CIRCUIT DESCRIPTION

CD-83102-01
ISSUE: 2AC
APPENDIX: 5A
DWG ISSUE: 7A
DISTN CODE: BM99

# POWER SYSTEMS
# RECTIFIER CIRCUIT
# 208/240 OR 480 VOLT, 60 HZ INPUT
# 48 VOLT, 400 AMPERE OUTPUT
# J85503C

CHANGES

DESCRIPTION OF CHANGES

D.1 Information Note 303 has been changed to show option ZM replacing option B on a Class A Basis. This is being applied to the List 6 (480Vin) Rectifier

D.2 Information Note 303 has been changed to show option ZN replacing option ZA on a Class A basis. This is being applied to the List 2 (208Vin) and List 4 (240Vin) Rectifiers.

D.3 Information Note 317 has been added.

D.4 Information Note 318 has been added.

AT&T MICROELECTRONICS

# POWER SYSTEMS
# RECTIFIER CIRCUIT
# 208/240 OR 480 VOLT, 60-HERTZ INPUT
# 48-VOLT, 400-AMPERE OUTPUT
# J85503C

## CHANGES

### B.1 Changes in Apparatus

| 1. Superseded | Superseded By |
|---|---|
| T3 Transformer, Z option, 3245D - FS1, App Fig 1 (A option) | T3 Transformer, Z option, 3245G - FS1, App Fig 1 (ZM option) |
| T3 Transformer, Y option, 3245C - FS1, App Fig 1 (ZB option) | T3 Transformer, Y option, 3245F - FS1, App Fig 1 (ZN option) |
| R6 Potentiometer, 3540S-701-102, 1K Bourns - FS1, App Fig 1 (ZP option) | R6 Potentiometer, M22S10, 1K MEPCO/COPAL - FS1, App Fig 1 (ZQ option) |
| L1, L2 Inductor, Y & Z option, 1337B - FS1, App Fig 1 (D option) | L1, L2 Inductor, Y & Z option, 1337A - FS1, App Fig 1 (E option) |
| C1-C5, C8-C12 Capacitor, Y & Z option, 97F5349AA6, 40 uF, GE - FS1, App Fig 1 (D option) | C1-C12 Capacitor, Y&Z option, 97F5349AA6,uF,GE- FS1, App Fig 1 (E option) |

### D. Description of Changes

D. 1 The OPTION INDEX table has been changed by the addition of options ZM, ZN, ZP and ZQ.

D. 2 The SHEET INDEX table has been changed by the addition of the sheet issue numbers that have been changed.

D. 3 In FS1 and App Fig 1, option Z transformer T3 code 3245D has been designated option A and has been superseded by code 3245G, which has been designated option ZM

D. 4 In FS1 and App Fig 1, option Y transformer T3 code 3245C has been designated option ZB and has been superseded by code 3245F, which has been designated option ZN.

D. 5 In FS1 and App Fig 1, R6 potentiometer 3540S-701-102, 1K Bourns has been designated option ZP and has been superseded by code M22S10, 1K MEPCO/COPAL which has been designated option ZQ.

D. 6 In FS1 and App Fig 1, option Y and Z, Inductors L1 and L2 code 1337B which has been designated option D, has been superseded by code 1337A which has been designated option E.

D. 7 In FS1 and App Fig 1 option Y and Z, capacitor C1-C5 and C8-12, 97F5349AA6, 40uf, GE which has been designated option D, has been superseded by capacitors C1-C12 97F5349AA6, 40uf, GE which has been designated option E.

D. 8 Equipment note 206 which deals with grounding methods for this rectifier is reworded.

D. 9 Information note 316 has been added.

D.10 Information note 303 has been changed by the addition of options ZM, ZN and ZQ designated (Avail) and options A, ZB and ZP designated (DA).

D.11 In Information note 303, option D which was previously rate (Avail) has been changed to (LA).

D.12 In Information note 303, option E which was previously rated (LA) has been changed to (AVAIL).

AT&T Microelectronics

# POWER SYSTEMS
# RECTIFIER CIRCUIT
# 208/240 OR 480 VOLT, 60 Hz INPUT
# 48 VOLT, 400 AMPERE OUTPUT
# J85503C

## CHANGES

### A. Changed and Added Functions

A.1 A new function has been added to permit the use of this rectifier for EM cell charging.

