Marvair®
An ACS Brand

Installation & Operation Manual

7.5, 10, 12.5 & 15 Ton 10EER Vertical Wall Mount Air Conditioners

Installation & Operation Manual

10 EER Vertical Wall-Mount Air Conditioners

MODELS:

MGA3090A • MGA3120A
MGA3150A • MGA3180
(Dual Compressor)

AHRI CERTIFIED® www.ahridirectory.org Single Package Vertical AC AHRI Standard 390

Intertek

Designed, Engineered & Assembled In the USA

IMPORTANT

This manual may include information for options and features which may not be included on the unit being installed. Refer to the unit data label or Model Identification to determine which features and options this unit is equipped with.

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

Manufactured By:

Marvair, An ACS Brand

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

Marvair MGA3090-3180 Wall Mount AC I&O Manual 04/2024 Rev.21

How To Use This Manual

This manual is intended to be a guide to Marvair'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.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

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⚠ 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.

Table of Contents

Chapter 1 Air Conditioner Description & Specifications
1.1 General Description 5
1.2 Model Identification 6
1.3 Serial Number Date Code 6
1.4 Capacities, Weights and Filter Sizes 6
1.5 General Operation 10
1.6 Programmable Logic Controller (PLC) 10
1.7 Optional Controls and Packages 11
1.8 Electrical Operation 12

Chapter 2 Installation
2.1 Equipment Inspection 16
2.2 Installation Requirements 16
2.3 Installation Materials 17
2.4 Porting and Duct Work 19
2.5 Top Flange Installation 19
2.6 Installing the Lifting Brackets 20
2.7 Mounting the Unit 20
2.8 Compressor Chocks Removal 21
2.9 Unit Support Recommendations 22
2.10 Electrical Connections 22

Chapter 3 Start-Up
3.1 Check-Out of Cooling Cycle 26
3.2 Check-Out of Heating Cycle 26

Chapter 4 Troubleshooting
4.1 Overview 27
4.2 Failure Symptoms Guide 28
4.3 Compressor Troubleshooting 29

Chapter 5 Maintenance
5.1 Scheduled Maintenance 30

Chapter 6 Warranty
6.1 Limited Product Warranty 31

Chapter 7 Start-Up Check List
7.1 Start-Up Check List....32

Illustrations

Figure 1. PLC 10
Figure 2a. Typical Electrical Schematic - MGA3090A....13
Figure 2b. Typical Electrical Schematic - MGA3120A & MGA3150A 14
Figure 2c. Typical Electrical Schematic - MGA3180A....15
Figure 3. Top Flange and Lifting Bracket Installation 20
Figure 4. Compressor Chock Removal....21
Figure 5. Wall Mounting Detail....21
Figure 6a. Unit Compression Support Examples 22
Figure 6b. Unit Tension Support Examples....22
Figure 7a. Humidistat Wiring to a Marvair Air Conditioner with Reheat....24
Figure 7b. CommStat™ 4 Connection Diagram 25

Tables

Table 1 Efficiency and Capacity Ratings at ANSI/AHRI Standard 390.... 7
Table 2 SCFM @ Various External Static Pressures 7
Table 3 Single Compressor Cooling Performance (BTUH) at Various Outdoor Temperatures 7
Table 4 Dual Compressor Cooling Performance (BTUH) at Various Outdoor Temperatures.... 8
Table 5 Economizer Cooling Performance.... 8
Table 6 Ambient Temperature Operating Ranges.... 8
Table 7 Shipping Weights & Dimensions.... 9
Table 8 Return Air Filter Sizes 9
Table 9 Refrigerant Charge.... 9
Table 10 Minimum Clearances.... 17
Table 11 Voltage Limitations.... 17

Appendix A: PLC SetUp and Operation....36
Appendix B: PLC Sequence of Operation....45
Appendix C: PLC Modbus Variables 49
Appendix D: PLC Bacnet Analog Variables....52
Appendix E: PLC Bacnet Binary Variables....54
Appendix F: Fresh Air Damper Installation 55
Appendix G: MGA3150A/3180A Center Supply/Top Return w/Economizer Exhaust Hood Installation 57

Chapter 1 Description & Specifications

1.1 General Description

The Marvair MGA3090A, MGA3120A, MGA3150A & MGA3180A are a series of vertical wall-mounted air conditioning systems that provide heating, cooling, and ventilation for telecommunication shelters, and other applications with high internal heat gains. The series is available in nominal cooling capacities of 90,000-180,000 BTUH. A factory installed economizer, resistance heating elements and Center Supply/Top Return configurations are available.

All Marvair MGA wall mount air conditioners feature an exclusive electronic control board or PLC-based controls.

The control board and PLC consolidate several of the 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 is in Section 1.6

Other standard components include:

- Hot gas by-pass valve to allow operation in cold temperatures
- 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

Marvair air conditioners 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	M	G	A	3	0	9	0	A	D	1	5	0	C	+	+	+	+	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	**M** = Marvair Wall Mount
2	Energy Efficiency Ratio (EER)	**G** = 10
3	Refrigerant Type	**A** = R-410a
4	Compressor Type/ Quantity	**3** = Dual Compressors
5 6 7	Unit Capacity/Nominal Cooling (BTUH)	**090** = 90,000 | **150** = 150,000 **120** = 120,000 | **180** = 180,000
8	System Type	**A** = Air Conditioner
9	Power Supply (Volts-Phase-Hz)	**A** = 208/230-60-1 **C** = 208/230-60-3 **D** = 460-60-3 **Z** = 575-60-3 **$** = Special
10 11 12	Heat Designation @ Rated Voltage **KW** = Kilowatt	**000** = No Heat **050** = 5KW **090** = 9KW **150** = 15KW **180** = 18KW
13	Ventilation Configuration	**A** = Solid Front Door **C** = Economizer **D** = Motorized Damper w/Pressure Relief **E** = Motorized Damper w/Pressure Relief & Independent Motorized Damper Control **F** = No Free Cooling, 100% Emergency Ventilation Only w/Independent Control
14	Dehumidification	**R** = Electric Reheat **T** = Electric Reheat w/Humidity Control **+** = None
15	Controls	**A** = Power Fail Alarm w/Additional Lockouts **C** = 24V EMS Relay Kit **D** = 24V EMS Relay Kit w/Factory Installed T-Stat **E** = Factory Installed T-Stat **F** = PLC w/Summed Alarms **G** = PLC w/Summed Alarms & Factory Installed T-Stat **H** = PLC **J** = PLC w/Factory Installed T-Stat **K** = Summed Alarms **N** = Relay Logic Controls **2** = PLC w/2-Stage Controller Activated **+** = None (Greenboard Standard on all Units) **$** = Special
16	Operating Condition	**A** = Evaporator Freeze Sensor (EFS) **C** = EFS w/Hot Gas Bypass **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	**D** = Dry Bulb Sensor **E** = Dry Bulb Sensor w/Dirty Filter **G** = Dirty Filter Sensor **+** = None
18	Air Flow	**1** = Top Supply/Center Return (STD) **2** = Center Supply/Top 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 Grille **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 **G** = Coastal Environmental Package & Evap Coil **K** = Coastal Package **+** = None **$** = Special
22 23	Engineering Revision Level	A2 B2 C2
24	Cabinet Color	**1** = Marvair Beige (STD) **2** = Gray (STD) **3** = Carlsbad Canyon (STD) **4** = White (STD) **5** = Stainless Steel Exterior **9** = Pebble Gray **A** = Stainless Steel - Unit **$** = Custom Color (Powder Coat)
25	Sound Attenuation	**2** = Compressor Blanket **+** = None
26	Security Option	**A** = Lockable Access Plate/Tamper Proof **+** = None
27	Fastener/Drain Pan Option	**A** = Stainless Steel Fasteners **C** = Stainless Steel Drain Pan **D** = Stainless Steel Fasteners & Drain Pan **E** = IP55 Ingress **+** = None
28	Unused	**+** = None **$** = Special
29	Unused	**+** = None **$** = Special
30	Special Variation	**+** = None **$** = Special Configuration Not Covered by Model Nomenclature

Note: Not all options are available with all configurations. Contact your Marvair 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 Capacities, Weights and Filter Sizes

See the Product Data Sheet for complete electrical and performance specifications and dimensional drawings.

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	Cooling BTUH[1]	EER[2]	Rated Air Flow (CFM)[3]
MGA3090A	89,000	10	3,500
MGA3120A	118,000	10	4,000
MGA3150A	146,000	10	4,500
MGA3180A	182,000	10	6,000

[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]EER=Energy Efficiency Ratio
[3]CFM=Cubic Feet per Minute
Ratings are with no outside air. Performance will be affected by altitude.
Ratings are at 230 volts for 208/230 volt units ("A" & "C" models) and 460 volts for "D" models. Operation of units at a different voltage from that of the rating point will affect performance and air flow.

Table 1. Efficiency and Capacity Ratings at ANSI/AHRI Standard 390

Model Number	IWG Static Pressure											
	0	0.2	0.4	0.6	0.8	1	1.2	1.4	1.6	1.8	2	2.2
MGA3090A	3,846	3,570	3,286	3,003	2,722[1]	2,515[1]	2,164[1]	1,888[1]	1,612[1]	1,338[1]	1,065[1]	794[1]
MGA3120A	4,301	4,064	3,808	3,533	3,238	2,924[1]	2,590[1]	2,237[1]	1,865[1]	1,472[1]	1,061[1]	630[1]
MGA3150A	4,801	4,564	4,308	4,033	3,738	3,424	3,090	2,737	2,365	1,972	1,561	1,130
MGA3180A	6,876	6,622	6,378	6,143	5,916	5,686	5,487	5,285	5,090	4,902	4,721	4,547

[1]Operation in the shaded area is not recommended

Table 2. SCFM @ Various External Static Pressures

Model Number	Return Air DB/WB °F (°C)	Outdoor Temperature												
		Cooling Capacity BTUH	75°F (24°C)	80°F (27°C)	85°F (30°C)	90°F (32°C)	95°F (35°C)	100°F (38°C)	105°F (41°C)	110°F (43°C)	115°F (46°C)	120°F (49°C)	125°F (52°C)	130°F (54°C)
MGA3090A	72/61 (22/16)	Total	42,039	40,581	39,164	37,706	36,248	34,790	33,332	31,914	31,185	30,456	29,727	28,998
		Sensible	37,564	37,021	36,494	35,953	35,414	34,790	33,332	31,914	31,185	30,456	29,727	28,998
	76/63 (24/17)	Total	43,700	42,201	40,662	39,164	37,665	36,167	34,668	33,129	32,400	31,671	30,942	30,213
		Sensible	41,395	40,856	40,305	39,164	37,665	36,167	34,668	33,129	32,400	31,671	30,942	30,213
	80/67 (27/19)	Total	46,980	45,360	43,740	42,120	40,500	38,192	37,260	35,640	34,830	34,101	33,372	32,643
		Sensible	40,841	40,300	39,761	39,224	38,688	37,926	37,260	35,640	34,830	34,101	33,372	32,643
	84/71 (29/22)	Total	50,261	48,519	46,818	45,077	43,335	41,594	39,852	38,151	37,260	36,531	35,802	35,073
		Sensible	40,097	39,560	39,037	38,503	37,970	37,438	36,908	36,392	36,122	35,901	35,681	35,073
MGA3120A	72/61 (22/16)	Total	61,242	59,118	57,053	54,929	52,805	50,681	48,557	46,492	45,430	44,368	43,306	42,244
		Sensible	61,242	59,118	57,053	54,929	52,805	50,681	48,557	46,492	45,430	44,368	43,306	42,244
	76/63 (24/17)	Total	63,661	61,478	59,236	57,053	54,870	52,687	50,504	48,262	47,200	46,138	45,076	44,014
		Sensible	63,661	61,478	59,236	57,053	54,870	52,687	50,504	48,262	47,200	46,138	45,076	44,014
	80/67 (27/19)	Total	68,440	66,080	63,720	61,360	59,000	56,640	54,280	51,920	50,740	49,678	48,616	47,554
		Sensible	68,440	66,080	63,720	61,360	59,000	56,640	54,280	51,920	50,740	49,678	48,616	47,554
	84/71 (29/22)	Total	73,219	70,682	68,204	65,667	63,130	60,593	58,056	55,578	54,280	53,218	52,156	51,094
		Sensible	72,324	70,682	68,204	65,667	63,130	60,593	58,056	55,578	54,280	53,218	52,156	51,094
MGA3150A	72/61 (22/16)	Total	75,809	73,180	70,623	67,994	65,365	62,736	60,107	57,550	56,236	54,921	53,607	52,292
		Sensible	75,809	73,180	70,623	67,994	65,365	62,736	60,107	57,550	56,236	54,921	53,607	52,292
	76/63 (24/17)	Total	78,803	76,101	73,326	70,623	67,921	65,219	62,517	59,741	58,427	57,112	55,798	54,483
		Sensible	78,803	76,101	73,326	70,623	67,921	65,219	62,517	59,741	58,427	57,112	55,798	54,483
	80/67 (27/19)	Total	84,719	81,798	78,876	75,955	73,034	70,112	67,191	64,269	62,809	61,494	60,180	58,865
		Sensible	84,374	81,798	78,876	75,955	73,034	70,112	67,191	64,269	62,809	61,494	60,180	58,865
	84/71 (29/22)	Total	90,635	87,494	84,427	81,286	78,146	75,005	71,865	68,798	67,191	65,876	64,562	63,247
		Sensible	83,360	82,358	81,383	80,389	78,146	75,005	71,865	68,798	67,191	65,876	64,562	63,247
MGA3180A	72/61 (22/16)	Total	94,458	91,182	87,997	84,721	81,445	78,169	74,893	71,708	70,070	68,432	66,794	65,156
		Sensible	94,458	91,182	87,997	84,721	81,445	78,169	74,893	71,708	70,070	68,432	66,794	65,156
	76/63 (24/17)	Total	98,189	94,822	91,364	87,997	84,630	81,263	77,896	74,438	72,800	71,162	69,524	67,886
		Sensible	98,189	94,822	91,364	87,997	84,630	81,263	77,896	74,438	72,800	71,162	69,524	67,886
	80/67 (27/19)	Total	105,560	101,920	98,280	94,640	91,000	87,360	83,720	80,080	78,260	76,622	74,984	73,346
		Sensible	105,560	101,920	98,280	94,640	91,000	87,360	83,720	80,080	78,260	76,622	74,984	73,346
	84/71 (29/22)	Total	112,931	109,018	105,196	101,283	97,370	93,457	89,544	85,722	83,720	82,082	80,444	78,806
		Sensible	108,205	106,965	105,196	101,283	97,370	93,457	89,544	85,722	83,720	82,082	80,444	78,806

Table 3. Single Compressor Cooling Performance (BTUH) at Various Outdoor Temperatures

