Installation & Operation Manual
Vertical Air Conditioners

CFA1120A/1150A/3150A/ 3180A/3240A/3300A/3360A & CGA3180

CFA1120A

Intertek

Manufactured By:

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The most current version of this manual can be found at www.acice.com.

How To Use This Manual

This manual is intended to be a guide to Industrial Climate Engineering's line of vertical air conditioners. It contains installation, troubleshooting, maintenance, warranty, and application information. The information contained in this manual is to be used by the installer as a guide only. This manual does not supersede or circumvent any applicable national or local codes.

If you are installing the air conditioner first read Chapter 1 and scan the entire manual before beginning the installation as described in Chapter 2. Chapter 1 contains general, descriptive information and provides an overview which can speed up the installation process and simplify troubleshooting.

If a malfunction occurs, follow this troubleshooting sequence:

1. Make sure you understand how the air conditioner works (Chapters 1 & 3).
2. Identify and correct installation errors (Chapter 2).
3. Refer to the troubleshooting information in Chapter 4.

If you are still unable to correct the problem, contact the Factory at 1-229-273-9558 for additional assistance.

Please read the following "Important Safety Precautions" before beginning any work.

Important Safety Precautions

1. USE CARE when LIFTING or TRANSPORTING equipment.
2. TRANSPORT the UNIT UPRIGHT. Laying it down on its side may cause oil to leave the compressor and breakage or damage to other components.
3. TURN ELECTRICAL POWER OFF AT THE breaker or fuse box BEFORE installing or working on the equipment. LINE VOLTAGES ARE HAZARDOUS or LETHAL.
4. OBSERVE and COMPLY with ALL applicable PLUMBING, ELECTRICAL, and BUILDING CODES and ordinances.
5. SERVICE may be performed ONLY by QUALIFIED and EXPERIENCED PERSONS.
    * **Wear safety goggles when servicing the refrigeration circuit**
    * **Beware of hot surfaces on refrigerant circuit components**
    * **Beware of sharp edges on sheet metal components**
    * **Use care when recovering or adding refrigerant**
6. **Use COMMON SENSE - BE SAFETY-CONSCIOUS**

This is the safety alert symbol ⚠. When you see this symbol on the air conditioning unit and in the instruction manuals be alert to the potential for personal injury. Understand the signal word DANGER, WARNING and CAUTION. These words are used to identify levels of the seriousness of the hazard.

⚠ DANGER Failure to comply will result in death or severe personal injury and/or property damage.

⚠ WARNING Failure to comply could result in death or severe personal injury and/or property damage.

⚠ CAUTION Failure to comply could result in minor personal injury and/or property damage.

IMPORTANT Used to point out helpful info that will result in improved installation, reliability or operation.

⚠ WARNING

- **If the information in these instructions are not followed exactly, a fire may result causing property damage, personal injury or loss of life.**
- **Read all instructions carefully prior to beginning the installation. Do not begin installation if you do not understand any of the instructions.**
- **Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life.**
- **Installation and service must be performed by a qualified installer or service agency in accordance with these instructions and in compliance with all codes and requirements of authorities having jurisdiction.**

INSTALLER: Affix the instructions on the inside of the building adjacent to the thermostat.
END USER: Retain these instructions for future reference.

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Chapter 1 Description & Specifications

1.1 General Description

Industrial Climate Engineering's (ICE) "CFA" and "CGA" Environmental Control Units are a series of vertical wall-mounted air conditioning systems that provide heating, cooling, and ventilation for electronic equipment shelters, process control centers, E-Houses, and other applications with high internal heat gains. The series includes multiple sizes and nominal cooling capacities from 120,000 to 360,000 BTUH. Resistance heating elements are available in various wattages.

Industrial Climate Engineering models feature an exclusive electronic control board.

The control board consolidates several electrical components, improves the air conditioner's reliability and has LED's to indicate operating status and fault conditions to assist the service technician. A complete description of functions of the control board is in Section 1.6

Other standard components include:

- Hot gas by-pass valve provides for closer temperature control in mechanical cooling and protects against coil freeze-updуring low load conditions.
- Thermal expansion valve to improve both efficiency and capacity over a wide range of ambient temperatures
- Phase monitor to prevent operation if the unit is not properly phased and high/low voltage

ICE CFA & CGA units are designed for easy installation and service. Major components are accessible for service beneath external panels.

All units have internal disconnects. Depending upon state and local code requirements, this feature may eliminate the need for an external breaker or disconnect.

1.2 Model Identification

The model identification number is found on the data sticker. Rating plate located on side panel.

Example	C	F	A	3	1	8	0	A	D	0	5	0	D	R	+	+	+	1	C	A	+	A	2	1	+	+	+	+	+	+
Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

1	Unit Designation/Family	**C** = Industrial Climate Engineering (ICE)
2	Energy Efficiency Ratio (EER)	**F** = EER <9 **G** = 10 EER
3	Refrigerant Type	**A** = R-410a
4	Compressor Type/Quantity	**1** = Single **3** = Dual
5 6 7	Unit Capacity/Nominal Cooling (BTUH)	**120** = 120,000 **240** = 240,000 **150** = 150,000 **300** = 300,000 **180** = 180,000 **360** = 360,000
8	System Type	**A** = Air Conditioner
9	Power Supply (Volts-Hz-Phase)	**A** = 208/230-60-1 **E** = 380-50-3 (4 Wire) **C** = 208/230-60-3 **M** = 400-60-30 **D** = 460-60-3 **Z** = 575-60-3
10 11 12	Heat Designation @ Rated Voltage **KW** = Kilowatt	**000** = No Heat **150** = 15KW **050** = 5KW **180** = 18KW **090** = 9KW
13	Ventilation Configuration	**A** = Solid Front Door **C** = Economizer **D** = Motorized Damper w/Pressure Relief **E** = Motorized Damper w/Pressure Relief & Independent Motorized Damper Control **F** = No Free Cooling, 100% Emergency Ventilation Only w/Independent Control
14	Dehumidification	**R** = Electric Reheat **T** = Electric Reheat w/Humidity Control **+** = None
15	Controls	**A** = Power Fail Alarm w/Additional Lockouts **C** = 24V EMS Relay Kit **D** = 24V EMS Relay Kit w/Factory Installed T-Stat **E** = Factory Installed T-Stat **+** = None
16	Operating Condition	**A** = Evaporator Freeze Sensor (EFS) **C** = EFS w/Hot Gas Bypass **M** = Extreme Duty w/Hard Start & EFS **N** = Hard Start **P** = Hard Start w/Low Ambient & CCH **Q** = Hard Start w/Low Ambient & Fan Cycle Control (FCC) **R** = Crank Case Heater (CCH) **T** = Hard Start w/EFS **U** = Hard Start w/Hot Gas Bypass **V** = Hard Start w/Low Ambient & CCH & EFS **W** = Low Ambient w/CCH **X** = Hot Gas Bypass **Y** = Low Ambient w/CCH & FCC **Z** = Low Ambient w/CCH & EFS **1** = Low Ambient w/FCC **2** = Low Ambient w/FCC & EFS **3** = CCH w/Hot Gas Bypass **+** = None

17	Indoor Air Quality Features	**A** = UV Light **D** = Dry Bulb Sensor **E** = Dry Bulb Sensor w/Dirty Filter **G** = Dirty Filter Sensor **K** = Bi-Polar Ionization **+** = None
18	Air Flow	**1** = Top Supply/Bottom Return
19	Compressor Location	**C** = Center
20	Filter Option	**A** = 2" Pleated (MERV 8, AC/HP-C) **C** = 2" Charcoal **D** = MERV 11 High Filtration Package **E** = MERV 13 High Filtration Package **F** = Filter Access Through Return Air Opening **G** = F + C **H** = F + D **J** = F + E **K** = F + W **W** = Aluminum Washable **+** = None
21	Corrosion Protection	**A** = Condenser Coil Only **C** = Evaporator Coil Only **D** = Both Coils Condenser & Evaporator **E** = All Coils Cond/Evap/Reheat **F** = Coat All **K** = Coastal Package **+** = None **$** = Special
22 23	Engineering Revision Level	A1 A2
24	Cabinet Color	**1** = Beige **2** = Gray **3** = Carlsbad Canyon **4** = White **5** = Stainless Steel Exterior **6** = Dark Bronze **7** = .050 Aluminum Stucco **8** = Mesa Tan **9** = Pebble Gray **A** = Stainless Steel - Unit **$** = Custom Color (Powder Coat)
25	Sound Attenuation	**2** = Compressor Blanket **+** = None
26	Security Option	**A** = Lockable Access Plate/Tamper Proof **B** = Lockable Latch/Hinge **+** = None
27	Fastener/Drain Pan Option	**A** = Stainless Steel Fasteners **C** = Stainless Steel Drain Pan **D** = Stainless Steel Fasteners & Drain Pan **+** = None
28	Special Variation	**+** = None **$** = Special Configuration Not Covered by Model Nomenclature
29	Unused	**+** = None **$** = Special
30	Unused	**+** = None **$** = Special

Note: Not all options are available with all configurations. Contact your ICE sales representative for configuration details and feature compatibility.

1.3 Serial Number Date Code

20 = 2020	01 = January	05 = May	09 = September
21 = 2021	02 = February	06 = June	10= October
22 = 2022	03= March	07 = July	11 = November
23 = 2023	04 = April	08 = August	12 = December

1.4 Weights and Filter Sizes

Electrical and performance specifications and dimensional drawings are in the Product Data Sheet.

Note: Follow local codes and standards when designing duct runs to deliver the required airflow. Minimize noise and excessive pressure drops caused by duct aspect ratio changes, bends, dampers and outlet grilles in duct runs.

Model Number	CFA1120	CFA1150/3150	CFA3180	CFA3240	CFA3300	CFA3360	CGA3180
Cooling BTUH[1]	125,000	150,000	182,200	216,600	300,000	330,000	180,000
Rated Air Flow (CFM[2])	4,500	4,500	6,500	7,400	11,900	10,200	6,000
ESP[3] @ Rated Conditions	0.30	0.35	0.35	0.40	0.45	0.55	0.35

[1]Cooling rated at 95°F (35°C) outdoor and 80°F DB/67° WB (26.5°C DB/19.5°C WB) return air
[2]CFM=Cubic Feet per Minute [3]ESP=External Static Pressure
Ratings are with no outside air. Performance will be affected by altitude.
Ratings are at 230 volts for 208/230 volt units ("C" models), 460 volts for "D" models, 380 volts for "E" models, 575 volts for "Z" models. Derate performance by 17% for ACE (380v. 3ø, 50 Hz) models
Operation of units at a different voltage from that of the rating point will affect performance and air flow.

Table 1. Cooling Performance and Air Flow Ratings

MODEL	Description	INCHES	MILLIMETERS	PART #	# OF FILTERS	MERV RATING
CFA1120/1150 & CFA3150	For Optional Fresh Air Hood	11 x 22 x 1	279 x 559 x 25	80119	2	N/A
CFA1120/1150 & CFA3150	Exterior Access Return Air Filter	25 x 16 x 2	635 x 406 x 51	80137	3	8
CFA1120/1150 & CFA3150	Interior Access Return Air Filter	15 x 20 x 2	381 x 508 x 51	92365	3	8
CFA1120/1150 & CFA3150 w/Economizer	Fresh Air Hood Pre-filters	26 x 12 x 1"	660 x 305 x 25	92526	2	N/A
CFA1120/1150 & CFA3150 Reverse Flow w/Economizer	Economizer Pre-filter	9¼ x 37 x ⅜	235 x 940 x 10	92127	1	N/A
CFA3180/3240	Exterior Access Return Air Filter	25 x 16 x 2	635 x 406 x 51	80137	4	8
CFA3180/3240	Interior Access Return Air Filter	24 x 18 x 2	610 x 457 x 51	81257	4	8
CFA3180/3240 w/Economizer	Fresh Air Hood Pre-filters	26 x 12 x 1	660 x 305 x 25	92526	2	N/A
CFA3180/3240 Reverse Flow w/Economizer	Fresh Air Hood Pre-filters	16 x 32 x 1	406 x 813 x 25	93187	3	N/A
CFA3300/3360	Exterior Access Return Air Filter	30 x 30 x 2	762 x 762 x 51	80156	4	8
CFA3300/3360	Interior Access Return Air Filter	24 x 18 x 2	610 x 457 x 51	81257	4	8
CGA3180	Exterior Access Return Air Filter	30 x 30 x 2	762 x 762 x 51	80156	4	8
CGA3180	Interior Access Return Air Filter	24 x 18 x 2	610 x 457 x 51	81257	4	8
CGA3180	For Optional Fresh Air Hood, #K/04657	26 x 12 x 1	660 x 305 x 25	92526	2	N/A
CGA3180 Reverse Flow	Exterior Access Return Air Filter	30 x 30 x 2	762 x 762 x 51	80156	4	8
CGA3180 Reverse Flow	Interior Access Return Air Filter	24 x 18 x 2	610 x 457 x 51	81257	4	8

Table 2. Filter Sizes/Part Numbers

MODEL	Unit Weight		Shipping Weight		Shipping Dimensions					
					Height		Width		Depth	
	LBS	KG	LBS	KG	Inches	MM	Inches	MM	Inches	MM
CFA1120	1,160	527.3	1,285	584.1	98	2,489	56	1,422	48	1,219
CFA1150 & CFA3150	1,166	530	1,291	586.8	98	2,489	56	1,422	48	1,219
CFA3180	2,307	1,046	2,420	1,098	98	2,489	76	1,930	51	1,295
CFA3240	2,523	1,144	2,636	1,196	98	2,489	76	1,930	51	1,295
CFA3300	2,625	1,193	2,750	1,250	108	2,743	72	1,829	72	1,829
CFA3360	3,210	1,456	3,335	1,513	108	2,743	72	1,829	72	1,829
CGA3180	3,210	1,456	3,335	1,513	108	2,743	72	1,829	72	1,829

Table 3. Shipping Weights & Dimensions

Model	CFA1120	CFA1150	CFA3150	CFA3180	CFA3240	CFA3300	CFA3360	CGA3180
Refrigerant Charge (Oz)	367	367	152[1]	240[1]	264.5[1]	432[1]	416[1]	320[1]

[1]Per circuit on dual compressor models

Table 4. Refrigerant Charge (R410A, Ounces)

1.5 General Operation

Hot Gas By-Pass

Standard on all models except the CGA3150, Hot Gas By-Pass is normally used in specialty applications (i.e Magnetic Resonance Imaging (MRI) buildings) to prevent magnetic voltage disturbance caused by cycling. This technology is applied in this product to extend the operation envelope for the compressor to 20º F (-6.6ºC). Combined with a condenser low ambient Fan Cycle feature, compressor operation can be extended to 0º F (-17.8ºC). During Hot Gas operation mode, system performance will be reduced. If product operation is in mild outdoor ambient conditions, the installed shut-off ball valve may be closed, thus disabling the Hot Gas By-Pass feature.

Refrigerant Cycle (Cooling Mode)

The air conditioners use R-410A refrigerant in a conventional vapor-compression refrigeration cycle to transfer heat from air in an enclosed space to the outside. A motorized impeller assembly blows indoor air across the evaporator. Cold liquid refrigerant passing through the evaporator is boiled into gas by

heat removed from the air. The warmed refrigerant gas enters the compressor where its temperature and pressure are increased. The hot refrigerant gas condenses to liquid as heat is transferred to outdoor air drawn across the condenser by the condenser fan. Liquid refrigerant is metered with a thermal expansion valve (TXV) into the evaporator to repeat the cycle.

Economizer

The factory installed economizer saves energy and reduces the run time on the compressor and condenser fan motor by using outside air – when suitable – to cool the shelter.

Note: The economizer option is currently available on the 1120,1150, 3180, 3240, 3300 and 3360.

On a signal from the wall mounted indoor thermostat that cooling is required, either mechanical cooling with the compressor or free cooling with the economizer is provided. A factory installed enthalpy controller determines whether the outside air is sufficiently cool and dry to be used for cooling. If suitable, the compressor is locked out and the economizer damper opens to bring in outside air through fresh air hoods located on each side of the air conditioner. The outside air is filtered with filters in each of the outside air hoods. Integral pressure relief allows the interior air to exit the shelter, permitting outside air to enter the shelter. The temperature at which the economizer opens is adjustable from 63°F (17°C) at 50% Relative Humidity to 73°F (23°C) at 50% Relative Humidity.

After the enthalpy control has activated and outside air is being brought into the building, the mixed air sensor measures the temperature of the air entering the indoor blower and then modulates the economizer damper to mix the right proportion of cool outside air with warm indoor air to maintain 50°-63°F (10° - 17°C) air being delivered to the building. This prevents shocking the electronic components with cold outside air.

The compressor is not permitted to operate when the economizer is functioning.

If the outside air becomes too hot or humid, the economizer damper closes completely, or to a field selectable minimum open position, and mechanical cooling is activated.

Fresh air hoods with prefilters are field installed on each side of the air conditioner.

CFA (Single Compressor) Units: The cooling input terminal is terminal (1) of the low voltage terminal strip. When terminal (1) has 24vac applied the system operates in the cooling mode.

CFA/CGA (Dual Compressor) Units: The CFA and CGA is factory wired for maximum cooling utilizing both compressors. If 2 stage compressor operation is desired, the factory installed jumper between terminals 1 and 2 of the low voltage terminal strip must be removed. The 1st stage cooling input is terminal 1 of the low voltage terminal strip and the 2nd stage cooling input is terminal 2 of the low voltage terminal strip. The thermostat must be programmed for 2 stage cooling operation when 2 stage compressor operation is desired.

Heating Mode

A wall-mounted thermostat controls the heating cycle of models which incorporate resistance heating elements. On a call for heat, the thermostat closes the heat relay to energize the indoor fan and the resistance elements.

1.6 Optional Controls & Packages

Protective Coating Packages

Coated Coils: Either the condenser or evaporator coil can be coated. For harsh conditions, e.g., power plants, paper mills or sites were the unit will be exposed to salt water, the coils should be coated. ***Note:*** Cooling capacity may be reduced by up to 5% on units with coated coils.

Coastal Environmental Package: This package includes:

- Corrosion resistant fasteners,
- Sealed or partially sealed condenser fan motor,
- Coating applied to all exposed internal copper and metal in the in the condenser section, and
- A protective coating on the condenser coil.

All Coat Package: Includes the same features as the Coastal Environmental Package and adds a coating on the evaporator coil and on all exterior and interior components and sheet metal. (**Note:** the insulated internal sheet metal and the internal control box are not coated).

Dirty Filter Indicator

A diaphragm type of indicator measures the air pressure on either side of the filter and when the pressure drops below the set point, a red LED is illuminated. The set point is adjustable.

