

Application Engineering

Copeland®

AE4-1357 R7

September 2012

Upgrade Procedures for Parallel Applications Using Digital Capacity Control for Copeland[™] and Intelligent Store Discus[™] Refrigeration Compressors (for 3D Discus)

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Introduction

There are three main steps in the Copeland Discus Digital[™] upgrade procedure: (1) head and valve plate conversion, (2) wiring the digital solenoid and/or the digital compressor controller, and (3) programming the master controller (in this document CPC's E2 Rack Controller).

On refrigeration applications where the load may vary over a wide range, some means of capacity control is often desirable for optimum system performance and control. In addition, compressor capacity modulation can reduce power and energy consumption, provide better load matching, reduce compressor cycling, and decrease the starting electrical load.

Copeland[™] 3D Discus[™] compressors can be retrofitted for enhanced modulation performance. Once a Copeland 3D Discus compressor is upgraded to Discus digital, the compressor can modulate from 10-100 percent of its capacity range, allowing the system to more precisely match capacity to the desired load of the refrigeration system.

This bulletin describes upgrade procedures for the Copeland Discus Digital and Intelligent Store Discus v2.x digital compressors.

Requirements

As Copeland[™] and Intelligent Store[™] brand Discus Digital compressors become more readily adopted and used in the marketplace, revised recommendations are being outlined for the use of Discus Digital compressors in existing systems.

It is always the best choice to install a new Discus Digital compressor when the benefits of modulation are desired in an existing refrigeration system. However, if the compressor is less than 4 years old, then the Discus[™] compressor can be upgraded to a digital with the recommended retrofit kit.

These revised guidelines will ensure that all digital upgrades of existing compressors in the field will function reliably under all circumstances of operation. If you have any questions or need additional information, please contact your Application Engineer or Service Engineering.

If using E2, E2 controller version 2.3 or later is required, or any rack control capable of providing a 1-5 variable voltage signal. Update firmware if necessary. An analog output point is needed on the controller. See section on analog output (AO) board for E2.

On-Site Parts

As you work through the procedures below, make sure that you keep any parts removed from the compressor or mounted to the compressor, including bolts and studs. Some of the parts will be reused for the upgrade. The existing compressor head, valve plate and corresponding gaskets will not be reused.

Tools/Supplies Needed

In order to upgrade a 3D Discus compressor there are some extra tools or supplies you may need. The following is a suggested list:

Mechanical Installation

- Ratchet
- Torque Wrench Capable of 60 ft-lbs
 - 9/16" Deep Well Socket
 - ¾" Crow's Foot Attachment
- Hex Jaws Pipe Wrench for Rotalock Fitting
- Pipe Sealant
- Gasket Scraper





- Hammer
- Adjustable Wrench
 ³⁄₄" Wrench
- Pliers
- · Assembly Oil

NOTE! Emerson strongly recommends using a torque wrench to ensure all bolt torque specifications are met.

Note! If using a torque wrench for tightening bolts, you will need a 3/4" crow's foot to properly attach the discharge flange connection to the cylinder head.

Electrical Installation

- Drill & Self Tapping Screws for Mounting Components in Electrical Panel
- Screwdriver
 - Large and Small
- Wire Stripper
- Wire Connector Ends (1/4" Spade)
- Conduit Connections
- Wire Ties
- Electrical Tape
- Power wires (to connect Digital Compressor Controller to solenoid coil, transformer, and AO Board)
- Shielded cable (for connection to the E2)
- Flexible 3/8" Metal Conduit For High Voltage Coil Applications
- Flexible 3/8" Plastic Conduit (Optional)

Note! Consult your rack controller manufacturer for the appropriate wire and power cables.

Choosing the Correct Upgrade Kit

When deciding which upgrade kit to choose, you need to know two things: (1) is the compressor equipped with Intelligent Store Discus v2.x? and (2) what is the application? (e.g. low, or medium/ high temperature) Based on this information, you have four different upgrade kits to choose from in **Tables 1 and 2** on the following pages. Each upgrade kit includes a digital head, valve plate, gaskets, sensors, and high cycle solenoid coils. Each part is numbered and depicted in **Figure 1**. For further explanation of the kit pieces, refer to the Appendix of this bulletin.

Emerson also recommends using a select fit valve plate gasket for each Discus Digital upgrade to ensure optimal compressor performance. The Select Fit Valve Plate Gasket Kits are shown in Table 3. There are kits available for both OEM compressors and remanufactured service compressors. If the compressor you are upgrading is the original compressor for the site, then it is most likely an OEM compressor. However, if the compressor has been replaced by a compressor from a wholesaler, then there is a good chance this is a remanufactured service compressor. You can verify by checking the compressors serial number listed on the nameplate. Remanufactured service compressors are indicated by a "6", "7", or "8" in the 4th character of the serial number. Any other character in this location will designate an OEM compressor. More information on selecting the appropriate valve plate gasket is covered on Page 8.



Figure 1 – Items in a Typical Discus Digital Upgrade Kit (corresponding to Item No. in Tables 1 and 2)



Table 1 - Non-ISD Discus Digital Upgrade Kits

<u>Kit</u>	<u>Kit P/N</u>	Item No.	Item Description	<u>Item P/N</u>			
		1 & 2	Head-Service Kit - Gaskets	902-0317-00			
					3	3D Discus Digital Valve Plate Kit - Gaskets	998-6661-30
		4	IDCM Module Kit /Copeland Digital Compressor Controller - 5kOhm, 1W Resistor**	943-0086-00			
Medium Temperature	000 0000 00	6	Sensor Temp Probe Kit	985-0109-07			
Non-ISD Upgrade Kit	980-3000-00	7	Solenoid Coil x2 (120V & 220V) - Solenoid Bracket - Screw	923-0084-01, -02			
		8	24V Transformer	037-0023-00			
		9	Instructional Sheets - AE8-1328 Copeland Digital Compressor Controller - AE4-1357 Upgrade Procedures - 2009ECT-48 Discus Digital Upgrade Kit Instructions	N/A			
		1 & 2	Head-Service Kit - Gaskets	902-0317-00			
		3	3D Discus Digital Valve Plate Kit - Gaskets	998-6661-31			
		4	IDCM Module Kit /Copeland Digital Compressor Controller - 5kOhm, 1W Resistor**	943-0086-00			
Low		5	074-0805-00				
Temperature Non-ISD	980-3000-01	6	Sensor Temp Probe Kit	985-0109-07			
Upgrade Kit		7		Solenoid Coil x2 (120V & 220V) - Solenoid Bracket - Screw	923-0084-01, -02		
		8	24V Transformer	037-0023-00			
		9	Instructional Sheets - AE8-1328 Copeland Digital Compressor Controller - AE4-1357 Upgrade Procedures … - 2009ECT-48 Discus Digital Upgrade Kit Instructions	N/A			



Table 2 - Intelligent Store Discus v2.x Digital Upgrade Kits

<u>Kit</u>	<u>Kit P/N</u>	Item No.	Item Description	Item P/N
		1 & 2	Head-Service Kit - Gaskets	902-0317-00
Medium Temperature	080 2000 40	3	3D Discus Digital Valve Plate Kit - Gaskets	998-6661-30
Intelligent Store v2.x	980-3000-10	7	Solenoid Coil (24V)	923-0084-00
Upgrade Kit		9	Instructional Sheets - AE4-1357 Upgrade Procedures … - 2009ECT-48 Discus Digital Upgrade Kit Instructions	N/A
		1 & 2	Head-Service Kit - Gaskets	902-0317-00
Low		3	3D Discus Digital Valve Plate Kit - Gaskets	998-6661-31
Temperature Intelligent	980-3000-11	5	Tall Fan Bracket	074-0805-00
Store v2.x Upgrade Kit		7	Solenoid Coil (24V)	923-0084-00
opgrade nit		9	Instructional Sheets - AE4-1357 Upgrade Procedures - 2009ECT-48 Discus Digital Upgrade Kit Instructions	N/A

Table 3 - Select Fit Valve Plate Gasket Kit Part Numbers

	Kit Part #				
Kit Description	OEM Compressor	Remanufactured/ Service Compressor			
3DB*,3DP*, 3DJ* Select Fit Valve Plate Gasket Kit	920-1367-00	920-1233-01			
3DF*,3DK*, 3DG* Select Fit Valve Plate Gasket Kit	920-1367-01	920-1233-03			
3DA*,3DE*, 3DH* Select Fit Valve Plate Gasket Kit	920-1367-02	920-1233-05			
3DS*,3DT*, 3DR* Select Fit Valve Plate Gasket Kit	920-1367-03	920-1233-07			

Note: More information on Choosing the Correct 3D Valve Plate Gasket available on Page 8.

Remanufactured compressors are designated by a "6", "7", or "8" in the 4th character in the serial number (e.g. 06B6xxxxx). Any other character in this location will designate an OEM compressor. (e.g. 03C0xxxxx)



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Copeland Discus/Intelligent Store Discus v2.x to Copeland Discus Digital Head and Valve Plate Conversion

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Note! Please review this section even if you are familiar with a standard Discus head and valve plate conversion. Refer to **Checklist#1** for the compressor head and valve plate change, which can be found in the Appendix at the end of this document.

- 1. Prepare compressor for a head change, per industry standards:
 - Front seat suction service valve
 - Pumpdown compressor
 - Disconnect power to compressor
 - Front seat discharge service valve and oil supply valve (If applicable)
 - Depressurize compressor
- 2. Loosen the discharge service valve away from the compressor.
- 3. Remove the discharge valve adaptor (it will be used on the new head); keep it in a safe place.
- 4. Scrape off all gaskets from the discharge flange and adaptor.
- 5. Remove any high pressure connections from the head and the head fan (if equipped).
- 6. Note the location of any studs on the head (high pressure control and oil pressure module may be mounted here).
- 7. Remove the cylinder head bolts.
- 8. Tap the head to break it loose from the valve plate.
- 9. Remove dowel pins and save for digital head and valve plate installation.
 - Record valve plate gasket thickness and part number for reference when selecting appropriate new valve plate gasket. (See **Figure 2**.)
- 10. Lightly tap up on the tab or on the side of the valve plate to loosen and then remove valve plate. Use caution to not damage the compressor deck surface.
- 11. Check that the pistons travel up and down freely.