Model Number	Return Air DB/WB °F (°C)	Outdoor Temperature												
		Cooling Capacity BTUH	75°F (24°C)	80°F (27°C)	85°F (30°C)	90°F (32°C)	95°F (35°C)	100°F (38°C)	105°F (41°C)	110°F (43°C)	115°F (46°C)	120°F (49°C)	125°F (52°C)	130°F (54°C)
MGA3090A	72/61 (22/16)	Total	92,382	89,178	86,063	82,859	79,655	76,451	73,247	70,132	68,530	66,928	65,326	63,724
		Sensible	68,795	67,490	66,228	64,938	63,655	62,379	61,110	59,883	59,255	58,629	58,004	57,381
	76/63 (24/17)	Total	96,031	92,738	89,356	86,063	82,770	79,477	76,184	72,802	71,200	69,598	67,996	66,394
		Sensible	74,809	73,513	72,189	70,907	69,633	68,366	67,107	65,821	65,214	64,609	64,006	63,404
	80/67 (27/19)	Total	103,240	99,680	96,120	92,560	89,000	83,927	81,880	78,320	76,540	74,938	73,336	71,734
		Sensible	74,266	72,960	71,663	70,374	69,092	67,278	66,551	65,292	64,665	64,103	63,542	62,982
	84/71 (29/22)	Total	110,449	106,622	102,884	99,057	95,230	91,403	87,576	83,838	81,880	80,278	78,676	77,074
		Sensible	73,358	72,057	70,794	69,509	68,233	66,964	65,702	64,478	63,840	63,319	62,799	62,281
MGA3120A	72/61 (22/16)	Total	122,484	118,236	114,106	109,858	105,610	101,362	97,114	92,984	90,860	88,736	86,612	84,488
		Sensible	90,613	88,836	87,121	85,368	83,627	81,897	80,179	78,519	77,669	76,823	75,979	75,138
	76/63 (24/17)	Total	127,322	122,956	118,472	114,106	109,740	105,374	101,008	96,524	94,400	92,276	90,152	88,028
		Sensible	98,429	96,663	94,862	93,121	91,391	89,673	87,966	86,225	85,404	84,586	83,771	82,959
	80/67 (27/19)	Total	136,880	132,160	127,440	122,720	118,000	113,280	108,560	103,840	101,480	99,356	97,232	95,108
		Sensible	97,820	96,040	94,274	92,519	90,778	89,048	87,330	85,625	84,776	84,015	83,257	82,500
	84/71 (29/22)	Total	146,438	141,364	136,408	131,334	126,260	121,186	116,112	111,156	108,560	106,436	104,312	102,188
		Sensible	96,728	94,953	93,233	91,483	89,747	88,023	86,312	84,652	83,787	83,082	82,379	81,678
MGA3150A	72/61 (22/16)	Total	151,618	146,359	141,247	135,988	130,730	125,472	120,213	115,101	112,472	109,842	107,213	104,584
		Sensible	107,262	105,020	102,857	100,648	98,455	96,279	94,118	92,033	90,966	89,904	88,845	87,790
	76/63 (24/17)	Total	157,606	152,202	146,651	141,247	135,842	130,438	125,033	119,483	116,854	114,224	111,595	108,966
		Sensible	115,990	113,761	111,489	109,294	107,115	104,952	102,806	100,617	99,587	98,560	97,536	96,517
	80/67 (27/19)	Total	169,438	163,595	157,752	151,910	146,067	140,224	134,382	128,539	125,618	122,988	120,359	117,730
		Sensible	115,320	113,072	110,842	108,629	106,434	104,255	102,093	99,949	98,882	97,926	96,973	96,024
	84/71 (29/22)	Total	181,269	174,988	168,853	162,573	156,292	150,011	143,730	137,595	134,382	131,752	129,123	126,494
		Sensible	114,052	111,808	109,634	107,426	105,237	103,064	100,909	98,821	97,734	96,848	95,964	95,084
MGA3180A	72/61 (22/16)	Total	188,916	182,364	175,994	169,442	162,890	156,338	149,786	143,416	140,140	136,864	133,588	130,312
		Sensible	137,105	134,350	131,690	128,973	126,274	123,594	120,932	118,362	117,046	115,735	114,429	113,127
	76/63 (24/17)	Total	196,378	189,644	182,728	175,994	169,260	162,526	155,792	148,876	145,600	142,324	139,048	135,772
		Sensible	148,659	145,921	143,128	140,428	137,747	135,085	132,440	129,744	128,473	127,206	125,944	124,686
	80/67 (27/19)	Total	211,120	203,840	196,560	189,280	182,000	174,720	167,440	160,160	156,520	153,244	149,968	146,692
		Sensible	147,750	144,990	142,250	139,530	136,830	134,149	131,488	128,845	127,531	126,352	125,178	124,006
	84/71 (29/22)	Total	225,862	218,036	210,392	202,566	194,740	186,914	179,088	171,444	167,440	164,164	160,888	157,612
		Sensible	146,097	143,344	140,675	137,962	135,270	132,597	129,945	127,374	126,034	124,942	123,853	122,767

Table 4. Dual Compressor Cooling Performance (BTUH) at Various Outdoor Temperatures

Basic Model	Fan Watts	Fan CFM	EER @ 55 F OAT	Outside Air Temperature ºF (ºC)				
				50 (10)	55 (13)	60 (16)	65 (18)	70 (21)
MGA3090A	730	3,500	125	110,128	91,140	72,153	53,165	34,178
MGA3120A	970	4,000	107	125,860	104,160	82,460	60,760	39,060
MGA3150A	1,300	4,500	90	141,593	117,180	92,768	68,355	43,943
MGA3180A	1,850	6,000	84	188,790	156,240	123,690	91,140	58,590
Based upon indoor setpoint temperature of 79 (26).								

Table 5. Economizer Cooling Performance

Basic Model	Special Option	TEMPERATURE RANGES
Non-Economizer	Base Unit	0ºF - 131ºF (-18ºC - 55ºC)
Economizer-Equipped	Base Unit	-40ºF - 131ºF (-40ºC - 55ºC)

Table 6. Ambient Temperature Operating Ranges

Model	Unit Weight		Shipping Weight		Shipping Dimensions					
					Height		Width		Depth	
	LBS	KG	LBS	KG	Inches	MM	Inches	MM	Inches	MM
MGA3090A	1,085	492	1,160	527	98	2,489	56	1,422	48	1,219
MGA3090A Center Supply/Top Return	1,085	492	1,160	527	98	2,489	56	1,422	48	1,219
MGA3090A Center Supply/Top Return w/Economizer	1,131	513	1,210	550	98	2,489	56	1,422	48	1,219
MGA3120A	1,195	542	1,277	579	98	2,489	56	1,422	48	1,219
MGA3120A Center Supply/Top Return	1,195	542	1,277	579	98	2,489	56	1,422	48	1,219
MGA3120A w/Economizer	1,245	565	1,331	604	98	2,489	56	1,422	48	1,219
MGA3120A Center Supply/Top Return w/Economizer	1,245	565	1,331	604	98	2,489	56	1,422	48	1,219
MGA3150A	1,212	550	1,294	587	98	2,489	56	1,422	48	1,219
MGA3150A Center Supply/Top Return	1,212	550	1,294	587	98	2,489	56	1,422	48	1,219
MGA3150A w/Economizer	1,262	572	1,348	611	98	2,489	56	1,422	48	1,219
MGA3150A Center Supply/Top Return w/Economizer	1,262	572	1,348	611	98	2,489	56	1,422	48	1,219
MGA3180A	2,463	1,117	2,523	1,148	98	2,489	56	1,422	48	1,219
MGA3180A Center Supply/Top Return	2,247	1,019	2,307	1,049	98	2,489	56	1,422	48	1,219
MGA3180A w/Economizer	2,603	1,181	2,663	1,208	98	2,489	56	1,422	48	1,219
MGA3180A Center Supply/Top Return w/Economizer	2,285	1,036	2,345	1,063	98	2,489	56	1,422	48	1,219

Table 7. Shipping Weights & Dimensions

Model	Description	Inches	Millimeters	Part Number	Filters Per Unit	MERV Rating
MGA3090A	Exterior Access Return Air Filter	25" x 16" x 2"	635 x 406 x 51	80137	3	8
	Interior Access Return Air Filter	15" x 20" x 2"	381 x 508 x 51	92365	3	8
MGA3090A Center Supply/Top Return	Exterior Access Return Air Filter	25” x 16” x 2”	635 x 406 x 51	80137	3	8
	Interior Access Return Air Filter	15” x 20” x 2”	381 x 508 x 51	92365	3	8
MGA3090A Center Supply/Top Return w/Economizer	Exterior Access Return Air Filter	25” x 16” x 2”	635 x 406 x 51	80137	3	8
	Interior Access Return Air Filter	15” x 20” x 2”	381 x 508 x 51	92365	3	8
	Economizer Pre-filter	9.25” x 37” x .375”	235 x 940 x 10	92127	1	N/A
MGA3120A & MGA3150A	Exterior Access Return Air Filter	25” x 16” x 2”	635 x 406 x 51	80137	3	8
	Interior Access Return Air Filter	15” x 20” x 2”	381 x 508 x 51	92365	3	8
	For Optional Fresh Air Hood, #K/04657	11” x 22” x 1”	279 x 559 x 25	80119	2	N/A
MGA3120A & MGA3150A Center Supply/Top Return	Exterior Access Return Air Filter	25” x 16” x 2”	635 x 406 x 51	80137	3	8
	Interior Access Return Air Filter	15” x 20” x 2”	381 x 508 x 51	92365	3	8
MGA3120A & MGA3150A w/Economizer	Exterior Access Return Air Filter	25” x 16” x 2”	635 x 406 x 51	80137	3	8
	Interior Access Return Air Filter	15” x 20” x 2”	381 x 508 x 51	92365	3	8
	Fresh Air Hood Pre-filters	26” x 12” x 1”	660 x 305 x 25	92526	2	N/A
MGA3120A & MGA3150A Center Supply/Top Return w/Economizer	Exterior Access Return Air Filter	25” x 16” x 2”	635 x 406 x 51	80137	3	8
	Interior Access Return Air Filter	15” x 20” x 2”	381 x 508 x 51	92365	3	8
	Economizer Pre-filter	9.25” x 37” x .375”	235 x 940 x 10	92127	1	N/A
MGA3180A	[1]Exterior Access Return Air Filter	25 x 16 x 2	635 x 406 x 51	80137	4	8
	Interior Access Return Air Filter	24 x 18 x 2	610 x 457 x 51	81257	3	8
MGA318A Center Supply/Top Return	Interior Access Return Air Filter	24 x 18 x 2	610 x 457 x 51	81257	4	8
	Mist Eliminator Filter	15 5/8 x 25 5/8 x 1	397 x 625 x 25	92971	1	N/A
MGA3180A w/Economizer	[1]Exterior Access Return Air Filter	25 x 16 x 2	635 x 406 x 51	80137	4	8
	Interior Access Return Air Filter	24 x 18 x 2	610 x 457 x 51	81257	3	8
	Fresh Air Hood Pre-Filter	26 x 12 x 1	660 x 305 x 25	92526	2	N/A
MGA3180A Center Supply/Top Return w/Economizer	Interior Access Return Air Filter	20 x 30 x 2	508 x 762 x 51	92545	3	N/A
	Mist Eliminator Filter	15 5/8 x 24 5/8 x 1	397 x 625 x 25	92971	4	N/A
	Fresh Air Hood Pre-filters	14 x 32 x 1	356 x 813 x 25	93187	2	N/A

[1]Standard Configuration [2]Optional (can not be combined)

Table 8. Return Air Filter Sizes

MGA3090A				MGA3120A “A”			MGA3120A “B”				MGA3150A			MGA3180A		
A	C	D	Z	C	D	Z	A	C	D	Z	C	D	Z	C	D	Z
146				168			128				144			240		

Table 9. Refrigerant Charge Per Circuit (R410A, Ounces)

1.5 General Operation

Optional Hot Gas By-Pass

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.

MGA3090A/3120A/3150A/3180A (Dual Compressor) Units: These units are 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 Programmable Logic Controller)

MGA3090A-3180A models include a factory installed PLC to control the operation of the HVAC system The built-in PLC display screen shows operational status and provide assistance with diagnosis if troubleshooting is ever required. Various control functions are field selectable and programmable. The PLC is also capable of communicating to other PLCs to allow run time leveling and does not require additional equipment to be installed. The PLC provides improved reliability because of the reduction of components. The components utilized are more durable and the control box wiring has been simplified. Pertinent statistical data about the life of the refrigeration system can be accessed through the PLC.

Figure 1.
Programmable Logic Controller

The PLC is factory installed and tested, requires no adjustments or changes when the air conditioning system is installed.

Location

Remove the HVAC unit front access panel and open the panel door to the control cabinet. The PLC is located on the left side the low voltage section of the control box.

PLC Inputs & Outputs

Relay outputs can be located on the top of the PLC. The PLC has 1(Qty) Form C relay that is used as

a common alarm output. All other outputs are used for Air conditioning operation. Along the bottom of the PLC, there are 7 banks of terminals, which represents 4 analog outputs, 8 digital inputs and 8 Analog inputs. The PLC also comes with communication interface for MODBUS RS485, BACnet MSTP, BACnet IP and MODBUS IP. A built in power supply is also integrated into the PLC for powering peripheral sensors.

See Appendix A for more PLC related information

1.7 Optional Controls & Packages

Protective Coating Packages

Two corrosion protection packages are offered- one for the condenser section (the Coastal Environmental package) and the other for the entire unit (the Coat-All Package).

The condenser protection package includes:

- Corrosion resistant fasteners
- Sealed or partially sealed condenser fan motor
- Two layer epoxy/urethane applied to all exposed internal copper and metal in the condenser section
- A protective coating on the condenser coil

The Coat-all package includes all of the above but also includes a protective coating on the evaporator coil and the two layer epoxy/urethane on all exterior and interior components and sheet metal. (Note: the internal sheet metal which is insulated 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 the state of the relay contacts changes. Dry contacts are available to the end user for monitoring.. The set point is adjustable.

Protective Coil Coatings

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 condenser coil should be coated. Note: Cooling capacity may be reduced by up to 5% on units with coated coils.

Cabinet Color and Material

Marvair air conditioners are available in six different cabinet colors. The standard colors are Marvair® beige, white, gray and Carlsbad Canyon (brown). The standard cabinet's sides, top and front panels are constructed of 20 gauge painted steel. Contact your Marvair representative for color chips. Custom colors are also available; contact Marvair for details.

Two stainless steel cabinet constructions are available:

Stainless Steel Exterior (Option "5"): This option replaces all standard exterior painted surfaces with stainless steel. This option also replaces the standard unpainted compressor base of the unit and exterior cabinet screws with stainless steel. No other standard construction surfaces are stainless steel in this option, unless listed in this description. Back panel is not stainless steel with this option. This option is designed to give a more economical alternative to full stainless steel, and still offer an enhanced level of protection. For further corrosion protection, please see our "A" offering at full stainless on all metal components.

Stainless Steel Unit (Option "A"): This option replaces all interior and exterior steel sheet metal parts with stainless steel. All galvanized and painted steel surfaces found in the standard unit are stainless steel with this option. All cabinet screws are stainless steel. No other standard construction surfaces are stainless steel, unless listed in this description. This option is designed to give our most robust protection against steel corrosion.

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”.

Center Supply/Top Return Configuration
Location of Supply and Return Air Openings are reversed.

1.8 Electrical Operation

The compressor and the electric heater are controlled by contactors which change state based on a 24 VAC signal from the PLC dictated by load demand in the space being maintained.

All motors are Electronically Commutated Motors (ECM) and are powered continuously. The motors are controlled by a control signal from the PLC based on Air conditioning operational request.

All units come equipped with a crankcase heater on each compressor. The crankcase heaters are powered continuously when circuit breakers are ON. Power must be applied to the unit for 24 hours to energize the crankcase heater before running the compressor for the first time.