Cabinet Color and Material

ICE air conditioners are available in two cabinet colors -the standard gray and beige. The standard cabinet's sides, top and front panels are constructed of 16 gauge painted steel. Contact your sales representative for color chips, custom colors and 316 stainless steel cabinets.

Fresh Air Damper

Allows introduction of outside air into the building to provide positive pressurization. Field installed on either the left or right hand side of the unit. See Appendix A for installation instructions.

Model Number	Fresh Air Damper Part #	Fresh Air Damper Filter Part #	Fresh Air Damper Filter Size In (mm)
CFA1120/1150 & CFA3150	K/04657-xxx	80119	11″ x 22″ x 1″ (279 x 559 x 25)
CFA3180/3240 & CGA3180	K/04757-xxx	92127	9¼″ x 37″ x ⅜″ (235 x 940 x 10)
CFA3300/3360	K/10169-xxx	92526	12″ x 26″ x 1″ (305 x 660 x 25)
xxx designates the color. 200 = Grey (standard). 100 = Beige. 500 = Stainless Steel			

Crankcase Heater

Crankcase Heater Recommended for use for units installed in cold climates.

Dual Compressors With Lead/Lag Operation

Freeze Sensor On Indoor Coil

Prevents frost on the indoor coil caused by a loss of air flow or restrictive duct work.

Filter Access From Return Air Grille

Factory or field installed filter bracket allows changing and access to the filters from the return air grille. See model ID, special option code "I".

Reverse Air Flow Configuration

Location of Supply and Return Air Openings are reversed.

1.7 Electrical Operation

The compressor and condenser fan are energized with a contactor controlled by a 24 VAC pilot signal.

Some compressors incorporate an internal PTC crankcase heater that functions as long as primary power is available. The heater drives liquid refrigerant from the crankcase and prevents loss of lubrication caused by oil dilution. Power must be applied to the unit for 24 hours before starting the compressor.

The condenser (outside fan) motor is energized by the same contactor.

The indoor evaporator fan motor is controlled by the fan purge on the electronic control board.

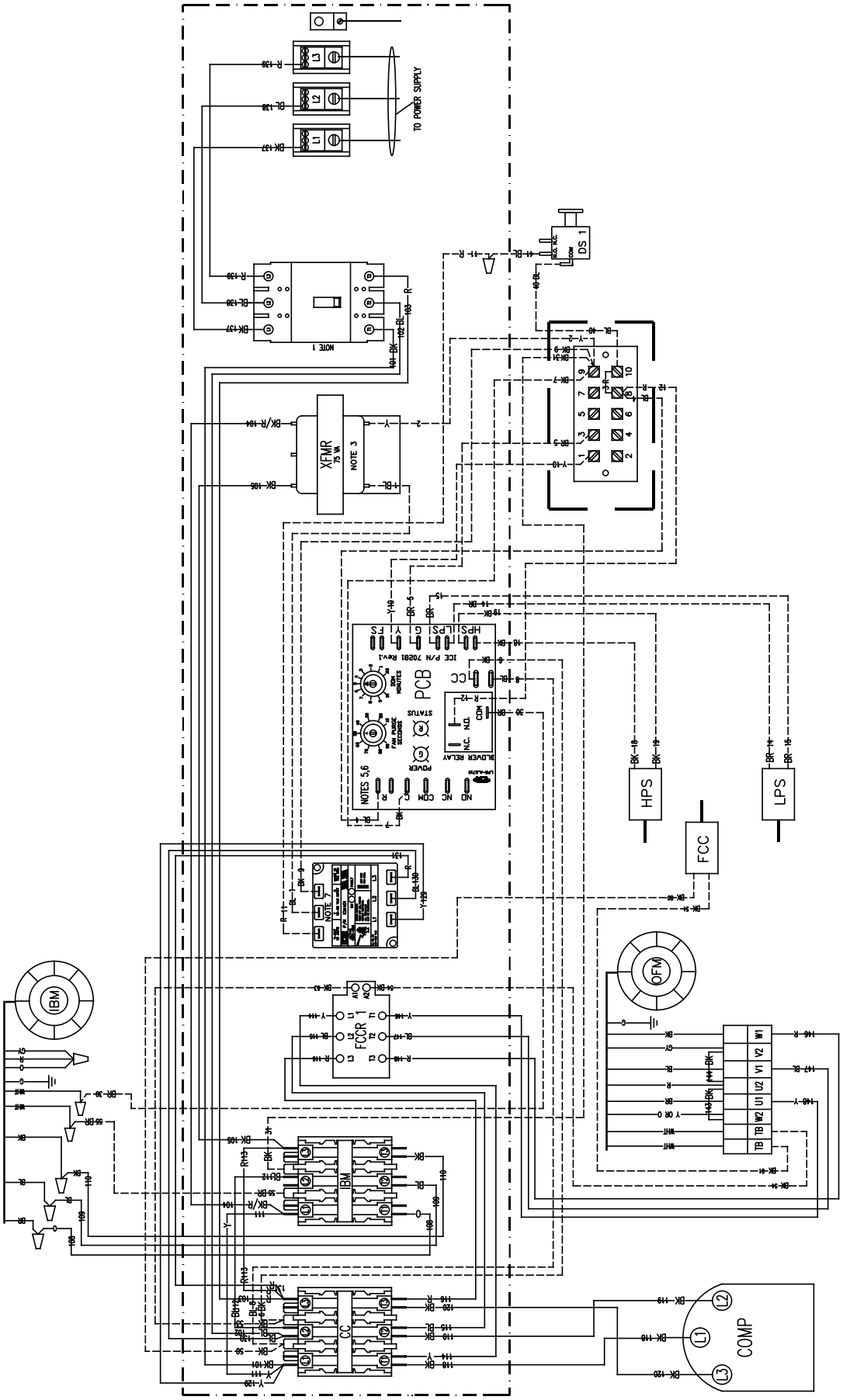


Figure 1a. Typical Electrical Schematic for Single Compressor Units

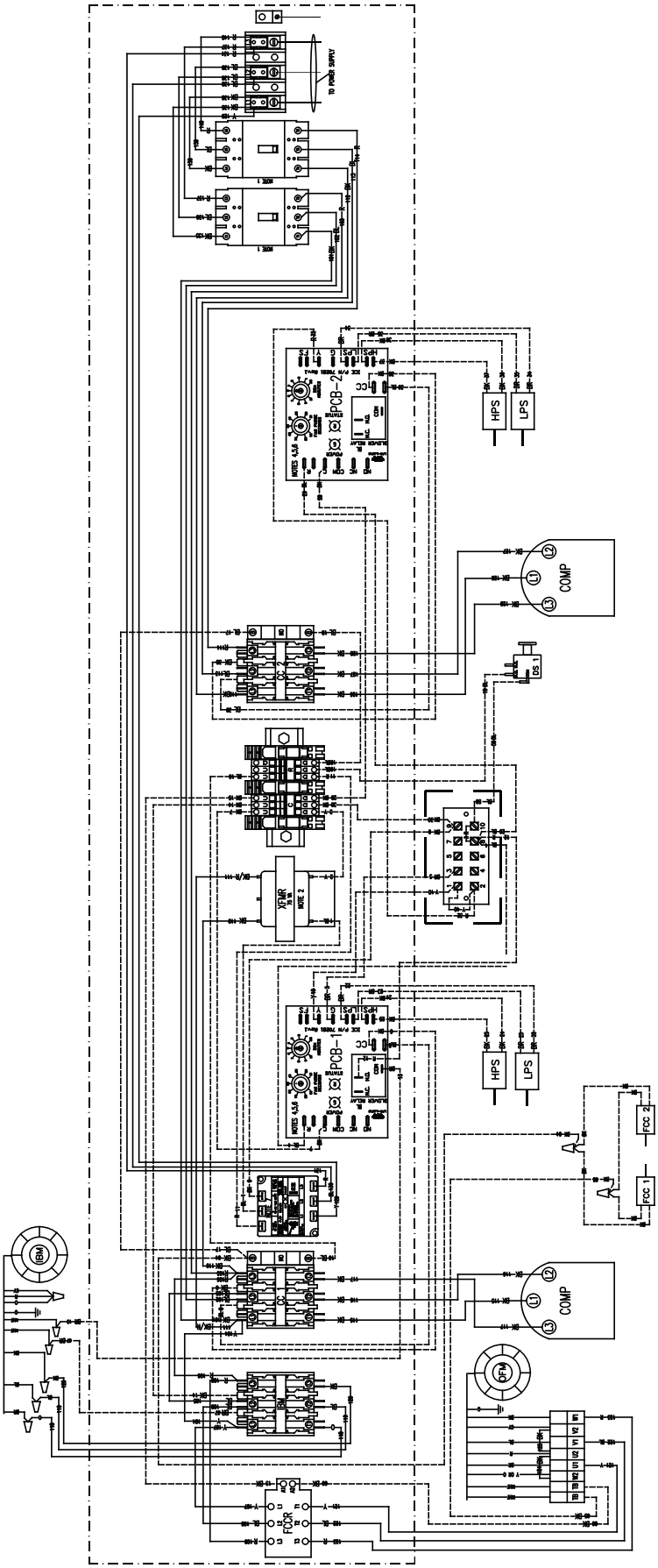


Figure 1b. Typical Electrical Schematic for Dual Compressor Units

Chapter 2 Electronic Control Board

2.1 Introduction

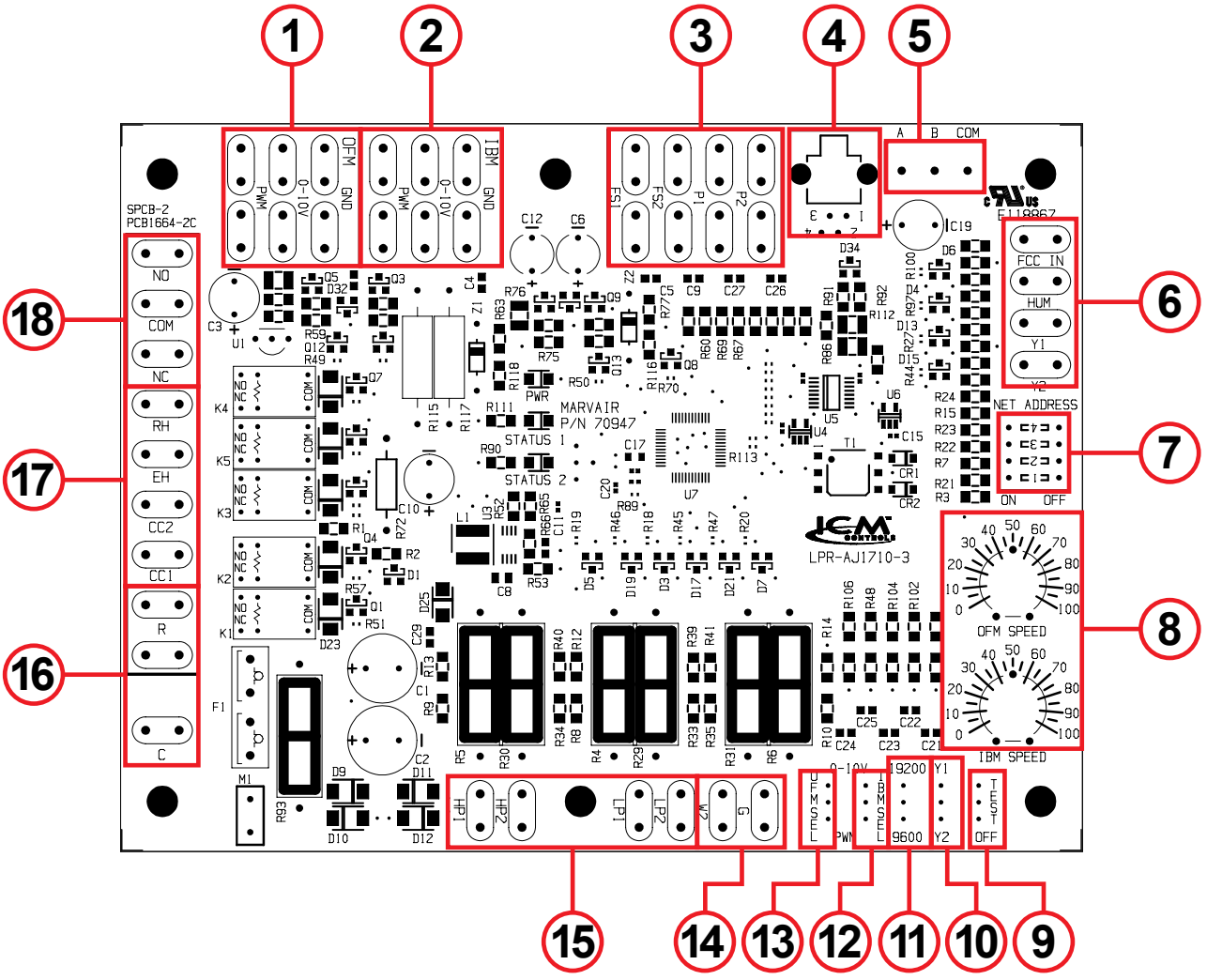
⚠ WARNING

Failure to observe the instructions contained in this document may result in personal injury and/or property damage and may void the warranty. Read this manual before installing, replacing or using this product.

ICE's proprietary Printed Circuit Board (PCB) sets the standard for the industry in flexibility, reliability and performance. This UL certified component is engineered to optimize Heating, Cooling and Dehumidification operation while communicating valuable information to the end user. Special features include 2-Stage operation with varying speed control to optimize latent and sensible capacity, built in remote communication (MODBUS) for monitoring and/or control, optimized head pressure control and the ability to function autonomously without the need for an off the shelf thermostat. The ICE PCB comes equipped with LEDs to monitor lockouts for independent circuits, which drastically reduces troubleshooting time and system downtime. Lockout contacts are also provided along with the alarms being transferred via MODBUS.

This chapter provides the necessary information for installing and operating the ICE PCB.

The diagram below identifies the inputs, outputs and connections for the ICE PCB.



Item	Description
1	Outdoor Motor Control Signal Output
2	Indoor Motor Control Signal Output
3	P 1/2- Pressure for Circuit 1 and Circuit 2 (Respectively) FS1 – Freeze Stat for Circuit 1 FS2 – Indoor Temperature Input
4	Modbus Communication 3 Wire [A, B, COM] and Parallel RJ-11 Port
5	
6	Fan Cycle Control Input (only Applicable for EC Outdoor Motors) Hum – Humidity Control Input (Connect to R Node) Y 1/2 - Cooling Request for Stage 1 and Stage 2 Cooling Operation
7	Modbus Network Address. Set All 4 to OFF for Local Control
8	Potentiometers for Indoor and Outdoor Speed
9	Energize or De-Energize Test Mode
10	Set Speed of Indoor Motor for Y1 and Y2 Operation
11	Set Baud Rate. 19.2k Between Top and Mid. 9.6k Between Mid and Bottom
12	Set Indoor Motor Control Signal Type
13	Set Outdoor Motor Control Signal Type
14	Thermostat Inputs: W2 – Heat Request G – Indoor Fan Request ON – Connect Respective Terminal to R Node. Off – Open Circuit
15	Pressure Switch Inputs for Respective Circuit HP – High Pressure Switch LP – Low Pressure Switch Switch to Be Closed for Cooling Operation. Switch to Be Connected to “R” Node
16	24 VAC Power Input to PCB.
17	Digital Outputs (24 VAC): The PCB Makes and Breaks R. RH – Reheat EH – Electric Heat CC 1/2– Compressor (Respectively)
18	Alarm Contacts

2.2 Installation and Replacement

The PCB is factory installed. To install a replacement PCB, use the six mounting holes along with the appropriate screw size to firmly secure the board to the control box. After this is achieved, follow the wiring diagram and pin configuration for the respective system for appropriate operation. Ensure that the terminals used do not make any unwanted electrical connection (via strands etc.) with any other terminals. Please allow a 1” creepage distance between the board and all other adjacent electrical components.

2.3 Operation

LED Status Indicators

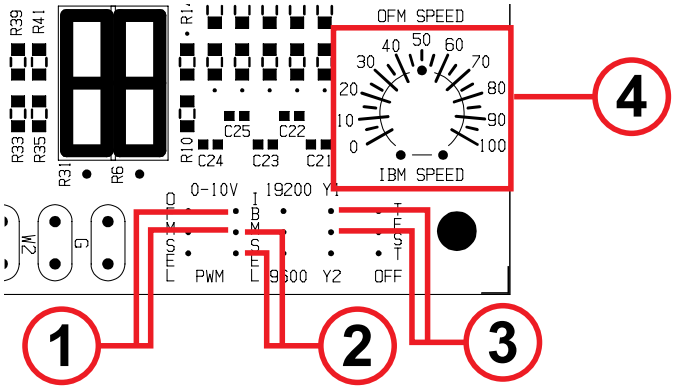
Color	Type	Status	Description
Green	Power	Constant On	24 VAC power has been applied
Red	Status 1 and Status 2	Constant On	Normal Operation
		1 Blink	High pressure switch has opened twice
		2 Blinks	Low pressure switch has opened twice
		3 Blinks	Freeze stat (optional) - Indoor coil temperature is below 35°F (1°C)
		Continuous Flash of Both LEDs	Insufficient voltage to the board. Less than 20 Volts

Power

The ICE PCB requires 24 VAC to operate. When the board is sufficiently powered, the "PWR" status light on the PCB illuminates "Green." If there is insufficient power to the board, the "STATUS 1" and "STATUS 2" flashes continuously. Insufficient power to the board will result in no outputs being energized.

Setting the Speed for the Y1 and Y2 Operation for Indoor Motor

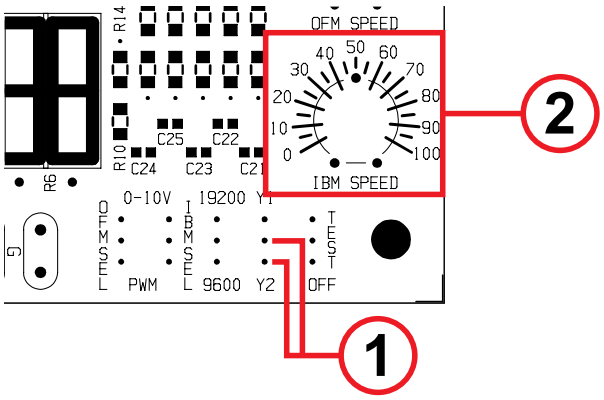
Put Bridge Jumper between the "Y1 pin and center pin" shown in the figure below. Use the potentiometer marked "IBM SPEED" to set the required speed for first stage cooling (Y1 request). Note that the type of control signal required by the motor must be set and the appropriate signal terminations must be used. This jumper will be factory installed. In replacing the PCB, verify the necessary signal and configure the board accordingly. Only 2 of the 3 pins should be used for the necessary configurations. **DO NOT CONNECT ALL 3 PINS**.