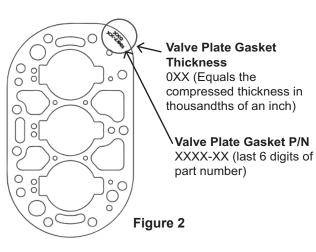




Figure 3 - Check that the pistons travel up and down freely by pressing down on each of the cylinders.

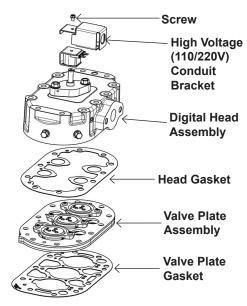


Figure 4 - Exploded View of Copeland Discus Digital head and valve plate assembly



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12. Inspect the valves and valve plate for any damage (i.e. broken reeds) and that there are not any existing system issues that should be addressed.

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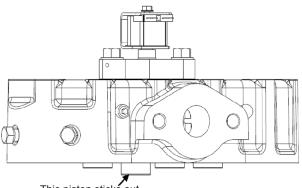
- 13. Scrape any gasket material from the compressor deck; take care to keep any debris from entering suction passages of the body or cylinder bores and make sure not to damage the compressor deck.
- Select the proper valve plate gasket for the bore size of the compressor. (See Choosing the Correct 3D Valve Plate Gasket Selection on Page 7.)
- 15. Lightly coat both sides of the new valve plate gasket with assembly oil. Orient the valve plate gasket with dowel pins and ports. Install valve plate gasket. TAB SHOULD BE ORIENTED ON THE OIL PUMP END WITH PART NUMBER ON TOP.
- 16. Inspect new valve plate for handling damage and install.
- 17. Lightly oil both sides of the Discus digital head gasket and install. TAB SHOULD BE ORIENTED ON THE OIL PUMP END WITH PART NUMBER ON TOP.
- Visually inspect pistons in head for loose debris.
 Note! The digital head has four internal pistons, one protrudes farther out than the other three. This is intentional. See Figure 5.

CAUTION: DO NOT REMOVE PISTONS FROM INSIDE HEAD!

- 19. Install the Discus digital cylinder head. Take care to not damage the solenoid stem mounted on the compressor head.
- 20. Replace stud bolts (if equipped) in their correct location to mount components/head fan.

NOTE! If upgrading on a low temperature Discus compressor with head fan, you will need to replace the fan bracket with taller fan bracket supplied in the upgrade kit. **Figure 6** shows the new stud bolt locations.

- 21. Finger tighten bolts and torque evenly in crossing pattern to 50 ft-lbs. (See **Torque Patterns** on following page for proper torquing procedures.)
- 22. Reassemble the high pressure port connections with appropriate thread sealant.



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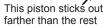


Figure 5 - Four pistons inside the digital cylinder head, one piston sticks out farther by design



Figure 6 - (left) Standard discus head fan mounting stud bolt locations; (right) Discus Digital head fan mounting stud bolt locations with taller bracket. The taller fan bracket (also used with Moduload) requires different stud bolt locations than the standard 3D Discus.

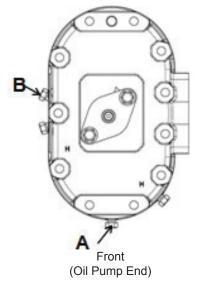


Figure 7 - Top view of 3D Discus cylinder head with possible temperature probe locations.



- 23. Install discharge temperature probe (see Figure 7)
 - Copeland Discus use port (A) or port (B)
 - If equipped with Demand Cooling¹ use the existing discharge temperature probe from the removed head assembly. Only install the demand cooling temperature probe in port (A)
 - ISD v2.x use port (B) only
- 24. Tighten temperature probe and discharge pressure pickup connections firmly and recheck torque on all the bolts.
- 25. Install new teflon seal provided in gasket kit in the discharge/flange adapter. (See **Figure 8**.)
- 26. Place metal gasket (Orient raised ribbed side towards compressor body) on the discharge adaptor and connect adaptor to head.

Note! If there is a muffler plate install gaskets on both sides of muffler plate.

- 27. Incrementally torque flange bolts to 60 ft-lbs. in an alternating pattern. (See **Torque Patterns** below for proper torquing procedures.)
- 28. Reconnect the discharge service valve.
- 29. Refer to **Checklist #1** in Appendix to verify all steps have been completed in the head and valve plate conversion.
- 30. Evacuate compressor and reopen all the necessary valves to the compressor per industry standards.
- 31. Leak test the compressor.
- Install Discus Digital[™] solenoid coil, solenoid bracket², and conduit² on solenoid valve stem². Make sure to choose correct voltage solenoid coil. See Figure 9.
- 33. If the compressor is equipped with a head fan, install³ taller fan bracket (Used on Copeland 3D Moduload[™] models) and head fan³.
 - ¹ Intelligent Store Discus compressors with Demand Cooling are pending approval.
 - ² Required for non-Intelligent Store Discus only.
 - ³ Refer to installation instructions supplied with fan mounting kit.



Figure 8 - Install a new Teflon seal into the discharge/flange adapter.

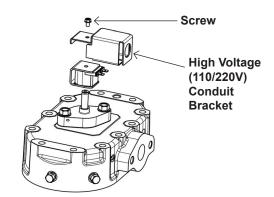
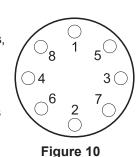


Figure 9 - Solenoid coil assembly including bracket

Torque Patterns

For all cover plates (heads, bottom plates, shipping pads, valves, etc.) to achieve a proper seal, it is important when applying torque to use a criss-cross pattern. Follow the steps below.



Do not apply torque in

a circular pattern. For the initial torque, apply no more than 70% of the final torque using a diagonal criss-cross pattern, similar to the example in **Figure 10**. Once the initial torque has been applied, apply the proper full torque value, again using a criss-cross pattern. Once the final torque has been applied, start at any bolt, and circle the entire part in sequence. This will verify that a bolt has not been missed and that final torque has been applied.



Choosing the Correct 3D Valve Plate Gasket

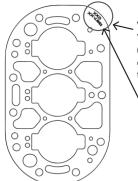
For use with 3D Delta Reed compressors only.

Note! Emerson offers an optional select-fit valve plate gasket kit (sold separately) to optimize your compressor's performance. If you choose not to use select fit gaskets the thickest gasket for each compressor bore size is alreaady provided to you in your upgrade kit.

Valve plate gasket kits with thicknesses in 0.002" increments are offered to minimize compressor performance loss due to increased re-expansion volume. Kits are available for each bore size (both OEM and remanufactured* models). OEM kits range from 031(0.031") to 039 (0.039"). Remanufactured kits range from 031 to 041. The thickest remanufactured gasket (045) will be provided with the head and valve plate kits.

1. Record the existing valve plate gasket part number and thickness found on the tab of the valve plate gasket before removing existing valve plate and head.

- Choose the correct gasket part number (per the table below) and match the thickness shown on the tab of the existing gasket.
 - If the exact thickness is not available, select the next thickest gasket. For example, existing gasket reads 032, select 033 gasket or thicker.
 - If you can not read the gasket thickness on existing valve plate gasket, use the thickest replacement gasket (see table below).



Valve Plate Gasket Thickness 0XX (Equals the compressed thickness in thousandths of an inch)

Valve Plate Gasket P/N XXXX-XX (last 6 digits of part number)

	OEM Compr	essor Valve I	Plate Gasket	Selection	Remanufacture	ed Compressor	Valve Plate Ga	sket Selection*	
3D Model		sor gaskets are elect Fit Valve P			The maximum thickness remanufactured compressor gaskets for ear 3D bore size are included in Upgrade Kits. Other thickness gaskets are available in a Select Fit Valve Plate Gasket Kit (sold separately).				
	Existing Part #	Gasket Kit #	Number of Gaskets & Thickness	Maximum Thickness	Existing Part #	Gasket Kit #	Number of Gaskets & Thickness	Maximum Thickness	
3DB* 3DP* 3DJ*	020-1367-00 020-1232-00	920-1367-00	 (1) 0.031 (4) 0.033 (4) 0.035 (2) 0.037 (2) 0.039 	039	020-1233-01	920-1233-01	(1) 0.031 (1) 0.033 (2) 0.035 (2) 0.037 (2) 0.039 (1) 0.041	045	
3DF* 3DK* 3DG*	020-1367-02 020-1232-02	920-1367-01	 (1) 0.031 (4) 0.033 (4) 0.035 (2) 0.037 (2) 0.039 	039	020-1233-03	920-1233-03	(1) 0.031 (1) 0.033 (2) 0.035 (2) 0.037 (2) 0.039 (1) 0.041	045	
3DA* 3DE* 3DH*	020-1367-04 020-1232-04	920-1367-02	 (1) 0.031 (4) 0.033 (4) 0.035 (2) 0.037 (2) 0.039 	039	020-1233-05	920-1233-05	(1) 0.031 (1) 0.033 (2) 0.035 (2) 0.037 (2) 0.039 (1) 0.041	045	
3DS* 3DT* 3DR*	020-1367-06 020-1232-06	920-1367-03	 (1) 0.031 (4) 0.033 (4) 0.035 (2) 0.037 (2) 0.039 	039	020-1233-07	920-1233-07	 (1) 0.031 (1) 0.033 (2) 0.035 (2) 0.037 (2) 0.039 (1) 0.041 	045	

*Remanufactured compressors are designated by a "6", "7", or "8" in the 4th character in the serial number (e.g. 06B6xxxxx). Any other character in this location will designate an OEM compressor. (e.g. 03C0xxxxx)



Warning: Using a gasket that is too thin may result in reduced compressor life due to piston or valve plate damage.

