Instruction Book

I.L. 19-613A

AccurCon II Static
Fixed Frequency Inverters

Master Pulse Generator

April 1973

Westinghouse Electric Corporation
Inverter Systems
Industrial Systems Division
Buffalo, New York

MASTER PULSE GENERATOR

Ref. Diagram:
- 3616C28 Schematic
- 2978D09 Assembly (P.C. Board)
- 2978D08 Block Schematic
- 2978D11 Wiring (Panel)
- 482B542 P.G. Oven Assembly

Purpose and Description

When a multiplicity of inverters are required to be paralleled for redundancy or to increase system power ratings, it is necessary to synchronize their individual oscillators to a common frequency source. This signal is present at all times and has sufficient redundancy in its circuitry to make it failure-proof.

The basic frequency source is a pulse generator which operates at a repetition rate equivalent to two (2) times (x) the output frequency of the inverter. Each pulse generator printed circuit board and components are in an oven cavity whose temperature stability is maintained to ± .005°C at 65°C within an ambient temperature range of -40°C to +60°C. Warm-up time is approximately 30 minutes from -20°C.

Referring to drawing 6353D02, oven power of 28 volts DC is supplied by redundant power supplies, power supply A and power supply B, transformers RC and TD, rectifiers RC and RD, filter capacitors CC and CD and isolation diodes D13 and D14.

The master pulse generator signal is achieved by using three (3) pulse generators timed for the same period. The output is arranged so that two of them have to be coincident to allow a pulse through to an output stage. If any one of the three (3) pulse generators is not operating or is at a different frequency, the other two still provide the proper output pulse. The first output pulse which occurs, also provides a start pulse which is fed as an input to the other pulse generators to insure that they start their timing at the same time in every period. To insure the optimum in reliability, integrated circuits are used to perform the coincident gate function, and the square wave generator which provides the synchronizing signal.

A further precaution is taken against failure in one of the gate or output stages: the final output is produced via a transformer which is designed to saturate with 10% margin on voltage. If a pulse is lost due to a failure, the transformer (T1, T2 or T3, 2978D08) saturates and the higher current is detected. The input is then crow-barred to prevent a disturbance. Transistor Q6 turns on to energize relay (#) MPR, indicating which board has failed. An indicating light and disconnect switch are provided on the test panel to isolate the bad board from the system. This board can be removed and repaired or replaced when a scheduled shutdown or bypass transfer can be performed. Otherwise, the board can remain disconnected for any period of time without any danger to the system, except the loss of redundancy of the pulse generators.

In addition to the three MPG failure indicating lights and disconnect switches, there is a light and switch to disconnect the input to each power supply. Under normal operating conditions, all switches should be "on" and should be turned off only when the system has a "Master Pulse Failure" (indicating light on).

Power supply switches are provided to facilitate testing. Switch S4 in conjunction with test point (TP) will allow the testing of the synchronizing board with an external synchronizing signal (12 VAC). Normal "on" position of this switch will permit the master pulse generator to synchronize to the bypass line.

S.B.D.
4/25/72

Paralleling Control Panel

Ref. 3594C34

The paralleling control circuit consists of a three-phase control transformer (1T) with primary (28,29, 30) fed from the three-phase bypass line and with two isolated three-phase secondaries. One secondary (X1-X2) supplies the synchronizing signal, via terminal sync. of the logic drawer, to terminal U12 of the universal synchronous board. The other secondary (X3-X4) feeds a three-phase full-wave rectifier with a voltage divider output, which is fed via terminal RR of the logic drawer, into terminal L3 of the voltage regulator board to adjust the inverter output to match the bypass line voltage. In addition, relays are provided to permit remote operation of the synchronizing circuit.

a. The synchronizing signal from the output of X1-X2 winding of 1T is a sine wave of a voltage roughly between 10 to 20 volts rms. A coarse adjustment of phase displacement between inverter output and bypass line is made by picking the correct combination of taps on this X1-X2 secondary winding. With X2 (20) and X1 (34) pick-up point for the synchronizing signal changed from X1-X2 phase 1 to X1-X2 phase 2, the inverter output will shift by 120 degrees with respect to the bypass line. There are a total 12 different phase references (every 30 degrees) that can be picked off this secondary winding. Three phase references result from connecting X2 to terminal 20 and X1 of the three phases to terminal 34. Three more phase references result from connecting X1 to 20 and X2 to 34. Six more phase references result from jumpering the three X2 terminals together and connecting terminals 34 and 20 from phase-to-phase in the six different combinations.

