

DENISON HYDRAULICS

Jupiter 500 Driver Card

Series S20-11712-0



Publ. 9-AM681

DENISON Hydraulics

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SYSTEM FEATURES

- Controls “Goldcup” and “Worldcup” Series Piston Pumps and the F5C Flow Control Valve
- Open or Closed Loop Control (w/Options Card)
- Eurocard Format for Eurorack or Panel mounting
- Separately Adjustable Positive and Negative Ramps (.1-40 sec.)
- Adjustable Dither for F5C
- Multiple Input Commands:
- Remote Potentiometer (10K CT)
- (± 5) and (± 10) VDC Voltage Inputs
- (± 4 -20mA), (± 0 -20mA) and (12 ± 8 mA) Current Loop Inputs
- Differential or Single-Ended
- Auxiliary Inputs
- Front Panel Operator Controls:
- Easy Calibration
- LED Control Indicators
- Potentiometer Adjustments
- Special Field Calibration Features
- Special Safety Features

SPECIFICATIONS

REMOTE COMMAND INPUTS

(Choice of one)

Potentiometer Input:	10K, 5K ohms
Input Impedance:	100K ohms
Voltage Inputs (Single or Differential):	$\pm 0-5\text{VDC}$, $\pm 0-10\text{VDC}$
Input Impedance (Single Ended):	100K ohms
Input Impedance (Differential):	200K ohms
Current Loop Inputs (Differential):	$\pm 4-20\text{mA}$, $\pm 0-20\text{mA}$, $12\pm 8\text{mA}$
Input Impedance (4-20mA, $12\pm 8\text{mA}$):	309 ohms
Input Impedance (0-20mA):	249 ohms
Soft Stop Input:	Gnd to stop

AUXILIARY REMOTE COMMAND INPUT

(Choice of one)

Potentiometer Input:	10K ohms
Input Impedance:	100K ohms
Voltage Input (Single Ended):	$\pm 0-10\text{VDC}$
Input Impedance:	100K ohms
Voltage Input (Single Ended):	$\pm 0-1\text{VDC}$
Input Impedance:	10K ohms

RAMP GENERATOR

Switchable On or Off	
Positive Ramp (Rising)	Range A: 0.1-6 Sec Range B: 0.4-40 Sec
Negative Ramp (Falling)	Range A: 0.1-6 Sec Range B: 0.4-40 Sec
Ramp at zero output:	+13VDC

OUTPUT DRIVER

Linear Constant Current with Current Feedback
Switchable Unidirectional or Bidirectional
Switchable Dither On or Off
Current Limited Short-Circuit Protected

Current Gain Adjustment:	$\pm 100-350\text{mA}$
Zero Current Adjustment (@ Min Gain):	$\pm 0-20\text{mA}$
Stroker Coil Operating Characteristics (25 ohm Coil) Output current (Bidirectional)*	$\pm 0-350\text{mA}$
Voltage Compliance (Jupiter Supply):	$\pm 0-15\text{VDC}$
Voltage Compliance ($\pm 15\text{VDC}$ Supply):	$\pm 0-11\text{VDC}$

*May be switched to Unidirectional Operation for Worldcup Pumps.

F5C Operating Characteristics (60 ohm Coil)
(See Note 1)

Output Current (Unidirectional)	0-220mA
Voltage Compliance (Jupiter Supply):	0-17VDC
Dither Amplitude (% of Current Output):	0-10%
Dither Frequency:	10-100HZ

SPECIFICATIONS

Maximum Output Ratings	
Short-Circuit Current (Positive):	+370mA
Short-Circuit Current (Negative):	-410mA
Open-Circuit Voltage (Jupiter Supply):	±28VDC
Open-Circuit Voltage (±5VDC Only):	±14VDC

ANALOG FEEDBACK INPUTS

Horsepower Limit:	±10VDC
Major Loop:	±10VDC
Minor Loop w/Balance Adjustment:	±2.5-15VDC
Input Command Disable:	Gnd to Disable

FRONT PANEL LED INDICATORS

+15VDC	+15VDC Power Supply Operational
-15VDC	-15VDC Power Supply Operational
+I	Positive Output Current to Coil
-I	Negative Output Current to Coil
Off	Open Circuit to Coil, Output Current I Off, Emergency Shutdown Relay K1 De-Energized

FRONT PANEL POTENTIOMETER ADJUSTMENTS

+Ramp	Adjusts Positive Ramp Time
-Ramp	Adjusts Negative Ramp Time
Zero	Adjusts Zero Scale Output Current I for Zero Input
Gain	Adjusts Full Scale Output Current I for Max Input
Bal	Balances the Input Command with the Minor Loop Feedback
+4mA Zero	Adjusts Zero Output Current I for +4mA Current Input Also Adjusts Zero Output for +12mA (12±8mA Loop)
-4mA Zero	Adjusts Zero Output Current I for -4mA Current Input

FRONT PANEL LOCAL CONTROLS

(See Note 2)

Local-Off-Remote Switch selects the mode of operation for the Driver Card. Remote selects Remote Operations and Local selects Front Panel Operation. Off de-energizes the shutdown relay to open the circuit to the coil.

Command Level Potentiometer adjusts the input command from maximum input in one direction thru zero to maximum input in the opposite direction in **Local Mode**. If zero and gain of the output stage are adjusted for full scale output current, this pot can swing the output from positive full scale to negative full scale, which for a pump means swinging the pump from full stroke in one direction to full stroke in the opposite direction. Only the positive side of the pot is functional if unidirectional output is selected.

Step Command Pushbutton triggers ramping of the output from zero current to the ±current level set by the command level pot, permitting direct measurement and adjustment of ramp times.

FRONT PANEL TEST POINTS

In	Input Command (±10VDC)
Ramp	Ramp Output (±10VDC)
Out	Coil Current Scaled ±1mV per ±1mV per ±1mA
GND	Signal Ground Reference

EMERGENCY SHUTDOWN

The normally-open contact of shutdown relay K1 is placed in series between the output power transistor and the coil to provide an open circuit backup in the event of an emergency. The shutdown input is grounded to energize the coil for normal operation and opened to de-energize the coil for emergency shutdown. This relay is normally operated externally, but may be overridden locally by placing the Local-Off-Remote switch in the Off position.

Coil Energized (40mA sinking):	0 VDC (Gnd)
Coil De-Energized:	15 VDC (or Open)
Remote Shutdown Option:	+12-24 VDC

EMBEDDED POTENTIOMETER ADJUSTMENTS

Dither is Switchable On or Off.	
Dither Frequency (R55):	Adjusts Frequency of Dither on Output Current between 10 and 100 HZ.
Dither Amplitude (R61):	Adjusts Amplitude of Dither on Output Current between 0 and 10% of Output.

EMBEDDED DIP SWITCHES

SW1	Close Switch For:
1	12±8mA Input
2	0-20mA Input
3	4-20mA or 12±8mA Input
4	±10VDC Input
5	All Inputs Except 12±8mA
6	4-20 or 12±8mA Input
7	4-20mA Input
8	All Inputs except 12±8mA
SW2	Close Switch For:
1*	Ramping On, Range A (SW2-2 Must be Off)
2*	Ramping On, Range B (SW2-1 Must be On)
3	Dither on Output (F5C Only)
4	Unidirectional Current Output

*To turn Ramping off, open both switches SW2-1 and SW2-2.

DRIVER CARD PIN-OUT
(Male Din 32C)

A2+	10VDC Ref Out	C2	Command Out
A4-	10VDC Ref Out	C4	TP1
A6	Command Disable In	C6	TP2
A8	Soft Stop In	C8	Remote shut down option
A10	+Voltage In	C10	TP4
A12	Sig Gnd	C12	±1VDC Aux In
A14	Maj Loop In	C14	±10VDC Aux In
A16	Min Loop In	C16	HP Limit In
A18	Sig Gnd	C18	Ramp at zero out
A20	Current Loop In	C20	Current Loop Ret
A22	Coil Out	C22	Sig Gnd
A24	+15VDC Reg In	C24	+15VDC Reg In
A26	-15VDC Reg In	C26	-15VDC Reg In
A28	Coil Ret	C28	+24VDC Unreg In
A30	Remote Shutdown In	C30	-24VDC Unreg In
A32	Pwr Gnd	C32	Pwr Gnd

POWER SUPPLY REQUIREMENTS DRIVING THE STROKER

(25 ohm Coil) (Notes 3,4)	
+15VDC Tracking Regulated:	+450mA
-15VDC Tracking Regulated:	-400mA

POWER SUPPLY REQUIREMENTS DRIVING THE F5C VALVE
(60 ohm Coil) (Note 5)

+15VDC Tracking Regulated:	+100mA
-15VDC Tracking Regulated:	-75mA
+24VDC Unregulated:	+220mA

TEMPERATURE RANGE

0-60° C

MECHANICAL

Dimensions, Eurocard:	3U, 100 x 160mm
Dimensions, Card w/Front Panel (mm):	128.4H x 193D x 50.5W
Connector:	DIN 32C, Male
Weight:	241g (8.5 oz)