If you can not read the part number on the existing valve plate gasket, select replacement gasket by matching existing valve plate gasket or by matching the compressor cylinder bores. You can verify correct selection by using the model number, serial number and table below.

Warning: The proper valve plate gasket will match the cylinder bore or be slightly larger. Gasket material should never overlap into the cylinder bore.

The following pages cover wiring the solenoid and digital compressor controller as well as programming the E2 for Non- Intelligent Store Discus (ISD) compressors. If you are upgrading an ISDv2.x compressor to Discus digital, skip to page 14 for further instruction.

Wiring for Non-Intelligent Store Discus Compressors

Digital Compressor Controller

The Digital Compressor Controller is the electronics interface between the Discus digital compressor and the system controller. The rack controller measures temperature or pressure to calculate the needed compressor capacity and communicates that capacity to the Digital Compressor Controller via a 1-5VDC analog signal. The wiring diagram for the digital compressor controller is shown below in **Figure 11**.

For more information and installation instructions for the Copeland Digital Compressor Controller refer to Application Engineering Bulletin **AE4-1328**, Copeland Digital Compressor Controller.

Analog Output (AO) Board (If spare analog output is not available)

Find room in the electrical panel to install the AO board. The AO board takes the variable voltage signal from the E2 controller and delivers it to the Digital Compressor Controller and other components. The AO board has a plastic mounting plate which is mounted in the electrical control panel; the board is snapped into place. Slide the AO board into the bracket. Wire power supply to the AO board. Connect the 485 network to the AO board; the AO will communicate with the E2 controller. Emerson Climate Technologies has used CPC's 4AO board (CPC part number 810-3030) for most of their own testing with Discus digital. However, any analog output can be applied for use with the Discus digital compressor.

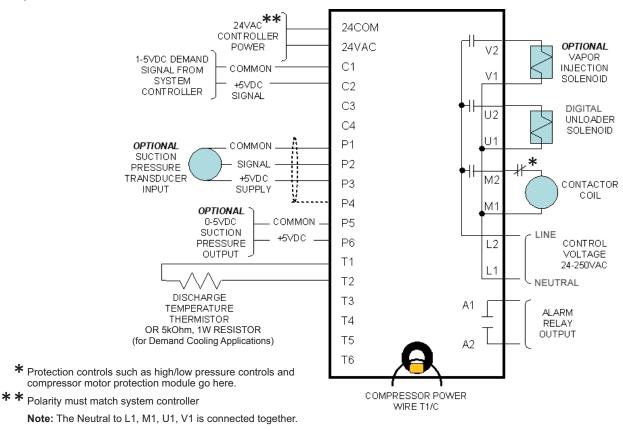


Figure 11 – Digital Compressor Controller Wiring Diagram



Programming The E2 For Non-ISD Copeland Discus Digital

When using the digital compressor controller you need an E2 v2.3 or newer. An analog output point is needed on the controller. You may need to install an AO board if there is not an available point in the E2.

Note! The digital compressor should be set as one stage in the E2. If upgrading from Copeland Moduload[™], you will need to delete the extra unloader stage set up accordingly in the suction group.

Note! These instructions are based on E2 v2.6

These are suggested E2 instructions based on Emerson's experience. There may be more than one

way to properly program the E2 for Discus digital. Use **Checklist #3** in the Appendix to verify the digital is being controlled properly.

In order to program the E2 for Copeland Discus Digital using the digital compressor controller you will perform the following steps:

- 1. Override compressor OFF
- 2. Setup suction group and assign an output to the Digital Compressor Controller
- 3. Setup analog output
- 4. Disable compressor override

Below you will see screen shots taken from the E2 to perform the above steps.

1. After Logging Into¹ The E2, From The Home Screen² Press **F1: Suction** To Arrive At the '**Summary For Suction Groups and Enhanced Suction**' **Screen**. Select The Enhanced Suction³ Group That Has The Digital Compressor Installed.

10-15-09 ♦ (? RX-400 Press 'Log In/Out' to Log On RX DEV	Unit 1 🕅 SUMMARY	15:06:16	10-15-09 • 🥐 🎟 RX-400 Unit 1 🕅 15:06:49 Press 'Log In/Out' to Log On SUMMARY
EN SUC GRP01 21.7	[22.0]		Summary For Suction Groups and Enhanced Suction
CAP	08		Name Suct Suct Suct Temp Special Stages 0f % Cap Status SUCTION GRP01 22.0 NONE 1 100 0K EN SUC GRP01 21.7 22.0 NONE 0 1 0 0K
S1 Req			
Act NO			
SUCTION GRP01 [22.0] STAGES Cap 100%	5: 1/ 1		
Press enter for a list of actions.			Press enter on desired application for status.
F1: SUCTION		F5: SETUP	F5: SETUP
F1 F2 F3 F4	F5		F1 F2 F3 F4 F5
P6 P7 P8 P3		rev fit+;	Provide Provide <t< td=""></t<>
¹ Press The Log In/Out And En	ter Your User ID ar	na Password To Lo	og On
² The Button Takes Y	ou To The Home S	Screen	
³ When Using Copeland Dia	ital™ Compressors	s With CPC E2 Yo	ou Must Use The Enhanced Suction Feature To
Properly Control The Digital		······································	



2. Scroll Down And Highlight The Compressor That Contains The Digital Unloader And Press Enter To Show The 'Actions Menu'. Select **Override** And Press Enter.

11-38-89 🕜 🔟		OAT: 37 8:54:19 Iss Full	11-30-09 🕜 💷		AT: 37 8:53:01 S Full
Enhanced Suction Group Name: R1 (NORMAL) Stages Cap State Cyd #1 : Comp 15.6 #2 : Comp 7.6 #3 : Comp 12.0 #4 : Comp 15.8 	Suct: 39. Dsch: 101.		Enhanced Suction Grou- R1 (NORMAL) Stages Cap Sta #1 : Comp 15.0 #2 : Comp 7.0 #3 : Comp 12.0 #4 : Comp 15.0	Actions Menu 1. Graph 2. Log 3. Override 4. Expanded Information 5. Setup 6. Detailed Status 8. Application Logs/Graphs	[39.0] Control Status Shutdown Condensor R1 CONDENSER
'State' Ind	ed Box Below licates The Selected…	-General Information Sat Suct Temp : 16.4 Rack Failure : OK Capacity : O Capacity % : O			-General Information Sat Suct Temp : 17.2 Rack Failure : OK Capacity : O Capacity % : O
Press enter for a list of act F1: SUCTION		SENSORS / F5: SETUP	Press menu number or s		F5: CANCEL

The 'Override Update' Window Will Appear. <u>Type</u> "YES" in The In Override Space and <u>Type</u> "OFF" Where It Shows Override Value. You Do Not Need To Change The Override Time. Press Enter To Return To the Suction Group Summary Screen.

10-15-09 • 🧖 🔟	RX-400 Unit 1 🕅 ENH SUC STATUS 🕅	MES ED	15:09:06	11-38-89 🦪 🔟	RX-400 Unit 2 ENH SUC STATU		8:54:19
Enhanced Suction Group Name EN SUC GRP(<u>.</u> .	- [22	.0] 	Enhanced Suction Group Name: R1 (NORMAL)	Suct: Dsch:	39.3 [101.0	39.0]
I	Override Update IS.01.1:EN SUC GRP01 :STAG In Override : Yes Dverride Time : 0:00:00			#2 : Comp 7.0	es Status Ø Ready Ø Ready Ø Ready Ø Ready Ø Ready	-Control Shutdov -Condensc R1 COND	n
0	Dverride Value: OFF	Sat Suct Temp Rack Failure Capacity Capacity %		Highlighted Box 'State' Should Re "OFF"		Sat Suc	
Enter State: Use Next/Pre F1: SELECT	v keys	F5:	CANCEL	Press enter for a list of acti F1: SUCTION		F4: SENSORS	F5: SETUP



3. Press **F5: Setup** To Enter the 'Setup' Screen. Advance To **C7: Stage Setup.** Select The Compressor Stage With Digital Installed, Press **F4: Look Up** To Show The 'Options List Selection' Window.

18-15-09 🗣 🧑 🔟 RX-400 Unit 1 🔞 Use Ctrl-X to Select CX Tabs SETUP MONES EI	15:09:52		10-15-09 🔹 Use Ctrl-X	⑦ Ⅲ to Select C?	a Tabs	RX-400 Un Setup		A NAMES	ED	15:10:06
C1: General C2: Circuits C3: Setpoints C4:	C5: Inputs C0: MORE	Tabs -	C1: General			C3: Setpo:		4:		: Inputs : MORE
C6: Outputs C7: Stage Setup C8: Stage Outs C9: Enhanced Suction: EN SUC GRP01	CO: MUKE		C6: Outputs	5 C7: St		C8: Stage Suction:			64	: PIUKE
Emilanced Succion. En Suc annon					Linianceu	SUCCION.	EH 300	anrei		
General Value				etup Type	Capacity		Oil Sen	sor Oil	D1y 0	il Pres
Name : <mark>EN SUC GRP61</mark> Long Name :				#1 : <u>Comp</u>	15.0	Yes	None			
Strategy : Normal										
Number - Stages: 1										
Refrigerant : R22 Phase Protect : Yes										
Comp On Always : No										
Comp On Defrost: No		\longrightarrow								
Comp On Reclaim: No Enable Float : No										
Enable Float : No Condenser :										
eendenser .										
									NEX	TTAD
					Use F	1: PRE	V IAE	s or F2	: NEX	I IAB
				1	To Nav	igate B	Betwee	en Tab	S	
						Ŭ				
							_			
Enter desired text Name of this suction group			n	ng Newt/Pres						
F1: PREV TAB F2: NEXT TAB F3: EDIT F4: STATUS	F5: CANCEL		F1: PREV	TAB F2: N	EXT TAB	F3: ED	<u>11 </u>	F4: LOOK		F5: CANCEL
F1 F2 F3 F4 F5			F1	F2	F3	F4	F5			
	Prev Next		? F6	F7	F8	F9	F10	F11	Prev Shift +	, Next