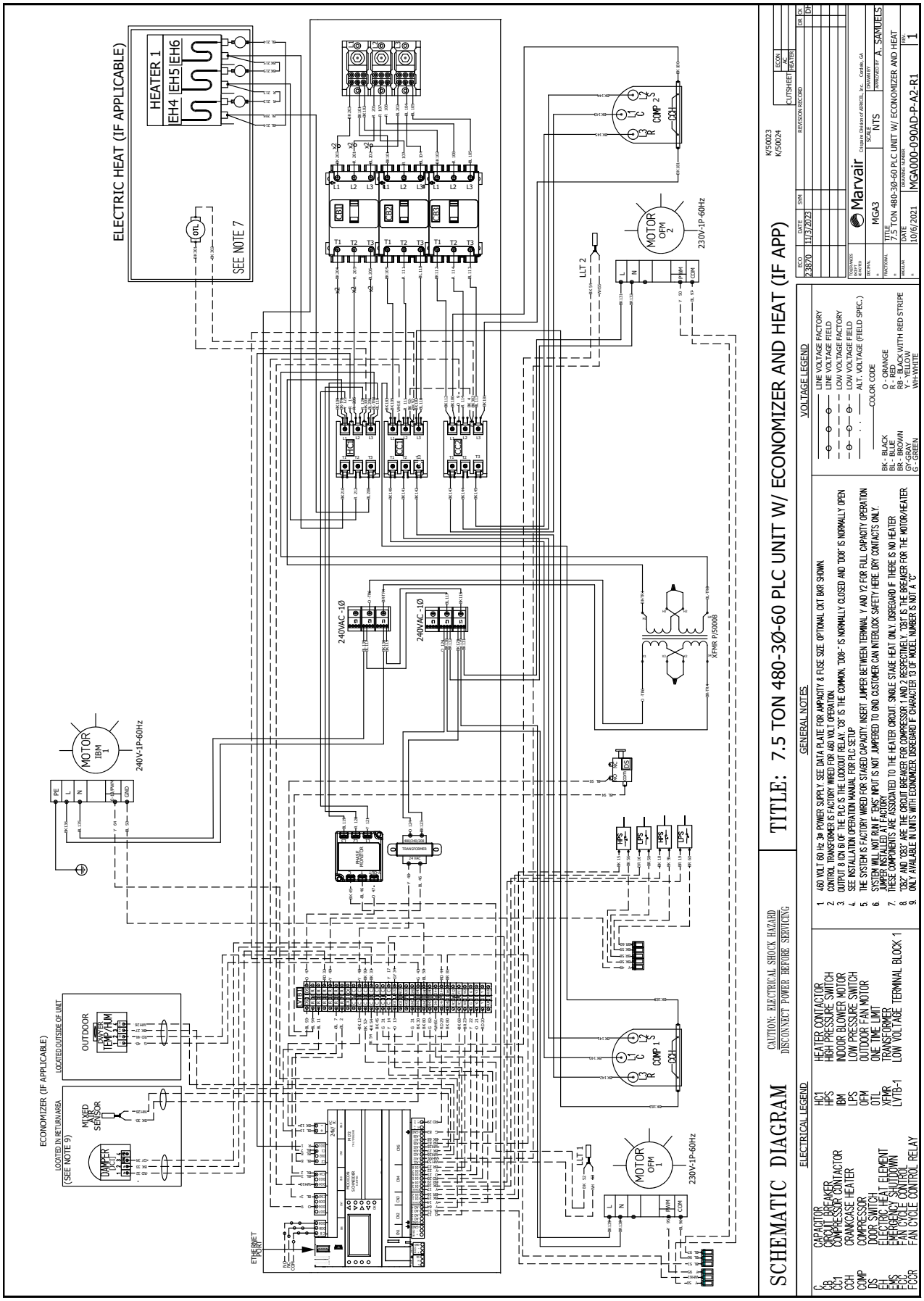


Figure 2a. Typical Electrical Schematic - MGA3090A

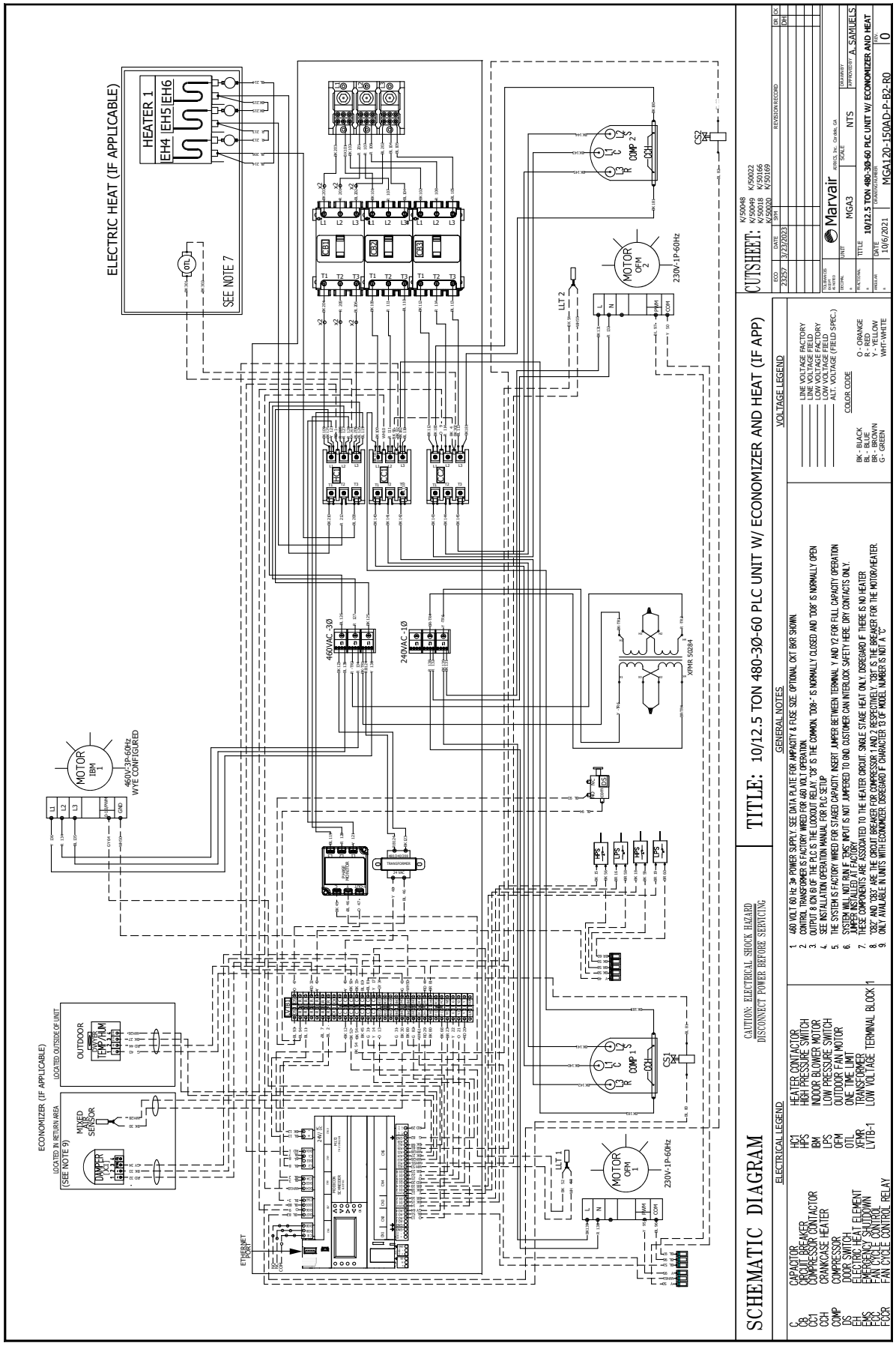


Figure 2b. Typical Electrical Schematic - MGA3120A & MGA31050A

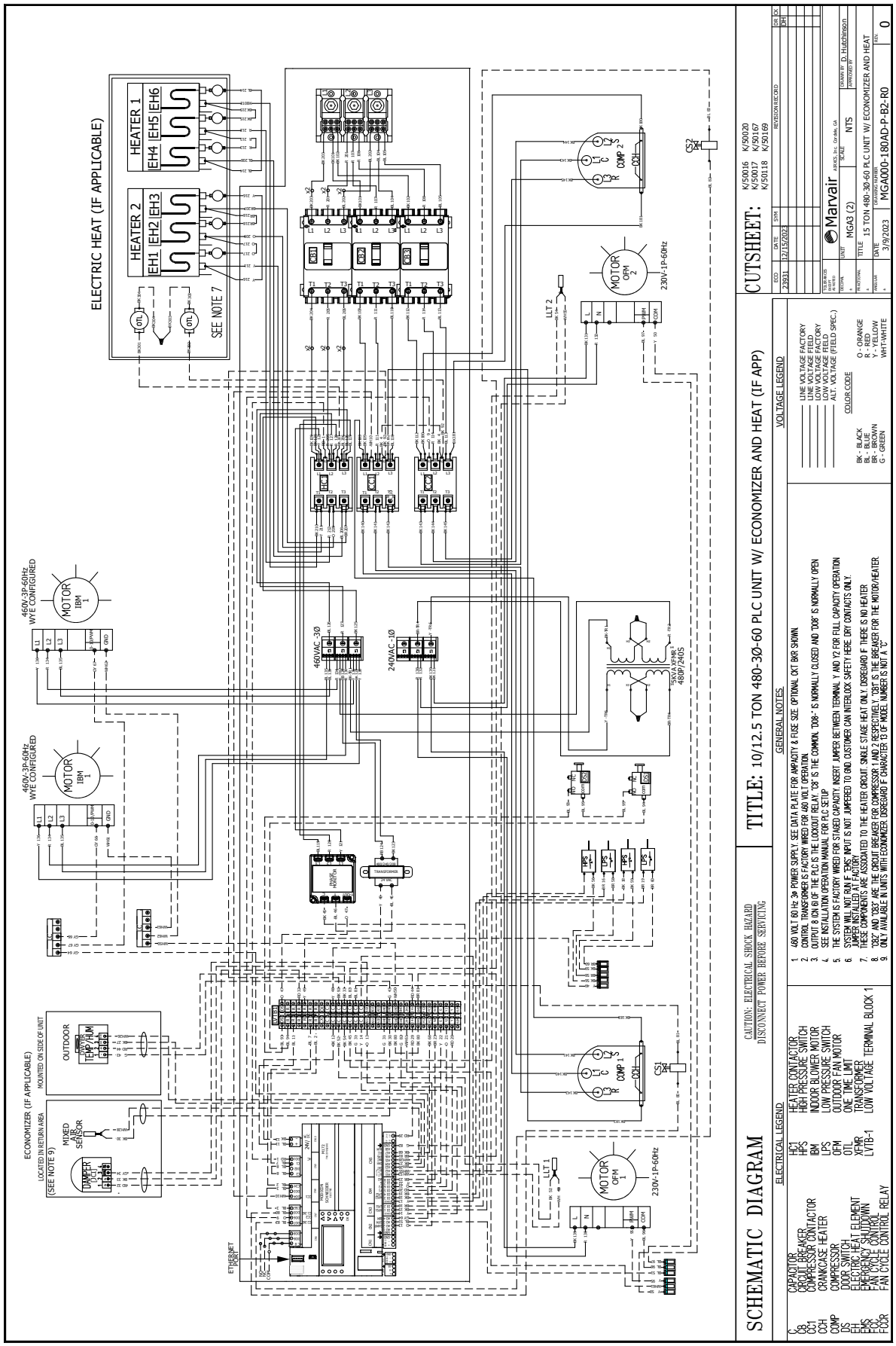


Figure 2c. Typical Electrical Schematic - MGA3180A

Chapter 2 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 unit.

2.1 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.

2.2 Installation Requirements

⚠ WARNING

Do not remove P-Trap Loop from condensate drain hose. P-Trap Loop must be primed at initial startup before unit is run.

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.
4. **Airflow Requirements:**

Maximum Static Pressures	MGA3090A	MGA3120A	MGA3150A	MGA3180A
IWG	0.7	0.8	0.8	1.0
Pa	174	200	200	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. Marvair 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.

MODEL	MIN. CLEARANCE AROUND SIDES (SINGLE UNIT)	MIN. CLEARANCE BETWEEN UNITS (TWO UNITS)	MIN. SPACE ABOVE UNIT	MIN. SPACE BEHIND UNIT
MGA3090A	24 inches (61 cm)	24 inches (61 cm)	24 inches (61 cm)	120 inches (305 cm)
MGA3120A				
MGA3150A				
MGA3180A				

Table 10. 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 specified values listed below. Refer to the data sticker on the unit for ampacity requirements.

Electrical Rating Designations*	A	C	D	E	F	Z
Nominal Voltage	208/230	208/230	460	380	220	575
Phase	1	3	3	3	1	3
Minimum Voltage	197	197	414	342	198	518
Maximum Voltage	253	253	506	418	242	632

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

Table 11. Voltage Limitations

2.3 Installation Materials

The air conditioners may be shipped with an optional top bracket and 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

The Lifting brackets are shipped attached to the back panel of the unit. These brackets provide a method for lifting it. The installation of the brackets is described in Section 3.6.

Accessories:

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

P/N	Description
S/07846	CommStat 4 HVAC Controller, Solid State Lead/Lag Controller
K/400119-100	MPC-10 PLC 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.

Supply Grille

P/N	Description
93189	MGA3090A, MGA3120A & MGA3150A: 42½" x 15¼" (1,080 mm x 387 mm)
93190	MGA3180A: 54½" x 15½" (1,384 mm x 394 mm)

Return Grille

P/N	Description
93188	MGA3090A, MGA3120A & MGA3150A: 42½" x 21½" (1,080 mm x 546 mm)
93191	MGA3180A: 54½" x 21½" (1,384 mm x 546 mm)

Lifting Eye Kit

P/N	Description
K/40025	MGA3090A/3120A/3150A
K/40026	MGA3180A

Additional Items Needed:

Additional hardware and miscellaneous supplies (not furnished by Marvair®) 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. Marvair 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.

2.4 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 Marvair® 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: Marvair 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. Marvair 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.

2.5 Top Flange Installation *(See Figure 3)*

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.

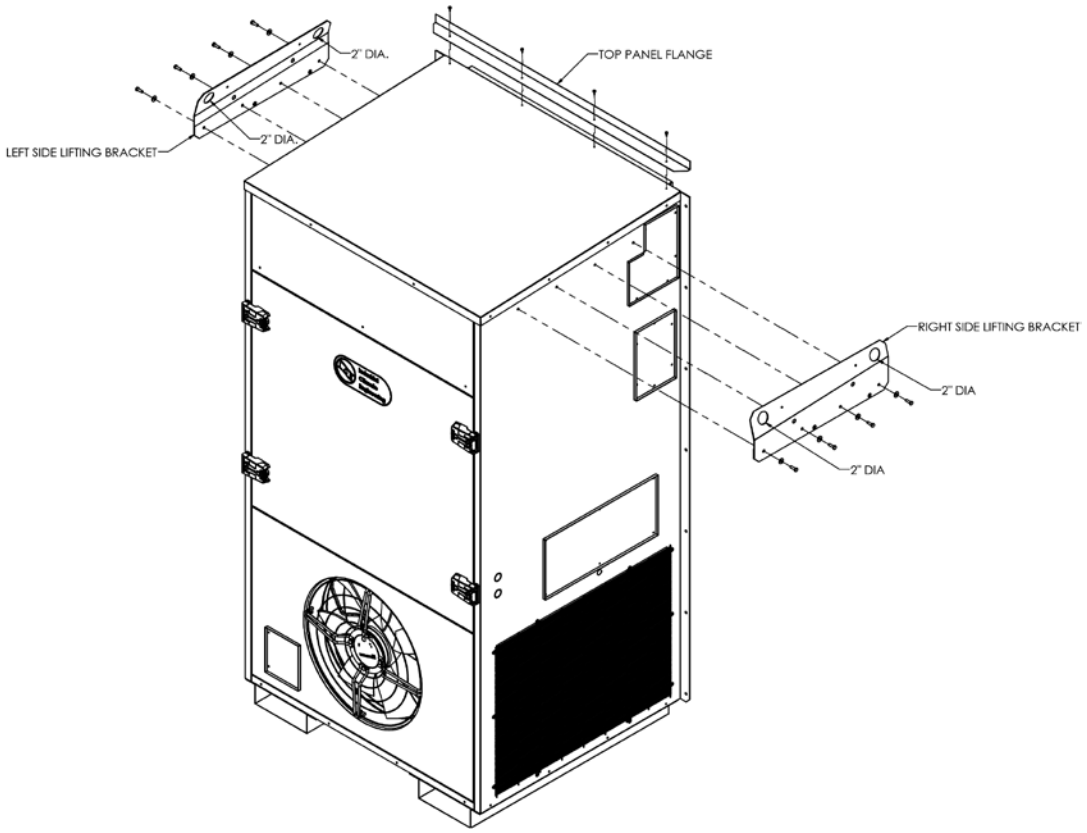


Figure 3 Top Flange and Lifting Bracket Installation (Typical)

2.6 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. The MGA 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.

2.7 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.

