1. SAFETY PRECAUTIONS

To prevent injury and property damage, follow these instructions. Failure to adhere to installation/operation procedures and all applicable codes may result in hazards as indicated by warning codes below:

The meaning of each symbol in this manual, and on your equipment, is as follows.

⚠️ This is the safety alert symbol. Read and follow instructions carefully to avoid a dangerous situation.

⚠️ This symbol alerts the user to the presence of “dangerous voltage” inside the product that might cause bodily harm or electric shock.

This manual should be placed in a location where it can be accessed by users.
This manual should be given to the person who actually operating the control panel and is responsible for its maintenance.

⚠️ CAUTION As with all electrical products, read manual thoroughly. Only qualified, expert personnel should perform installation and maintenance. Do not disassemble or repair unit unless described in this manual; death or injury to electrical shock or fire hazard may result. Specifications and manual data are subject to change. Consult factory for additional information.

⚠️ Disconnect and lock out all power before installing or servicing equipment.
This equipment may require locking out multiple power sources prior to service.
2. INTRODUCTION

The RDP control package with DDP option is designed to meet UL-508 and NEC requirements and to provide control redundancy, different alternating and control modes based on digital and analog input signals from local or BMS (building management system) control. The RDP provides control redundancy with alternation for one motor and DDP for two motors one at a time with alternation.

The purpose of RDP is to replace standard VFD-Bypass packages and provide maximum reliability and full system control in both VFD and “Bypass” modes and ability to run three-phase motors from single-phase power. Both VFDs are identically programmed and the system does not lose any control or protection functionality no matter which VFD is active. The input contactors provide more reliability to the package by keeping powered only main VFD and standby VFD will not be subject to any power line surges. The output contactors have mechanical latching units to prevent VFD trips or damage from opening motor circuit during VFD operation by momentarily control power loss.

The RDP consists of:

1. Two identical drives
2. NEMA 1 enclosure
3. MCP disconnect
4. VFD isolating MMSs
5. Input contactors
6. Output contactors
7. PLC
8. Optional input and output reactors
9. Control transformer with terminal blocks

The switches and LED pilot lights are mounted on the door.
All the VFD and PLC inputs and pressure transducer (if used) are powered by PLC internal 24VDC power supply. The control panel has a provision for proper mode or setting selections for control and protection features. The changes of the settings can be done in programming mode by adjusting two PLC potentiometers. For example, there are four selections for operation of the Fireman’s SW: Override or Shutdown with N.O. or N.C. type of the contact. The control system monitors Ready and Run status of main VFD and generates a VFD alternation and alarm output when abnormal state is detected.

3. INSTALLATION AND WIRING

**RDP Power wiring**

![RDP Control Panel Diagram]

**Check if supply voltage matches the voltage rating on the provided drawing & manufacturer’s panel label before wiring and powering up the RDP control panel!**

Verify correct input voltage and wiring to RDP power and motor terminals. Connect three-phase input power wires to the bottom MCP terminals 2, 4, and 6 and motor wires to terminal blocks T1, T2 and T3. Single-phase power wires should be connected to MCP terminals 2 and 4. Connect power and motor ground wires to ground stud or terminal block. The wire gauge should be determined by a licensed electrician based on NEC requirements.

*The input power, motor and control wires should be in separate conduits, otherwise VFD malfunction or damage can occur.*

For the VFD protection and better power filtering it is recommended to install line reactors for each VFD if distance to the service transformer is greater than 50’. For the motor winding protection for 480VAC systems it is recommended to install output reactor from 45’ to 100’, output dV/dt filter from 100’ to 1000” and Sine wave filter above 1000’ from VFD to motor.

**DDP Power wiring**

In DDP configuration there are no output jumpers on OUT1 and OUT2 contactors and Motor-1 and Motor-2 wires should be connected directly to corresponding contactor. The output contactors are still mechanically interlock and only one motor can be running at a time. The RDP package can only accommodate two optional inductive reactors. If a line reactor and output reactors options was selected, either line reactor or one output reactor should be installed externally in proper NEMA rated enclosure.

