

# OPERATION & MAINTENANCE MANUAL

## Revision 2



### DCPro Model FSMA 30-20 30V-20A Air Cooled, Switch Mode Cathodic Protection Power Supply

Version 1.0



FARWEST CORROSION CONTROL COMPANY  
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TABLE OF CONTENTS

DCPRO INTRODUCTION .....3

COMPONENT LOCATIONS & IDENTIFICATON.....4

INSTALLATION CONSIDERATIONS .....5

REMOTE MONITORING UNIT (RMU) INTERCONNECT.....6

SYSTEM START-UP AND ADJUSTMENT .....7

NORMAL OPERATIONS.....9

TROUBLESHOOTING.....12

FIELD REPAIRS.....13

THREE (3) YEAR LIMITED WARRANTY.....14

DCPRO SWITCH MODE POWER SUPPLY .....14

ABOUT FARWEST CORROSION CONTROL COMPANY .....15

## DCPro INTRODUCTION

The DCPPro Cathodic Protection Power Supply changes the landscape of the traditional rectifier power supply. This advanced rectifier is a durable, switch-mode power supply that provides clean, efficient DC power using state-of-the-art technology. The “constant current” design allows simple current output control in 0.1 amp increments and, once set, the DCPPro will hold the desired current output.

Unlike other switch-mode power supplies, there are no confusing menus and no need for a computer interface. The DCPPro is designed to look like a conventional rectifier, yet it offers many more features.

The bright color display, readable in direct sunlight, presents both analog and digital output voltage and current readings. Additional status information is available in this same display.

With the DCPPro, the desired output current level is maintained the first time and every time.

## DCPro FEATURES

### Superior Technology

- Fully solid-state “switch-mode” operation
- 85 to 90% efficient power conversion
- Output adjustments in 0.1 amp increments
- Rejects induced AC for accurate “off” readings
- Over-temperature protection
- Provides pure DC power without AC ripple issues
- Standard AC & DC surge protection
- Built in separate 12-volt power supply for RMU and interrupter
- Dead-front safety panel

### Constant Current Output

- Maintains desired DC current output
- Output voltage adjusts automatically
- Circuit resistance variations will not affect current output
- DC output current remains constant despite AC power fluctuations
- Analog and digital output readings

### Simple to Operate

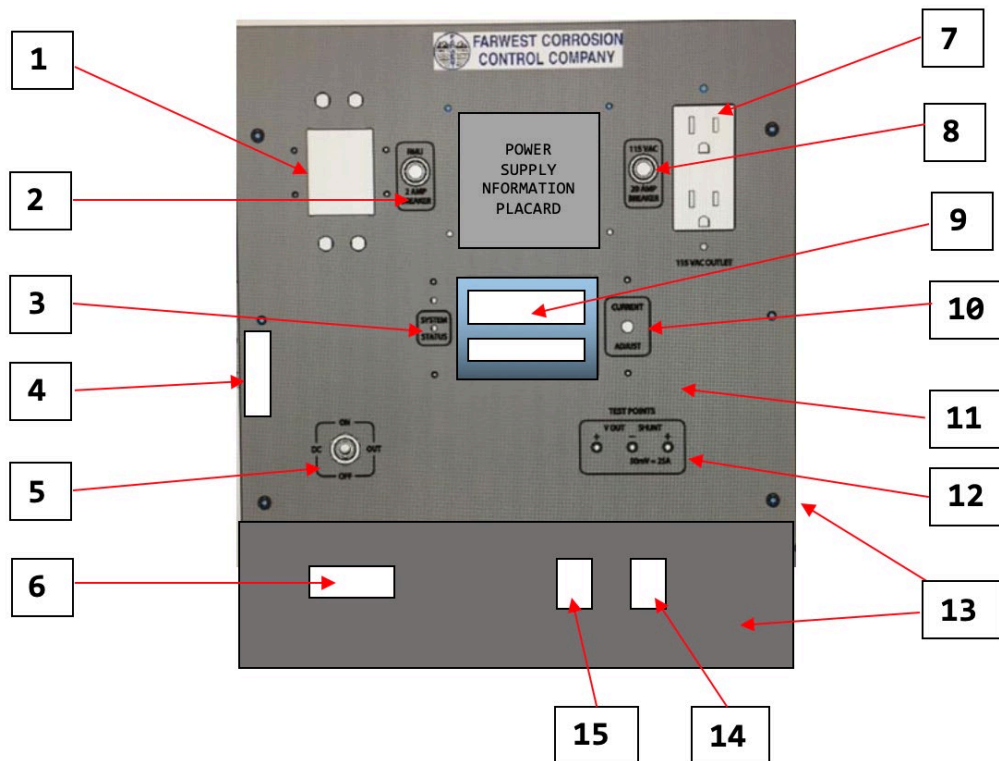
- Adjust DC current output with a single knob
- No tap changes required
- Operates on any single-phase power from 115 to 240 VAC
- Easily connects to an RMU with interface terminal strip (included)
- Connect a portable interrupter with interface terminal strip (included)
- Cross-check meter accuracy with front panel test ports
- Lightweight chassis and aluminum cabinet for easy installation (standard)

