

**INSTRUCTION MANUAL D2-3301  
FlexPak 3000 Drive I/O Expansion Kit  
Model Number 914FK0101**

**DANGER**

**ONLY QUALIFIED PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT SHOULD INSTALL, ADJUST, OPERATE, AND/OR SERVICE THIS EQUIPMENT. READ AND UNDERSTAND THIS INSTRUCTION MANUAL IN ITS ENTIRETY BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.**

**CAUTION:** All interconnecting wiring must be sized and installed in conformance with applicable local, national, and international codes. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

## **PRODUCT DESCRIPTION**

The products described in this instruction manual are manufactured or distributed by Reliance Electric Industrial Company.

This instruction manual contains the installation procedure for the optional I/O Expansion kit used by FlexPak® 3000 drives. The I/O Expansion kit can be used only in drives that have software version 3.00 (or later). This kit provides the following additional input/output capability to the FlexPak 3000 drive:

- 5 digital inputs
- 2 digital outputs
- 2 analog inputs
- 2 analog outputs
- 1 frequency input
- 1 frequency output

The above inputs/outputs can be selected from 19 inputs and 8 outputs which have been added to support the I/O Expansion kit. These new inputs/outputs are described briefly later in this manual. For detailed descriptions of all drive parameters, refer to the FlexPak 3000 drive instruction manual (D2-3358).

## **VERIFYING THE KIT MODEL NUMBER MATCHES THE DRIVE MODEL NUMBER**

The I/O Expansion kit can be used in any FlexPak 3000 drive that has software version 3.00 or later. Verify that the next to last digit of the drive model number is 3 or greater.

## CHECKING THE CONTENTS OF THE KIT

Figure 1 shows the I/O Expansion kit, and table 1 lists its contents.

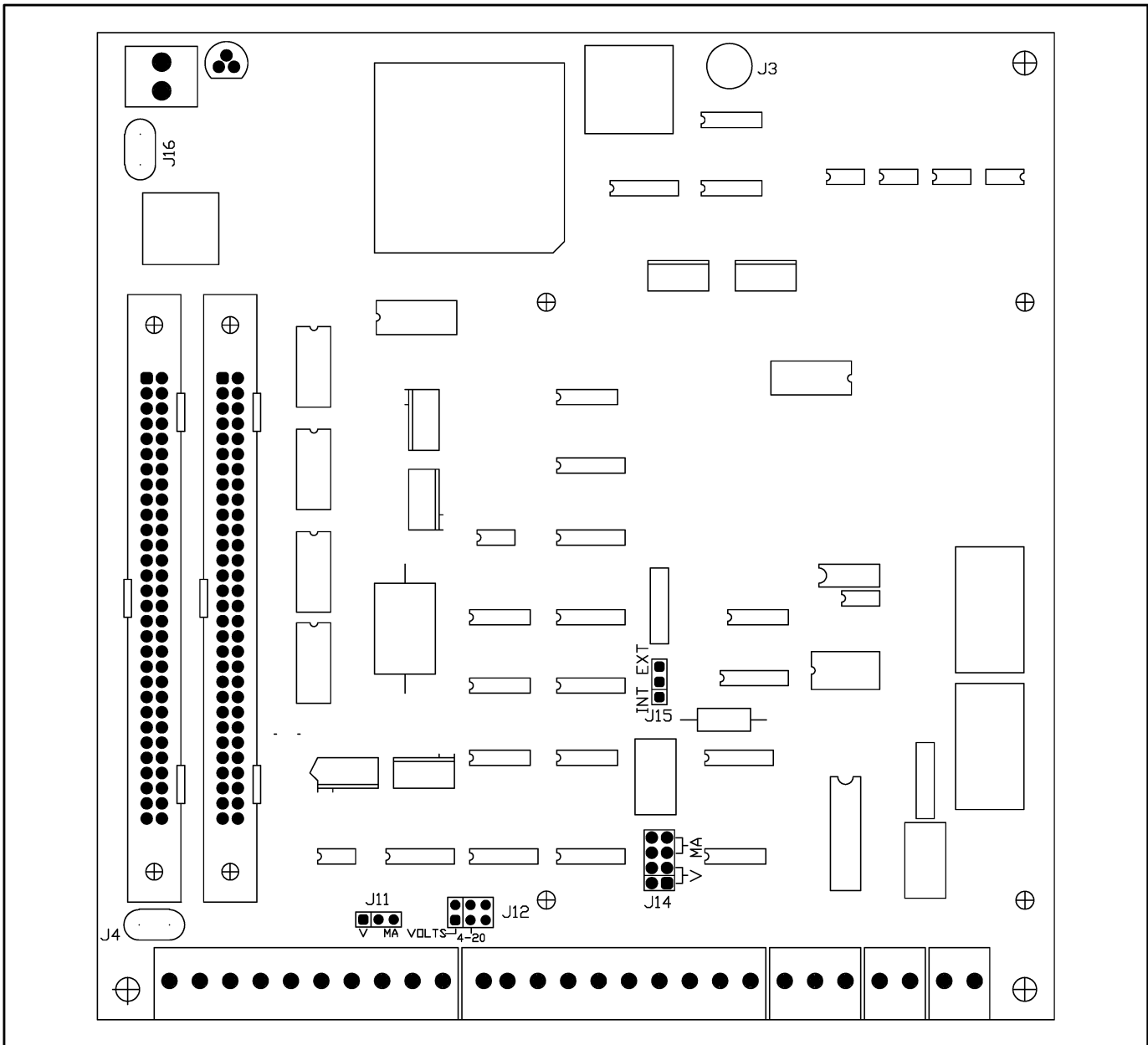


Figure 1 - I/O Expansion Kit

Table 1 - Kit Contents

Kit Model Number	Part Number	Description	Quantity
914FK0101	0-58773	Printed Circuit Board Assembly	1
	D2-3301	Instruction Manual	1