**Environmental ratings.** The NEMA1 RDP is intended for installation inside the building with 104°F (40°C) maximum ambient temperature. The temperature rating can be increased up to 122°F (50°C) by upsizing VFDs by 20%. Provide minimum 2 inch spacing on each side and 4 inches on the top of the package for proper ventilation.

**Digital Inputs and Outputs Wiring.** The control wiring for digital inputs is shown on the diagram below. It includes Damper SW, Vibration SW, Fireman’s SW, Alternation SW and remote start.
**Damper SW.** Remove the JDS jumper to connect N.O. damper switch contact wires to terminal blocks 24+ and DSW. 120VAC damper motor should be wire to terminals DM and N. 24VAC damper motor control is optional and requires an extra 120/24VAC transformer.

**Vibration SW.** Remove the JVS jumper to connect N.C. vibration switch contact wires to terminal blocks 24+ and VSW.

**Fireman’s SW.** Remove the JFS jumper to connect N.C. shutdown contact wires to terminal blocks 24+ and FMS. When contact is open, the RDP will stop and disable VFDs in any control mode.

**Remote Start.** Connect BMS N.O. run contact wires to enclosure terminals 24+ and STR. When contact is closed in Auto mode, main VFD will start.

**Run Status Output.** Connect BMS run status input wires to VFD1 and VFD2 terminals A1 and C1 (N.O. relay contact).

**Fault Status Output.** Connect BMS fault status input wires to VFD1 and VFD2 terminals 3A and 3C (N.O. relay contact).

**Analog Inputs and Outputs Wiring.** Use shielded cable with shield connected to chassis ground for better noise protection in analog signal circuitry. The system will automatically switch analog signal to main VFD during alternation.

- **0-10VDC.** Connect BMS 0-10VDC output positive wire to enclosure terminal block marked V1 and negative to terminal AG.
- **0-4-20mA.** Connect BMS 4-20mA output positive wire to terminal block marked I and negative to terminal AG.

- **0-10VDC Transducer.** Wire the pressure or temperature transducer’s positive (POWER) wire to terminal block marked 24+ and negative (COM) wire to terminal -24. The output wire should be connected to terminal V1.

- **4-20mA Transducer.** Wire the pressure transducer’s positive (POWER) wire to terminal block 24+ and the output wire to terminal I.

**VFD Frequency Output.** Connect 0-10VDC frequency output terminal block S0 to BMS positive wire and AG to negative wire. S0 is set by default to Output Frequency but can be programmed to other parameters.

Note: The transducer wire colors are shown for transducers supplied by FCS. Other brand transducers could have different wire colors.

**4. SETUP**

Put VFD SW in VFD1 position and HOA SW in OFF position. Turn the MMS1, MMS2, TCB1 and CBP breakers on. Turn MCP disconnect on to apply power to the panel. Main VFD IN and OUT contactors should be engaged and VFD will be powered. Change VFD SW from VFD1 to VFD2 and back to VFD1 positions to power up a standby VFD for 30 minutes for programming. Adjust VFD parameters with motor data for proper system operation and motor protection: SET-02 motor HP rating, SET-03 Motor FLA, SET-04 motor synchronous speed (example: 1750rpm = 1800rpm), SET-07 Line Voltage and SET-08 Motor Voltage.

**Damper SW.** The default settings for VFD I/O-68, I/O-78 and I/O-21 parameters are [Damper] and [Damper SW]. The damper timer I/O-69 parameter sets a time delay for a damper fault when damper N.O. switch is not closed. The default setting is 30 seconds and it should be adjusted to a time enough to open a damper.
The PLC selection of Fault delay should be greater than I/O-69 setting. Remove the factory installed jumper JDS to wire a damper switch. If damper does not have a damper switch and VFD should start after damper is open, set parameter I/O-21 to [Reserved] and parameter I/O-69 to time enough to open a damper. In this case the damper fault feature will be disabled.

**Vibration SW.** The default setting for I/O-22 is [EXT. TRIP] and Bit #3 in I/O-95 is set to [1], which is N.C. contact. Remove the jumper JVS to wire a vibration switch. When contact between 24+ and VSW terminals is open, the VFD trips on External Trip and can be reset by pressing STOP key on the VFD keypad after vibration switch is reset.

