



PARALLELED AF-400 *
AC ADJUSTABLE SPEED DRIVE

INSTALLATION

DESCRIPTION

START-UP

TROUBLESHOOTING

MAINTENANCE

* Trademark of General Electric Company, U.S.A.

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to General Electric Company.

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GENERAL

INTRODUCTION

This instruction manual is a supplement of the basic AF-400* AC Adjustable Speed Drive Instruction Book GEK-24982, and covers the higher power ratings obtained by paralleling. This manual provides the additional information beyond that furnished in GEK-24982 for check-out, operation and troubleshooting a paralleled drive. Any special purpose equipment, as requested on the order, will normally be covered in the schematic drawings included with this package. These instructions do not purport to cover all details or variations in the equipment nor to provide for every possible contingency to be met in connection with the installation, operation or maintenance. Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purpose, the matter should be referred to General Electric Company.

Handling and Installation

Refer to GEK-24982 for information on receiving, handling and storage, and for safety recommendations for this equipment.

Refer to GEK-24982 for information on location, mounting and wiring of this equipment.

DESCRIPTION

The description of the AF-400 drive in GEK-24982 is the basis for understanding the paralleled AF-400 drive. The only differences are the addition of input and output paralleling reactors and the provisions in the driver module for SCR firing and fault protection for the additional "slave" power unit. This is shown in the system block diagram of Figure 1, which differentiates between the identical power units, each enclosed in dotted lines for clarity, by labeling one the master power unit and the other the slave power unit. Following is a description and operating explanation of the areas which differ from that described in GEK-24982.

Power Modules and DC Link Filter

The converter modules, DC link filters, inverter modules, commutation power supplies, and protection and cooling are all identical with non-paralleled drives, except that two power units are required rather than one. Refer to the Description section of GEK-24982 for a description of each power unit. The two power units are furnished in separate cases and are connected

together only at their AC inputs and AC outputs, with no interconnection of their DC links, as shown in Figure 1.

Paralleling Reactors

Paralleling reactors are used to connect the two power units together at both their inputs and outputs, as shown in Figure 1, to force current sharing of the paralleled units. The same type of iron core reactor is used at both input and output, with one reactor being required in each phase. However, additional reactors in a series arrangement may be required in the power unit output phases depending on the minimum operating frequency required.

System Control

The system control and associated operator's devices will vary considerably depending on the drive application. Refer to the system elementary diagrams and instructions for description of your particular drive system.

Driver Module

The driver module operates the same as for a non-paralleled drive, except for providing additional SCR firing and fault protection for the slave power unit. This requires the addition of another Power Supply Card and a Paralleling Card. In addition, a second card receptacle for the optional Meter Card is provided to monitor slave unit operating signals.

All of the descriptive material in GEK-24982 covering the driver module applies to the parallel driver module. Also refer to the "Driver Notes" on the driver elementary diagram for detailed information on inputs, feedbacks, adjustments, readouts, etc. Following is description of the Paralleling Card which is used only in the paralleled driver module.

Paralleling Card

The Paralleling Card provides master-slave paralleling unbalance detection and slave fault detection, plus fault shutdown readout logic.

The inverter output current feedbacks from the master and slave power units are compared in each phase to detect output current unbalance. The DC link voltage feedbacks of the two power units are also compared to detect unbalance. If an unbalance condition occurs, a VCU light indication and fault logic output signal is

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Paralleling Card (continued)

produced. An unbalance sensitivity adjustment input normally programs the unbalance trip point as a function of frequency, so that intermittent output paralleling reactor saturation at low operating frequencies will not shut down the drive.

Rectification and steering diodes on this card enable the slave power unit output current feedback signals and inverter commutation current feedback signals to be combined with the master power unit signals. This provides current limit, inverse time overcurrent protection, and commutation current regulation for the entire drive.

When a converter input current feedback signal is provided, a converter instantaneous overcurrent trip circuit will produce a CIOC light indication and fault logic output signal at a current level of over 200% of rated.

The three AC supply phase voltages and the DC link voltage of the slave power unit are fed to this card through high impedance isolating resistors contained in the wire harness. The AC supply voltages are used to detect loss of one or more phases, or an AC undervoltage condition. This produces an LOP-S light indication and a fault logic readout signal. The AC supply undervoltage trip point is set at 60 to 70% of rated, but can be recalibrated to a lower voltage level by connecting a suitable resistor to card mounting posts.