## INSTALLATION INSTRUCTIONS

### DANGER

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### DANGER

THE DRIVE IS AT LINE VOLTAGE WHEN CONNECTED TO INCOMING A-C POWER. DISCONNECT, LOCK OUT, AND TAG ALL INCOMING POWER TO THE DRIVE BEFORE PERFORMING THE FOLLOWING PROCEDURE. AFTER POWER IS REMOVED, VERIFY WITH A VOLTMETER AT POWER TERMINALS 181, 182, AND 183 THAT NO VOLTAGE EXISTS BEFORE TOUCHING ANY INTERNAL PARTS OF THE DRIVE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

### WARNING

THE DRIVE CONTAINS PRINTED CIRCUIT BOARDS THAT ARE STATIC-SENSITIVE. AN ANTI-STATIC WRIST BAND SHOULD BE WORN BY ANY PERSON WHO TOUCHES THE DRIVE'S COMPONENTS, CONNECTORS, OR LEADS. ERRATIC MACHINE OPERATION AND DAMAGE TO, OR DESTRUCTION OF, EQUIPMENT MAY RESULT IF THIS PROCEDURE IS NOT FOLLOWED. FAILURE TO OBSERVE THIS PRECAUTION MAY RESULT IN BODILY INJURY.

Use the procedure that follows to install the I/O Expansion kit. Refer to figures 1 through 6 as you perform the procedure.

- Step 1. Disconnect, tag, and lockout power to the drive.
- Step 2. Remove the drive cover by loosening the four (4) cover retaining screws.
- Step 3. Loosen the captive screw and swing open the carrier.
- Step 4. Loosen and remove the four (4) screws attaching the carrier shield to the carrier.
- Step 5. Disconnect the shield's ground wire from the power supply board. Set the shield aside.  
If the drive has an AC Tachometer Interface board or a Pulse Tach Interface board, continue to step 6. Otherwise, proceed to step 8.
- Step 6. (Drives with Pulse Tach Interface boards only) Disconnect the option board ribbon cable connector from the Pulse Tach Interface board. The connector is held in place by retaining clips at its ends. Spread these clips apart to release the connector.
- Step 7. (Drives with AC Tachometer Interface or Pulse Tach Interface boards only) Remove the AC Tachometer Interface board or Pulse Tach Interface board from the carrier. The AC Tachometer Interface board is held in place by two captive screws. The Pulse Tach Interface board is held in place by four captive screws. Loosen these screws to remove the board.
- Step 8. Remove the I/O Expansion board from its anti-static wrapper. Verify that the jumpers are set properly for your application (refer to figure 2). The jumpers can be set as follows:

#### Analog Input 1 Jumpers

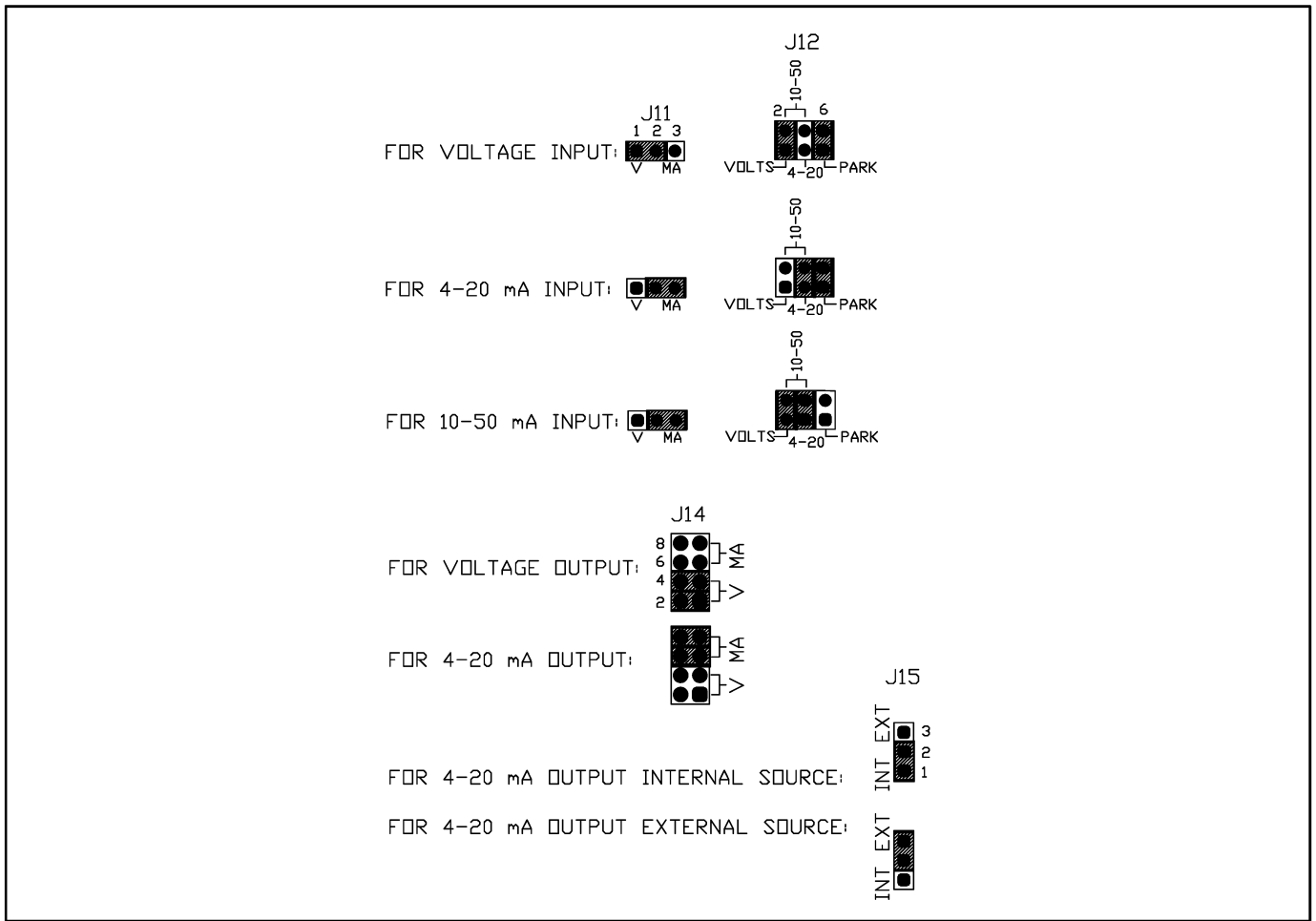
- J11: For voltage input, jumper terminals 1-2 (V) (default);  
for 4-20 or 10-50 mA input, jumper terminals 2-3 (MA).
- J12: For voltage input, jumper terminals 1-2 (VOLTS) and 5-6 (PARK) (default);  
for 4-20 mA input, jumper terminals 3-4 (4-20) and 5-6 (PARK);  
for 10-50 mA input, jumper terminals 1-2 and 3-4 (10-50).

