INTROL IPC 2100 POSITIONER
OPERATIONS MANUAL

JUNE, 1988

Introl Design, Inc..
48 North Street
Lockport, NY 14094

Introl Design, Inc.

INTROL DESIGN IPC-2100
ABSOLUTE MOTION CONTROLLER

Introl IPC-2100 is a precision Servo/Regen, Stepper/Microstepper positioner specially designed to operate with an incremental encoder for Servo Systems. Encoders may be used with Steppers/Microsteppers for verification only. IPC-2100 allows operation through the front panel key pad and manual positioning through the external operator station input. After power-up IPC-2100 will reset its position counter to a zero position and any position command will be referenced to that position unless the Home Input is activated. If Home Input is activated, the system will establish a reference point by detecting the Home Limit Switch and/or Index Marker of the encoder.

SPECIFICATIONS

INPUT POWER - 115 VAC ±10%, 10VA, 50/60HZ, OPTIONAL 230VAC

ENCODER POWER - ON BOARD 5VDC, ±5% at 150ma

OPERATION - CLOSED LOOP/OPEN LOOP OPERATION FOR BOTH VELOCITY AND POSITION. ABSOLUTE POSITIONING OF SERVO/REGEN WITH INCREMENTAL ENCODER FEEDBACK UP TO 50KC EXTERNAL (100KC INTERNAL) OR STEPPERS-MICROSTEPPERS POSITIONING UP TO 500KC STEPS OUTPUT. WITH STEPPERS/MICROSTEPPERS ENCODER COULD BE USED FOR VERIFICATION ONLY.

SPEED - POSITIONING SPEED, JOG SPEED,INCREMENT SPEED, HOME SEARCH SPEED, AND HOME FINAL APPROACH. 1% TO 100% OR 1 TO 255% OF THE SELECTED SPEED RANGE FOR MORE FINITE PROGRAMABILTIY.

CALIBRATOR - 6-DECADE. THIS IS NUMBER OF THE ENCODER COUNTS TIMES 2 FOR CLOSED LOOP OR NUMBER OF THE STEPS THAT WILL BE MEASURED TO ONE UNIT OF DESIRED MEASUREMENT. PROGRAMMING DECIMAL POINTS IS PERMITTED FROM .000,001 TO 999,999.

POSITION COUNTER - ±8 DECADE. THIS IS THE NUMBER OF THE ENCODER COUNTS TIMES 2 OR NUMBER OF STEPS FOR EACH INDEX. PRESET LENGTH TIMES CALIBRATOR EQUALS NUMBER OF STEPS.

FEED BACK INPUT - INCREMENTAL TWO CHANNEL WITH OPTIONAL INDEX MARKER FOR PRECISION HOMING. CURRENT SINKING WITH 4.7K PULL-UPS OR TTL 90 DEGREE QUADRATURE TYPE. MAXIMUM FEED BACK FREQUENCY 50 KC EXTERNAL. 100KC INTERNAL AFTER X2 LOGIC.

HOME LIMIT SWITCH - CURRENT SINKING TYPE 24 VDC MAX.

INTROL DESIGN INC.,48 NORTH STREET,LOCKPORT,NY 14094
PHONE (716)434-6919 or FAX (716)434-1911

CONTROL INPUTS -	CURRENT SINKING, EDGE AND LEVEL SENSITIVE. 5 VDC MINIMUM TO 24 VDC MAXIMUM.
ANALOG OUTPUT -	OPTICALLY ISOLATED BI-POLAR 0 TO ±10 VDC AT 5 ma WITHOUT THERMAL DRIFT.
OUTPUTS -	3 CURRENT SINKING 50 ma AT 24 VDC. open collector, <1 ohm impedence
-	INDEX COMPLETE OUTPUT (IN-POSITION) MAINTAINED WHEN THE LOAD IS WITHIN THE ACCEPTANCE WINDOW.
-	DIRECTION OUTPUT LOW (SINKING) FOR (-) DIRECTION FOR STEPPERS AND MICRO-STEPPERS.
-	STEPS OUTPUT DC TO 500 KC. 50% DUTY CYCLE NORMALLY OFF FOR STEPPERS AND MICRO-STEPPERS.
SERIAL INTERFACE	RS422 STANDARD, OPTIONAL RS233. FULL DUPLEX 8 ASCII DATA BITS, ONE START AND STOP BIT, PARITY IS NOT CHECKED
DISPLAY -	8 DECADE 0.6" RED LED WITH REAL TIME COUNTER TO DISPLAY INSTANTANEOUS POSITION IN UNITS OF MEASUREMENT.
MECHANICAL -	STEEL ENCLOSURE WITH CAST ALUMINUM BEZEL AND EASY DISCONNECT TERMINAL BLOCKS. WATER-PROOF OIL RESISTANT KEY BOARD.
DIMENSIONS -	5.375" W. x 3.00" H. x 7.350" DEEP. BEZEL SIZE 6.625" x 4.00".

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INITIAL SET-UP AND ALIGNMENTS PROCEDURE:

THE IPC-2100 IS FACTORY SET TO OPERATE WITH 115 VAC POWER UNLESS OTHERWISE SPECIFIED. TO OPERATE WITH 230 VAC REMOVE THE UNIT FROM ITS CHASSIS AND CONNECT THE JUMPERS ON THE BOTTOM BOARD NEAR THE FUSE FROM B TO C AND D TO C. MAKE SURE THAT THE JUMPERS ARE A SNUG FIT. PUT THE UNIT BACK INTO ITS CHASSIS. FOR STEPPERS AND MICROSTEPPERS L5 LOGIC IN THE TOP BOARD MUST BE REMOVED.

