



December 2012

# Upgrade Procedures for Parallel Applications Using Digital Capacity Control for Copeland<sup>™</sup> and Intelligent Store Discus<sup>™</sup> Refrigeration Compressors (for 4D & 6D Discus)

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## Introduction

There are three main steps in the Copeland Discus Digital<sup>™</sup> 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<sup>™</sup> 4D & 6D Discus<sup>™</sup> compressors can be retrofitted for enhanced modulation performance. Once a Copeland 4D or 6D Discus compressor is upgraded to Discus digital<sup>1</sup>, the compressor can unload up to 33 or 67% on a 6D or 50% on a 4D, 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 v2.1 digital compressors.

<sup>1</sup>6D Digital is only available with Emerson's Intelligent Store Discus v2.1 and newer.

### Requirements

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 4D or 6D compressor is less than 4 years old, then the Discus compressor can be upgraded to a digital with the recommended retrofit kit. A 6D compressor must be equipped with CoreSense Diagnostics to utilize a digital 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. If upgrading to digital on an Intelligent Store Discus (ISD) compressor. The ISD must be hardware version 2.1 or newer to be compatible with 4D or 6D Digital. For more details on ISD v2.1, refer to engineering bulletin **AE8-1368**.

### **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 4D or 6D 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
  - Pipe Sealant
- Gasket Scraper
- Hammer
- Adjustable Wrench
- Pliers
- · Assembly Oil



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

Electrical Installation

- Drill & Self Tapping Screws for Mounting Components in Electrical Panel
- Screwdriver

   Large and Small
- Wire Stripper
- Wire Connector Ends (<sup>1</sup>/<sub>4</sub>" 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 v2.1<sup>1</sup> 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, seen 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.

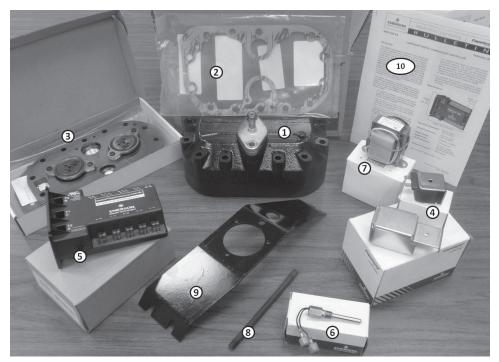


Figure 1 – Items in a Typical Discus Digital Upgrade Kit (Corresponding to "Item No." in Tables 1 and 2)



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Table 1 – 4D Discus Digital Upgrade Kits

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Item Kit Kit P/N Item P/N **Item Description** No. Head Service Kit 1&2 - Digital Head Assembly 902-0323-00 - Gaskets 4D Discus Digital Valve Plate Kit (MT) 3 - Digital Valve Plate 998-2661-66 - Gaskets Medium Solenoid Coil Kit x2 (120V & 220V) 923-0084-01, Temperature 4 - Solenoid Bracket -02 4D Discus - Screw 980-6000-00 Digital 5 4D IDCM Module Kit / Copeland Digital Compressor Controller 943-0088-00 **Upgrade Kit** (Non-ISD) 6 Sensor Temp Probe Kit 985-0109-07 7 24V Transformer (Class 2) 037-0023-00 8 Head Stud 103-0087-07 Instructional Sheets 10 - AE8-1328 Copeland Digital Discus Compressor Controller N/A - AE4-1373 Upgrade Procedures for Copeland Digital Discus Head Service Kit 1&2 - Digital Head Assembly 902-0323-00 - Gaskets 4D Discus Digital Valve Plate Kit (LT) - Digital Valve Plate 3 998-2661-65 - Gaskets Solenoid Coil Kit x2 (120V & 220V) 923-0084-01, Low - Solenoid Bracket 4 -02 Temperature - Screw 4D Discus 980-6000-01 5 4D IDCM Module Kit / Copeland Digital Compressor Controller 943-0088-00 Digital **Upgrade Kit** 6 Sensor Temp Probe Kit 985-0109-07 (Non-ISD) 7 24V Transformer (Class 2) 037-0023-00 8 Head Stud 103-0087-07 9 Fan Bracket 074-1243-00 Instructional Sheets 10 - AE8-1328 Copeland Digital Discus Compressor Controller N/A - AE4-1373 Upgrade Procedures for Copeland Digital Discus

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### Table 2 – 4D/6D Intelligent Store Discus v2.x Digital Upgrade Kits

Kit	Kit P/N	ltem No.	Item Description	Item P/N
Medium		1&2	Head Service Kit - Digital Head Assembly - Gaskets	902-0323-00
Temperature 4D/6D Intelligent	980-6000-10	3	4D/6D Discus Digital Valve Plate Kit (MT) - Digital Valve Plate - Gaskets	998-2661-66
Store Discus v2.x Digital		4	Solenoid Coil (24VAC)	923-0084-00
Upgrade Kit		8	Head Stud	103-0087-07
		10	Instructional Sheets - AE4-1373 Upgrade Procedures for Copeland Digital Discus	N/A
		1 & 2	Head Service Kit - Digital Head Assembly - Gaskets	902-0323-00
Low Temperature 4D/6D	980-6000-11	3	4D/6D Discus Digital Valve Plate Kit (LT) - Digital Valve Plate - Gaskets	998-2661-65
Intelligent Store Discus		4	Solenoid Coil (24VAC)	923-0084-00
v2.x Digital Upgrade Kit		8	Head Stud	103-0087-07
opyrade Mit		9	Fan Bracket	074-1243-00
		10	Instructional Sheets - AE4-1373 Upgrade Procedures for Copeland Digital Discus	N/A

### Table 3 – Valve Plate Gasket Kit Part Numbers

	Kit	Part #
Kit Description	OEM Compressor	Remanufactured/ Service Compressor
4DA*,4DE*,4DN* Select Fit Valve Plate Gasket Kit	920-1378-04	920-1378-05
4DB*,4DC*,4DH*,4DK*,4DL*,4DP*,6DB*,6DW*,6DY*,6DH*,6 DK*,6DP*,6DL*,6DC*,6DD* Select Fit Valve Plate Gasket Kit	920-1378-00	920-1378-01
6DG*,6DM*,6DN*	920-1378-06	920-1378-07
4DJ*,4DR*,4DT*,4DS*,6DJ*,6DR*, 6DS*,6DT*,6DE*,6DF* Select Fit Valve Plate Gasket Kit	920-1378-02	920-1378-03

There are four valve plate gaskets provided in both the head-service kit and the valve plate kit. The appropriate gasket should be matched to the first three digits of the compressor model number.