#### Analog Output 1 Jumpers

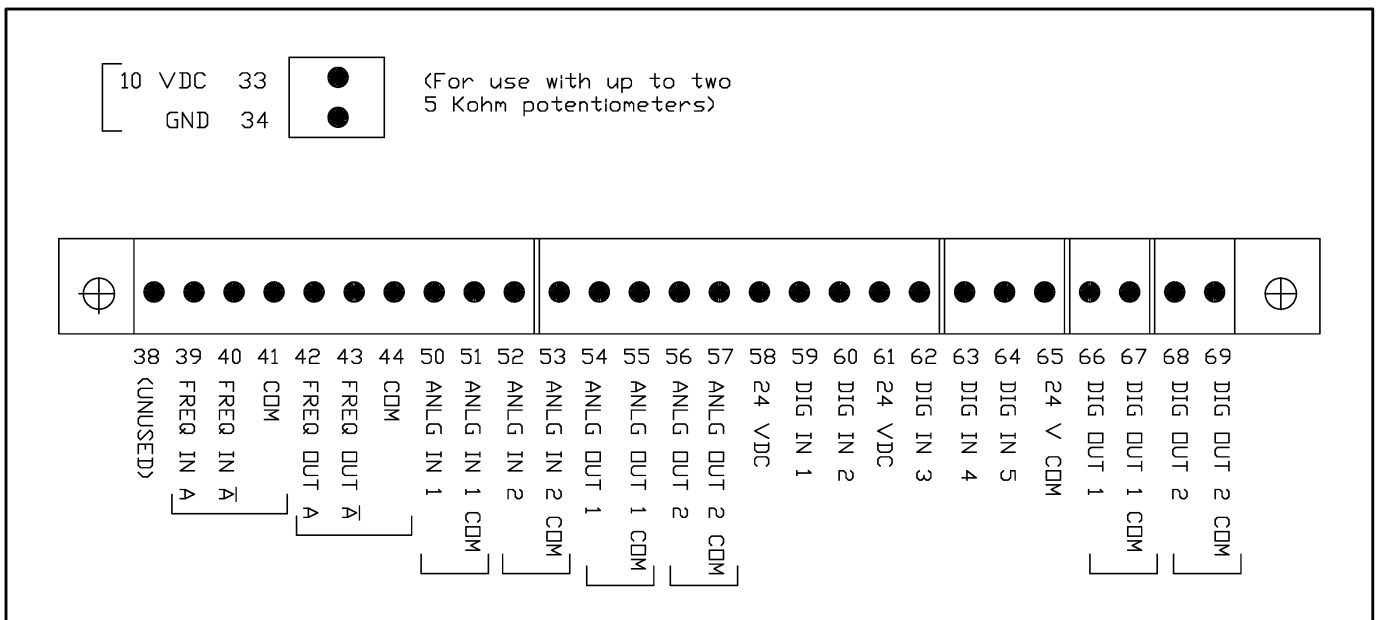
J14: For voltage output, jumper terminals 1-2 and 3-4 (V) (default);  
for 4-20 mA output, jumper terminals 5-6 and 7-8 (MA).

J15: For 4-20 mA output internal source, jumper terminals 1-2 (INT) (default);  
for 4-20 mA output external source, jumper terminals 2-3 (EXT).