Select **Dgtl** By Typing "D." This Will Return You To The Stage Setup Screen. Press The Stairstep () Key To Return To The 'Enhanced Suction Summary' Screen And Confirm 'DGTL' Appears Under The 'Stages' Column For The Digital Compressor. When You Return To The Setup Screen The **C9:Var Cap** Tab Will Appear

	RX-400 Unit 1 OPTION LOOKUP ircuits C3: Setpoints iane Setup C8: Stage Outs	DAT: 41 NAMES FULL C4: C9: Var Cap	C5: Inputs C0: MORE		11-30-09 @ OAT: 41 Use Ctrl-X to Select CX Tabs SETUP C1: General C2: Circuits C3: Setpoints C4: C6: Outputs C3: Stage Outs C6: Outputs C4: C6: Outputs C4: C7: General C3: Setpoints C6: Outputs C4: C7: Status C4: C6: Outputs C4: C7: Status C4: C8: Stage C4: C9: MORE C4:
Stage Setup Ty #1 : Co #2 : Dg	Option List Selectio Select: Description	Select	Oil Pres		Stage Setup Type Capacity Proof Oil Sensor Oil Dly Oil Pres #1 : Comp 4.0 No None #2 : DDL 5.0 No None
	Comp Unld US Dg tl CTdr	C U U D		→	•
Use Up-Down Arrow key F1: SELECT	ys or function keys to sele J F3: BEGINNING /		BACK. F5: Cancel		Scroll using Next/Prev keys Type of stage F1: PREV TAB \ F2: NEXT TAB \ F3: EDIT \ F4: LOOK UP \ F5: CANCEL



5. Open The **C9: Var Cap** Tab. Select the '*Dgtl Lower* %*' field and change value to 10.0 (Where * Refers To The Stage Number Assigned To The Digital Compressor On The Suction Group). Make Sure The '*Dgtl Period*' Is Set To 0:00:20.

6. Scroll Down To '**VAR STAGE OUT***' Press **F3: Edit** To Pull Up The "Press Desired Selection" Menu

11-30-09 67 Image: Constraint on the second	11-30-09 6 D RX-400 Unit 1 D DR1: 41 Jse Ctrl-X to Select CX Tabs SETUP MALES FULL C1: General C2: Circuits C3: Setpoints C4: C5: Inputs C6: Outputs C7: Stage Setup C8: Stage Outs EOF Unit eepo C0: HORE Enhanced Suction: EN SUC GRP01-RACK & E FMANCE SUCTION C0: HORE
Enhanced Suction: EN SUC GRP01-RACK B EMMANCE SUCTION Var Cap Value ACTIVE VAR CAP 1 ACTIVE VAR CAP 1 Introduction 1.1 Var Cap L Introduction 1 Introduction 1 </td <td>Uar Cap UaBoard Point ACTIVE VAR CAP : 1:1.1 VAR CAP CP L ACTIVE VAR 2: : : L Dgtl Lower 22 : 50.0 UAR STAGE OUT2 :</td>	Uar Cap UaBoard Point ACTIVE VAR CAP : 1:1.1 VAR CAP CP L ACTIVE VAR 2: : : L Dgtl Lower 22 : 50.0 UAR STAGE OUT2 :
Enter 0 to 100.0 [Lower variable capacity percentage F1: PREU TAB F2: NEXT TAB F3: EDIT F4: STATUS F5: CANCEL	Enter Board/Controller Hultiple variable capacity device outputs F1: PREV TAB F2: NEXT TAB F3: EDIT F4: LOOK UP F5: CANCEL

Select **1. Alternate I/O Formats.** This Brings Up The "Select Format For The Pointer", Choose **1 = Board : Point** and Enter The Analog Output Point That Controls The Digital Compressor Controller (i.e. 1:1, 1:2, 1:3, etc)

ACTIVE VAR % 2 Set Multi Dati Lower % 3. Output Cr	TUP TANES FULL points C4: C5: Inputs nor nuts F0: Uar Can C6: MORE d selection e 1/0 Formats hange Delta Alarm Setup Setup etup	Enhanced Su Uar Cap ACTIVE UAR CAP : 1 ACTIVE UAR % : Pgtl Lower Dgtl Perio UAR STAGE 1 = Boo 2 = Con		R9= Var Cap Co ICE SUCTION	L
Press menu number or scroll to selectio	ON F5: CANCEL	Press menu number or scrol	11 to selection		F5: CANCEL



7. Return To The Home Screen (Press). Go To The Main Menu (Press). Select 7. System Configuration. Select 2. Output Definitions.

11-30-09 🔹 📧	RX-400 Unit 1 RX DEV SUMMARY	â OAT: 41 ⁴₽-	45.90	1-30-09 🔹 🔟		RX-400 Unit 1 RX DEV SUMMARY	🗟 OAT: 41	1 <u>0:17:34</u>
A-23 R404	4A LT 18.3 [18.0]	Circuits State T		A-23 R40	4A LT 1	8.3 [18.0]	Circuits	State Temp
	MAIN MENU	ZER .Refr FD FRZ .Refr DEL FZ <mark>E</mark> Refr	-4.8 -2.5 4.5		SYSTEM	CONFIGURATION		.Refr -4.8 .Refr -2.7
0. 0.	S3 1. Suction Groups	CAKES .Refr	-4.9	S1 S2	S3 1. Input Def	initions		.Refr -6.0
ON ON	ON 2. Condenser Control	EAT .Refr ROST .Refr N EAT .Defr		ON ON	ON 2. Output De	finitions	EAT ROST EAT	.Refr -5.7 .Refr NONE .Defr 43.0
	 Circuits 		-5.7		3. System In	formation	MEAT	.Refr -5.8
	4. Sensor Controls	CREAM .Refr -			4. Remote Co	mmunications	CREAM	.Refr -6.4 .Refr -9.9
EN SUC GRP01	5 5. Configured Applications	FOOD .Refr	-8.0	EN SUC GRP01	⁵ 5. Alarm Set	up	CREAM Food	.Refr -7.8 .Refr -6.4
CONDENSE	6. Add/Delete Application	CREAM .Refr CREAM .Refr	-9.3 -8.3	CONDENSE	6. Logging S	etup	CREAM Cream	.Refr -8.8 .Refr -8.2
	7. System Configuration				7. Network S	etup		
Controlled By: D	8. Status Dis	trl Value VENT. 56.9 VENT NOTAC	Cmd OFF OFF	Controlled By:	8. Global Da Dis		trl VENT. VENT	Value Cmd 56.0 OFF NOTAC OFF
54 50 50 Fb		#2 EMER. VENT. 56.9	OFF		9. Licensing		VENT.	
F1 F2 F3 F4 ON		#2 EMERG VENT OFF A COLD H20 TMP 90.8	OFF OFF	F1 F2 F3 F4 ON ON			A COLD H20 TMP	0FF 0FF 86.0 0FF
Press menu numbe	er or scroll to selection			Press menu numb	oer or scroll to s	election		
	L)	, L						

8. Scroll Down To Select The Analog Output Point Connected To The Digital Compressor Controller. Press Enter and Select **5. Setup** From The Actions Menu. Modify The **'Low End Point'** and **'High End Point'** To 1.0 And 5.0 Respectively.

11-30-09 Press 'Lo		t' to Log	RX-400 Unit 1 On OUTPUT STATUS	🖻 OAT: 41	End 4	11-30-09 ● ⑦ □ RX-400 Unit 1 ᡚ OAT: 41 ANALOG OUTPUT NAMES FULL
Type 8R0 8R0 8R0 8R0 8R0 8R0 8R0 8R0 8R0 8R0	Brd 15 16 16 16 16 16 16 16	Poin* 7 8 1 2 3 4 5 6 7	Actions Menu 	- sociation IG SOLEMOID IG SOLEMOID IG SOLEMOID IG SOLEMOID IG SOLEMOID REFRIG SOLEMOID REFRIG SOLEMOID REFRIG SOLEMOID	Value OFF OFF ON ON ON ON ON ON	Board/Point # : 1.1 Point Name : 1.1 VAR CAP CP Output Type : USComp Select Eng. Units: PCT Default Value : NONE
8R0 8R0 8R0 8R0 8R0 8R0 8R0 8R0 8R0 4A0	16 17 17 17 17 17 17 17 17 17	7 8 1 2 3 4 5 6 7 8 1 2	D BR32LOPROF MT D BR32LOPROF MT D BR34LOPROF ORG D GRP1 IDCM BYP D GRP1 IDCM BYP D GRP2 IDCM BYP D GRP2 IDCM BYP - - - A EN SUC GRP01 A EN SUC GRP02	REFRIG SOLEMOID REFRIG SOLEMOID COMMAND OUT Command Out Command Out Command Out Command Out Command Out	0N 0N 0FF 0FF 0FF 0FF 10.0 PCT 100.0 PCT	Modify Output Equation Low End Point: 1.0 Low Eng. Units : 0 High End Point: 5.0 High Eng. Units : 100.0 OUERRIDE SETUP PRIORITY OUR : : : : Priority Override Timeout : 0:30 INPUT : RACK A&B :EN SUC GRP01 :ACTIVE VAR CAP
4A0 4A0	1 1 <u>enu numb</u>	2 3 4 er or scr	oll to selection		F5: CANCEL	Enter 0 to 10.0 Low End Value



9. Return To The Suction Group Page And Remove The Compressor Override (Type "No" After '*In Override'*)

	AT: 37 8:53: S FULL	1-38-89 • 🤗 📧		DAT: 42 Es Full	_
Enhanced Suction Group Names	[39.0]	Enhanced Suction Group Name GRP01 (NORM	· <u>-</u> -	- [4 7	.0]
Stages Cap Sta #1 : Comp 15.0 #2 : Comp 7.0 #3 : Comp 15.0 #4 : Comp 15.0 #4 : Comp 15.0	Control Status Shutdown Condensor R1 CONDENSER	I	Override Update (A&B :GRP01 (NORMAL):STAGE) Override : NO perride Time : 0:00:00	0072	
	-General Information	0	verride Value: NOTACT	Sat Suct Tem Rack Failure	
Press menu number or scroll to selection	Capacity : Capacity % : F5: CANCEL	Enter State: Use Next/Prev F1: SELECT 人	keys		: 0 : 0



Wiring for Intelligent Store Discus v2.x

If installing Discus digital on an Intelligent Store Discus v2.x compressor the only wiring needed after head and valve plate change is connecting the unloader wire connections found in the Intelligent Store Discus wiring harness. To connect, remove the pressure switch cover and connect the unloader wires (yellow) found in the wiring harness to the solenoid coil. Replace the pressure switch cover. See **Figure 12**.

