

Application Engineering

Copeland

AE4-1373 R1

### October 2010

## 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.

<sup>1</sup> 6D Digital is only available with Emerson Climate Technologies' Intelligent Store Discus v2.1 and newer. This bulletin describes upgrade procedures for the Copeland Discus Digital and Intelligent Store Discus v2.1 digital compressors.

### Requirements

Copeland<sup>®</sup> and Intelligent Store<sup>®</sup> brand 4D/6D Discus compressors produced with serial code 03D (April 2003) or later can be updated to digital capacity modulation. This is because the compressor valving design prior to April 2003 is different than the design currently used that is compatible with Discus digital hardware.

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 **AE8-1368, Intelligent Store Discus 2.1**.

### **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 (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 v2.1<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 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.

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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 <u>Item No</u>. in Tables 1 and 2)

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



## Table 1 – 4D Discus Digital Upgrade Kits

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



### 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 Store Discus v2.x Digital Upgrade Kit	980-6000-10	3	4D/6D Discus Digital Valve Plate Kit (MT) - Digital Valve Plate - Gaskets	998-2661-66		
		4	Solenoid Coil (24VAC)	023-0084-00		
		8 Head Stud				
		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		
Store Discus		4	Solenoid Coil (24VAC)	023-0084-00		
v2.x Digital		8	Head Stud	103-0087-07		
opgrade Alt		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

First 3 Digits of Compressor Model Number	Valve Plate Gasket P/N (From Discus Digital Upgrade Kit)
4DA*, 4DE*, 4DN*	020-1378-04
4DB*, 4DC*, 4DH*,4DK*, 4DL*, 4DP* 6DB*, 6DW*, 6DY*, 6DH*, 6DK*, 6DP*,6DL*, 6DC*, 6DD*	020-1378-00
6DG*, 6DM*, 6DN*	020-1378-06
4DJ*,4DR*, 4DT*, 4DS* 6DJ*, 6DR*, 6DS*, 6DT*, 6DE*, 6DF*	020-1378-02

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.



#### 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.
- 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.
- 10. 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**.



**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.

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- 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<sup>®</sup> Digital Compressor Controller refer to **AE4-1328, Copeland Digital Compressor Controller**.

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### 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<sup>®</sup> 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.

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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.

Press Log In/Out' to Log Un RX DEV SUMMARY		Press 'Log In/Out' to Log On SUMMARY
EN SUC GRP01 21.7 [ 22.0]		Summary For Suction Groups and Enhanced Suction
CAP 0%		Name         Suct Suct SP Ctl Tmp Temp SP Stages Of % Cap Status           SUCTION GRP01         22.0         NONE         1         100         0K           CTLSIC GRD02         21.7         22.0         NONE         1         100         0K
S1 Beg		
Act NO		
SUCTION GRP01 [ 22.0] STAGES: 1/ 1 Cap 100%	-	
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
F6         F7         F8         F9         F10         F11	Prev Next Shift + 3	Provide         Provide <t< td=""></t<>
1 Drees The Loginfort And Enter Veyn Lies		
And Enter Your User	ID and Password	
<sup>2</sup> The Button Takes You To The Ho	me Screen	
<sup>3</sup> When Using Copeland Digital <sup>™</sup> Compre	essors With CPC F	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.



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 🔹	⑦ 画 RX-400 Unit 1 箇 15:09:0 ENH SUC STATUS <u>NAMES</u> 日	11-30-09 🧭 🔟 RX-400 Unit 2 👩 OAT: 37 8:54:19 ENH SUC STATUS NAMES FULL
Enhanced S EN SU	C GRP(	Enhanced Suction Group Name: Suct: 39.3 [ 39.0] R1 (NORMAL) Dsch: 101.0
Stages #1 : Comp	Override Update Property: THIS.01.1:EN SUC GRP01 :STAGE OUT1 In Override : Yes Override Time : 0:00:00	Stages         Cap         State         Cycles         Status         Shutdown           #1 : Comp         15.0         1         0         Ready         Shutdown         1           #2 : Comp         7.0         Ready         -Condensor         -         -         0         Ready         -Condensor         -           #3 : Comp         12.0         -         0         Ready         R1 CONDENSER         -
	Override Value: OFF Sat Suct Temp : -3.1 Rack Failure : OK Capacity : O Capacity % : O	Highlighted Box Below 'State' Should Read "OFF" Back Failure : 0K Capacity : 0 Capacity % : 0
Enter Stat	e: Use Next/Prev keys CT F5: CANCEL	Press enter for a list of actions. F1: SUCTION F2: CONDENSER F3: CIRCUITS 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.

