CONTROL TECHNOLOGY

PHANTOM VIII

SINGLE PHASE FOUR QUADRANT CONVERTOR

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PHANTOM VIII

SINGLE PHASE FOUR QUADRANT CONVERTOR

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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 VIII series of DC Motor Controllers are high performance units designed for precise, high speed, regenerative operation of permanent magnet and shunt wound DC Motors. They are used for speed and torque control in inertia loaded systems, motor reversing and position control.

Four models are available:
220 vac up to 2.2 Kw
220 vac / 380 vac up to 3.7 Kw
380 vac up to 5.5 Kw
380 vac up to 7.5 Kw

Two full waves, fully controlled, Thyristor power bridges in isolated packages ensure Chassis to mains isolation. The speed of the DC Motor is controlled using linear closed loop circuitry with either Armature Voltage or Tachogenerator feedback. The Armature Voltage is isolated from the control circuit by a high impedance buffer. An AC, shunt derived, current feedback signal, galvanically isolated from the control circuitry, completes the current loop. Should the motor stall, the user may select (solder link selectable) an inverse time / current trip or a speed / current timed true stall detector.

STANDARD FEATURES

- Field supply selectable for internal or external AC voltages.
- Open collector outputs, suitable for operating relays, for zero speed and trip functions.
- 0 – 5 vdc output for 0 to 100 % speed indication.
- 0 – 5 vdc output for 0 to 100 % current indication.
- Three speed reference inputs suitable for a wide range of system design requirements.
- Switch selectable stopping sequence i.e. Coast, ramp or regenerate to halt.
- 220 or 380 vac supply voltage link selectable.
- External trip reset input from a potential free contact.
- LED indication of important control.

ELECTRICAL SPECIFICATIONS

MODEL	SUPPLY VOLTAGE	INPUT CURRENT	OUTPUT VOLTAGE	OUTPUT CURRENT	HEAT DISS.
2.2 Kw	220 VAC	18 A	160 VDC	15 A	108W
3.7 Kw	220 VAC	30 A	160 VDC	16 A	216W
3.7 Kw	380 VAC	30 A	260 VDC	16 A	216W
5.5 Kw	380 VAC	38 A	260 VDC	20 A	300W
7.5 Kw	380 VAC	50 A	160 VDC	26 A	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 1000 M DERATE 1 % PER 100 M

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 TWO STAGE 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 airflow 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: Series field should be left unconnected in a regenerative system).
   d) More than 2 megohm 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 current.

11. High speed fuses or circuit breakers, suitably rated, are recommended for incoming supply protection on all versions except the 2.2 Kw unit which 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. Tachogenrator feedback:	Tachogenerator input.
2. 0 volt Common:	Tachogenerator output.
3. -12 VDC:	Negative Power Supply rail maximum load 20 mA.
4. 0 volt Common:	Signal ground for control inputs.
5. + 12 VDC:	Positive Power Supply rail maximum load 20 mA.
6. Slow Start Speed reference input:	0 – 12 VDC for 0 – 100 %. Ramp rate adjustable on P7.
7. Direct speed reference 1:	0 – 12 VDC for 0 – 100 %. Unramped. Link to 8. for 0 – 5 VDC for 0 – 100 %.
8. Direct speed reference 2:	0 – 12 VDC for 0 – 100 %. Unramped. Link to 7. for 0 – 5 VDC for 0 – 100 %.
9. Speed indication output:	0 – 5 VDC for 0 – 100 %. Short Circuit protected.
10. Current indication output:	0 – 5 VDC for 0 – 100 %. Short Circuit protected. Maximum load 10 mA.
11. Current amplifier:	Link to terminal 12 for speed input control.
12. Speed amplifier output:	Link to terminal 11 for speed Control Technology
13. Stop:	- 24 VDC supply for internal start relay. Maximum 10 mA. Connect to stop button when internal latch required. Connect to term. 15 via a potential free contact for remote starting.
14. Common Stop / Start:	Connected to common of stop start circuitry when latch Required.
15. Start:	Internal relay coil. Connect to start button when internal Latch required. Connect to terminal 13 via a potential free contact for remote starting.
16. + 24 Volts:	+ supply for powering loads connected to terminals 17 and 18 maximum load 50 mA.
17. Zero speed output:	Open collector transistor, conducts at zero speed. Maximum load at 24 VDC 25 mA.
18. Overload / stall output:	Open collector transistor, conducts when controller tripped. Maximum load at 24 VDC 25 mA.
19. Stall / Overload reset:	Momentary to + 12 VDC at terminal 5 resets a trip condition.