### Certifications & Warranty

- ETL certified
- 3-year warranty

## COMPONENT LOCATIONS & IDENTIFICATION

Figure 1



1. Main AC input circuit breaker
2. AC input circuit breaker for 12-volt DC power supply to power RMU and customer supplied portable Interrupter
3. Multi-color LED system status indicator light
4. RMU interface terminal block (behind main panel board)
5. DC output ON-OFF switch
6. Interrupter interface terminal block (behind removable safety panel)
7. Convenience outlet rated for 20 amps AC
8. AC input circuit breaker for convenience outlet
9. TFT color graphics display; Displays output voltage and current in analog and digital format, as well as providing system status messages
10. Output adjustment knob; Press to turn on display; Rotate to adjust current output.
11. Main "dead front" safety panel
12. Test points to cross check digital and analog volt and ammeter accuracy
13. Removable dead front and side safety panels
14. Negative (Structure) DC output cable terminal (behind removable lower safety panel)
15. Positive (Anode) DC output cable terminal (behind removable lower safety panel)

## INSTALLATION CONSIDERATIONS

### **WARNING!**

**This equipment poses an electrical shock hazard. Any manipulation or maintenance actions should be performed by qualified personnel only.**

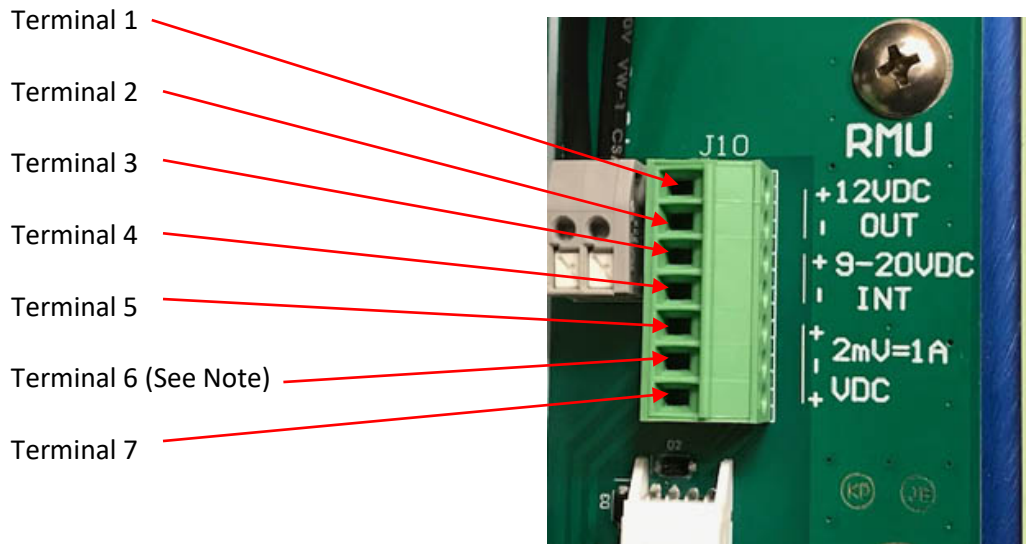
It is strongly recommended that the installation technician familiarize themselves with the main features and locations for the interface hardware as shown on Figure 1.