2.8 Compressor Chocks Removal

⚠ WARNING

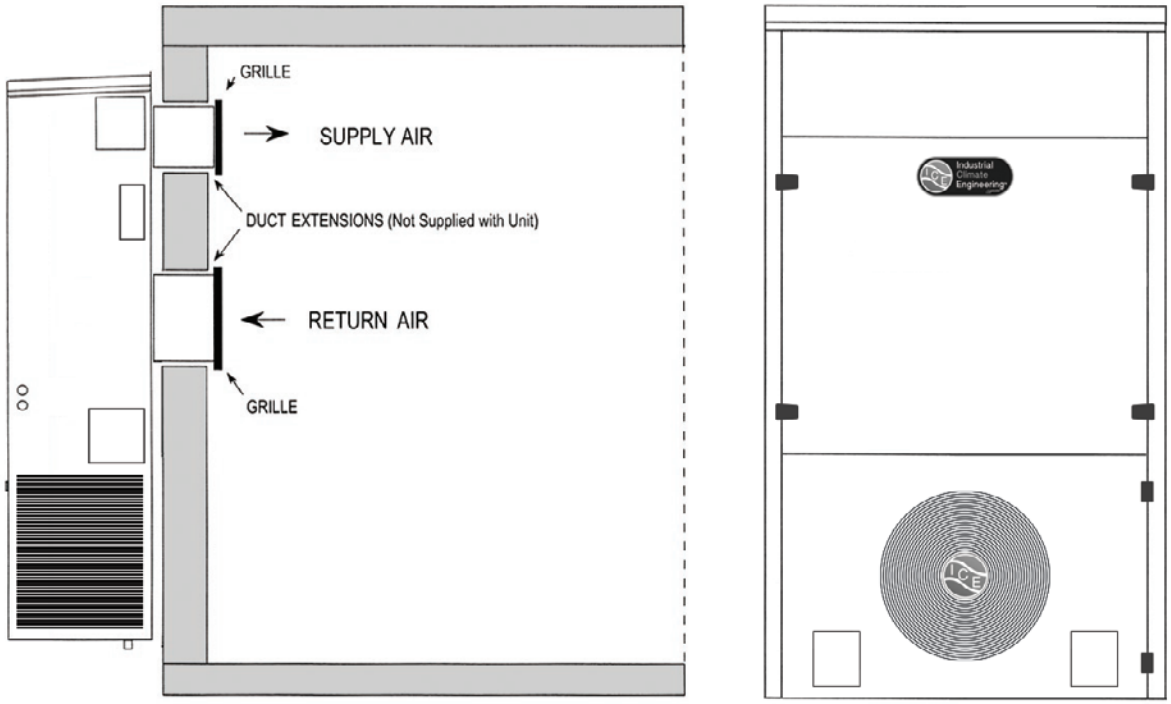
Wooden compressor chocks must be removed and discarded when unit is at final shipping destination. If chocks are not removed damage to compressor or copper system may occur.

Final installer must remove wooden chocks from beneath compressors.

Remove screw from in front of wooden chock, pull chock out from underneath compressor and discard both screw and wooden chock.

Note: There are two chocks to be removed one in the front of the compressor and one at the back of the compressor.

Figure 4 Compressor Chock Removal



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 5 Air Conditioner Wall Mount Detail

2.9 Unit Support Recommendations

Guidelines:

1. For units 15 tons and larger, the base of the unit should be fully supported in transit and in stationary applications to not allow deflection in static or dynamic loading.
2. For units ranging from 7.5 tons to 12.5 tons, the base of the unit should be fully supported in transit to not allow deflection in dynamic loading.
3. The supports should run perpendicular to the fork pockets on the base of the unit.
4. The fork pockets should remain in place for best support.
5. The supports should be 12” on center and include all outer edges.
6. The unit should be mechanically fastened to the support platform to not allow independent movement between the unit and its support.

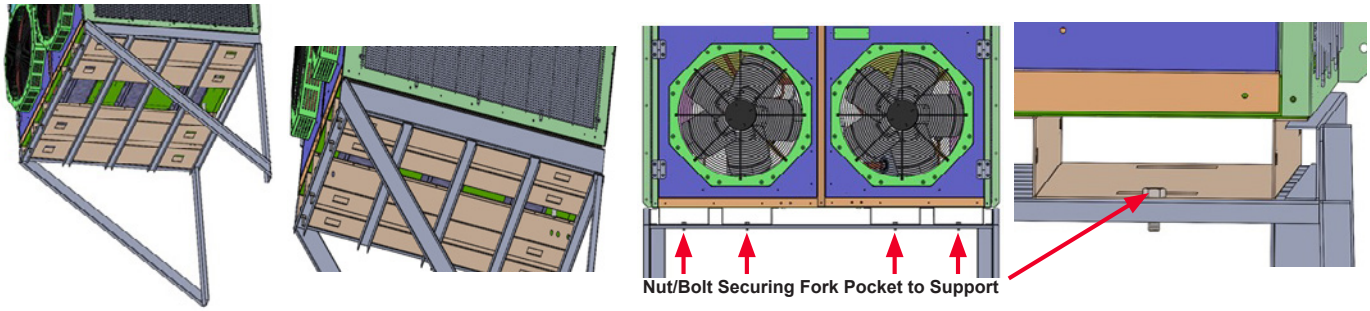


Figure 6a Unit Compression Support Examples

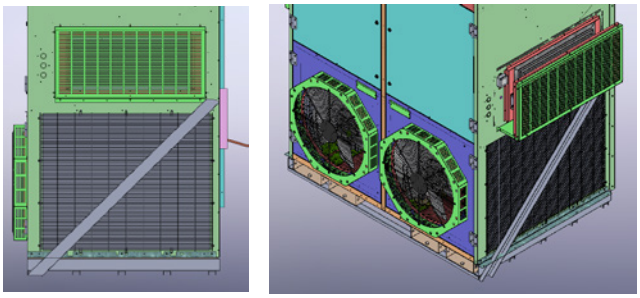


Figure 6b Unit Tension Support Examples

This is a recommendation as it relates to best practices for supporting the unit. Understand that how the unit should be supported varies based on several factors such as available space, supporting structure (concrete, metal), application (static or dynamic) etc. We recommend that the structural integrity of the design be evaluated by a structural expert before integration into the design. ***Any decision on use of materials or geometry is the sole responsibility of the customer. Please be advised that supporting the unit along the entire base is required for proper logistics movement. Supporting the unit along the entire base is also required for in place operation on units 25 tons and larger.***

2.10 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.

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 the 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 4 HVAC Controller

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

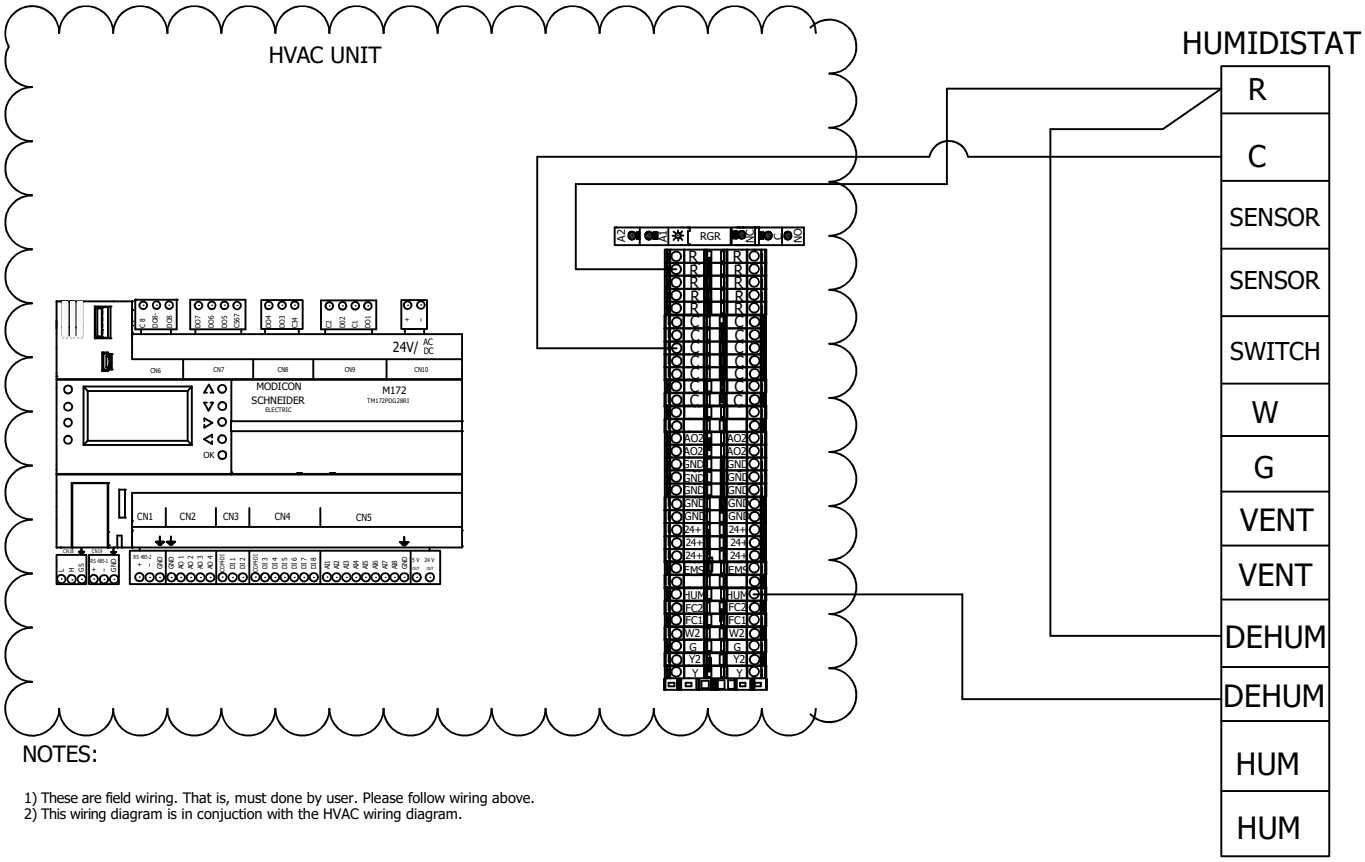
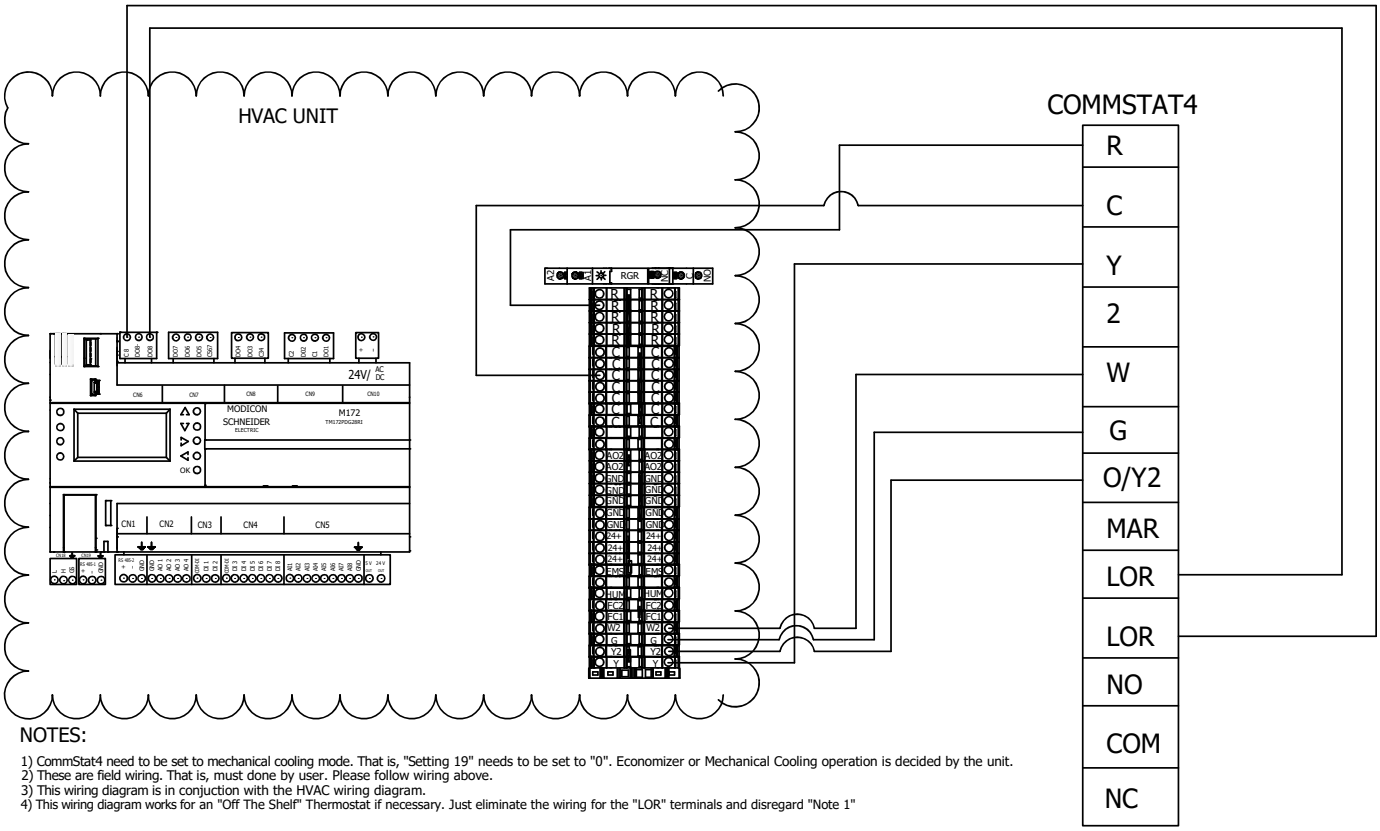


Figure 7a. Humidistat Wiring to a Marvair Air Conditioner with Reheat.



NOTES:

1) CommStat4 need to be set to mechanical cooling mode. That is, "Setting 19" needs to be set to "0". Economizer or Mechanical Cooling operation is decided by the unit.
2) These are field wiring. That is, must done by user. Please follow wiring above.
3) This wiring diagram is in conjuction with the HVAC wiring diagram.
4) This wiring diagram works for an "Off The Shelf" Thermostat if necessary. Just eliminate the wiring for the "LOR" terminals and disregard "Note 1"

Figure 7b. CommStat 4 Connection Diagram

Chapter 3 Start-Up

3.1 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.

3.2 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 4 Troubleshooting

4.1 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. Although unlikely, 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 <u>ONLY</u> BY QUALIFIED AND EXPERIENCED PERSONS.

4.2 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.

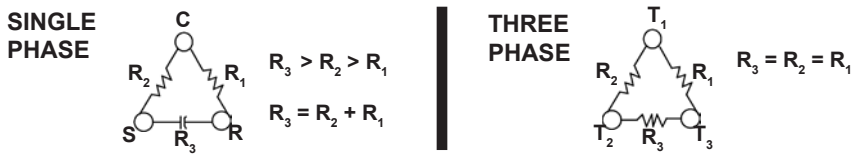
4.3 Compressor Troubleshooting

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.

Chapter 5 Maintenance

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.