ACCESSORIES

A. Jupiter Power Supply w/Eurocard Holder: For Driver Card 110/220 VAC, 50/60 HZ	S20-11715
B. Eurocard Holder Only (32 Screw Terminals):	701-00007-8
C. Jupiter Options Card:	S20-11716
D. Panel-Mount Command Input Potentiometers:	
Single Turn 0-100 Dial	S17-21872
Single Turn 100 — 0-100 Dial	S17-22773
Ten-Turn 0-100 Dial	S17-22746
E. Quadrant Command Input Potentiometer:	Consult Factory
F. Minor Loop Pump Feedback Potentiometer:	S20-02345 10K Ct
G. Optical Isolation for Signal Inputs:	Consult Factory

Notes

1. The Driver Card requires a 24 VDC power supply, in addition to the ± 15 VDC regulated power supply, to operate the F5C, due to higher compliance voltage requirements. Jupiter Power Supply Accessory S20-11715 provides both 24VDC and ± 15 VDC for operation of either valve.
2. Use extreme caution when switching from **Remote** thru **Off** to **Local** mode since the output will immediately begin to ramp to the output level set by **Command Level Potentiometer** which may be set at some higher level, or even in the opposite direction, or both, resulting in unexpected output. Always dwell in the **Off** position first, checking proper **Command Level** settings, before switching into **Local** mode. Remember that the output is controlled by the front panel in **Local** mode.
3. Tie both +15VDC in (A24) and +24VDC in (C28) to Power Supply +15VDC. Tie both -15VDC in (A26) and -24VDC in (C30) to Power Supply -15VDC.
4. If the Options Card is used, additional +15VDC current capacity is required as follows:

ADDITIONAL POWER SUPPLY REQUIREMENTS WHEN USING THE OPTIONS CARD

+15VDC Tracking Regulated: +250mA *
15VDC Tracking Regulated: 80mA

**Includes 5VDC Full Load of 300mA*

5. The Jupiter Power Supply Accessory provides all power supply voltages necessary for operating a stroker or an F5C valve.

GENERAL

Jupiter Driver Card S20-11712-0 is a linear bidirectional constant current coil driver used for proportional open-loop control of the Goldcup and Worldcup piston pumps and the F5C Flow Control valve. Input commands to the card may be voltage, current loop, or potentiometer, single-ended or differential. Multiple input commands are permitted but must be interlocked by the user to insure that the card is controlled by only one input at a time. The card also features two ranges of positive and negative ramping, optional dither for the F5C, remote emergency shutdown control, and provisions for closed-loop control with Jupiter Options Card S20-11716. The Driver card is packaged in a 3U Eurocard size and may be operated with stand alone DC power supplies or with Jupiter Power Supply Accessory S20-11715, which conveniently combines the required DC power supplies with a Eurocard holder in a single panel mounted package.

OPEN LOOP CONTROL

The Driver Card with its power supply accessory is used for open-loop control. It provides multiple input commands, ramping, dither and front panel set-up controls. The panel mounted power supply furnishes the driver Card with regulated DC power and features a holder and screw terminals for simplified panel wiring.

CLOSED LOOP CONTROL

The Options Card is used in conjunction with the Driver Card for precise closed-loop control. It features digital and DC tachometer feedback, horsepower limiting, and PI control of feedback error. A panel mounted Eurocard holder with screw terminals is available for easy mounting. Power for the Options Card is obtained from the Driver Card's power supply.

OPERATION

Circuit Description for Driver Card

OUTPUT

The output stage of the Driver Card is a linear, bidirectional, DC constant current source with current feedback for precise control of current thru the coil regardless of changes in coil resistance. The compliance voltage across the coil is a function of coil resistance and the current thru the coil.

The direction of the current thru the coil may be made unidirectional for F5C and Worldcup controls and bidirectional for Goldcup controls via a dip switch embedded on the card. Dither may be applied to the F5C by AC modulating the DC output also enabled by a dip switch embedded on the card. Dither must never be used with the Goldcup or Worldcup pump stroker since the jet pipe construction of the stroker cannot withstand the strain of AC modulation.

Zero and Gain of the output stage are adjusted by potentiometers located on the front panel. Dither Amplitude and Frequency are adjusted by potentiometers embedded on the card. The output stage is completely protected against short circuits across the coil and short circuits to ground by the current limiting action of the power amplifier.

INPUTS

The output of the driver card may be controlled by the Command Level potentiometer on the front panel in Local mode or by user-wired remote inputs in the Remote mode. Local and Remote modes are selected via a switch located on the front panel. The Command Level potentiometer is a single-turn pot providing \pm full scale input and is recommended for set-up purposes only.

Use of the remote inputs is the primary method of wiring the card for routine input connections from standard industrial control sources such as voltage and current loop controllers and potentiometers. Use of the auxiliary remote inputs permits the user to have a secondary input source in addition to the remote inputs. But in this multiple source case, the user must interlock the remote input with the auxiliary remote input to insure that the Driver Card is controlled by only one input at a time. This provision for multiple inputs could, for example, allow the user to wire a current loop from a process controller, into the remote inputs and a potentiometer from the operator's control station into the auxiliary remote input. Wiring both inputs thru a single double-pole double throw switch would give the operator a convenient choice of input sources and insure that the card is controlled by only one source at a time.

The user has a choice of a voltage, current loop or potentiometer input using the remote input and a choice between a voltage and potentiometer input using the auxiliary remote inputs. Voltage inputs may be ± 5 or ± 10 VDC, single-ended or differential. Current loop inputs are differential ± 4 -20, ± 0 -20, or 12 ± 8 mA. All potentiometer inputs are 10K. On board ± 10 VDC reference supplies provide convenient sourcing for the potentiometer input. Dip switches embedded on the card are used to configure the user's choice of input.

RAMP GENERATOR

Adjustable positive and negative ramping of the output for changes in the input command are provided in two ranges of .1-6 and .4-40 seconds. Ramping and ramping ranges are selected by dip switches embedded on the card. The Command Level potentiometer and the Step Command pushbutton located on the front panel may be used for accurate adjustment of ramp times.

FRONT PANEL CONTROLS AND INDICATORS

Key indicators, potentiometer adjustments, switches, and test points are brought out to the front panel for monitoring, set-up and calibration purposes. LEDs are provided for indicating the status of the ± 15 VDC internal supplies, the direction of output current, and the status of emergency shutdown relay K1.

Potentiometer adjustments include \pm Ramp times, Zero, Gain, Bal, and ± 4 mA Zero. Test points accepting industry standard probe tips are furnished for measurement of the input, output, ramp, and signal ground.

A Local-Off-Remote switch is provided to switch control of the Driver card from local front panel control to user-wired remote control. Off de-energizes emergency shutdown relay K1, opening the circuit between the power amplifier and the valve coil. The Command Level potentiometer permits the operator to drive the output \pm full scale if Zero and Gain are set for full scale output.

IMPORTANT NOTE:

Use extreme caution when switching from Remote thru Off to Local mode since the output will immediately begin ramping to the output level set by Command Level Potentiometer which may be set at some higher level or even in the opposite direction or both, resulting in unexpected output. Always dwell in the Off position first, checking proper Command Level settings, before switching into Local mode. Remember that the output is controlled by the Front Panel Pot in Local mode.

The Command Level pot is used in conjunction with the Step Command pushbutton for set-up and calibration of the Driver card. Pressing then releasing the Step Command pushbutton in Local mode triggers ramping of the output from zero current to the current level set by the Command Level potentiometer, permitting accurate and simple adjustment of both positive and negative ramp times.

EMERGENCY SHUTDOWN OPTION

A normally-open relay contact (K1) is embedded in the output stage of the Driver card and is connected in series between the power amplifier and the valve coil in order to provide a true open circuit for emergency shutdown requirements. The coil of K1 is brought out as an input to permit the user to operate the relay remotely thru a normally-closed emergency shutdown switch. If the user declines the use of this option, he must jumper this input to power ground for the card to operate. This relay is also operated by the onboard 12 ± 8 mA current loop shutdown detector which will shutdown the output if a break in the current loop is detected. K1 is not a latching relay.

"Remote Shutdown" circuit is enhanced to permit the Remote Shutdown function to be operated with a +15-+24VDC signal on terminal C8. JP3 selects this function. This function is not available on the Jupiter Power Supply. The drawings on the following pages illustrate the wiring connections. Please note that J1 or a user supplier relay or switch must be installed.

The soft stop option input causes the Driver card output to go to zero, at the set ramp rate, when this input is pulled to signal ground thru a user supplied external relay contact. Use terminal A8 on the Driver card or terminal block 21 on the Jupiter Power Supply S20-11715. This function, when activated, will cause the Driver card output to ramp to zero (soft stop), where as the Remote Shutdown will cause the Driver card output to go immediately to zero (hard stop).

POWER SUPPLY REQUIREMENTS

The Driver card requires only a single ± 15 VDC dual tracking regulated power supply rated at 500mA for driving a Goldcup or Worldcup stroker. It requires an additional 24VDC unregulated supply rated at 300mA for driving an F5C.

Jupiter Power Supply Accessory S20-11715 conveniently provides both ± 15 VDC and 24VDC supplies combined with a Eurocard holder for the driver card in a single panel-mounted package. This power supply is also designed to handle the power required by Jupiter Options Card S20-11716 used for closed-loop applications. A separate Eurocard holder is required for the Options card.