b. The external voltage reference signal at terminal 21 (terminal 20 is common) is a DC signal that can attain both positive and negative values depending on the voltage at the primary of 1T. To set up this circuit initially, it is necessary to set the voltage at terminals E1, E2, E3 (bypass line voltage) to be equal to the inverter output voltage with the LR relay de-energized. Then potentiometer 1P should be adjusted until wire 37 is at 0 volts. This can be checked by connecting a meter from 37 to 20 (common). It can be seen then that as the bypass line voltage is increased above the inverter output voltage, the voltage at 37 goes positive with respect to terminal 20 (common); and as the bypass line voltage becomes less than the inverter output voltage, the voltage at 37 becomes negative with respect to 20 (common). Thus, if relay LR is energized, the voltage error signal at 21 will be applied to the external reference voltage input terminal L3 of the voltage regulator board via terminal RR of the logic drawer and will correct the inverter output to match the bypass line.

c. The following relays are provided to allow remote control of the signal voltages:

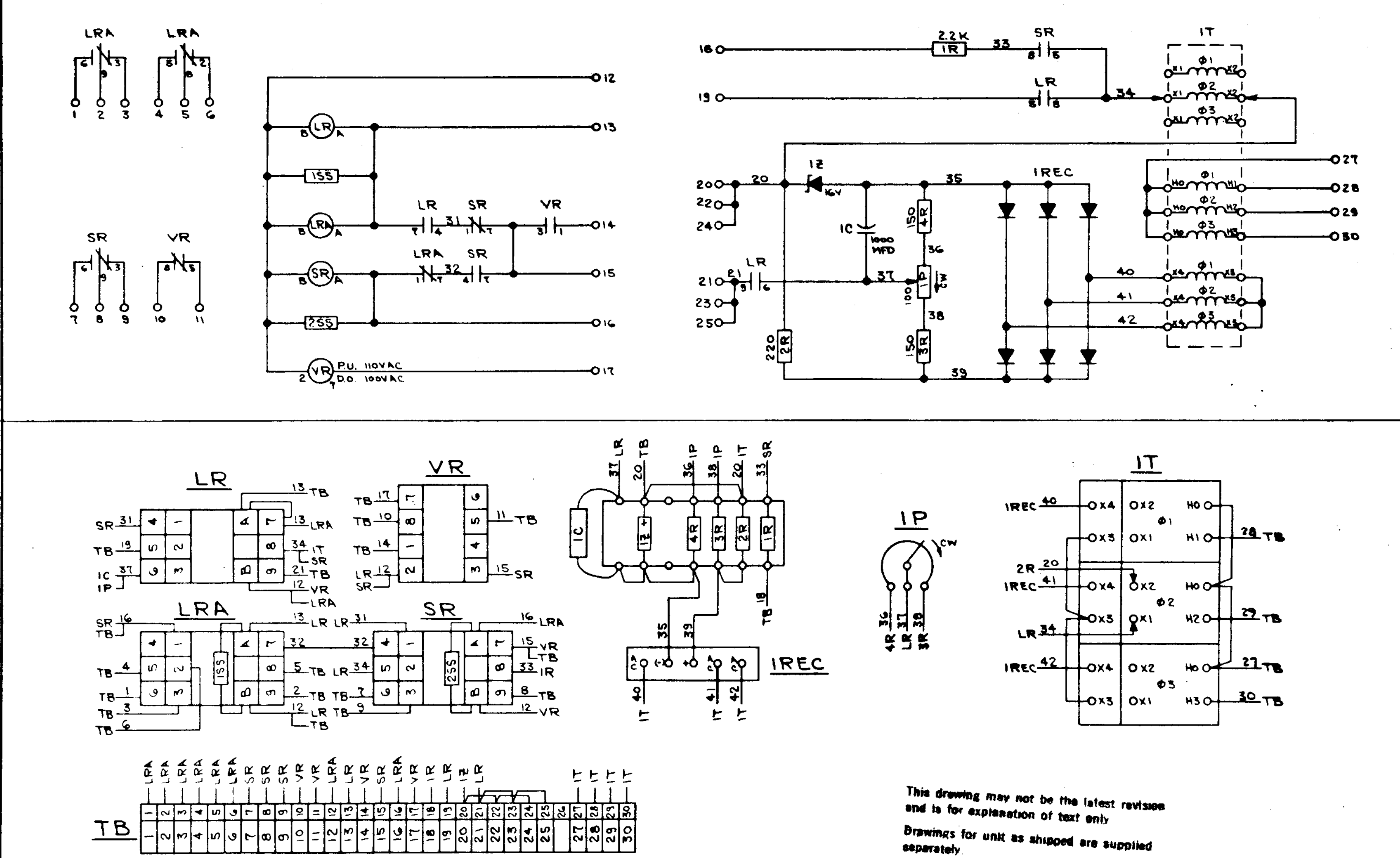
"LR" - "LRA" Relays are energized when "lock" pushbutton is operated to phase lock the "UPS" with the bypass line and automatically match voltages for a make-before-break transfer. Relay will de-energize if (1) "sync lock release" P.B. is operated, (2) "SR" relay is energized, (3) "VR" relay de-energizes at set point.