Protection against loss or undervoltage of the additional power supply used for slave power unit SCR firing, is provided. If the +20 volt control voltage goes below approximately 18 volts, a CUV-S light indication and fault logic output signal is produced.

The fault logic output signal from this card is used to shut down the entire drive using the fault shutdown control contained in the other driver cards.

START-UP AND CHECK-OUT

All of the information furnished in this section of GEK-24982 applies to the start-up and check-out of a paralleled drive. Particular attention should be paid to the testing safety precautions and all warning and caution notes contained in this section of GEK-24982. The test equipment required is listed, and a power-off continuity test is given in GEK-24982

Driver Selections

All of the selection information in GEK-24982 applies to the paralleled driver. Observe all warning and caution notes. An additional selection possibility is given below:

AC Supply Undervoltage Trip Recalibration on Paralleling Card (193X384___G01)

The normal undervoltage trip point is set at 60 to 70% of rated AC supply voltage. If a lower trip level is desired, a ½ watt, 1% tolerance resistor can be soldered between the X and Y posts provided on the card. A 274K ohm resistor will cause the trip level to be from 50 to 60% of rated, and a 121K ohm resistor will produce an undervoltage trip level of 40 to 50% of rated AC supply voltage. It is recommended that the minimum resistance used be no less than 82.5K (35 to 45% trip level).

Inverter Phase Module Selection

A jumper selection on the current Feedback Card (193X382___), which is mounted on the front of each inverter phase module, provides the means to calibrate the inverter current feedback signal to the drive current rating. The card group number and jumper selection should be the same on all six inverter phase modules in the two paralleled power units. The jumper selection should be made using the table on the phase module elementary diagram or Table 2 of the Current Feedback Card printed circuit diagram. Use the nominal inverter RMS amps given in the table that is closest to one-half the total drive nameplate output current rating to check for the correct Current Feedback card group number and jumper selection. Incorrect jumper selection will affect the current limit and overcurrent shutdown levels.

Start-up Procedures

Perform the following step by step procedure in the sequence given. Although this procedure is essentially the same as that contained in the Start-up Procedure section of GEK-24982, it is repeated here with clarifying instructions for the paralleled configuration. If during this procedure a problem is encountered, refer to the Troubleshooting Section of this manual.

1. Before applying AC supply power to the drive, verify that it is the proper voltage, phase and frequency as denoted on the equipment data nameplate.

Start-up Procedure

2. Disconnect the three phase output cables to the motor from the drive terminals T1, T2 and T3, or deactivate the output contactor if one is provided.
3. Disconnect control wire harness plugs APL-M, BPL-M, CPL-M, DPL-M, APL-S, BPL-S, CPL-S and DPL-S from their receptacles at the bottom of the driver, Do not disconnect the EPL-M, and EPL-S plugs.
4. Using a volt-ohmmeter selected to the X1 ohms, scale, check that no short exists between DC link buses P1 and P2 in either power unit. Also check the six AC supply power fuses, all fuses on both commutation power supply modules, and all control power fuses to confirm that they are not blown.
5. Apply AC power to the drive and check that the "Power On" light indicates.
6. Check the driver card indicating lights. Only the IF inverter frequency light should be indicating and it should be blinking at a low frequency. If the LOP-S loss of phase light is indicating, check that driver wire harness EPL-S containing the slave unit AC supply input is plugged into the driver, and that the correct voltage is present on all three AC supply power terminals L1, L2 and L3 in the slave power unit. If the PS/LOP phase sequence/loss of phase light is indicating, check that driver wire harness EPL-M containing the master unit AC supply input is plugged into the driver, and that the correct voltage is present on all three AC supply power terminals L1, L2 and L3 in the master power unit. If these are correct, the phase sequence is wrong. Disconnect the AC power, interchange any two input power cables, and repeat steps 5 and 6.
7. Check that blower and fan rotation is correct and that they are operating properly and producing air flow through the power modules in both power units. Refer to the sketches below and to labels on the air distribution chamber for correct operation.



CCW Blower



CW Blower

- If blower rotation is incorrect, interchange any two AC supply leads to the blower motor. If no rotation occurs, check blower fuses on the commutation power supply modules.
8. Set the driver reference input at zero. Check for zero reference voltage by selecting Meter Card switch position 2, or measure the voltage between driver terminal board points TB16 and TB8.
 9. Remove AC power to the drive, connect the DPL-M and DPL-S wire harness plugs to the driver (which control the converter modules), and reapply AC power.
 10. Check the driver lights again. Only the IF light should be on, blinking at a low frequency. Run through the Meter Card selector switch positions 1 through 18 and compare these readings with the readings shown on the driver label mounted on the inside of the power unit enclosure door. This label also is sheet 4 of the driver connection diagram. Also place the Meter Card in the "L" receptacle and check switch positions 4, 16, 17 and 18. The readings taken should compare with those given for the "Off Condition" (except for positions 7, 8 and 9 which are meaningless since master and slave wire harnesses APL, BPL, and CPL are not connected).