10-15-09 ● ⑦ Ⅲ RX-400 Unit 1		10-15-09 • 🝘 🎟 RX-400 Unit 1 🕅 15:10:06 Use Ctrl-X to Select CX Tabs SETUP MANES ED
C1: 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 SUC GRP01
General Value Name : ENISUC GRP01 Long Name :		Stage Setup Type Capacity Proof Oil Sensor Oil Dly Oil Pres #1 : Donn 15.0 Ves None
Strategy : Normal Number - Stages: 1 Referingerant : R22		
Phase Protect : Yes Comp On Always : No		
Comp On Defrost: No Comp On Reclaim: No Enable Float - No	$\rightarrow$	
Condenser :		
		Use F1: PREV TAB or F2: NEXT TAB
		To Navigate Between Tabs
Enter desired text   Name of this suction group	-	Sevell using New News Line of stage
F1: PREU 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
Image: Product of the second		Image: Product of the second

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 🔹 🕜 🔟	RX-400 Unit 1 OPTION LOOKUP	🕅 OAT: 41 NAMES FULL	0.53.10		11-30-09 🔹 🤭 🛄 Use Ctrl-X to So	) elect CX Tabs	RX-400 Unit 1 SETUP	🗴 OAT: 41 NAMES FULL	0-50-50
C1: General   C2	2: Circuits   C3: Setpoints	C4:	C5: Inputs		C1: General	C2: Circuits	C3: Setpoints	94:	<b>№5:</b> Inputs
Có: Outputs 🛛 🕅	: Stage Setup C8: Stage Outs	C9: Var Cap	CO: MORE		C6: Outputs	C7: Stage Setup	C8: Stage Outs	C9: Var Cap	CO: MORE
Enhance	e	СТІ	0N		Enha	anced Suction: E	N SUC GRP01-RACK	B ENHANCE SUCTI	
Stage Setup Ty #1 : Co #2 : D	y Option List Selection	on ly	Oil Pres		Stage Setup #1 #2	Type Capacity :Comp 4.0 :Dgtl 5.0	y Proof Oil Se No None No None	ensor Oil Dly	Oil Pres
	Description	Select							
	Comp Unld US Dg <b>cl</b> CTdr	C U U D T		<b></b>					
					Scroll using N	ext/Prev keys	Type of stage		
Use Up-Down Arrow	keys or function keys to sele	ect entry. Pres	s BACK.		F1: PREV TAB	F2: NEXT TAB	F3: EDIT	F4: LOOK UP	F5: CANCEL
F1: SELECT	F3: BEGINNING	F4: END	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 • 7 m RX-400 Unit 1 🙆 OAT:	41 0-51-88	11-30-09 ● 73 Jse Ctrl-X to Select CX Tabs	RX-400 Unit 1 💼 DAT: 41 SETUP NAMES FULL
C1: General C2: Circuits C3: Setpoints C4:	C5: Inputs	C1: General C2: Circuits	C3: Setpoints C4: C5: Inputs
C6: Outputs C7: Stage Setup C8: Stage Outs (59: Var 6		C6: Outputs C7: Stage Setup	C8: Stage Outs C9: Var Cap C0: HORE
C1: General C2: Circuits C3: Setpoints C4: C6: Outputs C7: Stage Setup C8: Stage Outs C62: Unr C4 Enhanced Suction: EN SUC GRP01-RACK B ENHANCE Var Cap Value ACTIVE VAR CAP : 1 :1.1 VAR CAP CP ACTIVE VAR CAP : 1 : : : Dgtl Lower 32 : 50 0 UAR STAGE OUT2 : :	CS: Inputs CO: MORE SUCTION L L	C6: Outputs C7: Stage Setu C6: Outputs C7: Stage Setu Enhanced Suction: E Var Cap VaBoard ACTIVE VAR CAP : 1 ACTIVE VAR CAP : 1 Dgtl Lower %2 : 50.0 Vgt I Lower %2 : 0:00:20 VAR STAGE OUT2 :	CB: Stage Duts [C9: Uar Carp Co: Hore N SUC GRP01-RACK B ENHANCE SUCTION Point :1.1 UAR CAP CP L :
Enter 0 to 100.0   Lover variable capacity percentage	TUS F5: CANCEL	Enter Board/Controller   Hulti	ple variable capacity device outputs
F1: PREV TAB F2: NEXT TAB F3: EDIT F4: STA		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)