Programming The E2 for Intelligent Store Discus Digital

When using with ISD v2.x, E2 v2.6 or newer must be used. Update E2 firmware if necessary. An analog output point is not needed on the controller. Communication is done through the RS485 communication cable.

Note! The digital compressor should be set as one stage in the E2. If upgrading from Copeland Moduload, you will need to delete the extra unloader stage set up accordingly in the suction group.

Note! These instructions are based on E2 v2.6

These are suggested E2 instructions based on Emerson's experience. There may be more than one

way to properly program the E2 for Intelligent Store Discus Digital. Use Checklist #3 to verify the digital is being controlled properly.

In order to program the E2 for Copeland Discus Digital using the digital compressor controller you will perform the following steps:

- 1. Establish the E2 control and communication SEND link
 - a. Override compressor OFF
 - b. Identify the compressor stage as a digital compressor
- 3. Establish the ISDv2.x communication RECEIVE link
 - a. Setup unloader control in ISDv2.x and define unloader control type as digital
 - b. Define digital controller, application and property inputs
 - c. Disable compressor override

On the following pages you will see screen shots taken from the E2 to perform the above steps.

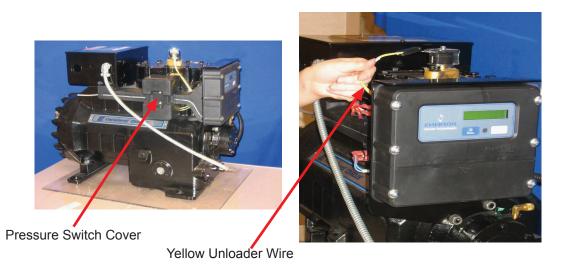
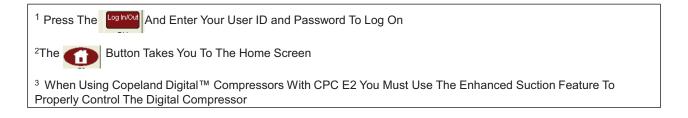


Figure 12 Intelligent Store Discus v2.x Wiring



1. After Logging Into¹ The E2, From The Home Screen² Press **F1: Suction** To Arrive At the '**Summary For Suction Groups and Enhanced Suction**' **Screen**. Select The Enhanced Suction³ Group That Has The Digital Compressor Installed.

10-15-09 ● 73 ₪ Press 'Log In/Out' to Log Or	RX-400 Unit 1 RX DEV SUMMARY	ß 15:06:16	10-15-09 • 🕜 🗐 Press 'Log In/Out'	to Log (X-400 Un SUMMAR		Â			15:06:49
EN SUC GRP01	21.7 [22.0]		Sunn	nary For	Suction	Groups	and Enh	nanced Su	ictior	1	
S1	CAP 08		Name SUCTION GRP01 EN SUC GRP01	Suct 21.7	22.0	Ctl Tmp	Temp S NONE NONE			100	Status OK OK
Req Act NO											
SUCTION GRP01 [22 Cap 1											
CHP	002										
Press enter for a list of a	ctions.		Press enter on des	ired app	licatio	n for st	atus.				
F1: SUCTION		F5: SETUP								F	5: SETUP
F1 F2 F3	F4 F5		F1 F2	F3		F4	F5				
	F9 F10	F11 Shift +; .	? F6 F7	G F8		F9	F10			Prev Shift + 3	Next

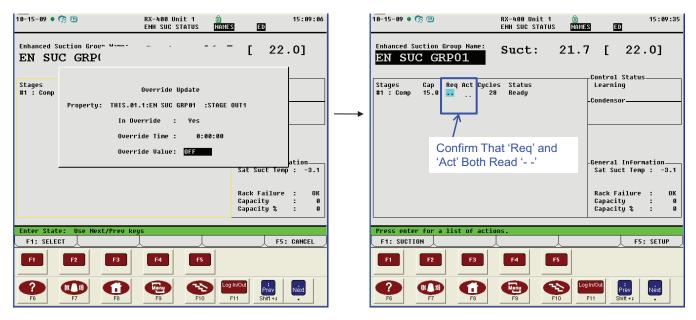




2. Scroll Down And Highlight The Compressor That Contains The Digital Unloader And Press Enter To Show The 'Actions Menu'. Select **Override** And Press Enter.

10-15-09 • 7 m Press 'Log In/Out' to Log On ENH SUC STATUS	15:07:22	10-15-09 • 🝘
Enhanced Suction Group Name: Suct: 21. EN SUC GRPO1 Stages Cap Red oct Cycles Status H1 : Comp 15.0 28 Ready	7 [22.0] Control Status Learning Condensor	Enhanced Suction Group Manner EN SUC GRP(Stages Cap Req #1 : Comp 15.0 • S Setup 6. Detailed Status 8. Application Logs/Graphs
Highlighted Box Below 'Req' Indicates The Stage Is Selected	-General Information Sat Suct Temp : -3.1 Rack Failure : OK Capacity : 0 Capacity % : 0	-General Information Sat Suct Temp : -3.1 Rack Failure : OK Capacity : O Capacity % : O
Press enter for a list of actions.	F5: SETUP	Press menu number or scroll to selection F5: CANCEL
		F1 F2 F3 F4 F5
P P P P P F6 F7 F8 F9 F10 F10	og In/Out F11 Shift + ; .	Product Product <t< td=""></t<>

The 'Override Update' Window Will Appear. <u>Type</u> "YES" in The In Override Space and <u>Type</u> "OFF" Where It Shows Override Value. You Do Not Need To Change The Override Time. Press Enter To Return To the Suction Group Summary Screen.





3. Press **F5: Setup** To Enter the 'Setup' Screen. Advance To **C7: Stage Setup.** Select The Compressor Stage With Digital Installed, Press **F4: Look Up** To Show The 'Options List Selection' Window.

10-15-09 0 (7) 00 RX-400 Unit 1 (1) 15:09:52 Use Ctrl-X to Select CX Tabs SETUP NALLSS ED	10-15-09 • 77 💷 RX-400 Unit 1 👜 15:10:06
Di: General C2: Circuits C3: Setpoints C4: C5: Inputs C6: Outputs C7: Stage Setup C8: Stage Outs C9: C0: MORE	Tabs C1: General C2: Circuits C3: Setpoints C4: C5: Inputs C6: Outputs C7: Stage Setup C8: Stage Outs C9: C0: MORE
Enhanced Suction: EN SUC GRP01	Enhanced Suction: EN SUG GRP01
General Ualue Name : Long Name : Strategy : Number - Stages: 1 Refrigerant : R22 Phase Protect Phase Protect : Comp On Always: : No Comp On Reclaim: No : Enable Float :	Stage Setup Type Capacity Proof Oil Sensor Oil Dly Oil Pres #1 : BODD 15.0 Yes None
	Use F1: PREV TAB or F2: NEXT TAB To Navigate Between Tabs
Enter desired text Name of this suction group	Scroll using Mont/Prov koys Type of stage
F1: PREV TAB F2: NEXT TAB F3: EDIT F4: STATUS F5: CANCEL	F1: PREV TAB F2: NEXT TAB F3: EDIT F4: LOOK UP F5: CANCEL
	F1 F2 F3 F4 F5
Provide Provide <t< td=""><td>P6 P7 P8 P9 P10 P11 P11 Next</td></t<>	P6 P7 P8 P9 P10 P11 P11 Next

Select **Dgtl** By Typing "D." This Will Return You To the Stage Setup Screen.

10-15-09 🔹 🤭 🖲	D RX-400 L Option L		15:10:21 ED	10-15-09 • 😚 🛛 Use Ctrl-X to S		RX-400 Unit 1 SETUP	岗 NAMES E	15:10:34 D
C1: General	C2: Circuits C3: Setp		C5: Inputs	C1: General	C2: Circuits	C3: Setpoints	C4:	C5: Inputs
C6: Outputs	C7: Stage Setup C8: Stag	e Outs C9:	CO: MORE	C6: Outputs		C8: Stage Outs		CO: MORE
Stage Setup #1		Selection	ly Oil Pres	Stage Setur #1		d Suction: EN SU y Proof Oil S Yes None		Oil Pres
	Select Description	:: Select						
	Comp	C						
	Unld VS	U V						
	Dgtl CTdr	D						
	Ciui	•						
			J					
Use Up-Down Ar	row keys or function keys	to select entry.	Press BACK.	Scroll using H	Next/Prev keys	Type of stage		
F1: SELECT	F3: BEG	INNING F4: END	F5: CANCEL	F1: PREV TAB	F2: NEXT TAB	F3: EDIT	F4: LOOK UP	F5: CANCEL
F1 F1	2 F3 F4	F5		FI	F2 F3	F4	-5	
1 F6		F10 F11	Prev Shift + 3	? F6	F7 F8			Prev Next Shift +;



4. Press The Home Key To Return To The Home Screen. A Window Will Pop Up Notifying That Changes Were Made To The Application Type "**Y**" To Confirm You Would Like To Continue. The Home Screen Should Show DGTL 0%