1. BEFORE CONNECTING A SERVO DRIVE TO THE IPC 2100, SET UP THE DRIVE AS FOLLOWS:
   A. WITH 0.0 VDC REFERENCE INTO THE DRIVE SET THE DRIVE BIAS FOR ZERO SPEED.
   B. WITH 10 VDC REFERENCE INPUT TO THE DRIVE SET THE GAIN/SPEED/TACH ADJUSTMENT OF THE DRIVE SO THAT THE MOTOR SPEED IS AT MAXIMUM OPERATING SPEED. THIS IS TO INSURE THAT THE OUTPUT OF THE IPC 2100 DOES NOT GET SATURATED DURING INDEXING.
   C. SET THE RESPONSE OF THE DRIVE FOR AS FAST AS POSSIBLE.
   D. SET THE ACCEL/DECEL OF THE DRIVE FOR AS FAST AS POSSIBLE. ZERO ACCEL/DECEL TIME IS PREFERRED IN THE DRIVE. THE IPC 2100 WILL GENERATE THE ACCELERATION AND DECELERATION RAMPS. BEFORE CONNECTING THE DRIVE TO THE IPC 2100 THE DRIVE MUST BE SET UP PROPERLY TO VARY SPEED AS THE INPUT REFERENCE VARIES AND REVERSES DIRECTION AS THE INPUT REFERENCE POLARITY CHANGES.

2. REMOVE THE TOP COVER OF THE IPC 2100 TO FACILITATE SETTING OF THE BASE FREQUENCY AND GAIN SWITCHES. BY USING THE FOLLOWING FORMULA CALCULATE THE BASE FREQUENCY PRESET NUMBER. THIS NUMBER IS A FUNCTION OF THE MAXIMUM SPEED AND THE RESOLUTION OF THE INCREMENTAL ENCODER (ROTOPULSER) OR STEPPER USED. AS AN EXAMPLE: ASSUME THAT A 1000 PULSE PER REVOLUTION ENCODER IS DIRECTLY COUPLED TO THE MOTOR SHAFT WITH A MAXIMUM SPEED OF 2000 RPM AT THE MOTOR SHAFT.

PRESET # = 195312.5 / FREQUENCY AT THE MAXIMUM SPEED.

$$\text{FREQUENCY} = \frac{2000 \times 1000 \times 2}{60} = 66{,}667 \text{ PULSES/SECOND.}$$

THE CALCULATED NUMBER MUST NEVER BE GREATER THAN 100,000. THIS IS THE MAXIMUM FEEDBACK FREQUENCY AFTER TIMES TWO LOGIC FOR SERVO SYSTEMS. THE MAXIMUM FREQUENCY FOR STEPPERS AND MICROSTEPPERS IS 500Kc. NOW CALCULATE THE PRESET NUMBER FOR SW3 GROUP OF SWITCHES.

PRESET # = 195312.5 / MAX. INTERNAL FEEDBACK FREQUENCY OR STEPS.

$$\text{PRESET} = \frac{195312.5}{66,667} = 2.93 \text{ (APPROXIMATELY 3)}$$

PROGRAM THIS NUMBER INTO SW3 SET OF DIP SWITCHES. THIS SWITCH IS BINARY AND WEIGHT OR VALUE IS GIVEN BELOW.

SWITCH #		VALUE
1	-	1
2	-	2
3	-	4
4	-	8
5	-	16
6	-	32
7	-	64
8	-	128
9	-	256
10	-	512
11	-	1024
12	-	2048

TURN ON THOSE SWITCHES WHOSE VALUES ADD UP TO THE CALCULATED PRESET NUMBER. FOR THE CALCULATED PRESET NUMBER OF 3, TURN ON SWITCHES 1 AND 2 ONLY ON SW3 GROUP OF SWITCHES. FRONT PANEL PROGRAMMING SPEED FOR 100% WILL CORRESPOND TO :

$$\text{ACTUAL SPEED} = \frac{1953.125 \times \text{PROGRAMMED SPEED} \times 60}{\text{SW3 PRESET NUMBER} \times (\text{ENCODER RESOLUTION} \times 2)}$$

$$\text{ACTUAL SPEED AT 100\%} = \frac{1953.125 \times 100 \times 60}{3 \times 2000} = 1953.125 \text{ RPM}$$

EACH 1% OF CHANGE IN PROGRAMMED SPEED WILL VARY BY 19.53125 RPM EXACTLY.

NOTE - FOR STEPPERS AND MICRO STEPPERS FOLLOW THE ABOVE CALCULATIONS AND USE THE NUMBER OF STEPS PER REVOLUTION RATHER THAN ENCODER RESOLUTION.

3. SW1 AND SW2 GROUPS OF DIP SWITCHES ARE FOR SERVO SYSTEMS ONLY.

A. SW1 GROUP OF SWITCHES. THIS IS THE CLOSED LOOP GAIN SETTING. IT IS FURNISHED AS AN INTERNAL SETTING TO AVOID OPERATOR TAMPERING OR REPROGRAMMING. THIS GROUP OF SWITCHES SHOULD BE SET WITH THE POWER ON AND DRIVE ENABLED. PRIOR TO POWER UP, SET SWITCH NUMBER ONE ON. THIS IS A LOW GAIN SETTING. AFTER POWER UP GRADUALLY INCREASE THE GAIN BY TURNING ON THE NEXT HIGHER VALUE SWITCH AND TURNING OFF THE PREVIOUS SWITCH. COMBINED SELECTION OF THE SWITCHES IS ALSO POSSIBLE.

B. SW2 GROUP OF SWITCHES. ON THIS GROUP OF SWITCHES, SWITCH NUMBER 8 IS TO ENABLE THE COMPENSATION CIRCUITRY FOR SERVO APPLICATIONS WITH OVERHANGING LOADS OR TO USE WITH LOW GAIN DRIVES OR WITH DRIVES THAT ARE THERMALLY UNSTABLE. SWITCHES 1 TO 7 ARE TO PROGRAM THE ACCEPTANCE WINDOW. THIS IS TO ALLOW THE MOTOR TO BRING THE LOAD WITHIN AN ACCEPTABLE LENGTH TOLERANCE BEFORE THE INPOSITION OUTPUT (INDEX COMPLETE) IS INITIATED.

SWITCH #	±	VALUE OF ENCODER PULSE
1	-	1
2	-	2
3	-	4
4	-	8
5	-	16
6	-	32
7	-	64

NOTE THAT ONCE THE INTERNAL SWITCHES ARE SET YOU MAY NEVER HAVE TO MODIFY THEM. PUT THE COVER BACK ON.

