; and every claim on account of breakage, short count, or any defect ascertainable upon receipt by Buyer shall be waived by Buyer, unless made in writing within fifteen (15) days after the receipt of the articles to which the claim relates.