CONTROL TECHNOLOGY

PHANTOM IV

SINGLE PHASE TWO QUADRANT CONVERTOR

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PHANTOM IV

SINGLE PHASE TWO QUADRANT CONVERTOR

CONTENTS

This equipment is guaranteed for twelve months from the date of delivery. The terms of this guarantee are valid provided that CONTROL TECHNOLOGY is informed of the fact within fourteen days of equipment malfunction and the equipment is returned to the nearest agent with a factory accredited service department. The equipment should be suitably packed and the transport prepaid.

WARNING

THIS EQUIPMENT MUST BE HANDLED WITH THE UTMOST CARE, AS DANGEROUS ELECTRICAL POTENTIALS ARE PRESENT WHEN A SUPPLY VOLTAGE IS APPLIED. WHEN PRINTED CIRCUIT BOARD REPAIR OR PART REPLACEMENT IS REQUIRED ALWAYS ISOLATE ALL SUPPLY VOLTAGES TO THE SYSTEM.

PRODUCT OVERVIEW

The PHANTOM IV is a dual purpose controller designed to operate either as a two quadrant DC brake or for exciting DC motor fields. With regard to the latter, it is possible to configure the controller to operate in the field spillover mode. When used as a straight field exciter it will accept either a voltage or current reference.

One model caters for all the single phase ranges.

Two dual thyristors in isolated packages, configured as a DC bridge ensure chassis to mains isolation. The speed of the DC motor, armature or field, is controlled using linear closed loop circuitry with either armature\field voltage or tachogenerator feedback. The armature\field voltage is isolated from the control circuit by a high impedance buffer. An ACCT derived, current feedback signal, galvanically isolated from the control circuitry, completes the current loop.

OTHER STANDARD FEATURES

TWO QUADRANT CONTROLLER

* 220 or 380 vac supply voltage link selectable.
* Field supply selectable for 220vac or 380vac.
* On board high speed fusing of field and armature.
* Torque reference input.
* Single board simplicity, bolts directly on SCR's.

FIELD REGULATOR

* Speed linearising curve. Corrects the exponential relationship between field excitation and motor speed.
* Current reference input, eliminates speed variations due to temperature changes in the motor.
* Field OK relay with a normally closed potential free contact.
* Field economy. In spill-over mode the field voltage is reduced to 50% if the armature voltage is absent for 90 seconds.
* Full block firing. Allows for trouble free control of highly inductive loads.

ELECTRICAL SPECIFICATIONS

MODEL	SUPPLY VOLTAGE	INPUT CURRENT	OUTPUT VOLTAGE	OUTPUT CURRENT	HEAT DISS.
0.1 – 7.5 KW	220-380 VAC	.1-38 AAC	200-340 VDC	.1-30 ADC	10-432W

ALL MODELS:

FIELD VOLTS:	.9 X SUPPLY VOLTAGE.
FIELD CURRENT:	2 AMPS.
MAXIMUM OVERLOAD ON UNIT:	150% FOR 15 SECONDS.
MAXIMUM FORM FACTOR:	1.5.
I SQ.T FUSING REQUIREMENT:	300 AMPS SQ. PER SEC.
SUPPLY FREQUENCY:	50 HZ.
ENCLOSURE:	IP00
OPERATING TEMPERATURE:	-10 TO 40 DEG.C
HUMIDITY:	85% R.H. AT 40 DEG. C NON CONDENSING.
ALTITUDE:	ABOVE 1000M DERATE 1% PER 100M

SPEED CONTROL

ARMATURE FEEDBACK

SPEED REGULATION:	3% TYPICAL
TORQUE/SPEED RANGE:	20:1

TACHOGENERATOR FEEDBACK

SPEED REGULATION:	1% TYPICAL
TORQUE/SPEED RANGE:	100:1

CONTROL FUNCTION:
CLOSED LOOP PROPORTIONAL PLUS INTEGRAL CONTROL WITH ADJUSTABLE STABILITY.

TORQUE CONTROL

ACCURACY: 2% TYPICAL
CONTROL FUNCTION:
CLOSED LOOP PROPORTIONAL PLUS INTEGRAL

INSTALLATION INFORMATION

Before commissioning it is essential to ensure the following installation information has been complied with.

1. A good air flow is essential for maximum cooling. When fitting in an enclosure allow 100 mm clearance on all sides. If a smaller enclosure is used it may be necessary to fit a cooling fan. When fitting in a system with cable trunking ensure a 50 mm clearance top and bottom and 25 mm side clearance.

2. Operating temperature range 0 - 40 deg. C.

3. Avoid vibration. Excessive vibration can cause general deterioration of connections and component damage.

4. Ensure that the motor is correctly mounted and aligned as per the manufacturer's specifications.

5. Ensure that motor cooling accessories and louvers are functional.

6. Check dynamic mechanical integrity of all bushes, bearings and brushgear by manually rotating the motor.

7. Check that pulleys are correctly aligned.

DISCONNECT PHANTOM POWER WIRING TO DRIVE!