### B. Changes in Apparatus

B.1 Added

S3 Switch ED-83113-30,GR1 - FS 1, App Fig 3 - ZL Option

### D. Description of Changes

D.1 The Option Index table has been changed by the addition of options ZK and ZL.

D.2 In FS 1 and App Fig 3, switch S3 has been added and designated option ZL.

D.3 Apparatus figure App Fig 3 has been added on the drawing.

D.4 Information Note 302 has been changed by the addition of option ZK and ZL.

D.5 Information Note 302 has been changed by the addition of the feature or option information pertaining to EM cell charging.

D.6 Information Note 303 has been changed by the addition of options ZK and ZL, which have been designated AVAILABLE (AVAIL).

D.7 Cabling diagram CAD 5 has been added on the drawing.

F. Changes in Description of Operation

F.1 In Section II, add paragraph 1.06, as follows:

1.06 When this circuit is used for 23-cell operation with EM cell charging for 25 or 27 cells, the nominal output voltage of the rectifier should vary between 49.50 and 60.6 volts for a 400-ampere load. The maximum battery feeder loop voltage drop should not exceed 1-volt maximum between the rectifier and the point of regulation.

AT&T NETWORK SYSTEMS

# POWER SYSTEMS
# RECTIFIER CIRCUIT
# 208/240 OR 480 VOLT, 60 Hz INPUT
# 48 VOLT, 400 AMPERE OUTPUT
# J85503C

## CHANGES

### D. Description of Changes

D.1 Equipment Note 210 has been added on the drawing.

AT&T NETWORK SYSTEMS

# POWER SYSTEMS
# RECTIFIER CIRCUIT
# 208/240 OR 480 VOLT, 60 Hz INPUT
# 48 VOLT, 400 AMPERE OUTPUT
# J85503C

## CHANGES

### B. Changes in Apparatus

B.1

| Superseded | Superseded By |
|---|---|
| C1 thru C12 Capacitor, GE 97F5349FA, 40 $\mu$F - FS 1, App Fig 1 - ZF Option | C1 thru C12 Capacitor, GE 97F5349AA6, 40 $\mu$F - FS 1, App Fig 1 - ZG Option |
| CR1 thru CR4 Diode, GE A390C - FS 1, App Fig 1 - ZD Option | CR1 thru CR4 Diode, GE A390N - FS 1, App Fig 1 - ZE Option |
| R4 Resistor KS-20289 L2A, 30.1 k$\Omega$ - FS 1, App Fig 1 - Z Option | R4 Resistor KS-20289 L2A, 16 k$\Omega$ - FS 1, App Fig 1 - Y, Z Options |
| T3 Transformer - Z Option, 3245B - FS 1, App Fig 1 - B Option | T3 Transformer - Z Option, 3245D - FS 1, App Fig 1 - A Option |
| T3 Transformer - Y Option, 3245A - FS 1, App Fig 1 - ZA Option | T3 Transformer - Y Option, 3245C - FS 1, App Fig 1 - ZB Option |

B.2 Added

C25, C26 Capacitor KS-19774 L2, 150 pF - FS 1, App Fig 1 - ZH Option

CR8 Diode, 1N3289A - FS 1, App Fig 1 - ZC Option

CR9 Diode, 1N3289RA - FS 1, App Fig 1 - ZC Option

### D. Description of Changes

D.1 The Option Index table has been changed by the addition of options A, B, ZA, ZB, ZC, ZD, ZE, ZF, ZG, ZH, ZI, and ZJ.

D.2 The Sheet Index table has been changed by the addition of the sheet issue numbers that have been changed.

D.3 In FS 1 and App Fig 1, C1 through C12 GE capacitor code 97F5349FA, 40 $\mu$F has been designated option ZF and has been superseded by GE capacitor code 97F5349AA6, 40 $\mu$F, which has been designated option ZG.

D.4 In FS 1 and App Fig 1, CR1 through CR4 GE diode code A390C has been designated option ZD and has been superseded by GE diode code A390N, which has been designated option ZE.