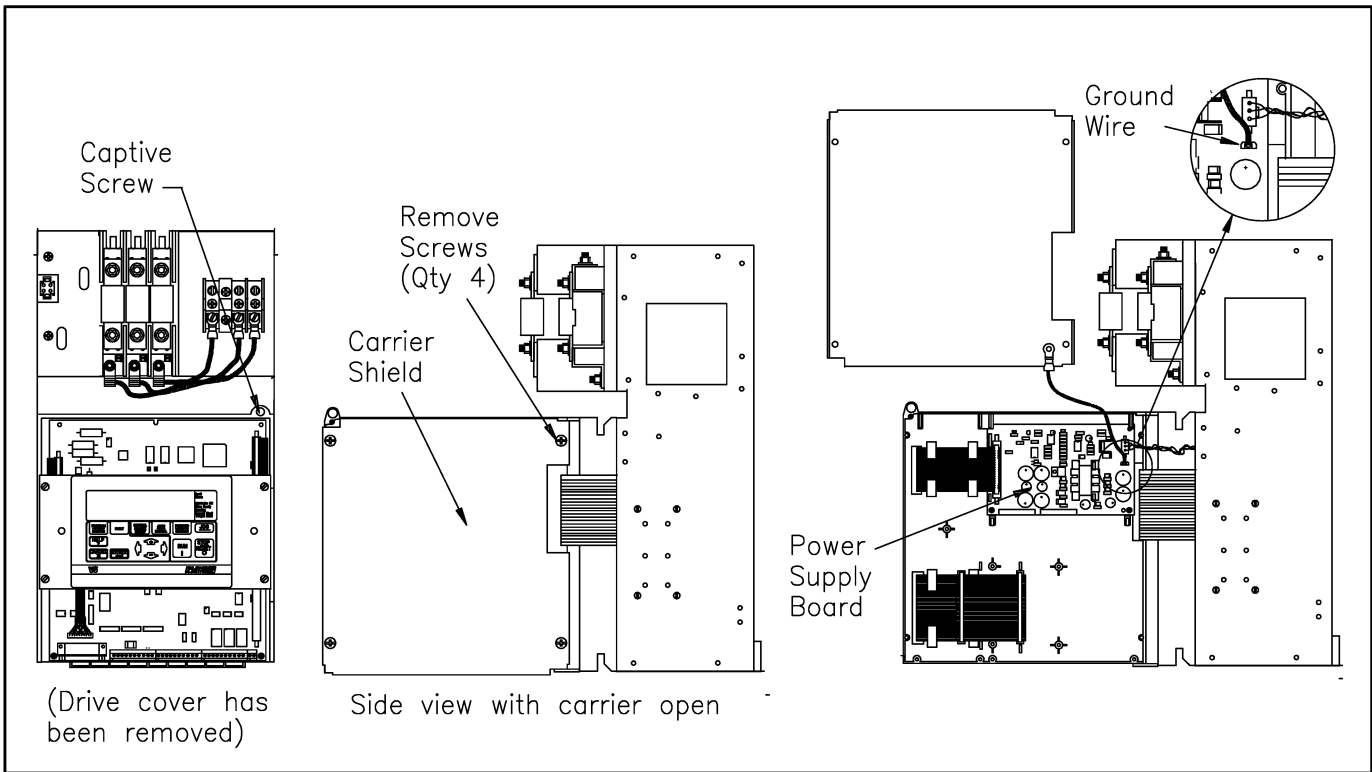
- Step 9. Lifting the option board ribbon cable out of the way, position the I/O Expansion board over the four molded standoffs on the carrier and connect the I/O Expansion board to the carrier using the fasteners provided.
- Step 10. Align the key on the option board ribbon cable connector with the slot in the I/O Expansion board's leftmost connector and press the ribbon cable connector in until it locks into position.  
If the drive has an AC Tachometer Interface board or a Pulse Tach Interface board, continue to step 11. Otherwise, proceed to step 14.
- Step 11. (Drives with AC Tachometer Interface or Pulse Tach Interface boards only) Position the Interface board over the standoffs on the I/O Expansion board.
- Step 12. (Drives with AC Tachometer Interface or Pulse Tach Interface boards only) Fasten the Interface board to the I/O Expansion board using the attached screws.
- Step 13. (Drives with Pulse Tach Interface boards only) Connect the extension ribbon cable (supplied with the Pulse Tach Interface board) to the I/O Expansion board and the Pulse Tach Interface board.
- Step 14. Make the input and output connections to the I/O Expansion board terminal strip as required for your drive configuration. See figure 3 for the terminal strip wiring connections.
- Step 15. Reconnect the carrier shield's ground wire to the power supply board.
- Step 16. Reattach the carrier shield to the carrier using the four (4) screws.
- Step 17. Close the carrier and fasten with the captive screw.
- Step 18. Reattach the drive cover using the four (4) cover retaining screws.
- Step 19. Turn on power to the drive.