1. The DCPPro power supply can be provided with an industry-standard, air-cooled, NEMA 3R aluminum (3 door) enclosure that can be pole or wall mounted. Suitable mounting hardware should be used to install the cabinet to the appropriate pole or wall surface.
2. As a possible alternative, the DCPPro's aluminum chassis is suitable for "slide-in" installation into many existing industry-standard, air-cooled rectifier enclosures. Check with Farwest Corrosion for installation details.
3. The DCPPro DOES NOT require any manual AC input tap configuration. The DCPPro units self-configure and can accept any single-phase voltage between 110 to 240-volts AC and 48 to 63 Hz.
4. AC input power should be supplied from a local disconnect circuit breaker (safety switch) or branch circuit breaker. This will allow the DCPPro power supply to be disconnected from all power sources to provide a positive lock out/tag out condition during any maintenance on the DCPPro power supply.
5. If the front panel AC convenience outlet is to be enabled, it should be provided with a separate AC line source (See FIGURE 1 Item 7). **ONLY 115-volts AC should be wired to this device. It is recommended that a dedicated 115/1/60 (20 A) service be installed to operate this option.** (If wired in the recommended configuration, this AC outlet can then be utilized even when the main, front panel mounted, AC input circuit breaker is in the "OFF" position.)
6. The AC input wire size, type and configuration must comply with the National Electrical Code (NEC).
7. **It is imperative that the power supply unit and enclosure be properly grounded.** A dedicated ground terminal is provided on the power supply chassis adjacent to the AC input terminal block in addition to a ground terminal on the cabinet's external mounting channel.
8. DC output cables shall be properly sized for connection to the DC output cable terminals.
9. **Always** connect the structure to be protected to the NEGATIVE output lug. Anode shall be connected to the POSITIVE output lug.

## REMOTE MONITORING UNIT (RMU) INTERCONNECT

There is a 7-position terminal block located behind the left side of the main panel. This terminal block provides a convenient interface connection to a customer supplied Remote Monitoring Unit (RMU). (See Figure 1 Item 4)

Figure 2



Terminals **1 & 2** are 12-volt DC output power from the DCPro onboard supplemental DC power supply to provide power to operate the RMU. Maximum continuous current is 2.0 amps DC.

- **Terminal 1** = Voltage Positive
- **Terminal 2** = Voltage Negative

Terminals **3 & 4** are DC inputs (9 to 20 volts DC) from the RMU to electronically interrupt the DC output of the DCPro power supply.

- **Terminal 3** = Voltage Positive
- **Terminal 4** = Voltage Negative

Terminals **5 & 6** are connected across an internal 0.002-ohm shunt that is in series with the negative DC output terminal. This allows accurate measurement of the DC output current.

- **Terminal 5** = Shunt Positive
- **Terminal 6** = Shunt Negative (common negative) See NOTE

Terminals **6 & 7** are connected to the DC output of the power supply.

- **Terminal 6** = Voltage Negative (common negative) See NOTE
- **Terminal 7** = Voltage Positive
  - **NOTE:** Two negative wires will be installed on Terminal 6.

## SYSTEM START-UP AND ADJUSTMENT

*Once the DCPPro is properly installed and all cable attachments have been made, it is strongly recommended that a qualified corrosion professional be consulted for start-up and commissioning of the DCPPro and the CP system. It is also very important to check the security and polarity of all the cables connected to the DCPPro prior to start-up.*

1. Verify that AC input power is available and properly installed. Do this by measuring the AC voltage at the input terminal blocks. **Note that extreme care shall be taken to avoid electrical shock.**
2. To energize the DCPPro unit, simply “close” the main AC input circuit breaker (Figure 1 Item 1) to the “ON” position. The graphics display will automatically start and display the Farwest Logo, Hardware and Software Version.
3. Ensure that the DC output switch (Figure 1 Item 5) is in the ON position
4. The DCPPro is shipped with the output control set to zero. To set the desired DC output current, press the adjustment knob (Figure 1 Item 10) once to enter the “Set Current” mode. The message “Set Current” will be blinking on the display. Turn the output adjustment knob clockwise to increase the DC output current. Each click of the knob will increase (or decrease when turned counterclockwise) the current output by 0.100 amps. As the knob is adjusted, the display will show the current value that the operator has selected.
5. Once the unit is adjusted to the desired DC current output, the analog bar graphs and the digital display should indicate the same values.