4. MAKE ALL CONNECTIONS IN ACCORDANCE WITH THE HOOK UP DIAGRAM PROVIDED AT THE END OF THE MANUAL. USE THE CUT-OUT DIMENSION AND TEMPLATE PROVIDED FOR ENCLOSURE MOUNTING. MAKE SURE TO USE EARTH GROUND WHERE IT IS DESIGNATED AND USE SHIELDED CABLES WITH THE SHIELD CONNECTED TO COMMON ON THE IPC 2100 ONLY.

5. TURN THE POWER ON AND TURN THE MOTOR CONTROLLER ON. THE MOTOR SHOULD HOLD POSITION. IN SERVO SYSTEMS IF THE MOTOR RUNS AWAY, DISCONNECT THE POWER AND REVERSE CHANNEL A AND CHANNEL B OF THE ENCODER.

6. FOLLOW THE PROGRAMMING SEQUENCE FOR PROGRAMMING THE PARAMETERS.

TURN THE POWER ON THEN PRESS ENTER. THE DISPLAY SHOULD NOW READ (Code). PROGRAM IN 8788, ENTER, THEN GO THROUGH THE FOLLOWING SEQUENCE TO ENTER IN THE SETUP PARAMETERS THAT ARE NOT ACCESSIBLE TO THE OPERATOR. IN THE FOLLOWING, PRESS TO ENTER AND SCROLL DOWN AND TO ENTER AND SCROLL UP. TO EXIT: PRESS JOG THEN (CLR).

Default
100 Per.P. - PERCENT POSITIONING SPEED, 1 -250 PERCENT OF THE SELECTED

Default

SPEED RANGE. (SEE DIP SWITCH SETTING SECTION)

20 Per.H. - HOME LIMIT SWITCH SEARCH SPEED

10 Per.L. - HOME FINAL APPROACH AND ANTIBACKLASH SPEED

100 Per.J. - JOG SPEED

90 Per.I. - INCREMENTAL SPEED

0.2 ACCE. - ACCELERATION AND DECELERATION .1 sec. TO 6.0 sec. IN .1 sec. INTERVALS TO 100% SPEED AND 12.0 sec. TO 200% SPEED.

1000 C.C. - CONSTANT OF THE CALIBRATION. THIS IS THE NUMBER OF ENCODER PULSES TIMES TWO FOR SERVO SYSTEMS OR STEPS FOR STEPPERS/MICROSTEPPERS THAT IS EQUAL TO ONE UNIT OF MEASUREMENT (INCH, CENTIMETER, ECT.)

0.25 in. - AMOUNT OF MOVEMENT WHEN THE INCREMENT COMMAND IS INTITATED.

1 D.C. - DISPLAY CALIBRATOR. THIS IS THE RECIPROCAL OF C.C. MULTIPLIED BY THE RESOLUTION TO DISPLAY.

3 dp.no. - NUMBER OF DECIMAL POINTS TO BE DISPLAYED

4800 Baud - 300,600,1200,2400,4800 BAUD RATES

41 Id.no. - ASCII REPRESENTATION OF THE LETTER ASSIGNED TO THE DEVICE (EXAMPLE : ASCII 41 = A, ASCII 42 = B, ...)

0 inPo
0 dLy

ALL OF THE ABOVE SHOULD BE PROGRAMMED BEFORE PROCEEDING TO THE NEXT STEP.

HOW TO OPERATE

THROUGH FRONT PANEL

IPC-2100 IS FULLY FUNCTIONAL THROUGH THE FRONT PANEL. TO COMMAND THE UNIT TO ESTABLISH A HOME POSITION, DEPRESS THE "HOME" KEY. THE MOTOR WILL THEN MOVE TOWARD THE HOME LIMIT SWITCH AND WILL STOP ACCURATELY AFTER THE LEADING EDGE OF THE LIMIT SWITCH IS DETECTED. UNIT THEN RESETS THE POSITION COUNTER AND THE DISPLAY TO ZERO. TO PROGRAM A POSITION, DEPRESS "CLEAR". THE DISPLAY NOW WILL READ THE PREVIOUSLY COMMANDED POSITION. YOU MAY NOW CLEAR THE PREVIOUSLY ENTERED DATA BY PRESSING "CLEAR" AGAIN, THEN PROGRAM THE DESIRED POSITION FOLLOWED BY "ENTER". SINCE POSITION COMMAND CAN BE TO EITHER SIDE OF THE HOME POSITION, IT WILL REQUIRE THAT THE POSITION COMMAND BE PRECEDED WITH THE "+" OR "-" . TO JOG, PRESS "JOG" KEY AND THE LETTER "J" WILL BE DISPLAYED INDICATING JOG MODE.