CLOSED-LOOP CONTROL

The Driver Card operating as a stands alone driver is used primarily for open-loop control. With the Jupiter Options Card, S20-11716, the Driver Card can be used for closed-loop control systems. The Options Card provides digital and DC tachometer feedback, horsepower limiting and PI control of feedback error in a single Eurocard, designed to accompany the Driver Card. Inputs from the summing junction of the power amplifier in the output stage of the Driver card are brought out for feedback control by the Options card in closed-loop systems. These feedback inputs are, however, general purpose enough to accept feedback from sources other than the Options Card making elementary closed-loop control possible with just the Driver Card. A Balance adjustment is provided on the front panel of the Driver Card for convenient scaling of a minor loop feedback input.

The "Ramp-at-Zero" output goes high (+13VDC) when ramp is at zero and zero volts when ramp is not at zero. The Ramp-at-Zero output is located on terminal C18 on the Driver card and terminal block 24 on the Jupiter Power Supply S20-11715. This function is useful when connected to the Integrator Reset, C4, on the Jupiter Options card S20-11716. The integrator is held reset when the Ramp-at-Zero goes high. This action will keep the system from hunting under no-load conditions at a speed command of zero.

CALIBRATION PROCEDURE JUPITER DRIVER CARD

Preparation

1. Having selected the hydraulic valve to be driven by Jupiter, determine the type of input(s), ramping ranges, direction of output current, etc., and set switches **SW1** and **SW2** per tables 1 thru 4 shown in the wiring diagrams.

F5C or Stroker

Configure the F5C and the Worldcup pump for unidirectional output. The Goldcup Pump may be configured for unidirectional or bidirectional output. **In either case, coil output is always positive for positive input commands.**

Dither

Dither may or may not be used on the F5C **but must never be used on a stroker.**

Remote Shutdown Pin A30

(Screw Terminal #10 on Power Supply)

The remote shutdown input must be at ground for the Driver Card to operate in the Remote mode. This Input may be grounded thru a normally-closed Remote Emergency Shutdown switch which will remove the Input from Ground when activated, thus shutting down the driver Card, **or** it may be jumpered directly to Ground if the Remote Shutdown feature is not required. **Be sure to use Pin A32 (or Screw Terminal #11 on Power Supply Accessory) as Ground.**

2. Review wiring diagrams to insure proper connections.

WARNING:

To prevent damage to the card, always remove power from the Driver Card before removing it from its holder.

3. Only a digital voltmeter and a small plastic screwdriver will be required for calibration. The test points on the front panel accept industry standard probe tips.
4. Shutdown hydraulics but leave power on to the driver card and coil. This will eliminate any inadvertently hazardous operation of the hydraulics while calibrating the card and coil.
5. Switch the Driver Card into **Remote**.
6. Adjust **+Ramp** and **-Ramp** Potentiometers fully CCW to minimize the effects of ramping while adjusting Zero and Gain. If ramp times have already been set, ramping may be bypassed entirely by placing both **1** and **2** of **SW2**, located on the Driver Card, in the open position.
7. Adjust the **Gain** Potentiometer fully CW to provide maximum sensitivity for zero adjustments.

A. Zero Adjustment

Zero adjustment provides zero output current I to the coil for zero volts input command or zero current input command. If you are using a potentiometer input, follow the adjustments below for a voltage input since a potentiometer input actually generates a voltage input command.

1. Adjust the input command to zero volts for voltage inputs, or to zero current for current loop inputs. (Zero current input can be obtained by opening the current loop connection at the input.)
2. Connect a voltmeter across the Out and GND test points on the front panel. Adjust the Zero pot on the front panel until zero volts is read. The Out test point is scaled to provide $\pm 1\text{mV}$ per $\pm 1\text{mA}$ of coil current.

B. $\pm 4\text{mA}$ Zero Adjustments

($\pm 4\text{-}20\text{mA}$ current loop input command only)

$\pm 4\text{mA}$ zero adjustments provide zero output current I to the coil for input commands between $+4\text{mA}$ and -4mA inclusive.

1. Perform **Zero Adjustment, Part A** before proceeding.
2. Adjust both **$+4\text{mA}$** and **-4mA** pots fully CW.
3. Set the input command to $+4\text{mA}$.
4. With the voltmeter connected across the **Out** and **Gnd** test points on the front panel, adjust the **$+4\text{mA}$ pot slowly CCW** just until zero volts is read and stop. **Do not adjust the pot beyond this point.** The **Out** test point is scaled to provide $\pm 1\text{mV}$ per $\pm 1\text{mA}$ of coil current.
5. Set the input command to -4mA .
6. With the voltmeter connected across the **Out** and **Gnd** test points on the front panel, adjust the **-4mA pot slowly CCW** just until zero volts is read and stop. **Do not adjust the pot beyond this point.** The **Out** test point is scaled to provide $\pm 1\text{mV}$ per $\pm 1\text{mA}$ of coil current.

C. $12\pm 8\text{mA}$ Zero Adjustments

($12\pm 8\text{mA}$ current loop input command only)

$12\pm 8\text{mA}$ zero adjustments provide zero output current I to the coil for $+12\text{mA}$ input. (+Full Scale = 20mA and -Full Scale = 4mA)

1. Perform **Zero Adjustment, Part A** before proceeding.
2. Set the input command to $+12\text{mA}$.
3. With the voltmeter connected across the **Out** and **Gnd** test points on the front panel, adjust the **$+4\text{mA}$ pot** on the front panel until zero volts is read. The **Out** test point is scaled to provide $\pm 1\text{mV}$ per $\pm 1\text{mA}$ of coil current.

WARNING:

Negative full scale output is produced for a $12\pm 8\text{mA}$ current loop input of $+4\text{mA}$. A broken current loop connection (0 mA Input) will drive the output even more negative than full scale, resulting in an unintentional and possibly hazardous hydraulic-mechanical situation. Remember to Place Switch SW1-8 in the Open Position to enable the automatic current loop shutdown detector which trips shutdown relay K1 if an open-circuit is detected in the loop.

D. Gain Adjustment

Gain Adjustment provides full scale output current I thru the coil for maximum input command.

1. Reconnect input and adjust the input command to + or - Full Scale. Full scale **Voltage Inputs** may be $\pm 5\text{V}$, $\pm 10\text{V}$, or a potentiometer rotated fully CW or CCW. Full scale **Current loop inputs** may be $\pm 20\text{mA}$ for $\pm 0\text{-}20\text{mA}$ and $\pm 4\text{-}20\text{mA}$ loops, and $+20$ and $+4\text{mA}$ for the $12\pm 8\text{mA}$ loop.
2. Adjust the **Gain** pot to provide **Full Stroke at the Pump or Full Flow thru the F5C**. The output current from the driver card required to produce Full Stroke or Full Flow may be read across the **Out** and **Gnd** test points scaled to provide $\pm 1\text{mV}$ per $\pm 1\text{mA}$ of coil current.

E. Ramp Adjustments

A Ramp Adjustment sets the time it takes for the output current to change in response to a step change in the input. The output current may ramp up or ramp down to the changed output commanded by the input depending upon the direction the input changes. The **$+ \text{Ramp Pot}$** adjusts ramp-up time and the **$- \text{Ramp Pot}$** adjusts the ramp-down time.

1. Shutdown hydraulics but leave power on to the Driver Card.
2. Switch the Driver Card into **Local** mode.

WARNING:

Remember that the Driver Card responds to the local command pot in the Local Mode and will drive the coil as commanded. Shutting down the hydraulics during this set-up operation will prevent any inadvertently hazardous operation of the load.

3. To adjust **Positive Ramp Time**, connect a voltmeter across the **Ramp** and **Gnd** test points on the front panel, adjust the **Local Command** pot fully CW to +I, press **Step Command** and hold until zero volts is read, then release. Ramp voltage will begin ramping from zero to 10VDC full scale. Ramp time is the time it takes to ramp from zero to 10VDC and may be measured by a simple wrist watch. Ramp time is adjustable between .1 and 6 sec. or between .4 and 40 sec. depending upon the ramp range selected on the Driver Card. (See **SW2**). Adjust the **+Ramp** pot on the front panel **CW** to **Increase Ramp Time** and **CCW** to **Decrease Ramp Time**.
4. To adjust **Negative Ramp Time**, connect a voltmeter across the **Ramp** and **Gnd** test points on the front panel, adjust the **Local Command** pot fully CCW to -I, press **Step Command** and hold until zero volts is read, then release. Ramp voltage will begin ramping from zero to -10VDC full scale. Ramp time is the time it takes to ramp from zero to -10VDC and may be measured by a simple wrist watch. Ramp time is adjustable between .1 and 6 sec. or between .4 and 40 sec. depending upon the ramp range selected on the Driver Card (See **SW2**). Adjust the **+Ramp** pot on the front panel **CW** to **Increase Ramp Time** and **CCW** to **Decrease Ramp Time**.

F. Balance Adjustment

(Use only with Minor Closed-Loop Feedback on pin A16)

1. To begin, adjust **Bal** pot fully CW to provide Maximum Minor Loop Feedback.
2. Apply power to the hydraulics and set the Input Command at the desired operating point. With the **Bal** adjusted fully CW in Step 1, the system should not be able to reach this operating point since maximum feedback is overriding the Input Command. Turn the **Bal** pot slowly CCW to reduce the amount of feedback to the point where the feedback matches the Input Command and the system moves toward the operating point.