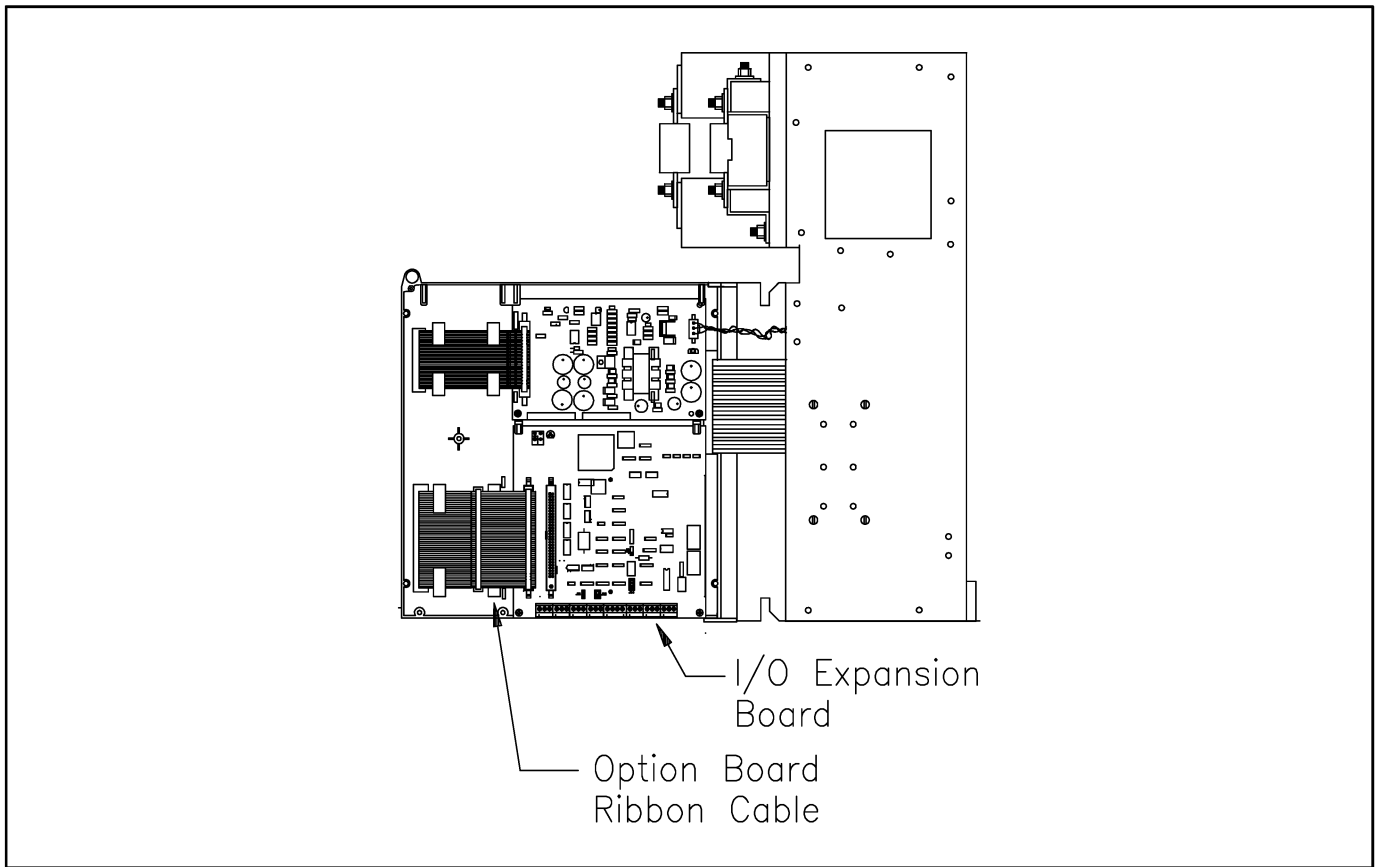
**Figure 2 - Jumper Settings**



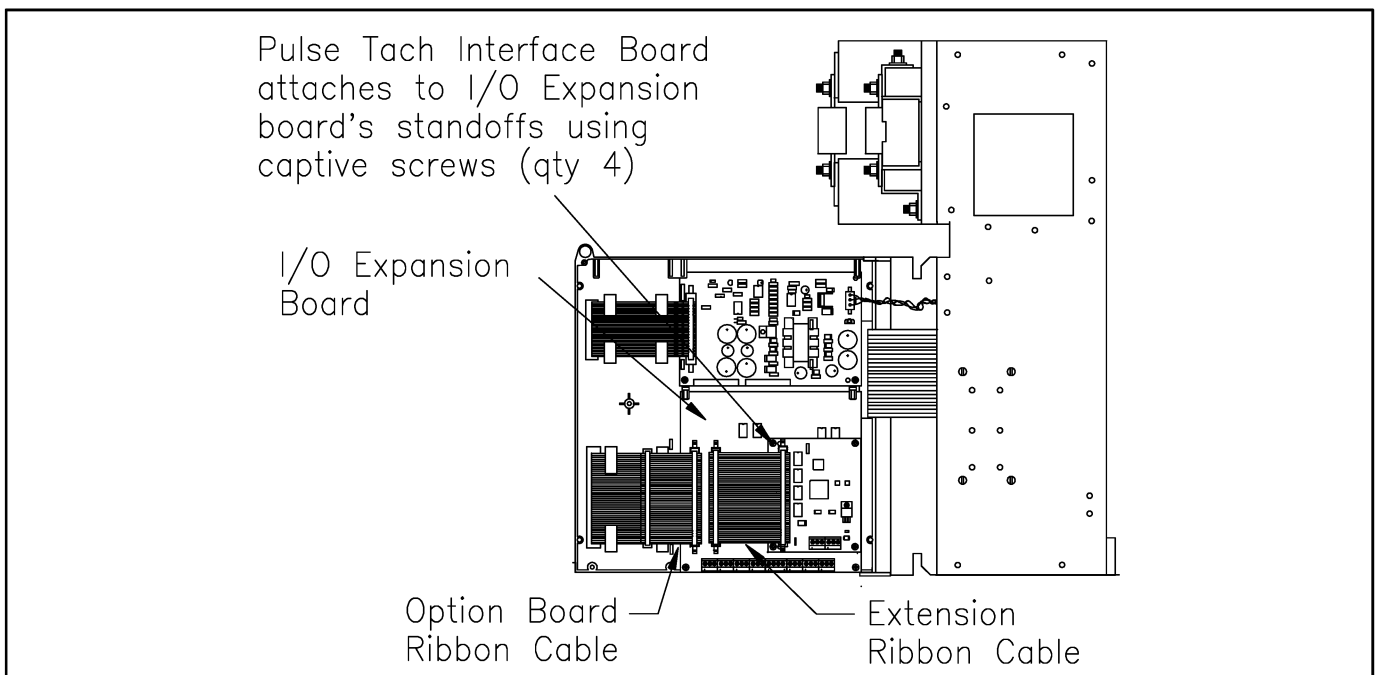
**Figure 3 - Terminal Strip Wiring**



**Figure 4 - Carrier Shield Removal**



**Figure 5 - Installing the I/O Expansion Board (w/o Pulse Tach Board)**



**Figure 6 - Installing the I/O Expansion Board (with Pulse Tach Board)**

## I/O EXPANSION BOARD DRIVE PARAMETERS

The version 3 software contains 19 inputs and 8 outputs which have been added to support the I/O Expansion board. These new inputs/outputs are described briefly in the sections that follow. Refer to the FlexPak 3000 drive instruction manual (D2-3358) for complete parameter descriptions.

### Digital Inputs

The I/O Expansion board supports five digital inputs. The function of each digital input is fixed, and is shown in table 2. The drive will recognize a change in the state of a digital input signal (e.g., 0 → 24 VDC) if it is applied for longer than 20 msec. The digital input parameters are listed in table 2. See figure 7 for the digital inputs block diagram.

Table 2 - I/O Expansion Digital Inputs

Parameter Name	Parameter Number	Function	Terminal Strip Location*
DIG IN 1	P.495	Preset Speed B	59
DIG IN 2	P.496	Preset Speed A	60
DIG IN 3	P.497	MOP decrement	62
DIG IN 4	P.498	MOP increment	63
DIG IN 5	P.499	OCL enable	64

\* Terminals 58 and 61 (+24 VDC) and 65 (24 V COM) are available for use with the digital inputs.