D.5 In FS 1 and App Fig 1, the value of resistor R4 has been corrected from 30.1 kilohms (designated option Z) to 16 kilohms (designated options Y and Z). There never has been and never will be any unit in the field that contains the 30.1 kilohm resistor.

D.6 In FS 1 and App Fig 1, option Z transformer T3 code 3245B has been designated option B and has been superseded by code 3245D, which has been designated option A.

D.7 In FS 1 and App Fig 1, option Y transformer T3 code 3245A has been designated option ZA and has been superseded by code 3245C, which has been designated option ZB.

D.8 In FS 1, the 18 gauge wiring to the primary winding of transformer T3 has been designated option ZI and has been superseded by 22 gauge wiring, which has been designated option ZJ.

D.9 In FS 1 and App Fig 1, CR8 diode 1N3289A has been added and designated option ZC.

D.10 In FS 1 and App Fig 1, CR9 diode 1N3289RA has been added and designated option ZC.

D.11 In FS 1 and App Fig 1, C25 and C26 capacitors KS-19774 L2, 150 pF have been added and designated option ZH.

D.12 Equipment Note 209 has been added on the drawing.

D.13 Information Note 303 has been changed by the addition of options A, ZB, ZC, ZE, ZG, ZH, and ZJ (designated AVAILABLE [AVAIL]) and options B, ZA, ZD, ZF, and ZI (designated DISCONTINUED AVAILABILITY [DA]).

AT&T NETWORK SYSTEMS

CD-83102-01
ISSUE 2AC
DWG ISSUE 2AC
DISTN CODE 1P99

# POWER SYSTEMS
# RECTIFIER CIRCUIT
# 208/240 OR 480 VOLT, 60 Hz INPUT
# 48 VOLT, 400 AMPERE OUTPUT
# J85503C

TABLE OF CONTENTS



## SECTION I - GENERAL DESCRIPTION

### 1. PURPOSE OF CIRCUIT

1.01 This circuit charges or floats storage batteries by providing regulated dc power from an ac source.

1.02 Rectifier J85503C converts a nominal 208/240- or 480-volt 60 ±3 Hz ac input into a filtered and regulated dc output voltage of 48 volts at any current between 0 and 400 amperes.

### 2. GENERAL DESCRIPTION OF OPERATION

RECTIFIER CIRCUIT

2.01 The rectifier circuit of the J85503C rectifier consists of two Scott-T connected ferroresonant transformers, four rectifying diodes, two banks of dc filter capacitors, and two filter inductors. The dc output is obtained by paralleling the outputs of the transformers after the outputs pass through full-wave rectifiers. The inductance-capacitance (LC) filter reduces the ripple voltage to the required value.

FERROCONTROL CIRCUITS

2.02 The ferrocontrol circuits, one for each ferroresonant transformer, consist of an ac capacitor, an ac inductor, and two back-to-back silicon controlled rectifiers (SCRs). The switching action of the SCRs simulates saturation of the transformer secondary winding at flux levels below magnetic saturation and thus controls the output of the transformer and therefore the dc output.

AUXILIARY POWER SUPPLY

2.03 The auxiliary power supply consists of transformer T3, rectifying diodes, filter capacitors, and zener controlled series transistor regulators. Located on the CM 2 circuit module, this power supply furnishes ±12 volts to power the control circuits and +27 volts to energize the relays for the alarm circuits.

±5 VOLT POWER SUPPLY

2.04 The ±5 volt power supply, derived from the ±12 volt output of the auxiliary power supply, consists of a positive and a negative 3-terminal series voltage regulator and filter capacitors.

CURRENT-LIMIT CIRCUIT

2.05 The current-limit circuit limits the output of the rectifier under overcurrent conditions. This circuit consists of an operational amplifier, a CURR LIMIT ADJ potentiometer, and a zener diode. When the output current increases above the set limit, the operational amplifier output overrides the voltage-regulating signal and limits the output current of the rectifier.

WALK-IN CIRCUIT

2.06 The walk-in circuit controls the time required for the rectifier to reach its rated output voltage after it is turned on. This circuit mainly consists of a resistance-capacitance (RC) network. The time-constant of the network controls the start-up of the rectifier after the POWER switch has been turned to the ON position. The walk-in circuit is reset each time input contactor K1 of the rectifier releases.