10-15-09 ● ⑦ □□ RX-400 Unit 1	10-15-09 • 🕼 🔟 RX-400 Unit 1 💩 15:11:47 RX DEU SUHMARY NAMES ED
C1: General C2: Circuits C3: Setpoints C4: C5: Inputs C6: Outputs C7: Stage Setup C8: Stage Outs C9: C0: MORE	EN SUC GRP01 21.7 [22.0]
Enhanced Suction: EN SUC GRP01	
Stage Setup Type Capacity Proof Oil Sensor Oil Dly Oil Pres #1 : Dot 15.0 Yes None	DGTL 0% CAP 0%
Changes to this application will be saved. Do you wish to continue and exit this screen? Press Y=Yes or N=No	SUCTION GRP01 [22.0] STAGES: 1/ 1 CAP 100%
Scroll using Next/Prev keys Type of stage	Press enter for a list of actions.
F5: CANCEL	F1: SUCTION F5: SETUP
F1 F2 F3 F4 F5	F1 F2 F3 F4 F5
Image: Product of the second	Provide Provide <t< td=""></t<>

----Communication SEND Link Is Now Established----

5. Press The Menu Button () To Bring Up The 'Main Menu.' Select **Configured Applications.** This Produces The 'Configured Applications' Window, Select **ISD 2.0**

10-15-09 🔹 🧖 🔟	RX-400 Unit 1 🕅	15:12:11	i 1	 10-15-09 • 😚 🔟	RX-400 Unit 1	â 15:12:34
18 19 89 • (79 00	RX DEV SUMMARY				MAIN MENU	NAMES ED
EN SUC GRI	201 21.7 [22.0]			EN SUC GRP01		
DGTL 08 S1 Req Act NO SUCTION GRP01	HAIN MENU 1. Suction Groups 2. Condenser Control 3. Circuits 4. Sensor Controls 5. Configured Applications 6. Add/Delete Application 7. System Configuration 8. Status				Configured Application: 1. Suction Groups 16. Logging Groups 90. Global Data 104. ISD 2.0 [22.0] STAGES: 1/ 1 100%	5
Press nenu number		INQU Prey Next 11		Press menu number or st F1 F2 F2 F5 F7 F7	F3 F4 F5 F3 F4 F5 F5 F3 F1	F5: CANCEL



6. The 'Summary of ISD 2.0 Compressors' Screen Will Come Up. Select The ISD Compressor You Have Upgraded To Discus Digital. Press Enter To Show The ISD Compressor Summary Screen. Press **F5: Setup** To Proceed To The Setup Screen. Go To **C2: Setup** Tab.

10-15-09 ● 🤗 💷 RX-400 Unit 1 💩 15:33:53 Press 'Log In/Out' to Log On ISD2 Compressor 🗊	10-15-09 ● ⑦ ──
ISD 2.0 Compressor TSD2 COMPOOL Req In: Act Out: OFF OFF [21.7] Devision : 1.16F04 Sens Mod Rev : 1.12F01 Bus Address : 000 time Alarn Status: Display Code: Confirm That Req In: C: and Act Out Both Read "OFF" or "" RUN STATUS Comp Run Time : 0 Comp Run Time : 0 Comp Starts : 0	C1: General 1922 Status C3: Inputs C4: Dutputs C5: ISD Out; C6: Device C7: ID Config C8: Alarms C9: Alarm Out C8: MORE ISD 2.0: ISD2 COMPOSI Setup Value Unider 1 Enable: Disabled Unider 2 Enabled Unider 2 Enabled Unider 4 Enable: Disabled Unider 5 Enabled Control: Enabled C7: Ankcase Alg Control: Enabled C7: Ankcase Alg C0: MORE MCC Value 1: 80.0 Comp Frequency: 60 Language Selt: English Volt Imb Set 5%
Press enter for a list of actions. F1: SUCTION F5: SETUP	Scroll using Next/Prev keys Unloader 1 Enabled F1: PREV TAB F2: NEXT TAB F3: EDIT F4: LOOK UP F5: CANCE
Image: Product of the second	Provide Provide <t< td=""></t<>

7. Move The Cursor To "Unldr 1 Enable" Press The Next Button () To Change From 'Disabled' To '**Enabled**.' Do The Same With "Unldr 2 Enable" if using blocked suction on middle of 6D or if using with Copeland Demand Cooling, otherwise leave Unldr 2 Enable set to "Disabled." Change The "Unlder Mod Type" To '**Digital**' Again By Pressing The Next Button. When Finished Go To The **C3: Inputs** Tab

10-15-09 • (*) (*) (*) (*) (*) (*) (*) (*	 10-15-00 € 7 0 15:37:36 Use Ctrl-X to Select CX Tabs SETUP MANES ED Ct: General C2: Setup (C: Inducs C4: Outputs C5: ISD Outs C6: Device C7: ID Config C8: Alarms C9: Alarm Out C0: MORE ISD 2.0: ISD2 COMP001 Inputs Board Point CAPCITY REQ IN : : COMP LOCKOUT IN: : : ALARM RESET IN : : CRMKISS HEAT IN : : RESET REQ IN : : SAT SUCT TEMP : THIS.01.1:EN SUC GRP01 :FAT SUCT TEMP SUCTION PRES IN: THIS.01.1:EN SUC GRP01 :FILTERED PRES DGTL PERIOD IN : :
Scroll using Next/Prev keys Unloader Hodulation Type F1: PREU TAB F2: NEXT TAB F3: EDIT F4: LOOK UP F5: CANCEL F1 F2 F3 F4 F5 F4 F5 F2 F3 F4 F5 CogNUCA F: Prev Next F6 F7 F8 F9 F10 F11 Prev Next	Enter Board/Controller Digital Capacity Request F1: PREU TAB F2: NEXT TAB F3: EDIT F4: LOOK UP F5: CANCEL F1 F2 F3 F4 F5 F4: Loog Prood F9: F8: F8: F9: F8: F9: F8: F1: F1: F8: F1: F1:



8. Move The Cursor To "Capcity Req In". Press **F3: Edit.** In The New Window, Select **Alternate I/O Formats**

10-15-09 ● ⑦ Ⅲ RX-400 Unit 1	1	10-15-09 ● (⑦ Use Ctrl-X to Select CX Tabs	RX-400 Unit 1 🙆 SETUP NAMES	15:37:56
C1: General C2: Setup C3: Inputs C4: Outputs C5: ISD Outs	•	C1: General C2: Setup	C3: Inputs C4: Output	
C6: Device C7: ID Config C8: Alarms C9: Alarm Out C0: MORE			1 C8: Alarms C9: Alari	
ISD 2.0: ISD2 COMP001 Inputs Board Point CAPCITY REQ IN : COMPLOCKOUT IN: ALARM RESET IN : CRNKCSE HEAT IN: RESET REQ IN : SAT SUCT TEMP : THIS.01.1:EN SUC GRP01 :SAT SUCT TEMP SUCTION PRES IN: THIS.01.1:EN SUC GRP01 :FILTERED PRES		Pr Inputs CAPCITY REQ IN : 1. COMP LOCKOUT IN: ALARM RESET IN : 4. CRNKCSE HEAT IN : 5. RESET REQ IN : 5. SAT SUCT TEMP : 1 7. SUCTION PRES IN: 1 7.	ess desired selection Alternate 1/0 Fornats Set Witiple Outputs Output Change Delta Generic Alarn Setup Logging Setup Bunass Setup	EMP
DGTL PERIOD IN : :		DGTL PERIOD IN :		
Enter Board/Controller Digital Capacity Request		Press menu number or scroll	to selection	
F1: PREV TAB F2: NEXT TAB F3: EDIT F4: LOOK UP F5: CANCEL				F5: CANCEL
F1 F2 F3 F4 F5		F1 F2 F3	F4 F5	
Image: Product state Image: Pr		2 F6 F6	F9 F10 F1'	Prev Next

9. Type "2" To Select The **Controller : Application : Property** Format For The Pointer. With The Cursor In The Controller Field Of "Capcity Req In" Press **F4: Look Up**. Select the Controller From The 'Controller Selection' Window.

10-15-09 ● ⑦ Ⅲ RX-400 Unit 1	·	10-15-09 🔹 🎲 🔟	RX-400 L Cntrollef	LOOKUP N	<u>rames</u> ed	
C1: General C2: Setup C8: Incuts C4: Outputs C5: ISD Outs C6: Device C7: ID Confin C8: Alarms C9: Alarm Out C0: MORE			: Setup C3: Inpu			C5: ISD Outs
C6: Device C7: ID Ennfin FR: Alarms F0: Alarm Out C0: MORE Inputs CAPPITY REQ IN : COMP LOKOO COMP LOKOO CARANKOSE HE CRNKCSE HE RESET REQ 1 = Board : Point SAT SUCT T 2 = Controller : Application: Property SUCTION PR 3 = Fixed Value DGTL PERIO Press desired selection Press menu number or scroll to selection	→	Inputs CAPCIT COMP L ALARM CRNKCS RESET SAT SU SUCTIO DGTL P	11.01 TSD 2.0 Comp	election Bus Su ETH MOD	Board#/ ubnet Node	
F5: CANCEL			keys or function keys			i
		F1: SELECT	F3: BEG		F4: END	F5: CANCEL
		F1 F2	F3 F4	F5		
Prev Prev Prev Not F6 F7 F8 F9 F10 F11 Stift + 3 •		6 1 1 1 1 1 1 1 1 1 1	F 8 F 9	F10		ift +;



Move the Cursor To The Application Space. Press **F4: Look Up** And Select The Suction Group Application The Digital Is On. Next Move The Cursor To The Output Space And <u>Type</u> "VAR STAGE OUTX" Where X Represents The Stage Number Of The Digital Compressor.