8. Measure the resistance of the windings for
   correct terminal allocation.
   a) Low impedance across armature.
   b) High impedance across shunt field.
   c) Low impedance across series field.
   (NOTE Shunt field should be left unconnected in a regenerative system.)
   d) More than 2 mega ohm from any terminal to ground.

9. All control cabling should be 0.75 sq.mm. minimum. A noisy environment could necessitate screening of the reference and feedback control signals. Care should be taken in the grounding of the screen conductor so as to avoid earth loops.

CONNECT SCREEN TO EARTH ONLY AT CONTROLLER END.

10. Power cable to be minimum 600 vac rated at 1.5 X armature\field current.

11. High speed rated, are protection unit which fuses or circuit breakers, suitably recommended for incoming supply on all versions except the 2.2 KW is internally fused.

2.2 KW	20A
3.7 KW	25A
5.5 KW	30A
7.5 KW	40A

12. Ensure good quality earth bonding.

TERMINAL INFORMATION

CONTROL TERMINALS

1.	0 volt Common	: Tachogenerator + input reference.
2.	0 volt Common	: Tachogenerator + input reference.
3.	0 volt Common	: Tachogenerator + input reference.
4.	Tachogenerator	:Tachogenerator feedback.
5.	Speed indication output	:0 - 5 vdc for 0 to 100%, short circuit protected. Maximum load 10 ma.
6.	Speed reference input	:0 - 12 vdc for 0 - 100%. Ramp rate adjustable on P2
7.	Current reference input.	:0 -12 vdc for 0 - 100% current control.
8.	Stop	:- 22 vdc supply for internal start relay. Connect to stop button when internal latch required. Connect to term.16 via a potential free contact for remote starting.
9.	Common stop/start	:Connected to common of stop/start circuitry when latch required.
10	Start	:Internal relay coil. Connect to start button when internal latch required. Connect to terminal 8 via a potential free contact for remote starting.

11.	Field OK	:Potential free n/o contact 4 amps 250 vac. Energises when field current exists. May be used to signal field integrity. Refer to terminal 12.
12.	Field OK	:Potential free n/o contact 4 amps 250 vac. Energises when field current exists. May be used to signal field integrity. Refer to terminal 11.
13.	- 12 vdc	:Negative power supply rail maximum load 20 ma.
14.	0 volt Common	:Tachogenerator + input reference.
15.	+ 12 vdc	:Positive power supply rail maximum load 20 ma.

POWER TERMINALS

L1 and L2	Main supply terminals, if a live and neutral supply is used connect neutral to L2. NOTE! On board fusing may be retained for up to 15 amps DC output current. For greater output currents the onboard fuses F1 and F2 must be replaced with the shorting bars supplied and external fuses must be wired in.
A+ and A-	DC output from controller to motor armature\field. Polarity will effect direction of rotation.
F+ and F-	DC output to field winding. if controller is used as a two quadrant DC drive. Polarity will effect direction of rotation.
N	If selected by links a neutral may be connected to to this terminal to supply a 200 volt field if required.
EARTH	Connect to chassis in bottom left hand corner with 5mm fixing system.
TERM 16 + 17	Refer to layout for location. These terminals are connected to the armature of the master DC drive when this controller is used as a field weakener in spill-over configuration.

COMMISSIONING INFORMATION

INTERNAL PRE-SET POTENTIOMETER INFORMATION

CW = Clockwise CCW = Counter clockwise

REFER TO PAGE 23 for component location.

ALL QUICKSET POSITIONS ARE GIVEN FOR TEST PURPOSES ONLY. DAMAGE MAY OCCUR IF FULL COMMISSIONING PROCEDURE IS NOT ADHERED TO.

P1 MAX. Sets the maximum speed of the motor with 12 vdc speed reference.

Quickset position: 50%

P2 RAMP. Controls the rate of deceleration and acceleration of the motor. Fully CW is equal to quickest acceleration.

Quickset position: 100% CW

P3 Minimum speed. Sets the minimum speed of the motor with zero speed reference. CW from the 50% position will increase the speed from zero. CCW from the 50% position is used to offset a 4 - 20 ma. speed reference input if required. Adjusts the spillover point when used as a field weakener.

Quickset position: 50%

P4 PROP. Optimizes the speed loop. Rotate CCW for faster response. Excess adjustment may cause instability. Further optimization may be obtained by different values. for RBi and C22. (Altering the integral time)

Quickset position: 50%

P5 FIELD FAIL. When this controller is used as a field controller this potentiometer sets the minimum current allowed before the field OK relay will de-energize.

Quickset position: 1001. CCW

P6 I MIN. When this controller is used as a field controller this potentiometer sets the minimum field current. When used as a two quadrant DC controller this potentiometer must be left in the fully CCW position

Quickset position: 100% CCW

P7 I MAX. CCW for minimum current setting CW for maximum setting, must be readjusted if motor is changed.