1	Set for 0-10V Signal. Jumper To Remain On The Appropriate Terminal For Correct Operation
2	Set For PWM Signal. Jumper To Remain On The Appropriate Terminal For Correct Operation
3	Bridge Jumper Position for Setting Y1 Speed
4	IBM SPEED Potentiometer

Figure 2a. Setting the Speed for the Y1 and Y2 Operation for Indoor Motor

To set second stage cooling (Y2 request) speed, put Bridge Jumper on the "Y2 pin and center pin" shown in the figure below. Use the potentiometer marked "IBM SPEED" to set the required speed.

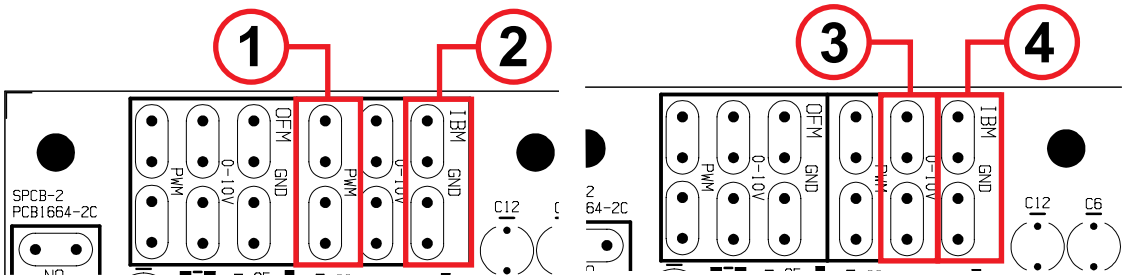


1	Bridge Jumper Position For Setting Y2 Speed
2	IBM SPEED Potentiometer

Figure 2b. Second Stage Cooling Speed

Output Termination for Indoor Motor Control Signal

Note: Follow data (wiring and signal control signal type) of the appropriate motor to setup the PCB

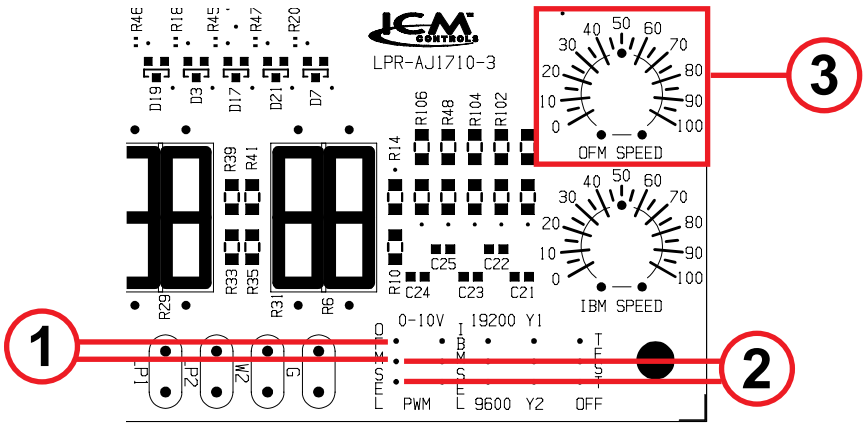


1	Indoor Motor PWM Signal Output. Reference Wire Connected to “GND” and the Signal Connected to “PWM”
2	
3	Indoor Motor 0-10V Signal Output. Reference Wire Connected to “GND” and the Signal Connected to “0-10V”
4	

Figure 3. Output Termination for Indoor Motor Control Signal

Setting the Speed for Outdoor Motor

The Outdoor Motor runs at constant speed dictated by the potentiometer. See figure below.

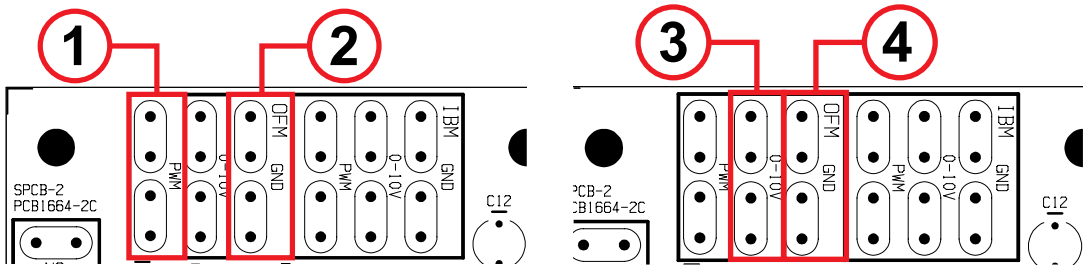


1	Set for 0-10V Signal. Jumper To Remain On The Appropriate Terminal For Correct Operation
2	Set For PWM Signal. Jumper To Remain On The Appropriate Terminal For Correct Operation
3	Outdoor Motor Speed Potentiometer

Figure 4. Outdoor Motor Speed Setting

Output Termination for Outdoor Motor Control Signal

Note: Follow data (wiring and signal control signal type) of the appropriate motor to setup the PCB.



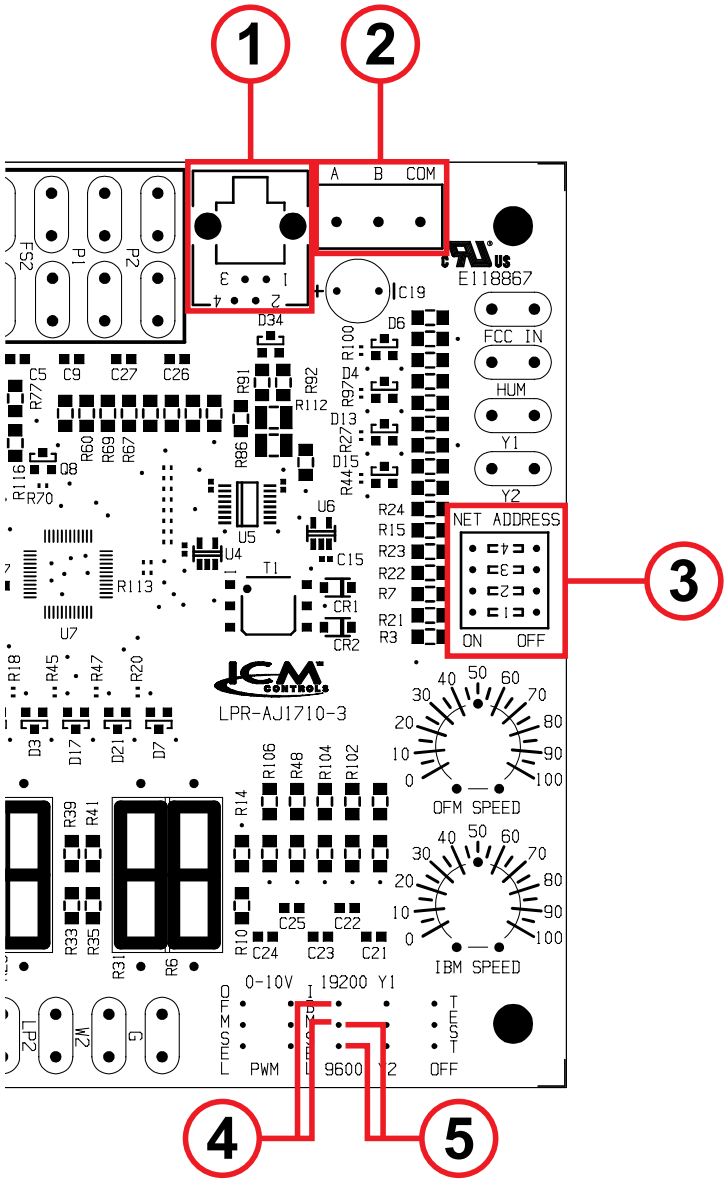
Note that there are redundant (2 of each) output signal terminations for each motor.

1	Outdoor Motor PWM Signal Output. One Wire Connected to “GND” and the Other Connected to “PWM”
2	
3	Outdoor Motor 0-10V Signal Output. One Wire Connected to “GND” and the Other Connected to “0-10V”
4	

Figure 5. Output Termination for Outdoor Motor Control Signal

Communication

The ICE PCB comes equipped with MODBUS communication standard. There are 2 adjacent MODBUS communication ports connected in parallel. That is, both ports transmit the same information. The difference between the ports is the physical connection. One port is for RS-485 (3 wire shielded cable is recommended) and the other port is RJ-11. The board allows you to set the Baud Rate at 9600 bits per second or 19200 bits per second. The board also allows 15 different MODBUS addresses based on the position of the "NET ADDRESS" DIP switches. The Net Addresses are written in Binary (see table below) with switch 4 being the least significant bit. **THE NUMBERS ON THE DIP SWITCHES DO NOT CORRELATE TO MODBUS ADDRESSES**. The figure below shows the positions of the various components necessary to set up communication on the on the PCB.



Note: No Parity; Serial Data Bit = 8; Stop Bit = 1

1	RJ-11 Termination
2	RS-485 Termination
3	MODBUS Network Address DIP switches. See Addressing Table
4	Baud Rate - 19200 BPS: Between Upper and Middle Pin
5	Baud Rate - 9600 BPS: Between Lower and Middle Pin

Figure 6. Communications SetUp

Address	DIP Switch 1	DIP Switch 2	DIP Switch 3	DIP Switch 4
0 [Local Control]	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	ON
2	OFF	OFF	ON	OFF
3	OFF	OFF	ON	ON
4	OFF	ON	OFF	OFF
5	OFF	ON	OFF	ON
6	OFF	ON	ON	OFF
7	OFF	ON	ON	ON
8	ON	OFF	OFF	OFF
9	ON	OFF	OFF	ON
10	ON	OFF	ON	OFF
11	ON	OFF	ON	ON
12	ON	ON	OFF	OFF
13	ON	ON	OFF	ON
14	ON	ON	ON	OFF
15	ON	ON	ON	ON

Table 5. MODBUS Network Address DIP Swith Positions

2.4 Sequence of Operation

IMPORTANT

All equipment should go through the recommended commissioning/start up sequence to ensure safety and system reliability. This document is only valid if the system is used as intended.

This section defines the manner and method of control of the HVAC system. It will cover the following operations and protections.

1.0 Blower Operation

2.0 Cooling Operation

- 2.1 Mechanical Cooling
  - 2.1.1 Partial Capacity - 50-60%
  - 2.1.2 Partial Capacity - 50%
  - 2.1.3 Full Capacity

3.0 Heating

- 3.1 Electric Heat

4.0 Dehumidification

- 4.1 Independent Reheat Output

5.0 Refrigeration Protection

- 5.1 High Pressure Lockout
- 5.2 Low Pressure Lockout
- 5.3 Low Voltage
- 5.4 Anti-short Cycle

6.0 Additional Features

- 6.1 MODBUS communication
- 6.2 Modulating Head Pressure Control
- 6.3 Freeze Stat Operation
- 6.4 Onboard Thermostat

Equipment, devices and necessary system components are specified in the respective section.

Note:

1. All inputs on the Controller go through a 5 seconds Time-On Delay to prevent nuisance request. Compressor Outputs go through 5 seconds staggered Time On delay to prevent nuisance tripping of breaker due to the inrush associated with these large inductive loads.
2. Normal Operating Mode describes a mode in which there are no active faults which would interrupt the operation of the system.
3. A control voltage being "High" describes the event in which 24VAC is supplied to that input. Conversely, a "Low" control signal describes an event in which less than 5VAC is supplied to the

1.0 – Blower Operation

A request for Fan Only (independent G-signal via Digital input or MODBUS), results in the indoor motor turning "ON" and operating at the "Y2" motor speed (Only Applicable for EC motors). See Installation/ Operation manual to see how to set the speeds for the various operations. As long as there is a request for Fan (G-input High or a request for Indoor Fan Only via MODBUS), the indoor motor will continue to operate at the Y2 speed setpoint.

When there is a request for Indoor Fan (G-input High) along with a request for cooling, heating or dehumidification, the G-Input becomes lowest priority. This means that in any combination involving the G-input, the speed associated to Fan Only will never take precedence.

The priority list from Highest to Lowest goes as follows:

1. Stage 2 Cooling Request (Y2-Input)
2. Stage 1 Cooling Request (Y1-Input)
3. Electric Heat Request (W2-Input)
4. Dehumidification Request (Hum-Input)
5. Indoor Fan Request (G-Input)

Note – The priority list above also describes the operation that takes precedence in the event that there is a request for all operations or a combination of operations. The controller will NOT energize the compressor outputs and the heater output simultaneously.

The speed at which the Indoor Fan Operates during Stage 1 (Y1) and Stage 2 (Y2) Cooling Request can be set directly at the board using the jumper associated to the "Y1" and "Y2" pin. All other requests run at 80% of Y2 speed except for the lone G-input which runs at the Y2 speed settings. All requests are interlocked with the Indoor Fan and will run the Fan at the respective speed associated with the operation. This means that a lone call for Stage 1 (Y1) Cooling will automatically run the Indoor Fan at Stage 1 (Y1) Cooling Speed even without a request for Indoor Fan. This holds true for all request.

2.0 – Cooling Operation

2.1– Mechanical Cooling

This section will describe the sequence of operation which takes place during Direct Expansion (DX) cooling from a control standpoint.

2.1.1 Y1 Cooling (Partial Capacity 50-60%)

In normal operating mode, a request for "Stage 1 Cooling (Y-input)" via MODBUS, Digital Input or Onboard Thermostat, energizes Compressor 1 Relay Output (CC1) on the PCB. The controller provides a continuous control signal associated to the Indoor Fan Motor, that is proportional to the "Y1" speed setting on the board or via MODBUS. It also outputs a request dependent (based on FCC IN) control signal for the Outdoor Fan Motor. In Stage 1 Cooling operation, the compressor

and the indoor fan remains on continuously but the outdoor fan cycles based on head pressure. The Fan Cycle Control Switch (Low Ambient Control Switch) closes at 400 PSIG to set the "FCC IN" input High which in turn outputs a speed proportional to the "OFM Speed" setting on the board or by MODBUS. This brings on the outdoor fan which runs until the switch reopens (at 290 PSIG). These outputs function as described until the Cooling setpoint is satisfied.

2.1.2 Y2 Cooling (Partial Capacity 50%)

If the space temperature continues to increase pass the defined differential, Stage 2 Cooling (Y2-input) is energized. Under normal operation, this energizes the Compressor 2 Output (CC2). The Indoor Fan motor, will operate at "Y2" speed instead of "Y1" speed since Y2 has higher priority. These outputs remain energized until the cooling setpoint is satisfied. Once the setpoint is satisfied, the Compressor and the Outdoor fan outputs are de-energized. The Indoor motor continues to run for 90 seconds after the operation.

2.1.3 Y1 and Y2 Cooling (Full Capacity)

In the event that both Y1 and Y2 inputs are triggered, both CC1 and CC2 outputs are energized under normal conditions. The Indoor Fan motor, will operate at "Y2 speed" since Y2 has higher priority. Outputs described in the partial cooling operation above continue to function as described until the cooling setpoint is satisfied. Once the setpoint is satisfied, the Compressor and the Outdoor fan outputs are de-energized. The Indoor motor continues to run for 90 seconds after the operation.

Note: With staged compressors, a CC2 output without a CC1 output will neither result in partial capacity nor full capacity. Only CC1 output can achieve partial capacity. Both CC1 and CC2 outputs are required to achieve full capacity.

Request	Active Input	Active Output
Stage 1 Cooling (1 Fixed Compressor)	Y1	CC1 (Partial Capacity)
Stage 1 Cooling (2 Fixed Compressors)	Y1 or Y2	CC1 or CC2 Respectively (Partial Capacity)
Stage 1 Cooling (1 Staged Compressor)	Y1	CC1 (Partial Capacity)
Stage 2 Cooling (2 Fixed Compressors)	Y1 + Y2	CC1 + CC2 (Full Capacity)
Stage 2 Cooling (2 Staged Compressors)	Y1 + Y2	CC1 + CC2 (Full Capacity)
Stage 2 Cooling (2 Staged Compressors)	Y2	CC1 But the compressors will not run without CC1 being active. No Cooling.

3.0– Heating

3.1– Electric Heat

When there is a request for "Heating (W2-Input High)" via MODBUS, Digital Input or On-board Thermostat, the HVAC unit will run the Indoor Motor for 10 seconds prior to energizing the Heater Output. Once the Heater output is energized, the Heater comes on at full capacity (no staging). The Heater will remain on until the Heating setpoint is satisfied and the request is dropped. Once the heating setpoint is satisfied, the Indoor Fan will continue to run for 90 seconds while all other associated outputs are de-energized. Indoor Fan will default at 80% of Y2 speed.

4.0– Dehumidification

4.1– Independent Reheat Output

A request for "Dehumidification (Hum – Input High)" via MODBUS or Digital input will result in the control board energizing the Compressor 1 (CC1), Compressor 2 (CC2) and the Reheat (RH) relay outputs on the board. It also produces a continuous control signal for the Indoor Fan Motor that is proportional to the 80% (default) of the Y2 speed. The Outdoor Fan Motor is request dependent (based on "FCC IN" Input) and outputs a signal proportional to board or MODBUS setting when the "FCC IN" input is High. The board continues to produce these outputs until the Dehumidification request is dropped. Once this request is dropped, the Indoor Fan Motor continues to run for 90 seconds.

5.0 – Refrigeration Protection

5.1– High Pressure Lockout

This condition describes the abnormal rise in Head Pressure pass the system acceptable limit of 660 PSI (+/-20PSI). The fault will only be active when the High-Pressure Switch (Normally Closed) opens during a request for Cooling. The first time this fault condition occurs, the system cuts the compressor off WITHOUT locking out. Once the pressure normalizes (drops below 450 PSI), the system will resume operation if the cooling call still exist. If this fault occurs a second time on the same Cooling request, the system locks out. Lockouts can be monitored using the Status 1 and Status 2 LEDs. These LEDs correspond to a particular circuit and has a flash sequence associated to the various faults. The faults can also be monitored via MODBUS by reading the respective value based on the MODBUS map that is provided. After this lockout condition is reached, the cooling call must be cycled (on/off of respective cooling request) or the system must be power cycled to clear the fault. For a 2-compressor system, each lockout is isolated to the respective circuit and will not interfere with the operation of the other circuit providing that the circuits operate independently. The system will continue to lockout until the problem is rectified.