**Alternation.** The default setting for RDP alternation is by main VFD fault or 2 second pulse on ALT terminal (contact between 24+ and ALT should be closed for 2 sec. or longer). Close ALT input for 2 seconds and main VFD should stop and then standby VFD starts. The default setting for DDP is 1-Day alternation. There are following settings for alternation: At Fault, At Start, By Pulse, 7-days, 90-days/1-day and by the state of contact between 24+ and ALT (open for VFD1 and closed for VFD2). Refer to chapter 6 for details.

**Fireman’s Input.** The default setting is Shutdown with N.C. contact. When contact is open, the system will stop and disable VFD’s. Remove jumper JFS to wire Shutdown or Override contact between 24+ and FMS terminals based on its type selection. There are following settings for Fireman’s SW: N.C. or N.O. Shutdown and N.C. or N.O. Override. The selection of the Fireman’s SW type should match the VFD’s I/O-24 & I/O-95 parameters selections. Refer to chapter 6 for details.

**Fault Delay.** The system monitors a main VFD run status, ready status and OUT contactor auxiliary contact during run to determine a VFD failure. The default time delay setting for Fault by run status is 15 seconds and can be changed to 75sec., 135sec., 195sec., 375sec. and Disabled. If VFD damper timer (time to open the damper) is set to 120 seconds, the 135 second fault delay should be selected. If Fault delay is disabled, the RDP only generates a VFD fault based on VFD Ready and OUT contactor status. If OUT contactor or VFD Ready relay is open, the system will initiate a fault mode after 15 second delay and second VFD will be activated.

**Standby VFD power up.** The Standby VFD can be powered for 30 minutes at any time by turning VFD SW from VFD1 to VFD2 and back to VFD1 position. The RDP monitors if standby VFD was not powered for more than 90 days and turns its input contactor on for 30 minutes to provide charge/discharge cycle for DC bus capacitors and run cooling fans. The DDP control mode runs with alternation and does not usually require a power up cycle.

5. **PRINCIPLE OF OPERATION**

**Basic Operation.** When MCP disconnect is in on position and HOA switch is in “OFF” position, the main VFD will be powered and stay in stop mode. The VFD corresponding to VFD SW selection will start and run with preset speed when HOA switch is put in “Hand” position and stop when HOA is in “OFF” position. The Hand mode speed is adjustable in parameter DRV-01 (Step Frequency-1).

The main VFD will start and run when HOA SW is in Auto position and Start contact between terminals 24+ and STR is closed. The VFD will run at frequency adjusted by selected frequency reference source in parameter SET-10. Example: If SET-10 selection is V1, the VFD will run in Auto mode at speed set by 0-10VDC signal. The VFD will run at variable speed based on feedback signal if internal PID control is enabled in parameter SET-20. When HOA SW is in Hand position, the PID control is disabled.

**Main VFD Fault.** The RDP package provides two ways to monitor a Main VFD fault: by VFD ready status (VFD is powered and ready) and by VFD run status (VFD is ready and running). The Run fault will be determined by VFD RUN relay status when there is a start command. The time delay for VFD Run fault is set in Feature #5 and it should be greater than any VFD run delay including damper delay. The VFD Ready fault monitoring is based on Ready relay and OUT contactor status with non-adjustable 15 second delay. If Feature # 5 is disabled, the RDP only provides VFD Ready fault monitoring. If feature #2 (alternate at fault) is set to 1 (enabled) and RDP determines that VFD faulted, the main OUT contactor will be disengaged, standby OUT engaged and standby VFD will replace the faulty VFD automatically and alarm output and light will be activated. If the feature #2 is set to 2 (disabled) and main VFD failed, the RDP will activate an alarm output and light without activating a standby VFD. The VFD fault can be reset by putting VFD SW to faulty VFD.
position and changing HOA SW from OFF to HAND and back to OFF position. The faulty VFD can be electrically isolated by turning OFF a corresponding MMS. There is a provision for a padlock on the MMS knob in OFF position.