G. Dither Adjustments

(Use only with the F5C Flow Control Valve)

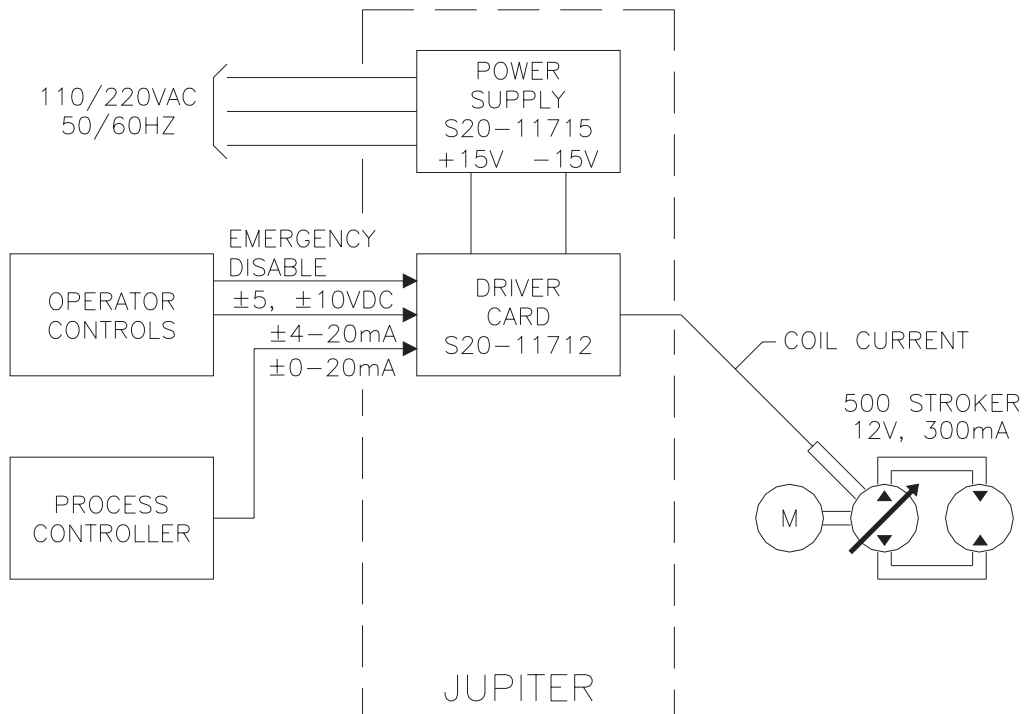
Dither is a sinusoidal signal superimposed upon the coil current flowing thru the F5C. It is used to reduce hysteresis in the valve, thus making the control of the flow thru the valve more responsive to the Input Command. Dither is adjusted by varying the frequency and amplitude of the sinusoidal signal.

Potentiometer adjustments for **Dither Frequency** and **Amplitude** are embedded on the Driver Card and labeled **R55** and **R61** respectively. Dither may be entirely disabled by placing SW2-3 in the Open position.

WARNING:

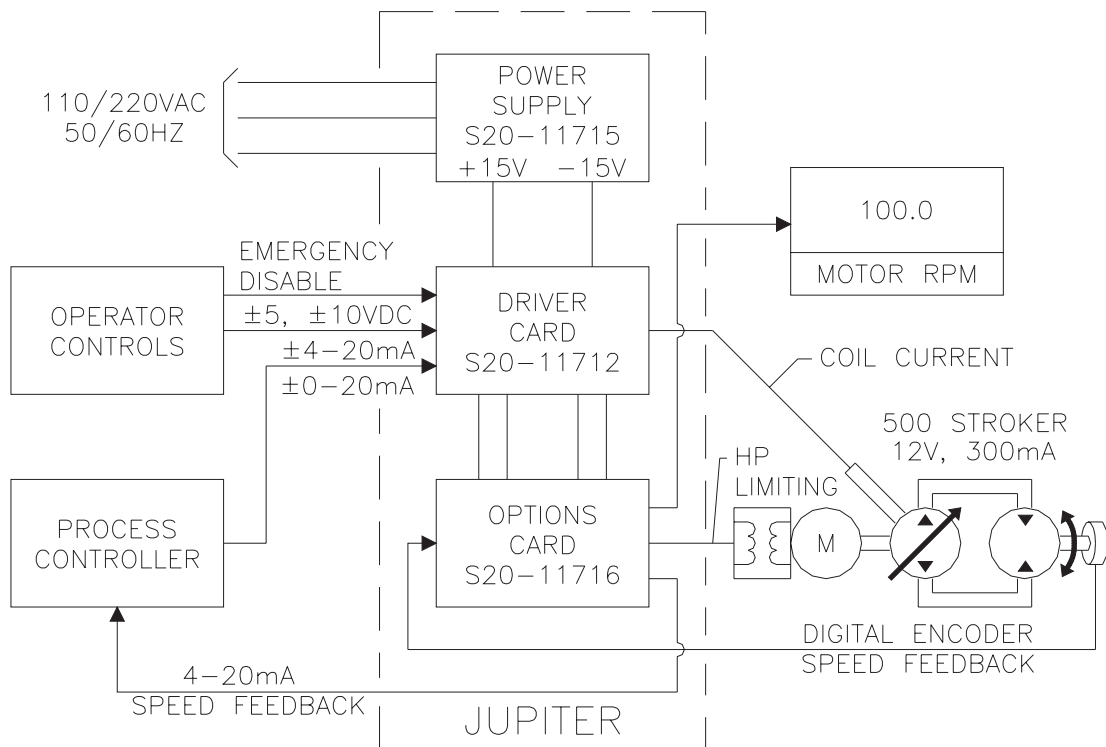
Never use Dither with a Pump Stroker. Always disable Dither by placing SW2-3 in the Open position.

1. Dither adjustments are made with power applied to the hydraulics and the system operational.
2. Place SW2-3 in the Closed position to enable Dither.
3. To begin, adjust **Dither Frequency** pot **R55** fully **CCW** for minimum frequency and the **Amplitude Pot R61** fully **CW** for maximum amplitude.
4. Apply power to the hydraulics and observe valve pulsating and humming to the dither set at maximum amplitude and minimum frequency.
5. Decrease the amplitude (**R61 CCW**) and increase the frequency (**R55 CW**) until an optimum point is reached where pulsating and humming of the valve body has ceased, yet the spool is still felt to be moving and flow control responds to the input command in both directions indicating reduced hysteresis.