Quickset position: 50%

P8 ISTAB. Optimizes the current loop. Rotate CCW for faster response. Excess adjustment may cause instability.

Quickset position: 50%

LINKING OPTIONS

LK.1 Selects terminal N and L1 to be connected to the on board field rectifier. When a Neutral is connected to terminal N, a 200 vdc field supply is available at terminals F+ and F-.

LK.2 The supply voltage connected to terminals L1 and L2 supply the on board field rectifier.

IMPORTANT!!!! LK.1 and LK.2 must not be both connected.

220 vac Link :Insert for 220 vac main incoming supply. Remove 380 vac link.

380 vac Link :Insert for 380 vac main incoming supply. Remove 220 vac link.

LINK.1 + LINK.2 + LK 5 inserted for internal armature\ voltage feedback. Remove LK 5 for tachogenerator feedback.

IMPORTANT!!!! Remove LINK.1 and LINK.2 when used as field controller.

COMISSIONING INFORMATION.

TWO QUADRANT DC MOTOR BRAKING CONTROLLER

Although the following information is fairly general, it is assumed that the system being commissioned is a simple braking controller and motor.

Before energising the controller for the first time choose the correct application connections from the descriptions given in the application information section of this manual.

CHECK :Main power supply voltage is correct.
:Motor current and voltage ratings are compatible with controller.
:The controller has not been mechanically damaged in transit.
:All power and control wiring fasteners are tightened adequately.
:The motor is free to rotate in either direction and no personnel or machinery will be injured or damaged if the motor is rotated at maximum speed.

STARTUP PROCEDURE

1. ISOLATE THE INCOMING MAINS SUPPLY.

2. Ensure correct linking for main supply voltage.

3. Ensure correct LINKS are selected for armature or tacho. feedback. SEE SECTION 11.

4. Turn pre-set potentiometers to the positions listed below.

   P1 100% CCW
   P2 100% CW
   P3 50%
   P4 50%
   P5 100% CW
   P6 100% CCW
   P7 100% CCW
   P8 50%

5. TACHO scaling resistor R18 has been selected for 1750 RPM, 60 volts DC per 1000 RPM. If tacho feedback is used the correct value R18 for other motor\tacho combinations must be calculated using the formula below.

   If armature feedback is required ensure the correct value's for R6 + R7 are inserted.

   310 volt armature R6 + R7 = 3.3 Mega ohms
   180 volt armature R6 + R7 = 2.2 Mega ohms

6. Select the correct settings for Dip switches 1 + 2

S1	1	OFF	S2 1 OFF
S1	2	ON	S2 2 ON

7. Ensure the fuses are correctly rated. Unscrew the motor field DC supply terminal.

8 . CURRENT LIMIT ADJUSTMENT

   This adjustment must be completed as swiftly as possible to prevent damage to the motor armature.

   Ensure instruction 7 is completed before the main isolator is switched on.

   Select the ACCT terminating resistor as per the following formula.

   Fit a DC ammeter in one leg of the armature circuit.

   Switch on the mains isolator. Measure at the incoming mains supply terminals for the correct voltage.

   Set the speed reference to + 12 vdc.
   Check that LED's L0,L2 + L4 (Power on, zero speed and field OK respectively) are illuminated. Press the start button check that LED L3 (run) and, one second later, L1 (enable) are illuminated. Turn the IMAX. (current limit) potentiometer slowly clockwise until the DC ammeter indicates the armature current on the motor nameplate.
   Press the stop button.

   Switch off main isolator. Reconnect the motor field.

9. MAXIMUN SPEED ADJUSTMENT

If the product being pulled off this braking motor is severed the motor will accelerate to the speed set below.
The controller is factory set to accept a
60 vdc per 1000 RPM tachogenerator.
ensure that the output shaft can rotate in the opposite direction for unwinding.

With Tachogenerator feedback.

Ensure LK 5 has been removed.

Select the correct tachogenerator scaling resistor. SEE SECTION 5
Set the speed reference to +/-10%. Press the start button. If the motor accelerates to full speed, correct the wiring as follows:

a. Direction correct but motor runs away. :Reverse tacho polarity only.

b. Direction incorrect and motor runs away. :Reverse field polarity only.

c. Direction incorrect but in control. :Reverse tacho and field polarity.

Increase speed demand to + 12 vdc and check that the motor accelerates smoothly and that the DC output level listed on the controller nameplate or the maximum armature voltage, whichever is lower, is not exceeded.
Adjust on P1 (MAX SPD)

With armature feed back.

Ensure that LK 5 is inserted.

If armature feedback is used the motor will not run away. The direction of the motor can be corrected by reversing the field or armature polarity.
Select the correct armature feedback scaling resistor.
310 volt armature R6 + R7 = 3.3 Mega ohms
180 volt armature R6 + R7 = 2.2 Mega ohms

Press the start button. Set the speed reference to + 12 vdc. Ensure that the motor accelerates smoothly and that the DC output
level listed on the controller nameplate or the maximum armature voltage, whichever is lower, is not exceeded.
Adjust on P1 (MAX SPD)

10 Set the minimum speed to the required level on P3 (MIN SPD).

11. Set the deceleration and acceleration of the motor on P2 (RAMP).

12 SPEED STABILITY ADJUSTMENT

Set the speed reference to the level where the motor is most unstable. Slowly rotate P4 (PROPORTIONAL GAIN) until motor stabilizes.