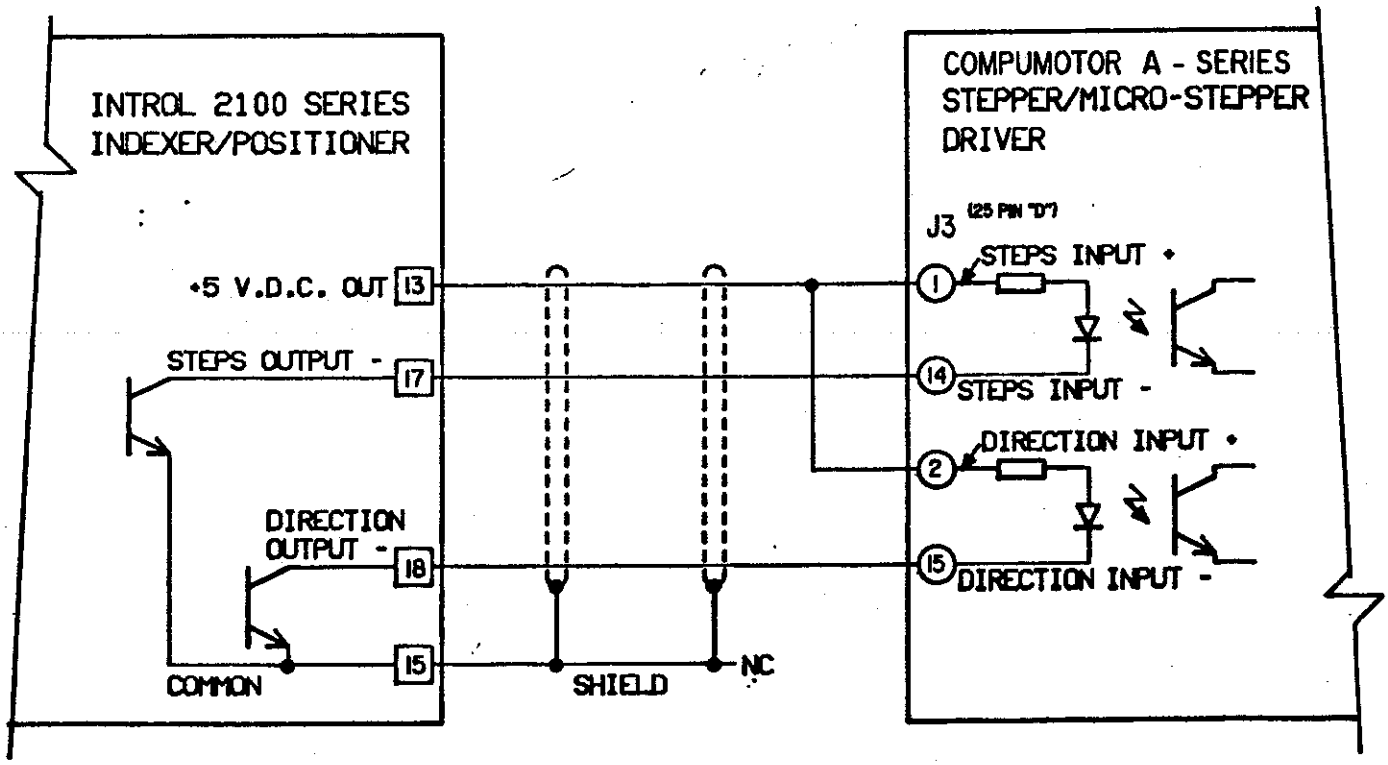
PRESS EITHER ▼ OR ▲ FOR THE DIRECTION DESIRED. ADDITIONAL DEPRESSION OF THE JOG KEY WILL PUT THE UNIT INTO AN INCREMENTAL MODE. EACH TIME ▼ OR ▲ IS PRESSED, THE SYSTEM WILL INDEX BY THE PROGRAMMED AMOUNT IN THE APPROPRIATE DIRECTION. TO EXIT THE JOG OR INCREMENTAL MODE, SIMPLY PRESS "CLEAR". REGARDLESS OF JOGGING OR INCREMENTING, IPC-2100 KNOWS ITS LOCATION WITH RESPECT TO THE REFERENCE POINT. JOGGING AND INCREMENTING IS ALSO AVAILABLE THROUGH THE OPERATOR STATION INPUTS. TO RETURN TO THE ORIGINAL POSITION (ZERO) PRESS THE "RETURN" KEY.

SERIAL INTERFACE

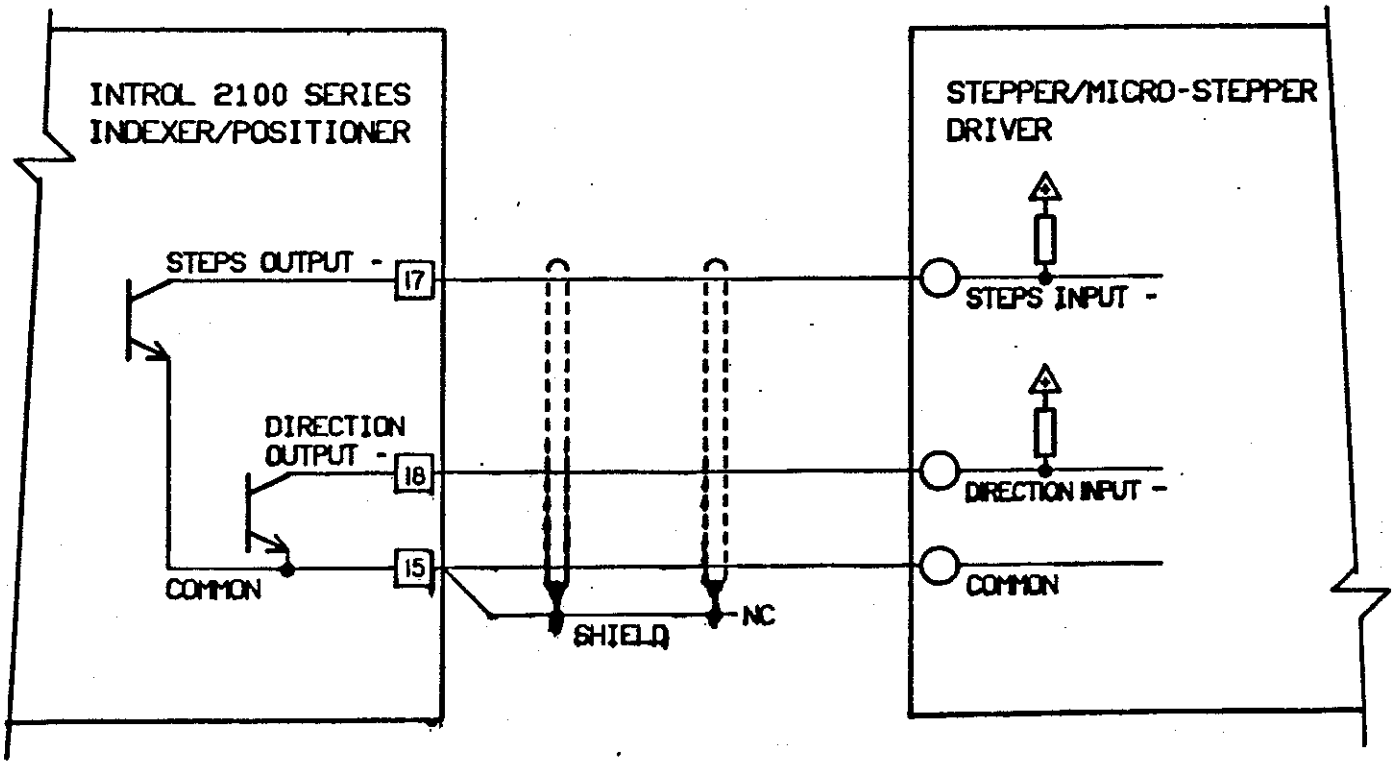
IPC-2100 IS OFFERED WITH RS422 STANDARD FOR MULTI-AXIS POSITIONING VIA EXTERNAL PC FOR CNC. ALL COMMANDS TO THE IPC-2100 WILL BE RECOGNIZED WHEN THE COMMAND IS STARTED WITH THE LETTER THAT IS PROGRAMMED AS THE I.D. NUMBER FOR THE DEVICE (EXAMPLE : X,Y,Z....).
TO COMMAND A POSITION TO A DEVICE THAT HAS AN I.D. NUMBER OF "A" IT WOULD BE : A1.835 - MEANING THAT UNIT "A" IS TO GO TO THE 1.835 INCH POSITION. WHEN THE POSITION IS REACHED, THE IPC-2100 WILL TRANSMIT TO THE DEVICE : IPNO. IPC-2100 CAN BE INTERROGATED OF ITS PRESENT POSITION AT ALL TIMES BY SENDING THE CORRECT I.D. NO. FOLLOWED BY "?" THEN "ENTER". IPC-2100 WILL TRANSMIT BACK TO THE DEVICE THE PRESENT POSITION . TO JOG, ENTER I.D.NO. OF THE IPC-2100 FOLLOWED BY "J" AND THE DIRECTION "+" OR "-" THEN PRESS "ENTER". THE MOTOR WILL RUN UNTIL "S" IS RECEIVED TO STOP.