HIGH-VOLTAGE SHUTDOWN CIRCUITS

2.07 Two separate high-voltage shutdown circuits are provided. The first circuit, called selective, accepts a high-voltage signal from the external battery plant. The second circuit, called internal, senses the output voltage of the rectifier, and when this voltage exceeds the specified value, shuts off the rectifier. Operation of the selective high-voltage shutdown circuit depends on two conditions: that the rectifier be delivering at least 10 percent of its rated output current, and that the rectifier receive a high-voltage shutdown signal from the plant.

REMOTE SHUTDOWN CIRCUIT

2.08 This circuit consists of a relay and a current-limiting resistor connected in series. One end of this series combination is connected to a battery; the other end is connected to the plant connector and will accept a remotely initiated ground signal. The presence of the ground signal on the relay coil initiates the shutdown of the rectifier, and its removal allows the rectifier to restart.

PHASE MONITOR CIRCUIT

2.09 The phase monitor circuit will issue an alarm when any one of the ac input phase voltages has decreased 20 percent from the nominal value. If the voltage on phase L1, L2, or L3 is missing, input contactor K1 will release, and the rectifier will shut down. The phase monitor circuit (monitoring each phase separately) rectifies, filters, and attenuates the three secondary winding voltages of transformer T3. Each secondary winding voltage is fed to a comparator and compared with a reference voltage. The output of the comparator changes states and energizes the alarms of the phase monitor c. c when the ac input phase voltages have decreased to unacceptable levels.

UNBALANCE ALARM CIRCUIT

2.10 An unbalance alarm circuit serves each ferroresonant transformer. One will issue an alarm if a severe unbalance develops, for example, if either SCR becomes shorted. This circuit rectifies and filters the secondary winding voltages from the ferroresonant transformers. Normally, the voltages across the filter capacitors are equal but opposite in polarity so that the net voltage across them is zero. When an SCR shorts, the voltage difference between the capacitors causes the zener diodes to conduct current, which turns on an opto-isolator. The operation of the opto-isolator actuates the RFA relay, and the rectifier will shut down.

FUSE ALARM CIRCUITS

2.11 Each output filter capacitor is guarded by a main fuse and an alarm fuse. The internal +V and -V dc outputs are also guarded by alarm fuses. When either of the fuse alarm circuits operates, it actuates the RFA relay, which shuts down the rectifier.

RESTART CIRCUIT

2.12 Triggered by an external signal that is coupled through an opto-isolator, the restart circuit attempts to restart a rectifier that has been shut down. The restart circuit is a one-shot multivibrator that switches states when the restart signal is applied. The multivibrator output turns off the transistor that holds the RFA relay operated and allows the relay to release. The rectifier then restarts and stays on if the original cause of the shutdown has been cleared. The rectifier will try to restart once for each application of the external restart signal.

DIGITAL METER CIRCUIT

2.13 The CM 3 digital meter circuit displays the output current, the output voltage of the rectifier, or the battery voltage selectively by means of a 3-position switch.

CONTROL BOARD

2.14 The circuits listed below are located on the CP 2, 208B control board, circuit module.

(a) local power supplies (+27, ±12, ±5 volts)

(b) feedback regulator, ferrocontrol

(c) walk-in circuit

(d) current-limit circuit

(e) high-voltage shutdown circuits

(f) remote shutdown circuit

(g) restart circuit

(h) phase monitor circuit

(i) unbalance alarm circuit

(j) fuse alarm circuit

(k) isolated current-measuring circuit.

OPTION BOARD

2.15 Option board CM 1 serves as an interface between circuit modules CM 2 and CM 3 and the cabinet-mounted components. It also contains certain optional components and all wiring straps of the rectifier. Option board CM 1 is manufactured with all optional resistors and straps in place. Superfluous straps and resistors must be removed before the rectifier is placed in service.

## SECTION II - DETAILED DESCRIPTION

### 1. RECTIFIER CIRCUIT

1.01 Ferroresonant transformers T1 and T2 isolate the output of the rectifier from the ac input source and provide the required voltage level for the rectifier. The primary windings of T1 and T2 are connected to the ac input source through make-contacts L1 and T1, L2 and T2, and L3 and T3 of input contactor K1.