I1-38-09       Image: Construct and the second	Unit 1 (a) OAT: 41 (a) OAT: 41 TUP (NAUES EUL) ippoints (C4: (c) C5: Inputs inon Ints (NS2-UNP Car) (c) HORE d selection E I/O Formats iple Outputs hange Delta Alarm Setup Setup etup	 11-38-89 • (? ) Ise Ctrl-X to Select CX Tat C1: General C2: Circui G6: Outputs C7: Stane Enhanced Su Uar Cap ACTIVE UAR CAP : 1 ACTIVE UAR CAP : 1 ACTIVE UAR CAP : 1 ACTIVE UAR S: Dgtl Lower Dgtl Perio UAR STAGE 1 = Bo: 2 = Con	RX-400 Unit 1 bs SETUP Lts C3: Setpoints Seturn C8: Stare Outs and : Point ntroller : Application Press desired selectio	C4: C5 C4: C5 C4: C5 C5 C5 C6 C6 C6 C6 C6 C6 C6 C6 C6 C6	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	🖻 OAT: 41	40.	45.90	11-30-09 🔹	M		RX-400 Unit 1 RX DEV SUMMARY	👌 OAT:	41	10	1:17:34
A-23 R4	104A	LT 18.3 [ 18.0]	Circuits	State T	emp	A-23 B	R4042	A LT	18.3 <sub>[ 18.0]</sub>	Circuits	5	State	Temp
S1 S2 ON OI	2 S3 1. N ON 2.	MAIN MENU . Suction Groups . Condenser Control	FD FRZ DEL FZ CAKES EAT ROST	.Refr .Refr .Refr .Refr .Refr .Refr N	-4.8 -2.5 4.5 -4.9 -5.2 IONE	S1 On	S2 S3 ON OF	S <sub>3</sub> 1. Inpu <sup>N</sup> 2. Outp	YSTEM CONFIGURATION t Definitions ut Definitions		ZER FD FRZ DEL FZ Cakes Eat Rost	.Refr .Refr .Refr .Refr .Refr .Refr	-4.8 -2.7 4.4 -6.0 -5.7 NONE
	3.	. Circuits . Sensor Controls	EAT Meat Srusfd Cream	.Defr .Refr .Refr .Refr -	43.4 -5.7 -2.8 10.0			3. Syst 4. Remo	em Information te Communications		EAT Meat Srusfd Cream	.Defr .Refr .Refr .Refr	43.0 -5.8 -6.4 -9.9
CONDENS	<sup>5</sup> . 55.	. Configured Applications . Add/Delete Application	CREAM Food Cream Cream	.Refr .Refr .Refr .Refr	-8.0 -6.4 -9.3 -8.3	IN SUC GRPC	ISER	5 5. Aları 6. Logg	m Setup ing Setup		CREAM Food Cream Cream	.Refr .Refr .Refr .Refr	-7.8 -6.4 -8.8 -8.2
Controlled R	7. 8. u. Dis	. <mark>System Configuration</mark> . Status	tr1 VENT.	Value 56.9 NOTAC	Cmd OFF OFF	Controlled		7. Netw 8. Glob	ork Setup al Data		trl VENT.	Value 56.0	
F1 F2 F3 I ON	F4 F5		#2 EMER. VENT. #2 EMERG VENT A COLD H20 TMP	56.9 OFF 90.8	OFF OFF OFF	F1 F2 F3 ON ON	F4 F9	9. Lice 5	nsing	A COLD F	VENT. VENT 20 TMP	56.0 OFF 86.0	OFF OFF OFF
Press menu ni	umber or	scroll to selection	L.			Press menu	I NUMBER	or scroll	to selection		Ţ		