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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	OEM Compressor	-	Valve Plate Gasket Selection		Remanufactu	Ired Compresso	Remanufactured Compressor Valve Plate Gasket Selection*	: Selection*
OEM Compres Valve Plate Ga	OEM Compressor gaskets are NOT incl Valve Plate Gasket kits(sold Separately)	e NOT included i eparately)	OEM Compressor gaskets are NOT included in Upgrade Kit, only the Select Fit Valve Plate Gasket kits(sold Separately)	he Select Fit	The maximum thick for each 4D-6D bore thickness gaskets a Kit (sold separately)	thickeness rema ) bore size are in ets are available ately)	The maximum thickeness remanufactured compressor gaskets for each 4D-6D bore size are included in Upgrade Kits. Other thickness gaskets are available in select Fit Valve Plate Gasket Kit (sold separately)	or gaskets ts. Other ate Gasket
First 3 Digits of Compressor Model Number	Existing Part #	Gasket Kit #	Number of Gaskets & Thickness	Maximum Thickness	Existing Part #	Gasket Kit #	Number of Gaskets & Thickness	Maximum Thickness
4DA*, 4DE*, 4DN*	020-1378-04	920-1378-04	(1).029", (2).031", (4).033", (4).035", (1).037", (1).039"	0.039	020-1378-05	920-1378-05	(1).029", (1).031", (2).033", (2).035", (1).037", (1).041", (1).045"	0.045
4DB*, 4DC*, 4DH*, 4DK*, 4DL*, 4DP*, 6DB*, 6DW*, 6DY*, 6DH*, 6DL*, 6DC*, 6DD*	020-1378-00	920-1378-00	(1).029", (2).031", (4).033", (4).035", (1).037", (1).039"	0.039	020-1378-01	920-1378-01	(1).029", (1).031", (2).033", (2).035", (1).037", (1).041", (1).045"	0.045
6DG*, 6DM*, 6DN*	020-1378-06	920-1378-06	(1).029", (2).031", (4).033", (4).035", (1).037", (1).039"	0.039	020-1378-07	920-1378-07	(1).029", (2).031", (4).033", (4).035", (1).037", (1).039"	0.045
4DJ*, 4DR*, 4DT*, 4DS*, 6DJ*, 6DR*, 6DS*, 6DT*, 6DE*, 6DF*	020-1378-02	920-1378-02	(1).029", (2).031", (4).033", (4).035", (1).037", (1).039"	0.039	020-1378-03	920-1378-03	(1).029", (1).031", (2).033", (2).035", (1).037", (1).041", (1)0.045"	0.045

Table 4 – Compressor Valve Plate Gasket Selection



### Copeland Discus/Intelligent Store Discus v2.1 to Copeland Discus Digital Head and Valve Plate Conversion

**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.

**Note!** The 4D/6D Digital head must be installed on the far right hand bank (when facing the oil pump end) of compressor

- 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. Remove any high pressure connections from the head and the head fan (if equipped).
- 3. Note the location of any studs on the head (high pressure control and oil pressure module may be mounted here).
- 4. Remove the cylinder head bolts.
- 5. Tap the head to break it loose from the valve plate.
- 6. Remove dowel pins and center bolt. Save dowel pins for digital head and valve plate installation. Center bolt will NOT be needed for digital head and valve plate installation.
- 7. 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.
- 8. Check that the pistons travel up and down freely.
- 9. 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.
- 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.

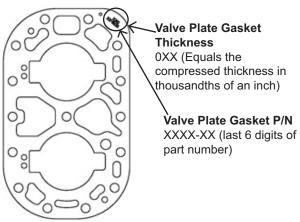


Figure 2



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



- 11. Select the proper valve plate gasket for the bore size of the compressor. (See **Table 3**)
- 12. 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.
- 13. Inspect new valve plate for handling damage and install.
- 14. 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.
- 15. Visually inspect pistons in head for loose debris. **Note!** The digital head has two internal pistons, one protrudes farther out than the other. This is intentional. See **Figure 5**.

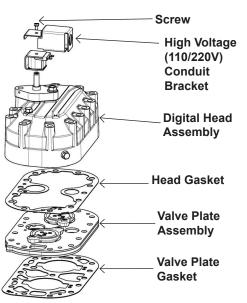
# CAUTION: DO NOT REMOVE PISTONS FROM INSIDE HEAD!

- 16. Install the Discus digital cylinder head. Take care to not damage the solenoid stem mounted on the compressor head. Install the longer head stud (p/n 103-0087-07) into the unloader solenoid valve flange. Ensure that the bolt is threaded completely into the compressor body.
- 17. Relocate existing stud bolts (if equipped) to their correct location to mount components/head fan.

**NOTE!** If upgrading on a low temperature 4D Discus compressor with head fan the stud bolt locations will change. A new mounting bracket is included in the Low Temp Upgrade kits for this purpose. See **Figure 6**.

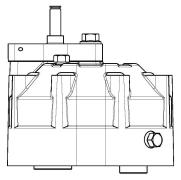
The head fan for 6D does not need to be changed. Refer to **AE4-1135**, **Cooling Requirements for Copelametic™ and Copeland Discus™ Compressors** for more details on Discus head fan requirements.

- Finger tighten bolts and torque evenly in crossing pattern to 50 ft-lbs. (See Torque Patterns on following page for proper torquing procedures.)
- 19. Reassemble the high pressure port connections with appropriate thread sealant.
- 20. Discharge temperature probe should be installed on far left hand bank when facing the oil pump end of the compressor. Tighten temperature probe and discharge pressure pickup connections firmly and recheck torque on all the bolts. See **Figure 7**.



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



**Figure 5** – Two pistons inside the digital cylinder head, one piston sticks out farther by design

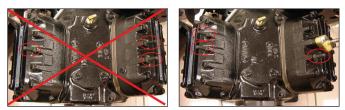


Figure 6

**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.



- 21. Refer to **Checklist #1** in Appendix to verify all steps have been completed in the head and valve plate conversion.
- 22. Evacuate compressor and reopen all the necessary valves to the compressor per industry standards.
- 23. Leak test the compressor.
- Install Discus Digital<sup>™</sup> solenoid coil, solenoid bracket<sup>2</sup>, and conduit<sup>2</sup> on solenoid valve stem<sup>2</sup>. Make sure to choose correct voltage solenoid coil. See Figure 8.
- 25. If the compressor is equipped with a head fan, install<sup>3</sup> fan bracket and head fan<sup>3</sup>.