The display will indicate three values:

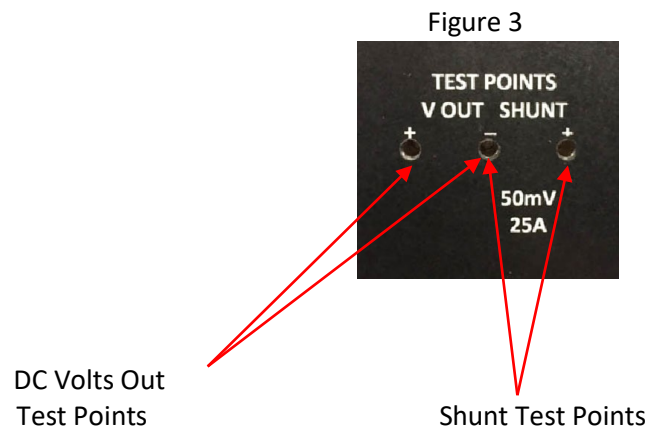
- 1) The DC output voltage.
- 2) The DC output current.
- 3) The assigned “Set Current”. Under normal operating conditions, the “Set Current” and the DC output current should be the same values. The blinking Set Current message will revert to solid in approximately 5 mins.

6. NOTE: The display will “time-out” and go dark after approximately 15 minutes of non-use. To turn the digital display back on, either press the adjustment knob (Figure 1 Item 10) one time or turn the knob one click in either direction.

7. Crosscheck the accuracy of both the digital and analog meters (viewed in the graphics display window) by using of the front panel test points. (Figure 1 Item 12 and Figure 3 below).

Using a calibrated, portable multimeter, the operator can measure the actual DC output voltage and current. The voltage is measured between the + and - "V OUT" test points. Current output is confirmed by measuring the DC millivolt drop between the - and + "SHUNT" test points. This measurement is taken across a 50 mV 25 Amp shunt with a resistance value of 0.002 ohms (.002Ω).

Example: 2 mV = 1.0 amps.





## NORMAL OPERATIONS

The DCPro power supply is a “constant current” design allowing the operator to set the desired DC current output for the CP system. The DCPro will maintain the DC output current level. Therefore, if the anode-to-earth resistance (load circuit resistance) changes for any reason, such as seasonal moisture changes, anode deterioration, or similar, the DCPro will sense the resistance change and increase or decrease the voltage output to maintain the desired DC output or “SET” current.

The DCPro is rated to operate continuously up to a maximum of 30 Volts @ 20 Amperes. Therefore, the DCPro can operate at full output rating on systems with anode to structure circuit resistance up to 1.5 ohms. Any anode-to-earth resistance values greater than 1.5 ohms will limit the DC current output to whatever level can be produced with the maximum rated 30 Volt output.

## SYSTEM STATUS LED

The following are the color code descriptions, which may be displayed by the LED status indicator: See (Figure 1 Item 3.)

**FLASHING GREEN** – “SYSTEM NORMAL” message will show in the display as well.

**FLASHING ORANGE** – A system issue has been detected. Check the display message.

**FLASHING RED** – The DC output is switched “OFF” via the DC output ON-OFF switch and/or the unit is in “interrupt mode” via an input from an RMU. In the event of a broken anode and or structure cable, the LED will flash red and the message “ZERO CURRENT OUTPUT” will appear on the display.

## GRAPHICS DISPLAY - INFORMATION AND MESSAGES

The color graphics display provides real-time DC output voltage and current values in both analog “Bar Graph” and Digital display.

When in the manual current adjustment mode, the message “SET CURRENT” will blink. Once the desired current is set, “SET CURRENT” level will be stored and displayed below the actual current output value. After approximately 15 minutes, the blinking SET CURRENT message will revert to solid on display.

Additional messages (below) are presented in the lower portion of the display screen. NOTE: To clear any message, press the adjustment knob one click.

**“SYSTEM NORMAL”** - The DCPro is in normal operation mode operating at the assigned “SET CURRENT” and is within normal DC output voltage and current ratings. The LED will provide a flashing green system status light.

**“MAXIMUM CURRENT”** - Either the “SET CURRENT” is at 20 DC amps or the unit is operating at maximum rated 30 volts. Note that the current output level may be less than 20 amps when the anode-to-earth circuit resistance is greater than 1.5 ohms.

**“MAXIMUM VOLTAGE”** - System is operating at maximum rated voltage of 30 volts. Under this condition, the desired “SET CURRENT” may not be possible if the anode-to-earth resistance is greater than 1.5 ohms.