The MOP and Preset Speed digital input signals can affect the speed reference only when **CONTROL SOURCE SELECT = TERMBLK**.

The OCL enable digital input signal can affect the Outer Control Loop only when **CONTROL SOURCE SELECT = TERMBLK** or **KEYPAD**.

Note that if the I/O Expansion kit is not installed, the Outer Control Loop (OCL) enable signal can still be controlled from a network master if **CONTROL SOURCE SELECT = NETWORK**. However, the Motor Operated Potentiometer (MOP) and Preset Speed functions will not be supported.

### Digital Outputs

The I/O Expansion board supports two digital outputs. Digital outputs can be sourced from various functions of the drive, and hold their state for a minimum of 20 msec. The digital output parameters are listed in table 3. See figure 8 for the digital outputs block diagram.

Table 3 - I/O Expansion Digital Outputs

Parameter Name	Parameter Number	Terminal Strip Location
DIG OUT 1 SELECT	P.409	66, 67
DIG OUT 2 SELECT	P.411	68, 69
DIG OUT 1 CONTACT TYP	P.410	
DIG OUT 2 CONTACT TYP	P.412	

NOTE: If digital output 1 or 2 is configured as normally closed, it will act as normally open during a power cycle until the software contact type is read. This should be accounted for in your application program.

### Analog Inputs

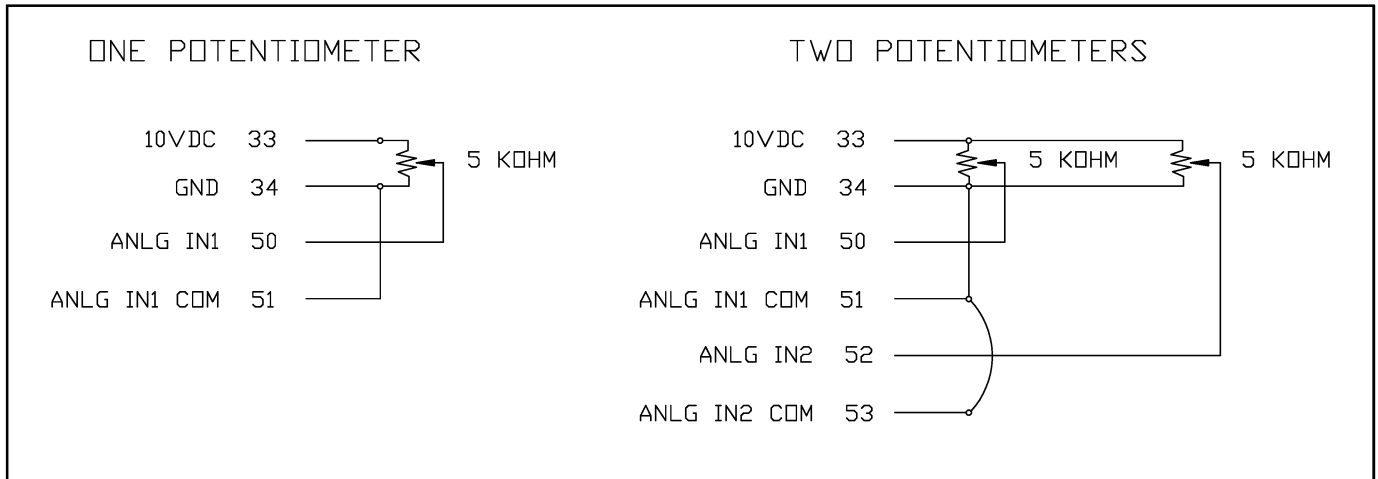
The I/O Expansion board supports two analog inputs: **ANLG IN 1** (P.492) and **ANLG IN 2** (P.493). **ANLG IN 2** accepts a bipolar DC voltage only. **ANLG IN 1** can be configured to accept any of the following signals: bipolar DC voltage, unipolar DC voltage, 4-20 mA, or 10-50 mA. Analog inputs can be scaled to use DC voltage signals as low as 4.5 V (5V ± 10%), but maximum resolution (0.024%) is obtained when the full scale input signal is used.

Analog input signals are read every 20 msec. Table 4 lists the analog input parameters that can be configured. Figure 8 provides wiring diagrams for connecting 5 kΩ potentiometers. See figure 9 for the analog inputs block diagram.

**Table 4 - I/O Expansion Analog Inputs**

Parameter Name	Parameter Number	Terminal Strip Location*
ANLG IN 1	P.492	50, 51
ANLG IN 2	P.493	52, 53
ANLG IN 1 SIG TYPE	P.413	
ANLG IN 1 ZERO ADJ	P.414	
ANLG IN 1 GAIN ADJ	P.415	
ANLG IN 2 ZERO ADJ	P.416	
ANLG IN 2 GAIN ADJ	P.417	

\* Terminals 33 (+10 VDC) and 34 (GND) are available for use with up to two 5 kΩ potentiometers.



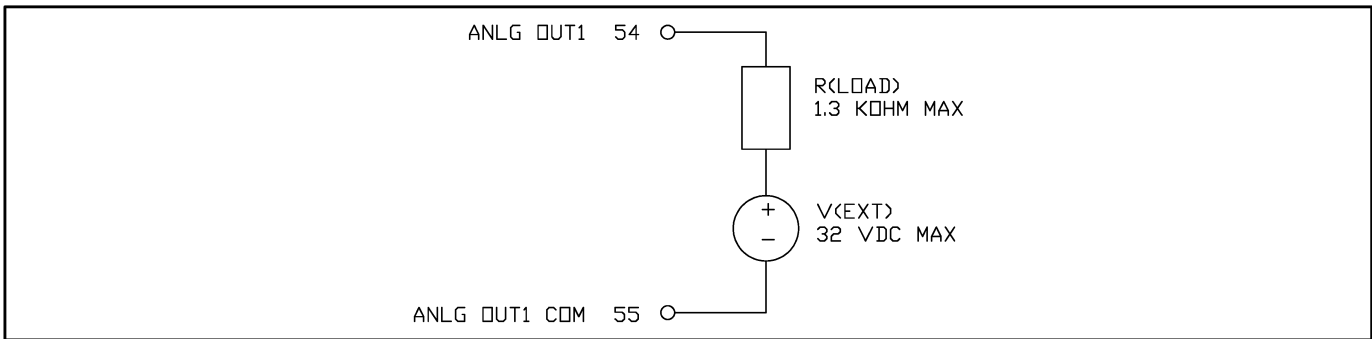
**Figure 7 - Potentiometer Connection Diagrams**