If a Meter Card is not available, use a volt-ohmmeter to check REF (TB16 to TB8), FVRO, (TB22 to TB8) and the converter output voltages between P1 and P2 in both power units. The P1 to P2 voltages should not exceed 30 volts DC for 230 volt AC drives or 60 volts DC for 460 volt AC drives, before the inverter is started
 11. Press the drive "Start" pushbutton. Check driver lights and Meter Card position 4, or P1 to P2 voltage for both power units. They should be the same as for step 10.
 12. Increase reference input to the driver slowly until both power unit P11 to P2 voltages reach half of rated DC link voltage (150 volts DC for 230 volt AC drives and 300 volts DC for 460 volt AC drives). The Meter Card positions 2 and 4 should both read 7.5 (7.5 volts between TB16 and TB8).

Start-up Procedures (continued)

CAUTION

WHEN THE DRIVE HAS NOT BEEN OPERATED FOR 6 MONTHS OR MORE, THE ELECTROLYTIC CAPACITORS IN THE FILTER CAPACITOR ASSEMBLY(S) MUST BE REFORMED, FOLLOW THE PROCEDURE IN STEP 13 IF FORMING IS REQUIRED, OR SKIP STEP 13 IF NOT REQUIRED.

- 13. If capacitor forming is required, increase the P11 to P2 DC link voltages in the following steps pausing for 5 minutes at each step in the forming process.

Operating Voltage Level		Operating Time
230V AC Drive	460V AC Drive	
200V DC	400V DC	5 Min.
250V DC	500V DC	5 Min.
300V DC	600V DC	5 Min.

(or at maximum reference)

During each step of the forming process, check the voltage in both power units at the Q or midpoint of the seriesed capacitor asm(s). (460V AC drives only). The difference between the P11 to Q and Q to P2 voltage readings should not exceed 5% of the P11 to P2 voltage. For example, at a P11 to P2 voltage of 600 volts, the difference between the P11 to Q and Q to P2 voltages should not exceed 30 volts. If the Q midpoint varies more than 5% refer to the Troubleshooting Section of this manual. In no case should more than 400V DC be applied across a single capacitor.

- 14. Press the drive "Stop" pushbutton and decrease the driver reference to zero. Both the master and slave power unit DC link voltages between P11 to P2 (Meter position 4) should discharge down to less than 10% of maximum in about 30 seconds.
- 15. Remove AC supply power to the drive, connect the APL-M, BPL-M, CPL-M, APL-S, BPL-S and CPL-S wire harness plugs to the driver (which control the inverter phase modules), and reapply AC power.
- 16. With reference input to the driver at zero, press the drive "Start" pushbutton and check the driver card lights. Run through the Meter Card switch positions 1 through 18 in the receptacle K position, and switch positions 4, 7, 8, 9, 16

17 and 18 in the receptacle L positions and compare these readings with those given on the driver label for "0 Ref 0 Load".

If the Meter card is not available, use an oscilloscope to check the inverter commutation current feedback signals, using the driver SEL1 and SEL2 back plane diagnostic probes which are color coded black and violet respectively. Connect these probes to terminals 32, 31 and 30 of both driver receptacles K and L. Connect the oscilloscope leads to driver terminal board points TB39 (SEL1) or TB40 (SEL2) and TB34 (COM). The peak voltage level of the higher commutation pulse in each phase should agree with the values given on the driver label, and the waveshapes should appear as shown in Figure 6 of GEK-24982. The positive commutation current pulse is attenuated on the Current Feedback Card.

- 17. Slowly increase the driver reference input up to maximum while checking the inverter commutation current peak level of each phase, by means of selector positions 16, 17 and 18 on the Meter Card, or by means of SEL1 and SEL2 and an oscilloscope as described in step 16. The commutation current peaks should increase somewhat, as shown on the driver label, but should remain in the ranges shown.

Also check that the base frequency is correct for your motor drive system and readjust if necessary. See Base Frequency in the Adjustments section for checking and adjustment instructions.