13. CURRENT STABILITY ADJUSTMENT

Set the speed reference to the level where the motor is most unstable. Slowly rotate P8 (ISTAB.) until motor stabilizes.

14. BRAKING TENSION SETTING

The braking tension input terminal (Term. 7) is scaled to accept a 0 - +12 vdc reference input. Refer to the application connection diagram drawing.

COMISSIONING INFORMATION.

SIMPLE FIELD CONTROLLER (CURRENT CONTROL)

Although the following information is fairly general, it is necessary to choose whether to make use of the speed linearising curve option described below.

Most DC motors are characterised by a non linear relationship between field current and motor speed. If the signal being supplied to the external current limit input has taken the above into account it will be necessary to choose OPTION 1 .

OPTION 1. Uncompensated 1:1 relationship between current reference and field current.

Remove R102
Change R107 to 27K

OPTION 2. is a four break point analog curve converter, the values of which, have been selected to generally improve the field voltage\motor speed exponential, taking into account variations there of between motor size and manufacturer.

A standard controller is set up for option 2
R102 = 1K2
R107 = 150K

Before energising the controller for the first time choose the correct application connections from the descriptions given in the application information section of this manual.

CHECK :Main power supply voltage is correct.

:Motor current and voltage ratings are compatible with controller.

:The controller has not been mechanically damaged in transit.

:All power and control wiring fastners are tightened adequately.

:The motor is free to rotate in either dir¬ection and no personnel or machinery will be injured or damaged if the motor is rotated at maximum speed.

STARTUP PROCEDURE

1. ISOLATE THE INCOMING MAINS SUPPLY.

2. Ensure correct linking for main supply voltage.

3. Remove LK 5.

4. Turn pre-set potentiometers to the positions listed below.

   P1 100% CCW
   P2 100% CW
   P3 100% CW
   P4 100% CW
   P5 100% CCW
   P6 100% CCW
   P7 100% CCW
   P8 50%

5. Replace C22 with a 100K ¼ watt resistor.

6. Select the correct settings for Dip switches 1 + 2

   Input reference options

   0 vdc = Minimum field excitation.
   12 vdc = Maximum field excitation.

S1 1	ON	S2 1	ON
S1 2	OFF	S2 2	OFF

   0 vdc = Maximum field excitation.
   12 vdc = Minimum field excitation.

S1 1	OFF	S2 1	ON
S1 2	ON	S2 2	OFF

7. Select the mode of operation.

   OPTION 1. Uncompensated 1:1 relationship between current reference and field current.

   Remove R102
   Change R107 to 27K

   OPTION 2. is a four break point analog curve convertor, the values of which, have been selected to generally improve the field voltage\motor speed exponential, taking into account variations there of between motor size and manufacturer.

   A standard controller is set up for option 2
   R102 = 1K2
   R107 = 150K

8. CURRENT LIMIT ADJUSTMENT

   Select the ACCT terminating resistor as per the following formula.

   It is assumed that the Stop\Start buttons referred to below control the master DC drive.

   Fit a DC ammeter in one leg of the field circuit.

   Switch on the mains isolator. Measure at the incoming mains supply terminals for the correct voltage.

   Set the field weaken reference at terminal 6 for maximum field strength.

   0 vdc = Minimum field excitation.
   12 vdc = Maximum field excitation.

S1 1	ON	S2 1	ON
S1 2	OFF	S2 2	OFF

   0 vdc = Maximum field excitation.
   12 vdc = Minimum field excitation.

S1 1	OFF	S2 1	ON
S1 2	ON	S2 2	OFF

   Check that all the LED's are illuminated.
   Turn P7 (IMAX.) potentiometer slowly clockwise until the DC ammeter indicates the field current on the motor nameplate.

Press the start button and increase the MASTER DC CONTROLLER speed reference to maximum.

Set the field weaken reference at terminal 6 for minimum field strength.

0 vdc = Minimum field excitation.
12 vdc = Maximum field excitation.

S1 1	ON	S2 1	ON
S1 2	OFF	S2 2	OFF

0 vdc = Maximum field excitation.
12 vdc = Minimum field excitation.

S1 1	OFF	S2 1	ON
S1 2	ON	S2 2	OFF

Adjust P6 (IMIN) CW until the required minimum field current or maximum required motor speed is attained.

9. CURRENT STABILITY ADJUSTMENT

Set the current reference to the level where the motor is most unstable. Slowly rotate P8 (ISTAB.) until the motor stabilizes.

10. FIELD FAILURE ADJUSTMENT

Set the field weaken reference at terminal 6 for minimum field strength.