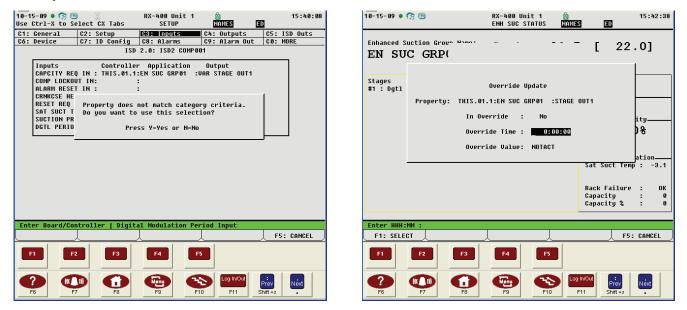
10-15-09 🔹 🌠 🛛	<u>m</u>	RX-400 Unit 1 CELL LOOKUP	I NAMES	15:36:07 ED	10-15-09 • 🤭 (Use Ctrl-X to 3		RX-400 Unit 1 SETUP	A NAMES E	15:38:53
C1: General		C3: Inputs	C4: Outputs	C5: ISD Outs	C1: General	C2: Setup	C3: Inputs	C4: Outputs	C5: ISD Outs
Có: Device	C7: ID Config	C8: Alarms	C9: Alarm Out	C0: MORE	Có: Device	C7: ID Config	C8: Alarms	C9: Alarm Out	CO: MORE
Inputs CAPCITY RE COMP LOCK ALARM RESS CRNKCSE HE RESET REQ SAT SUCT I SUCTION P DGTL PERIO	UT IN: DUT IN: T IN: APP1/Poin T IN: IN: TIME SERU IN: GLOBAL DA RES IN: SUCTION G	ICES Time Se TA Global RP01 Suction P01 Enhance	rvices		 Inputs CAPCITY RI COMP LOCK ALARM RESI CRNKCSE HI RESET REQ SAT SUCT	Controlle Controlle EQ IN : THIS.01.1 DUT IN: ET IN : EAT IN: IN : EMP : THIS.01.1 EENP : THIS.01.1 EES IN: THIS.01.1	2.0: ISD2 COMP r Application :EN SUC GRP01 : : : : : : : : : : : : :	001 Output SAT SUCT TEMP	
Use Up-Down Ar F1: SELECT	row keys or funct:	ion keys to se F3: BEGINNING		SS BACK. F5: CANCEL	Enter Propert	, Digital Capac	ity Request	1	
TT. SELECT		ra. BEGIMAING	<u> </u>	TO GHINGEL	F1: PREV TAB	F2: NEXT TAB	F3: EDIT	F4: LOOK UP	F5: CANCEL
F1	F2 F3	F4	F5		F1	F2 F3	F4	F5	
	F7 F8	F9	F10 F11	Prev Next Shift +;		P 7 F 8			Prev Next

10. Move The Cursor Down To "Dgtl Period In" Follow The Same Steps As Before To Edit The Format Of The Input (Use **F3: Edit** and **F4: Look Up** Features). In The Output Space Type "DGTL PERIOD".

10-15-09 ● ⑦ □ RX-400 Unit 1	10-15-09 • 🕜 💷 RX-400 Unit 1 💩 15:35:14 Use Ctrl-X to Select CX Tabs SETUP NAMES ED
C1: General C2: Setup C3: Inputs C4: Outputs C5: ISD Outs C6: Device C7: ID Config C8: Alarms C9: Alarm Out C0: MORE	C1: General C2: Setup C3: Inputs C4: Outputs C5: ISD Outs C6: Device C7: ID Config C8: Alarms C9: Alarm Out C0: MORE
ISD 2.8: ISD2 COMP801	ISD 2.0: ISD2 COMPOOL
Inputs Controller Application Output CAPCITY REQ IN : THIS.01.1:EN SUG GRP01 :UAR STAGE OUT1 COMP LOCKOUT IN: : ALARM RESET IN : : CRNKCSE HEAT IN: : RESET REQ IN : : SAT SUCT TEMP : THIS.01.1:EN SUC GRP01 :SAT SUCT TEMP SUCTION PRES IN: THIS.01.1:EN SUC GRP01 :FILTERED PRES DGTL PERIOD IN : THIS.01.1:EN SUC GRP01 :	Inputs Controller Application Output CAPCITY REQ IN: COMPLOCKOUT IN: ALARM RESET IN CENNCES HEAT IN SAT SUCT TEMP SUCTION PRES IN: DGL PERIOD IN: THIS.01.1:EN SUC GRP01 SUCTION PRES IN: CHINCS HEAT IN: SAT SUCT TEMP SUCTION PRES IN: CHINCS CRP01 SUCTION PRES IN CHINCS CRP01 S
	T Controller And Application Should Remain The Same For All Inputs.
Enter Property Digital Modulation Period Input F1: PREV TAB / F2: NEXT TAB / F3: EDIT / F4: LOOK VP / F5: CANCEL	Enter Board/Controller Digital Capacity Request F1: PREV TAB F2: NEXT TAB F3: EDIT F4: LOOK UP F5: CANCEL
F1 F2 F3 F4 F5 (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (***) (**) (***)<	F1 F2 F3 F4 F5 C2 K000 C100 C000 C000 <thc000< th=""> <thc000< th=""></thc000<></thc000<>



After Establishing The Digital Inputs, Press The Home Key To Return To The Home Screen. A Warning Will Pop Up Saying The Property Does Not Match The Category Criteria. Type "Y" For Yes To Use This Selection. Finally Disable The Override (Refer Back To Step 1) Change The "In Override" Field To '**No**' And Use The Stair Step Key To Back Out



--The ISDv2.x Communication RECEIVE Link Is Now Established--

18-15-89 🔹 🎲 🎟	RX-400 Unit 1 ENH SUC STATU	A S NAMES	ED	15:43:40
Enhanced Suction Group Name: EN SUC GRP01	Suct:	22.8	[22	. 0]
Stages Cap Req Act Cycl #1 : Dgtl 15.0 ON 2	es Status 18 Ready	L -Co -Va -Ge	ntrol Stat earning ndensor riable Cap 100. neral Info at Suct Ten	acity 08
Press enter for a list of acti	ons.	C	ack Failur apacity apacity %	: 15.0
F1: SUCTION	Ϊ	<u> </u>	F	5: SETUP
F1 F2 F3	F4	F5		
P P P F6 F7 F8	F9	F10 F11	Prev Shift +;	Next •

For more detailed information on programming the E2, refer to the E2 User manual found at http://www.emersonclimate.com/Documents/026-1610.pdf



Warranty Information

Emerson Climate Technologies, Inc. warrants its Digital Compressor Controller to be free from defects in materials and workmanship under normal use for a period of one year from the date of purchase or twenty months from manufacture whichever comes first. During this period, Emerson Climate Technologies, Inc. will replace any defective module without charge.

This warranty is valid for the original purchaser from the date of initial purchase and is not transferable. Keep the original sales receipt. Proof of purchase is required to obtain warranty replacement. Dealers or service centers selling this product do not have the right to alter, modify or in any way change the terms and conditions of this warranty.

This warranty does not cover normal wear of parts or damage resulting from any of the following: negligent use or misuse of the product, use on improper voltage or current, use contrary to the operating instructions, disassembly, repair or alteration by anyone other than Emerson Climate Technologies, Inc.. Further, the warranty does not cover acts of God, such as fire, flood, hurricanes and tornadoes. EMERSON CLIMATE TECHNOLOGIES, INC. MAKES NO IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE WITH RESPECT TO THE Copeland Digital Compressor Controller.

Emerson Climate Technologies, Inc. shall not be liable for any incidental or consequential damages caused by the breach of any express or implied warranty. Some states, provinces, or jurisdictions do not allow the exclusion or limitation of incidental or consequential damages or limitations on how long an implied warranty lasts, so the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights that vary from state to state, or province to province.

Units under warranty and in need of repair should be returned to an authorized wholesaler or original equipment manufacturer.

Support

For more information visit **www.EmersonClimate. com** or contact Emerson Climate Technologies, Inc. at 1-888-EMR-9950.



AE4-1357 R7

APPENDIX

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Upgrade Kit Piece Description

1 & 2	Head Service Kit
3	3D Discus Digital Valve Plate Kit
4	IDCM Module Kit/ Copeland Digital Compressor Controller
5	Tall Fan Bracket
6	Sensor Temp Probe Kit
7	Solenoid Coil Kits
8	24V Transformer
9	Instructional Sheets

Β

Head Service Kit - Included in the head kit, the 3D digital head has four individual pistons built inside the bottom of the head and a solenoid valve mounted on top of the head. One of the four pistons will stick out farther than the other three. This is intentional. DO NOT REMOVE PISTONS FROM INSIDE HEAD! Handle the cylinder head carefully, so as not to damage either the solenoid valve stem or the individual unloader pistons.

The head kit contains the Discus Digital cylinder head, the digital head gasket, four valve plate gaskets (one gasket for each 3D bore size) and the gaskets and seals for the discharge/flange adapter.

Discus Digital Valve Plate - Like the cylinder head, the valve plate is unique to Discus digital. It has four ports that are blocked and unblocked by the unloader pistons in the head when modulating takes place.

The valve plate kit contains the Discus digital valve plate (either for low temperature (LT) or medium temperature (MT) based on the kit selected), a head gasket, and four valve plate gaskets (one gasket for each 3D bore size).

Note! In the upgrade kits you will notice you have multiple gaskets. You will only need one valve plate gasket and one head gasket per compressor upgrade. This will be described in more detail in **Copeland Discus/Intelligent Store Discus v2.x to Copeland Digital Head and Valve Plate Conversion** found on Page 3 of this bulletin.

Note! To ensure your digital compressor operates correctly, the valve plate gasket and head gaskets are designed specifically for Copeland Discus Digital. <u>Make sure you install only the provided head and valve plate gaskets (in upgrade kit and/or select fit valve plate gasket kit)</u> when upgrading your compressor to Discus digital.

Tall Fan Bracket -

Because the solenoid valve stem makes the compressor assembly slightly taller, you may need to replace the existing head fan bracket to accommodate the height change. Therefore, in each of the low temperature upgrade kit you will find the taller fan bracket that has traditionally been used with Copeland Moduload compressors.