1.02 The primary windings of T1 and T2 are connected to the ac input source in a Scott-T connection. The Scott-T connection facilitates a balanced loading of a 3-phase system by means of only two transformers. The T1 output winding is connected to CR1 and CR2, and the T2 output winding is connected to CR3 and CR4.

1.03 The outputs of the full-wave rectifiers are combined in parallel, then filtered by inductors L3 and L4 and capacitors C13 through C16 and C17 through C20. The total output current passes through shunt R3 from which a millivolt signal indicates load amperes on the included meter. Bleeder resistors R1, R2, R5, R7, R8, and R9 discharge C13 through C16 and discharge C17 through C20 when the rectifier is turned off and disconnected from the battery.

1.04 Operating POWER switch S1 to the ON position applies power to the coil of relay K2 (K3 for option Z). The circuit is operated from the +27 volt power supply located on circuit module CM 2. The +27 volt signal is routed to terminal A of relay K2 through switch S1 and terminal 6 of connector J2. The other end of relay K2 (terminal B) connects to the ground of the +27 volt supply through terminal 8 of connector J2 and break-contacts 9 and 10 of the TB and 3 and 4 of the RFA2 relays (located on circuit module CM 2). Diode CR1 on the CM 1 option board suppresses the transient voltage across the coil of relay K2.

1.05 When relay K2 operates, its make-contacts 4 and 7 close and connect the ac input voltage across the coil of input contactor K1. When K1 operates, it connects the primary windings of transformers T1 and T2 to the ac input source through its make-contacts L1 and T1, L2 and T2, and L3 and T3. (With option Z, relay K3 connects the ac line to the coil of K1 in a similar manner.)

1.06 The DS3 POWER light-emitting diode (LED) in series with current-limiting resistor R23 on the CM 1 option board are together in parallel with the coil of relay K2. Therefore, the POWER light-emitting diode is on whenever contactor K1 is closed and the ac line voltage is applied to the primary windings of transformers T1 and T2.

1.07 The S2 RECT TEST switch permits a test to determine the ability of the rectifier to regulate. When the switch is moved to the NL position, the output voltage of the rectifier should decrease. In the FL position, the output voltage should increase.

1.08 Transformer T3 feeds the internal power supplies of the rectifier. The transformer also provides signals for the phase-monitoring circuit of the rectifier. An unbalance in phase voltages results in the lighting of the DS2 PH light-emitting diode and in a closure on the PH lead on the plant connector.

1.09 Make-contacts 6 and 9 on relay K2 interrupt the power to the digital meter when the rectifier is off.

### 2. FERROCONTROL CIRCUITS

2.01 Both ferrocontrol circuits, one for each ferroresonant transformer, work in the same manner. Only the control circuit for transformer T1 is presented in this circuit description.

2.02 The control circuit for ferroresonant transformer T1 consists of resonant capacitors C1 through C6, C21, and C23; inductor L1; silicon controlled rectifiers (SCRs) Q1 and Q2 and their associated firing circuit (located on the CM 4 circuit module); and an error amplifier common to both transformers T1 and T2 (located on the CM 2 circuit module). The remaining elements of the control circuit are on the CM 2 circuit module.

2.03 When SCRs Q1 and Q2 are fired, they connect control inductor L1 across capacitors C1 through C6, C21 and C23. The resulting resonant discharge reverses the voltage on the capacitors. This action simulates saturation of the T1 transformer secondary winding and thereby limits its output voltage. By varying the timing of the gate pulses of Q1 and Q2 and thereby the timing of the turnon of Q1 and Q2, the level of output voltage from T1 can be

controlled and thereby the dc output. The gate pulses are generated on the CM 2 circuit module and are controlled by the feedback error amplifier. The error amplifier senses a voltage proportional to the rectifier output voltage and compares it with a reference voltage. The result is an error voltage, which is amplified and compared with a synchronizing signal obtained from secondary winding Y1-Y2 of the transformer. The comparator output signal fires the SCR sooner or later in the half-cycle depending on the magnitude of the error voltage. The output voltage is thereby regulated for changes in load, line, voltage, frequency, and temperature.