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	• 🕅 og In/Out'	to Log	On	RX-400 Unit 1 OUTPUT STATUS	🗟 OAT: 41		11-38-89 🔹 👘 📖	RX-400 U Analog o	nit 1 👩 OAT: UTPUT NAMES FL	41 ILL	40-00-17
Type 8R0 8R0 8R0 8R0 8R0 8R0 8R0 8R0 8R0 8R0	Brd 15 15 16 16 16 16 16 16 16 16 16 17 17 17 17 17 17 17 17 17	Point 7 8 1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8 1 2 3 4 5 7 8 1 2 3 4 5 7 8 1 2 3 4 5 7 8 1 7 8 1 7 8 1 7 8 1 7 8 1 7 8 1 7 8 1 7 8 1 7 8 1 7 8 1 7 8 1 7 8 1 7 8 1 7 8 1 7 8 1 7 8 1 7 8 1 7 8 1 7 8 1 8 1	Action 5. SC D D D D D D D D D D D D D D D C C C C	Anniistion s Menu TUTP BR30LOPROF COM BR31LOPROF ME BR32LOPROF ME BR32LOPROF ME BR32LOPROF ME BR32LOPROF ME BR34LOPROF ORG GRP1 IOCM BVP GRP2 IOCM BVP GRP2 IOCM BVP GRP2 IOCM BVP EN SUC GRP01 EN SUC GRP01	A SOCIATION IG SOLENOID IG SOLENOID IG SOLENOID IG SOLENOID IG SOLENOID IG SOLENOID REFRIG SOLENOID REFRIG SOLENOID REFRIG SOLENOID REFRIG SOLENOID COMMAND OUT COMMAND OUT COMMAND OUT COMMAND OUT COMMAND OUT	End 4 Ualue Off Off ON ON ON ON ON ON ON ON ON OFF Off Off Off Off Off	Boa Pri Out Sel Def Modify Output Equation Low End Point : High End Point : UVERRIDE SETUP PRIORITY OUR : Priority Override T INPUT : RAC	ard/Point # : Int Name : :put Type : tect Eng. Units: I Fault Value : I 5.0 U 5.0 U fimeout : : :X A&B :EN SUC GRP	1. 1 1.1 UAR CAP CP USCOMP PET NONE Low Eng. Units : High Eng. Units: : 0:30 01 :ACTIVE VAR Cf	9 100.0	
Press me	enu number	or scri	oll to s	election			Enter 0 to 10.0	Low End Value	Ţ	F5:	CANCEL
	L L		L L		, , , , , , , , , , , , , , , , , , ,	F5: CANCEL					



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

11-30-09 🦪 🔟	RX-400 Unit 2 🖻 0 ENH SUC STATUS NAME	DAT: 37 8:53: <b>Is Full</b>	1-30-09 🕈 🦪 🔟	RX-400 Unit 1 🙍 O ENH SUC STATUS NAME	AT: 42 S Full	
Enhanced Suction Group • • • • • • • • • • • • • • • • • • •	Actions Menu	[ 39.0]	Enhanced Suction Grou GRP01 (NOR)	Un Namo	· [ 47.	0]
Stages Cap Sta #1 : Comp 15.0 •• #2 : Comp 7.0 • #3 : Comp 7.0 • #4 : Comp 15.0 ••	1. Graph 2. Log 3. <u>Override</u> 4. Expanded Information 5. Setup 6. Detailed Status 8. Application Logs/Graphs	Control Status Shutdown Condensor R1 CONDENSER	Stages #1 : Comp #2 : Comp Property	Override Update : RACK A&B :GRP01 (NORMAL):STAGE In Override : <b>NO</b> Override Time : 0:00:00	OUT2 -	
		-General Information Sat Suct Temp : 17.: Rack Failure : OI Capacity : Capacity : I		Override Value: NOTACT	a Sat Suct Temp Rack Failure Capacity Capacity %	ition : 19.3 : OK : O : O
Press menu number or scr	roll to selection	F5: CANCEL	Enter State: Use Ne: F1: SELECT	xt/Prev 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 ♦ (? Press 'Log In/Out' to Log On	RX-400 Unit 1 RX DEV SUMMARY	A 15:06:16	10-15-09 ♦ (? Press 'Log In/Out'	to Log On	RX-400 Unit 1 SUMMARY	ß	15:06:49
EN SUC GRP01	$21.7_{[22.0]}$		Sur	mary For Sucti	ion Groups and En	hanced Suction	n
S1	CAP 08		Name SUCTION GRP01 EN SUC GRP01	Suct Suct 22 21.7 22	SP Ct1 Tmp Temp .0 NONE .0 NONE	SP Stages Of 1 1 Ø 1	% Cap Status 100 OK 0 OK
Req Act NO							
SUCTION GRP01 [ 22. Cap 10	0] STAGES: 1/ 1 0%						
Press enter for a list of ac	tions.		Press enter on de	sired applicat	tion for status.		
F1: SUCTION		F5: SETUP					F5: SETUP
F1 F2 F3	F4 F5		F1 F2	F3	F4		
<b>?</b> F6 <b>F7 F8</b>	F9 F10	F11 Shift +; .	<b>?</b> F6 <b>(((_)))</b> F7	F8	F9 F1	Log In/Out F11	Prev Next Shift +:

<sup>1</sup> Press The Log Mout 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 <sup>™</sup> 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.