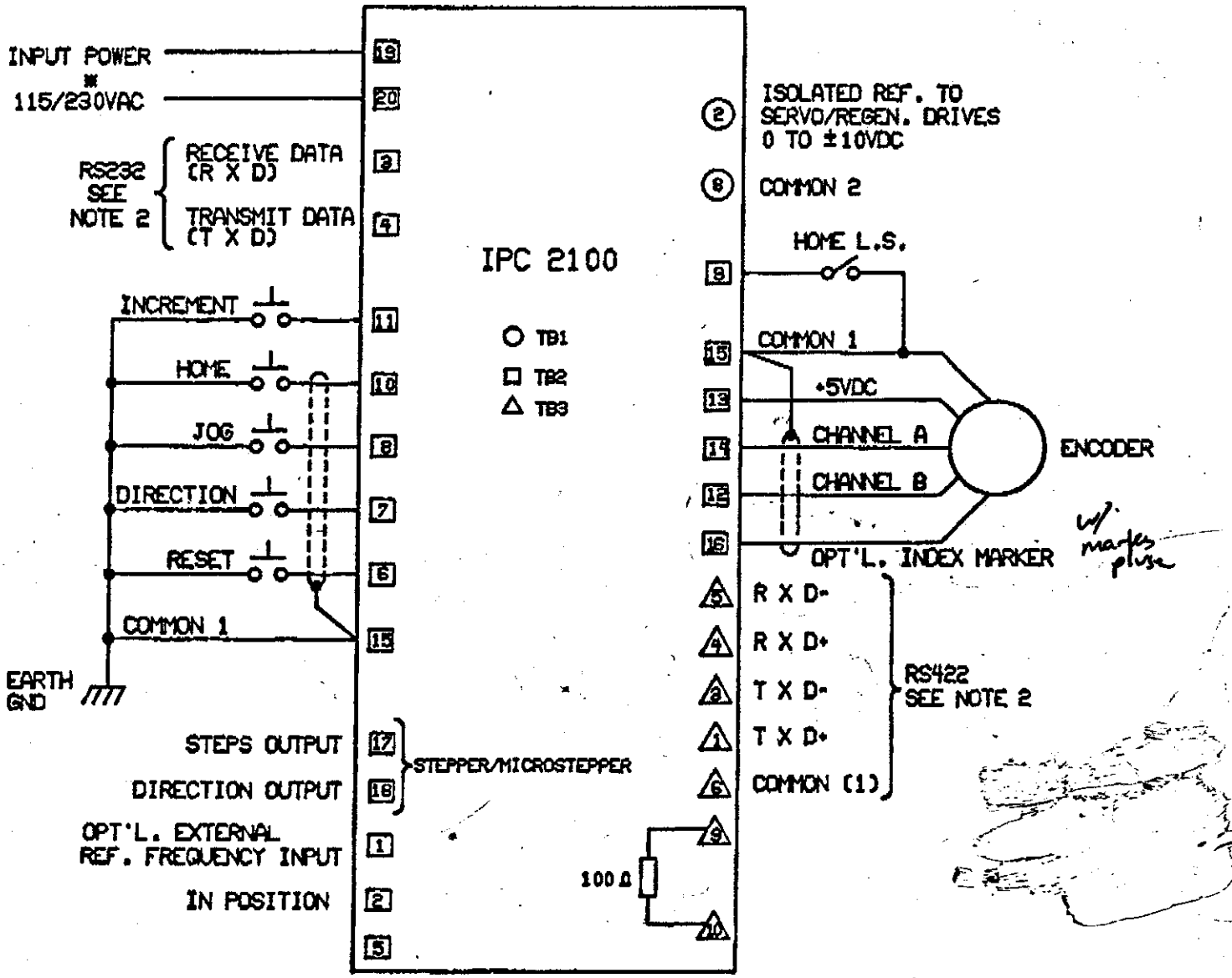
IN MUTIL-AXIS CONFIGURATIONS IT IS ADVISED TO START EACH COMMAND BY TRANSMITTING THE ESCAPE CHARACTER FOLLOWED BY I.D.NO. AND THE COMMAND.