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5.1 Scheduled Maintenance

Marvair 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 6 Warranty

6.1 Marvair, Inc. 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 7 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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7.1 Start-Up & Commissioning Form

Please complete the information on this form and return to Marvair 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: _____

Marvair 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 Marvair 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: $\frac{\text{Maximum Deviation from Average Voltage}}{\text{Average voltage}}$ X 100 (for Percent)

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:

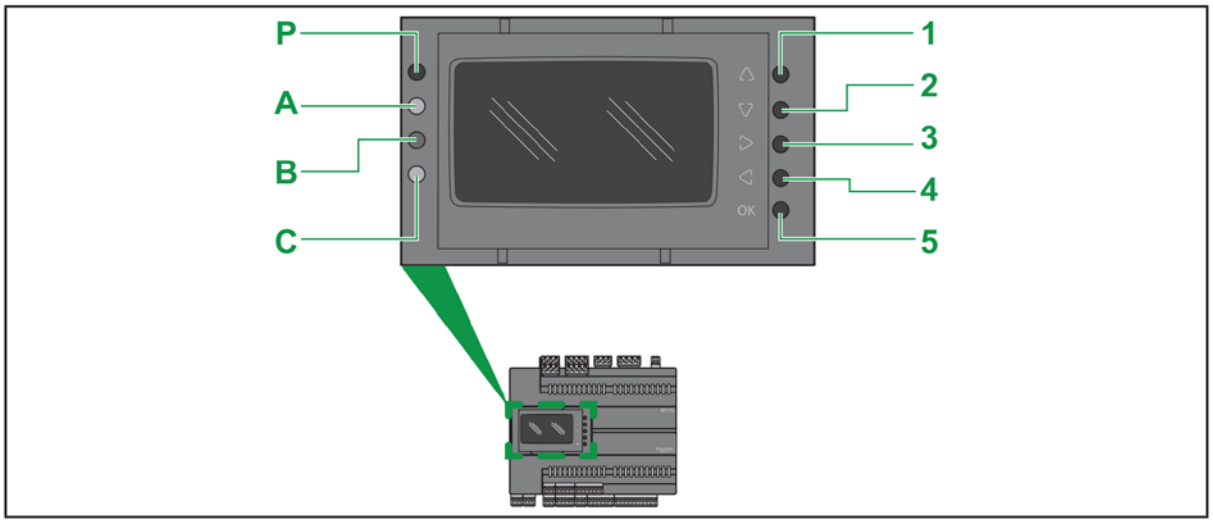
Appendix A: PLC SetUp and Operation

These instructions are intended to assist users in navigating through the different PLC screens as well as understanding the variables located on each screen.

Note:

1. Screen numbers are referenced from "Digital Inputs" which is the first screen seen when PLC's display is populated.
2. Normal mode represents the state in which there are no active faults and no user emergency functionality is triggered.

Navigation



The keys can be programmed from the controller application. In the following table are described the keys default setting (keys are configurable through the logic controller.

Each control can be adjusted by using the directional buttons. Note: In "Edit Mode", the cursor flashes under the value that is going to be modified by the user.

No.	Key	Press Once (press and release)
1	△ UP	• Scroll Up • Increase/Modify a Value
2	▽ DOWN	• Scroll Down • Decrease/Modify a Value
3	▷ RIGHT	• Move Cursor Right In Edit Mode • Back to Next Menu/Page
4	◁ LEFT	• Move Cursor Left In Edit Mode • Go Back to Previous Menu/Page • Press and Hold to Exit Edit Mode Without Saving
5	OK	• Enter/Exit Edit Mode • Confirm Operation

Digital Inputs

This screen correlates each PLC's digital input to the specific input that is being monitored. It also provides the status of each input. This drastically expedites troubleshooting which consequently decreases downtime of the unit. The "Digital Input" is the first screen that will populate on the PLC's display when the PLC has loaded.

Figure 1 shows the digital input screen when all pressure switches are properly functioning, and the emergency shutdown is closed.

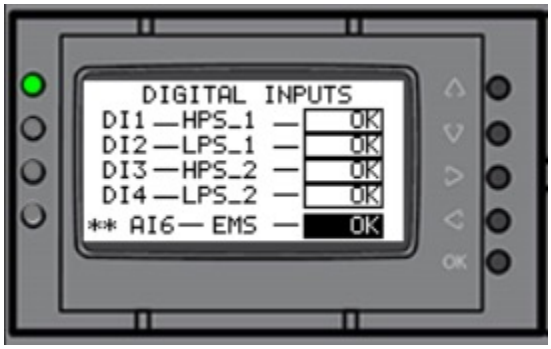


Figure 1

Table 1 shows the designations for each input and their status based on the input.

Digital Input	Designation	Normal Status	Fault Status
1	HPS_1 [HIGH PRESSURE - CIRCUIT 1]	OK [CLOSED]	FAULT [OPEN]
2	LPS_1 [LOW PRESSURE - CIRCUIT 1]	OK [CLOSED]	FAULT [OPEN]
3	HPS_2 [HIGH PRESSURE - CIRCUIT 2]	OK [CLOSED]	FAULT [OPEN]
4	LPS_1 [HIGH PRESSURE - CIRCUIT 2]	OK [CLOSED]	FAULT [OPEN]
AI6*	EMS [SHUTDOWN/USER INTERLOCK]	OK [CLOSED]	FAULT [OPEN]

Table 1

Note that pressure faults only affect the operation of the respective circuit.

Operational Request

This screen maps each thermostat input to a digital input on the PLC. The state of each input is monitored which gives the end user the ability to see what operation is being requested by the controller (Thermostat, Lead/Lag, etc).

Figure 2 shows the operation request screen when stage 1 cooling is being requested.

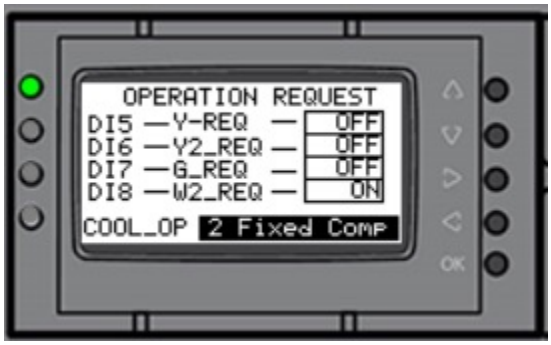


Figure 2

Table 2 shows the designations for each input and their status based on the input.

Digital Input	Designation	Active	Inactive
5	Y-REQ [STAGE 1 COOLING REQUEST]	ON	OFF
6	Y2-REQ [STAGE 1 COOLING REQUEST]	ON	OFF
7	G-REQ [FAN ONLY REQUEST]	ON	OFF
8	W2-REQ [HEATING REQUEST]	ON	OFF

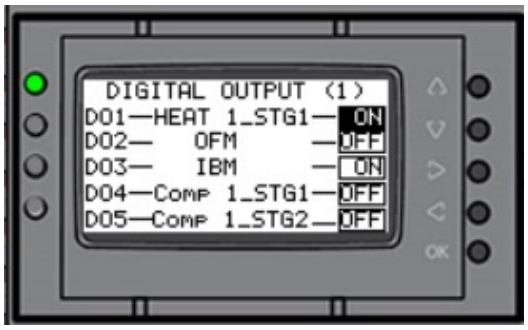
Table 2

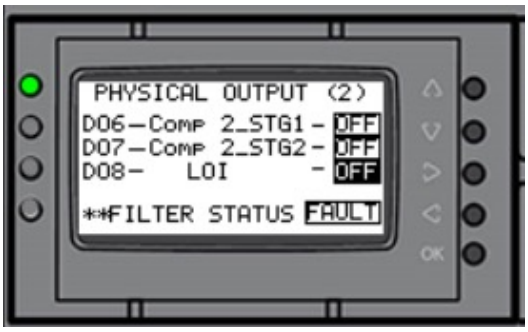
"**COOL_OP**" represents the setting on the PLC which allows the HVAC unit to operate with a different number of cooling stages.

1. **2 Fixed Compressor –** This allows the unit to operate with 2 independent cooling stages. Therefore, allows the stages to be turned on as needed which effective provides a more optimal management of the temperature of the space being cooled. (Default)
2. **5 Stages –** This allows the compressor to operate with 5 stages of cooling. Note that HVAC unit must be equipped with necessary compressors and associated controls for this work. A indicator is Character "15" of model number is "2" for units with this capability.

Digital Output

These screens show the status of each digital output as well as a description of the respective output.

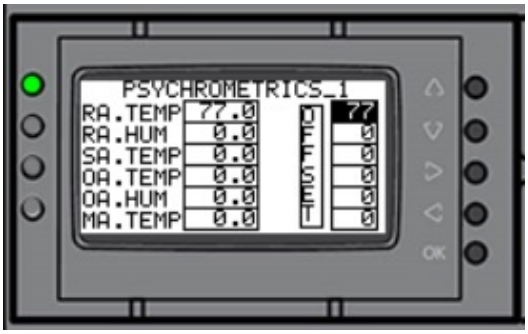




Note: In normal operation, the status of "DO8" is "OFF". If "DO8" is "ON" all outputs are turned off.

Psychrometrics 1|2

This screen monitors some air conditioning of the indoor and outdoor air as well as provide the user with the ability to calibrate these numbers with the adjacent respective offset.



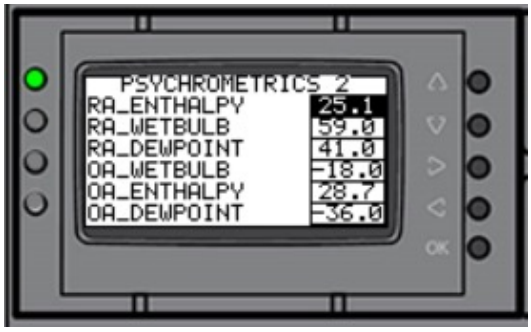


Table 3 shows the description of each variable displayed on screen above.

Variable	Description
RA[1] TEMP	Space Temperature measured
RA[1] HUM	Space Humidity measured
SA TEMP	Supply Air Temperature
OA[2] TEMP	Outdoor Temperature measured
OA[2] HUM	Outdoor Humidity measured
MA TEMP	Mixed Air Temperature measured
[1]RA = Room Air	[2]OA = Outside Air

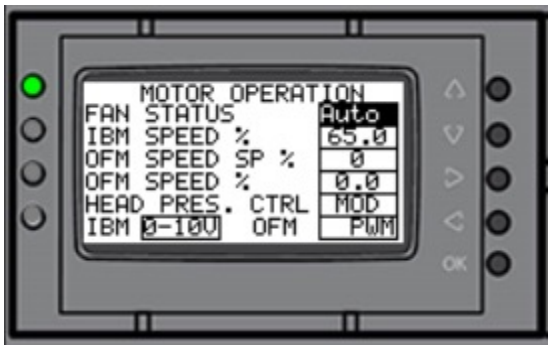
Table 3

Note:

1. "*SA TEMP*" and "*MA TEMP*" are the same in most designs unless specified otherwise.
2. "*OA TEMP*", "*OA HUM*" and *SA TEMP* are only monitored in units with Economizers.

Motor Operation

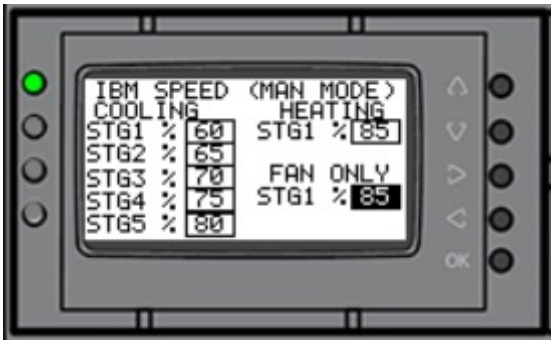
This screen allows the end user to configure the operation of the air movers in the HVAC unit.



1. **FAN STATUS –** This setting manages the indoor motor operation.
   b. *AUTO (Default)* – This setting allows the indoor blower to run based on a request for an air conditioning operation. Once the operation terminates, the blower goes off after the 90 second time off delay.
   c. *ON*– This setting forces the blower to run continuously irrespective of an air conditioning operation. The blower operation only terminates if and emergency shutdown input is triggered.
2. **IBM SPEED % –** The speed at which the PLC is commanding the indoor fan motor to operate.
3. **OFM SPEED % –** The speed at which the PLC is commanding the condenser fan to operate at.
4. **OFM SPEED SP –** This setting forces outdoor motor to operate at a speed designated by the user. Note that this is only applicable if the outdoor motor being used is an EC motor and "*HEAD PRES. CTRL*" is set to "*CYC*". (Default to 80%)
5. **HEAD PRES. CTRL –** This allows the end user to either modulate the outdoor fan or cycle the outdoor fan to manage the head pressure of the HVAC unit.
   a. *MOD (Default)* – Allows the condenser fan to modulate based on Head Pressure. As the head pressure rises, the condenser fan increases and vice versa. The system modulates to maintain a liquid line temperature of approximately 80 - 85ºF.
   b. *CYC* – Allows the condenser fan to cycle on at the speed set a "*OFM SPEED SP*". The fan operates in an ON/OFF manner to maintain a liquid line temperature of about 90 - 95ºF on average.
6. **Control Signals –** This allows the end user to set the control signal for motors. These are factory configured and should not be changed. If configured incorrectly, it will result in the motors not operating. IBM and OFM represents the options for the Indoor Blower Motor and Outdoor Fan Motor respectively.
   g. *0-10VDC (Default for IBM)* – Set to be PWM for units 6 Tons and smaller
   h. *WM* – (Default for OFM)

IBM SPEED

This allows the end user to set the operational speed of the Indoor Blower Motor for each air conditioning operation. If the unit is only 2 stages, "STG 2" represents first stage cooling speed and "STG 5" represents second stage cooling speed.



Default Values:

Cooling (%)

Stage 1: 50
Stage 2: 55 (1st Stage Speed – 2 Fixed Compressor Setting. See "*COOL_OP*")
Stage 3: 60
Stage 4: 60
Stage 5: 65 (2nd Stage Speed– 2 Fixed Compressor Setting. See "*COOL_OP*")

Heating (%)

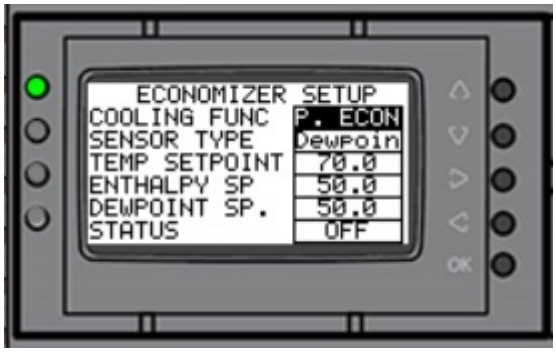
Stage 1: 60

Fan Only (%)

Stage 1: 60

<u>ECONOMIZER SETUP</u>

This allows the end user to configure the economizer operation. See *Sequence of Operation* for in depth explanation of the function

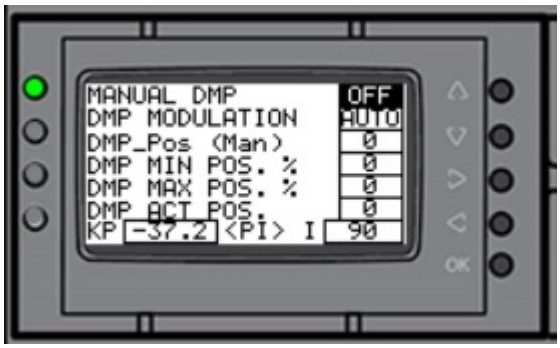


1. **COOLING FUNC –** Allows the selection of the various cooling approach.
   b. *MECH* – Mechanical Cooling (DX) Only. Cools space by activating the compressors without allowing infiltration of outside air.
   c. *ECON* – Basic Economizer. Attempts to Cools space initially by allowing infiltration of outside air without operating the compressor first. Activates compressor and a stop the infiltration of outside air if outside air cannot manage the heat load.
   d. *P. ECON* (Default) – Partial Economizer. Attempts to Cools space initially by allowing infiltration of outside air without operating the compressor first. Activates compressor as well as continue to allow infiltration of outside air to manage the heat load.
2. **SENSOR TYPE** – Allows the selection of the parameters necessary for economizer operation.
   c. Dry-bulb
   d. Enthalpy
   e. Dewpoint (Default)

3. **TEMP SETPOINT –** Temperature Differential required between the space and the outside air at which economizing is allowed. (Default = 70.0ºF)
4. **ENTHALPY SETPOINT –** Enthalpy Differential required between the space and the outside air at which economizing is allowed. (Default = 50%)
5. **DEWPOINT SP. –** Dewpoint Setpoint is maximum dewpoint required between the space and the outside air at which economizing is allowed. (Default = 55ºF)
6. **STATUS** – This tells if the HVAC unit is economizing or not.
   a. *ON* – Economizing
   b. *OFF* – Not economizing

DAMPER SETUP

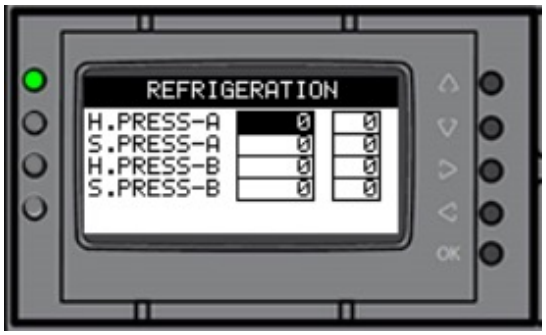
Allows the end user to configure and monitor damper operation



1. **MANUAL DMP –** Allows user to control the position of the damper manually
   b. *OFF* (Default) – Dampers are controlled automatically
   c. *ON* – Damper goes to the position configured in "*DMP_Pos (Man)*".
2. **DMP MODULATION –** Allows the selection of modulation during economizing or go to a fix position configured in "*DMP_Pos (Man)*".
   c. *AUTO* (Default) – Modulates to maintain a 55ºF supply air temperature
   d. *MAN* – Damper position dictated by "*DMP_Pos (Man)*".
3. ***DMP_Pos (Man)* –** Allows the end user to define a position for the Damper. Note that immediate operation is dependent on previous settings. (Default = 0)
4. ***DMP MIN POS %*** – Minimum allowed damper position (Default = 20%)
5. ***DMP MAX POS %* –** Maximum allowed damper position (Default = 55%)
6. ***DMP ACT POS.* –** Requested damper position.
7. Control Signal Response tuning values. Tuned at factory. DO NOT CHANGE
   a. *Propotional Value (KP)* = -37.2 (Default)
   b. *Integral Value (I)* = 90 (Default)

REFRIGERATION

Allows the user to the monitor the liquid line temperature of each refrigeration circuit as well as offset the measured values.