Copeland

IDCM Module Kit/ Copeland Digital Compressor Controller - The Copeland Digital Compressor Controller (formerly IDCM) is used to convert a demand signal from the master controller to a 1-5V signal to properly energize and de-energize the solenoid coil on a non-ISDv2.x compressor. Included with digital compressor controller is a 5 kOhm, 1 Watt resistor. This resistor is for use in <u>low</u> temperature applications requiring Demand Cooling only and is used to bypass the discharge temperature protection feature in the digital compressor controller to allow the Demand Cooling module to properly protect against high discharge temperature. The Application Engineering Bulletin (AE8-1328) for the digital compressor controller is included in your upgrade kit, but is also available online at www.emersonclimate.com.

Sensor Temp Probe Kit - The non-ISD digital upgrade kits each contain a special discharge temperature probe that connects to the digital compressor controller. If upgrading on ISDv2.x you will need to remove the existing probe from the current compressor head and install into the new digital cylinder head. This is covered in more detail on Page 5.

Note! If installing Discus Digital on a compressor using Copeland Demand Cooling use the discharge temperature probe from the current compressor head, not the probe included in your upgrade kit!

Solenoid Coils (available for 24V,120V, 220V) - Included in each of the upgrade kits you will find one or two solenoid coils. If upgrading on an ISDv2.x compressor, your kit will only contain the 24V solenoid coils. Non-ISDv2.x kits will contain 120V and 220V coils. In addition to the 120V and 220V solenoid coils, a special bracket and screw are included to attach the conduit to the coil. You will also need to insert the coil wires through protective conduit per UL high voltage requirements. There is a conduit connector also included to connect the bracket to the conduit. Because wiring lengths will vary, conduit was not included in the Discus digital upgrade kits.

Note! These coils were specifically designed for high-cycle life. Any other coil is not approved for use with Discus digital!

24V Transformer - A 24V transformer is included in each of the Non-ISDv2.x kits to power the digital compressor controller.

Instructional Sheets - The digital upgrade kits include this bulletin along with additional instructional documentation for the Copeland Digital Compressor Controller where applicable. This information and more product information on Emerson Climate Technologies products can be found on the Online Product Information website at www. emersonclimate.com.



Copeland

Functionality Checklists

EMERSON

Climate Technologies

Checklist #1 (After Head and Valve Plate Conversion)

□ Valve Plate And Head Gasket Tabs Are Oriented At The Oil Pump End With Part Numbers On Top

F

- Bolts (Including Solenoid Valve Bolts), Temperature Probe And Pressure Connections Are All Properly Torqued
- All Valves To The Compressor Are Open

Β

- Head Fan (If Installed) Is Properly Wired In The Terminal Box
- Leak Check Performed

Checklist #2 (After Wiring The Solenoid Coil and Digital Compressor Controller (if equipped) Into The Control Circuit)

- □ Verify Solenoid Coil Voltage Is The Same As Contactor Coil Voltage When Using The Digital Compressor Controller
- ☐ If Using ISD v2.x, The Solenoid Coil Is 24V.
- □ Verify That All Wire Connections Are Correct And Secure

Checklist #3 (After Programming The E2 and Starting The Compressor)

Non-ISD/With Digital Compressor Controller

- □ Verify That There Is 24V At The Digital Compressor Controller (24VAC, 24COM) Connection
- □ Verify That Sentronic[™] Oil Protection Is Operational

Green Light Should Be On When Compressor Is Running

Unplug The Oil Pressure Transducer. The Compressor Should Shut Off In Approximately Two Minutes And Light On Sentronic Will Turn Red

- □ Verify That Control Circuit Panel Switch Will Shut Off 24V Transformer For The Digital Compressor Controller
- Check To See If Unloader Solenoid Coil Is Energized When Yellow Unloader Light On Digital Compressor Controller Is On
- Compressor Amp Reading Changes When The Compressor Unloads
- Voltage Across Terminals C1 And C2 On Digital Compressor Controller Should Be Between 1 And 5 VDC

ISDv2.x

Amp Reading On Control Module LCD Changes When The Compressor Unloads

Note! At Lower % Load Conditions, The Compressor May Unload And Load Quicker Than The LCD Screen Updates. May Need To Use Ammeter To Read Compressor Amperage



Optimizing your System with Discus Digital

When applying digital in a multiple compressor application, please consider the following to optimize system performance: (1) compressor staging with respect to Discus Digital, (2) raising your suction pressure setpoint and (3) minimum digital capacity.

Compressor Staging

In an upgrade situation, enhanced performance will result from installing Discus Digital. However; if you have multiple 3D Discus compressors (with serial number of 99C or newer) to choose from, performance can be optimized by applying the following guideline:

Compressor Selection Guideline (from Pages 5 and 6 of AE-1355)

To ensure smooth and continuous modulation, selection of the digital and non-digital compressor capacities can be made according to the following rule.

Rule: For optimum suction pressure control, the following guideline is recommended in the selection of Discus digital and fixed compressors, per suction header:

- D > F1
- F2 < D+F1
- F3< D+F1+F2
-
- FN<D+F1+2+....FN-1

In the above equations, D is digital Discus capacity or horse power, F1,...FN are the standard Discus compressor capacity or horse power. The compressor selected should be the smallest compressor capacity that still covers all the gaps between steps to ensure the most efficient system control.

Note! For best results, the digital compressor needs to be the lead compressor. It must be the first compressor on and last compressor off in multiple compressor applications.

Exam	ple	#1
LAGIII	hie	πι

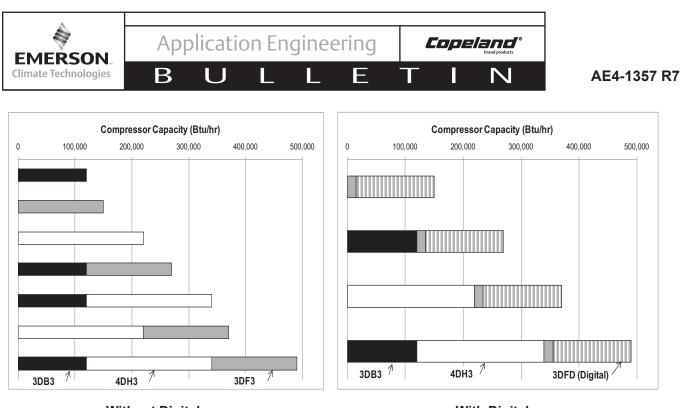
Cooling	Digital	Fixed	Fixed	Fixed	System
Demand (HP)	(HP)	(HP)	(HP)	(HP)	Output (HP)
Load = 0	OFF	OFF	OFF	OFF	0
10.10 < Load < 17.50	0.10 - 10	7.5	OFF	OFF	10.10 17.50
17.10 < Load < 25	0.10 - 10	7.5	7.5	OFF	17.10 25
23.10 < Load < 31.50	0.10 - 10	7.5	7.5	7.5	23.10 31.50

Example #2

Consider the following suction group (the approximate compressor capacity at the ARI rating point is listed next to the compressor model number):

- 1. 3DB3R12ML-TFD (120,000 BTUH)
- 2. 3DF3R15ML-TFD (150,000 BTUH)
- 3. 4DH3R22ML-TFD (220,000 BTUH)

Based on the above guideline, the second compressor should be upgraded to Discus digital. The figures on the following page show both the staging with and without digital; each box represents a compressor stage. The digital compressor is indicated by the box with vertical cross-hatching for the variable capacity control from 10-100%.



Without Digital

With Digital

Raised Suction Pressure Setpoint

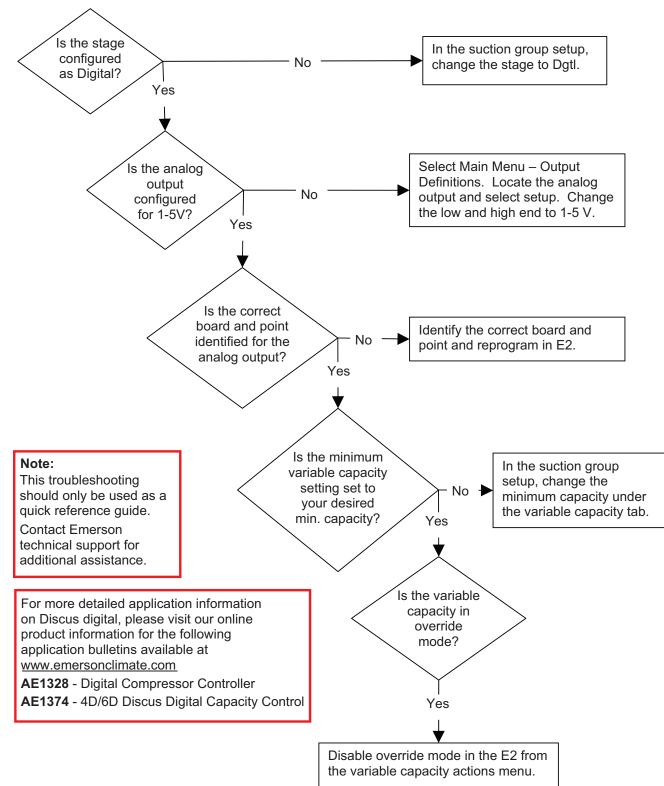
With Copeland Discus Digital, suction pressure can be controlled much tighter. By eliminating large pressure swings and improving case temperature control, there is often the opportunity to raise suction pressure set points. Compressors running at higher suction pressures run more efficiently and theoretically should increase system efficiency approximately 2% per pound of raised suction pressure.

Minimum Percent Digital Capacity

Copeland Discus Digital is designed to run all the way down to 10% compressor capacity. An unloaded compressor has a lower overall efficiency compared to a fully loaded compressor because the compressor motor is still running but not pumping. To improve your system's efficiency the minimum percent digital capacity can be adjusted in your rack controller to a higher percent digital capacity (e.g. 50% minimum capacity). However, a higher minimum capacity will negatively affect suction pressure control and increase overall compressor cycling versus allowing the digital compressor to modulate down to 10% full load compressor capacity.









Troubleshooting Guide - Digital Compressor Controller