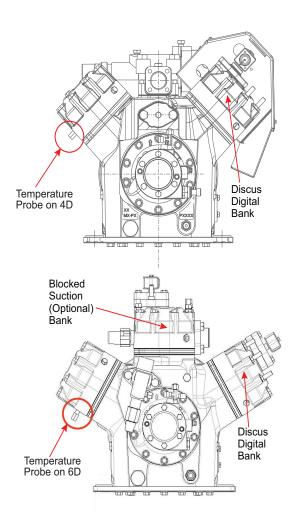
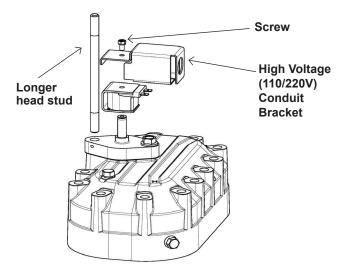
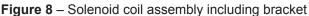


Figure 7 – The temperature probe should be installed on the far left bank of the 4D/6D.





## 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.

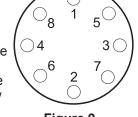


Figure 9

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 9**. 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.

- <sup>1</sup> Intelligent Store Discus compressors with Demand Cooling are pending approval.
- <sup>2</sup> Required for non-Intelligent Store Discus only.
- <sup>3</sup> Refer to installation instructions supplied with fan mounting kit.



The following pages cover wiring the solenoid and digital compressor controller as well as programming the E2 for 4D/6D Discus digital compressors. If you are upgrading an ISDv2.1 compressor to Discus digital, skip to page 15 for further instruction.

# Wiring for 4D Discus Digital Compressors (Non-ISD)

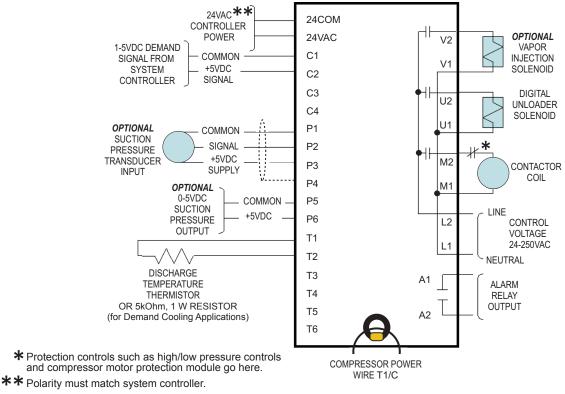
### **Digital Compressor Controller**

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 10**.

For more information and installation instructions for the Copeland Digital Compressor Controller refer to **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.



Note: The Neutral to L1, M1, U1, V1 is connected together.

Figure 10 – 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 blocked suction, 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

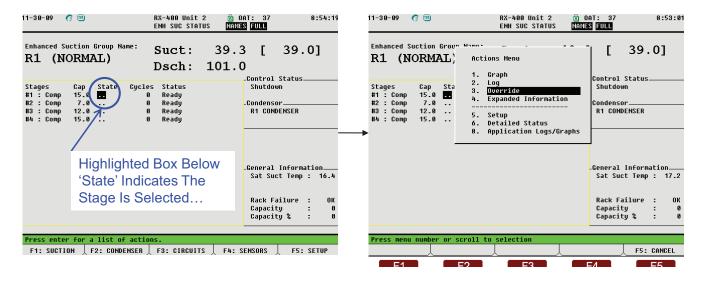
Below you will see screen shots taken from the E2 to perform the above steps.

1. After Logging Into<sup>1</sup> The E2, From The Home Screen<sup>2</sup> Press **F1: Suction** To Arrive At the '**Summary For Suction Groups and Enhanced Suction**' **Screen**. Select The Enhanced Suction<sup>3</sup> Group That Has The Digital Compressor Installed.

10-15-09 ♦ 77 Press 'Log In/Out' to Log On	RX-400 Unit RX DEV SUMM		A 15:06:16		10-15-09 🔹 🕜 🔟 Press 'Log In/Out'	to Log I		RX-400 Un Summar		園		15:06:49
EN SUC GRP01	21.7	2.0]			Sum			· ·		anced Suc		
		08			Name SUCTION GRP01		22.0	°Ctl Tmp	NONE		1 100	ОК
S1	0/11	00			EN SUC GRP01	21.7	22.0		NONE	0	1 0	OK
Req Act NO												
SUCTION GRP01 [ 22.0 Cap 100		1/ 1		<b></b>								
Press enter for a list of act	tions.				Press enter on des	ired ap	plicatio	on for st	atus.			
F1: SUCTION			F5: SETUP			1				- 1		F5: SETUP
<b>F1 F2 F3</b>	<b>F4</b>	F5			F1 F2	F		F4	F5			
<b>?</b> F6 <b>F7 F8</b>	F9	F10	F11 Shift+;		<b>1</b> F6 F7	G		F9	F10	Log In/Or F11	A Prev Shift + ;	Next
<sup>1</sup> Press The Log In/Out	And Enter	Your	User ID and Passwor	d To Log	g On							
<sup>2</sup> The Button	Takes You	To Tł	ne Home Screen									
<sup>3</sup> When Using Copela Properly Control The				E2 You	Must Use The	Enha	nced	Suctio	on Fea	ature To	)	



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.



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.