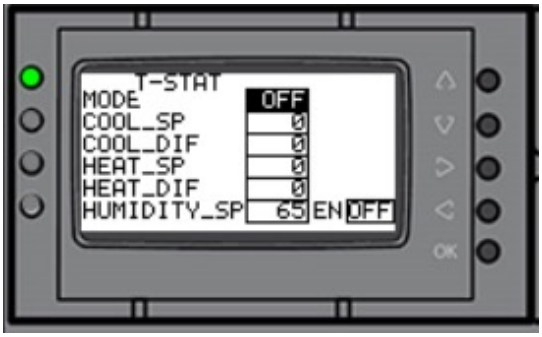
1. **H. PRESS –** A|B represents the liquid line temperature of circuit 1 and 2 respectively.

2. **S. PRESS –** A|B represents the suction pressure of circuit 1 and 2 respectively. (Not monitored)

Note: The system modulates to maintain a liquid line temperature of 100ºF.

THERMOSTAT (T-STAT)

This screen allows end users to setup the onboard thermostat. Note that this is only applicable if the associated sensors are purchased with the device. Note that Thermostat only works if a local sensor is purchased with the HVAC unit.



1. **MODE –** This allows the end user to select the allowable operation on the thermostat. See *Sequence of Operation* for explanation of the operation.
   b. *OFF* (Default) – Does not allow cooling, heating or dehumidification based on the sensor values measured. These operations can only be triggered by digital inputs. See digital inputs above for the respective inputs.
   c. *COOL* – This setting only allows cooling operation only.
   d. *HEAT* – This setting will only allow heating operation only.
   e. *AUTO* – This setting will allow both cooling and heating operation to occur.

2. **COOL_SP –** This variable represents the reference value used for triggering the cooling operation. (Default = 75ºF)

3. **COOL_DIF –** This variable represents the allowable differential between each stage of cooling. For example. If [*COOL_SP* = 80 and *COOL_DIF* = 2], First Stage is triggered at 80, and second stage would be triggered at 82. (Default = 4ºF)

4. **HEAT_SP –** This variable represents the reference value used for triggering the heating operation. (Default = 60ºF)

5. **HEAT_DIF –** This variable represents the allowable differential between each stage of Heating. For example. If [*HEAT_SP* = 50 and *HEAT_DIF* = 2], First Stage is triggered at 50, and second stage would be triggered at 48. (Default = 4ºF)

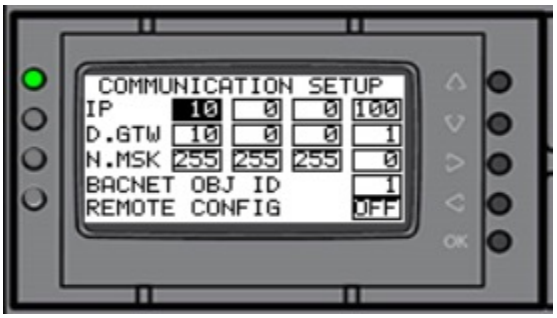
6. **Humidity**

   a. **HUMIDITY_SP –** This variable represents the reference value used to trigger the dehumidification operation. (Default = 50%)

   b. **EN –** This variable allows the end user to Enable or Disable the dehumidification operation. Note that this is unit dependent and supporting utility should be capable of supporting the full load capacity of the HVAC unit. See SPPE value on data label.
      i. *ON* (Default) = Enabled
      ii. *OFF* = Disable

COMMUNICATION SETUP

This screen allows end user to setup up some communication parameters. Note that the IP address set here is the IP address of the device and the address that would be used to access the local web server on the PLC. [DEFAULT VALUES SHOWN ON SCREEN ILLUSTRATION BELOW]



1. **REMOTE CONFIG**
   b. *OFF* – Allows the IP address to be configured locally
   c. *ON* – Allows the IP address configuration to be configured remotely

   Web Server Default Credentials
   Username: *administrator*
   Password: *marvair01*

   Use the IP address in any web server while connected to the PLC via Ethernet to access the local web server on the PLC. Note that the PLC and the device being used to access the webserver MUST be on the same subnet for the user to gain access.

PLC GENERAL PURPOSE INPUT/OUTPUT

Analogue Input		
Name	**Variable**	**Type**
AIL1	Liquid Line Temp – Circuit 1	NTC
AIL2	Liquid Line Temp – Circuit 2	NTC
AIL3	Outdoor Air Temperature	VOLTAGE [0-10VDC]
AIL4	Outdoor Air Humidity	VOLTAGE [0-10VDC]
AIL5	Mixed Air Temperature	NTC
AIL6	Emergency Shutdown Input	BOOL [N.C]
AIL7	Dirty Filter	BOOL [PLC GND]
AIL8	Dehumidification	BOOL [PLC GND]
Analogue Output		
Name	**Variable**	**Type**
AOL2	DAMPER MOTOR SIGNAL	0-10VDC
AOL3	OUTDOOR MOTOR SIGNAL	PWM/0-10VDC
AOL4	INDOOR MOTOR SIGNAL	PWM/0-10VDC
Digital Input		
Name	**Variable**	**Type**
DIL1	HIGH PRESSURE SWITCH 1 [HPS1_INPUT]	BOOL [24 VAC]
DIL2	LOW PRESSURE SWITCH 1 [LPS1_INPUT]	BOOL [24 VAC]
DIL3	HIGH PRESSURE SWITCH 2[HPS2_INPUT]	BOOL [24 VAC]
DIL4	LOW PRESSURE SWITCH 2 [LPS2_INPUT]	BOOL [24 VAC]
DIL5	COOL REQUEST 1 [Y_INPUT]	BOOL [24 VAC]
DIL6	COOL REQUEST 2 [Y2_INPUT]	BOOL [24 VAC]
DIL7	BLOWER REQUEST [G_INPUT]	BOOL [24 VAC]
DIL8	HEATER REQUEST [W2_INPUT]	BOOL [24 VAC]
Digital Output		
Name	**Variable**	**Type**
DOL1	HEATER CONTACTOR	BOOL [24 VAC]
DOL2	OUTDOOR MOTOR RELAY	BOOL [24 VAC]
DOL3	INDOOR MOTOR RELAY	BOOL [24 VAC]
DOL4	COMPRESSOR 1 CONTACTOR	BOOL [24 VAC]
DOL5	COMPRESSOR 1 STAGE 2	BOOL [24 VAC]
DOL6	COMPRESSOR 2 CONTACTOR	BOOL [24 VAC]
DOL7	COMPRESSOR 1 STAGE 2	BOOL [24 VAC]
DOL8	LOCK OUT RELAY	BOOL [24 VAC]

Appendix B: PLC Sequence of Operation

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

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

0.0 – Fan Operation
- 0.1 – On Mode
- 0.2 – Auto Mode

1.0 - Cooling Operation
- 1.1 – Mechanical Cooling Only
- 1.2 – Economizer Operation
  - Economizer Enable Modes
  - Standard Economizer
  - Partial Economizer

2.0 – Heating
- 2.1 – Electric Heat

3.0 –Refrigeration Protection
- 3.1 – High Pressure Lockout
- 3.2 – Low Pressure Lockout
- 3.3 – Anti-Short Cycle Function
- 3.4 – Emergency Shutdown

4.0 – Dehumidification
- 4.1 – Electric Heat Dehumidification

5.0 – User Enabled Protection
- 5.1 – Emergency Shutdown
- 5.2 – Emergency Ventilation

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

Note:

1. All inputs on the Controller goes through a 5 second Time-On Delay to prevent nuisance request. Outputs go through a 5-10 second staggered Time On delay to prevent nuisance tripping of breaker due to the inrush associated with inductive loads.
2. Normal Operating Mode describes a mode in which there are no active faults which would interrupt the operation of the system.

0.0 - Fan Operation

0.1 - On-Mode
Indoor Blower Motor Runs continuously.

0.2 - Auto Mode
Indoor Blower Motor runs when there is a request for Cooling, Heating or Dehumidification and continues to run for 90 Seconds after the request is satisfied. When using the built-in thermostat, the indoor fan comes on 10F below the setpoint and continues to run until 90 seconds after the respective condition is satisfied. This function is only applicable with the Marvair designed sensor. Off-the-shelf thermostat operates based on a request for blower (G signal).

1.0 - Cooling Operation

1.1 – Mechanical Cooling Only

This section will describe the sequence of operation which takes place during Direct Expansion (DX) cooling with the OA dampers at their minimum position.

In normal operating mode, a request for "Stage 1 Cooling (Y-input)" via communication (BACnet or MODBUS), Digital Input or Onboard Thermostat, energizes the Indoor Blower Motor and Compressor 1 relay outputs on the PLC continuously. The controller also provides analog outputs (PWM or 0-10VDC Signal) associated to the Indoor 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) closes at approximately 400 PSI to bring on the outdoor fan and reopens at approximately 290 PSI to turn the outdoor fan motor off. The described operations remain active until the Cooling Setpoint is satisfied (Stage 1 request drops out).

If the temperature continues to increase pass the defined setpoint [Cooling Setpoint + Cooling Differential], Stage 2 Cooling is energized. This energizes the Compressor 2 Output along with maintaining all previous outputs for Stage 1 Cooling. This output remains energized until the thermostat's Cooling Setpoint is satisfied. Once the setpoint is satisfied, the Compressor and the Outdoor fan outputs are de-energized. The indoor fan continues to operate of 90 sec

Note: This process describes the functionality with both an "off-the-shelf" thermostat and built-in thermostat.

1.2 – Economizer Operation

In Economizer mode, there are multiple process variables that are monitored and used to trigger Economizer operation. The process variables that are monitored are Outdoor Air Temperature (OAT), Outdoor Air Dewpoint (OAD) and Outdoor Air Enthalpy (OAE). The desired economizer option for control can be selected from the display on the PLC or via BACnet. The available options are described below.

1. **<u>DRY-BULB FUNCTIONALITY</u>: (Default): [TOAT < TEconomizer Setpoint]**ENTHALPY AND DEWPOINT ARE DESREGARDED
2. **<u>ENTHALPY FUNCTIONALITY:</u> [OAE< Enthalpy Calculate]**
   Uses [OAT + Humidity Setpoint] to calculate an enthalpy for operation.
3. **<u>OA Dewpoint Lockout (Enable/Disable):</u> [OADewpoint < OADewpoint Lockout User Defined] and [TOAT < TEconomizer Setpoint]**
   Uses [OAT + Humidity Setpoint] to calculate the dewpoint for operation.

When there is a request for "Stage 1 Cooling" and the outdoor conditions are satisfactory (based on selected mode of operation), the HVAC unit functions as follows.

Standard Economizer

1. **Using- On-Board Thermostat**
   If economizer enable setpoint is satisfied, the Economizer Damper modulates to maintain the Room Temperature. If Room Temperature increases "20F" above the Cooling Setpoint, the system energizes the first compressor. Once the compressor is energized, the OA dampers close to the minimum position. If the Room temperature continue to rise above the [Cooling Setpoint + Cooling Differential (User Defined)], the system then energizes the second compressor/ cooling stage if applicable. During this mode, supply air temperature will operate

between 55ºF and 60ºF. The cooling stages remain energized until the Cooling Setpoint is satisfied. Note that in this mode, the economizer and the compressor CANNOT operate simultaneously.

2. **Using Off-the-shelf Thermostat**

   If economizer enable setpoint is satisfied, the Economizer Damper modulates to maintain the Room Temperature. During this mode, supply air temperature will operate between 55ºF and 60ºF. If the economizer process is not sufficient to meet the cooling requirement, the thermostat energizes the second stage output which forces the HVAC unit into full capacity. Once the compressor(s) are energized, the OA dampers close to the minimum position. The cooling stages remain energized until the Cooling Setpoint is satisfied. Note that in this mode, the economizer and the compressor CANNOT operate simultaneously.

   Note: If the economizer enable setpoint is not satisfied, the economizer closes to its minimum position and mechanical cooling is used to cool the space.

2.0 – Heating

2.1 – Electric Heat

When there is a request for "Heating (W2)" via communication (BACNET or 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. Note that the heater and indoor motor are interlocked in software which means that only a heating request is required.

3.0 – Refrigeration Protection

3.1 – High Pressure Lockout

This condition describes the abnormal rise in Head Pressure pass the system acceptable limit of approximately 660 PSI (+/- 10 PSI). 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 at lockout contacts in the system, via BACnet or MODBUS or on the display on the PLC. After this lockout condition is reached, the cooling call must be cycled or the system must be power cycled to clear the fault. The system will maintain the lockout until the problem is rectified.

3.2 – Low Pressure Lockout

This condition describes the abnormal fall in Suction Pressure below approximately 45 PSI (+/- 10 PSI). This fault will only be active when the Low-Pressure Switch (Normally Closed) opens 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 off the compressor. Once the pressure normalizes, the system will restart the cooling operation. If 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. The system will continue to lockout unit the problem is rectified.

3.3 – 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 out.

3.4– Emergency Shutdown

This condition is customer triggered. It can be done by opening the EMS-input on the PLC or triggered from BACnet. If this circuit is opened, all outputs are immediately terminated. That is, all dampers close completely and all motors immediately go off. If this input remains open, the system will not run. The display on the PLC provides the status of all inputs on the PLC.

4.0 – Dehumidification

4.1 – Electric Heat Dehumidification

Dehumidification mode needs to be Enabled on the PLC for this functionality to work. The Dehumidification mode has the lowest priority and will only be executed after the Cooling or Heating setpoints are met. Dehumidification request can also be triggered via BACnet. If the dehumidification functionality is enabled and the space humidity is greater than the dehumidification setpoint (User Defined), the HVAC unit will run the Indoor Motor, Stage 1 Compressor Only and the Electric Heat Simultaneously.

5.0 – User Enabled Protection

5.1 – Emergency Shutdown

This operation is customer triggered. It can be done by opening the EMS-input on the PLC or triggered from BACnet. If this circuit is opened, all outputs are immediately terminated. That is, all dampers close completely and all motors immediately go off. If this input remains open, the system will not run. The display on the PLC provides the status of all inputs on the PLC.

