INSTALLATION MANUAL

A241-PA SERVO CONTROLLER

PENNINE AUTOMATION LIMITED
Brookwoods Industrial Estate
Burrwood Way
Holywell Green
Halifax
West Yorkshire
HX4 9BH

Telephone: +44 (0) 1422 370109
Fax: +44 (0) 1422 371338

Jan 2006 : Subject to change without prior notice

TABLE OF CONTENTS

1. INTRODUCTION

1.1 GENERAL DESCRIPTION

The A241-PA is a transistorized PWM Servo Controller that is intended for use as a controller of DC permanent magnet servomotors with power ratings up to 2160 watts. It must be used in conjunction with a filtered power supply and mounted on a fan-cooled heat sink assembly.

The normal command signal source is the analogue output (error signal) of a CNC or Motion Controller. A customisable personality module allows the drive to be configured for a variety of applications and includes settings for offset, stability, current limit, maximum speed and ramp adjustments.

Typical applications include machine tool feed drives, robot axis drives, and general system automation.

The purpose of this manual is to provide the necessary basic information for the installation, set up, operation and troubleshooting of the A241-PA Servo Controller. Operating personnel should be familiar with the contents of this manual before any connections are made to the drives or their supporting equipment. This manual does not cover every possible contingency to be met in connection with installation, operation or troubleshooting. Should further information be required or should problems arise which are not dealt with in this manual, please contact a Pennine Automation applications engineer.

1.2 SPECIFICATION

Auxiliary dc supplies		+22	Volts
		–22	Volts
DC Bus Voltage	Maximum	220	Volts
	Over-voltage	230	Volts
Armature Output Current (+/– 10%)	Peak	30	Amps
(Dependent on cooling arrangements)	Continuous	12	Amps
Armature Inductance	Minimum	2.0	mH
Output Switching Frequency	Nominal	12	kHz
Torque Amplifier Bandwidth		>1	kHz
Operating Temperature		0 to 50	°C
Overall Dimensions	Height	287	mm
	Width	49	mm
	Depth	175	mm
Protection Class		IP00	

1.3 FAULT PROTECTION

The A241-PA servo drive is protected against the following fault conditions:

Over temperature: A thermal sensor mounted on the chassis adjacent to the power transistor modules detects when the temperature exceeds 85°C. This fault is latched, the red LED is lit and the transistor switching is inhibited.

Short circuit: The switching of each transistor is monitored to detect excessive currents caused by any of the following:
a) Motor armature leads shorted together
b) Motor armature shorted to ground
c) Motor armature shorted to -DC Bus
d) Transistor failure
On detecting any of these conditions the fault is latched, the red LED is lit and the transistor switching is inhibited.

Tach loss: The tach feedback signal is monitored for a non-zero value whenever an armature voltage is present. If the tach is either not connected or shorted then a fault condition is latched, the red LED is lit and the transistor switching is inhibited.
Note: this does not detect if the tach or armature polarity has been reversed.

Bus over voltage: If the DC Bus exceeds its maximum limit the switching of the output transistors is temporarily inhibited until the voltage falls below the limit. When the voltage exceeds the limit the yellow LED goes off. Unlike the conditions mentioned above, this fault is not latched.

1.4 STATUS INDICATION

Three LEDs on the front of the unit indicate the following conditions:

LED1	RED	Fault (tach loss / short-circuit / over-temperature)
LED2	YELLOW	Voltages healthy (DC bus < over-voltage level & VCC > minimum level)
LED3	GREEN	Enable input signal present

2 INSTALLATION

WARNING

Dangerous power levels exist in the A241-PA servo controller together with its power supply and all associated equipment. Only qualified personnel should work on this equipment. At all times during the initial set-up, be prepared to remove power if a mechanical or electrical problem occurs.

2.1 GENERAL

The A241-PA must be mounted on the backplane / cooling assembly. The power supply is on the left of the assembly and the drives are mounted to the right of the power supply. Before mounting, the base of the drive must be coated with a thin layer of thermal grease to ensure good thermal conduction from the drive to the heat sink.