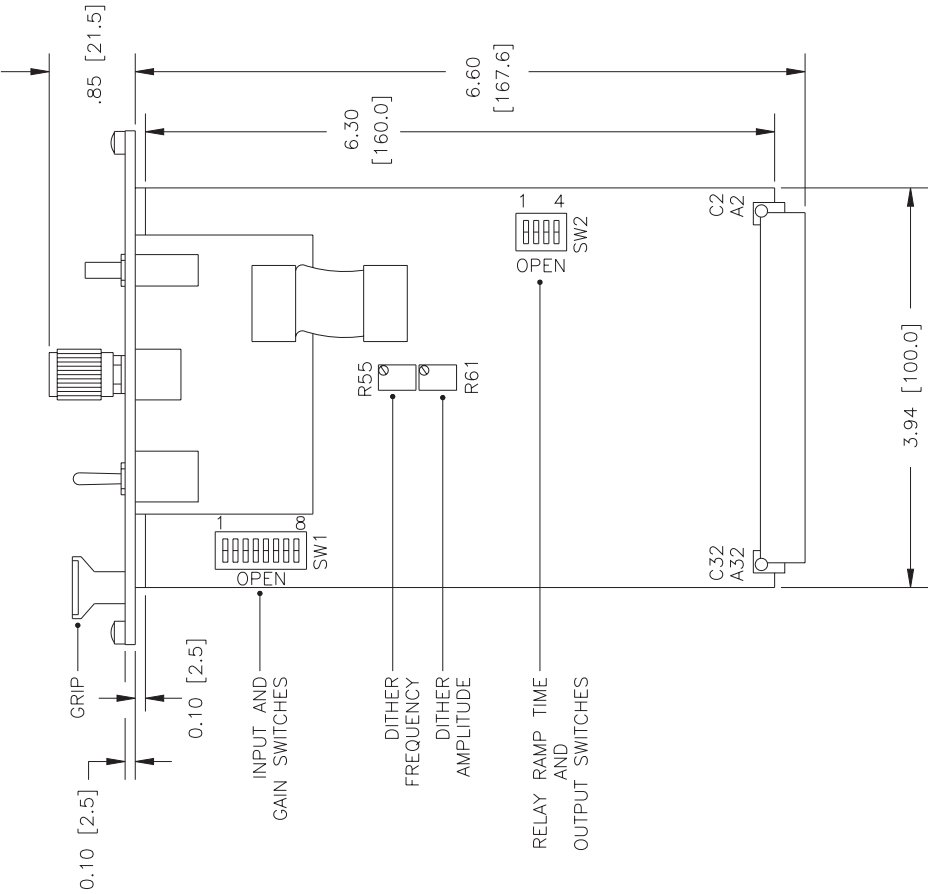
Open Loop Control

- Goldcup pumps
- Worldcup pumps

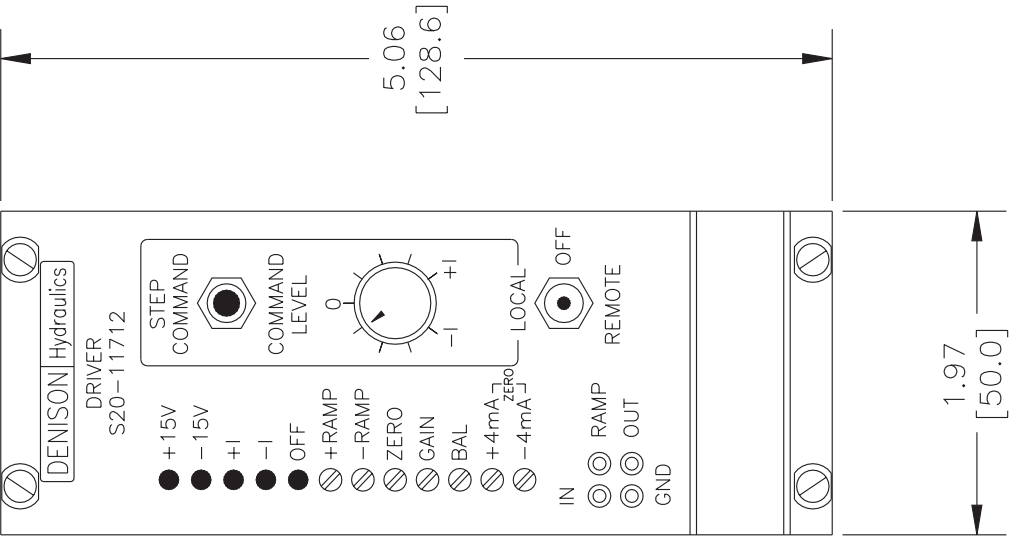


Closed Loop Control

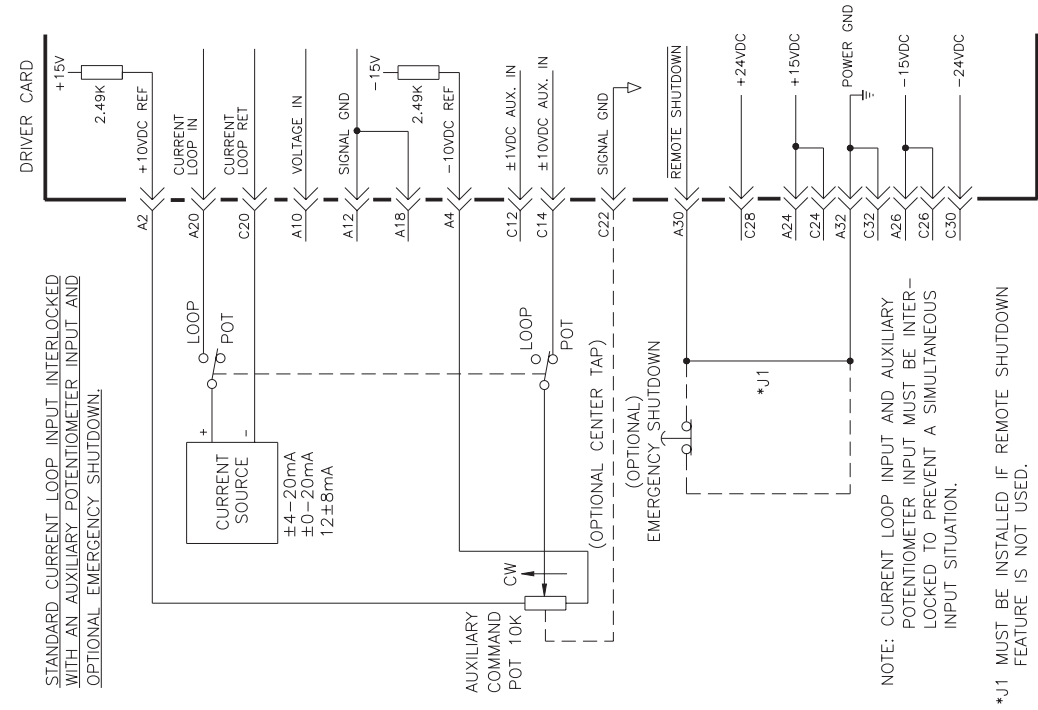
- Goldcup pumps
- Worldcup pumps



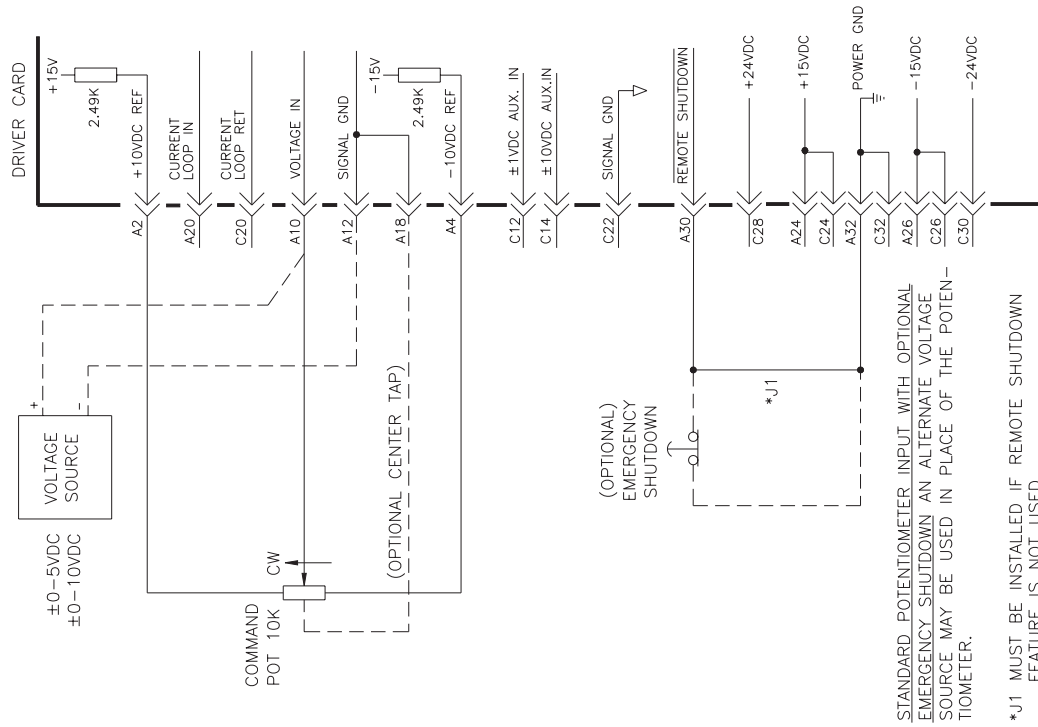
Top View Driver Card



Front Panel Driver Card



Current Loop Input Connections



Remote Voltage and Potentiometer Input Connections

STROKER OPERATION

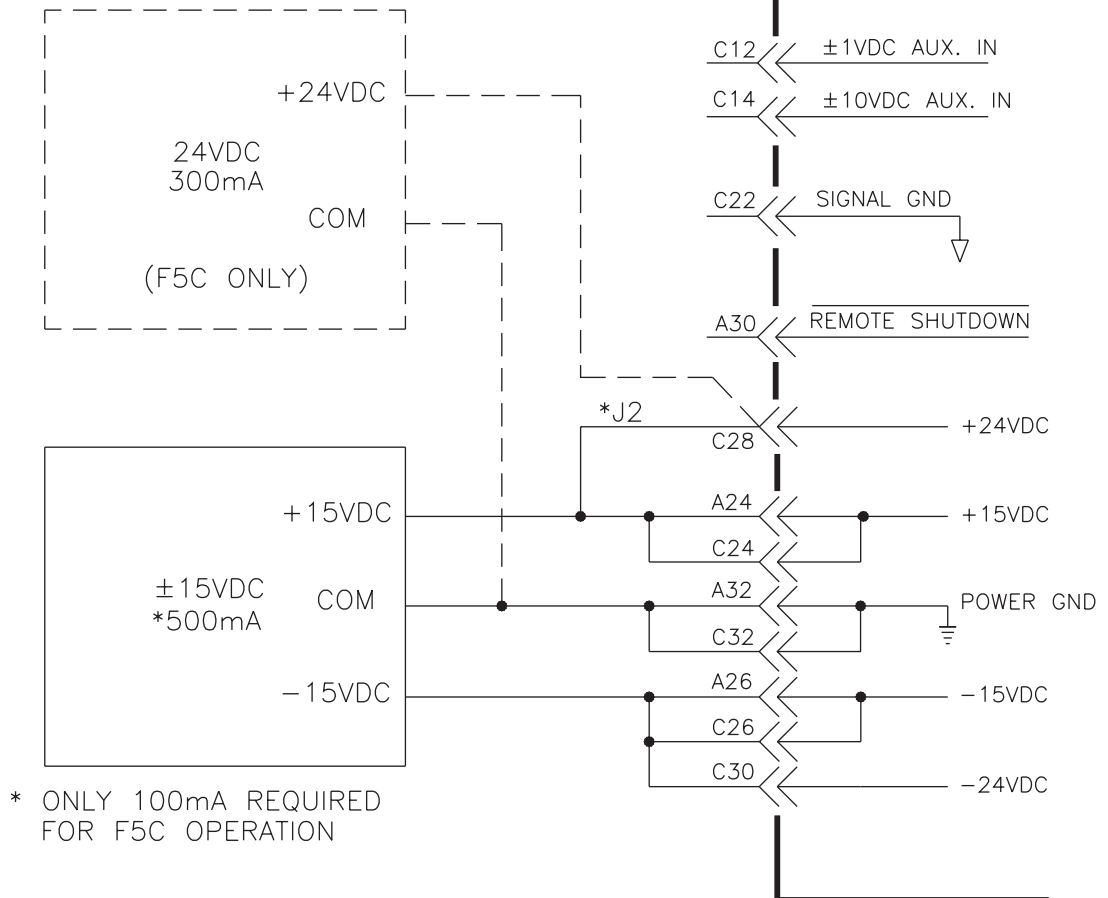
USING THE DRIVER CARD WITH THE STROKER ONLY REQUIRES A $\pm 15\text{VDC}$, 500mA REGULATED SUPPLY WIRED AS SHOWN BELOW.