0 vdc = Minimum field excitation.
12 vdc = Maximum field excitation.

S1 1	ON	S2 1	ON
S1 2	OFF	S2 2	OFF

0 vdc = Maximum field excitation.
12 vdc = Minimum field excitation.

S1 1	OFF	S2 1	ON
S1 2	ON	S2 2	OFF

Without starting the MASTER DC CONTROLLER Adjust the F/FAIL potentiometer (P5) CW until the field fail relay de energises and the LED L4 (FIELD OK) is extinguished. Back off P5 slowly until LED L4 illuminates.

COMISSIONING INFORMATION.

FIELD CONTROLLER (SPILLOVER MODE)

When used in spillover configuration the Phantom 4 uses a four break point analog curve converter the values of which have been selected to
generally improve the field voltage\motor
speed exponential, taking into account variations thereof between motor size and manufacturer.

Check the PC card for the correct values for this option.

R102 = 1K
R107 = 150K

Before energising the controller for the first time choose the correct application connections from the descriptions given in the application information section of this manual.

CHECK :Main power supply voltage is correct.

:Motor current and voltage ratings are compatible with controller.

:The controller has not been mechanically damaged in transit.

:All power and control wiring fasteners are tightened adequately.

:The motor is free to rotate in either direction and no personnel or machinery will be injured or damaged if the motor is rotated at maximum speed.

STARTUP PROCEDURE

1. ISOLATE THE INCOMING MAINS SUPPLY.

2. Ensure correct linking for main supply voltage.

3. Ensure correct LINKS are selected for Spillover mode

   Connect LK 5

   NOTE!!!

   DISCONNECT LINK.l AND LINK.2

   FAILURE TO DISCONNECT THESE LINKS WILL DAMAGE THE CONTROLLER.

4. Turn pre-set potentiometers to the positions listed below.

P1	100% CCW	MAX
P2	100% CCW	RAMP
P3	50%	MIN
P4	100% CW	PROP
P5	100% CCW	FIELD FAIL
P6	100% CCW	IMIN
P7	100% CCW	IMAX
P8	50%	ISTAB

5. Check that LINK.1 and LINK.2 are removed.

6. Select the correct settings for Dip switches 1 + 2

S1 1	OFF	S2 1	ON
S1 2	ON	S2 2	OFF

7. Ensure the fuses are correctly rated.

8. Select the correct armature feedback scaling resistor.

   310 volt armature R6 + R7 = 3.3 Mega ohms
   180 volt armature R6 + R7 = 2.2 Mega ohms

9. CURRENT LIMIT ADJUSTMENT

   SELECT THE ACCT TERMINATING RESISTOR

   It is assumed that the Stop\Start buttons referred to below are controlling the master DC drive.

   Fit a DC ammeter in one leg of the field circuit.

   Connect an oscilloscope on the output to the field. CAREFULL HIGH VOLTAGE!

   Switch on the mains isolator. Measure at the incoming mains supply terminals for the correct voltage.

   Adjust P8 (ISTAB) on the field controller, if necessary, until the waveform is most stable.

   Check that all LED's are illuminated.
   Turn the P7 (IMAX) on the field controller slowly clockwise until the DC ammeter indicates the full field current on the motor nameplate.

10. It is necessary to determine the base and final speeds that the motor is required to achieve. Use this information in the following equation.

Base speed	=	The RPM of the motor when the armature voltage is at maximum and no field weakening has occurred.
Final speed	=	The RPM of the motor when the armature voltage is at maximum and full field weakening has occurred.
Base reference	=	The DC voltage to be set on the master DC drive reference input in the next procedure. Item 11.
Max. ref.	=	The maximum reference supply voltage of the master DC drive.

$$\frac{\text{Base speed}}{\text{Final speed}} \times \frac{\text{max. ref.}}{1} = \text{base reference}$$

11. Run Master DC Drive and set it's reference to the base reference. ie, the result of the above equation as a DC voltage level.
    (NOTE: THE MASTER DC DRIVE MUST USE TACHO FEEDBACK).
    Increase the Maximum speed Potentiometer on the master DC Drive until the required maximum armature voltage is achieved.
    (NOTE: TACHO FEEDBACK MAY HAVE TO BE RE-SCALED).
    Stop the master DC drive.

12. Turn P3 (MIN) on the field controller fully counter clockwise. Measure at IC 6 pin When the voltage has stopped rising, (at approximately +/- 10 VDC.) turn P6 (IMIN) on the field controller slowly clockwise until the required minimum field current is achieved.

13. Turn P5 (F/FAIL) on the field controller CW until the F/Fail LED extinguishes. Back off slowly until F/Fail LED is again illuminated.

14. Turn P3 (MIN) on the field controller fully CWo Start the master DC controller and set the speed reference to the base reference. (As per item 11.)
    Measure the output voltage from the field controller to the field. Turn P3 (MIN) on the field controller slowly CCW until the field voltage just reduces.
    Set the speed reference on the master DC controller to maximum. The field will continue to weaken. Trim the final speed on the Speed Maximum potentiometer on the master DC drive.