10-15-89 • 😚 🖮 Enhanced Suction Group Name	RX-400 Unit 1 🕅 ENH SUC STATUS NOM		15:09:06	11-30-09 🦪 🖲	E	X-400 Unit 2 NH SUC STATUS	© 0AT: 37 NAMES FULL 39.3 [	8:54:19
EN SUC GRP(			 	R1 (NOR	(MAL)		01.0 .Control S	-
1	Override Update S.01.1:EN SUC GRP01 :STAG n Override : Yes verride Time : 0:00:00	E OUT1		#1 : Comp 15 #2 : Comp 7 ₽3 : Comp 12	ap State Cycles 5.0 1 0 2.0 1 0 5.0 . 0 5.0 . 0	Status Ready Ready Ready Ready	Shutdown -Condensor R1 CONDE	
0	verride Value: OFF	Sat Suct Tem Rack Failure Capacity Capacity %			ghted Box Be Should Read			: 0
Enter State: Use Next/Pred	i keys	F5:	: CANCEL		or a list of actions ↓ F2: CONDENSER ↓		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		<b>?</b> 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

11-30-09 • 77 (11) <u>C1: General</u> <u>C2: Circui</u> <u>C6: Outputs</u> <u>C7: Stage</u> Enhance	RX-400 Unit 1 OPTION LOOKUP ts C3: Setpoints I South C8: Stage Outs I		0.59.60 C5: Inputs C0: MORE		Use Ctrl-X to Select CX Tabs C1: General C2: Circuits	SETUP C3: Setpoints 04: C8: Stage Outs C9:	
Stage Setup Ty #1 : Co #2 : Do Des	Option List Selection Select: cription	ly Select	Oil Pres		Stage Setup Type Capacity #1 : Comp 4.0 #2 : DJ3 5.0	Proof Oil Sensor No None No None	Oil Dly Oil Pres
Com Un1 US DOL CTd	d 1	C U U D T		<b></b>			
Use Up-Down Arrow keys or F1: SELECT	Function keys to selec	t entry. Press	BACK. F5: CANCEL	(	Scroll using Next/Prev keys   ] F1: PREV TAB / F2: NEXT TAB /		I: LOOK UP / F5: CANCEL



5. Open The **C9: Var Cap** Tab. Select the '*Dgtl Lower* %\*' field and change value to 50.0 (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)

1-30-09       ? • ? • P       RX-400 Uf         Jse Ctrl-X to Select CX Tabs       SETUF         C1: General       C2: Circuits       C3: Stepo         C6: Outputs       C7: Stane Setur       C3: Stepo         Enhanced Su       Press desired s         Nattle VAR       :       Active VAR CAP : 1         Active VAR       :       .         Dgtl Lower %2 :       .       .         VAR STAGE OUT2 :       .       .         VAR STAGE OUT2 :       .       .         SETUR       .       .         Active VAR       .       .         Dgtl Lower %2 :       .       .         Dgtl Compase Setur       .       .         VAR STAGE OUT2 :       .       .         SETUR 1/0       .       .	NUMBES     FUEL       ints     CA:     C5:     Inputs       nuts     FADE     Uar     C0:     HORE       selection     CE     SUCTION       //O FORMALES     L       uge Delta     L       urm Setup     L	Enhanced St Uar Cap ACTIVE UAR CAP : 1 ACTIVE UAR CAP : 1 ACTIVE UAR % : Dgtl Lower Dgtl Perio VAR STAGE	rcuits C3: Setpoints and Setun C8: Stand Outs	L L Dn: Property
Press menu number or scroll to selection	F5: CANCEL	Press menu number or s	Scroll to selection	L 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 🔹	M		RX-400 Unit 1 RX DEV SUMMARY	🗟 OAT: 41	48.45.90	1-30-09 单	M		RX-400 Unit 1 RX DEV SUMMARY	🛕 OAT:	41	10	9:17:34
A-23 R	4047	LT	18.3 <sub>[ 18.0]</sub>	Circuits	State Temp	A-23 F	R4047	A LT	18.3 <sub>[ 18.0]</sub>	Circuits		tate	
			MAIN MENU		.Refr -4.8 .Refr -2.5 .Refr 4.5			SI	STEM CONFIGURATION		ZER - FD FRZ - DEL FZ <mark>E</mark>	Refr	
S1	S2 S3	1. Suct	ion Groups		.Refr -4.9	S1	S2 S3	1. Input	t Definitions		CAKES .		-6.0
ON	0N 0N	2. Cond	enser Control	EAT Rost	.Refr -5.2 .Refr NONE	ON	0N 01	2. Outpu	ıt Definitions		ROST .	Refr	
		3. Circ	uits	EAT Meat	.Defr 43.4 .Refr -5.7			3. Syste	em Information				43.0 -5.8
		4. Sens	or Controls	SRUSFO Cream	.Refr -10.0			4. Remot	te Communications		SRUSFD . Cream .	Refr Refr	-6.4 -9.9
EN SUC GRP01	5	5. Conf	igured Applications	CREAM Food	.Refr -8.0 .Refr -6.4	EN SUC GRPO	1 5	5. Aları	n Setup				-7.8
CONDEN	SER		Delete Application	CREAM Cream	.Refr -9.3 .Refr -8.3	CONDEN	ISER	6. Loggi	ing Setup		CREAM .	Refr	-8.8 -8.2
		7. Syst	em Configuration					7. Netwo	ork Setup				
Controlled	By: Dis	8. Stat	us	trl VENT. VENT	Value Cmd 56.9 OFF NOTAC OFF	Controlled	By: Dis	8. Globa			VENT.	alue 56.0 OTAC	Cmd OFF OFF
F1 F2 F3				#2 EMER. VENT. #2 EMERG VENT	56.9 OFF OFF OFF			9. Licer	ising		VENT. VENT	56.0 OFF	OFF
ON				A COLD H20 TMF		F1 F2 F3 ON ON				A COLD R		86.0	OFF OFF
Press menu	number	or scroll	to selection			Press menu	number	or scroll	to selection				
	Ţ		L L	Ĺ			Ţ				Ĺ		

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 8:53:1 S FULL	l1-30-09 🔹 🦪 🔟		AT: 42 S Full	_
Enhanced Suction Group Name R1 (NORMAL) Actions Menu	[ 39.0]	Enhanced Suction Group Name GRP01 (NOR)	•	[ 47	.0]
1. Graph         Stages       Cap         #1 : Comp       15.0         #2 : Comp       7.0         #3 : Comp       12.0         #4 : Comp       15.0         #4 : Comp       15.0         #4 : Comp       15.0         #4 : Comp       1.0         #4 : Comp       1.0         #4 : Comp       1.0         #4 : Comp       1.0         #5.0       Setup         6.0       Detailed Status         8.       Application Logs/Graphs	Control Status Shutdown Condensor R1 CONDENSER	II	Override Update A&B :GRP01 (NORMAL):STAGE Override : NO erride Time : 0:00:00	0UT2	
	General Information Sat Suct Temp : 17.; Rack Failure : OI Capacity : Gapacity % :	0	erride Value: NOTACT	Sat Suct Tem Rack Failure Capacity Capacity %	
Press menu number or scroll to selection	F5: CANCEL	Enter State: Use Next/Preu F1: SELECT	keys	F5:	CANCEL



### Wiring for Intelligent Store Discus v2.1 or Newer

If installing Discus digital on an Intelligent Store Discus v2.1 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 ISD side cover and connect the unloader wires (yellow) found in the wiring harness to the solenoid coil.