**Power up cycle.** The RDP provides periodic power up cycle for standby VFD if it was not powered for more than 90 days. This cycle will keep a standby VFD in better shape and increase system reliability. This mode can be disabled or enabled in feature #2 by selecting 4 or 5 respectively.

**Alternation.** The RDP provides following alternation modes: by pulse longer than 2 seconds; ON/OFF state of the ALT contact; at every start; by 7-day, 90-day (RDP) or 1-Day (DDP) run time. The alternation type can be selected in Feature #1 and alternation at VFD fault in feature #2. The alternation by VFD SW in Auto mode can be disabled or enabled in feature #4 by selecting 1 or 2 respectively. When it is enabled, the feature #1 selection is disabled automatically.

**Shutdown/Override.** The Shutdown or Override input mode and contact type (N.O. or N.C.) can be selected in feature #3. The Shutdown input disables VFD in Hand and Auto control modes. The Override input starts VFD in any mode and runs it at maximum speed with most of the protection features disabled.

If Shutdown N.C. is selected, VFD parameter I/O-24 is set to BX-Trip and I/O-30 (BX Self Reset) is set to YES, the system and both VFDs will be disabled when contact is open and enabled when contact is closed. The Shutdown input disables VFD in Hand and Auto control modes.

If Shutdown N.O. is selected, the system and both VFDs will be disabled when contact is closed and enabled when contact is open.

If Override N.C. is selected, VFD parameter I/O-24 is set to Smoke Purge, the main VFD will run when contact is open and return to normal operation when contact is closed. If RDP detects a main VFD failure, a standby VFD will automatically replace it. The activated Override input starts VFD in Hand, OFF or Auto control modes.

If Override N.O. is selected, the system starts main VFD when contact is closed and returns to normal operation when contact is open.

### 6. RUN TEST

Refer to Programming Mode below for selecting the RDP or DDP package control mode.

When RDP is powered and all necessary parameters are set, move HOA switch knob to HAND position with VFD SW in VFD1 position and the VFD1 will begin to run the motor at minimum speed and RPL1 RUN LED light will be on. Verify a proper motor rotation. Put VFD switch in VFD2 position, the VFD1 will stop and VFD2 will start. Verify a proper motor rotation. If rotation is incorrect, stop VFD by putting HOA in OFF position, turn the RDP power OFF and after about 10 minutes swap any two motor leads to change the rotation (swapping input power wires will not affect the motor rotation). Start system again and check motor rotation. If it is correct, the system is ready for Auto mode run test.

Move HOA SW in Auto position and close start contact between terminals STR and STA. The main VFD should start and run at supplied speed reference. If speed reference signal is below frequency limit setting, the VFD will run at frequency limit speed.

If VFD is set for PID control with transducer feedback, the motor speed will be determined by PID control based on feedback signal level and PID set-point. Refer to P-VFD manual for PID parameters set-up.

### 7. FEATURES AND SELECTIONS

Two internal PLC potentiometers TMR1 and TMR2 are located in the PLC’s top left corner under plastic cover. They are converted by PLC programming into five-position switches for easy adjustments. The full operating sector of each potentiometer is divided by five sectors to create a five-position switch in PLC program. The potentiometer position can be changed by a little control screwdriver.

- **Position #1** is a maximum counterclockwise potentiometer position.
- **Position #2** is 30-40 degrees from the maximum counterclockwise potentiometer position.
• **Position #3** is in the middle of the operating range of the potentiometer.
• **Position #4** is 30-40 degrees from the maximum clockwise potentiometer position.
• **Position #5** is a maximum clockwise potentiometer position.

TMR1 and TMR2 potentiometers are used in PLC program for Indication and Programming modes. The following is a table for features and selections available in RDP panel. The TMR1 position #2 has two features with Enabled and Disabled selections: Alternation at Fault and Standby VFD Power Up.