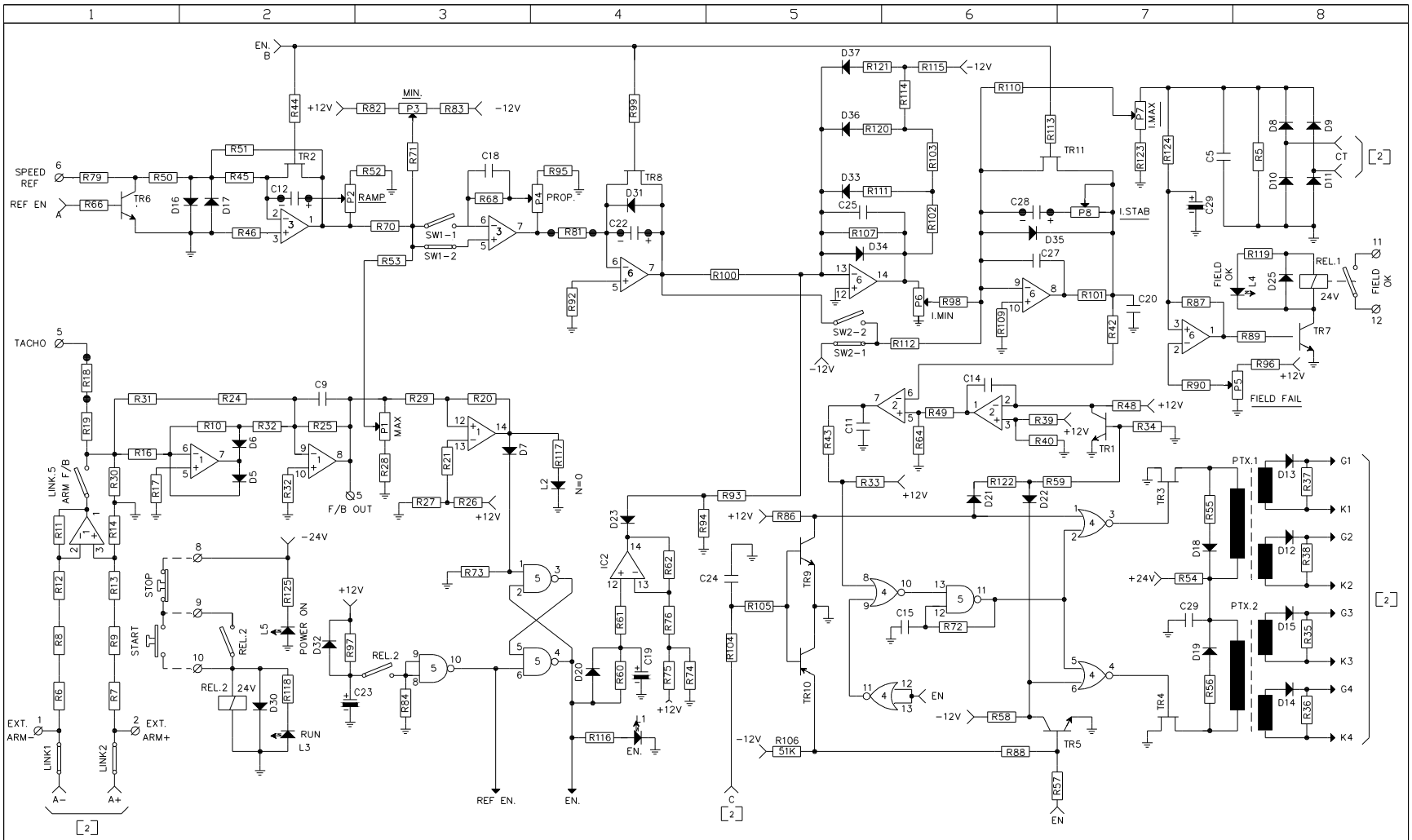
15. Adjust P4 (PROP) on the field controller, if necessary, until the waveform is most stable.

PROBLEM SOLVING INFORMATION

If either a control board or power board fails check all connections to the faulty card for the correct values before replacing the board.

INDICATION	POSSIBLE CAUSE	CORRECTIVE ACTION
AC line fuse blows when power is applied to controller	Wiring faulty or incorrect Motor Faulty Power bridge shorted	Check all power wiring to the load. Correct faulty wiring. Repair or Replace motor Replace power bridge
AC line fuse blows when motor is started	Power bridge faulty. Motor faulty. Control board failure causing SCR's to turn fully.	Replace power bridge Repair or replace motor Repair or replace motor board.
AC line fuse blows while motor is running.	Overload. Wiring faulty or incorrect. SCR intermittently faulty Control board failure	Check motor shunt field for DC supply. Check for mechanical problem. Check motor resistances. Repair accordingly. Check all power wiring to motor. Correct wiring fault. Replace power bridge. Repair or replace control board
Fuses not blown but motor will not run.	No AC mains supply. No LED's illuminated. Stop start circuit faulty. LED 1 does not illuminate. No speed demand reference. Control or power board faulty.	Check incoming mains and repair fault. Repair accordingly. Repair accordingly. Repair or replace faulty board.