2.2 MECHANICAL

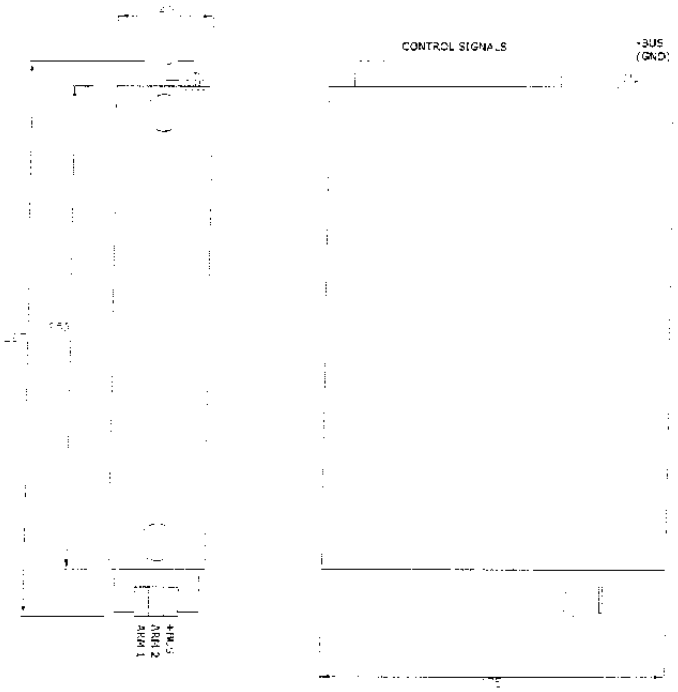

Figure 1
Outline Dimensions

2.3 ELECTRICAL CONNECTIONS

2.3.1 Control signals

TB1	RESW	Reference switch. Connecting RESW to 0V energises a relay on the personality module which switches in the velocity command signal to the error amplifier circuit.
TB2	STSW	Standby switch. Connecting STSW to 0V energises a relay on the personality module which puts the amplifier in standby mode. Standby mode can be programmed using links on the personality module to either: (a) LK3 fitted - Disable the velocity loop (b) LK4 fitted - Change the input velocity scaling
TB3	DIFF–	]
TB4	DIFF OUT	] Uncommitted differential amplifier
TB5	DIFF+	] for customer use
TB6	COMM	]
TB7	TG2	] Tach connection
TB8	TG1	] (TG1 connected to 0V internally)
TB9	COMM	Screen for tach cable
TB10	VREF	Velocity reference. Single-ended velocity command signal normally fed from either: TB13 - the output of the differential amplifier TB17 - the output of the ramp circuit
TB11	XREF	Secondary reference. Can be programmed using links on the personality module to either: (a) LK2 fitted - Secondary velocity reference input (b) LK1 fitted - Current monitor output
TB12	COMM	Internal 0V
TB13	DOUT	]
TB14	DREF–	] Differential amplifier for reference input
TB15	DREF+	]
TB16	COMM	]
TB17	ACC/DEC	The output of the ramp circuit.
TB18	DRSW	Drive switch. Connecting DRSW to 0V enables the drive.
TB19	DROK	] Drive OK.
TB20		] A voltage-free contact which is:] (a) Closed when the drive is healthy] (b) Open when the drive has latched a fault condition

2.3.2 –DC Bus

The –Bus connection is made to the GND tab using the M5 screw provided. This tab is located on the base of the drive adjacent to the control signal connector (see figure 1).

2.3.3 +DC Bus

The +Bus connection is made to pin 3 of the 3 way terminal block. This terminal block is located on the bottom of the drive (see figure 1).

2.3.4 ±22 VDC

The power supply module has a wiring harness that contains three supplies:
+22V
–22V
–20V (relative to the +BUS supply)

On this version of the drive only the ±22 VDC are actually used by the drive to generate the on-board ±15 volt logic supplies. There is no need to remove the –20V supply from the harness. This harness should be connected to PL1 on each individual drive module.

3. SET-UP

CAUTION

Extreme care must be exercised when applying these procedures to machine mounted motors to avoid incurring damage to the machine, drive, and/or motor. If at all possible the initial set-up should be performed with the motor decoupled from the machine and/or drive components.

3.1 GENERAL

All of the user adjustments and settings are to be found on a removable personality module, the layout of which is shown below. If it is necessary to remove the personality module to change one of the components you must ensure that all power has been removed from the drive and that all capacitors are discharged before you begin.