10-15-09 • 7 10 Press 'Log In/Out' to Log On ENH SUC STATUS	15:07:22	10-15-09 ♥ ⑦  RX-400 Unit 1 @ 15:08:18 ENH SUC STATUS NAMES
Enhanced Suction Group Name: Suct: 21. EN SUC GRP01	7 [ 22.0]	Enhanced Suction Group Manager [ 22.0] EN SUC GRP( Actions Menu 1. Graph
Stages Cap Req Oct Cycles Status #1 : Comp 15.0 = 10 28 Ready	Learning	Stages     Cap     Req     2. Log     Control status       #1 : Comp     15.0     -     -     Learning       4. Expanded Information     -     -     Condensor       5. 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 : O Capacity % : O	-General Information Sat Suct Temp : -3.1 Rack Failure : OK Capacity : 0 Capacity : 0
Press enter for a list of actions.		Press menu number or scroll to selection
F1: SUCTION	F5: SETUP	
F6         F7         F8         F9         F10	Log In/Out F11 Shift + ; Next	Image: Product of the second

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 ● ⑦  RX-400 Unit 1 இ Use Ctrl-X to Select CX Tabs SETUP NAMES	15:09:52 ED		10-15-09 ● ⑦ ₪ RX-400 Unit 1 @ 15:10:06 Use Ctrl-X to Select CX Tabs SETUP NAMES ED
C1: General C2: Circuits C3: Setpoints C4:	C5: Inputs	Tabs -	C1: General C2: Circuits C3: Setpoints C4: C5: Inputs
Enhanced Suction: EN SUC GREAT	CO: MORE		E0: OUTputs E7. State Setup C8: Stage Outs C9: C0: NOKE
General Value			Stage Setup Type Capacity Proof Oil Sensor Oil Dly Oil Pres
Name : EN SUC URPOR			#1 : Lond 15.0 Yes None
Strategy : Normal			
Number - Stages: 1			
Refrigerant : R22 Phase Protect : Yes			
Comp On Always : No			
Comp On Defrost: No			
Comp Un Reclaim: No Enable Float : No			
Condenser :			
			Use F1: PREV TAB or F2: NEXT TAB
			To Novinete Detreese Table
			To Navigate Between Tabs
Enter desired text   Name of this suction group			Scroll using Novt/Prov keys   Type of stage
F1: PREU TAB F2: NEXT TAB F3: EDIT F4: STAT	US F5: CANCEL		F1: PREV TAB F2: NEXT TAB F3: EDIT F4: LOOK UP F5: CANCEL
F1         F2         F3         F4         F5			F1 F2 F3 F4 F5
P         F	t Prev Next Shift +;		Image: Product state         Image: Pr

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

10-15-09 🔹 🎲 💷	RX-400 Unit 1 OPTION LOOKUP	周 NAMES	ED	15:10:21	10-15- Use Ct	09 🔹 🥱 rl-X to	💷 Select C	X Tabs	RX-400 U Setu	Init 1 IP	A MAME	S E	D	15:10:34
C1: General   C2	: Circuits   C3: Setpoints	C4:	C5: Inp	uts	C1: Ge	eneral	C2: Ci	ircuits	C3: Setp	oints	C4:		C5: 1	nputs
C6: Outputs 🖸	: Stage Setup C8: Stage Outs	C9:	CO: MOR	E	C6: Ou	utputs	C7: St	aqe Setup	C8: Stag	e Outs	C9:		C0: N	IORE
Stage Setup T #1 : C	y Option List Selecti Select: Description Comp Unid	ion Select	ly Oil Pre	25	St	age Setu #1	ıp Type : Dgt1	Enhanced Capacity 15.0	I Suction: Proof Yes	EN SUC Oil Se None	GRP01	Oil Dly	011	Pres
	US Dgtl CTdr	U D T												
Use Up-Down Arrow	keys or function keys to sel	ect entry. P	ress BACK.		Scrol	l using	Next/Pre	v keys	Type of s	stage				
F1: SELECT	F3: BEGINNING	F4: END	F5: C	ANCEL	F1:	PREV TAB	F2:	NEXT TAB	F3: E	DIT	F4: L	OOK UP	<u> </u>	: CANCEL
<b>F1 F2</b>	<b>F3F4</b>	FS			F1		F2	F3	F4	F5				
F6 F7		Log In/Out F11	: Prev Shift +;	Vext	<b>?</b> F6		F7	<b>G</b> F8	F9	FI		F11	Prev Shift + 3	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%