**“MINIMUM VOLTAGE”** – DC output voltage adjustment is set to minimum (zero) volts.

**“VOLTAGE DRIFT”** - Once the current level is set to the appropriate value, the DCPro stores the assigned set current and the voltage values. When the voltage changes more than 15% since the last set current event, the “VOLTAGE DRIFT” message will be displayed. Additionally, the system status LED will flash yellow. This indicates that a change in the output circuit resistance has occurred. This message can be cleared by depressing the output current adjust knob twice.

Note: The DC output of a CP system will normally remain stable. Seasonal changes in the anode-to-earth resistance can be caused by moisture variations and/or the anode system is approaching the end of its service life. Further investigation is advised to determine the root cause of the circuit resistance change.

**“INTERRUPT MODE”** - The DC ON/OFF switch has been turned off. This same message will also appear during timed interrupt cycles when a customer-supplied interrupter is connected to the power supply interrupt terminal block. In this mode, the system status LED will flash red.

**“ZERO CURRENT OUT”** - When there is an open circuit in the DC anode or negative cable system (such as a failed anode or structure cable), the message “ZERO CURRENT OUT” will be displayed. The system status LED will flash red.

**“OVER TEMPERATURE”** – The DCPro has multiple internal temperature sensors. The sensors continuously monitor internal equipment system temperatures.

If there is a high temperature event with internal system temperature of greater than 158 Deg. F, the DCPro will initiate a 10% reduction in output current to reduce stress on the electronics. Concurrently the message “OVER TEMPERATURE EVENT NOW” will be displayed. If the temperature has not returned to a safe operating condition within 30 minutes, the unit will initiate an additional reduction in output current.

When the temperature reduces to a safe level, the system will return to the assigned current set level. The message “OVER TEMPERATURE EVENT OCCURRED – NOW NORMAL” will appear on the display. Again, the message can be cleared by depressing the output current adjust knob twice.

## **INTERRUPTER FEATURES & INTERCONNECT**

The DCPro power supply has three options available to electronically interrupt the DC output of the unit during cathodic protection pipe-to-soil potential surveys. All three modes can be performed without disconnecting either of the DC output cables.

## **INDUCED AC ON THE PIPELINE DURING INTERRUPTION**

Conventional CPRs during the off cycle can rectify a portion of any induced AC, which results in a low-level, DC output even with the AC input power switched off. The DCPro will not allow this condition to occur.

The DCPro has circuitry specifically designed to reject any incoming induced AC. Therefore, the DCPro can be electronically interrupted on structures that have induced AC present. This feature enables a true Zero Off condition without disconnecting either of the DC output cables. When switched back on, the DCPro will return to a stable output set current within 50 milliseconds.

Any of the following options are preferred over disconnecting the DC cables from the power supply.

**Interrupt Option 1** – The operator can interrupt the power supply (manually) with the DC output ON-OFF toggle switch located on the front panel (Figure 1 Item 5). This switch will turn ON and OFF all DC output current *without* the need to switch off the main AC input circuit breaker or disconnect the DC cables.

**Interrupt Option 2** - Use a customer supplied, portable interrupter with *mechanical contacts*. Interconnect the interrupter to the pre-wired terminal block (Figure 1 Item 6) located behind the removable, lower front safety panel. For this purpose, use Terminals 5 & 6.