2.04 Capacitor C701 and resistor R701 (located on the CM 4 firing circuit) form a snubber network across Q1 and Q2 to reduce the rate of change of voltage across Q1 and Q2 when they turn off.

2.05 Terminals Y1 and Y2 of transformer T1 furnish a voltage that is used to synchronize the gate pulses of the SCRs with the voltage developed by the transformer. Terminals Z1 and Z2 of transformer T1 furnish a voltage that is used to develop an alarm signal if the transformer is operating in an unbalanced mode as a result of an SCR failure.

## SECTION III - REFERENCE DATA

### 1. WORKING LIMITS

1.01 Input Requirements

Phases: 3 phase, 3 wire, no neutral

Frequency: 57 through 63 hertz

Line-to-Line Voltage:

| Nominal | Allowable Limits |
|---|---|
| 208 | 184 through 220 - option Y |
| 240 | 212 through 254 - option Y |
| 480 | 424 through 508 - option Z |

Nominal Input Current, 400A Load:

| Nominal Line-to-Line Voltage | |
|---|---|
| 208 | 70A per phase |
| 240 | 59A per phase |
| 480 | 30A per phase |

Fusing and Wire Size:

Refer to Information Note 305 on SD-83102-01.

1.02 Output

Direct current output voltage at full load is adjustable between 48 and 56 volts.

Voltage regulation is ±1/2 percent for changes in input voltage, frequency, temperature, and load current.

1.03 Ambient Temperature

0° through 50°C

1.04 Relative Humidity

10 through 95 percent

1.05 Electrical Noise

Electrical noise, when measured at the terminals of a battery that has 1680 ampere-hour capacity, should not exceed 48 dBrnc, and the peak-to-peak ripple voltage across the battery is typically 350 millivolts.

### 2. FUNCTIONAL DESIGNATIONS

2.01 Diodes, Light-Emitting

| Designation | Meaning |
|---|---|
| PH | Phase Failure |
| RFA | Rectifier Failure Alarm |

2.02 Potentiometers

| Designation | Meaning |
|---|---|
| CURR LIMIT ADJ | Current Limit Adjustment |
| OUTPUT VOLTS ADJ | Output Voltage Adjustment |

2.03 Relays

| Designation | Meaning |
|---|---|
| PH | Phase Failure Indicator |
| RFA | Rectifier Failure. Shutdown and lockout of rectifier for fuse operation, high-voltage condition, or a connector not mating properly |
| TR | Actuator for remote TR shutdown |

2.04 Switch

| Designation | Meaning |
|---|---|
| RECT TEST | No-load and full-load regulation test |

### 3. FUNCTIONS

3.01 The rectifier includes the following features:

(a) charges or floats a 24-cell lead-acid battery at 2.17 volts per cell with a 2-volt maximum battery feeder loop drop

between the rectifier and the point of regulation

(b) permits connections to a Microprocessor Controlled System (MCS) LINEAGE® 2000 battery plant or a conventional LINEAGE® 2000 battery plant

(c) provides for manually turning on or turning off the rectifier by operating the POWER switch

(d) provides a POWER light to indicate that the K1 line contactor is closed and the ac line is applied to the transformer

(e) provides a manual OUTPUT VOLTS ADJ potentiometer to set output voltage

(f) provides for walk-in of output current at turn-on

(g) limits its output current electronically to an adjustable 90 to 110 percent of full load

(h) limits it output current inherently to about 140 percent of full load if the output is shorted off-battery

(i) provides a RECT TEST switch for testing the operation of the feedback regulator

(j) provides test jacks (REG+, REG-) for measuring the voltage at the point of regulation

(k) provides a digital meter for measuring output current, output voltage, and battery voltage

(l) shuts down and locks out on high-voltage shutdown if one of the following occurs:

(1) the rectifier is delivering output current and receives a high-voltage shutdown signal from the plant (This is called the selective high-voltage shutdown.)

(2) the output voltage increases to 59.9 volts (This is called the internal, or the backup, high-voltage shutdown.)

(m) shuts down and locks out if a fuse fails

(n) provides for shutting down the rectifier remotely

(o) provides for visible and remote indications of rectifier failure

(p) provides an output circuit breaker that closes its alarm terminals when it trips

(q) provides local (PB) and remote alarms if one of the following occurs:

(1) one of the input phases is lost

.(2) an SCR fails.