POWER TERMINALS

L1 & L2	Main Supply terminals, if a live and neutral supply is used connect neutral to L2.
	NOTE!
	Only the 2.2 Kw version has internal mains fusing: all other PHANTOM VIII's need external high speed fusing.
A+ and A-:	DC output from controller to motor armature. Polarity will effect direction of rotation.
F+ and F-:	DC output to field winding. Polarity will effect direction of rotation.
L3 and L4:	If selected by links any external AC Voltage connected to these terminals will power the internal field rectifier.
EARTH:	Connect to Chassis in bottom left hand corner with 5mm fixing system.

COMMISSIONING INFORMATION

INTERNAL PRE-SET POTENTIOMETER INFORMATION

CW = Clockwise CCW = Counter Clockwise

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

P1. Overload. CCW for minimum trip point. CW for maximum. Must be readjusted if the motor is changed.
Quickset position: 70 % CW

P2. Current Limit. CCW for minimum torque setting CW for maximum. Must be readjusted if the motor is changed.
Quickset position: 60 % CW

P3. Current stability. Optimizes the current loop. Rotate CCW for faster response. Excess adjustment may cause instability.
Quickset position: 100 % CW

P4. Gain 1. Optimizes the speed loop. Rotate CCW for faster response. Excess adjustment may cause instability.
Quickset position: 100 % CW

P5. Gain 2. Optimizes the speed loop. Rotate CW for faster response. Excess adjustment may cause instability.
Quickset position: 90 % CCW

P6. Minimum speed. Sets the minimum speed of the motor with zero speed reference.
Quickset position: 50 %

P7. Maximum speed. Sets the maximum speed of the motor with 12 VDC speed reference.
Quickset position: 50 %

P8. Ramp. Controls the rate of deceleration and acceleration of the motor if the slow start speed reference input is used.

P9. IR compensation. Counters EMF voltages from motor when armature voltage feedback is used. Rotate CW for maximum effect.
Quickset position: 100 % CCW

P10. Shift. Sets the amount of phase advance, which determines bridge change over speed. Excess adjustment may cause instability.
Factory set position: 100 % CCW

OPTION SWITCHES

S1 S2	OFF OFF	When the stop button is depressed the motor coasts to a halt.
S1 S2	OFF ON	When the stop button is depressed the motor brakes to a halt.
S1 S2	ON ON	If the ramp reference input is used when the stop button is depressed the motor will decelerate to a halt at the rate set on the ramp potentiometer.

OPTION PC BOARD LINKS

CONTROL BOARD

Tacho feedback link: Insert link for armature feedback. Remove for tachogenerator feedback.

Stall link: Insert link for speed / current timed tripping (stall detection). Remove for inverse Time / current tripping.

POWER BOARD

L1 & L2: Insert link for field AC supply compatible with main incoming AC supply. Remove For user selectable field AC supply.

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.

CONTROL FUNCTION INDICATION

LED 1	RUN:	Illuminated when drive is started.
LED 2	O/L:	Illuminated when drive is tripped.
LED 3	N = O:	Illuminated when motor is at zero speed
LED 4	ENABLE:	Illuminated when bridge interlocking determines either bridge can operate.
LED 5	REV:	Illuminated when the reverse bridge is operational.
LED 6	FOR:	Illuminated when the forward bridge is operational.