"SR"- Relay is energized when sync pushbutton is operated to synchronize master pulse generator frequency to bypass line frequency. Relay will de-energize when (1) "sync lock release" P.B. is operated, (2) "LR" relay is energized, (3) "VR" relay de-energizes at set point.

"VR"- Voltage sensing relay contact will open if bypass voltage is below 100 volts AC. Relays "LR" or "SR" will be de-energized to prevent a make-before-break transfer during low bypass line conditions or to remain synchronized to a failing bypass source. A spare contact is available if required to provide "low bypass voltage" alarm at terminals 10 and 11.

S.B.D.
9/11/72

Dwg 3594C34 Sub 1&3



This drawing may not be the latest revision and is for explanation of text only

Drawings for unit as shipped are supplied separately

S.O.	30K1314
1	CHANGE
2	VR 30K1314 WIRE #(10-11) WAS N.O.
	IT PRI WIRE #(27→30) WERE (22 TO 25).
	TB (20-22-24) (21-23-25) WERE NOT COMMON. A.G. SPECK 09/30/71
3	IT FUTURE H1 - WAS WIRE 27 H2 - WAS WIRE 28 H0 - WAS WIRE 29 DID NOT FOLLOW SIND. CHAPMAN 8.9.72

WIRE TABLE

UNMARKED WIRE TO BE #18 (16-.010) #62111JC GRAY.

B/M 2063A34

WESTINGHOUSE ELECTRIC CORPORATION

TITLE SCHEMATIC AND WIRING DIAGRAM PARALLELING CONTROL

DIMENSIONS IN INCHES - SCALE

DFTM. A.G. SPECK 10-15-71 APPD.

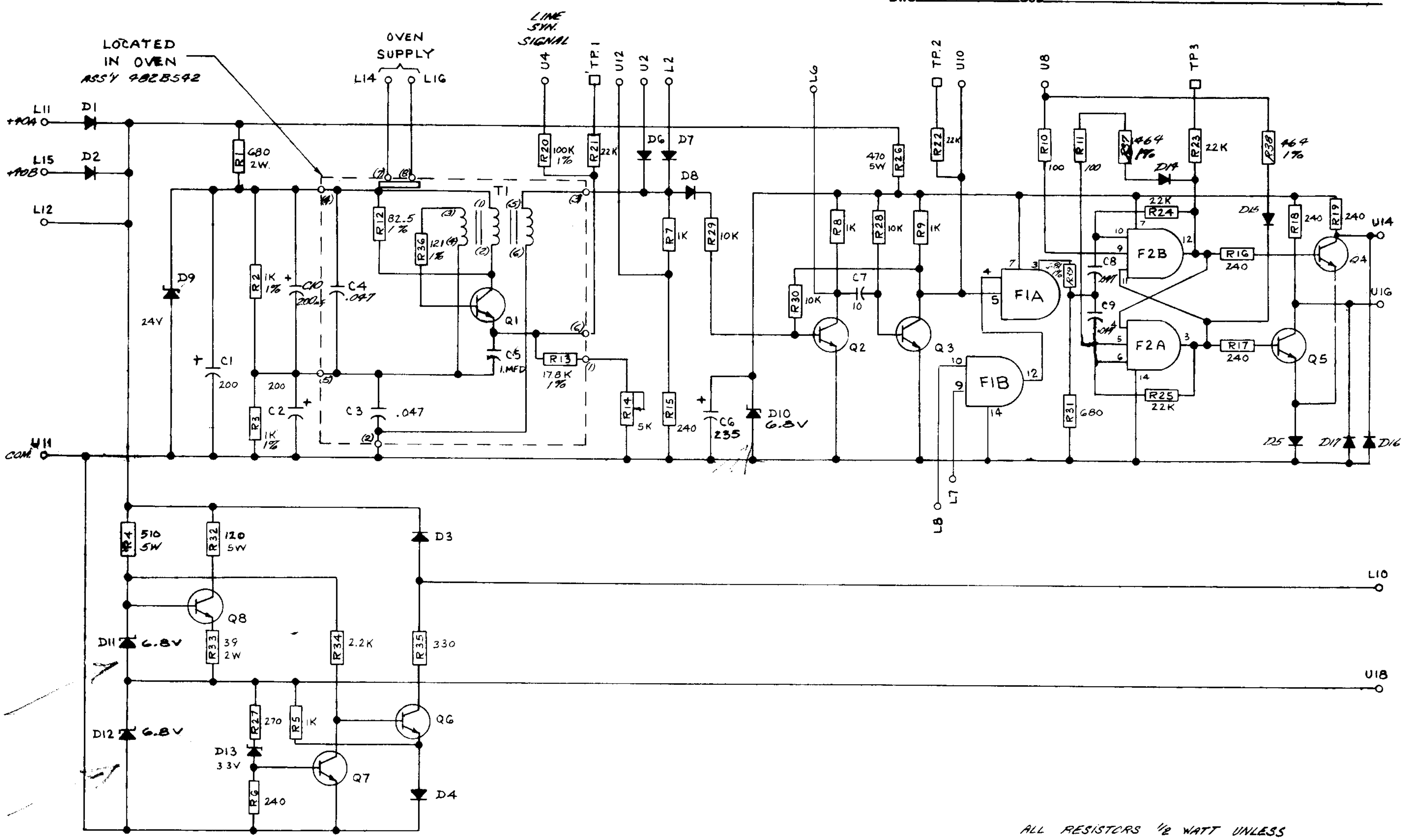
DIV. & PLANT LOCATION ISD E.P.C.