5.2 – Emergency Ventilation

This operation is customer triggered. When the respective input is set to the on-state, the HVAC controller terminates all air-conditioning processes and runs the indoor motor. If Emergency Ventilation and Emergency Shutdown are active simultaneously, Emergency ventilation takes priority. That is, the indoor motors would continue to operate while all air-conditioning operation is terminated.

Appendix C: PLC MODBUS Variables

Address	Name	Data Type	Default	Min	Max	Access Level	Description
8965	Y_MEM	Boolean	0			READ	MEMORY LOCATION FOR MONITORING COMPRESSOR 1 - STAGE 1 COOLING REQUEST (INPUT)
8966	Y2_MEM	Boolean	0			READ	MEMORY LOCATION FOR MONITORING COMPRESSOR 2 - STAGE 1 COOLING REQUEST (INPUT)
8967	G_MEM	Boolean	0			READ	MEMORY LOCATION FOR MONITORING INDOOR BLOWER REQUEST (INPUT)
8969	IBM_MEM	Boolean	0			READ	MEMORY LOCATION FOR MONITORING INDOOR BLOWER REQUEST (OUTPUT)
8970	OFM_MEM	Boolean	0			READ	MEMORY LOCATION FOR MONITORING OUTDOOR FAN REQUEST (OUTPUT)
8971	CC1_MEM	Boolean	0			READ	MEMORY LOCATION FOR MONITORING COMPRESSOR 1 - STAGE 1 COOLING REQUEST (OUTPUT)
8972	CC2_MEM	Boolean	0			READ	MEMORY LOCATION FOR MONITORING COMPRESSOR 2 - STAGE 2 COOLING REQUEST (OUTPUT)
8973	HEATER1_MEM	Boolean	0			READ	MEMORY LOCATION FOR MONITORING HEATING REQUEST (OUTPUT)
8977	LOI_MEM1	Boolean	0			READ	MEMORY LOCATION FOR MONITORING COMMON LOCKOUT ALARM (OUTPUT)
8978	LPS1_MEM	Boolean	0			READ	MEMORY LOCATION FOR MONITORING CIRCUIT 1 LOW PRESSURE SWITCH (INPUT)
8979	LPS2_MEM	Boolean	0			READ	MEMORY LOCATION FOR MONITORING CIRCUIT 2 LOW PRESSURE SWITCH (INPUT)
8980	HPS1_MEM	Boolean	0			READ	MEMORY LOCATION FOR MONITORING CIRCUIT 1 HIGH PRESSURE SWITCH (INPUT)
8981	HPS2_MEM	Boolean	0			READ	MEMORY LOCATION FOR MONITORING CIRCUIT 2 HIGH PRESSURE SWITCH (INPUT)
8982	EMS_MEM	Boolean	0			READ	MEMORY LOCATION FOR MONITORING EMERGENCY SHUTDOWN CONTACT (INPUT)
8983	SHORT_CYCLE_MEM	Boolean	0			READ	MEMORY LOCATION FOR MONITORING ANTI-SHORT CYCLE FOR COMPRESSOR CIRCUIT 1
8985	W2_MEM	Boolean	0			READ	MEMORY LOCATION FOR MONITORING HEATING REQUEST (OUTPUT)
8986	LOCKOUT_LPS1	Boolean	0			READ	MEMORY LOCATION FOR MONITORING CIRCUIT 1 LOW PRESSURE SWITCH LOCKOUT
8987	LOCKOUT_LPS2	Boolean	0			READ	MEMORY LOCATION FOR MONITORING CIRCUIT 2 LOW PRESSURE SWITCH LOCKOUT
8988	LOCKOUT_HPS1	Boolean	0			READ	MEMORY LOCATION FOR MONITORING CIRCUIT 1 HIGH PRESSURE SWITCH LOCKOUT
8989	LOCKOUT_HPS2	Boolean	0			READ	MEMORY LOCATION FOR MONITORING CIRCUIT 2 HIGH PRESSURE SWITCH LOCKOUT
8990	LOCKOUT_EMS	Boolean	0			READ	MEMORY LOCATION FOR MONITORING EMERGENCY SHUTDOWN LOCKOUT
8999	Y_MEM_STG2	Boolean	0			READ	MEMORY LOCATION FOR MONITORING COMPRESSOR 1 - STAGE 2 COOLING REQUEST (INPUT)
9000	Y2_MEM_STG2	Boolean	0			READ	MEMORY LOCATION FOR MONITORING COMPRESSOR 2 - STAGE 2 COOLING REQUEST (INPUT)
9001	CC1_STG2	Boolean	0			READ	MEMORY LOCATION FOR MONITORING COMPRESSOR 1 - STAGE 2 COOLING REQUEST (OUTPUT)
9002	CC2_STG2	Boolean	0			READ	MEMORY LOCATION FOR MONITORING COMPRESSOR 2 - STAGE 2 COOLING REQUEST (OUTPUT)

Address	Name	Data Type	Default	Min	Max	Access Level	Description
9003	IBM_OffDelay	Real	1			READ/WRITE	MEMORY LOCATION FOR SETTING INDOOR MOTOR TIME OFF DELAY
9005	ECON_HumSP	Real	0			READ/WRITE	MEMORY LOCATION FOR SETTING OUTDOOR HUMIDITY ENABLE (ONLY APPLICABLE IF LOCATION “9090” IS SET TO “0”)
9007	ECON_MAS_scaled	Real	0			READ	MEMORY LOCATION FOR MONITORING THE MIX/ SUPPLY AIR TEMPERATURE
9009	ECON_ORH_scaled	Real	0			READ	MEMORY LOCATION FOR MONITORING THE OUTDOOR AIR RELATIVE HUMIDITY
9011	ECON_STATUS	Boolean	0			READ	MEMORY LOCATION FOR MONITORING THE STATUS OF THE ECONOMIZER
9013	SHORT_CYCLE_ MEM_2	Boolean	0			READ	MEMORY LOCATION FOR MONITORING ANTI-SHORT CYCLE FOR COMPRESSOR CIRCUIT 2
9016	Cool_SP	Real	0			READ/WRITE	MEMORY LOCATION FOR SETTING COOLING SETPOINT (APPLICABLE IF INTERNAL THERMOSTAT IS USED)
9019	Tstat_Mode	Signed 16-bit	0			READ/WRITE	0:OFF, 1:COOL, 2:HEAT, 3:AUTO (ONLY WORKS IF SENSOR IS INSTALLED IN UNITS)
9020	Tstat_Cool	Boolean	0			READ	MONITORS STATUS OF TSTAT MODE [IF EQUAL TO 1 - TSTAT MODE IS COOL ONLY]
9021	Tstat_Heat	Boolean	0			READ	MONITORS STATUS OF TSTAT MODE [IF EQUAL TO 1 - TSTAT MODE IS HEAT ONLY]
9022	Tstat_Auto	Boolean	0			READ	MONITORS STATUS OF TSTAT MODE [IF EQUAL TO 1 - TSTAT MODE IS COOL OR HEAT ONLY]
9023	Tstat_Off	Boolean	0			READ	MONITORS STATUS OF TSTAT MODE [IF EQUAL TO 1 - TSTAT MODE IS OFF]
9024	Heat_SP	Real	0			READ/WRITE	MEMORY LOCATION FOR SETTING HEATING SETPOINT (APPLICABLE IF INTERNAL THERMOSTAT IS USED)
9034	Cool_DIf	Signed 16-bit	0	2		READ	MEMORY LOCATION FOR SETTING COOLING DIFFERENTIAL (APPLICABLE IF INTERNAL THERMOSTAT IS USED)
9035	Heat_DIf	Signed 16-bit	0	2		READ	MEMORY LOCATION FOR SETTING HEATING DIFFERENTIAL (APPLICABLE IF INTERNAL THERMOSTAT IS USED)
9036	HUM_SP	Signed 16-bit	0			READ	MEMORY LOCATION FOR SETTING HUMIDITY SETPOINT (APPLICABLE IF INTERNAL THERMOSTAT IS USED)
9037	HUM_CTRL	Boolean	0			READ/WRITE	0 : DISABLES DEHUMIDIFICATION CONTROL , 1 : ENABLES DEHUMIDIFICATION CONTROL
9038	RemoteShutdown	Boolean	0			READ/WRITE	0 : ALLOWS NORMAL OPERATION , 1 : TRIGGERS EMERGENCY SHUTDOWN
9039	RoomHumScaled	Real	0			READ	MONITORS SPACE HUMIDITY
9041	RoomTempScaled	Real	0			READ	MONITORS SPACE TEMPERATURE
9045	Temp2Scaled	Real	0			READ	MONITORS OUTDOOR TEMPERATURE
9047	Temp2_Offset	Real	0			READ/WRITE	OFFSET VALUE FOR OUTDOOR TEMPERATURE
9049	SHORTCYCLETIME	Signed 16-bit	0			READ/WRITE	MEMORY LOCATION FOR SETTING ANTI-SHORT CYCLE TIME
9050	HumidityOffset	Signed 16-bit	0			READ/WRITE	OFFSET VALUE FOR SPACE HUMIDITY
9056	TStat_G_Op	Boolean	0			READ/WRITE	0: INDOOR FAN RUNS ON AUTO, 1: INDOOR FAN RUNS CONTINOUSLY
9059	RoomTemp1_Offset	Real	0			READ/WRITE	ALLOWS USER TO CALIBRATE THE MEASURED ROOM TEMPERATURE

Address	Name	Data Type	Default	Min	Max	Access Level	Description
9063	BlowerSpeed	Signed 16-bit	0			READ/WRITE	MONITORS THE CURRENT SPEED OF INDOOR MOTOR. (VALUE SHOULD BE DIVIDED BY 10)
9064	OFMSpeed	Signed 16-bit	0			READ/WRITE	SET OPERATING SPEED OF THE INDOOR MOTOR
9065	HeadPressureCtrl	Boolean	0			READ/WRITE	0: OUTDOOR FAN RUNS AT “OFMSpeed” | 1:OUTDOOR FAN RUNS MODULATES TO MAINTAIN LIQUID LINE TEMP OF 100 F
9066	OFM_ProportionalVal	Real	0			READ/WRITE	PROPORTIONAL VALUE FOR MODULATING THE OUTDOOR FAN MOTOR.
9068	OFM_IntegralVal	Real	0			READ/WRITE	INTEGRAL VALUE FOR MODULATING THE OUTDOOR FAN MOTOR.
9070	HeadPressureScaled1	Real	0			READ	MONITOR LIQUID LINE TEMPERATURE OF CIRCUIT 1
9072	HeadPressureOffset1	Real	0			READ/WRITE	ALLOWS USER TO CALIBRATE THE MEASURED LIQUID LINE TEMPERATURE OF CIRCUIT 1
9078	HeadPressureScaled2	Real	0			READ	MONITOR LIQUID LINE TEMPERATURE OF CIRCUIT 2
9080	HeadPressureOffset2	Real	0			READ/WRITE	ALLOWS USER TO CALIBRATE THE MEASURED LIQUID LINE TEMPERATURE OF CIRCUIT 2
9086	ECON_TempSP	Real	0			READ/WRITE	CHANGEOVER SETPOINT FOR THE ECONOMIZER
9088	ECON_OAT_scaled	Real	0			READ	ALLOWS USER TO CALIBRATE THE MEASURED OUTDOOR AIR TEMPERATURE
9092	CoolOption	Signed 16-bit	0			READ/WRITE	0 : DX COOLING ONLY | 1 : ECONOMIZER
9093	OAH_Offset	Real	0			READ/WRITE	ALLOWS USER TO CALIBRATE THE MEASURED OUTDOOR AIR HUMIDITY
9095	MAT_Offset	Real	0			READ/WRITE	ALLOWS USER TO CALIBRATE THE MEASURED SUPPLY AIR TEMPERATURE
9097	EconDamper_HighLimit	Real				READ/WRITE	MAXIMUM ALLOWED POSITION FOR THE DAMPER
9099	EconDamper_LowLimit	Real	0		40	READ/WRITE	MINIMUM ALLOWED POSITION FOR THE DAMPER
9101	EconDamper_ManualCtrl	Boolean	0			READ/WRITE	0 : DAMPER MODULATES | 1 : DAMPER OPENS TO THE POSITION “EconDamper_ManualVal”. DURING ECONOMIZING
9102	EconDamper_ManualVal	Real	0			READ/WRITE	POSITION THE DAMPER OPENS TO DURING ECONOMIZING
9104	EconDamper_ActualPos	Real	0			READ	POSITION THE CONTROLLER IS REQUESTING THE DAMPER TO OPEN UP TO
9106	UnitNum	Signed 16-bit	1	1		READ/WRITE	BACNET ID
9116	Stg1_Speed	Signed 16-bit	50			READ/WRITE	INDOOR MOTOR COOL SPEED - STAGE 1
9117	Stg2_Speed	Signed 16-bit	55			READ/WRITE	INDOOR MOTOR COOL SPEED - STAGE 2
9118	Stg3_Speed	Signed 16-bit	60			READ/WRITE	INDOOR MOTOR COOL SPEED - STAGE 3
9119	Stg4_Speed	Signed 16-bit	60			READ/WRITE	INDOOR MOTOR COOL SPEED - STAGE 4
9120	Stg5_Speed	Signed 16-bit	65			READ/WRITE	INDOOR MOTOR COOL SPEED - STAGE 5
9121	G_Speed	Signed 16-bit	50			READ/WRITE	FAN ONLY SPEED
9122	W2_Speed	Signed 16-bit	65			READ/WRITE	INDOOR MOTOR - HEATER SPEED
9135	DirtyFilter_Warning	Boolean	0			READ	
9176	EconForceClose	Boolean	0			READ/WRITE	ALLOWS USER TO FORCE ECONOMIZER CLOSE. 0 : OFF | 1 : CLOSE DAMPER
9180	SystemCapacityOp	Signed 16-bit	0			READ/WRITE	0:Full Capacity; 1:Staged Capacity ; 2: Dual Compressor Op

Appendix D: PLC BACNET Analog Variables

PARAMETER Name	Description	Units	Access
BAV1_T-StatMode	0:OFF, 1:COOL, 2:HEAT, 3:AUTO	Binary	Read/Write
BAV3_CoolSetpoint	Cooling Setpoint	Temp (F)	Read/Write
BAV4_HeatSetpoint	HeatingSetpoint	Temp (F)	Read/Write
BAV5_HumiditySetpoint	Humidity Setpoint	RH (%)	Read/Write
BAV6_RoomTemp	Average Temperature Used To Control Unit	Temp (F)	ReadOnly
BAV7_RoomHumidity	Average Humidity Used To Control Unit	RH (%)	ReadOnly
BAV10_OutdoorAirTemp	Measured Outdoor Air Temperature	Temp (F)	Read Only
BAV11_OutdoorAirTempOffset	Offset value for calibrating Outdoor Air Temperature measurement	Temp (F)	Read/Write
BAV12_IndoorBlowerSpeed	Monitors the speed at which the indoor motor is being requested to operate at	(%)	Read Only
BAV13_OutdoorBlowerSpeed	Speed setting at which the outdoor motor will operate when requested	(%)	Read/Write
BAV14_CoolOption	0:Mechanical Cooling Only, 1: Economizer OR Mechanical Cooling , 2:Economizer AND Mechanical Cooling	N/A	Read/Write
BAV15_EconomizerTempSP	Temperature below which the economizer initiates on an active cooling request	Temp (F)	Read/Write
BAV16_EcoonmizerHumSP	Humidity at which the economizer initiates on cooling request. Only Applicable is “BAV14_CoolOption” and “BAV58_EconomizerSensorSelection” are not equal to 0	(%)	Read/Write
BAV17_EconomizerDamperMinimumPos	Minimum position of the economizer damper	Open (%)	Read/Write
BAV18_EconomizerDamperMaximumPos	Maximum position of the economizer damper	Open (%)	ReadOnly
BAV19_HeadPressure1	Monitors the Liquid Line Temperature of Circuit 1	Temp (F)	Read Only
BAV20_SuctionPressure1	Monitors the Suction Line Temperature of Circuit 1	Temp (F)	Read Only
BAV21_HeadPressure2	Monitors the Liquid Line Temperature of Circuit 2	Temp (F)	Read Only
BAV22_SuctionPressure2	Monitors the Suction Line Temperature of Circuit 1	Temp (F)	Read Only
BAV23_CoolStg1Speed	Indoor Blower Speed setpoint for Cool Stage 1	(%)	Read/Write
BAV24_CoolStg2Speed	Indoor Blower Speed setpoint for Cool Stage 2 (Stage 1 Cooling in 2 Stage Operation)	(%)	Read/Write
BAV25_CoolStg3Speed	Indoor Blower Speed setpoint for Cool Stage 3	(%)	Read/Write
BAV26_CoolStg4Speed	Indoor Blower Speed setpoint for Cool Stage 4	(%)	Read/Write
BAV27_CoolStg5Speed	Indoor Blower Speed setpoint for Cool Stage 5 (Stage 2 Cooling in 2 Stage Operation)	(%)	Read/Write
BAV28_HeatStg1Speed	Indoor Blower Speed setpoint for Heating operation	(%)	Read/Write
BAV29_BlowerOnlySpeed	Indoor Blower Speed setpoint for fan only operation	(%)	Read/Write
BAV30_EconomizerPosition	Economizer Damper Position	Open (%)	ReadOnly
BAV31_EconomizerManualValue	Economizer manual value. Only applicable when economizer is in manual mode (BBV31=1)	Open (%)	Read/Write
BAV32_CustomerTemp1	(Not Part of Standard Offering) Measure value for Temperature Sensor 1	Temp (F)	ReadOnly
BAV33_CustomerTemp2	(Not Part of Standard Offering) Measure value for Temperature Sensor 2	Temp (F)	ReadOnly
BAV34_CustomerTemp3	(Not Part of Standard Offering) Measure value for Temperature Sensor 3	Temp (F)	ReadOnly
BAV35_CustomerTemp4	(Not Part of Standard Offering) Measure value for Temperature Sensor 4	Temp (F)	ReadOnly