**NOTE!** Always connect Unl 1 (yellow wires) to digital bank solenoid. If using on a 6D with blocked suction bank on middle bank connect Unl 2 (purple wires) to blocked suction solenoid.

Replace the ISD side cover. See Figure 11.

# 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 blocked suction, you will need to delete the extra unloader stage(s) set up accordingly in the suction group.

Note! These instructions are based on E2 v2.8

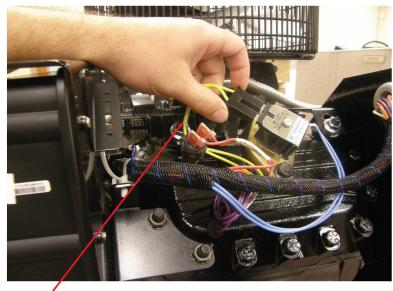
These are suggested E2 instructions based on Emerson's experience. There may be more than one way to properly program the E2 for Intelligent Store Discus Digital. Use Checklist #3 to verify the digital is being controlled properly.

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.





Yellow Unloader Wire

#### Figure 11 Intelligent Store Discus v2.1 Wiring



1. After Logging Into<sup>1</sup> The E2, From The Home Screen<sup>2</sup> Press **F1: Suction** To Arrive At the '**Summary For Suction Groups and Enhanced Suction**' **Screen**. Select The Enhanced Suction<sup>3</sup> Group That Has The Digital Compressor Installed.

10-15-09 ● ⑦ ₪ RX-400 Unit 1 Press 'Log In/Out' to Log On RX DEV SUMMARY	A 15:06:16	10-15-09 • 🕜 💷 Press 'Log In/Out'	to Log On	RX-400 UI Summai		b	15:06:49
EN SUC GRP01 21.7 [ 22.0]		Sunn	nary For Su	uction Groups	and Enhanc	ed Suction	
CAP 0%		Name SUCTION GRP01 EN SUC GRP01		uct SP Ctl Tm 22.0 22.0	p Temp SP S NONE NONE	<sup>-</sup> 1 1	
Req Act NO							
SUCTION GRP01 [22.0] STAGES: 1/ 1 Cap 100%							
Press enter for a list of actions.       F1: SUCTION	F5: SETUP	Press enter on des	ared appli	L L L L L L L L L L L L L L L L L L L	tatus.		F5: SETUP
F1 F2 F3 F4 F5		F1 F2	F3	F4	F5		
P6         P7         P8         P3         P10	F11 F11 Next	<b>F6</b>	F8	F9	F10	Eog In/Out F11	Prev Next Shift + 3

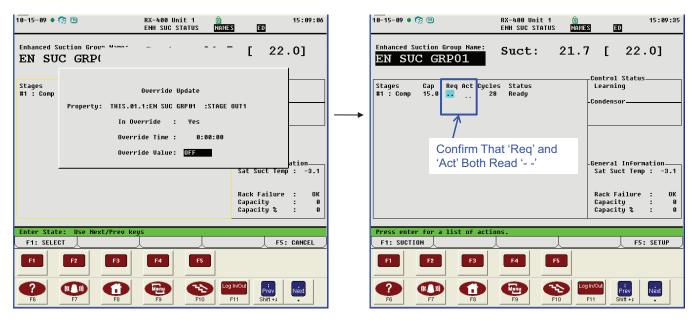
<sup>1</sup> Press The Log InvOut And Enter Your User ID and Password To Log On
<sup>2</sup> The Button Takes You To The Home Screen
<sup>3</sup> When Using Copeland Digital™ Compressors With CPC E2 You Must Use The Enhanced Suction Feature To Properly Control The Digital Compressor



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.

19-15-09 • 7 10 RX-400 Unit 1 👌 Press 'Log In/Out' to Log On ENH SUC STATUS	15:07:22	10-15-09 • 😚 💷 RX-400 Unit 1 🛕 ENH SUC STATUS MANN	15:08:18
Enhanced Suction Group Name: Suct: 21. EN SUC GRP01 Stages Cap Red oct Cycles Status #1 : Comp 15. 20 28 Ready	7 [ 22.0] Control Status Learning Condensor	Enhanced Suction Group Mann EN SUC GRP( Stages Cap Req #1 : Comp 15.0 Req 5. Setup 6. Detailed Status 8. Application Logs/Graphs	[ 22.0] Control Status Learning Condensor
Highlighted Box Below 'Req' Indicates The Stage Is Selected…	-General Information Sat Suct Temp : -3.1 Rack Failure : OK Capacity : O Capacity % : O		-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
	<u></u>		
P         P	F11	P         P	g In/Out F11 Shift +; •

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     :       Conplor Reclaim:     :       No     :       Condenser     :	Stage Setup Type Capacity Proof Oil Sensor Oil Dly Oil Pres #1 : BODD 15.0 Yes None
	Use <b>F1: PREV TAB</b> or <b>F2: NEXT TAB</b> 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 🕈 🧑 🔟	RX-400 Unit 1 OPTION LOOKUP	A MAMES	15 ED	:10:21		10-15-0 Use Ctr		m Select C:	K Tabs	RX-400 U Setu		A NAME:	S E	D	15:10:34
	2: Circuits   C3: Setpoints	C4:	C5: Input	ts .		C1: Ger		C2: Ci		C3: Setpo		C4:			nputs
Có: Outputs 🚺	7: Stage Setup C8: Stage Outs	C9:	CO: MORE			C6: Out	puts	C7: St	aqe Setup	C8: Stage	e Outs	C9:		C0: M	IORE
Stage Setup #1 : [	Ty Option List Select: Select: Description Unld US Dgtl		ly Oil Pres	]	<b>,</b>		ge Setu			Suction:		GRP 01	Dil Dly	011	
	CŤdr	T													
Use Up-Down Arrow	w keys or function keys to sel	ect entry. P	ress BACK.			Scroll	using	Next/Pre	v keys 📔	Type of s	tage				
F1: SELECT	F3: BEGINNING	F4: END	F5: CA	NCEL		F1: PI	REV TAB	F2: 1	IEXT TAB	F3: E	DIT	F4: L	OOK UP	F5:	CANCEL
F1 F2	<b>F</b> 3 <b>F</b> 4	-5				F1		F2	F3	F4	F5				
<b>1</b> <b>1</b> <b>1</b> <b>1</b> <b>1</b> <b>1</b> <b>1</b> <b>1</b>		Log In/Out 10 F11	Prev Ne Shift + ;			<b>7</b> 6		F7	<b>6</b> F8	F9	FIC			Prev Shift + ;	Next