5.2– Low Pressure Lockout

This condition describes the abnormal fall in Suction Pressure below 40PSIG (+/- 5PSIG). This fault will only be active when the Low-Pressure Switch (Normally Closed) opens up during a request for Cooling. The Low-Pressure Switch is bypassed on the initial call for cooling for 3 minutes to allow low ambient start-up of the system. Once these 3 minutes have elapsed, if the switch is still open, the system cuts the compressor off. Once the pressure normalizes, the system will restart the cooling operation. In the event that the fault occurs a second time on the same call for cooling, the system locks out. To clear the fault, the Cooling request must be cycled or the system must be power cycled. Status LEDs with associated flash codes or designated MODBUS values can be monitored to verify this fault. The system will continue to lockout unit the problem is rectified.

5.3– Low Voltage

In the event that the board is experiencing low voltage (less than 20 Volts), both Status 1 and Status 2 LEDs flashes continuously (see LED Status Indicators). The board will not energize any outputs until this problem is rectified. This fault can be monitored at the board level via LEDs or via MODBUS.

5.4– Anti-Short Cycle

This is a built-in protection mechanism that increases the reliability of the compressor by protecting it from excessive short cycling. When the compressor goes off, due to any fault, emergency or if the cooling setpoint is satisfied, a built-in 3-minute timer locks the compressor for that respective circuit out. This can be monitored via MODBUS by referencing the appropriate register. However, it can only be monitored at the board level by waiting for the 3 minutes to elapse.

6.0 – Additional Features

5.1 – MODBUS Communication

To control the board via MODBUS, the board ID must be non-zero. “Zero” a MODBUS ID represents local control which allows the board to be controlled at the board level by Digital thermostatic inputs. If the MODBUS ID is non-zero, the board ignores all inputs from the board and inputs used are based on the MODBUS registers associated to the various Digital Inputs and Registers. Read Only registers and Coils can still be monitored but all read/write values MUST be configured at the MODBUS register/coil level and NOT at the board level.

The sequence of operation is the same as described above for the various operation, but Indoor Motor speeds for various operation, Outdoor Motor Speed, Heating Setpoint and Cooling Setpoint (if applicable) has to be configured via MODBUS. See MODBUS register tables at the end of this section.

5.2 – Modulating Head Pressure Control

A 10K Nominal NTC Thermistor is connected to the "P1" and "P2" inputs for circuit 1 and circuit 2 respectively. When this sensor is connected, the "FCC IN" is ignored and the thermistor value is used as the process variable when controlling the head pressure. The controller modulates the Outdoor Fan Motor to maintain a 90ºF temperature setpoint. The controller will always use the greater value of P1 and P2 input as the reference point. In the event that the Thermistor is disconnected, the controller reverts to the "FCC IN" input to control the Head Pressure of the system.

5.3– Freeze Stat

A 10K Nominal NTC Thermistor is connected to the "FS1" input on the PCB. If the Thermistor is not connected, freeze protection will not be provided. If the Thermistor is connected, the control will provide the freeze protection by turning the compressor Off at a temperature of 35ºF (+/- 2ºF) on the Indoor Coil. The compressor will remain Off until the temperature measured is greater than 45ºF and the anti-short cycle time has elapsed.

5.4– Onboard Thermostat

The Onboard Thermostat requires a 10K NTC thermistor to be connected to the "FS2" input. It also requires that the MODBUS functionality is enabled via MODBUS. The Heating Setpoint, Cooling Setpoint and Calibration of the sensor has to be configured via MODBUS. Once configuration is complete, the unit has the capability to function autonomously to maintain the space temperature.

Discrete Registers:
Read with Function Code 02, Write to RW or WO registers with Function Code 05

ID	Description	Size	Data Format	R/W
1	Current Status of the Y1 Compressor Call	1 Bit	0 = no call, 1 = call	RW
2	Current Status of the Y2 Compressor Call	1 Bit	0 = no call, 1 = call	RW
3	Current Status of the Humidity Call	1 Bit	0 = no call, 1 = call	RW
4	Current Status of the G Fan Call	1 Bit	0 = no call, 1 = call	RW
5	Current Status of the W2 Electric Heating Call	1 Bit	0 = no call, 1 = call	RW
6	Current Status of the FCC Call	1 Bit	0 = no call, 1 = call	RO
7	High Pressure Switch 1 Status	1 Bit	0 = Open, 1 = Closed	RO
8	High Pressure Switch 2 Status	1 Bit	0 = Open, 1 = Closed	RO
9	Low Pressure Switch 1 Status	1 Bit	0 = Open, 1 = Closed	RO
10	Low Pressure Switch 2 Status	1 Bit	0 = Open, 1 = Closed	RO
11	OFM Mode Selection	1 Bit	0 = PWM, 1 = 0-10V	RO
12	IFM Mode Selectiion	1 Bit	0 = PWM, 1 = 0-10V	RO
13	Test Mode Status	1 Bit	0 = Normal Mode 1 = Test Mode	RO
14	Status of Compressor 1 Relay Output	1 Bit	0 = Off, 1 = Energized	RO
15	Status of Compressor 2 Relay Output	1 Bit	0 = Off, 1 = Energized	RO
16	Status of RH RelayOutput	1 Bit	0 = Off, 1 = Energized	RO
17	Status of W2 RelayOutput	1 Bit	0 = Off, 1 = Energized	RO
18	Enables or Disables the internal Thermostat Functionality	1 Bit	0 = Off, 1 = Energized	RW
19	Enables or disables reading the thermostat inputs in Modbus mode	1 Bit	0 = Modbus only 1 = Read thermostat Inputs Default is 0	RW

Table 6a. MODBUS Discrete Registers

Registers:
Read with Function Code 04, Write to RW or WO registers with Function Code 06

ID	Description	Size	Data Format	R/W
1	Heat Setpoint	16 Bit	45º-100º F	RW
2	Cool Setpoint	16 Bit	45º-100º F	RW
3	Temperature Calibration	16 Bit	0-20, 10 is default. Less than 10 is a negative offset, 11-20 is a positive offset	RW
4	W2 Speed Multiplier	16 Bit	0-100, 80 is default. Represents a percentage of the Y2 fan speed	RW
5	Dehumidification Speed Multiplier	16 Bit	0-100, 80 is default. Represents a percentage of the Y2 fan speed	RW
6	OFM Set Speed	16 Bit	0 - 1023	RW
7	IFM Y1 Set Speed	16 Bit	0 - 1023	RW
8	IFM Y2 Set Speed	16 Bit	0 - 1023	RW
9	Modbus Timout Setting	16 Bit	1 - 60, default 25; represents minutes of allowed MODBUS inactivity before switching to onboard T-Stat mode	RW
10	Current OFM Speed	16 Bit	0 - 1023	RO
11	Current IFM Speed	16 Bit	0 - 1023	RO
12	Anti Short Cycle Compressor 1	16 Bit	0 - 360, 0.5 sec. per step	RO
13	Anti Short Cycle Compressor 2	16 Bit	0 - 360, 0.5 sec. per step	RO
14	Voltage Reading	16 Bit	0 - 1023 1023 = Greater than 20V 965 = 18V cutoff	RO
15	P1 Temperature Reading	16 Bit	0º-160º F	RO
16	P2 Temperature Reading	16 Bit	0º-160º F	RO
17	Freeze Sensor 1 Temperature Reading	16 Bit	0º-160º F	RO
18	Freeze Sensor 2 Temperature Reading	16 Bit	0º-160º F	RO
19	Alarm Status	16 Bit	0 = No Fault 1 = Future Use 2 = HPS1 Fault 3 = Future Use 4 = HPS2 Fault 5 = Future Use 6 = Future Use 7 = LPS1 Fault 8 = LPS2 Fault 9 = Future Use 10 = Future Use 11 = Future Use 12 = Future Use 13 = Freeze Fault 1 14 = Freeze Fault 2 15 = Y1 Locked Out 16 = Y2 Locked Out 17 = Low Voltage	RO

Table 6b. MODBUS Registers

Chapter 3 Installation

⚠ WARNING

Failure to observe and follow Warnings and Cautions and these Instructions could result in death, bodily injury or property damage. Read this manual and follow its instructions and adhere to all Cautions and Warnings in the manual and on the ICE unit.

3.1 Equipment Inspection

Concealed Damage

Inspect all cartons and packages upon receipt for damage in transit Remove cartons and check for concealed damage. **Important: keep the unit upright at all times.** Remove access panels and examine component parts. Inspect refrigerant circuit for fractures or breaks. The presence of refrigerant oil usually indicates a rupture. If damage is apparent, immediately file a claim with the freight carrier.

Units that have been turned on their sides or tops may have concealed damage to compressor motor mounts or to the oil system. If the unit is not upright, immediately file a claim for concealed damages and follow these steps:

1. Set unit upright and allow to stand for 24 hours with primary power turned on.
2. Attempt to start the compressor after 24 hours.
3. If the compressor will not start, makes excessive noise, or will not pump, return the unit to the freight carrier.

3.2 Installation Requirements

General

1. Inspect unit for completeness. Check for missing parts (e.g. hardware). Refer to the installation kit information in section 2.3.
2. Remove access panels and check for loose wires. Tighten screw connections.
3. Complete and mail the warranty registration card.

You must consider all of the following when choosing the installation site:

1. **Noise.** Install the unit so that the least amount of noise will be transmitted to inhabited spaces.
2. **Condensate Drainage**. Condensate produced during operation must be discharged to a suitable drain.
3. **Placement.**
   A) Place the unit in a shaded area, if possible.
   B) Install it above ground for protection against flooding.
   C) The unit exhausts air. Be sure that the airflow is not impeded by shrubbery or other obstructions.
   D) When installing multiple units, please note the recommended clearances noted in Table 4.

⚠ CAUTION

CFA3180, 3240, 3300, 3360 & CGA3180 units require additional support. The mounting flanges alone are not adequate.

4. **Airflow Requirements:**
This is maximum external static pressures for duct design. Duct pressure drop not to exceed these values.

Maximum Static Pressures	CFA1120-1180/3150	CFA3180	CFA3240	CFA3300	CFA3360	CGA3180
IWG	1.6		1.4	1.6	0.8	1.0
Pa	398		348	398	149	249

Keep duct lengths as short as possible. Do not obstruct airflow through the unit.

Duct work should be designed and installed in accordance with *all* applicable safety codes and standards. Industrial Climate Engineering strongly recommends referring to the current edition of the National Fire Protection Association Standards 90A and 90B *before* designing and installing duct work. The duct system must be engineered to insure sufficient air flow through the unit to prevent over-heating of the heater element. This includes proper supply duct sizing, sufficient quantity of supply registers, and adequate return and filter areas. Duct work must be of correct material and must be properly insulated. Duct work must be constructed of galvanized steel with a minimum thickness of .019 inches. Duct work must be firmly attached, secured, and sealed to prevent air leakage. See section 2.4 for additional duct work requirements.

5. **Clearances:**
Note the minimum clearances required for proper operation and service. There must be no obstruction 24" from the sides of the unit, or 120"from the front of the unit. Additional clearance is required in high ambient temperatures, greater than 120°F (49°C).

MODEL	MIN. CLEARANCE AROUND SIDES (SINGLE UNIT)	MIN. CLEARANCE BETWEEN UNITS (TWO UNITS)	MIN. SPACE ABOVE UNIT	MIN. SPACE BEHIND UNIT
All Models	24 inches (61 cm)	24 inches (61 cm)	24 inches (61 cm)	120 inches (305 cm)

Table 7. Minimum Clearances

6. **Codes:**
Make sure your installation conforms to all applicable electrical, plumbing, building, and municipal codes. Some codes may limit installation to single story structures.

7. **Electrical Supply:**
The power supply must have the appropriate voltage, phase, and ampacity for the model selected. Voltage must be maintained above minimum and below maximum specified values listed below. Refer to the data sticker on the unit for ampacity requirements.

Note: Operation near the Minimum or Maximum limits at extended periods voids the waranty. Power supply should be at nominal Voltage.

Electrical Rating Designations*	A	C	D	Z
Nominal Voltage	208/230	208/230	460	575
Phase	1	3	3	3
Minimum Voltage	197	197	414	518
Maximum Voltage	253	253	506	632

* Letters refer to model number code designations. Refer to page 5.

Table 8. Voltage Limitations

3.3 Installation Materials

The CFA or CGA may be shipped with a top bracket and optional lifting brackets. The top bracket provides a method of sealing the top of the unit from water intrusion. The bracket is shipped attached to the top of the unit. Before installing the unit, remove the bracket and reattach as described in Section 2.5

If ordred, the lifting brackets are shipped attached to the back panel of the unit. These brackets provide a method for lifting the unit. The installation of the brackets is described in Section 2.6.

Kit Components:

Accessories:

The package may include other factory-supplied items (optional):

P/N	Description
70705	CommStat 6 2/4 HVAC Controller, Solid State Lead/Lag Controller
S/12087-04	CommStat 6 4/8 HVAC Controller, Solid State Lead/Lag Controller
S/12087-06	CommStat 6 6/12 HVAC Controller, Solid State Lead/Lag Controller
S/07846	CommStat 4 HVAC Controller, Solid State Lead/Lag Controller
S/04581	CommStat 3 HVAC Controller, Solid State Lead/Lag Controller
50123	Digital thermostat. 1 stage heat, 1 stage cool. 7 day programmable. Fan switch: Auto & On. Auto-change over. Keypad lockout. Non-volatile program memory.
93189	Double Deflection Aluminum Supply Grille for the CFA1120/1150 & CFA3150 42½ x 15¼ (1,080mm x 387mm)
93188	Aluminum Return Filter Grille for the CFA1120/1150 & CFA3150 42½ x 21½ (1,080mm x 546mm)
93190	Double Deflection Aluminum Supply Grille for the CFA3180/3240/3300/3360 54½ x 15½ (1,384mm x 394mm)
93191	Aluminum Return Filter Grille for the CFA3180/3240 54½ x 21½ (1,384mm x 546mm)
93192	Aluminum Return Filter Grille for the CFA3300/3360 54½" x 37½" (1,384mm x 953mm)

Additional Items Needed:

Additional hardware and miscellaneous supplies (not furnished by ICE®) are needed for installation.

The list below has the items typically needed for mounting a unit on a wood frame wall structure. Concrete or fiberglass structures have different requirements. ICE cannot recommend a specific method of attaching the air conditioner to the building due to the wide variety of building types, code requirements, wall construction and specific installation conditions. The installation of the air conditioner to the building must take in to account all of these factors and follow best industry practices to provide a safe and secure attachment to the building.

- Mounting bolts for unit mounting flanges. The length needed is typically the wall thickness plus one inch (25 mm).
- Washers
- Hex nuts
- Silicone Sealer to seal around cracks and openings
- Minimum 5 conductor low voltage multicolored wire cable (i.e. thermostat wire)
- Appropriate electrical supplies such as conduit, electrical boxes, fittings, wire connectors, etc.
- High voltage wire, sized to handle the MCA (minimum circuit ampacity) listed on the data plate.
- Over-Current Protection Device sized in accordance with the MFS (maximum fuse size) listed on the unit data plate.

⚠ WARNING FIRE HAZARD

Improper adjustment, alteration, service, maintenance or installation could cause serious injury, death and/or property damage.

Installation or repairs made by unqualified persons could result in hazards to you and others. Installation MUST conform with local codes or, in the absence of local codes, with codes of all governmental authorities have jurisdiction.

The information contained in this manual is intended for use by a qualified service agency that is experienced in such work, is familiar with all precautions and safety procedures required in such work, and is equipped with the proper tools and test instruments.

3.4 Porting and Duct Work

General Information

Note: The following instructions are for general guidance only. Due to the wide variety of installation possibilities, specific instructions will not be given. When in doubt, follow standard and accepted installation practices, or contact ICE™ for additional assistance.

Wall Openings

Measure the dimensions of the supply and return ports on the unit.

Cut the openings in the exterior wall for the supply and return. **IMPORTANT: All units with electric heat must have 1" (25.4mm) clearance on all four sides of the supply outlet duct flange on the unit. The 1" (25.4mm) clearance must extend on all sides of the supply duct for the first 3 feet (1 meter) from the unit.**

IMPORTANT: ICE™ requires a minimum of 1" (25.4mm) from the surface of any supply ducts to combustible material for the first 3 feet (1 meter) of the duct.

Ducting

Extensions should be cut flush with the inside wall for applications without duct work.

Applications using duct work should be designed and installed in accordance with *all* applicable safety codes and standards. ICE strongly recommends referring to the current edition of the National Fire Protection Association Standards 90A and 90B *before* designing and installing duct work. The duct system must be engineered to insure sufficient air flow through the unit to prevent over-heating of the heater element. This includes proper supply duct sizing, sufficient quantity of supply registers, adequate return and filter area. Ductwork must be of correct material and must be properly insulated. Duct work must be constructed of galvanized steel with a minimum thickness of .019 inches for the first 3 feet (1 meter). Ductwork must be firmly attached, secured and sealed to prevent air leakage. Do not use duct liner on inside of supply duct within 4 feet (122cm) of the unit.

Galvanized metal duct extensions should be used to simplify connections to duct work and grilles. Use fabric boots to prevent the transmission of vibration through the duct system. The fabric must be U.L. rated to a minimum of 197°F (92°C).

Minimum Airflow Requirements

The duct system must be engineered to assure sufficient air flow through the unit even under adverse conditions such as dirty filters, etc.

3.5 Top Flange Installation *(See Figure 2)*

1. All models have built-in side mounting flanges.
2. Attach the top flange to the top of the air conditioner. The holes in the top of the air condtioner have been predrilled. Remove the 4 screws in these holes and use these screws to attach the top flange to the air conditioner.
3. Apply a bead of silicone sealer on the wall side of the bottom support brackets on the unit. Circle the mounting holes with the silicone bead.