## 4. CONNECTING CIRCUITS

4.01 Connecting circuit information can be found in the AT&T Practice 802-445-002 Equipment Design Requirements and in the J85501 LINEAGE® Battery Plant Controller specification.

## 5. MANUFACTURING TESTING REQUIREMENTS

5.01 The manufacturing testing requirements are in the X-80065 specification.

## 6. TAKING EQUIPMENT OUT OF SERVICE

6.01 To take the rectifier out of service, operate circuit breaker CB1 to the OFF position and remove the ac input fuses and the plant control J2A connector cable assembly.

## SECTION IV - REASONS FOR REISSUE

### B. Changes in Apparatus

B.1

| Removed | Replaced By |
|---|---|
| CM 2 Circuit Module 208A - FS 1, App Fig 1 | CM 2 Circuit Module 208B - FS 1, App Fig 1 - D, E Options |

B.2

| Superseded | Superseded By |
|---|---|
| L1, L2 Inductor 1337A - FS 1, App Fig 1 - E Option | L1, L2 Inductor 1337B - FS 1, App Fig 1 - D Option |

B.3 Added

C21 thru C24 Capacitor, GE 97F5336FA, 10 µF - FS 1, App Fig 1 - D, E Options

R4 Resistor KS-20289 L2A, 16 kΩ - FS 1, App Fig 1 - Y, Z Options

R5, R7, R8, R9 Resistor KS-14603 L2AA, 820Ω - FS 1, App Fig 1 - C Option

R10 Resistor KS-20289 L2A, 16 kΩ - FS 1, App Fig 1 - Z Option

### D. Description of Changes

D.1 The Sheet Index table has been changed by the addition of Sheet G1.

D.2 The Option Index table has been changed by the addition of options C, D, and E.

D.3 In FS 1 and App Fig 1, the 208A code of circuit module CM 2 has been removed and replaced by the 208B code, which has been designated options D and E.

D.4 In FS 1 and App Fig 1, the 1337A code of inductors L1 and L2 has been

designated option E and has been superseded by code 1337B, which has been designated option D.

D.5 In FS 1 and App Fig 1, capacitors C1 through C6 and C7 through C12 have been designated option D [STANDARD (STD)] and option E [ADDITIONS AND MAINTENANCE ONLY (A&M ONLY)].

D.6 In FS 1 and App Fig 1, capacitors C21 through C24, GE 97F5336FA, 10 µF have been added and designated options D and E.

D.7 In FS 1 and App Fig 1, resistor R9 formerly was shown as R6.

D.8 Resistor R4 (16 kΩ) has been added in FS 1 and App Fig 1 and designated options I and Z.

D.9 On the drawing, FS 1 and App Fig 1 have been changed by the addition of resistors R5, R7, R8, and R9, which have been designated option C.

D.10 On the drawing, FS 1 and App Fig 1 have been changed by the addition of the KS-20289 L2A, 16 kΩ resistor R10, which has been designated option Z.

D.11 In FS 1 and App Fig 1, both resistors R4 and R10 have been designated options D and E.

D.12 In FS 2 and App Fig 2, the option letters associated with resistors R20 and R22 have been corrected (record change only).

D.13 Equipment Note 204 has been corrected and expanded.

D.14 Equipment Note 207 has been added on the drawing.

D.15 Equipment Note 208 has been added on the drawing.

D.16 Information Note 302 has been expanded.

D.17 Information Note 303 has been changed by the addition of options D and C (STD) and option E (A&M ONLY).

D.18 Information Note 304 has been expanded.

D.19 Information Note 305 has been changed to show the circuit breakers that can be used in place of fuses in the ac service panel.

D.20 Information Note 307 has corrected and expanded.

D.21 Information Note 309 has been corrected.

D.22 Information Note 312 has been expanded.

D.23 Information Note 313 has been added on the drawing.

D.24 Information Note 314 has been added on the drawing.

D.25 Information Note 315 has been added on the drawing.

D.26 Sheet Table A and CAD 1 through CAD 4 have been added on the drawing.

AT&T TECHNOLOGY SYSTEMS GROUP