## Analog Outputs

The I/O Expansion board supports two analog outputs. One output can generate a bipolar DC voltage only. The other can be configured to generate one of the following signals: DC voltage (0 to ±10 VDC) or 4-20 mA. Both outputs are unfiltered (whereas standard meter outputs are averaged). Analog outputs can be scaled to generate DC voltage signals as low as 5 V, but maximum resolution (0.025%) is obtained when the full scale output signal is used. The full scale value is determined based on the selected parameter group: load, speed, voltage, power, field, or other. Analog output signals are updated every I/O scan (typically 20 msec). Table 5 lists the analog output parameters that can be configured. Figure 8 provides an example of how to wire an external supply for 4-20 mA output. See figure 10 for the analog outputs block diagram.

**Table 5 - I/O Expansion Analog Outputs**

Parameter Name	Parameter Number	Terminal Strip Location
ANLG OUT 1 SELECT	P.418	54, 55
ANLG OUT 1 SIG TYPE	P.419	
ANLG OUT 1 GAIN ADJ	P.420	
ANLG OUT 2 SELECT	P.421	56, 57
ANLG OUT 2 GAIN ADJ	P.422	



**Figure 8 - Wiring An External Supply for 4-20 mA Output**

### Frequency Input

The I/O Expansion board supports one unipolar frequency input: **FREQ IN** (P.491). The frequency input signal is read every 20 msec. See figure 7 for the frequency input block diagram. Table 6 lists the frequency input parameters that can be configured.

**Table 6 - I/O Expansion Frequency Input**

Parameter Name	Parameter Number	Terminal Strip Location
FREQ IN	P.491	39, 40, 41
FREQ IN ZERO	P.423	
FREQ IN FULL SCALE	P.424	

### Frequency Output

The I/O Expansion board supports one unipolar frequency output. The output is unfiltered. The full scale value is determined based on the selected parameter group: load, speed, voltage, power, field, or other. The frequency output signal is updated every 20 msec. See figure 8 for the frequency output block diagram. Table 7 lists the frequency output parameters that can be configured.

**Table 7 - I/O Expansion Frequency Output**

Parameter Name	Parameter Number	Terminal Strip Location
FREQ OUT SELECT	P.425	42, 43, 44
FREQ OUT ZERO	P.426	
FREQ OUT FULL SCALE	P.427	

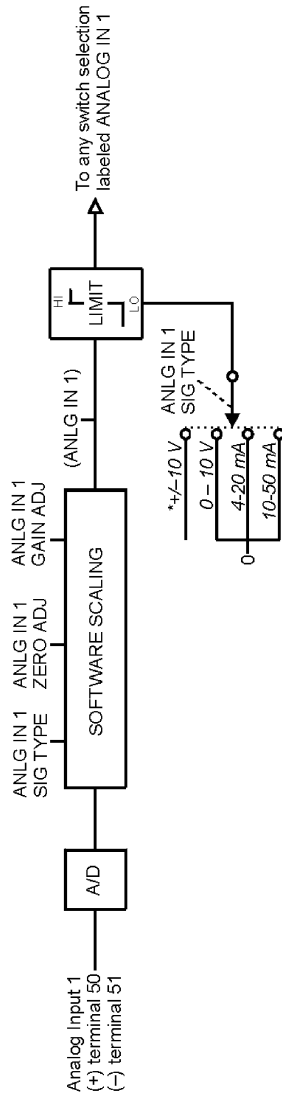
### Digital Inputs (n = 1 through 5)

- n = 1: terminal 59 (Preset Speed Select B)
  - n = 2: terminal 60 (Preset Speed Select A)
  - n = 3: terminal 62 (MOP Decrement)
  - n = 4: terminal 63 (MOP Increment)
  - n = 5: terminal 64 (OCL Enable)
- +24 VDC available at terminal 14 on regulator board and at terminal 58 and 61 on I/O Expansion board

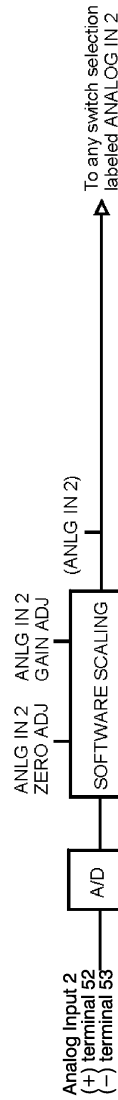
To function specified by digital input n

(DIG IN n)

### Analog Inputs

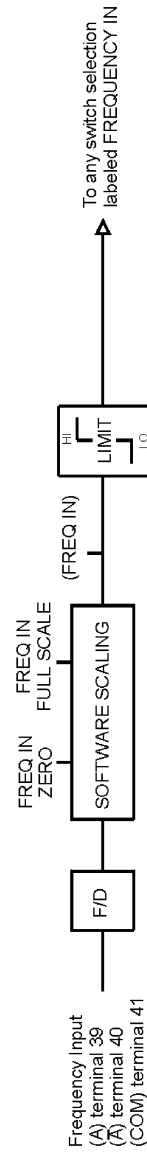


Analog Input 2  
(+) terminal 52  
(-) terminal 53



### Frequency Input

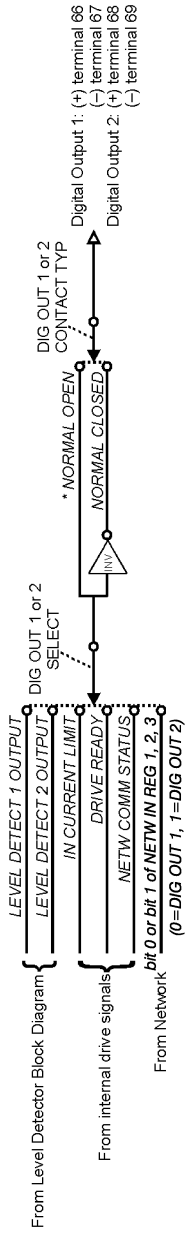
Frequency Input  
(A) terminal 39  
(A) terminal 40  
(COM) terminal 41