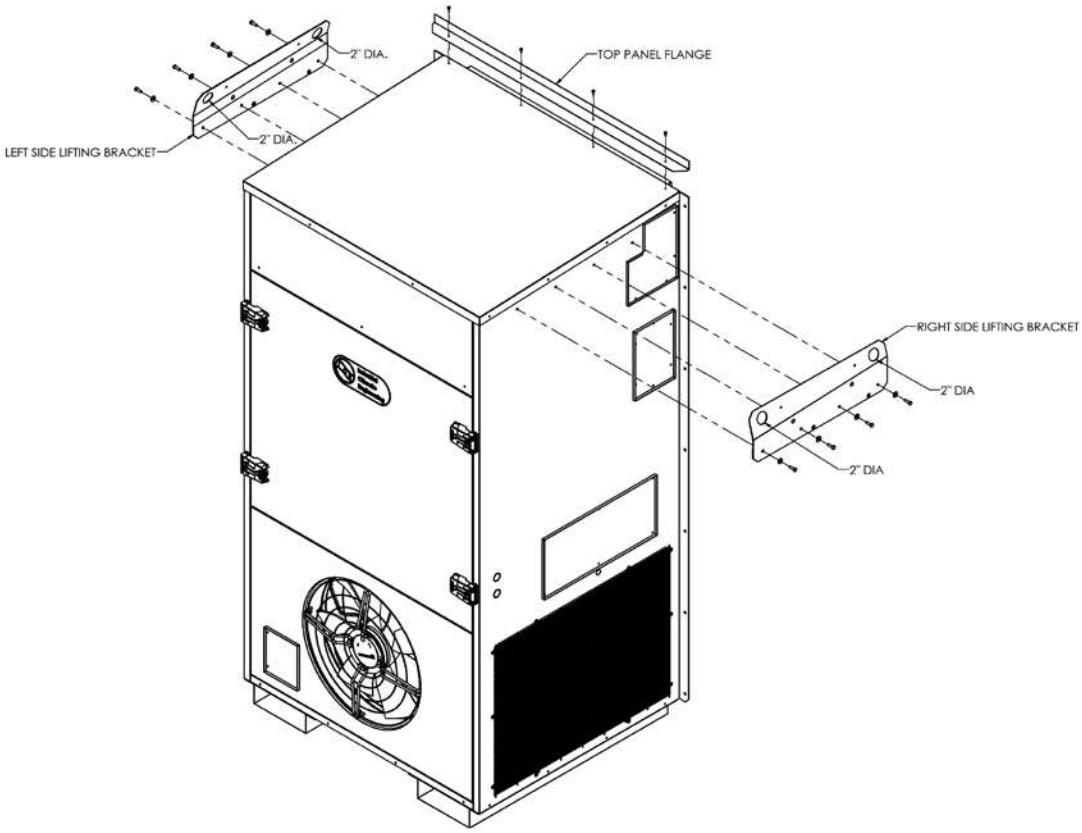


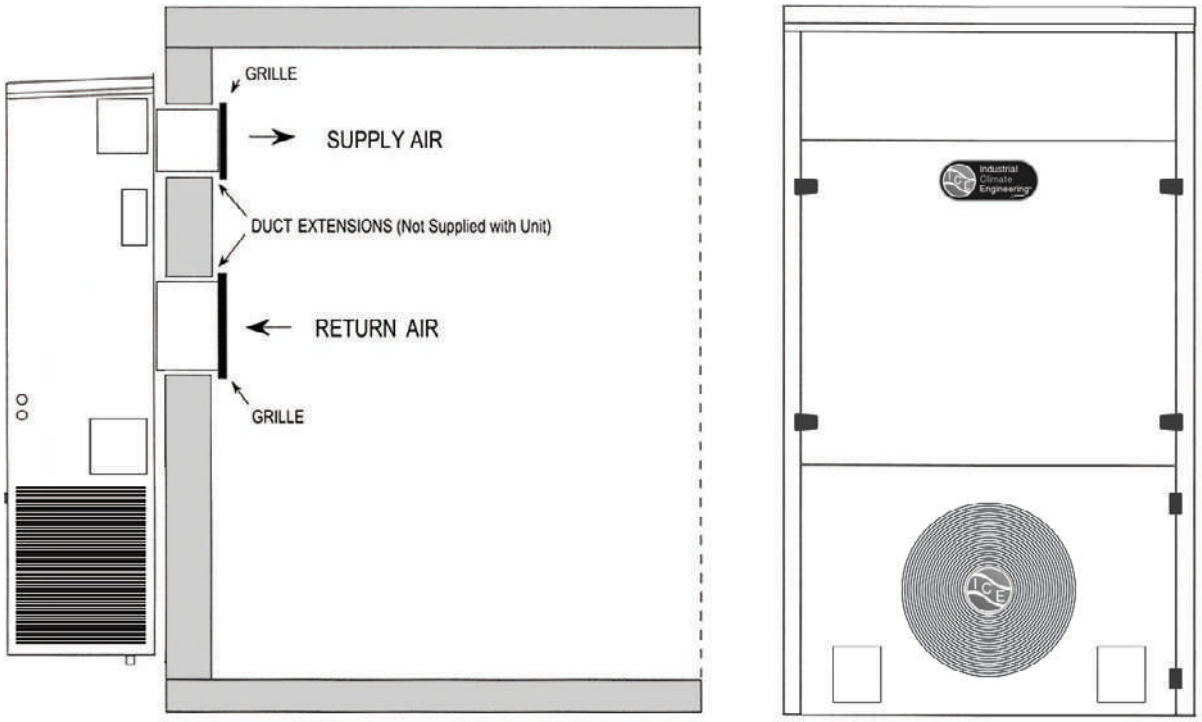
Figure 7. Top Flange and Lifting Bracket Installation (Typical)

3.6 Installing the Optional Lifting Brackets

Lifting brackets are available which can be installed on the top of the side panels. These brackets allow the unit to be picked up using lifting eyes in the brackets. Attach the brackets to the left and right side panels as shown in Figure 3. ICE units are shipped with the 4 screws for attaching the brackets installed in the holes at the top of the side panels. When attaching the brackets, remove and reinstall the screws and make sure the top of the bracket is angled towards the center of the unit.

3.7 Mounting The Unit

1. For wiring into the back of unit, locate the lower of the two knockouts on the wall side of the unit. Drill a one inch hole in the shelter wall to match this opening. Allow sufficient clearance to run 3/4" conduit through the hole and to the unit.
2. Lift the unit into position using an appropriate and safe lifting device.
3. Make sure that the duct flanges are properly aligned with the wall opening. Adjust as necessary.
4. Note the holes in each side flange. Using the holes for guides, drill holes through the wall with a drill bit. Insert the bolts through the flanges. Install nuts and washers on the inside of the shelter. Tighten the bolts to secure the unit.
5. Apply a bead of silicone where the side and top flanges contact the exterior wall.
6. On the inside of the shelter, install the wall sleeves in the supply and return air openings. The sleeves may be trimmed to fit flush with the inside wall.
7. Check the fit of each sleeve to its mating flange for possible air leaks. Apply silicone sealer to close any gaps. Install the air return and supply grilles.



For units with electric heat, a one inch clearance is required around the duct extensions. The duct extensions must be constructed of galvanized steel with a minimum thickness of .019" as per the NFPA standards 90A & 90B.

Figure 8. Air Conditioner Wall Mount Detail

3.8 Electrical Connections

⚠ WARNING ELECTRICAL SHOCK HAZARD

Failure to follow safety warnings exactly could result in serious injury, death, and/or property damage.

Turn off electrical power at fuse box or service panel BEFORE making any electrical connections and ensure a proper ground connection is made before connecting line voltage.

Important

All electrical work must meet the requirements of local codes and ordinances. Work should be done **only** by qualified persons.

The units may incorporate an internal crankcase heater for compressor protection. **The crankcase heater must be energized for at least 24 hours prior to starting the compressor.**

Scroll compressors, like several other types of compressors, will only compress in one rotational direction. The direction of rotation is not an issue with single-phase compressors since they will always start and run in the proper direction. However, three phase compressors will rotate in either direction depending upon phasing of power. Since there is a 50-50 chance of connecting power in such a way as to cause rotation in the reverse direction, it is imperative to confirm that the compressor is rotating in the proper direction at the initial field start-up of the system. Verification of proper rotation is made by observing that the suction pressure drops and the discharge pressure rises when the compressor is energized. An alternate method of verification for self contained system with small critical refrigerant charges, where

the installation of gauges may be objectionable, can be made by monitoring the temperature of the refrigerant lines at the compressor. The temperature should rise on the discharge line while the suction line temperature decreases. Reverse rotation also results in a substantially reduced current draw when compared to tabulated values.

There is no negative impact on durability caused by operating three phase compressors in the reversed direction for a short duration of time, usually defined as less than one hour. However, after several minutes of operation the compressor's internal protector will trip. The compressor will then cycle on the protector until the phasing is corrected. Reverse operation for longer than one hour may have a negative impact on the bearings.

To change the rotation, turn off power to the unit and reverse L1 & L2 at the disconnect in the air conditioner.

The middle front panel provides access to the electrical/control box and to the filters. This panel has hinges on the left and right hand side. This panel should ONLY be opened by using the two hinges on the left side **OR** the two hinges on the right side. **NEVER OPEN ALL FOUR HINGES SIMULTANEOUSLY**.

If all four hinges are opened simultaneously, the front panel will drop and may cause serious injury and damage the panel.

⚠ DANGER

NEVER open all four hinges simultaneously. The panel should ONLY be opened by using the two hinges on the left side OR the two hinges on the right side.

High Voltage Wiring

The power supply should have the proper voltage, phase, and ampacity for the selected model.

1. Refer to the electrical data on the data sticker on the unit for field wiring requirements of the unit. Size the incoming power supply lines and the fuse(s) or HACR breaker(s) according to requirements described in the National Electric Code. Run the power conductors through the knockouts on the side or back of the unit. Use appropriate conduit and strain reliefs.

⚠ CAUTION

Note: Power supply service must be within allowable range (+10% - 5%) of rated voltage stamped on the unit rating plate. To operate nominal 230/208V unit at 208V, change the transformer line tap from 240V to 208V following the instruction on wiring label in unit.

2. Connect the wires to the input side of the internal breaker or terminal block L1, L2, & L3 for three-phase models.
3. Install the ground wire on the ground lug.
4. For units designed for operation on 208/230V, 60Hz power supply, the transformer is factory wired for a 230V power supply. For a 208V power supply, remove the orange lead from the transformer and connect the red lead. Insulate the orange lead.

⚠ CAUTION

The external breaker(s) that provide power to the air conditioner must be sized per the maximum Fuse Size (MFS) shown on the Unit's data label.

Dual Unit Phasing

For applications where one controller operates two units, e.g., the CommStat 4.

1. Wire each unit as described in steps 1 through 4 above.
2. Test for proper phasing as follows:
   A. Power up the units.
   B. Using an AC volt meter set to the 300 volt scale, measure voltage between terminal L1 on the compressor contactor of unit #1 and terminal L1 on the compressor contactor of unit #2 If voltage is present, units are wired out of phase and must be rewired.
   C. If units are not in phase, turn off power and reverse the field power leads connected to the internal circuit breaker on one of the units only.
   D. Restore power and retest the phase (step B). When the voltage reads "0", the units are in phase.
   E. Turn off power and proceed.

Low Voltage Wiring

IMPORTANT. The following instructions are generic wiring instructions and may not be applicable for air conditioners with various options. Always refer to the wiring diagram in the air conditioner for the proper method to wire your unit.

1. On single units, pull the low voltage wiring (e.g., 18 gauge 4-conductor Class 2 thermostat wire) from the air conditioners into the thermostat / subbase assembly. See Figure 4a for connections to various thermostats.
2. Mount the thermostat on the wall of the shelter. The thermostat should be located so that the supply air from the unit does NOT blow directly on to the thermostat. Connect the thermostat to the terminal block in the air conditioner as shown in Figure 6a.
3. On dual units, refer to either the ICE CommStat 3 or CommStat 4 *Controller Specification sheet.* Wire the two air conditioners to the Lead/Lag Controller, according to the wiring diagram on the specification sheet.

Remote Signalling: Terminals 5 & 7(N.O.) and 6 & 7 (N.C.) on the air conditioners terminal board are dry contacts which can be used for remote signalling in the event of a/c cutoff on low or high pressure limit.

Continuous fan operation: For continuous indoor fan operation on single units, install a jumper between terminals 8 and 3.

CommStat 6 Lead /Lag HVAC Controller

The CommStat 6 HVAC controller is designed for controlling up to six redundant air conditioners in an E-House or telecommunication shelter and is available in three configurations.

CommStat 6 2/4 - Controls up to two single or 2-Stage air conditioners (4 Stages max.) Marvair Part Number: . 70705

CommStat 6 4/8 - Controls up to four single or 2-Stage air conditioners (8 Stages max.) Marvair Part Number:S/12087-04

CommStat 6 6/12 - Controls up to six single or 2-Stage air conditioners (12 Stages max.) Marvair Part Number:S/12087-06

In addition to the control of the air conditioners, the CommStat 6 controller has multiple configurable outputs for remote alarms or notification. The CommStat 6 controller is factory programmed with standard industry set points, but can be configured on site. Settings are retained indefinitely in the event of a power loss.

CommStat 4 Lead /Lag HVAC Controller

Please refer to the Product Data sheet for the CommStat 4 controller for complete instructions on installing and programming this controller.

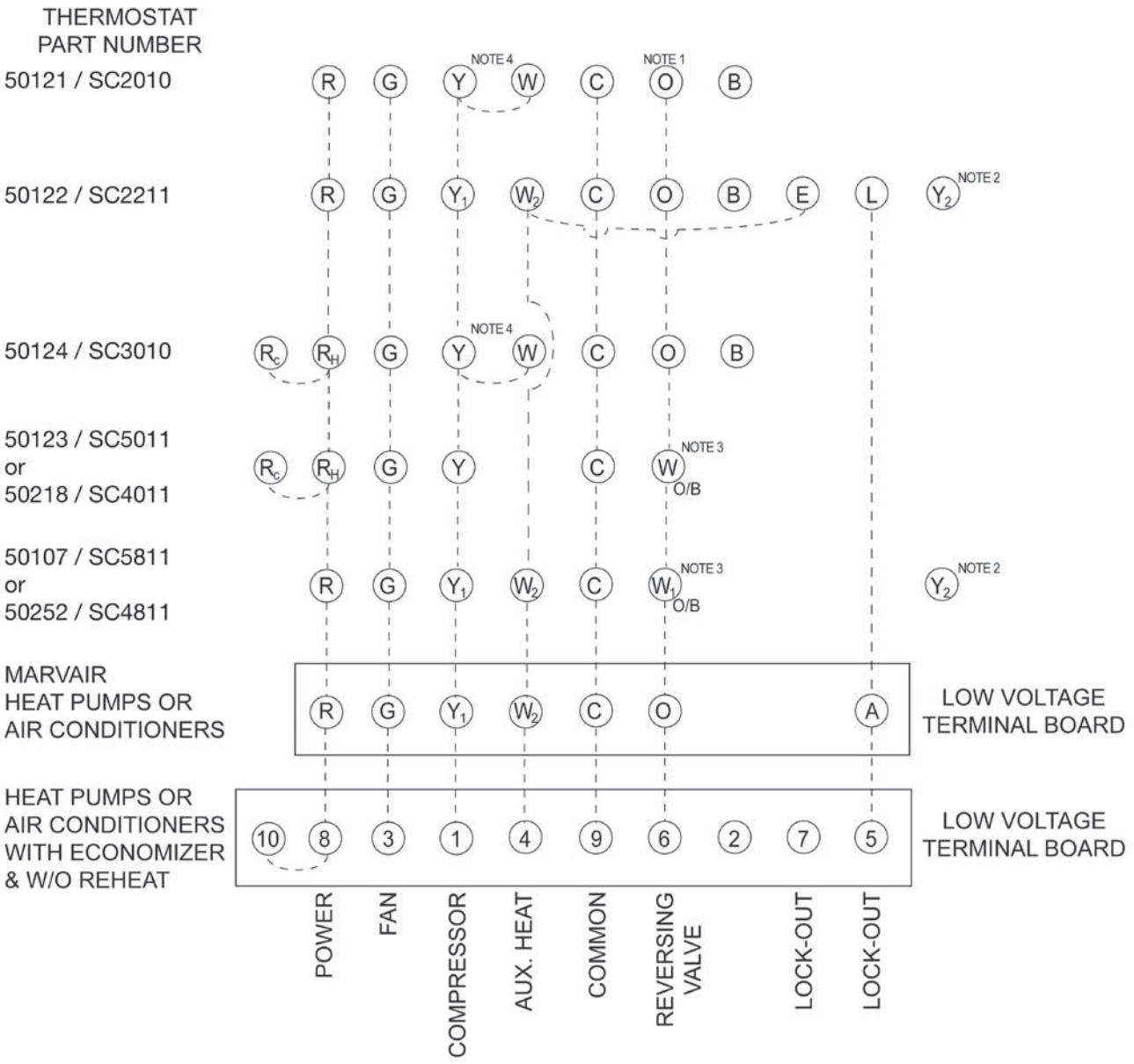
CommStat Touch Lead/Lag HVAC Controller (See Figure 4b)

The CommStat Touch telecom controller with a touch screen interface is designed to allow remote control and monitoring of ICE air conditioners with single or 2-stage compressors in a shelter

or enclosure and is certified by ETL for HVAC UL60950-1 and FCC47CFR compliance. In addition to the control of HVAC equipment, CommStat Touch includes the RemoteLink IPv4/IPv6 communication module to provide status information, alarm notifications, set point adjustment, and remote HVAC configuration. See the CommStat Touch PDS for more details.

ICE SIMPLE COMFORT THERMOSTAT CONNECTION DIAGRAM

for Marvair Heat Pumps and Air Conditioners (without hot gas reheat or electric reheat)



NOTES:

1. Reversing valve on heat pumps only.
2. For units with 2-stage compressors, connect lead from the compressor monitor and diagnostic module, e.g., Copeland's Comfort Alert, to Y_2
3. For air conditioners with strip heat, connect W/O/B to terminal W or 4.
4. Jumper for heat pump only, omit with air conditioners.

A. Terminals 5 & 7 are normally open dry contacts and close to indicate lockout.
B. Terminals 6 & 7 are normally closed dry contacts and open to indicate lockout.
C. If the thermostat has RC & RH terminals, install a jumper wire between RC & RH.
D. IMPORTANT. The instructions are generic wiring instructions and may not be applicable for air conditioners with various options. Always refer to the wiring diagram in the air conditioner for the proper method to wire your unit.

Figure 9. Thermostat Connection Diagram

Chapter 4 Start-Up

4.1 Check-Out of Cooling Cycle

Important: Be sure that the crankcase heater (if used) has been energized for at least 24 hours before starting the unit(s). Double-check all electrical connections before applying power. All air conditioners with scroll compressors running on 3Ø power must be checked for proper rotation during the initial start-up. Please refer to Section 2.8 for determining if the 3Ø compressors are rotating correctly. Incorrect rotation can damage the compressor and is not covered by the warranty

Procedure:

1. Set the cooling set point temperature on the wall thermostat to a point *higher* than the ambient temperature. Set the heating set point temperature to a temperature that is *lower* than the ambient.
2. Set the thermostat system switch in the AUTO position. Nothing should operate at this time.
3. Set the time delay in the control box to three minutes. See Section 1.6.
4. Slowly lower the thermostat's cooling set point temperature until the switch closes. The indoor fan should operate.

   Once the indoor fan turns on, allow approximately three minutes for the compressor to start.
5. To stop cooling, slowly raise the thermostat cooling set point to a temperature higher than the ambient.

If the unit fails to operate, refer to the troubleshooting information in Chapter 4.

Follow the same procedure for additional units.

NOTE: The fan purge allows the indoor fan to run for approximately 90 seconds after the compressor is off. This operation provides a small improvement in system rated efficiency.

