

## PWM SERVO AMPLIFIER

### FEATURES

- Dual four-quadrant bi-directional PWM servo amplifiers
- 5.0 A max. continuous; 8.5 A peak (per channel).
- Continuous background bit testing
- Optional RS-422 (Full Duplex) serial data link
- A/D, D/A or dual Resolver-to-Digital converters available.
- Optional programmable encoder (A & B) equivalent Hall Effect commutation outputs.

### SAFETY FEATURES

**Interrupt will be set and Status registers will indicate:**

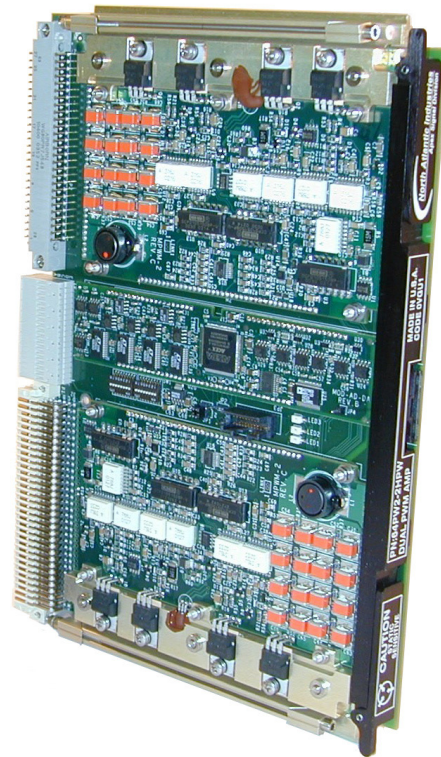
- Drive fail: bias loss etc.
- Over-current condition
- Supply over-voltage condition
- Supply under-voltage condition
- Over temperature condition for PWM card
- Over temperature condition for Power Supply card
- Master Drive Enable

### DESCRIPTION

The 64PW3 is a Servo Motor Drive featuring dual four-quadrant, bi-directional PWM servo amplifiers that drive brush or brushless (optional) DC servo motors. This conduction cooled VME card incorporates optional RS-422, A/D, D/A or dual Resolver-to-Digital converters. The required 65 VDC power (other voltages are available) is supplied by a separate power supply module that is controlled by this card by means of a pulse train. Optional programmable encoder (A & B) equivalent Hall Effect commutation outputs are also available.

The amplifiers can be set for either current or voltage control via the bus. Actual motor control, using the selected voltage or current mode, can be done with the RS-422 link. Both output drives can be shut down via a single discrete opto-isolated logic input. A thermal shutdown will prevent damage to the system caused by excessive temperature conditions. Motor drive power is opto-isolated from VME power.

Major diagnostics are incorporated that offer substantial improvements to system reliability because user is immediately alerted to malfunctions. The processor monitors every safety characteristic. Any failure triggers an Interrupt, and shut-down if applicable, with the results available in status registers. The testing is totally transparent to the user, requires no external programming, has no effect on the standard operation of this card and can be enabled or disabled via the bus. To simplify logistics, Part number, S/N, Date code, & Rev. are located in non-volatile memory locations.



## SPECIFICATIONS

### PWM amplifiers

	(Apply after a 5 second warm up period)
Power:	65 VDC $\pm 5\%$ (Motor rails will be within 35 volts of the chassis)
Resolution:	12 bits. Monotonic over temperature range
Output (per channel):	5.0 A max. continuous, 8.5 A peak based on a card edge temperature of +85C. Short circuit protected. Thermal protection will determine duration of peak current drive.
Peak output voltage:	Supply voltage -2.4 V max. at 8.5 A peak
Frequency (PWM):	50 Khz
Band width:	800 Hz open loop minimum in current mode with user programmable loop controller variables.
Quiescent power:	TBD with no motors connected
Efficiency:	At 65 VDC and 5.0 A: 96%
Heat to be dissipated:	10 watts per amplifier
Master Drive Enable:	A discrete input (N/O), opto-isolated from the motor supply, must receive a +5 VDC level to permit operation and cannot be overridden.
Shut-down conditions:	RS-422 time out PWM card time out Drive fail Ch. 1: bias loss etc. Drive fail Ch. 2: bias loss etc. Supply over-voltage condition: 71.5 VDC Supply under-voltage condition: 58.5 VDC Over-temperature condition: 110°C at heat sink An H-bridge short will trigger an immediate shut down Motor Output Ch. 1 shorted to ground Motor Output Ch. 1 shorted to +VDC Motor Output Ch. 2 shorted to ground Motor Output Ch. 2 shorted to +VDC A channel that is turned OFF by any 'Shut-down condition' except for Drive fail and H-bridge short, can be returned to active status when 'Shut-down condition' becomes normal by writing "1" to appropriate <i>Drive Reset</i> register.
Control of ext. Power:	A pulse train signal between the Power Supply Module and the Motor Drive PWM Module is used for ON/OFF and failure monitoring.