COMMISSIONING

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

Before energizing 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 linking for armature or tacho. Feedback.

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

P1	100 % CW
P2	100 % CCW
P3	100 % CW
P4	100 % CW
P5	100 % CCW
P6	50 %
P7	100 % CCW
P8	100 % CCW
P9	100 % CCW
P10	100 % CCW

5. Select stopping sequence on DIP switches.

6. Select tripping option with Stall link.

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

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

9. 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.

   Fit a DC amp meter in one leg of the armature circuit. Set the speed demand to + 12 VDC. Check That LED 3 (N = O) and either LED 5 or 6 (Forward or reverse bridge ready for operation) are Illuminated. Press the start button. Check that the LED 1 and LED 4 (RUN and ENABLE Respectively) are illuminated. Turn P2 (Current limit potentiometer) clockwise until the DC Amp meter indicates the armature current on the motor nameplate. Press the stop button. Set the Speed demand to – 12 VDC. Press the start button. The DC amp meter must indicate the same Armature current with reversed polarity. Press the stop button. Insert the motor field DC supply Terminal.

10. MAXIMUM SPEED ADJUSTMENT

The controller is factory set to accept a 60 VDC per 1000 RPM Tachogenerator.

Set the speed demand to 10 % demand. Press the run 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.

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.
Increase speed demand to + 12 VDC and check that the DC output level listed on the controller nameplate or the maximum armature voltage, whichever is lower, is not exceeded. Adjust on P7 (Max SPD). Set the speed demand to – 12 VDC and check that the motor reverses direction and the armature voltage is the same but with reversed polarity.

11. Set the minimum speed to the required level on P6 (MIN SPD).

12. Set the deceleration and acceleration of the motor on P8 (RAMP) if the slow start reference input is used.

13. SPEED STABILITY ADJUSTMENT

Set the speed demand to the level where the motor is most unstable. Slowly rotate P5 (GAIN 2) clockwise until motor stabilizes. If the speed is not stabilized leave P5 in the position where the speed is most stable.
Rotate P4 (GAIN 1) counter clockwise slowly until the motor is stable. If the speed is not stabilized leave P4 in the position where the speed is most stable.

Repeat the procedure with P3 (I STAB) rotated slowly counter clockwise. If the speed is still not stabilized and the controller is operating on armature feedback it might be necessary to introduce an amount of IR compensation. Rotate P9 (IR COMP) slowly clockwise until the motor stabilizes.

NOTE: IF CONTROLLER IS OPERATING ON TACHO FEEDBACK LEAVE P9 (IR COMP) FULLY COUNTER CLOCKWISE.

14. OVERLOAD / STALL TRIP SETTINGS

Turn the mains Isolator off. Unplug the field DC supply Terminal. Turn the mains isolator on. Set the speed demand to + 12 VDC. Press the start button. The current will rise to the value as set in the current limit adjustment procedure, Step 10. Rotate P1 (O/L) slowly counter clockwise until LED 2 illuminates. The overload is now set to the value set on the current limit potentiometer P2.