<table>
<thead>
<tr>
<th>TMR1 Position (Feature) Number</th>
<th>TMR2 Position (Selection) Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 Alternation in Auto mode</td>
<td>#1 * By Pulse</td>
</tr>
<tr>
<td>#2 Fault ALT &amp; Power Up</td>
<td>#4 * Enabled</td>
</tr>
<tr>
<td>#3 Fireman’s Switch</td>
<td>#5 Disabled</td>
</tr>
<tr>
<td>#4 Alternation by VFD SW in</td>
<td>#2 Disabled</td>
</tr>
<tr>
<td>Auto Mode &amp; RDP/DDP selection</td>
<td>#3 Disabled</td>
</tr>
<tr>
<td>#5 Fault Delay</td>
<td>#5 Disabled</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>TMR2 Indication #1</th>
<th>#1</th>
<th>TMR2 Indication #2</th>
<th>#1</th>
<th>TMR2 Indication #3</th>
<th>#1</th>
<th>TMR2 Indication #4</th>
<th>#1</th>
<th>TMR2 Indication #5</th>
<th>#1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>* Enabled</td>
<td>* Enabled</td>
<td>* Shutdown N.C.</td>
<td>* Disabled</td>
<td>* 15 sec.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>At Start</td>
<td>Disabled</td>
<td>Shutdown N.O.</td>
<td>Enabled</td>
<td>75 Sec.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>7-Day</td>
<td>N/A</td>
<td>Override N.C.</td>
<td>N/A</td>
<td>195 sec.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>By State</td>
<td>Enabled (* RDP)</td>
<td>N/A</td>
<td>DDP</td>
<td>Disabled</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: (*) indicates a default setting for the feature.

The Indication mode is designed to indicate a saved selection for each feature. It shows TMR1 position number (Feature #), after it was moved and saved selection number for it by pulses on PLC P40 output LED. In order to activate an Indication mode, set TMR1 and TMr2 to position #1, put HOA SW in OFF position, turn MMS1 and MMS2 OFF and put VFD SW in VFD1 position. The system is ready for the Indication mode. When TMR1 is moved to any position, the P40 LED light will flash to indicate a current position number and after 2 seconds a stored selection number for current feature. If TMR2 is in inapplicable for this feature position, the LED light will provide several bursts of fast flashes.

**Example:** If TMR2 is in position #5 and you need to check a selection for Fireman’s Switch feature (TMR1 position #3), moving TMR1 to position #3 will activate a wrong TMR2 position indication. Then put TMR2 in position #1 and move TMR1 to position #1 and wait until P40 LED indicates a current position and selection. Put TMR1 back to position #3 to start correct indication mode for feature #3. The Indication mode is useful for trouble-shooting and system set-up.

The Programming mode provides ability to select and save desired settings for RDP or DDP control features. In order to prepare system for Programming mode, put HOA SW in OFF position, turn MMS1 and MMS2 off, put VFD SW in VFD1 position, install a wire jumper between STA-STH terminals and power up the RDP package.

The **RDP** mode can be selected by switching HOA switch to HAND position five times with VFD SW in VFD1 position. The PLC P40 LED light will be on for about 3 seconds indicating an RDP mode selection.

The **DDP** mode can be selected by switching HOA switch to HAND position five times with VFD SW in VFD2 position. The PLC P40 LED light will flash twice indicating a DDP mode selection.

When RDP or DDP mode is selected, put HOA SW in Hand position and load default settings by switching VFD SW to VFD2 position five times. The PLC P40 LED light will create a burst of fast flashes indicating that default settings are loaded.

Make the following steps to program RDP/DDP features:

1. Turn TMR1 to desired position (Feature #) and PLC P40 LED will indicate current position number by number of flashes.
2. Turn TMR2 to desired position (Selection #) and P40 LED will flash the current position number.
3. If positions for both potentiometers indicated by P40 LED were correct, change VFD SW from VFD1 to VFD2 and back to VFD1 three times and P40 LED will be on for 2 seconds indicating that the selection number was saved.
4. Use TMR1 and TMR2 again to change settings for other features if needed. If PLC creates bursts of P40 LED flashes in programming mode, the TMR2 position is set to inapplicable selection (labeled N/A in the above table) for the feature selected by TMR1.