F5C OPERATION

USING THE F5C REQUIRES AN UNREGULATED 24VDC, 300mA SUPPLY AND A $\pm 15\text{VDC}$, 100mA SUPPLY WIRED AS SHOWN BELOW.

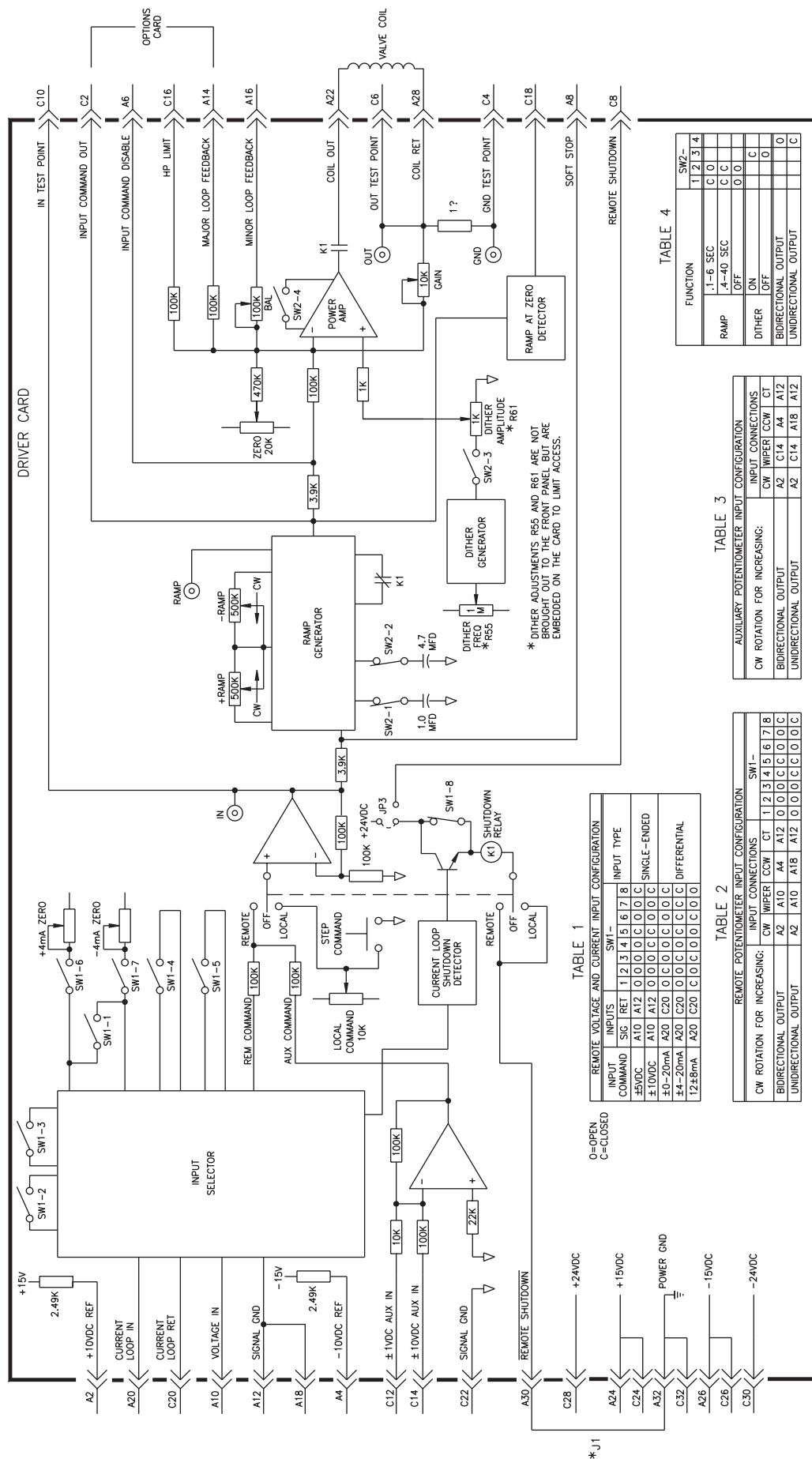
*J2 MUST BE INSTALLED FOR STROKER OPERATION AND REMOVED FOR F5C OPERATION.

USE JUPITER'S CONVENIENT POWER SUPPLY ACCESSORY S20-11715 WHICH PROVIDES BOTH 15VDC AND 24VDC SUPPLIES IN ONE PACKAGE AND AVOID WIRING TWO SEPARATE, INDEPENDENT SUPPLIES.



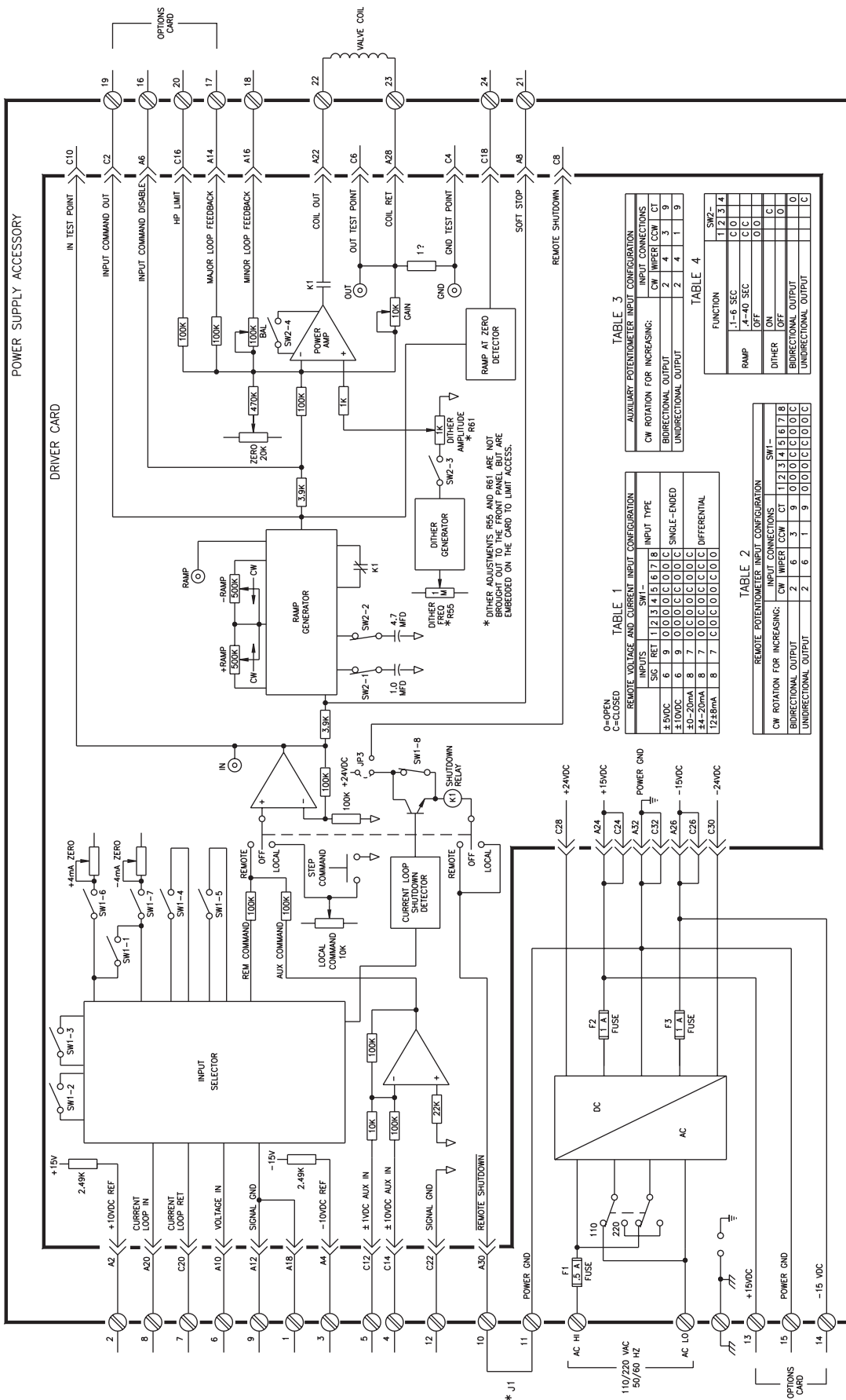
* ONLY 100mA REQUIRED FOR F5C OPERATION

Driver Card Power Supply Connections



*J1 MUST BE INSTALLED IF REMOTE SHUTDOWN FEATURE IS NOT USED

Block Diagram



* J1 MUST BE INSTALLED IF REMOTE SHUTDOWN FEATURE IS NOT USED

Block Diagram

Jupiter Driver Card S20-11712

with Power Supply Accessory S20-11715

TABLE 3

AUXILIARY POTENTIOMETER INPUT CONFIGURATION		
CW ROTATION FOR INCREASING:	INPUT CONNECTIONS	
	CW WIPER	CCW CT
BIDIRECTIONAL OUTPUT	2	4 3 9
UNIDIRECTIONAL OUTPUT	2	4 1 9