19-15-09 ● ⑦ ₪ RX-400 Unit 1 ⓓ 15:11:33 Use Ctrl-X to Select CX Tabs SETUP <u>MANUES</u> ED	18-15-89 • 🧑 🎟	RX-400 Unit 1 RX DEV SUMMARY	AMES ED
C1: General         C2: Circuits         C3: Setpoints         C4:         C5: Inputs           C6: Outputs         C7: Stane Setup         C8: Stage Outs         C9:         C0: MORE	EN SUC GRP01	21.7 [ 22.8]	
Enhanced Suction: EN SUC GRP01			
Stage Setup Type Capacity Proof Oil Sensor Oil Dly Oil Pres #1 : Dgtl 15.0 Yes None		CAP 08	
	Act		
Changes to this application will be saved.			
Do you wish to continue and exit this screen?			
Press Y=Yes or N=No	SUCTION GRP01 [2: Cap	2.0] STAGES: 1/ 1 100%	
Scroll using Next/Prev keys   Type of stage	Press enter for a list of a	actions.	E2- SETUP
F1 F2 F3 F4 F5	F1 F2 F3	F4 F5	
F6         F7         F8         F9         F10         F11         F11         Net	<b>?</b> F6 <b>F7 F8</b>	F9 F10	Log In/Out         Prev         Next           F11         Shift +;         .

# ----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** 

18-15-89 🔹 🧑 🔟	RX-400 Unit 1 🖻 RX DEV SUMMARY NAMES	15:12:11 ED	18-15-89 🔹 🧖 📧	RX-400 Unit 1 MAIN MENU	15:12:34
EN SUC GRI DGTL 08 Req Act NO SUCTION GRP81	21.7     [ 22.0]       HAIN HENU       1. Suction Groups       2. Condenser Control       3. Circuits       4. Sensor Controls       5. Configured Applications       6. Add/Delete Application       7. System Configuration		EN SUC GRPO	L 21.7 F 20 61 Configured Application 1. Suction Groups 16. Logging Groups 90. Global Data 104. ISD 2.0	5
Press menu number	8. Status		Press nenu number or s	F3 F4 F5	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	10-15-09 🕈 🕅 RX-400 Unit 1 🛕 15:34:36
Press 'Log In/Out' to Log On ISD2 Compressor 🗊	Use Ctrl-X to Select CX Tabs SETUP NAMES ED
ISD 2.0 Compressor     DEUICE INFORMATION       TSD 2 COMPONI     Product Name : ISD2.0       Manufacturer : ENERSON CLIMATE TECH       Part Number : S26-9999       OFF     OFF [ 21.7]       Comm status : on one       Display Code:	Ose Oct 1 w Co Select A rady Select and Select A rady S
CHRRENT STATUS       ASSET INFORMATION         Si Confirm That Req In:       Comp Model # : 6DD3F93KL-TSK-A42         Ci and Act Out Both Read "OFF" or ""       Comp Model # : 6B034568         RUN STATUS       USAGE STATUS         Comp Run Time : 0       Current : 0         Comp Starts : 0       Power : 0.0060	Anti ShortCycle: 0.10 MCC Value : 80.0 Comp Frequency : 60 Language Selt : English Volt Imb Set : 5%
Press enter for a list of actions.	Scroll using Next/Prev keus   Unloader 1 Enabled
F1: SUCTION F5: SETUP	F1: PREU TAB F2: NEXT TAB F3: EDIT F4: LOOK UP F5: CANCEL
F1 F2 F3 F4 F5	
F6         F7         F8         F9         F0         Log in/Out F10         Fit         Nod F11	P6         P7         P8         P3         P10         P11         Pier         Niet           F6         F7         F8         F3         F10         F11         Fit         Fit         Fit