4.2 Check-Out of Heating Cycle

Procedure: (Applies only to units with resistance elements)

1. Raise the heating set point temperature to a setting which is higher than the ambient temperature. The fan and electric heat should immediately cycle on.
2. Move the system switch to the "OFF" position. All functions should stop.

Chapter 5 Troubleshooting

5.1 Overview

The middle front panel provides access to the electrical/control box and to the filters. This panel has hinges on the left and right hand side. This panel should ONLY be opened by using the two hinges on the left side **OR** the two hinges on the right side. **NEVER OPEN ALL FOUR HINGES SIMULTANEOUSLY**.

If all four hinges are opened simultaneously, the front panel will drop and may cause serious injury and damage the panel.

⚠ DANGER

NEVER open all four hinges simultaneously. The panel should ONLY be opened by using the two hinges on the left side OR the two hinges on the right side.

A comprehensive understanding of the operation of the air conditioner is a prerequisite to troubleshooting. Please read the Chapter 1 for basic information about the unit.

Our air conditioners are thoroughly tested before they are shipped from the factory. Of course, it is possible that a defect may escape undetected, or damage may have occurred during transportation. However, the great majority of problems result from installation errors.

If you experience difficulties with the unit, please review the installation steps in Chapter 2.

Much time can be saved by taking a thoughtful and orderly approach to troubleshooting. Start with a visual check - are there loose wires, crimped tubing, missing parts, etc? Begin deeper analysis only after making this initial inspection.

The troubleshooting information in this manual is basic. The troubleshooting section contains problem/solution charts for general problems, followed by a compressor section.

Not every problem can be anticipated. If you discover a problem that is not covered in this manual, we would be very grateful if you would bring it to the attention of our service department for incorporation in future revisions.

As always, please exercise caution and good judgement when servicing the air conditioner. Use only safe and proven service techniques. Use refrigeration goggles when servicing the refrigeration circuit.

⚠ WARNING

The refrigerant circuit has hot surfaces, and the electrical voltages inside of the unit may be hazardous or lethal. SERVICE MAY BE PERFORMED ONLY BY QUALIFIED AND EXPERIENCED PERSONS.

5.2 Failure Symptoms Guide

PROBLEM/SYMPTOM	LIKELY CAUSE(S)	CORRECTION
A. Unit does not run. **NOTE**: An internal anti-short-cycle timer will prevent the unit from starting for .2 to 8 minutes following start-up.	1. Power supply problem.	1. Check power supply for adequate phase and voltage. Check wiring to unit and external breakers or fuses.
	2. Tripped internal disconnect.	2. Check internal circuit protection devices for continuity.
	3. Shut off by external thermostat or thermostat is defective.	3. Check operation of wall-mounted thermostat.
	4. Unit off on high or low pressure limit.	4. Reset pressure switch.
	5. Internal component or connection failure.	5. Check for loose wiring. Check components for failure.
B. Unit runs for long periods or continuously; cooling is insufficient.	1. Dirty filter or reduced airflow	1. Check air filter(s). Check blower operation. Remove airflow restriction.
	2. Low refrigerant.	2. Check for proper charge and possible refrigerant leak.
	3. Component failure.	3. Check internal components, especially compressor for proper operation.
	4. Unit undersized for job.	4. Add additional units for greater capacity.
C. Unit cycles on high/low pressure limit.	1. Loss or restriction of airflow.	1. Check blower assembly for proper operation. Look for airflow restrictions, e.g.. the air filter. Check blower motor and condenser fan.
	2. Restriction in refrigerant circuit.	2. Check for blockage or restriction, especially filter drier and capillary tube assembly.
	3. Refrigerant overcharge (following field service)	3. Evacuate and recharge to factory specifications.
	4. Defective pressure control.	4. Check limit cutout pressures. Control is set to actuate at approximately 60 PSIG (low pressure) and 650 PSIG (high pressure)
D. Unit blows fuses or trips circuit breaker.	1. Inadequate circuit ampacity.	1. Note electrical requirements in Chapter 2 and correct as necessary.
	2. Short, loose, or improper connection in field wiring.	2. Check field wiring for errors.
	3. Internal short circuit. Loose or improper connection(s) in unit.	3. Check wiring in unit. See wiring and schematic diagrams. Test components (especially the compressor) for shorts.
	4. Excessively high or low supply voltage or phase loss (3ø only)	4. Note voltage range limitations specific to the compressor troubleshooting section.
E. Water on floor near unit.	1. Obstruction in condensate line.	1. Check for clog or restriction.
	2. Obstruction or leak in condensate pan.	2. Check pan for leak or blockage.
	3. Unit is not level.	3. Level unit.
F. No space heating or reduced heating (units equipped with resistance elements)	1. Defective heating element(s).	1. Check resistance element(s) for continuity.
	2. Thermal limit open.	2. Check continuity across thermal limit switch.
	3. Defective heater contactor.	3. Check relay for proper operation. Replace if defective.

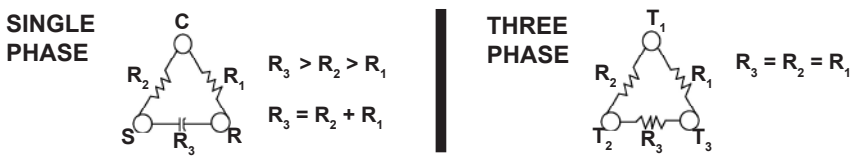
5.3 Compressor Troubleshooting

NOTE: It is important to rule out other component failures before condemning the compressor.

The following electrical tests will aid diagnosis:

1. **Start-Up Voltage**: Measure the voltage at the compressor contactor during start-up. The voltage must exceed the minimum shown in Table 5, section 2.2, or compressor failure is likely. A low voltage condition must be corrected.
2. **Running Amperage**: Connect a clip-on type ammeter to the (common) lead to the compressor. Turn on the supply voltage and energize the unit. The compressor will initially draw high amperage; it should soon drop to the RLA value or less. If the amperage stays high, check the motor winding resistances.

   NOTE: Feel the top of the compressor to see if it has overheated. If it is hot, the internal overload may be open. You may have to wait several hours for it to reset.
3. **Motor Winding Resistances:** Using a digital volt-ohm meter (VOM), measure the resistance across the compressor windings as shown below.



   Resistance can be measured as shown above. Any deviation from above values could indicate a defective compressor.
4. **High Voltage/Insulation Test:** Test internal leakage with a megohmeter. Attach one lead to the compressor case on a bare metal tube and to each compressor terminal to test the motor windings. A short circuit at high voltages indicates a motor defect. Do not do this test under vacuum.
5. On single phase models, check the capacitor by substitution.

5.4 Control Board Diagnosis

The control board (see section 1.6 for a complete description of the control board) has a red diagnostic LED which indicates the lockout fault. The control board will enter into and indicate lockout if either of the fault conditions (LPS or HPS) occur twice.

The compressor contactor must be closed before the first fault condition can be recognized by the control board. The contactor will be closed 3 minutes after the unit is energized and only if cooling is required. The first fault condition will open the contactor and shutdown the unit. The contactor on the unit that has the fault condition must be closed before the second fault condition can be recognized by the control board. The compressor contactor on the unit with the fault condition will close after 3 minutes if the unit is still calling for cooling and if the fault condition no longer exists. If you get a second fault condition, the contactor will open and shutdown the unit. The “red” led will have one blink if the high pressure switch has opened twice and will have two blinks if the low pressure switch has opened twice. The unit must be in the cooling mode (compressor contactor Closed) before a fault condition can occur.

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If all four hinges are opened simultaneously, the front panel will drop and may cause serious injury and damage the panel.

⚠ DANGER

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6.1 Scheduled Maintenance

Industrial Climate Engineering strongly recommends that the air conditioner be serviced a minimum of twice a year – once prior to the heating season and once prior to the cooling season. At this time the filters, evaporator coil, condenser coil, the cabinet, and condensate drains should be serviced as described below. Also at this time, the air conditioner should be operated in the cooling and heating cycles as described in Chapter 3, Start-Up. In addition to this seasonal check-out, the air conditioner should be maintained as follows:

Air Filter

Replace the air filter whenever it is visibly dirty. Never operate the unit without the filter in place. Depending upon the configuration of your unit, access to the filter can be either from the outside through the hinged door or from the return grille on the inside of the building.

Evaporator

If the evaporator becomes clogged or dirty, it may be cleaned by careful vacuuming or with a commercial evaporator cleaning spray. DO NOT use a solvent containing bleach, acetone, or flammable substances. Turn off power before cleaning. Be careful not to wet any of the electrical components. Be sure the unit has dried before restarting.

Condenser

Periodically inspect the outdoor condenser coil and the cabinet air reliefs for dirt or obstructions. Remove foreign objects such as leaves, paper, etc.

If the condenser coil is dirty, it may be washed off with a commercial solvent intended for this purpose. TURN OFF POWER BEFORE CLEANING! Be sure that all electrical components are thoroughly dry before restoring power. Use a fin comb of the correct spacing to straighten mashed or bent fins.

Cabinet

The cabinet may be cleaned with a sponge and warm, soapy water or a mild detergent. Do not use bleach, abrasive chemicals or harmful solvents.

Drains

The condensate is drained from the condensate pan through two drains – one on the left side of the pan and the other on the right side. The condensate lines drain to the outside at the bottom of the unit through the base pan. Each of the drain lines is looped to form a trap.

Regularly check each drain line to make sure it is not obstructed. If a commercial drain solvent is used, flush out the drain pan and system with sufficient water to remove the solvent. Some solvents can cause the drain pan to corrode.

Lubrication

The condenser fan motor(s) and the evaporator blower motor(s) never require oiling.

Chapter 7 Warranty

7.1 Industrial Climate Engineering Limited Product Warranty

Marvair Inc., warrants its products to be free from defects in materials and workmanship under normal use to the original purchaser for the period of time in the table below. If any part of your product fails within 12 months from start-up, or 18 months from shipment from the factory, whichever comes first, Marvair, Inc. will furnish without charge, EXW Cordele, Georgia, the required replacement part. The owner must provide proof of the date of the original start-up. The contractor's invoice, the certificate of occupancy, or similar documents are examples of acceptable proof of the date of the original start-up.

Marvair, ICE, Eubank Products
90 Days[1] w/Flat Rate Labor[2] *(See Marvair, ICE, Eubank Flat Rate Labor Guidelines)*
1 Year Parts[2,3]
5 Years Compressor[2]

[1]If any part of your Marvair, Inc. unit fails within 90 days of the commencement of the warranty, Marvair, Inc. will furnish without charge, EX Works, Cordele, Georgia, the required replacement part and pay for the labor to replace the part in accordance with the Marvair, Inc. Flat Rate Labor Guidelines.

[2]All OTR (over the road) applications that are moved from one location to another: Factory Warranty applies only up to the point of initial start-up and test at all OEM manufacturing locations or subsequent facility. Once it goes into OTR service, the warranty expires immediately for compressor and sealed system components. This OTR exemption does not apply to relocatable classrooms, construction or office trailers.

[3]All warranty replacement parts shall be shipped Ground only. Expedited shipping is available upon request for additional cost.

The responsibility of the equipment owner includes:

1. To operate the equipment in accordance with the manufacturer's instructions.
2. To provide easy accessibility for servicing.
3. To check and reset any circuit breaker(s) and/or disconnect(s) prior to calling for service.
4. To keep the unit clean and free of dirt and containment and replace filters as required.
5. To keep the outdoor coil clean and free of leaves, paper, or other debris.
6. To pay the charges incurred when any of the above have not been done.
7. To pay for repair or replacement of any material or part other than those within the Marvair unit or controller.

Marvair, Inc., will not be responsible for labor after 90 days, transportation costs, delays or failures to complete repairs caused by events beyond our control (labor hours incurred due to required site-specific training, time waiting to gain access, or extended drive time for remote sites). This warranty does not cover:

1. Any transportation, related service labor, diagnosis calls, filter, driers, refrigerant, or any other material charges.
2. Damages caused by shipping, accident, abuse, negligence, misuse, fire, flood, or Acts of God.
3. Damages caused by operating or staging the unit in a corrosive environment.
4. Damages caused by improper application of the product.
5. Damages caused by failing to perform proper routine maintenance.
6. Expenses incurred for erecting, disconnecting or dismantling the product or installing the replacement part(s).
7. Products not installed or operated according to the included instructions, local codes, and good trade practices.
8. Products moved from the original installation site.
9. Products lost or stolen
10. Consequential damages or incidental expenses including losses to persons, property or business.
11. Modifications to original unit after it leaves the factory, such as breaking into any part of the sealed systems unless authorized in advance in writing by Marvair, Inc..
12. Damages as a result of operating as a construction site cooler / dehumidifier.

When labor (first 90 days only) is required, it must be performed during normal working hours (8:00 AM - 5:00 PM) Monday - Friday and must be performed by Marvair, Inc., personnel or a designated Service Representative.

The owner of the product may ship the allegedly defective or malfunctioning product or part to Marvair, Inc.,, at such owner's expense, and Marvair, Inc., will diagnose the defect and, if the defect is covered under this warranty, Marvair, Inc., will honor its warranty and furnish the required replacement part. All costs for shipment and risk of loss during shipment of the product to Marvair, Inc., and back to the owner shall be the responsibility and liability of the owner. Upon written request by an owner, Marvair, Inc., may arrange for remote diagnosis of the allegedly defective or malfunctioning product or part but all costs for transportation, lodging and related expenses with regard to such diagnostic services shall be the responsibility and liability of the owner.

An owner requesting performance under this Warranty shall provide reasonable access to the allegedly defective or malfunctioning product or part to Marvair, Inc., and its authorized agents and employees.

THIS WARRANTY CONSTITUTES THE EXCLUSIVE REMEDY OF ANY PURCHASER OF A MARVAIR HEAT PUMP OR AIR CONDITIONER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR USE, TO THE FULLEST EXTENT PERMITTED BY LAW. IN NO EVENT SHALL ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR USE EXCEED THE TERMS OF THE APPLICABLE WARRANTY STATED ABOVE AND MARVAIR SHALL HAVE NO OTHER OBLIGATION OR LIABILITY. IN NO EVENT SHALL MARVAIR BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OR MONETARY DAMAGES.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE-TO-STATE. Some states do not allow limitations or exclusions, so the above limitations and exclusions may not apply to you.

Chapter 8 Start-Up Check List

The middle front panel provides access to the electrical/control box and to the filters. This panel has hinges on the left and right hand side. This panel should ONLY be opened by using the two hinges on the left side **OR** the two hinges on the right side. **NEVER OPEN ALL FOUR HINGES SIMULTANEOUSLY**.

If all four hinges are opened simultaneously, the front panel will drop and may cause serious injury and damage the panel.

⚠ DANGER

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8.1 Start-Up & Commissioning Form

Please complete the information on this form and return to ICE by mail or fax. The mailing address and fax number can be found at the end of the form.

A. Equipment Information

Date: _____ Equipment Owner _____

Installing Company: _____ Installer: _____

Address: _____ State _____

City: _____

ICE Air conditioner: Model No. _____

Serial No. _____

Compressor: Model No. _____

Serial No. _____

Compressor: Model No. _____

Serial No. _____

B. Pre-Start Up

Is there any shipping damage? ❒Yes ❒No

If so, where? _____

Will this damage prevent starting the unit? ❒Yes ❒No

Check Power Supply, does it agree with data sticker on air conditioner? ❒Yes ❒No

Has the ground wire been connected? ❒Yes ❒No

Has the circuit protection been sized and installed properly? ❒Yes ❒No

Controls

Are the thermostat control wiring connections made and checked? ❒Yes ❒No

Are all wiring terminals (including main power supply) tight? ❒Yes ❒No

If unit has a crankcase heater, has it been energized for 24 hours? ❒Yes ❒No

On a 208/230 v. units is control transformer (24 AC) wired for correct voltage? ❒Yes ❒No

Condensate Section

Has water been placed in drain pan to confirm proper drainage? ❒Yes ❒No

Are correct filters in place? ❒Yes ❒No

Refrigerant Piping

If leaks are found, report any leaks to ICE Warranty Service Dept.

C. Check Rated Voltage at Terminal Block for Imbalance before starting of Unit.

❒208/230V 1 Phase ❒208/230V 3 Phase ❒460V 3 Phase

❒380V 3 Phase 50Hz. ❒575 3 Phase 60 Hz.

Measured Line to Line Volts L1&L2_____V. L1&L3 _____V. L2&L3_____V.

(L1&L2 + L1&L3 + L2&L3)/3 = Avg. Voltage = _____

Max. Deviation from avg. voltage = _____volts

Voltage imbalance = (100 x Max. Deviation)/avg. Voltage = _____%

A voltage deviation greater than 2% with the unit running should be addressed and corrected. Excess voltage deviation can cause the compressor to overheat and to operate inefficiently.

Example: Maximum Deviation from Average Voltage X 100 (for Percent)
Average voltage

Measured Voltages:

L1 & L2 = 241 Volts
L1 & L3 = 243 Volts = 717 / 3 = 239 Average Voltage
L2 & L3 = 233 Volts

239 - 233 = 6
100 x 6/239 =2.5% Voltage Unbalance

Three phase units only check fan & compressor rotation.

D. Heating Mode Check & Record Readings

	Circuit 1	Circuit 2 *(if applicable)*
Room Temperature	_____	_____
Outside Temperature	_____	_____
Evap. Entering Air DB Temp	_____	_____
Evap. Entering Air WB Temp	_____	_____
Evap. Leaving Air DB Temp	_____	_____
Evap. Leaving Air WB Temp	_____	_____
Heater Contactor Amps (L1)	_____	_____
Heater Contactor Amps (L2)	_____	_____
Heater Contactor Amps (L3)	_____	_____

E. Cooling Mode Check & Record Refrigerant Pressures

Recheck voltage imbalance in cooling mode:

Measured Line to Line Volts L1&L2_____V. L1&L3 _____V. L2&L3_____V.