PARAMETER Name	Description	Units	Access
BAV36_CustomerTemp5	(Not Part of Standard Offering) Measure value for Temperature Sensor 5	Temp (F)	ReadOnly
BAV68_CustomerTemp6	(Not Part of Standard Offering) Measure value for Temperature Sensor 6	Temp (F)	ReadOnly
BAV32_CustomerTemp1	Qty of Humidity Sensors Used in Averaging Control	Temp (F)	Read/Write
BAV42_CustomerHum1	(Not Part of Standard Offering) Measure value for Humidity Sensor 1	RH (%)	ReadOnly
BAV43_CustomerHum2	(Not Part of Standard Offering) Measure value for Humidity Sensor 2	RH (%)	ReadOnly
BAV44_CustomerHum3	(Not Part of Standard Offering) Measure value for Humidity Sensor 3	RH (%)	ReadOnly
BAV45_CustomerHum4	(Not Part of Standard Offering) Measure value for Humidity Sensor 4	RH (%)	ReadOnly
BAV46_CustomerHum5	(Not Part of Standard Offering) Measure value for Humidity Sensor 5	RH (%)	ReadOnly
BAV69_CustomerHum6	(Not Part of Standard Offering) Measure value for Humidity Sensor 6	RH (%)	ReadOnly
BAV52_MixedAirSensorValue	Measured Value of the Mixed Air Sensor	Temp (F)	ReadOnly
BAV54_SupplyAirSensorValue	Measured Value of the Supply Air Sensor (Standard Design uses the “BAV54” for both supply and mixed measurement)	Temp (F)	ReadOnly
BAV55_SupplyAirTempOffset	Offset value to calibrate the value measured by the Supply Air Temperature Sensor	Temp (F)	Read/Write
BAV56_MixedAirTempOffset	Offset value to calibrate the value measured by the Mixed Air Temperature Sensor	Temp (F)	Read/Write
BAV57_OutdoorAirHumidityOffset	Offset value to calibrate the value measured by the Outdoor Humidity Sensor	RH (%)	Read/Write
BAV58_EconomizerSensorSelection	0 : Drybulb, 1: Enthalpy + Drybulb , 2: Dewpoint + Drybulb	Binary	Read/Write
BAV59_EconomizerTempDif	Deadband offset value for Economizer Temperature process variable as it relates to the Space Temperature	Temp (F)	Read/Write
BAV60_EconomizerEnthalpyDif	Deadband offset value for Economizer Enthalpy process variable as it relates to the Space Enthalpy	(BTU/lb-air)	Read/Write
BAV61_EconomizerDewpointSetpoint	Economizer Dewpoint Lockout Setpoint	Temp (F)	Read/Write
BAV63_SpaceEnthalpy	Measured Enthalpy of Space	(BTU/lb-air)	Read Only
BAV65_OutdoorEnthalpy	Measured Outdoor Enthalpy	(BTU/lb-air)	Read Only
BAV66_OutdoorDewpoint	Measured Outdoor Dewpoint	Dewpoint (F)	Read Only
BAV67_OutdoorHumidity	Measured Outdoor Humidity	RH (%)	Read Only
BAV74_RevisionLevel	Revision Level of the PLC software	N/A	Read Only

Appendix E: PLC BACNET Binary Variables

PARAMETER Name	Description	Units	Access
BBV0_HPS1_R	Monitor Circuit 1 High Pressure Input. 0:Fault, 1:OK	Binary	ReadOnly
BBV1_LPS1_R	Monitor Circuit 1 Low Pressure Input. 0:Fault, 1:OK	Binary	ReadOnly
BBV2_HPS2_R	Monitor Circuit 2 High Pressure Input. 0:Fault, 1:OK (Only Applicable on Dual Compressor Unit)	Binary	ReadOnly
BBV3_LPS2_R	Monitor Circuit 2 Low Pressure Input. 0:Fault, 1:OK (Only Applicable on Dual Compressor Unit)	Binary	ReadOnly
BBV4_EMS_R	Monitor Emergency Shutdown Input. 0:Fault, 1:OK	Binary	ReadOnly
BBV5_Cooling1_R	Monitor Compressor Circuit 1 Request. 1:ON, 0:OFF	Binary	ReadOnly
BBV6_Cooling2_R	Monitor Compressor Circuit 2 Request. 1:ON, 0:OFF (Only Dual Compressor Unit)	Binary	ReadOnly
BBV7_IndoorFan_R	Monitor Request for the Indoor Blower Motor. 1:ON, 0:OFF (Verifies if there is a call for the blower to be on)	Binary	ReadOnly
BBV10_RemoteShutdown_RW	Allow end user to Remote Shutdown the HVAC Unit. 1:Active, 0:Inactive (Emergency Shutdown)	Binary	Read/Write
BBV11_CoolReqStg1_RW	Variable for Requesting first stage cooling (Y signal). 1:Request, 0: No Request	Binary	Read/Write
BBV12_CoolReqStg2_RW	Variable for Requesting second stage cooling (Y2 signal). 1:Request, 0: No Request	Binary	Read/Write
BBV13_HeatReqStg1_RW	Variable for Requesting first stage heating (W1 signal). 1:Request, 0: No Request	Binary	Read/Write
BBV15_IndoorFanReq_RW	Variable for Requesting Fan Only. 1:Request, 0: No Request	Binary	Read/Write
BBV17_BlowerSetting_RW	Indoor Blower Control Setup. 0:Auto , 1:ON Mode. In auto Mode, the fan cycles when running. In “On” mode the fan runs continuously.	Binary	Read/Write
BBV20_EconomizerDamperControl_RW	Variable for controlling the Economizer Damper Manually or have it automatically controlled. In Manual Mode, opening position is set by end user (BAV31_EconomizerManualValue). 0:Automatic Mode, 1: Manual Mode. Note that the dampers will only open when there is a request for economizer.	Binary	Read/Write
BBV22_DirtyFilter_R	Variable for monitoring the status of the Dirty Filter switch. 1:OK, 0:Dirty	Binary	ReadOnly
BBV23_EconDamperForceClose	Variable for forcing damper close. 1: Close OA Damper, 0: Normal Operation (Emergency OA Shutdown)	Binary	Read/Write
BBV24_EconDamperForceOpen	Variable for forcing damper into manual control. This will force damper to position set by end user at variable “BAV31_ EconomizerManualValue”. Note that this is does not depend on an active request for economizer.	Binary	Read/Write
BBV25_HumidityCtrlEnable	Dehumidification Functionality Enable/Disable. 1:ENABLE, 0:DISABLE	Binary	Read/Write

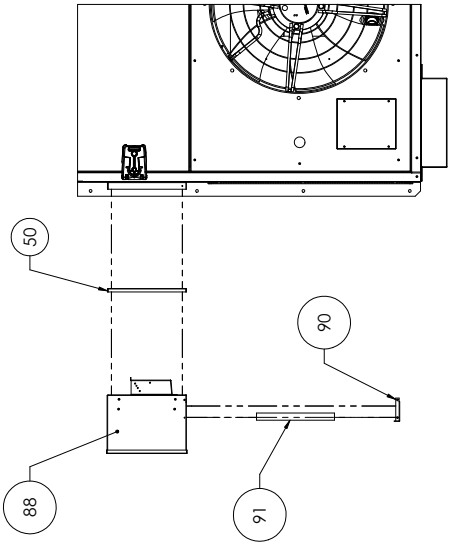
Appendix F: Fresh Air Damper Installation

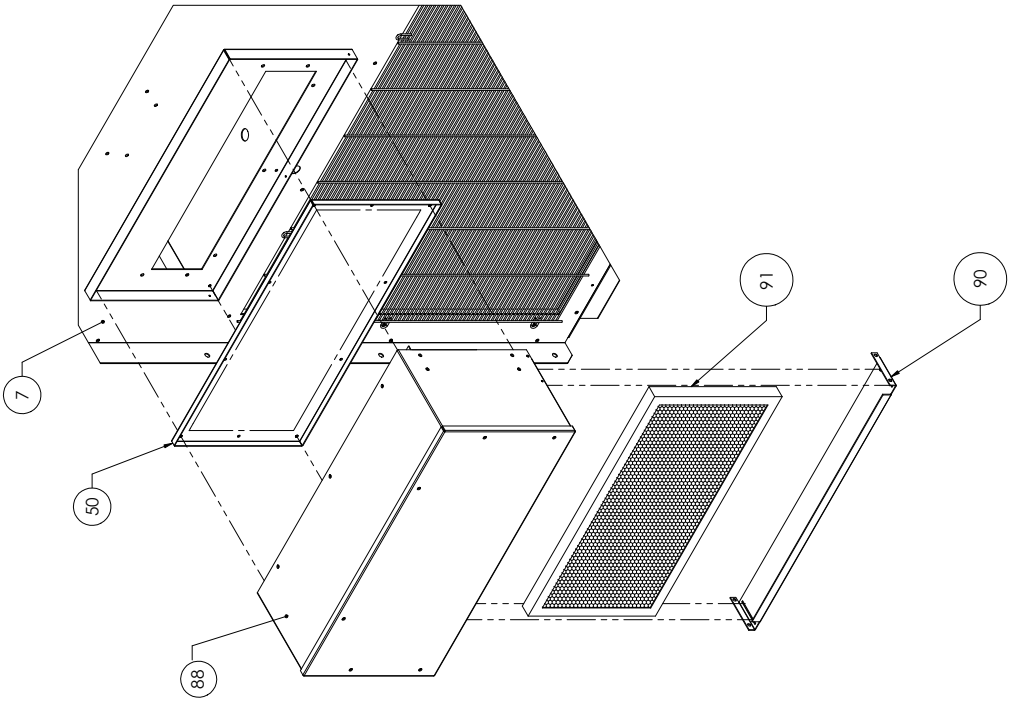
HOW TO INSTALL FRESH AIR DAMPER ASSY(88):

- 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):

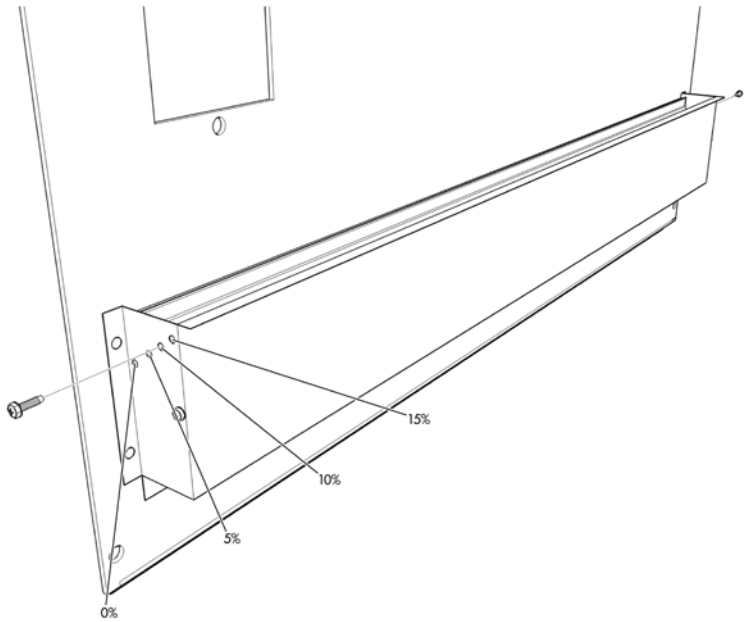
- DETACH ITEM 90 - FILTER COVER FROM ITEM 88 -DAMPER ASSY
- SLIDE ITEM 91 - FILTER OUT/IN
- ATTACH ITEM 90 - FILTER COVER TO ITEM 88 - DAMPER ASSY





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

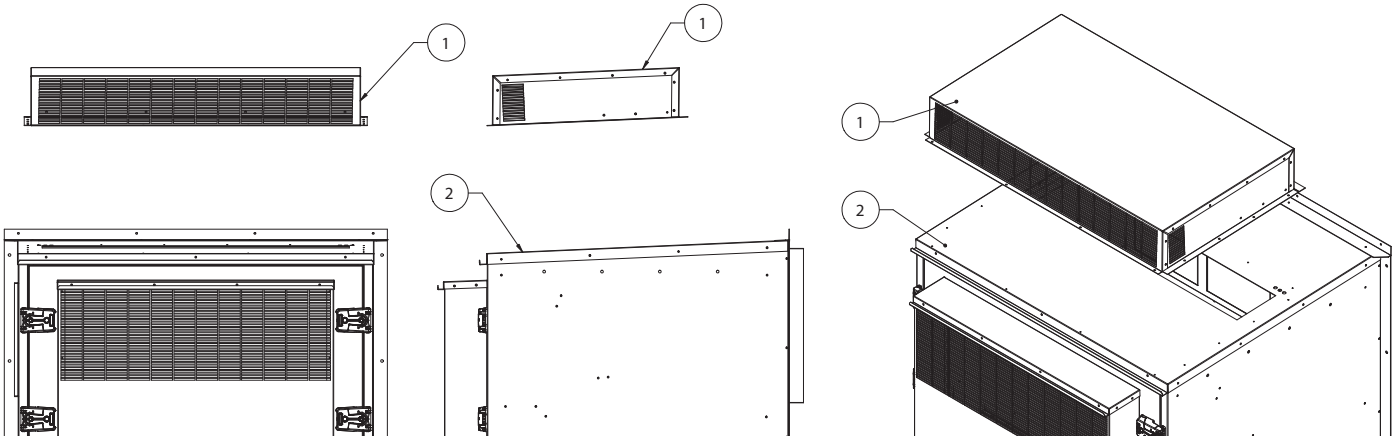
The fresh air hood is located on the inside, behind the slots on the bottom front panel. To access the hood, remove the screws that hold the front panel. The air flow can be adjusted from no (0%) fresh air to approximately 15% of rated air flow of fresh air, in 5% increments. The hood is shipped from 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 G:

MGA3150A/3180A Center Supply/Top Return 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: MGA3150A UNITS ARE A DIFFERENT CABINET TO MGA3180A BUT DAMPER INSTALLATION PROCEDURE IS THE SAME.

Notes:

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