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 RX DEV SUMMARY	▲ 15:12:11           NAMES         ED		10-15-09 🔹 🎲 🔟	RX-400 Unit 1 MAIN MENU	尚 15:12:34 NAMES ED
EN SUC GRI	201 21.7 [ 22.0]			EN SUC GRP01		
DGTL 08 S1 Req Act NO SUCTION GRP81	HAIN HENU 1. Suction Groups 2. Condenser Control 3. Circuits 4. Sensor Controls 5. Configured Applications 6. Add/Delete Application 7. System Configuration 8. Status		-	DGTL 08 S1 Req Act N0 SUCTION GRP01	Configured Application: 1. Suction Groups 16. Logging Groups 90. Global Data 104. ISD 2.0 [ 22.0] STAGES: 1/ 1 P 100%	5
Press menu number	or scroll to selection	•		Press menu number or s	croll to selection	F5: CANCEL
F1 F2	F3 F4 F5			F1 F2	F3 F4 F5	
<b>7</b> F6 <b>F7</b>	F8 F9 F10	F11		<b>?</b> F6 F7	F8 F9 F10	F11 Shift +;



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 ● ⑦ Ⅲ RX-400 Unit 1	10-15-09 ● ⑦ □ RX-400 Unit 1 ⓓ 15:34:36 Use Ctrl-X to Select CX Tabs SETUP NAMES ED
ISD 2.0 Compressor       DEVICE INFORMATION         TSD2 COMPOOL       Product Name : ISD2.0         Req In: Act Out: OFF OFF [21.7]       Product Name : ISD2.0         Part Number : 526-0999       Revision : 1.16F04         Sens Mod Rev : 1.12F01       Bus Address : 1         Fisplay Code:	C1: General D22= Staton C3: Inputs C4: Outputs C5: ISD Outs C6: Device C7: ID Config C8: Alarms C9: Alarm Out C0: MORE ISD 2.0: ISD2 COMP001 Setup Ualue Unider 1 Enable: Disabled Unider 2 Enable: Disabled Unider Mod Type: None ISD CCH Control: Enabled Crankcase Alg : Continuous Bank Config : One Bank Anti Shortbyle: 0.10 MCC Value : 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
Provide         Provide <t< td=""><td>Provide     Provide     Provide     Provide     Provide       F6     F7     F8     F9     F10     F11     Provide       F11     Shift + 2     Image: Shift + 2     Image: Shift + 2     Image: Shift + 2     Image: Shift + 2</td></t<>	Provide     Provide     Provide     Provide     Provide       F6     F7     F8     F9     F10     F11     Provide       F11     Shift + 2     Image: Shift + 2     Image: Shift + 2     Image: Shift + 2     Image: Shift + 2

7. Move The Cursor To "Unlder 1 Enable" Press The Next Button () To Change From 'Disabled' To '**Enabled**.' Do The Same With "Unlder 2 Enable" if using blocked suction on middle of 6D or if using with Copeland Demand Cooling, otherwise leave Unlder 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 • (?) (D) III IIIIII IIIIIIIIIIIIIIIIIIIIIII	10-15-09 • C III 1 1 15:37:36 Use Ctrl-X to Select CX Tabs SETUP INTES ED C1: General C2: Setup Gel Induts C4: Outputs C5: ISD Outs C6: Device C7: ID Config C8: Alarns C9: Alarn Out C8: MORE ISD 2.8: ISD2 COMP001 Inputs Board Point CAPPCITY REQ IN : COMP LOCKOUT IN: : CARMCSE HEAT IN: : RESET REQ IN : : SAT SUCT TEMP : 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       F2     F3     F4     F5     F5       F2     F3     F4     F5       F3     F4     F5       F5     F3     F4     F5       F5     F3     F4     F5       F5     F3     F4     F5       F6     F7     F8     F9       F6     F1     Staft+2     -	Enter Board/Controller       Digital Capacity Request         F1:       PREU TAB       F2:       NEXT TAB       F3:       EDIT       F4:       LOOK UP       F5:       CANCEL         F1       F2       F3       F4       F5       E       F5       E       Not         F2       F3       F4       F5       E



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

10-15-09 ● ⑦ □ RX-400 Unit 1			ect CX Tabs	RX-400 Unit 1 SETUP		15:37:56 D
C1: General C2: Setup C3: Inputs C4: Outputs C5: ISD Outs	6	1: General 🔤	C2: Setup	C3: Inputs	C4: Outputs	C5: ISD Outs
C6: Device C7: ID Config C8: Alarms C9: Alarm Out C8: MORE			C7: ID Confin		C9: Alarm Out	CO: MORE
C6: Device       C7: ID Config       C8: Alarms       C9: Alarm Out       C6: MORE         ISD 2.0: ISD2 COMP001         Inputs       Board       Point         CAPCITY REQ IN :       :       :         COMP LOCKOUT IN:       :       :         COMP LOCKOUT IN:       :       :         CARM RESET IN :       :       :         CRNKCSE HEAT IN:       :       :         SAT SUCT TEMP :       THIS.01.1:EN SUC GRP01 :SAT SUCT TEMP         SUGTION PRES IN:       :       :         SAT SUCT TEMP :       THIS.01.1:EN SUC GRP01 :FILTERED PRES         DGTL PERIOD IN :       :       :		6: Device    Inputs CAPCITY REQ COMP LOCKOUT ALARM RESET CRNKCSE HEAT RESET REQ IN SAT SUCT TEE SUCTION PRES DGTL PERIOD	Pre IN : ┃ 1. IN : 2. IN : 3. IN : 4. IN : 5. I : 6. IP : 1 7. IN : 7.	ICR: Alarms ss desired selec Alternate 1/0 F Set Multiple Ou Output Change D Generic Alarm S Logging Setup Bynase Setup 1/0 MODE SETUP 1/0	tion ormats tputs elta	
Enter Board/Controller   Digital Capacity Request	P	'ress menu numbe	er or scroll t	o selection		
F1: PREV TAB / F2: NEXT TAB / F3: EDIT / F4: LOOK UP / F5: CANCEL /	_	<u>\</u>			人	F5: CANCEL
F1 F2 F3 F4 F5		F1 F2	F3	F4	F5	
Image: Product state         Image: Pr		<b>?</b> F6	<b>1</b>		F10 F11	Prev Shift +;