(L1&L2 + L1&L3 + L2&L3)/3 = Avg. Voltage = _____

Max. Deviation from avg. voltage = _____volts

Voltage imbalance = (100 x Max. Deviation)/avg. Voltage = _____%

After 10 minutes of compressor operation, record the following:

	Circuit 1	Circuit 2 *(if applicable)*
Room Temperature	_____	_____
Outside Temperature	_____	_____
Suction Pressure	_____	_____
Suction Line Temperature	_____	_____
Discharge Pressure	_____	_____
Discharge Line Temperature	_____	_____
Entering Condenser Air	_____	_____
Leaving Condenser Air	_____	_____
Evap. Entering Air DB Temp	_____	_____
Evap. Entering Air WB Temp	_____	_____
Evap. Leaving Air DB Temp	_____	_____
Evap. Leaving Air WB Temp	_____	_____
Compressor Amps (L1)	_____	_____
Compressor Amps (L2)	_____	_____
Compressor Amps (L3)	_____	_____

Notes:

_____

_____

_____

_____

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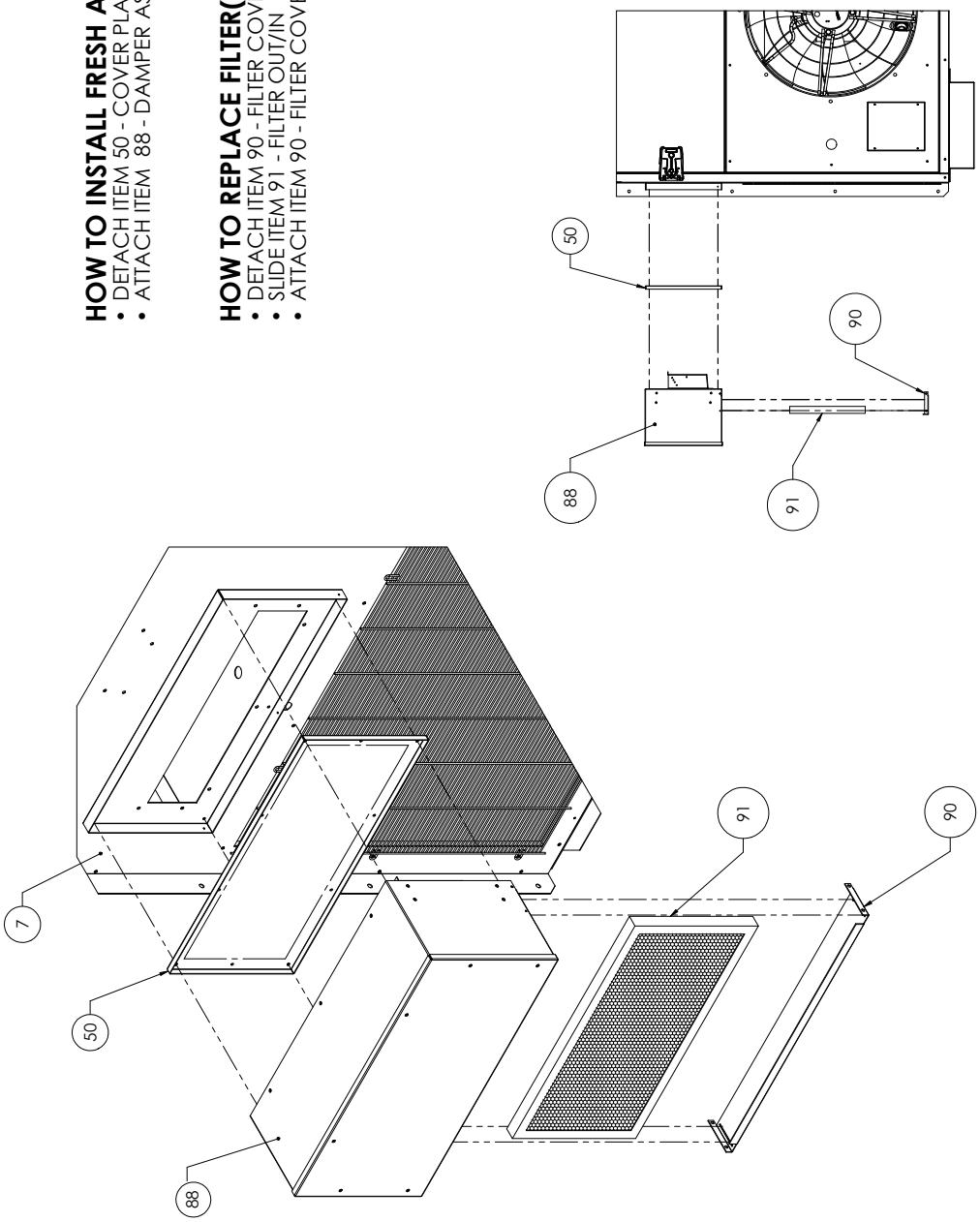
_____

_____

Appendix A Fresh Air Damper Installation

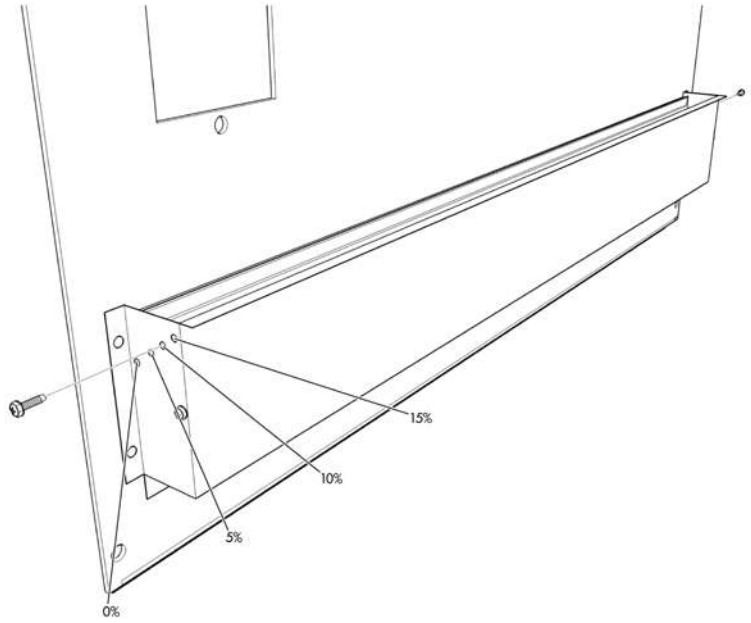
HOW TO INSTALL FRESH AIR DAMPER ASSY(88):
- DETACH ITEM 50 - COVER PLATE FROM ITEM 7 - MAIN UNIT AND DISCARD
- ATTACH ITEM 88 - DAMPER ASSY TO ITEM 7 - MAIN UNIT

HOW TO REPLACE FILTER(91):
- DETACH ITEM 90 - FILTER COVER FROM ITEM 88 -DAMPER ASSY
- SLIDE ITEM 91 - FILTER OUT/IN
- ATTACH ITEM 90 - FILTER COVER TO ITEM 88 - DAMPER ASSY



Fresh Air Hood Adjustment (non-economozer air conditioners only)

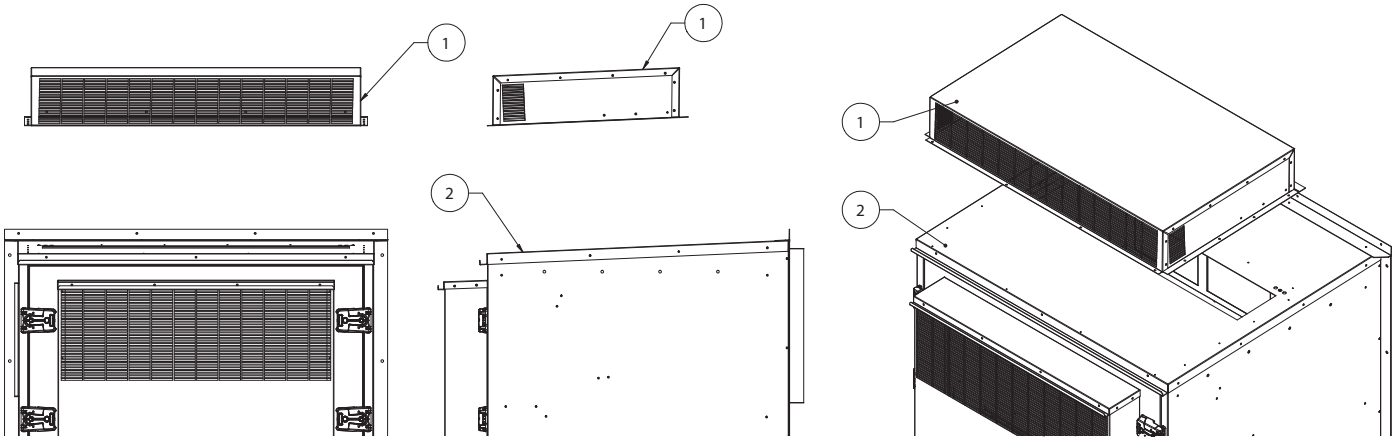
The fresh air hood is located on the inside, behind the slots on the bottom front panel. To access the hood, remove the screws that hold the front panel. The air flow can be adjusted from no (0%) fresh air to approximately 15% of rated air flow of fresh air, in 5% increments. The hood is shipped from the factory in the closed position (no fresh air). To provide fresh air, remove the two screws on either side of the hood and reposition as desired.



Fresh Air Hood Damper

Appendix B

CFA1120A/1150A/3150A/3180A/3240A Reverse Flow w/Economizer Exhaust Hood Installation



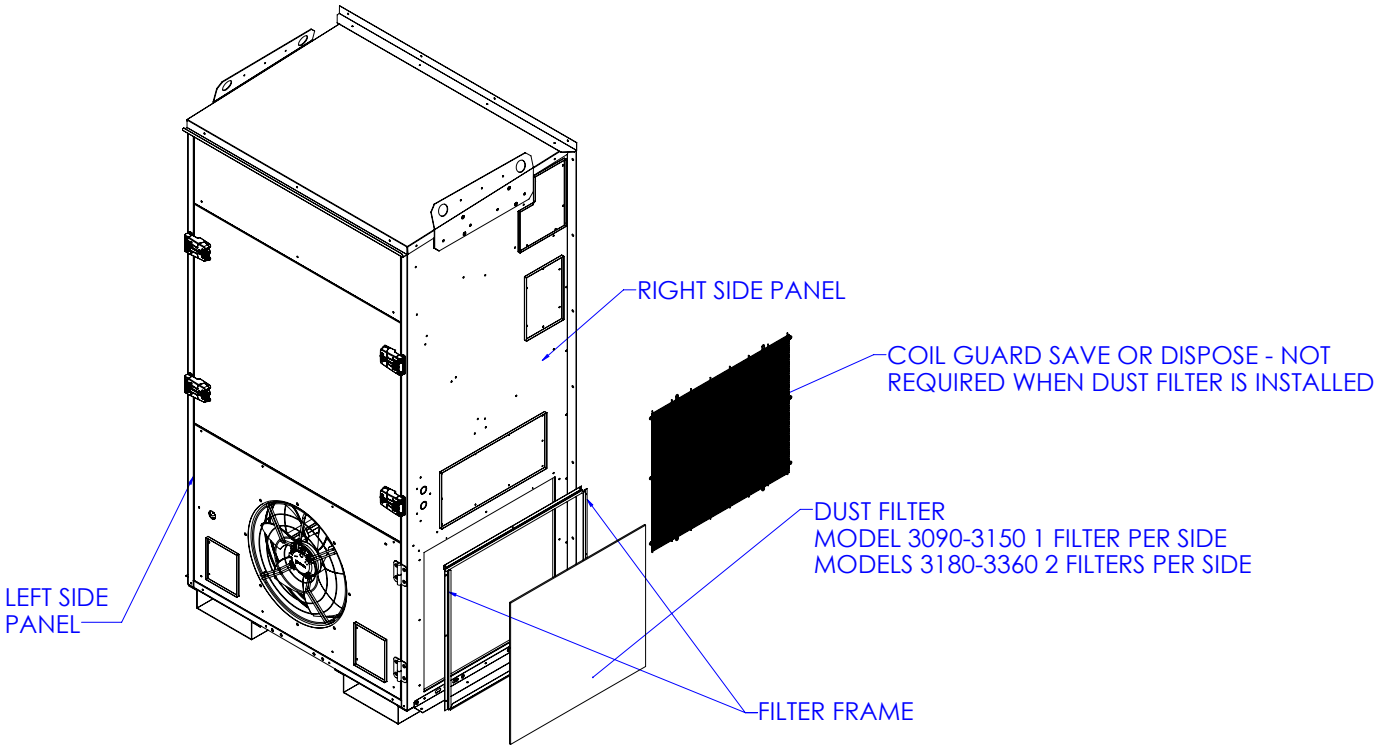
A. MAKE SURE FACTORY SUPPLIED GASKET IS PROPERLY ATTACHED TO THE BOTTOM FLANGES OF THE HOOD ASSY (ITEM 1)
B. PLACE HOOD ASSY (ITEM 1) ON TOP OF UNIT WITH SLOTTED VENTS TOWARDS THE FRONT OF THE UNIT
C. ALIGN HOLES IN THE HOOD ASSY FLANGES WITH PREDRILLED HOLES IN THE TOP PANEL OF UNIT (ITEM 2)
D. SCREW INTO PLACE WITH SHEET METAL SCREWS PROVIDED
E. ADD SILICONE BEAD AROUND THE TWO SIDES AND REAR OF THE HOOD ASSY

NOTE: CFA1120A/1150A/3150A UNITS ARE A DIFFERENT CABINET TO CFA3180A-3240A BUT DAMPER INSTALLATION PROCEDURE IS THE SAME.

Appendix C

Optional Condenser Filter Installation

STEP 1-REMOVE COIL GUARD SAVE SCREWS FOR MOUNTING FILTER ASSY
STEP 2-SCREW FRAME SIDES AND BOTTOM IN COIL GUARD MOUNTING HOLES
STEP 3-SLIDE FILTER INTO FRAME
STEP 4- SCREW FRAME TOP INTO COIL GUARD MOUNTING HOLES
STEP 5-REPEAT 1-4 FOR OTHER SIDE PANEL



S/12908**		EXTERNAL CONDENSER FILTER ASSY 300-360	
	SML17015	EXTERNAL COND COIL SIDE MGA 300-360	4
	SML17016	EXTERNAL COND COIL BOT MGA 300-360	2
	SML17017	EXTERNAL COND COIL TOP MGA 300-360	2
	93288	FILTER CONDENSER 300-360 64.75X36.625	4
S/12907**		EXTERNAL CONDENSER FILTER ASSY 180-240	
	SML17013	EXTERNAL COND COIL SIDE MGA 180-240	4
	SML17014	EXTERNAL COND COIL BOT MGA 180-240	2
	SML17018	EXTERNAL COND COIL TOP MGA 180-240	2
	93287	FILTER CONDENSER 180-240 44.875X36.5	4
S/12906**		EXTERNAL CONDENSER FILTER ASSY 120-+150	
	SML17009X	EXTERNAL COND COIL SIDE 1 MGA 90-150	2
	SML17010	EXTERNAL COND COIL SIDE 2 MGA 90-150	2
	SML17012	EXTERNAL COND COIL BOT MGA 120-150	2
	SML17019	EXTERNAL COND COIL TOP MGA 120-150	2
	93286	FILTER CONDENSER 120-150 36.875X28	2
S/12905**		EXTERNAL CONDENSER FILTER ASSY 90	
	SML17009X	EXTERNAL COND COIL SIDE 1 MGA 90-150	2
	SML17010	EXTERNAL COND COIL SIDE 2 MGA 90-150	2
	SML17011	EXTERNAL COND COIL BOT MGA 90	2
	SML17020	EXTERNAL COND COIL TOP MGA 90	2
	93285	FILTER CONDENSER 120-150 30.875X28	2

Appendix A

Appendix D

DPC200 Differential Pressure Controller

Installation and operation manual

DPC200 -
DIFFERENTIAL PRESSURE CONTROLLER

Low pressure with PI-control-mode

Doc.-no.: DPC200_01_EBM_UK Issue: 12/2015

Manufacturer: Arthur Grillo GmbH
Am Sandbach 7
40878 Ratingen

Phone: +49 21 02 - 47 10 22
Fax: +49 21 02 - 47 58 82
E-Mail: info@grillo-messgeraete.de
Website: www.grillo-messgeraete.de
www.sensor-store.de

Issue: 12/2015
Doc.-no.: DPC200_001_EBM_UK

Table of content

1. General safety instructions

1.1 Signal words for safety instructions

The safety instructions in this operation manual are designed to prevent hazards. They can be found in the operation manual before an operation / task / activity is described, which can entail a possible hazard.

CAUTION	Identification of a hazard with a low risk, which can lead to material damage or minor or moderate bodily injuries.

NOTICE	Signal word for important information regarding the product, which needs to be specifically pointed out.

Hazard word

Type of hazard
Hazard source
Hazard prevention

1.2 Used pictograms and symbols

In this manual the following symbols are used:

 General hazard symbol (danger, warning, caution)	 General information

1.3 General notes

NOTICE

This manual contains information for installation and operation of the pressure controller and is exclusively for the operator and expert staff. The guidelines in this manual will help to avoid danger and downtime.

2. Product description

The differential pressure controller DPC200 measures low pressure of inert gases, particularly of air.

2.1 Type plate

1. Product name
2. Measuring range
3. Supply voltage
4. Signal output
5. Serial no.
6. Manufacturer

pressure controller	1.	**DPC200-EP500**
measurement range:	500 Pa 2.	
supply voltage:	3. U_S (1+ 2-) = 10 ... 30 Vdc / 24 Vac	
signal output:	4. U_{out} (3+ 4-) = 0 ... 10 V	
part-no.: 2572	5. serial-no.: 15. 4700	IP54
Arthur Grillo GmbH • Ratingen 6.		Made in Germany

2.2 Intended use

This device is primarily intended for use with air conditioning systems, room pressure control or filter control with ebm-papst continuously variable speed fans. It can be operated solely as a sensor (measuring mode) or closed loop controller for pressure / volumetric flow rate control. As analogue output the operator can use a signal from 0 ...10 V DC. Depending on the settings the signal has different meanings:

1. If the device is used as a pressure sensor, the output signal is proportional to the measured pressure.
2. As a volume flow sensor the device outputs a square root signal.
3. With closed loop pressure or volume flow the output signal stands for the control variable of the PI-control.

2.3 Functional description

A soft silicone diaphragm is used as sensor. Under the influence of the differential pressure the diaphragm displaces a measuring spring until the spring force compensates for the pressure pushing on the diaphragm. A contactless differential transformer and suitable electronics convert this displacement into a continuously variable output voltage signal.
The DPC200 provides two function options:

1. On the one hand it is used as a measuring device. In the measuring mode the differential pressure is shown on the display, and a proportional 0...10V DC output signal is provided.
2. Besides the measuring mode the DPC200 also can be operated in a control mode. Two setpoints can be adjusted in the device and can be selected with the potential free contact input. The PI-Algorithm matches the measured differential pressure with the setpoint and operates the control variable so that a constant pressure results. The control variable is given as a 0...10 V DC output signal.

Instead of the quantity 'differential pressure' also the quantity 'volume flow' can be used for measuring and for control.

3. Installation

The differential pressure controller DPC200 is designed for wall mounting.

- The mounting surface must be solid enough and vibration-free.
- The environment has to fulfil the ambient climatic conditions as given in the technical data.