01 S

3594C34

BUFFALO DIVISIONS, BUFFALO N.Y. U.S.A.

DWG 3616C28 SUB 1


LOCATED IN OVEN ASS'Y 482B542
OVEN SUPPLY
LINE SYN. SIGNAL
L11 +40A
L15 +40B
L12
U11 COM
L14
L16
U4
TP.1
U12
U2
L2
L6
TP.2
U10
U8
TP3
U14
U16
L10
U18
L8
L7
D1
D2
D3
D4
D6
D7
D8
D9 24V
D10 6.8V
D11 6.8V
D12 6.8V
D13 33V
D14
D15
D16
D17
R1 680 2W.
R2 1K 1%
R3 1K 1%
R4 510 5W
R5 1K
R6 240
R7 1K
R8 1K
R9 1K
R10 100
R11 100
R12 82.5 1%
R13 17.8K 1%
R14 5K
R15 240
R16 240
R17 240
R18 240
R19 240
R20 100K 1%
R21 22K
R22 22K
R23 22K
R24 22K
R25 22K
R26 470 5W
R27 270
R28 10K
R29 10K
R30 10K
R31 680
R32 120 5W
R33 39 2W
R34 2.2K
R35 330
R36 121 1%
R37 464 1%
R38 464 1%
C1 200
C2 200
C3 .047
C4 .047
C5 1.MFD
C6 235
C7 10
C8 .047
C9 .047
C10 200
T1
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
F1A
F1B
F2A
F2B

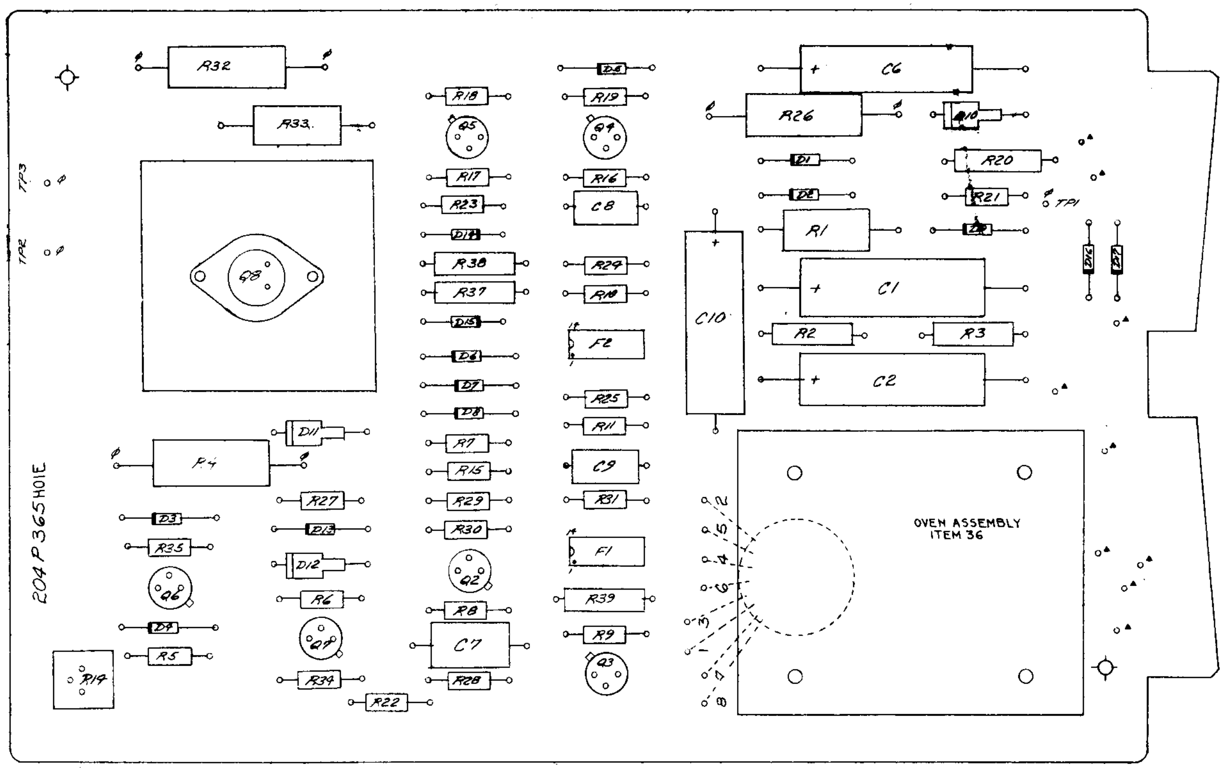
ALL RESISTORS 1/2 WATT UNLESS OTHERWISE STATED