- 18. Press the drive "Stop" pushbutton and reduce the driver reference to zero. The inverter should decelerate down to about one-fourth of rated frequency and voltage, and then stop.
- 19. Remove the AC power to the drive. Reconnect the three phase output cables to drive terminals T1, T2 and T3, or reactivate the output contactor, to connect the motor(s) to the inverter.
- 20. Reapply AC power to the drive. With the reference input to the driver at zero, press the drive "Start" pushbutton and slowly bring the reference up to half rated. Run through the Meter Card positions 2 through 18 (receptacle K) and 4, 7, 8, 9, 16, 17, and 18 (receptacle L) and compare these readings with those given on the driver label for "1/2 Ref., 1/2 Load". If the motor loading is different than one-half of rated,

Start-up Procedure (continued)

20. (continued)

the position 7, 8, and 9 readings will be different from those given, but they should all be balanced within $\pm 10\%$ of each other.

If any Meter reading discrepancies exceeding 5% of full scale (20.0) from those values given in the drive table are found, proceed to the Adjustments Section.

If a Meter Card is not available, use a clamp-on ammeter to read the inverter AC output current in each phase of both power units to check that they are balanced. Also check the AC supply input currents to the converter in each power unit to check that they are balanced. Current balance should be within $\pm 10\%$.

21. Slowly increase the driver reference up to the maximum of 15 volts. Run through the Meter Card position 2 through 18 (receptacle K) and 4, 7, 8, 9, 16, 17 and 18 (receptacle L) and compare these readings with those given on the driver label for "1 Ref., 1 Load". Again position 7, 8 and 9 readings will depend on the actual motor load.

ADJUSTMENTS

Refer to the Adjustment section of GEK-24982 for information on driver adjustments. All of this information also pertains to paralleled drives, except that the setting of the minimum frequency is adjusted as follows:

MINF – Minimum Frequency

The minimum frequency of a paralleled drive is normally set higher than a non-paralleled drive in order to prevent saturation of the paralleling reactors. Additional output paralleling reactors in series may be furnished to allow operation at lower frequencies. The MINF potentiometer should be set somewhere between the midpoint and the clockwise end, depending on output reactor capabilities, for best operation.

TROUBLESHOOTING

Refer to the Troubleshooting section of GEK-24982 for information and procedures for troubleshooting this drive, since all of the information given also per-

tains to paralleled drives. Additional information is provided in this manual covering fault indication and troubleshooting approaches that pertain only to paralleled drives. Note especially the part of this section entitled "Single Power Unit Operation".

Particular attention should be paid to the testing safety precautions and all warning and caution notes contained in the Troubleshooting section of GEK-24982. The test equipment required is also listed.

Fault Indication and Lights

Refer to GEK-24982 for instructions on usage of fault indication information in general and the Fault Indicating Light listing. This listing of possible fault indications and associated troubleshooting tips is also applicable to paralleled drives, but with the following clarifications:

CUV light on Inverter Card – This light indicates an undervoltage condition of the master Power Supply Card feeding all of the driver cards and supplying SCR firing power to the master power unit.

PS/LOP light on Converter Card – This light indicates a wrong phase sequence or a loss of one or more AC supply phases to the master power unit. It will indicate blown AC supply fuses in the master power unit or blown fuses in the commutating power supply of the master power unit.

The following additional fault indicating light listing covers the four fault lights contained on the Paralleling Card plus combinations of fault light indications.

CUV-S only – This indicates a slave control undervoltage trip which produces an inverter fault shutdown. Refer to Driver Troubleshooting in this Section.

LOP-S only – This indicates the presence of or a shutdown caused by the loss of one or more AC supply phases, or an AC supply undervoltage, to the slave power unit. Disconnect the AC power and check the supply fuses to the slave power unit. Also check the FUL1, FUL2 and FUL3 control fuses on the commutation power supply in the slave power unit. Refer to commutation Power Supply Troubleshooting if any of these fuses are blown.

PS/LOP and LOP-S – this indicates the loss of one or more AC supply phases, or an AC supply undervoltage, to both master and slave power units. Check the AC supply fuses and/or circuit breaker, especially if the driver is supplied from another power source.