CAUTION

Material damage

Read the manual carefully before installation and operation

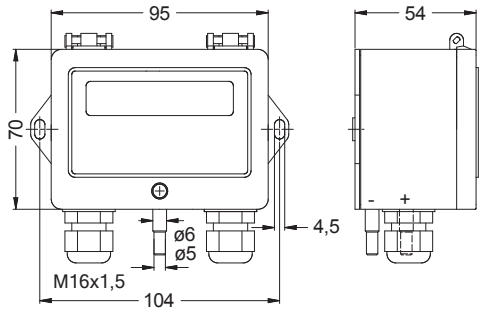
Only experienced staff may connect the device and bring it into operation.

NOTICE

- The device is position depended.
- The DPC200 must be mounted vertically.

3.1 Dimensions

All dimensions in mm.



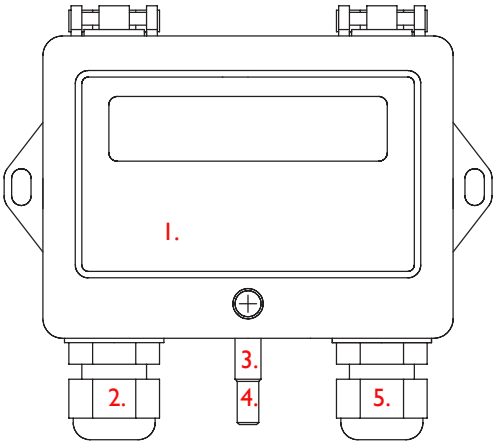
3.2 Wall mounting

1. Hold the DPC200 against the wall. Mark the mounting holes.
2. Drill mounting holes for properly sized screws.
3. Put the screws through the housing mounting holes.
4. Tighten screws.

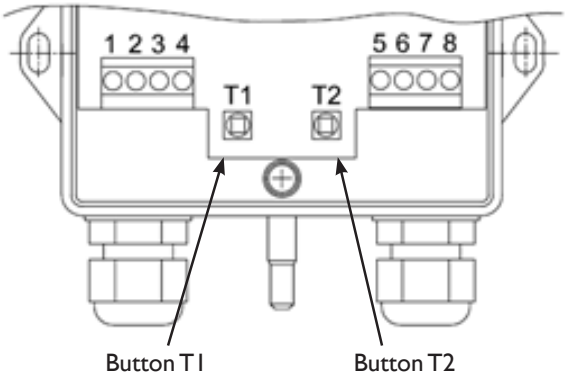
4. Start up

4.1 Overview DPC200

1. Front cover
2. Cable gland
3. Pressure connection 1
4. Pressure connection 2
5. Cable gland



4.2 Schematic view inside

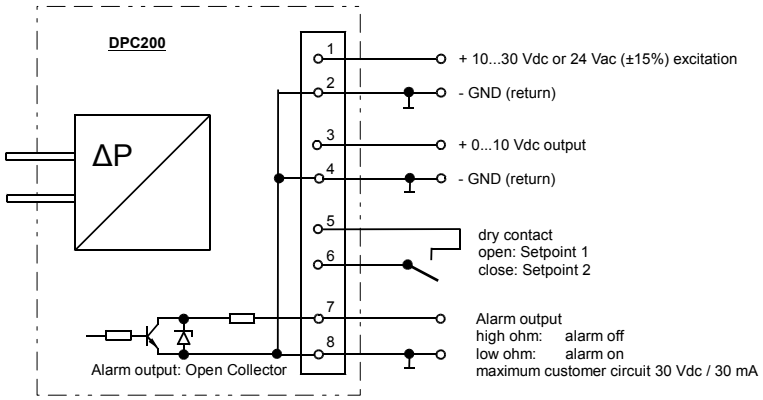


Button T1 and T2 serve for the operation of the menu

4.3 Pressure connections

Connect all pressure connections properly with plastic tubing (inner diameter 5 or 6mm).

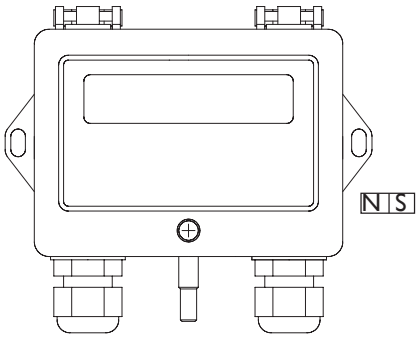
4.4 Electrical connection



1. Unscrew screws of the front cover.
2. Open front cover.
3. Use M16 cable glands for connecting wiring to terminals.

4.5 Zero adjustment

The output signal offset can be zeroed from the outside with a small bar magnet. Do not use buttons T1 or T2.



Adjustment:

- Remove the tubing from the pressure connections.
- Hold the bar magnet (N/S) as shown here to the zero point adjustment for a short period of time to activate an internal reed switch.

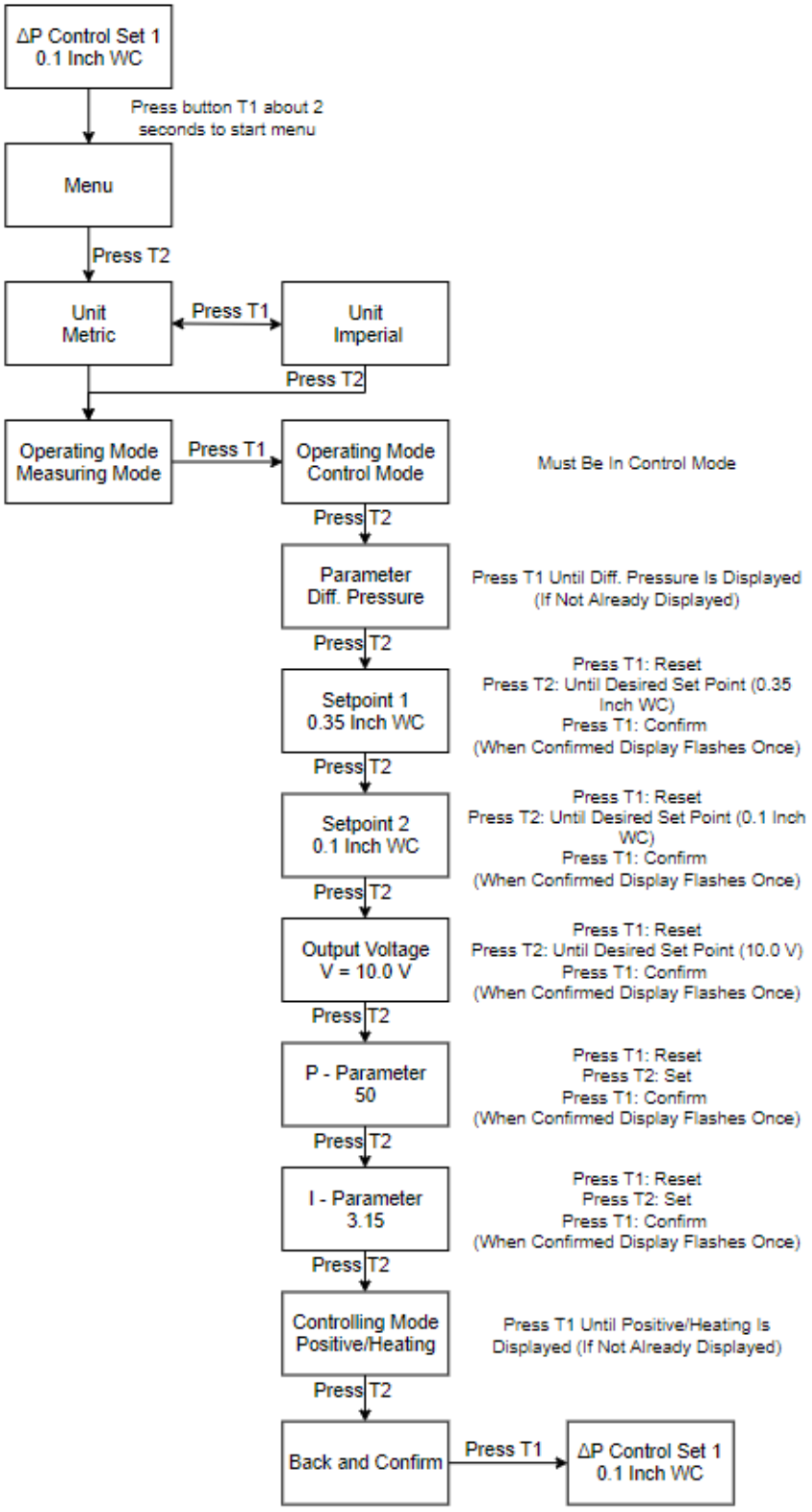
The new zero point will be displayed and stored.

5. Operation

5.1 Start menu

For operating the menu, unscrew the front cover to reach buttons T1 and T2.

5.2 Menu structure



5.3 Measuring mode

Display	Action
ΔP Measurement 200 Pa	**Start menu:** Press button T1 approx. two seconds
menu	Press button T2 to get to the next menu item
unit metric	Press button T1 to switch between: metric <=> imperial Press button T2 to get to the next menu item
operating mode control mode	Press button T1 to switch between: measuring mode <=> control mode Press button T2 to get to the next menu item
parameter diff. pressure	Press button T1 to switch between: diff. pressure <=> volume flow Press button T2 to get to the next menu item

	If selected parameter = diff. pressure
limit switch 150 Pa	Button T1: reset value Button T2: set value Button T1: confirm value, display flashes once Press button T2 to get to the next menu item
back and confirm	Press button T1 to leave the menu Press button T2 to stay in the menu

	If selected parameter = volume flow than follows the additional input for the k-factor
fan k-factor k = 70	Button T1: reset value Button T2: set value Button T1: confirm value, display flashes once Press button T2 to get to the next menu item
limit switch 300 m³/h	Button T1: reset value Button T2: set value Button T1: confirm value, display flashes once Press button T2 to get to the next menu item
back and confirm	Press button T1 to leave the menu Press button T2 to stay in the menu

5.4 Control mode

Display	Action
ΔP Measurement 200 Pa	**Start menu:** Press button T1 approx. two seconds
menu	Press button T2 to get to the next menu item
unit metric	Press button T1 to switch between: metric <=> imperial Press button T2 to get to the next menu item
operating mode control mode	Press button T1 to switch between: measuring mode <=> control mode Press button T2 to get to the next menu item
parameter diff. pressure	Press button T1 to switch between: diff. pressure <=> volume flow Press button T2 to get to the next menu item

	If selected parameter = diff. pressure resp. after the input of the k-factor follows:
setpoint 1 50 Pa	Button T1: reset value Button T2: set value Button T1: confirm value, display flashes once Press button T2 to get to the next menu item
setpoint 2 250 Pa	Button T1: reset value Button T2: set value Button T1: confirm value, display flashes once Press button T2 to get to the next menu item
output voltage U = 10,0 V DC	Button T1: reset value Button T2: set value Button T1: confirm value, display flashes once Press button T2 to get to the next menu item
P - parameter 50	Button T1: reset value Button T2: set value Button T1: confirm value, display flashes once Press button T2 to get to the next menu item
I - parameter 3,15	Button T1: reset value Button T2: set value Button T1: confirm value, display flashes once Press button T2 to get to the next menu item
controlling mode positive / heating	Press button T1 to switch between: positive / heating <=> negative / cooling Press button T2 to go to the next menu
back and confirm	Press button T1 to leave the menu Press button T2 to stay in the menu

	If selected parameter = volume flow than follows the additional input for the k-factor
fan k-factor k = 70	Button T1: reset value Button T2: set value Button T1: confirm value, display flashes once Press button T2 to get to the next menu item

5.5 Adjustable parameters

Parameter	Selection or parameter range	Default setting
Unit	Metric or imperial	metric
Operating mode:	Measuring mode or control mode	measuring mode
Parameter	Differential pressure ΔP [Pa or InH2O] Volume flow V [m^3/h or cfm]	differential pressure ΔP [Pa]
K-factor:	Volume flow calculation according to: $V = k \cdot \sqrt{\Delta p}$ with: V = Volume flow in m^3/h or cfm k = flow factor, adjustment range: 1...1000 measuring range up to 4000 Pa Δp = differential pressure in Pa or InH20 Volume flow calculation up to 65,500 m^3/h (38,514 cfm) In measuring or control mode Maximum volume flow (V_{max}) Measuring range: 50 Pa, k=1000 ⟶ V_{max} = 7,071 m^3/h; (4,157 cfm) Measuring range: 500 Pa, k=1000 ⟶ V_{max} = 22,360 m^3/h; (13,147 cfm) Measuring range: 1000 Pa, k=1000 ⟶ V_{max} = 31,622 m^3/h; (18,593 cfm) Measuring range: 2000 Pa, k=1000 ⟶ V_{max} = 44,721 m^3/h; (26,295 cfm) Measuring range: 4000 Pa, k=1000 ⟶ V_{max} = 63,245 m^3/h; (37,188 cfm)	K = 70
Limit values:	Differential pressure from 0 % up to 100 % of measuring range. Volume flow from 5 % up to 100 % of measuring range, k-factor is considered.	OFF
Nominal values (setpoints):	Differential pressure from 0 % up to 100 % of measuring range. Volume flow from 5 % up to 100 % of measuring range, k-factor is considered.	Set 1: 75 % Set 2: 25 %
Output voltage:	0…10 V DC	U_{out} = 10 V DC
P-gain:	0...1000	P = 50
I-gain:	0…100	I = 3.15
Control characteri-stic:	positive/(heating): Control deviation = set value – actual value The output increases when set value > actual value. negative/(cooling): Control deviation = actual value – set value The output increases when actual value > set value	positive / heating

5.6 Function alarm output

The DPC200 has an open collector alarm output; depending on the operating mode the function is different.
At the **alarm event** a contact between terminal no. 7 and no. 8 gets low-resistive and can be loaded with a maximum of 30 V DC/ 30 mA. When the alarm is switched off the contact will be high-resistive.
During alarm state in the control mode / measuring mode an exclamation point is displayed (2nd line / 16th character).

Control mode:
In order to recognize the limits of control, the alarm output in the control mode refers to the set maximum output voltage ($MaxU_{out}$). $MaxU_{out}$ can be set in the menu item „output voltage“.
In the default setting the value is set to 10 V DC.

Alarm ON: Output voltage for 12 seconds constantly greater than: $0.95 \cdot MaxU_{out}$
Alarm OFF: Output voltage for 12 seconds constantly less than: $0.9 \cdot MaxU_{out}$

Measuring mode:
For limit value monitoring a limit value can be entered. This value is set in the menu item „limit switch“. The previously set parameters are taken into account (unit, parameter, k-factor and the measuring range).

In the default setting the limits are not active. Display 2nd line: „OFF“
Alarm ON: Measurement for 12 seconds constantly greater than 1.0 • limit value
Alarm OFF: Measurement for 12 seconds constantly less than 0.95 • limit value

6. Maintenance

The DPC200 contains no wearing or consumable parts. Servicing is not required.
On request, Arthur Grillo GmbH offers an annual calibration with factory certificate.
For information, please contact:

Arthur Grillo GmbH
Am Sandbach 7
40878 Ratingen

Phone: +49 21 02 - 47 10 22
Fax: +49 21 02 - 47 58 82
E-Mail: info@grillo-messgeraete.de

7. Warranty

Warranty and liability claims for personal and property damage are excluded if they are caused by one or more of the following reasons:

- Improper use of the device.
- Improper installation, commissioning, operation and maintenance of the device.
- Unauthorized modifications to the device beyond the intended use.
- Disasters due to external influences and force majeure.

8. Troubleshooting

Description	Activity
Display does not show anything	Check electrical connection
Measurement stays zero	Function test with a slight pressure increase in measuring mode for differential pressure
Measuring error	Perform zeroing as described in chapter 4.5.
Error remains	Contact manufacturer

9. Disposal

Dispose of parts so as not to endanger human health or the environment. Follow the laws in the country of use for disposing of electronic components and devices during disposal.

10. Specifications

Measuring medium:	Air or inert gases
Measuring principle:	Silicon diaphragm with spring and differential transformer
Lowest span:	0...50 Pa
Highest span:	0...4000 Pa
Overpressure protection:	0.2 bar
Static pressure:	max. 0.2 bar
Pressure connections:	tubing 5 mm ø or 6 mm ø
Enclosure:	UL 94 HB; Case polyamid, cover ABS
Electrical connections:	cable inlet M16x1.5, screw terminal Electronic protection against reversed polarization
Supply voltage:	10...30 Vdc; 24 Vac (±15%)
Current consumption:	approx. 10 mA @ 10 Vdc, ca. 12 mA @ 24 Vdc
Output:	0...10 V (I_{max} = 0.5 mA @ 10 Vdc, I_{max} = 2 mA @ 20 Vdc)
Alarm output:	Open Collector, max. 30 V / 30 mA
Display:	LCD-Display, 2 x16 characters
Mode:	Measuring mode or controlling mode
Controlling algorithm:	PI
Setpoints:	2 setpoints adjustable within software, Setpoints are selectable with floating contact input
Protection class:	IP 54 according EN 60529
Ambient temperature:	-10...50 °C
Storage temperature:	-25...60 °C
Weight:	approx. 250 g
Mounting:	vertical, position dependence by turning of 90°: approx. 25 Pa
Interference / emission:	according EN 61000-6-2, EN 61000-6-3, CE mark

Influences / limits:	Zero error:	± 0.75 %
	Sum of linearity and hysteresis (depends on measuring range):	± 0.5 % ... ± 1 %
	Temperature drift, zero point:	± 0.3 % / 10 K
	Temperature drift, span:	± 0.2 % / 10 K

10.1 CE-labelling

As an electric device the DPC200 falls within the scope of the directive 2004/108/EG (EMV-directive). In the scope of the EMV-directive the following norms were applied:

DIN EN 61000-6-2:2006-03 Berichtigung 1:2011-06	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
DIN EN 61000-6-3:2011-09	Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light industrial environments

You can order the Declaration of Conformity at:

Arthur Grillo GmbH
Am Sandbach 7
40878 Ratingen
Phone: +49 21 02 - 47 10 22
Fax: +49 21 02 - 47 58 82
E-Mail: info@grillo-messgeraete.de

11. Ordering information

Article	Item no.
Differential pressure controller DPC200 Measurement range: **0...50 Pa**	2570
Differential pressure controller DPC200 Measurement range: **0...500 Pa**	2572
Differential pressure controller DPC200 Measurement range: **0...1000 Pa**	2574
Differential pressure controller DPC200 Measurement range: **0...2000 Pa**	2576
Differential pressure controller DPC200 Measurement range: **0...4000 Pa**	2578
Mounting set M-DS with screws, bleeders and 2m plastic tube (4 x 1,5 mm)	25110