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         Image: State Sta	18-15-89 • 🕅		- <b>1</b>	RX-400 Unit CNTROLLER LO	OKUP NAM		
C6: Device C7: ID Config C8: Alarms C9: Alarm Out C8: MORE	C1: General C6: Device		Setup ID Confiq	C3: Inputs C8: Alarms	C4: Ou	tputs arm Out	C5: ISD Outs C0: MORE
Inputs       Inputs         COMP LOCKO       Inputs         ALARM RESE       Select format for the pointer.         CRNKCSE HE       1 = Board : Point         SAT SUCT T       2 = Controller : Application: Property         SUCTION PR       3 = Fixed Value         DGTL PERIO       Press desired selection	 Inputs CAPCIT COMP L ALARM CRNKCS RESET SAT SU SUCTIO DETL P	Name <u>THIS.0</u> .IS.01	Co Model 1 RX400- 01 ISD 2.	ntroller Sele Refrig 0 Comp	ction Bus Subn ETT ET	Board#/ et Node 1	
	 		ys or func	tion keys to :		-	
F5: CANCEL	F1: SELECT			⊥ F3: BEGINNI	NG F4	: END	F5: CANCEL
	F1	F2	F3	F4	F5		
Image: Problem         Image:	<b>?</b> F6	F7	<b>6</b> F8	Menu F9			Prev Next



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.

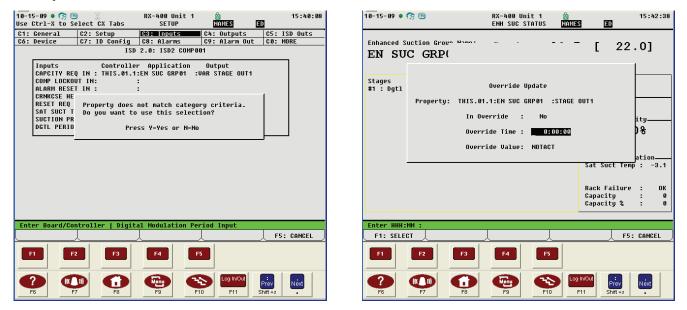
10-15-09 单 🕼 🗓	٩	RX-400 Unit 1 CELL LOOKUP	A NAMES	15:36:07 ED	10-15-09 • 😚 🗐 Use Ctrl-X to Se		RX-400 Unit 1 SETUP		15:38:53
C1: General	C2: Setup	C3: Inputs	C4: Outputs	C5: ISD Outs		C2: Setup	C3: Inputs	C4: Outputs	C5: ISD Outs
C6: Device	C7: ID Config	C8: Alarms	C9: Alarm Out	C0: MORE		C7: ID Config	C8: Alarms	C9: Alarm Out	CO: MORE
Inputs CAPCITY RE COMP LOCKO ALARM RESE CRNMCSE HE RESET REQ SAT SUCT SUCTION PR DGTL PERIO	Q IN : UT IN: T IN : Appl/Poi AT IN: IN : TIME SEP IN : GLOBAL I ENP : GLOBAL I ES IN: SUCTION	RVICES Time Ser DATA Global D GRP01 Suction GRP01 Enhanced	vices Data		 Inputs Capcity REQ Comp Lockou Alarm Reset Crnkcse Hea Reset REQ I Sat Suct te	ISI Controlle IN: THIS.01.1 IN: IN: N: N: MP: THIS.01.1 S IN: THIS.01.1	<ul> <li>2.0: ISD2 COMP</li> <li>Pr Application</li> <li>I:EN SUC GRP01</li> <li>:</li> </ul>		
	row keys or func	tion keys to sel		1	Enter Property	Digital Capac	ity Request		
F1: SELECT	λ	F3: BEGINNING	F4: END	F5: CANCEL	F1: PREV TAB	F2: NEXT TAB	F3: EDIT	F4: LOOK UP	F5: CANCEL
	2 F3		-5		F1 F2	F3	<b>F4</b>	F5	
	7 <b>F</b> 8		Log In/Out 10 F11	Prev Next Shift +:	<b>?</b> F6 <b>F7</b>			F10 F11	Prev Shift +;

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 ⓓ 15:39:54 Use Ctrl-X to Select CX Tabs SETUP MONES ED	Use Ctrl-X to Select CX Tabs SETUP MANES ED
C1: General         C2: Setup         C8: 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 2.0: ISD2 COMP001	ISD 2.0: ISD2 COMP001
Inputs Controller Application Output CAPCITY REQ IN : THIS.01.1:EN SUC 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 :FILTERED PRES SUCTION PRES IN: THIS.01.1:EN SUC GRP01 :FILTERED PRES DGTL PERIOD IN : THIS.01.1:EN SUC GRP01 :	Unputs CAPCITY REQ IN CAPCITY REQ IN COMPLOCKOUT IN CARRIN RESET IN CARRIN RESET IN CARRIN RESET IN CARRING REGAT IN SUBJECT REQ IN SAT SUCT TEMP SUCTION PRES IN DGTL PERIOD IN CONTROLLER SUC GRPOI CONTROLLER SUC
Enter Property         Digital Modulation Period Input           F1:         PREV TAB         F3:         EDIT         F4:         LOOK UP         F5:         CANCEL           F1         F2         F3         F4         F5         F6         F7         F8         F9         F0         F00         F00         F00         F00         F00         Shift +3         Not	Enter Board/Controller       Digital Capacity Request         F1:       PREU TAB       F2:       NEXT TAB       F3:       EDIT       F4:       LOOK UP       F5:       CANCEL         F1       F2       F3       F4       F5       CANCEL       F5         F2       F3       F4       F5       CANCEL       F5       CANCEL         F1       F2       F3       F4       F5       CANCEL       F5         F6       F7       F8       F9       F10       F11       Feer Shift+s       Next



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 STATUS	R NAMES	ED	15:43:40
Enhanced Suction Group Name: EN SUC GRP01	Suct:	22.8	[ 22	. 0]
Stages Cap Req Act Cycle #1 : Dgtl 15.0 ON 28	es Status 8 Ready	-C:	ontrol Stat earning ondensor ariable Cap 100.	acity
Press enter for a list of acti			eneral Info Sat Suct Te Rack Failur Capacity Capacity %	mp: -1.6 e: OK : 15.0
F1: SUCTION	L		F	5: SETUP
F1 F2 F3	F4	F5		
<b>?</b> F6 <b>F7 F8</b>		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.