**Note:** Some solid-state relays may not function in this mode.

**Important:** To enable this function, the DC output ON-OFF toggle switch must be in the “OFF” position.

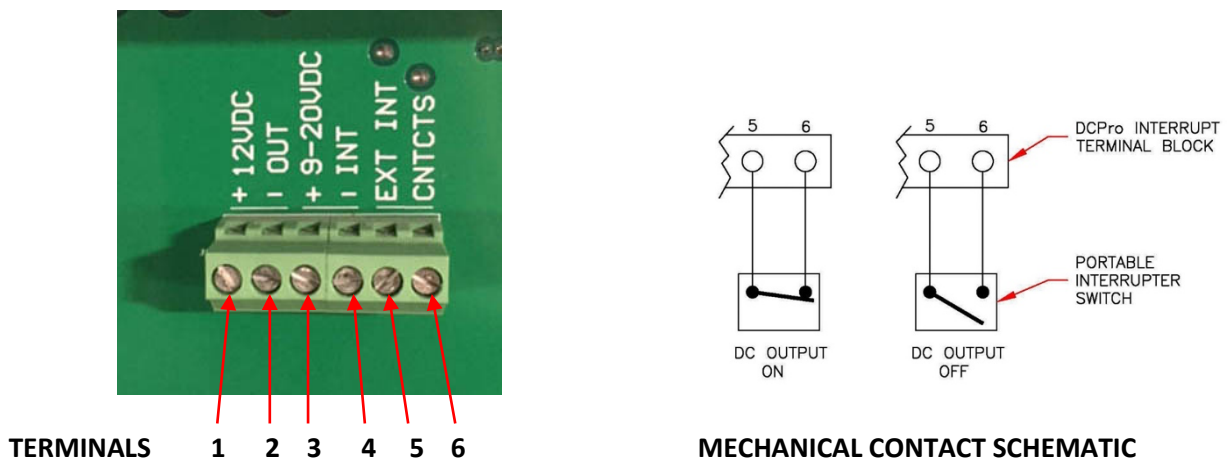
Terminal 5 = Short 5 & 6 together for power supply ON.

Terminal 6 = Open 5 & 6 for power supply OFF

**Interrupt Option 3** - Portable interrupter units that, can drive a separate DC relay, can be configured to interrupt the DCPro by connecting the DC output of the portable interrupter to terminals 3 & 4. This will electronically interrupt the DCPro.

Note: The DCPro has a built-in supplemental 12-volt DC power supply to operate the customer supplied interrupter at terminals 1 & 2. By using the 12-volt output from terminals 1 & 2 to power the portable interrupter and connecting the DC output of the Interrupter to terminals 3 & 4, the DCPro can be electronically interrupted without the need for supplemental AC or DC power to operate the interrupter and eliminate external portable relay.

Figure 4



## TROUBLESHOOTING

A basic wiring diagram is provided for troubleshooting use. **This should only be attempted by qualified personnel experienced in electrical troubleshooting and/or repairs.** Basic technical issues may be located and remedied as follows:

| ISSUE  | CHECK / ACTION REQUIRED   |
|--|---|
| No DC current or voltage output                      | Check the AC voltage available at AC input terminal block. If no AC power is available, determine the source of AC and attempt to re-establish.   |
| AC power is confirmed but no DC output is detected   | Turn output adjustment knob clockwise. The DCPro power supply is shipped with the current control setting at zero. If there is still no output current, check the power supply for loose connections on the DC output lugs. If no DC voltage or current is indicated at that point, there could be an issue with the Main Power Module. See "Repairs" section of this document. |
| DC voltage output but no (zero) current in indicated | The message ZERO CURRENT OUTPUT will appear in the display. The problem is likely an open circuit in either the anode or structure cable. Check DC output cables (anode and structure) for electrical continuity.   |
| Maximum DC current cannot be attained                | Check the anode-to-earth (load) resistance of external DC circuit. A maximum of 1.5 ohms is allowable and if that value is exceeded, a MAXIMUM VOLTAGE message will appear in the display.  |
| Main circuit breaker trips                           | Reset the breaker and retry. If the breaker continues to trip, then it is likely a problem with the Main Power Module. See "Repairs" section of this document.  |

**If the above actions do not correct the observed problem, the technician should call Farwest Corrosion Control's technical advisor at (888) 532-7937 for further assistance.**

## FIELD REPAIRS

The following procedures should only be attempted by qualified personnel experienced in electrical troubleshooting and/or repairs of electronic equipment.

90% of the electronic components are built into the Main Power Module (MPM). If it is determined that the MPM may be the source of the issue, the DCPPro power module is designed for easy field removal and replacement:

**VERY IMPORTANT SAFETY MESSAGE.** Confirm that the AC power supplied to the unit is switched off and locked out.

**Note:** It will be necessary to remove the chassis from the enclosure for this effort.

1. Mark and disconnect the wires from the AC input terminal block.
2. Mark and disconnect the cables from the DC output terminal lugs.
3. Mark and disconnect any wires connected to the RMU input terminal block.
4. Remove the two security bolts on the bottom front of the power supply chassis rails. Slide the entire DCPPro chassis out from the enclosure and set it on a stable work platform.
5. Locate and unplug the four cable connectors located on the silver MPM. Care should be taken to remove the connectors as there is a detent mechanism securing the connectors to the SMPM.
6. Unscrew the two (2) captive thumb screws on the back of the power module.
7. Remove the power module from the power supply chassis.
8. Reinstall a known functional MPM in reverse order of above.
9. Reinstall the DCPPro power supply chassis into enclosure.
10. Reinstall all wires to the RMU terminal block. Be careful to replace the wires in the exact position as marked.
11. Reconnect all AC input and DC output cables to the DCPPro power supply.