INDICATION	POSSIBLE CAUSE	CORRECTIVE ACTION
Motor rotates when speed demand reference is zero.	Power bridge is faulty. Control board faulty.	Replace faulty power bridge. Repair or replace faulty control board.
Motor does not attain top speed.	Overload. Control board faulty. SCR failure.	Check motor shunt field for DC supply. Check for mechanical problems. Check motor resistances. Repair accordingly. Repair or replace control board Replace faulty power bridge.
Motor runs at fast speed only.	SCR failure. Speed demand reference set at 100% Control board faulty. Feedback circuit fault.	Replace faulty power bridge. Repair accordingly. Repair or replace control board. Check tachogenerator. Repair or replace control or power board.
Unstable speed.	SCR misfiring Change in load characteristics affecting motor.	Replace power bridge or repair or replace control board. Repair or re-adjust accordingly



DATE				
DRAWN				
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APPR.				
APPROVED DATE	REVISION	DATE		

CON-TECH

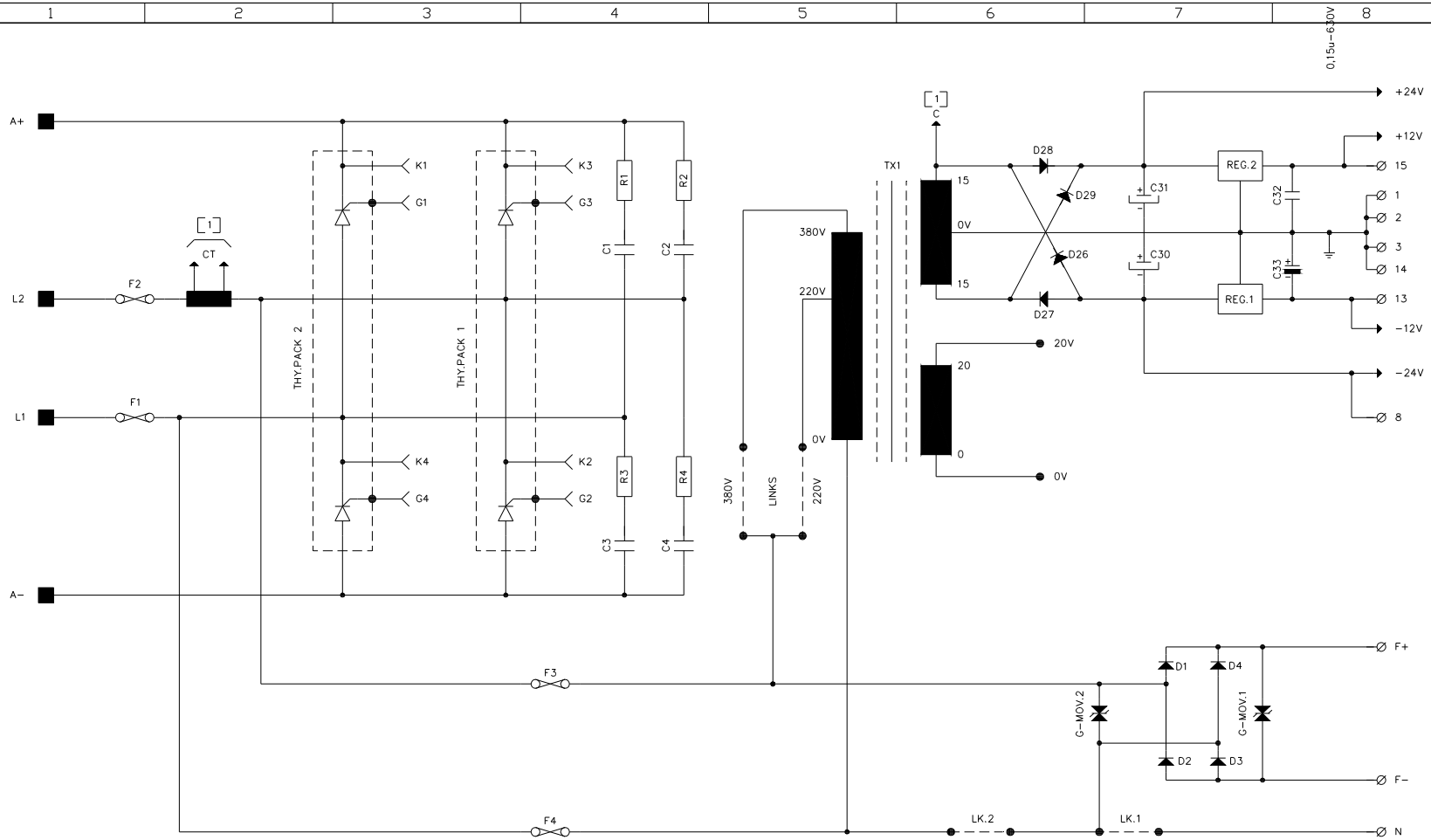
CONTROL TECHNOLOGY

P.O. BOX 1978 PINETOWN
35 CIRCUIT RD. WESTMEAD
Tel. 700-3474 *Telex 6-25222*

CLIENT :