\* = Default Selection

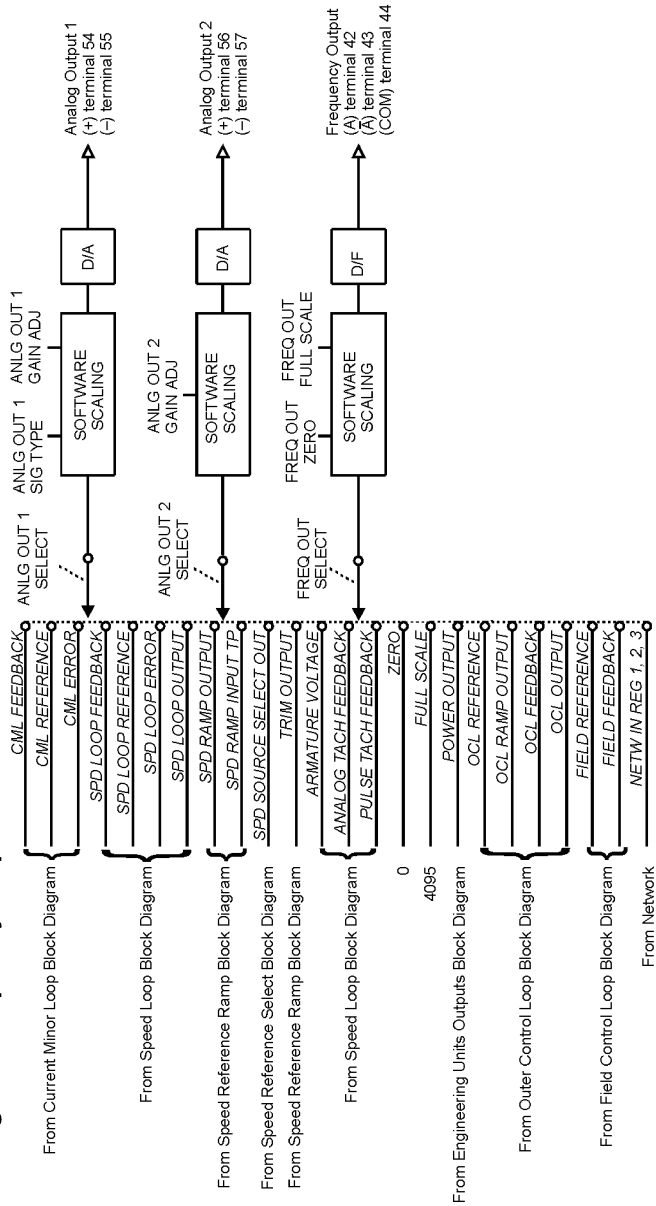
Figure 9 - I/O Expansion Board Inputs

## Digital Outputs 1 and 2



DIG OUT 1 SELECT default is LEVEL\_DETECT 1 OUTPUT.  
 DIG OUT 2 SELECT default is LEVEL\_DETECT 2 OUTPUT.

## Analog and Frequency Outputs



The digital, analog, and frequency outputs are only available if the I/O Expansion Kit is installed.

Figure 10 - Digital, Analog, and Frequency Outputs

## TECHNICAL SPECIFICATIONS

### Digital Inputs

Input Voltage:	+24 VDC
Input Current Draw:	9 mA (@ $V_{in} = 24$ VDC)
Common:	All inputs share the same common

### Digital Outputs

Operating Voltage:	250 VAC maximum 30 VDC maximum
Switching Current:	2 amps maximum resistive 1 amp maximum inductive

### Analog Inputs

Analog Input 1	
Potentiometer:	5 k $\Omega$ minimum
Input Voltage:	$\pm 10$ VDC
Input Current Reference:	4-20 mA, 10-50 mA
Analog Input 2	
Potentiometer:	5 k $\Omega$ minimum
Input Voltage:	$\pm 10$ VDC maximum

### Analog Outputs

Analog Output 1	
Output Voltage:	$\pm 10$ VDC
Maximum Load:	4 mA
Current Output:	4-20 mA
External Supply for 4-20 mA Output:	5-32 VDC, 0 - 1.3 k $\Omega$ maximum load
Analog Output 2	
Output Voltage:	$\pm 10$ VDC
Maximum Load:	4 mA

### Frequency Input

Maximum Frequency:	250 kHz
Minimum Duty Cycle: (time on to time off)	25% @ 250 kHz, 20% @ 100 kHz
Minimum Pulse Width:	2 $\mu$ s
Input:	Differential A and A Not
Input Voltage:	50 V maximum differential (25 V to common) 1.5 V minimum differential voltage swing
Input Impedance:	22 k $\Omega$ differential, 11 k $\Omega$ to isolated +15 V common
Signal Common:	100 $\Omega$ to isolated +15 V common

### Frequency Output

Maximum Frequency:	250 kHz
Duty Cycle:	50%
Output Voltage:	5 V differential
Maximum Output Offset:	0.4 V
Maximum Load:	5 mA
Signal Common:	100 $\Omega$ to isolated +15 V common
Signal Termination:	100 $\Omega$ in series with 3900 pf

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