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 ● ⑦ Ⅲ RX-400 Unit 1	5:34:56	10-15-09 ● 73 00 RX-400 Unit 1 @ 15:37:36 Use Ctrl-X to Select CX Tabs SETUP NAMES ED
C1: General     C2: Sclup     C3: Inputs     C4: Outputs     C5: ISD       C6: Device     C7: ID Config     C8: Alarms     C9: Alarm Out     C0: MORE       ISD 2.0: ISD2 COMP801	Outs E	C1: General     C2: Setup     C8: Inputs     C4: Outputs     C5: ISD Outs       C6: Device     C7: ID Config     C8: Alarms     C9: Alarm Out     C8: MORE       ISD 2.0: ISD2 COMP001
Setup     Ualue       Unider 1 Enabled     Enabled       Unider 2 Enabled     Enabled       Unider Mod Type:     Digital       ISD COH Control:     Enabled       Crankcase Alg :     Continuous       Bank Config :     Three Banks       Anti Short&Jcile:     0.10       MCC Value :     80.0       Comp Voltage :     260.0       Comp Frequency :     60       Language Selct :     English       Volt Imb Set :     5%		Inputs Board Point CAPCITY REQ IN : COMP LOCKOUT IN : ALARM RESET IN : CRWKCSE 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 : :
Scroll using Next/Prev keys   Unloader Modulation Type F1: PREV TAB _ F2: NEXT TAB _ F3: EDIT _ F4: LOOK UP _ F5: C4	ANCEL	Enter Board/Controller   Digital Capacity Request
F6         F7         F8         F9         F10         F11         F11	éxt	Image: Product



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	10−15-09 ● (?) 00 RX-400 Unit 1 (2) 15:37:56 Use Ctrl-X to Select CX Tabs SETUP NAINES ED
C1: General C2: Setup D8: Inputs C4: Outputs C5: ISD Outs	C1: General C2: Setup C3: Inputs C4: Outputs C5: ISD Outs
ISD 2.0: ISD2 COMP001	CO: DEVICE   C7: 1D CONTENT TEX: WIAPING TEX: WIAPING OUL   C0: NORE
Inputs Board Point CAPCITY RED IN :	Inputs CAPCITY RED IN : 1. Alternate I/O Formats
COMP LOCKOUT IN: : Alarm reset in : :	COMP LOCKOUT IN: 2. Set Multiple Outputs ALARM RESET IN : 3. Output Change Delta
CRNKCSE HEAT IN: : Reset Req in : :	CRNKCSE HEAT IN: 4. Generic Hiarm Secup Reset Req IN : 5. Logging Secup
SAT SUCT TEMP : THIS.01.1:EN SUC GRP01 :SAT SUCT TEMP Suction pres in: This.01.1:En suc grp01 :Filtered pres	SAT SUCT TEMP : T 7. I/O MODE TEMP PRES
DGTL PERIOD IN : :	DGTL PERIOD IN :
Enter Board/Controller   Digital Capacity Request	Press menu number or scroll to selection
F1: PREU TAB F2: NEXT TAB F3: EDIT F4: LOUK UP F5: CANCEL	L L L F5: CANCEL
F1         F2         F3         F4         F5	
F6         F7         F8         F9         F10         Log hourd F10         Prev F11         Natl	F7         F8         F9         F0         F11         F11         Nat

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 ● (?? 00 Use Ctrl-X to Select CX Tabs	RX-400 Unit 1 🕅 SETUP NAMES	15:38:10 ED		10-15-09 • 🥱 🔟	RX-400 Unit 1 CNTROLLER LOOKUP	A 15:35:42
C1: General C2: Setup C6: Device C7: ID Confin	C3: InputsC4: OutputsC8: AlarmsC9: Alarm Out	C5: ISD Outs C0: MORE		C1: General C2: Setup C6: Device C7: ID Cor	C3: Inputs C nfig C8: Alarms C	4: Outputs C5: ISD Outs 9: Alarm Out C0: MORE
Inputs CAPCITY REQ IN : COMP LOCKO ALARM RESE Select format f CRNMCSE HE RESET REQ 1 = Board : SAT SUCT T 2 = Controll SUCTION PR 3 = Fixed Va DGTL PERIO Press	or the pointer. Point er : Application: Property lue desired selection		<b>→</b>	Inputs CAPCIT COUP L ALARH RENES RESET SAT SU .IS.01.01 I SUCTIO DGTL P	Controller Selection Model Bus XX400-Refrig ETH ISD 2.0 Comp MOD	Board#/ Subnet Node
		F5: CANCEL		Use Up-Down Arrow keys or F1: SELECT	Function keys to select F3: BEGINNING	F4: END F5: CANCEL
	<b>F4 F5</b>				3 F4 F5	
<b>?</b> F6 F7 F8	Kenu         Log In/Out           F9         F10         F11	Prev Next Shift + 3			3 F9 F10	Log In/Out         :         Next           F11         Shift + ;         .