TITLE : PHANTOM 4 CONTROLLER

DWG. NO. : CT317BR1 | JOB NO: | SHEETS 2 | SH. NO. 1



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CON-TECH

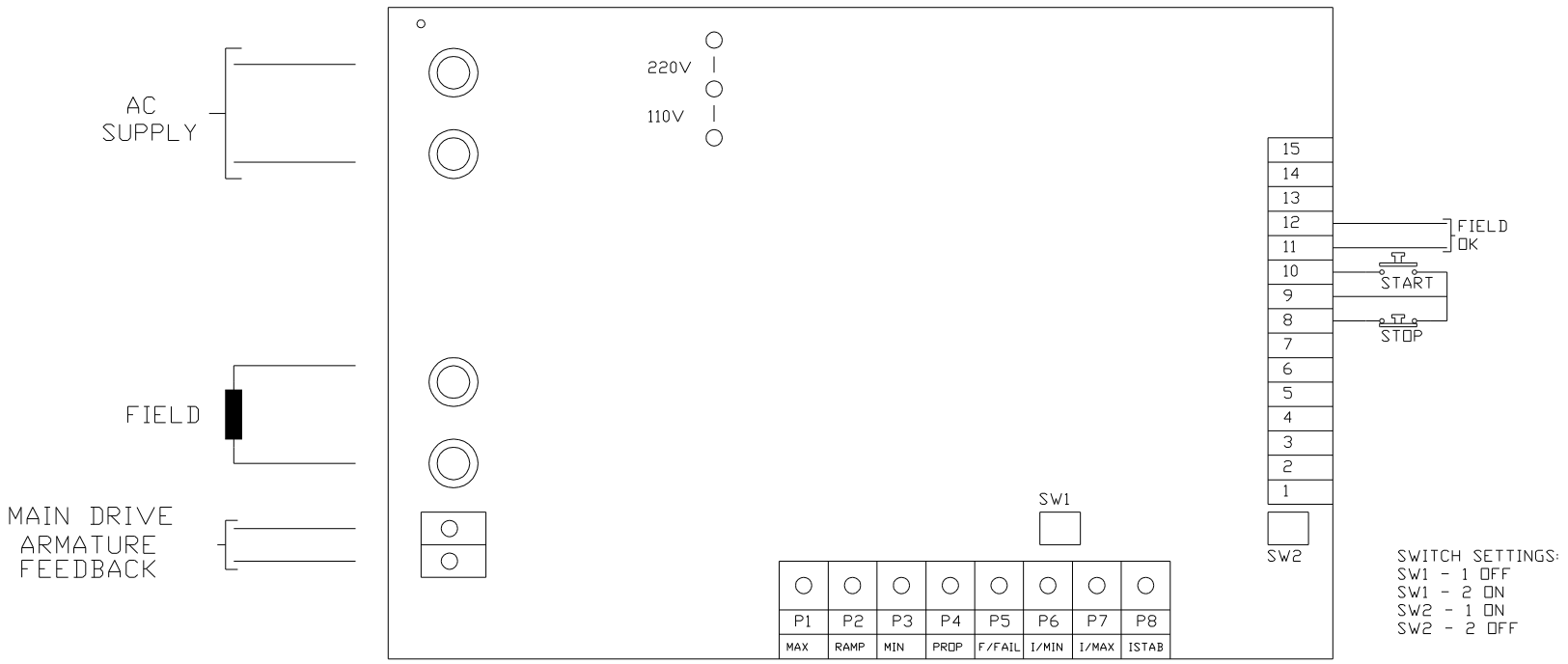
CONTROL TECHNOLOGY
P.O. BOX 1978 PINETOWN
35 CIRCUIT RD. WESTMEAD
Tel. 700–3474 Telex 6–25222

CLIENT :

TITLE : PHANTOM 4 CONTROLLER

DWG. NO. : CT317BR2 | JOB NO: | SHEETS 2 | SH. NO. 2

PHANTOM 4 FIELD CONTROLLER IN SPILL OVER MODE



REMOVE LINKS 1 AND 2 AND INSERT LINK 5

DATE	28/07/06		
DRAWN	B. WATSON		
CHECKED			
APPR.			
APPROVED DATE		REVISION	DATE

CONTROL TECHNOLOGY
P.O.BOX 15019
31 CIRCUIT RD. WESTMEAD
TEL: (031) 7003473 FAX: (031) 7002004

CLIENT:

TITLE: PH4 COINNECTION DIAG

DWG. NO.: APP33.DWG | JOB NO: | PAGE: 01 | SH. NO. 01