WESTINGHOUSE ELECTRIC CORPORATION	
TITLE	MASTER PULSE GENERATOR SCHEMATIC
DIMENSIONS IN INCHES - SCALE	
DFTM.	J CHAPMAN
APPD.	
ASSY	2978D09
	3616C28

FUTURE

CHANGE

1



NOTES

1) BOARD TO BE FLOW SOLDERED PER PROCESS SPEC. BU 293 614

2) BOARD TO BE COATED WITH PROTECTIVE VARNISH 32M138 AFTER TEST.

3) SHOP TO INSTALL 9 CLENCHED WIRES (FEEDTHRU CONNECTIONS) AT POINTS INDICATED ▲

TITLE MASTER PULSE GENERATOR
PRINTED CIRCUIT BOARD ASSEMBLY

DWG. 2978D09 SUB. 1 FINISH CHART 40052

SYM.	ITEM	DESCRIPTION - MATERIAL DIMENSIONS IN INCHES	PART NO. OR REF. DWG.	FIN. OR LINE NO.	STYLE NO.	REQ'D	TOOL RECORD
	01	PRINTED CIRCUIT BOARD			2978D10G01	1	
	02	RES 680Ω 2W 5%			436A138H59	1	R1
	03	RES 100K ¼W 1%			443A258H01	1	R20
	04	RES 22K ½W			436A133H09	5	R21 TO R25
	05	RES 510Ω 5W			443A290H74	2	R4, R26
	06	RES 1K ½W			436A132H63	4	R5, R7, R8, R9
	07						
	08	RES 270Ω ½W			436A132H49	1	R27
	09	RES 10K ½W			436A133H01	3	R28, R29, R30
	10	RES 240Ω ½W			436A132H48	6	R15 TO R19, R6
	11						
	12						
	13	RES 680Ω ½W			436A132H59	1	R31
	14						
	15	RES 120Ω 5W			443A290H57	1	R32
	16	RES 39Ω 2W			436A138H29	1	R33
	17	RES 2.2K ½W			436A132H71	1	R34
	18	RES 330Ω ½W			436A132H51	1	R35
	19	POT 5K ½W			2099A78H27	1	R14
	20	TRANSISTOR			461A590H02	2	Q2 TO Q3
	21	TRANSISTOR			461A590H05	2	Q6, Q7
	22	TRANSISTOR 2N3054				1	Q8
	23	DIODE			486A728H01	5	D6 TO D8, D14, D15
	24	DIODE			1521A17H02	7	D1 TO D5, D16, D17
	25						
	26						
	27	CAP. 200 µf 25V.			2043A88H01	1	C1
	28	CAP. 200 µf 15V.			461A675H05	2	C2, C10
	29	CAP. 295 µf 10V.			2043A19H01	1	C6
	30	CAP. 0.1 µf 100V.			486A738H08	1	C7
	31	CAP. .047µf 200V.			459A893H21	2	C8, C9
	32	ZENER DIODE			461A670H01	3	D10 TO D12
	33	ZENER DIODE			461A669H42	7	D13
	34	ZENER DIODE			491A779H03	1	D9
	35	TRANSISTOR			491A947H01	2	Q4, Q5
	36	OVEN ASSEMBLY			4882359G01	1	
	37	HEAT SINK			2819A26H01	1	
A	38	INTEGRATED CIRCUIT RY200				2	F1, F2
	39						
	40	RES 681Ω ½W 1%			443A250H01	1	R39
	41	RES 464Ω ½W 1%			443A255H65	2	R37, R38
	42	RES 1K ½W 1%			443A256H01	2	R2, R3
	43	RES 100Ω ½W			436A132H39	2	R10, R11
	44	TURRET LUG			26D7281-2	9	▲
	45	TEST SPECIFICATION			1671A02	REF	