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 🔹 🎲 📖		RX-400 Unit 1 CELL LOOKUP	NAMES	15:36:07		10-15-09 • 😚 Use Ctrl-X to	🔟 Select CX Tabs	RX-400 Unit 1 SETUP		15:38:53
C1: General C2	: Setup	C3: Inputs	C4: Outputs	C5: ISD Outs		C1: General	C2: Setun	C3: Innuts	CA: Outputs	C5. ISD Outs
C6: Device C7	: ID Config	C8: Alarms	C9: Alarm Out	CO: MORE		C6: Device	C7: ID Config	C8: Alarms	C9: Alarm Out	CO: MORE
Inputs CAPCITY REQ IF COMP LOCKOUT ALARM RESET IF CRNKCS HEAT RESET REQ IM SAT SUCT TEMP SUCTION PRES J DGTL PERIOD IF	N : N: Appl/Poi Global D Suction N: ISDC TION ISDC COM	Application Sel Int Type RUICES Time Se DATA Global GRP01 Suction GRP01 ISD 2.0	ection rvices Data Control d Suction Compressor			LO: Device Inputs CAPCITY R COMP LOCK ALARM RES CRNKCSE H RESET REQ SAT SUCT SUCTION P DGTL PERI	Controll Controll EQ IN : THIS.01. OUT IN: ET IN : ET IN : IN : TEMP : THIS.01. OD IN :	US: ALAPMS 0 2.0: ISD2 COMP er Application 1:EN SUC GRP01 : : : 1:EN SUC GRP01 1:EN SUC GRP01 :	UUEPUE ALAPA UUE OUEPUE OUEPUE SAT SUCT TEMP :FILTERED PRES	
Use Up-Down Arrow	keys or func	tion keys to se	lect entry. Pres	SS BACK.		Enter Propert	y   Digital Capa	city Request		
F1: SELECT		<u>↓ F3: BEGINNING</u>	F4: END	F5: CANCEL		F1: PREV TAB	F2: NEXT TAB	F3: EDIT	F4: LOOK UP	F5: CANCEL
F1 F2	F3	<b>F4</b>	F5				F2 F3	F4	F5	
<b>F</b> 6 <b>F7</b>	<b>6</b> F8	F9	F10 F11	Prev Next Shift +;		<b>1</b> F6	F7 F8	F9	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 NAMES ED	10-15-09 ● ⑦ □ RX-400 Unit 1 ② 15:35:14 Use Ctrl-X to Select CX Tabs SETUP NAMES ED
C1: General C2: Setup C3: Inputs C4: Outputs C5: ISD Outs	C1: General C2: Setup C3: Inputs C4: Outputs C5: ISD Outs
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: : CRMKCSE 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 CAPCITY REQ IN COMP LOCKOUT IN ALARM RESET IN SAT SUCT TEMP SUCTION PRES IN DGTL PERIOD IN CONTON PRES IN SAT SUCT TEMP SUCTION PRES IN THIS.01.1:EN SUC GRPO1 SUCTION PRES IN THIS.01.1:EN SUC GRPO1 SUCT PERIOD IN CONTON PRES IN THIS.01.1:EN SUC GRPO1 SUCT PERIOD IN CONTON PRES IN CON
	Controller And Application Should
	Remain The Same For All Inputs.
	Enter Board/Controller   Digital Capacity Request
Enter Property   Digital Modulation Period Input	F1: PREV TAB F2: NEXT TAB F3: EDIT F4: LOOK UP F5: CANCEL
F1: FREV HID     F2: F3     F4     F5       F1     F2     F3     F4     F5	
Prop         Prop         Prop         Prop         Next           F6         F7         F8         F9         F10         F11         Prop         Next	F6         F7         F8         F9         F10         F11         Prior         Not



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--

10-15-09 🔹 🧒 🔟	RX-400 Unit 1 ENH SUC STATUS	AMES	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	-Co	ntrol Statu earning ndensor	15
		-Va	riable Capa 100.	oty 08
		- <del>Ge</del> S	neral Infor at Suct Ter	mation np : −1.6
		R C C	ack Failure apacity apacity %	e : OK : 15.0 : 100.0
Press enter for a list of action	ons.			
F1: SUCTION			F	5: SETUP
F1 F2 F3	F4	=5		
F6         F7         F8	F9 F	Log In/O 10 F11	ti 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.



AE4-1373

## 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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### 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

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- 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 (with serial number of 03D 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
LAam	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. 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**