WIRING DIAGRAM - INTROL 2100 SERIES
TO STEPPER/MICRO-STEPPER DRIVER
WITH OPTO-ISOLATOR INPUTS



WIRING DIAGRAM - INTROL 2100 SERIES
TO STEPPER/MICRO-STEPPER DRIVER





NOTE:

*1. IPC 2100 IS FACTORY SET FOR 115 VAC. FOR 230VAC, REFER TO MANUAL.

2. IPC 2100 IS FURNISHED WITH RS422 OR RS232 SERIAL PORT PER CUSTOMER REQUEST.

A	ADDED NOTE 2 AND TB2 ☐ AND ☐	2-24-89	Ali
	DESCRIPTION	DATE	APPVD.
	REVISIONS		

Intrel Design, Inc. LOCKPORT, N.Y.

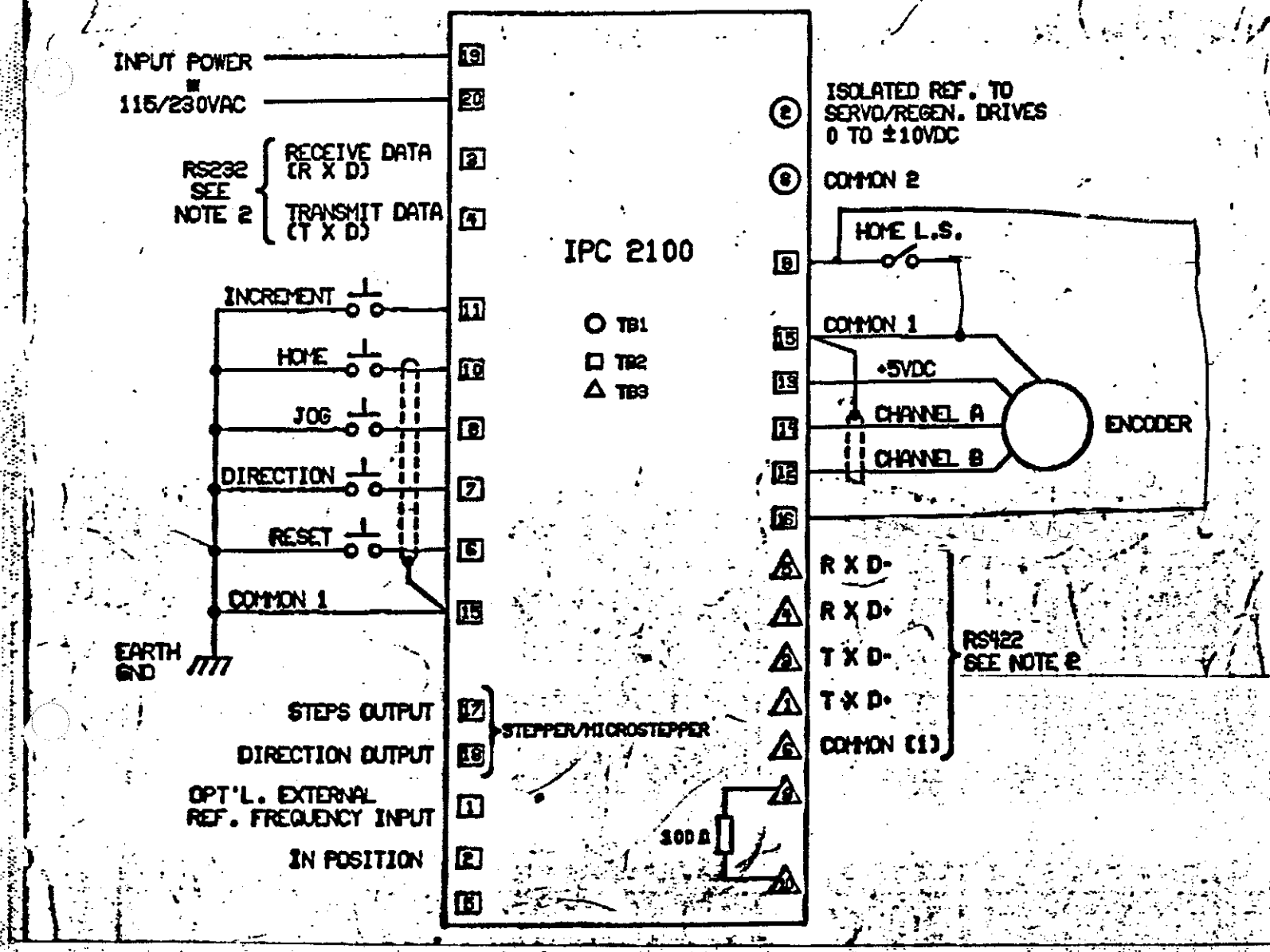
NO. 2100-CCP

TITLE IPC 2100 CUSTOMER CONNECTION DIAGRAM

GP	7-20-88	Ali	Ali
DRAWN	DATE	CHKD.	APPVD.