Re-start the DCPPro power supply per the *System Start-up and Adjustment* section of this manual.

If this procedure does not correct the issue, contact a technical representative at Farwest Corrosion Control Company for assistance and authorization to return the DCPPro. If it is determined that the DCPPro is to be returned for repair, the power supply chassis (not the enclosure) should be shipped to Farwest.

If return of the DCPPro is required, a Return Authorization number and shipping instructions MUST BE obtained from a Farwest Corrosion representative.

## **THREE (3) YEAR LIMITED WARRANTY FOR DCPro SWITCH MODE POWER SUPPLY**

### **Non-Transferrable Limited Warranty**

The Warranty for the DCPPro air-cooled, switch mode power supply, manufactured by Farwest Corrosion Control Company (Farwest), is effective for a period of three (3) years from the original date of purchase from Farwest.

### **What is Covered**

Except as specified below, the Farwest Limited Warranty covers all defects in materials and workmanship for the DCPPro power supply and related components within the first three (3) years of ownership from date of purchase.

### **This Limited Warranty does not cover any of the following occurrences:**

- 1) Damage, deterioration or malfunction resulting from:
  - a) Accident, act of nature, abuse, misuse, neglect, unauthorized product repair or failure to follow instructions supplied with the product.
  - b) Repair or attempted repair by anyone not authorized by Farwest.
  - c) Any damage of the product as a result or during shipment or transportation from Farwest. Such damage must be presented to the freight carrier in the form of a damage claim.
  - d) Periodic maintenance, check-ups or evaluation tests.
- 2) Any installation, removal, labor, shipping or costs, charges or expenses resulting from product failure or inability to perform.

### **Warranty Coverage**

If, during the applicable warranty period, the DCPPro or supplied components are found to be defective, Farwest will replace defective parts, or if required, make necessary repairs without charge for parts and/or repair labor.

### **How to Obtain Warranty Performance**

Contact Farwest at (888) 532-7937. Farwest will instruct you on how and what to return. The following procedures apply when transporting the DCPPro for warranty service:

- Return Authorization number and return shipping instructions must be obtained from a Farwest representative prior to return. During the call, you will be required to provide a company name, contact name, shipping address, phone numbers and a description of the technical problem. DCPPro test results will be discussed during the call.
- It is the responsibility of the shipper to arrange for and safely transport the DCPPro to a Farwest-designated location. The shipper is responsible for all shipping charges. Farwest will cover return shipping charges if the repairs are covered by the Warranty.

***FARWEST LIABILITY IS LIMITED TO THE REPAIR OR REPLACEMENT, AT OUR DISCRETION, OF ANY DEFECTIVE PRODUCT AND SHALL IN NO EVENT INCLUDE INCIDENTAL OR CONSEQUENTIAL COMMERCIAL OR PROPERTY DAMAGES OF ANY KIND. FARWEST IS NOT RESPONSIBLE FOR PRODUCTS LOST, STOLEN AND/OR DAMAGED DURING SHIPPING.***

## ABOUT FARWEST CORROSION CONTROL COMPANY

Farwest Corrosion Control Company is an industry pioneer and leader in comprehensive cathodic protection and corrosion control services and related products. Cathodic protection and corrosion control services include engineering, technical consultation and cathodic protection installation. The firm also distributes and manufactures products for cathodic protection and corrosion control.

Founded in 1956, the firm remains privately held and family owned and is a Certified Woman Owned Business. The firm is headquartered in Downey, California, has eight regional operations and over 175 employees nationwide.