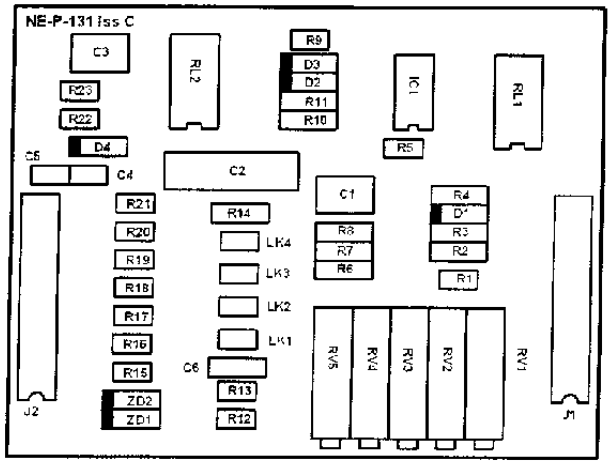

Figure 1
Personality Module Layout

3.2 TACH CALIBRATION

The fixed resistor R5 sets the maximum motor speed corresponding to a 10V command input with the Speed Adjust potentiometer, RV2, fully CW.

$$R5 = \frac{V\,tach}{3} \times 1000\,\Omega$$

In practise, R5 should be chosen to give a slightly higher top speed than required so that the actual speed can be adjusted using RV2.

3.3 COMMAND INPUT GAIN

The Speed Adjust potentiometer, RV2, is used to adjust the velocity command input sensitivity. Turning the potentiometer CCW reduced the top speed of the motor.

3.4 PEAK CURRENT LIMIT

The basic specification of the amplifier states that there is a peak current capability of 30 amps. Turning the Current Limit potentiometer, RV3, CCW reduces this value.

3.5 CONTINUOUS CURRENT

The potential divider network formed by R15, R16 & R18 sets the continuous current limit.

$$I_{cont} = 45 \, x \, \frac{R18}{R15 + R16 + R18}$$

The continuous current level must not be set greater than 12A.

3.6 VELOCITY STABILITY

The velocity stability function is performed by a lag-lead feedback network around the velocity error amplifier.

In the majority of applications optimum stability can be achieved by adjustment of the Stability potentiometer RV4. Adjustment should commence with RV4 fully CW. Turn the potentiometer CCW until the motor becomes unstable the turn the potentiometer CW until the motor becomes stable again.

If the application is such that the above approach is inadequate then C2 and R13 may need to be changed.

3.7 OFFSET ADJUSTMENT

To adjust the offset, set the velocity command to zero volts and adjust the potentiometer, RV5, until rotation of the motor shaft ceases.

3.8 ACCELERATION RAMP

The Ramp potentiometer, RV1, adjusts the time required to respond to a 10V step command. The time can be varied between 0.05 seconds and 0.5 seconds. If a time outside this range is required then the fixed resistor R1 will need to be changed.

This function is only operational when an external link is made between terminals 10 and 17.

4. TROUBLESHOOTING

4.1 FAULT CONDITIONS

When one of the following conditions is detected the fault latch is activated, the output stage is disabled and the red LED is switched on.

(a) Armature short circuit.
(b) Tach loss
(c) Over-temperature

Once the fault has been detected the following steps should be taken:

(a) Identify the nature of the fault.
(b) If possible, clear the fault.
(c) Disconnect the supply to the unit.
(d) Wait for the power supply capacitors to discharge.
(e) If the fault has been cleared, reconnect the supply.
(The fault latch can only be reset by removal and re-connection of the supply.)
(f) If the fault is within the unit itself see section 4.2.

4.2 FACTORY REPAIR SERVICE

Pennine Automation do not advise field repair of the A241-PA servo controllers. Defective units should be returned to Pennine Automation for factory repair.

When returning a defective unit:-

(a) If the unit has been disassembled, reassemble it making certain that all the hardware is in place.

(b) Tag the unit with the following:
(i) Serial Number.
(ii) Company and company representative returning the unit.
(iii) Date of return.
(iv) Any pertinent helpful information regarding the malfunction.

(c) Pack the unit carefully and apply appropriate cautionary stickers (e.g. FRAGILE).