HYATT BUFFALO

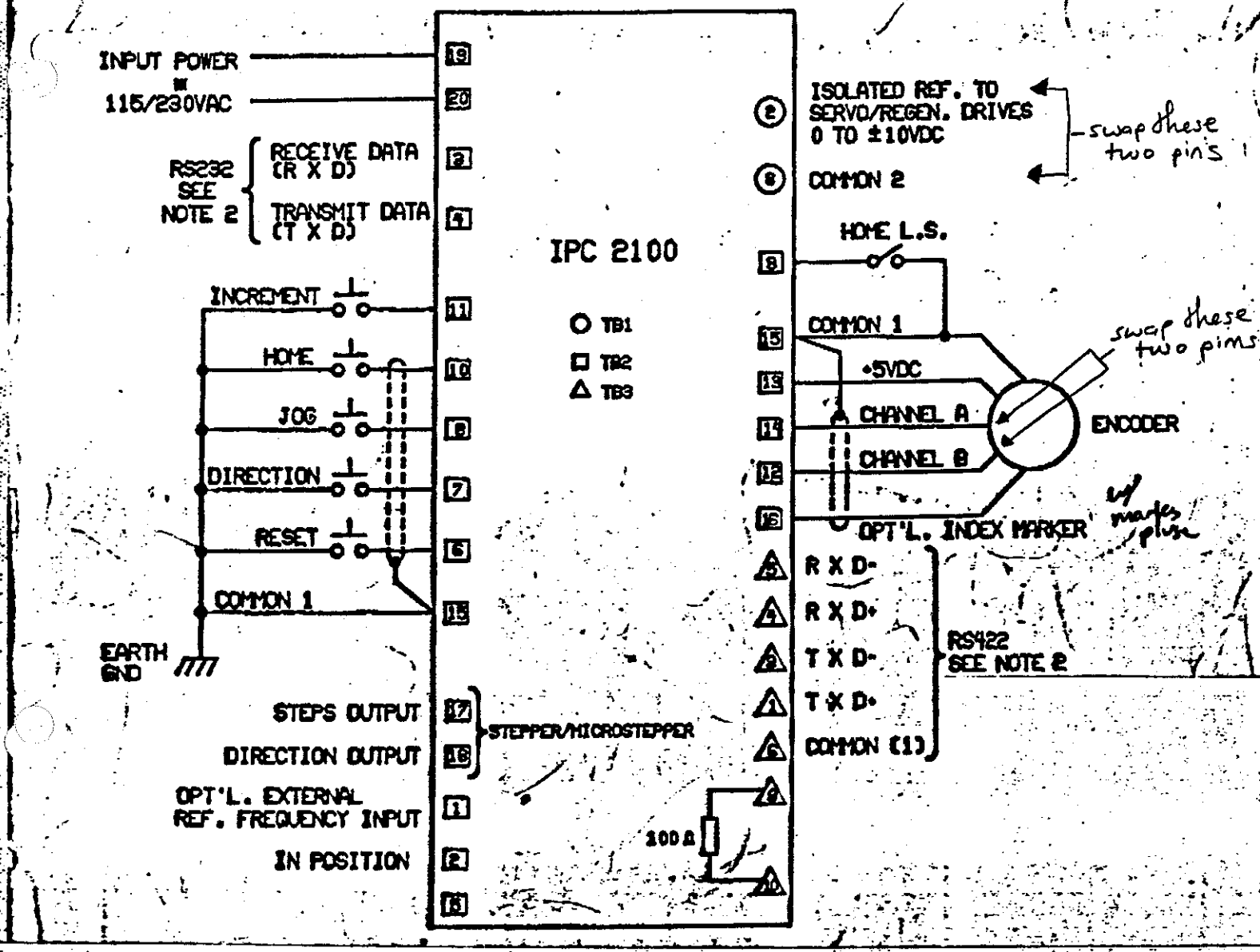
Incremental encoder without marker pulse



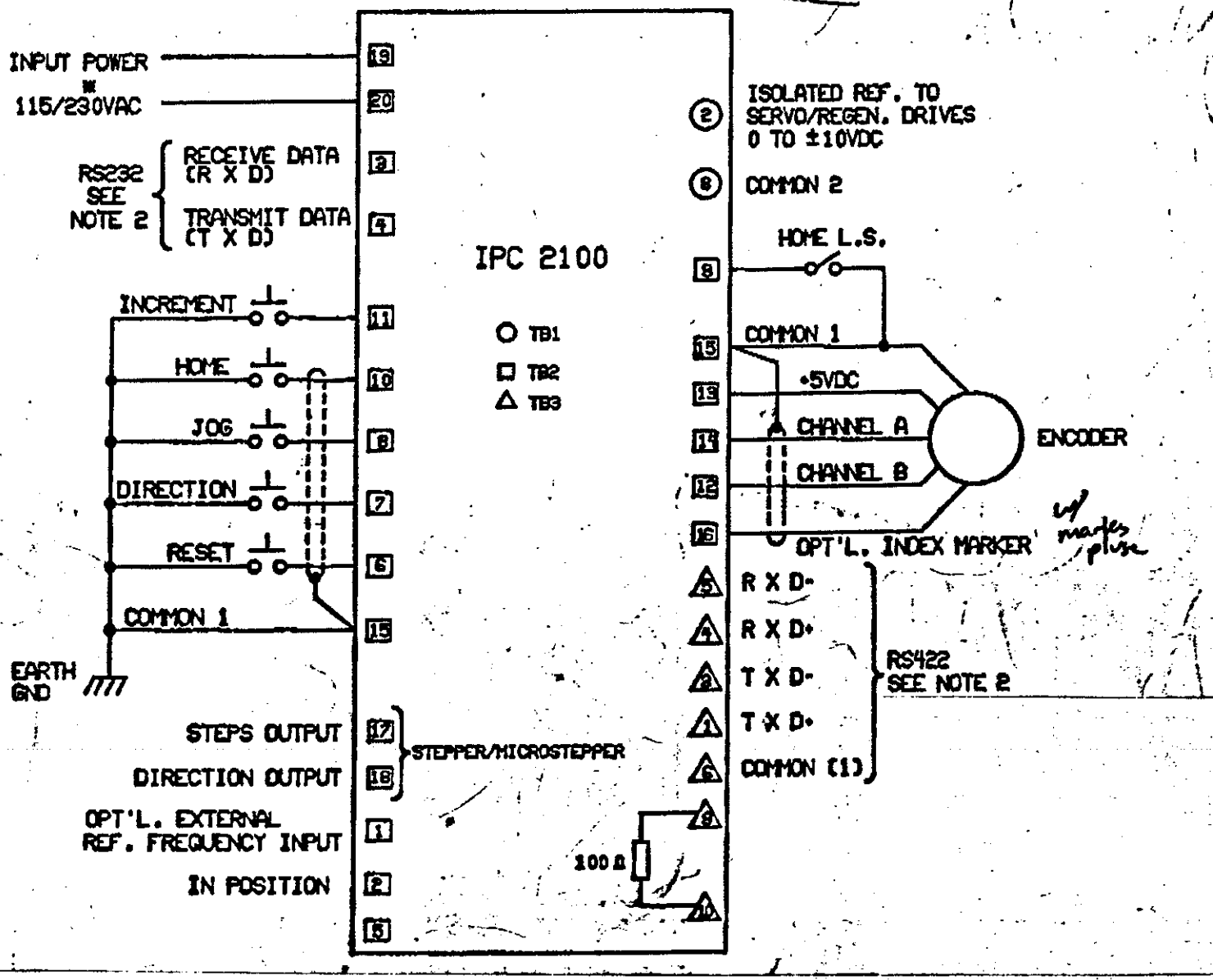
Also

Jumper J on component side of bottom board inside introl must be changed to pin EXT.