### RS-422 Serial Data link

Definition:	+ is non-inverted; - is inverted and internally terminated with 120 $\Omega$ . One side is pulled up (1000 $\Omega$ ) to +5 VDC and the other is pulled down (1000 $\Omega$ ) to ground. When Logic "1" is being transmitted, the High output will be +5 V and the Low output will be zero.
Clock rate:	2 Mhz, SLDC mode. User will generate the clock.
Clock edge:	Rising or Falling clock edge can be specified via VME bus.
Error status:	SDLC CRC checking is supported per IBM Specification GA27-3093-04. CRC error status is available thru the VME interface. First status is a 16-bit word containing the total number of CRC errors observed on the RX line pair. Second status is a 16-bit word containing the total number of data frames received thru the RX line pair. The third is a status bit indicating the status of the last data frame received (0=no CRC error, 1=CRC error on last frame). The first and second status words will stop counting when a max count of FFFF is reached. Clearing and restarting is thru the VME interface.
Watchdog timer (RS485):	With selectable time out period. When code is not received, drive power is shut down.



## **A/D & D/A**

Number of A/D channels:	TBD
Resolution:	12 bit, no missing codes
A/D Input voltage:	±10 VDC
A/D Input impedance:	10 K Ohms minimum
A/D Conversion Rate:	100 kSPS minimum
Number of D/A channels:	TBD
Resolution:	12 bit, guaranteed monotonic
DA Output voltage:	±10 VDC
D/A Load:	2 K Ohms minimum
D/A Conversion rate:	100 kHz minimum

## **Resolver-to-digital**

Resolution:	16 bits
Accuracy:	±1 arc-minute
Tracking Rate:	150 RPS max. is standard with normal band width
Bandwidth:	Standard is 40 Hz at 400 Hz, and 100 Hz above 1 kHz. Can be programmed in field. From 5 Hz to 1200 Hz per channel.
Input format:	Synchro or Resolver programmable.
Input voltage:	2-28 VL-L, Autoranging,
Input Impedance:	40 kΩ min. Reference:
Reference Input:	2-28 Vrms, Autoranging.
Reference Zin	100 kΩ min.
Frequency:	400 Hz to 10 kHz
Phase shift:	The synthetic reference circuit automatically compensates for phase shifts between the transducer excitation and output up to ±60°.
Velocity, Digital:	16-bit resolution; Linearity: 0.1%. Scalable to 0.1°/sec resolution. BW is same as Signal BW.
Wrap around Self Test:	The three different powerful test methods are available.

## **General**

Watchdog timer (VME):	With selectable time out period. When code is not received, drive power is shut down.
Temperature, operating:	-40°C to +85°C card edge temperature
Storage temperature:	-55°C to +95°C
Stress screening:	All boards are temperature cycled from -40°C to +85°C for 24 hours. The baseplate temperature will be controlled to -40°C to +85°C.
Altitude:	60,000 feet
VME Data transfer:	Data transfers within 200 ns.
MTBF:	A reliability prediction will be performed utilizing Mil-Hdbk-217, revision F, notice 2, in an airborne rotary wing environment at a constant temperature of + 55 °C.
Size:	6U (9.2") height, 8HP (0.8") width.

## BLOCK DIAGRAM TWO PWM SERVO AMPLIFIERS