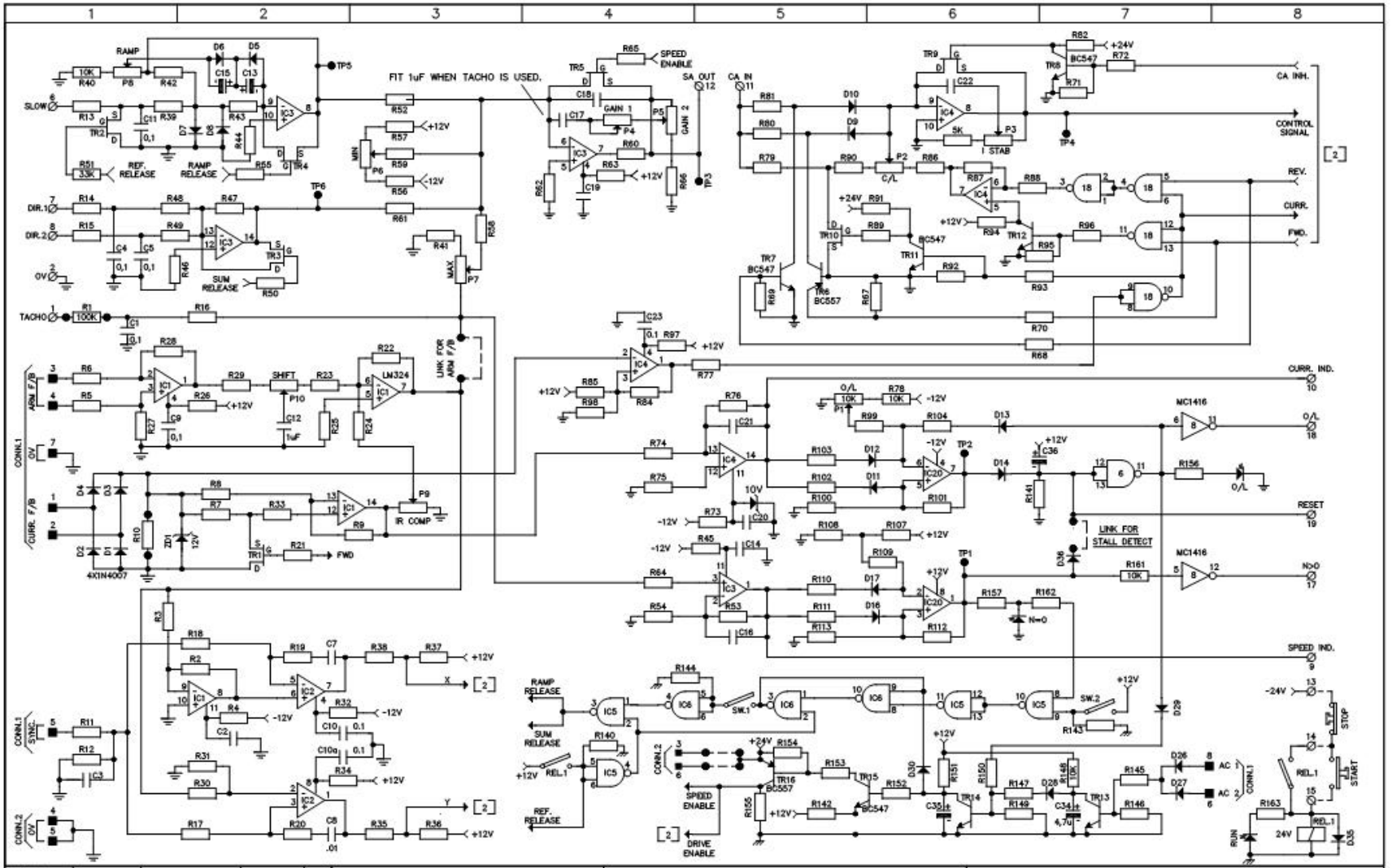
It should be noted that for the trip to unlatch the start relay a suitable relay should be fitted to the overload / stall open collector transistor output on terminal 18. A potential free normally closed contact of this relay should be connected in series with the stop button. If the stall link has been fitted the motor will have to be drawing this maximum current and be at zero speed for a preset period +/- 10 seconds before the trip functions. If the stall link is removed the trip will function if the motor is drawing the maximum set current for +/- 10 seconds even if the motor is not at zero speed.