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AE4-1373 R4

# APPENDIX

F

### **Upgrade Kit Piece Description**

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

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**Head Service Kit** - Included in the head kit, the 4D/6D digital head has two individual pistons built inside the bottom of the head and a solenoid valve mounted on top of the head. One of the 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 and four valve plate gaskets (one gasket for each 4D/6D bore size).

**Discus Digital Valve Plate** - Like the cylinder head, the valve plate is unique to Discus digital. It has two 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 4D/6D 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 v2.1 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</u> install only the provided head and valve plate gaskets (in upgrade kit and/or select fit valve plate gasket kit) when upgrading your compressor to Discus digital.

**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 ISDv2.1 compressor, your kit will only contain the 24V solenoid coils. Non-ISDv2.1 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.

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

**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-ISDv2.1 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. On 4D/6D ISDv2.1 there is a temperature probe already located in the left hand bank (when facing the oil pump end of compressor). This temperature probe should remain installed in the digital head.

**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!

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

**Head Stud** - a longer head stud is provided in the 4D/6D digital upgrade kits to hold the solenoid valve, and valve plate aligned. Ensure that the stud is fully threaded when installing.

**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 fan bracket.

**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.

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### Functionality Checklists

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**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

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- 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<sup>TM</sup> 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

Unl 1 (yellow wires) are connected to Digital solenoid. Purple (Unl 2) wires are connected to blocked suction or Demand Cooling solenoid or not used at all.



# **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 4D/6D Discus compressors (less than 4 years old) to choose from, performance can be optimized by applying the following guideline:

### **Compressor Selection Guideline**

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 Demand (HP)	Digital (HP)	Fixed (HP)	Fixed (HP)	Fixed (HP)	System 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

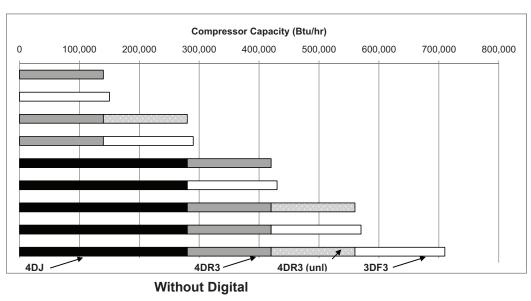
Consider the following suction group (the approximate compressor capacity at the ARI rating point is listed next to the compressor model number):

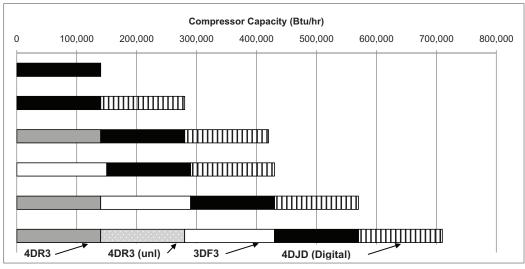
- 1. 4DJ3R28ML-TSK (280,000 BTUH)
- 2. 4DR3R28ML-TSK (280,000 BTUH) 1 Bank Unl
- 3. 3DF3R15ML-TFD (150,000 BTUH)

Based on the above guideline, the first compressor should be upgraded to 4D Discus<sup>2</sup>. 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 50 -100%.

<sup>2</sup> Or a 3D Discus Digital kit could be applied on compressor 3 (see AE4-1357 for more details on 3D Discus Digital). No more than one Digital compressor should be used per suction group.









## **Raised Suction Pressure Setpoint**

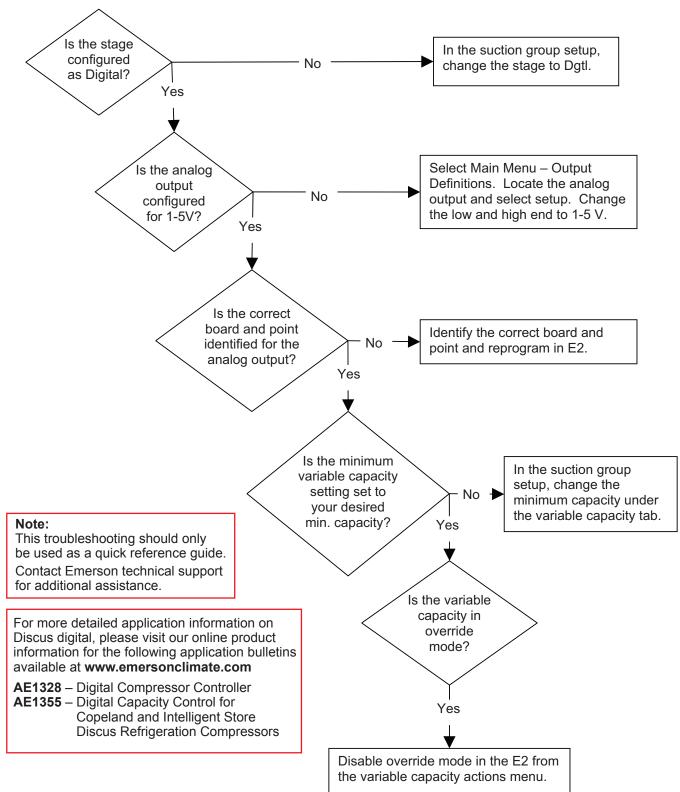
With Copeland Discus Digital, suction pressure can be controlled much tighter. By eliminating large pressure swings and improving case temperature control, there is often the opportunity to raise suction pressure set points. Compressors running at higher suction pressures run more efficiently and theoretically should increase system efficiency approximately 1-2% per pound of raised suction pressure.

## **Minimum Percent Digital Capacity**

Copeland Discus Digital is designed to run all the way down to 50% compressor capacity on a 4D or to 33% on a 6D Digital with blocked suction on the middle bank of the compressor. 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. 67% 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 the minimum allowable percentage of full load compressor capacity.









# **Troubleshooting Guide - Digital Compressor Controller**