TABLE 1

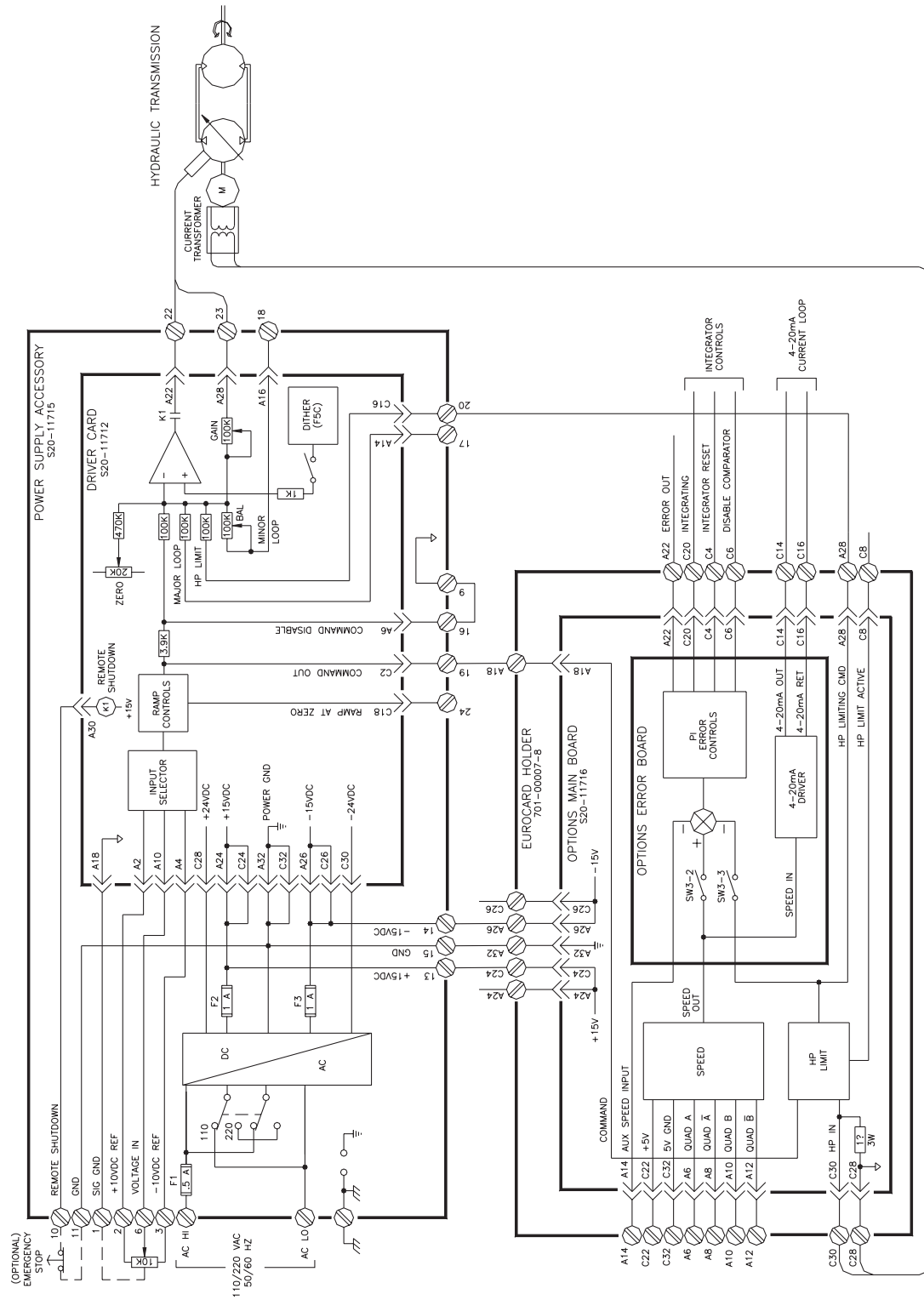
	REMOTE VOLTAGE AND CURRENT INPUT CONFIGURATION										INPUT TYPE	
	INP1		SWT-1									
	SIG	RET	1	2	3	4	5	6	7	8		
+5VDC	6	9	0	0	0	0	0	0	0	0	C	SINGLE-ENDED
+10VDC	6	9	0	0	0	0	0	0	0	0	C	
+0-20mA	8	7	0	0	0	0	0	0	0	0	C	
+4-20mA	8	7	0	0	0	0	0	0	0	0	C	DIFFERENTIAL
12+8mA	8	7	0	0	0	0	0	0	0	0	C	

TABLE 2

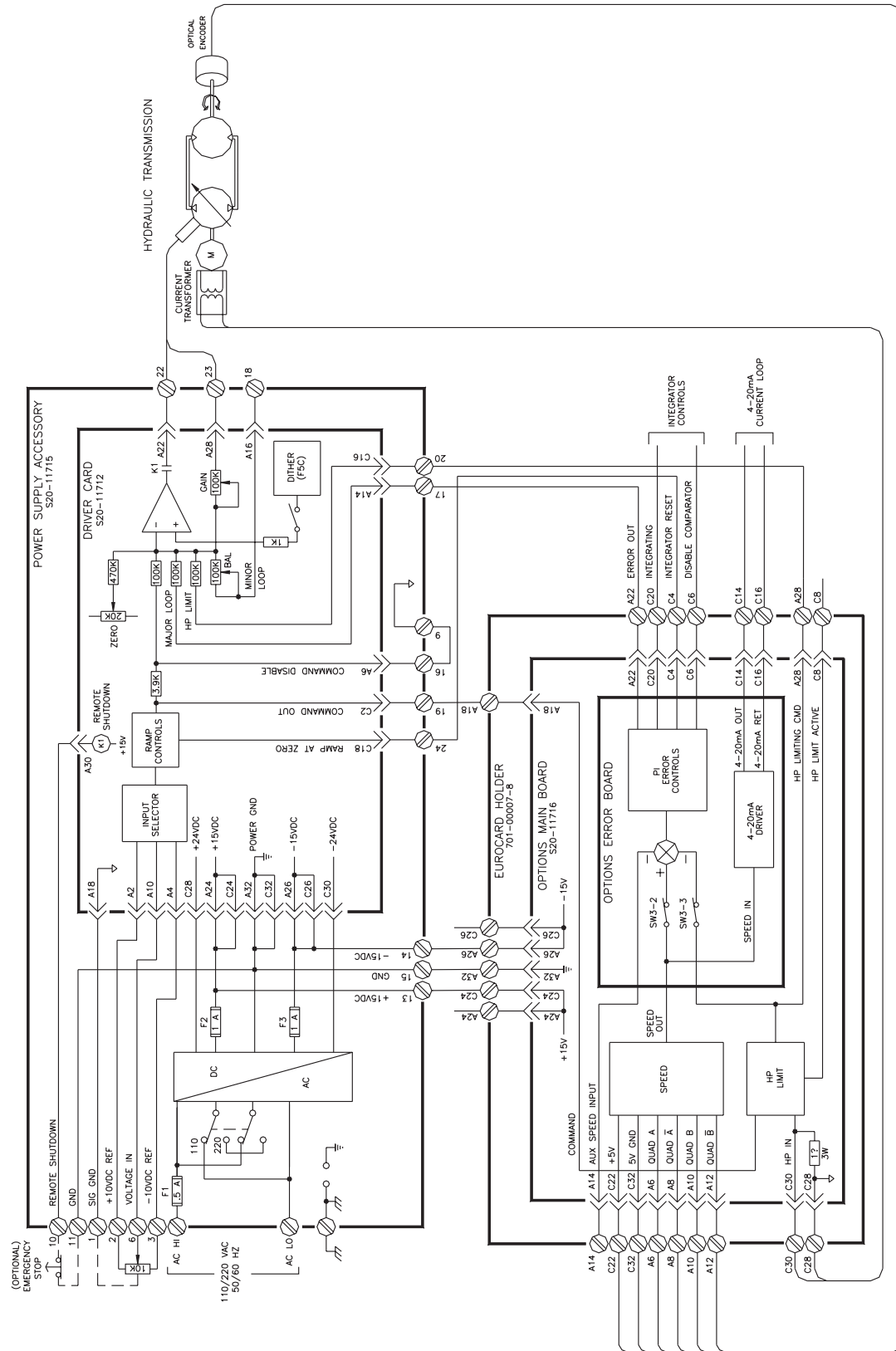
REMOTE POTENTIOMETER INPUT CONFIGURATION											
ADDL 2											
CW ROTATION FOR INCREASING:											
INPUT CONNECTIONS											
SW1 -											
CW	WIPER	CW	CT	1	2	3	4	5	6	7	8
BIDIRECTIONAL OUTPUT	2	6	3	9	0	0	C	0	C	0	C
UNIDIRECTIONAL OUTPUT	2	6	1	9	0	0	C	0	C	0	C