5. When programming is finished, put TMR1 and TMR2 to position #1, set HOA switch to OFF position, remove STA-STH jumper and turn MMS1 and MMS2 on.

- **Features reset.** The system features can be reset to factory default settings in Programming mode by switching VFD SW to VFD2 positions five times in 5 seconds. The P40 LED light will flash rapidly for 2 seconds indicating that the default settings are loaded.

### 8. SPECIFICATIONS

<table>
<thead>
<tr>
<th>Power</th>
<th>Input Power Voltage</th>
<th>208-240 or 480VAC or 575VAC (call factory for other voltages)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Input Power Frequency</td>
<td>50/60Hz</td>
</tr>
<tr>
<td></td>
<td>Output Voltage</td>
<td>Adjustable to motor voltage:</td>
</tr>
<tr>
<td></td>
<td>Output Frequency</td>
<td>200-240 or 380-480VAC or 525-600VAC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Adjustable to motor frequency up to 120Hz</td>
</tr>
<tr>
<td>Outputs</td>
<td>Relay Contacts (Alarm &amp; Damper)</td>
<td>Max. 6A 480VAC Motor Load</td>
</tr>
<tr>
<td></td>
<td>VFD Relay Contacts</td>
<td>Max. 1A 250VAC/30VDC Resistive Load</td>
</tr>
<tr>
<td>Inputs</td>
<td>PLC inputs</td>
<td>24VDC 10mA</td>
</tr>
<tr>
<td></td>
<td>Pressure transducer</td>
<td>24VDC 4-20mA or 0-10VDC</td>
</tr>
<tr>
<td>PLC Timers Adjustments</td>
<td>TMR1 Feature #</td>
<td>Five settings: #1, #2, #3, #4 and #5</td>
</tr>
<tr>
<td></td>
<td>TMR2 Selection #</td>
<td>Five settings: #1, #2, #3, #4 and #5</td>
</tr>
<tr>
<td>Environmental</td>
<td>Storage</td>
<td>12°F to 132°F (-10°C to 55°C)</td>
</tr>
<tr>
<td></td>
<td>Operating</td>
<td>32°F to 104°F (0°C to 40°C) Inside Installation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>32°F to 122°F (0°C to 50°C) With 20% de-rated VFD</td>
</tr>
<tr>
<td>Dimensions</td>
<td>RDP-FRM1-ENCL</td>
<td>18”W x 40.8”H x 8.4”D</td>
</tr>
<tr>
<td></td>
<td>RDP-FRM2-ENCL</td>
<td>22”W x 52.7”H x 8.9”D</td>
</tr>
<tr>
<td></td>
<td>RDP-FRM2-ENCL</td>
<td>26”W x 60.7”H x 10.1”D</td>
</tr>
</tbody>
</table>

This manual is applicable to all FCS standard RDP panels built after November 11th, 2013.

**Warranty Information**

FCS provides 5-year warranty for all FCS/Cerus brand electrical components excluding thermal protection devices. All other brand name devices installed in FCS control panels will carry original manufacturer warranties.

**Warranty period is 60 months after date of invoice. Detailed warranty terms and conditions are available from FCS or can be found at** [www.Franklin-Controls.com](http://www.Franklin-Controls.com)

- **Warranty service information.**
  - If the RDP panel does not operate properly because of any defective component under normal and proper use within the warranty term, contact an authorized FCS distributor or FCS technical support.

- **Warranty is void if damage to the unit was caused by any of the following:**
  - Misuse, negligence or accident.
  - Abnormal supplied power voltage.
  - Improper repair or altering by other than a FCS authorized distributor or service center.
  - Earthquake, fire, flooding, lighting, or other natural calamities
  - When the warranty period has expired
9. The RDP and DDP panels power schematics.

RDP/DDP VFD Parameter Settings

- SET-90 = 2\textsuperscript{nd} SOURCE
- FG2-24 = NO (Retry)
- I/O-21 = DAMPER SW
- I/O-22 = EXT. TRIP
- I/O-25 = LOC/REM
- I/O-68 = DAMPER
- I/O-77 = READY
- I/O-78 = DAMPER
- I/O-95 = 0000010100

I/O-77 = READY