CONTINUED ON SHEET

GROUP	DESCRIPTION	ITEMS OF THIS DWG.	MULT.	
01	PRINTED CIRCUIT BD.	01 TO 45	1	

A - BOUGHT OUTSIDE FROM RAYTHEON - 200 SERIES

STANDARD DRAWING

WESTINGHOUSE ELECTRIC CORPORATION

TITLE MASTER PULSE GENERATOR PRINTED CIRCUIT BOARD ASSEMBLY

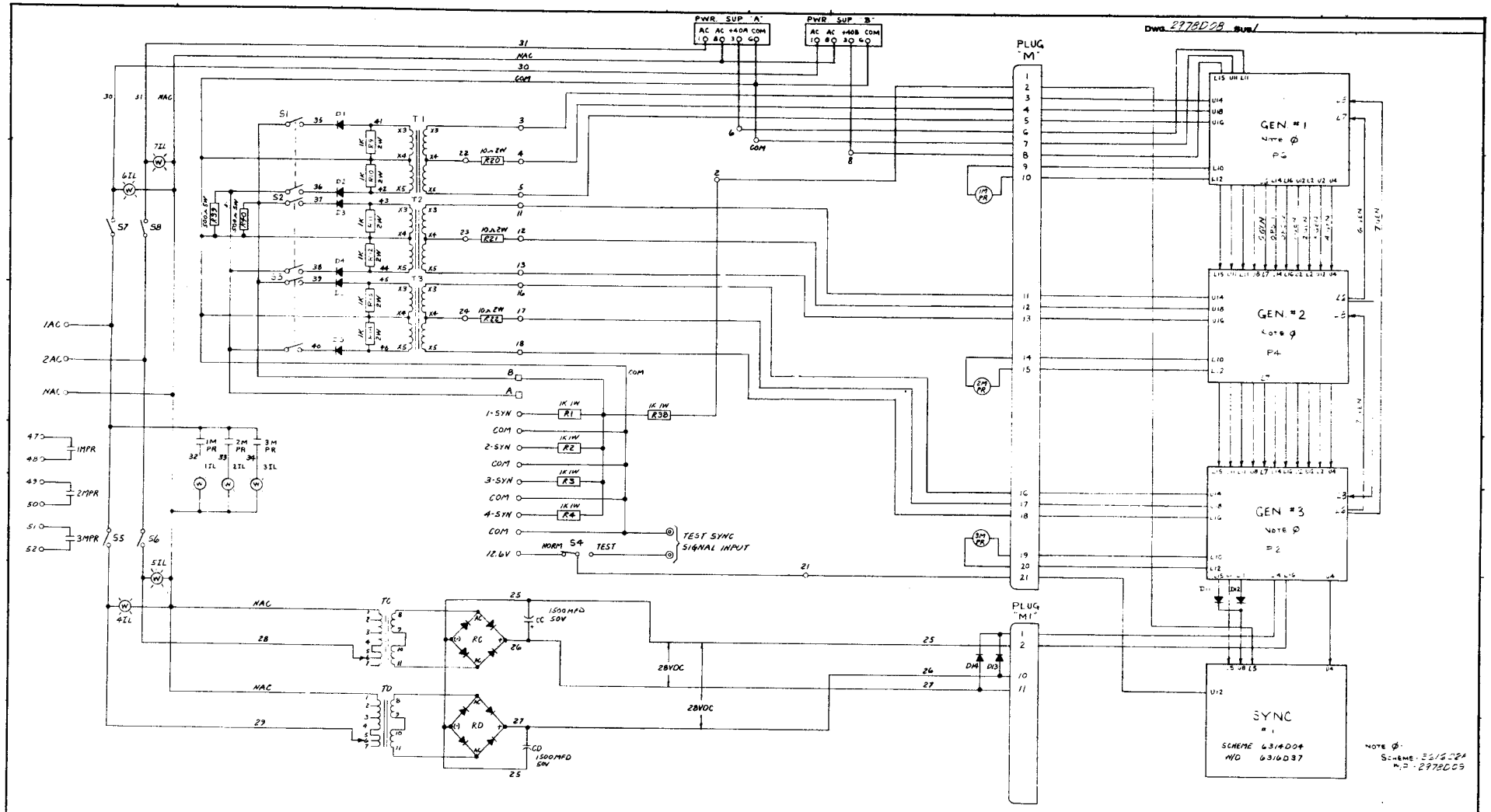
CHAPMAN

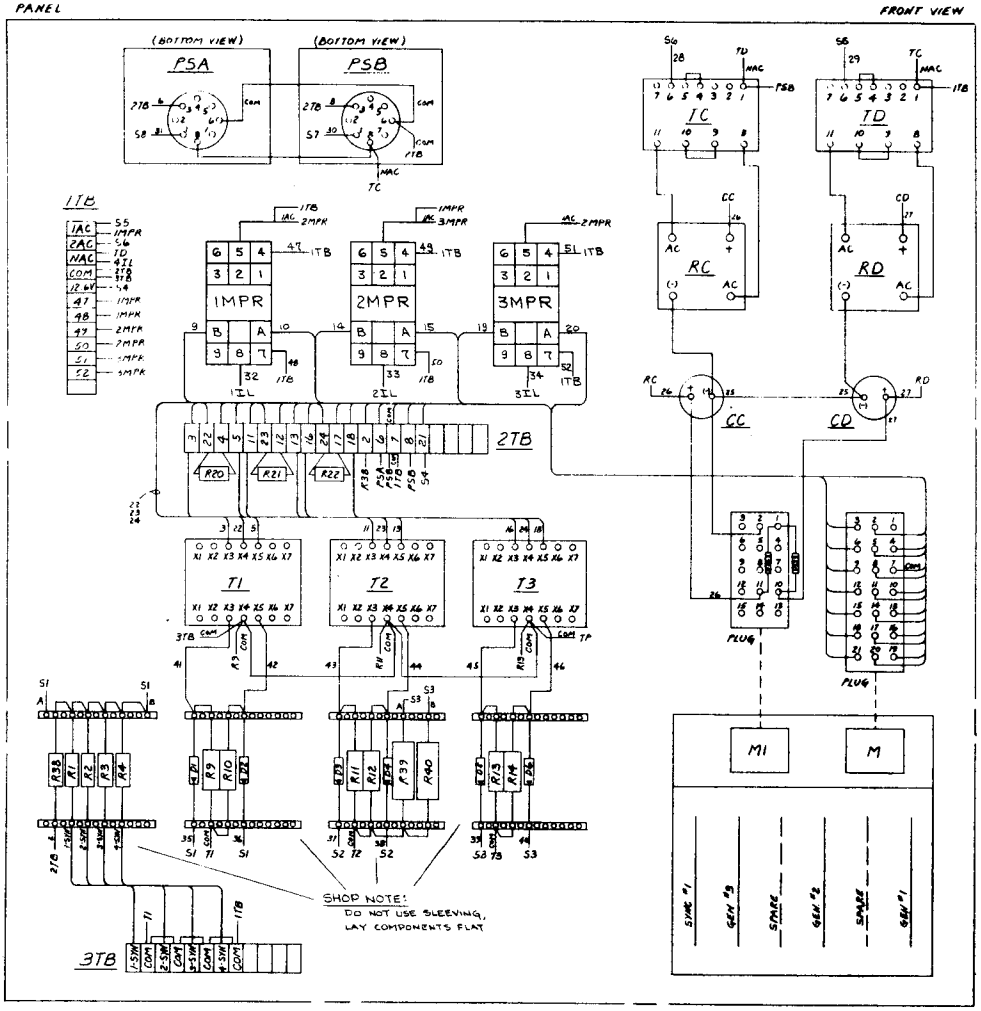
3616C28

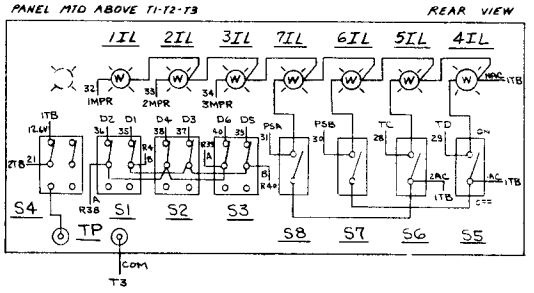
2978D09

1

CHANGE


PWR SUP "A"
AC AC +40A COM
PWR SUP "B"
AC AC +40B COM
Dwg. 2978D08 SUB/
PLUG "M"
PLUG "M1"
GEN #1
GEN #2
GEN #3
SYNC
1AC
2AC
NAC
1-SYN
2-SYN
3-SYN
4-SYN
COM
12.6V
NORM
TEST
TEST SYNC SIGNAL INPUT
28VDC
1500MFD 50V
NOTE Ø:
WRING DIAG. - 2978D11
WESTINGHOUSE ELECTRIC CORPORATION
TITLE MASTER PULSE GENERATOR
SCHEMATIC
2978D08
DIV. & PLANT LOCATION S/S CONT.





DWG. 2978D11 SUB 1

SCHEMATIC 2978D08

WIRE TABLE

UNMARKED WIRE TO BE #20 (10-.010) "621" JD WHITE.

AW 206X134

WESTINGHOUSE ELECTRIC CORPORATION

TITLE MASTER PULSE GENERATOR

WIRING DIAG.

2978D11

SYS. CONT. E.P.C.