TABLE 4

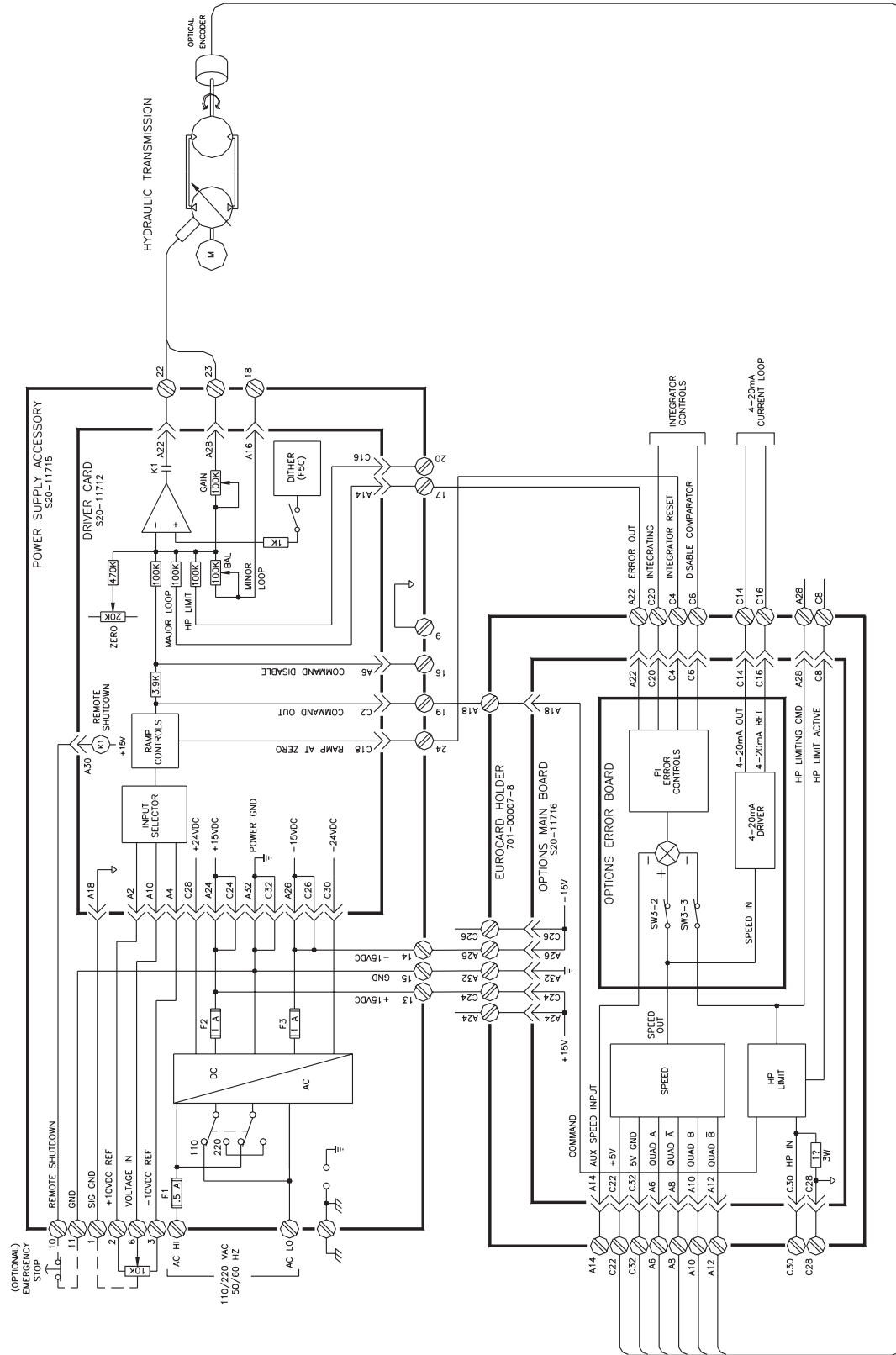
FUNCTION		SW2—			
		1	2	3	4
RAMP	.1–6 SEC	C	O		
	.4–40 SEC	C	C		
	OFF	O	O		
DITHER	ON			C	
	OFF			O	
BIDIRECTIONAL OUTPUT					O
UNIDIRECTIONAL OUTPUT					C



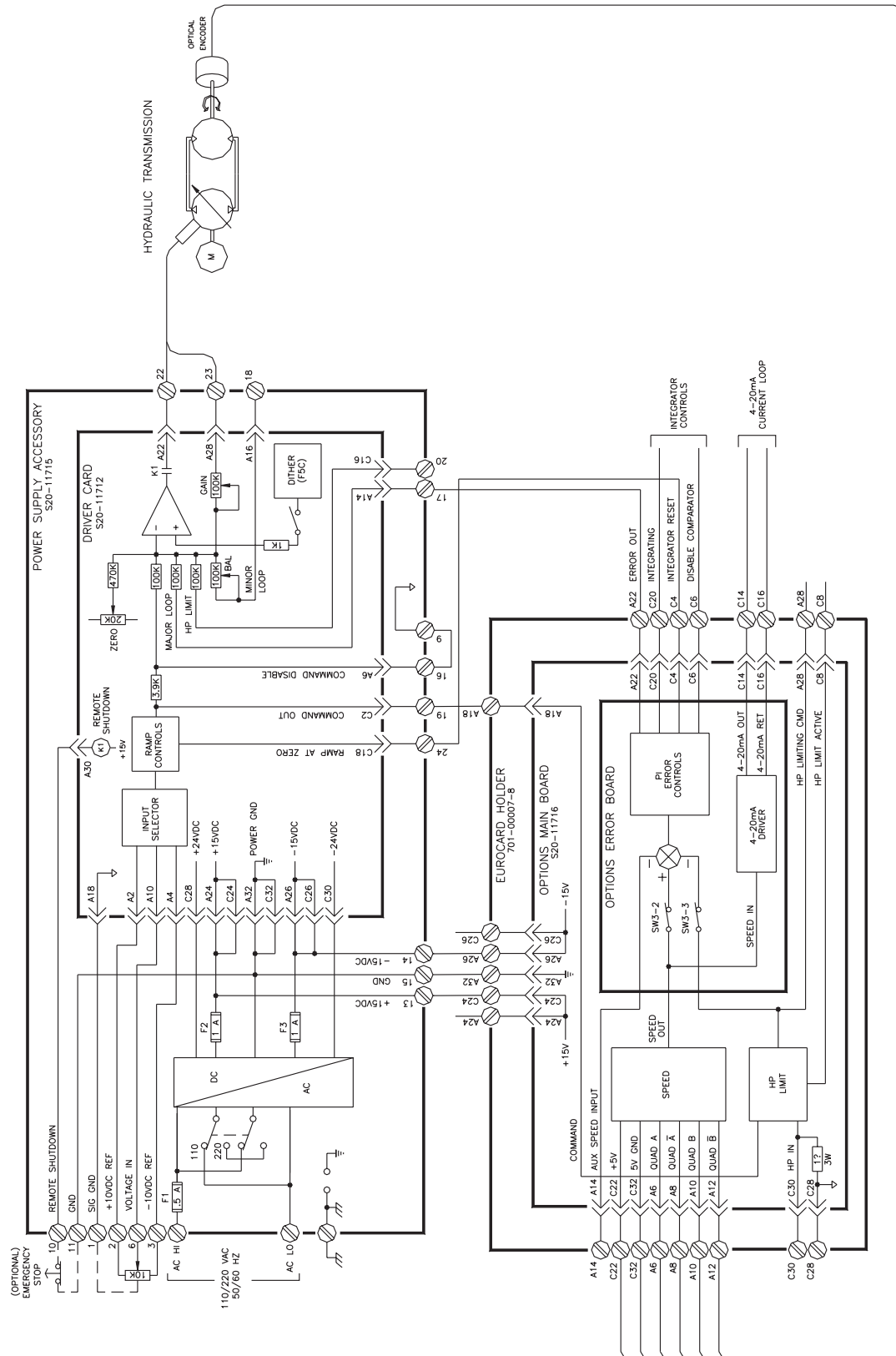
Block Diagram



Block Diagram
Jupiter 500 Driver Card with Options Card
Closed Loop Speed Control with Command Feedforward and Horsepower Limiting



Block Diagram
Jupiter 500 Driver Card with Options Card
Closed Loop Speed Control with Command Feedforward



Block Diagram
Jupiter 500 Driver Card with Options Card
Closed Loop Speed Control with PI

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