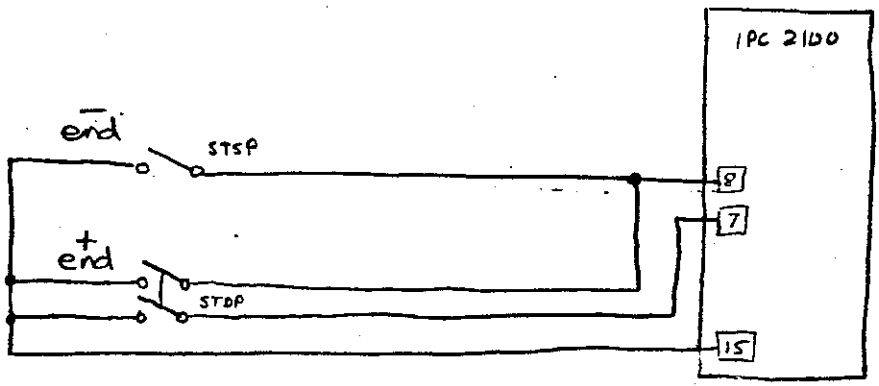
to reverse direction of motor



JOG SWITCH WIRING



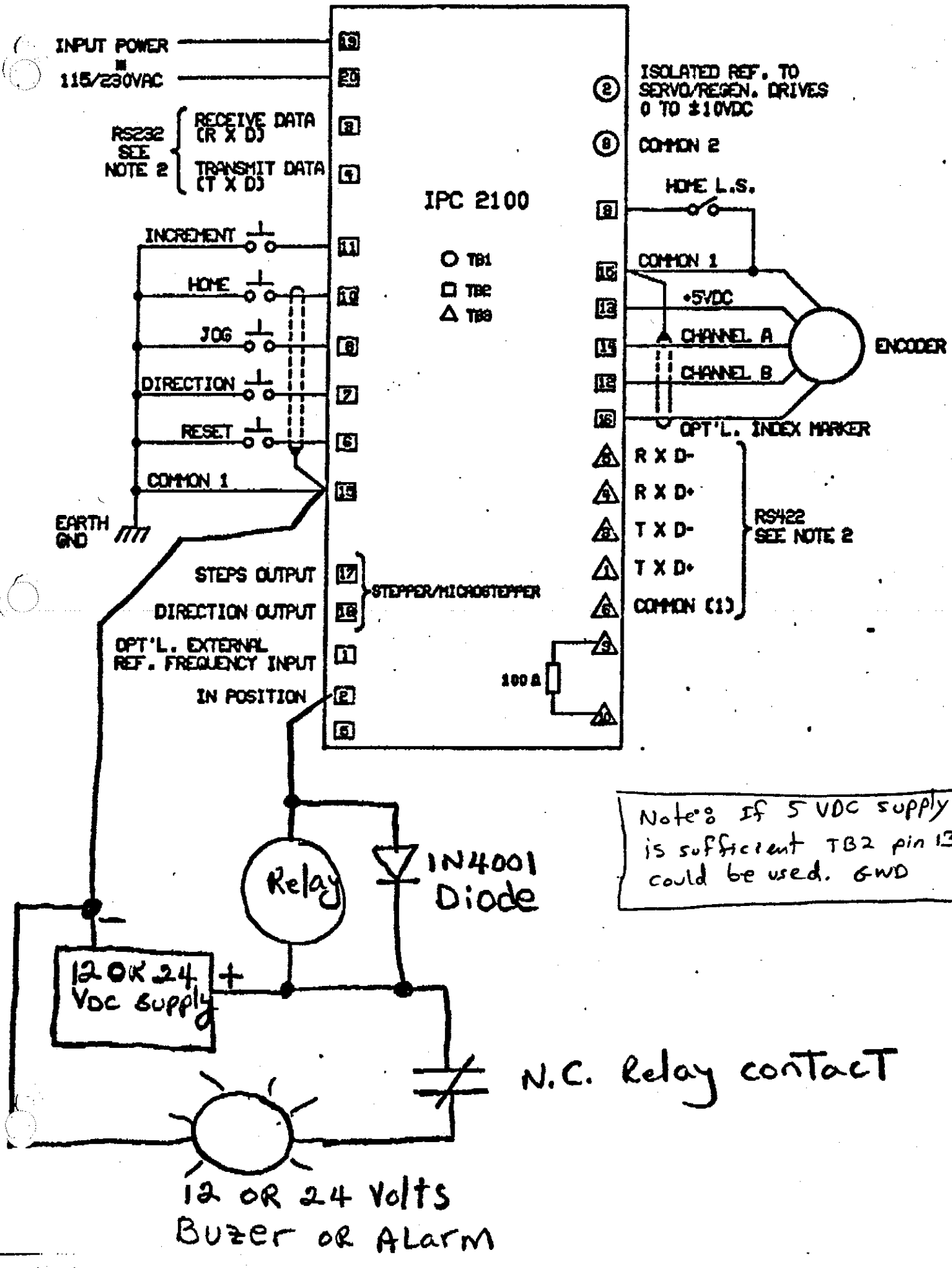
TO WIRE JOG SWITCHES:



if a double pole switch is not used on the + end, make sure switch to pin 7 trips before switch to pin 8.

- end of axis is end toward which position on IPC-2100 front panel decreases. Front panel is a signed number.

FOR AUDIBLE MOTION ALARM



Note's If 5 VDC supply is sufficient TB2 pin 13 could be used. GND