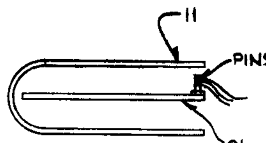


FIG. 1

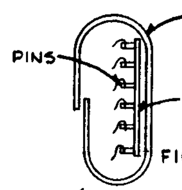
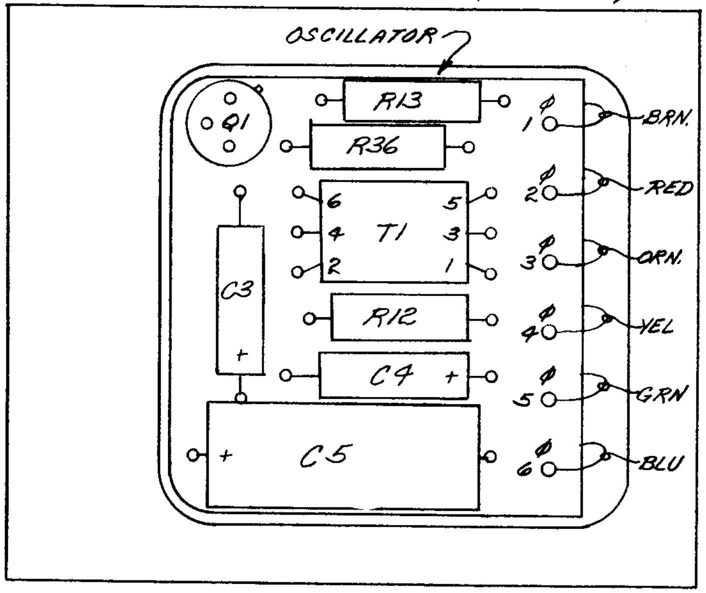


FIG. 2

(TOP VIEW)

OVEN



DWG. 482B542 SUB. 2

SYM.	ITEM	DESCRIPTION - MATERIAL DIMENSIONS IN INCHES	PATT. NO. OR REF. DWG.	FIN. CH. LINE NO.	STYLE NO.	REQD.	TOOL RECORD ROUTING
C	01	PRINTED CIRCUIT BOARD			204P442	1	
	02	TRANSFORMER	PE4002		494A511H01	1	T1
	03	RES 121Ω ½W 1%			443A255H09	1	R36
	04	TRANSISTOR	2N1711		461A590H02	1	Q1
	05	CAP. .097 mf 100V.			486A738H06	2	C3, C4
B	06	CAP. 1.0 mf 100V.			2038A79H83	1	C5
	07	RES. 17.8K ½W 1%			493A257H25	1	R13
	08	TURRET LUG			26D7281-2	6	Ø
A	09	OVEN CAT # 3765-1				1	B.O.
	10	RES. 82.5 ½W 1%			486A722H89	1	R12
C	11	NOMAX INS. MTL. 1.9" x 4"			PDS42333-AA	1	
C	12	NOMAX INS. MTL. 1.9" x 5"			PDS42333-AA	1	

GROUP	DESCRIPTION	ITEMS FOR THIS DWG.	MULT.	ROUTING
01	COMP. ASS'Y.	01 TO 12	1	MEO

A- B.O. OVEN INDUSTRIES INC.

B- TO BE PURCHASED FROM ELECTRO-CUBE NO SUBSTITUTION WITHOUT PERMISSION OF STATIC APPARATUS DEVEL.

C- SHOP ASSEMBLY PROCEDURE

1. CONNECT COLOR CODED WIRES TO OSCILLATOR P.C. BOARD 204P442 AS SHOWN.
2. WRAP P.C. BOARD 204P442 WITH IT.11 (NOMAX INS. MTL) AS SHOWN IN FIG.1. THEN WRAP P.C. BOARD WITH IT.12 (NOMAX INS. MTL.) AS SHOWN IN FIG. 2.
3. INSERT WRAPPED P.C. BOARD INTO OVEN CAVITY, SNAP TOP COVER ON AND COMPLETE OVEN ASSEMBLY.

P.C. BOARD 204P442 TO BE FLOW SOLDERED AND COATED WITH PROTECTIVE VARNISH 32101JB

V 9999
2-21-73
SUB 2 HD

A

S.D. 6G9230
D. 1
IT. CHANGE
6-2144
2 ITS. 11,12, FIG.1 & FIG.2 WERE NOT ON SYM. "C" WAS NOT ON WITH SHOP NOTES.
R. MUSZYNSKI 2-15-72
R. MISZKIEWICZ 2-16-72

TOOL REF. DWG.

ENG. REF. DWG. MASTER PULSE GEN. 3393D15

WESTINGHOUSE ELECTRIC CORPORATION

01 L

TITLE PRINTED CIRCUIT BOARD OVEN (FOR MASTER PULSE GENERATOR 3393D15) ASSEMBLY

DIMENSIONS IN INCHES—SCALE

DFTM. PHILIP B. GARRISON 7-10-69
APPD. W.R. Watkins 7/31/69
APPD.
APPD. J. Brown 9-9-69

482B542

DIV. & PLANT LOCATION ISD

BUFFALO DIVISIONS, BUFFALO, N.Y., U.S.A.

B. K. ELLIOTT NO. 102 ELLCO-VEL 1000-6-67

FORM B-3A