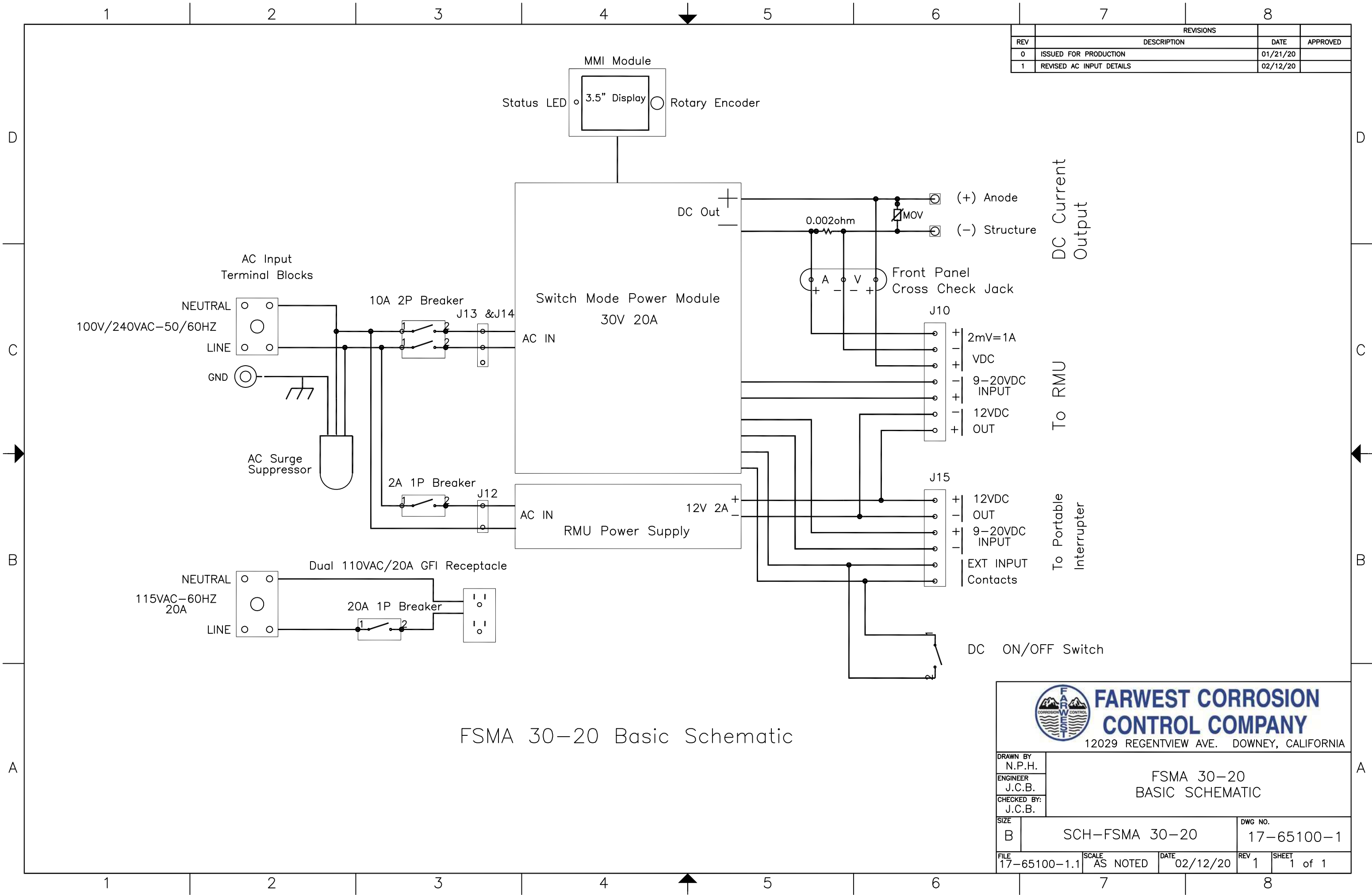
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| REVISIONS |                          |          |          |
|-----------|--------------------------|----------|----------|
| REV       | DESCRIPTION              | DATE     | APPROVED |
| 0         | ISSUED FOR PRODUCTION    | 01/21/20 |          |
| 1         | REVISED AC INPUT DETAILS | 02/12/20 |          |



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|                       |                               |                  |                       |
|-----------------------|-------------------------------|------------------|-----------------------|
| DRAWN BY<br>N.P.H.    | FSMA 30-20<br>BASIC SCHEMATIC |                  |                       |
| ENGINEER<br>J.C.B.    |                               |                  |                       |
| CHECKED BY:<br>J.C.B. |                               |                  |                       |
| SIZE<br>B             | SCH-FSMA 30-20                |                  | DWG NO.<br>17-65100-1 |
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