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

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



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CON-TECH

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

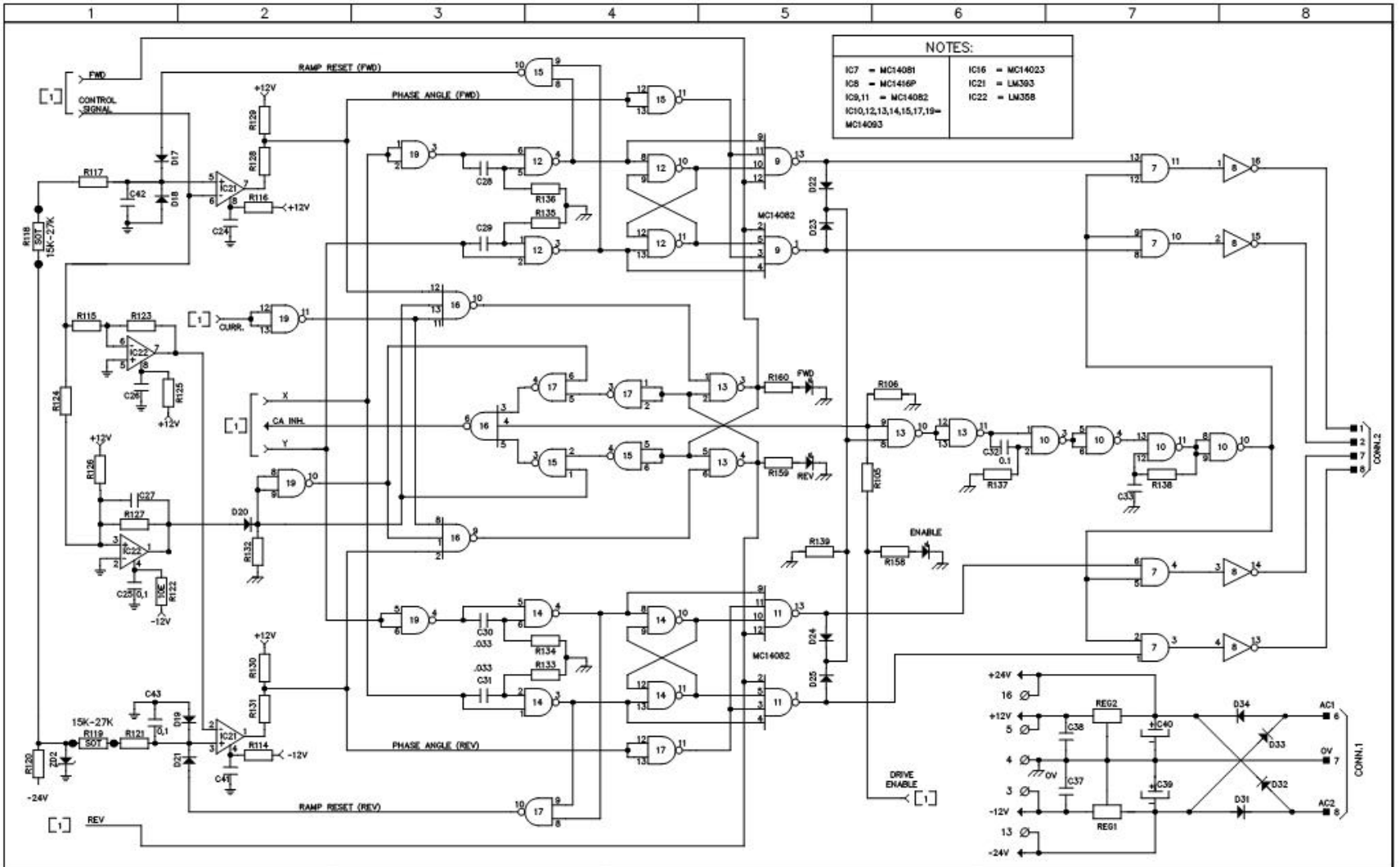
CLIENT

TITLE PHANTOM VII (MAIN BOARD)

DWG. NO. CT277

SHEETS 2

SH. NO. 1



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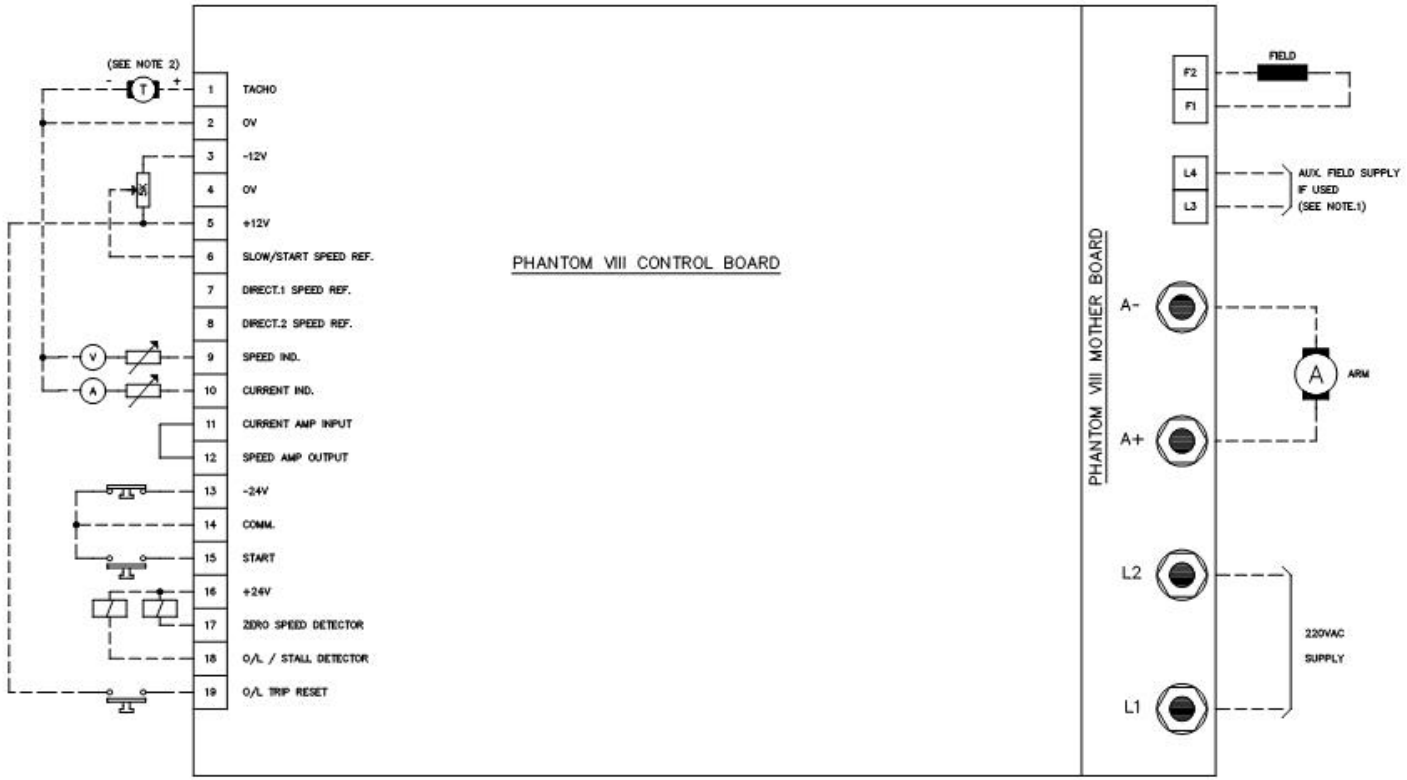
TITLE PHANTOM VIII (MAIN BOARD)

DWG. NO. CT277

SHEETS 2
SH. NO. 2



NOTE: 1. IF AUX FIELD SUPPLY IS USED. REMOVE LINKS LI AND L2 FROM MOTHER BOARD.

NOTE: 2. IF TACHO IS USED, REMOVE TACHO LINK FROM CONTROL CARD POLARITY SHOWN FOR POSITIVE SPEED REF.

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CLIENT

TITLE *PHANTOM VII CONNECTIONS*

DWG. NO. *CT277*

SHEETS 3

SH. NO. 3