Fault Indication and Lights (continued)

CUV, CUV-S, IFT, PS/LOP and LOP-S – This indicates a combination control and power under-voltage shutdown. Check the AC supply for outage problems

VCU only – This indicates a shutdown caused by an output voltage and/or output current unbalance between the master and slave power units. (The amount of current unbalance to cause a shutdown occurs only if enough voltage unbalance exists to cause paralleling reactor saturation). Check for excessive voltage boost, or too low a minimum frequency adjustment. Refer to Driver Troubleshooting in this section. Check for converter, inverter or commutation power supply SCR misfiring in either power unit. If shutdown occurs when starting or operating at very low speeds, check for shorted SCR's in the inverter modules or commutation power supplies, or shorted capacitors or cables in the DC link filters. Refer to Commutation Power Supply Troubleshooting, Inverter Module Troubleshooting, Converter Module Troubleshooting and DC Link Filter Troubleshooting in this section. Also check for motor overloading, locked rotor, motor single phasing, or shorts or grounds in the motor cables or motor. Finally, check for motor being switched on to the inverter at other than minimum voltage and frequency or synchronized conditions.

VCU and ITOC – This indicates an inverter output overcurrent shutdown due to current levels over 175% of rated power unit current in one or both power units. Check for motor overloading, locked rotor, motor single phasing, or shorts or grounds in the motor cables or motor. Also check for motor being switched on to the inverter at other than minimum voltage and frequency or synchronized condition. If shutdown occurs when starting or operating below 25% of rated speed, check for shorted SCR's in the modules or commutation power supplies, and shorted or grounded output cables. Refer to Commutation Power Supply Troubleshooting and Inverter Module Troubleshooting in this section.

VCU, ITOC and IFT – This indicates an inverter output overcurrent which is excessive enough to also cause an inverter fault. Check for motor jam-ups, locked rotor, motor single phasing, or shorts or grounds in the inverter output cables, motor cables or motor. Also check for motor being switched on to the inverter at other than minimum voltage and frequency or synchronized condition. Finally check for shorted SCR's in the inverter modules or commutation power supplies. Refer to Commutation Power Supply Troubleshooting and Inverter Module Troubleshooting in this section.

VCU, COC and IFT (and ITOC) – This indicates a commutation overcurrent (and motor overcurrent) trip which produces an inverter fault shutdown. Check for drive overloading at or near full, speed operation. Also refer to page 29 of the Driver Troubleshooting notes in GEK-24982.

CIOC only or CIOC and VCU (if converter input current sensing is provided) – This indicates a converter input overcurrent shutdown due to current input current levels over 200% of rated power unit input current in one or both power units. Check for shorted SCR's in the converter modules, or shorted capacitors or cables in the DC link filters. Also check for shorted SCR's in the inverter modules. Refer to the Inverter Module Troubleshooting, Converter Module Troubleshooting and DC Link Filter Troubleshooting in this section.

CIOC, VCU and PS/LOP – This indicates a converter input overcurrent shutdown plus probable failure of one or more AC supply fuses in the master power unit. Disconnect the AC power and check the AC supply fuses to the master power unit. Also check for shorted SCR's in the converter module of the master power unit. Refer to Converter Module Troubleshooting in this section.

CIOC, VCU and LOP-S – This indicates a converter input overcurrent shutdown plus probable failure of one or more AC supply fuses in the slave power unit. Disconnect the AC power and check the AC supply fuses to the slave power unit. Also check for shorted SCR's in the converter module of the slave power unit. Refer to Converter Module Troubleshooting in this section.

CIOC, ITOC, VCU and IFT – This indicates both a converter input and inverter output overcurrent which is excessive enough to also cause an inverter fault. Check for motor jam-ups, locked rotor, or shorts or grounds in the inverter output cables, motor cables or motor. Also check for motor being switched on to the inverter at other than minimum voltage and frequency or synchronized condition. Finally check for shorted SCRs in the converter modules, inverter modules, or commutation power supplies. Refer to Commutation Power Supply Troubleshooting, Inverter Module Troubleshooting and Converter Module Troubleshooting in this section.

Driver Troubleshooting

The driver used in paralleled power units drives is nearly identical in function to the driver used in non-paralleled drives. All of the functions shown in the block diagram of Figure 5 in GEK-24982 are included in the paralleled driver. The only differences are the

Driver Troubleshooting (continued)

addition of another Power Supply card to furnish SCR firing power to the slave power unit, and the additional fault detection and indication functions provided on the Paralleling Card. Therefore, all of the driver troubleshooting notes given in GEK-24982 applies to the paralleled driver. The following information is provided to either clarify the GEK-24982 information for paralleled driver usage, or to add to it.

The optional Meter Card is an important troubleshooting tool. When inserted in its normal receptacle K location, it provides 19 signal selections as explained in GEK-24982. However, in this location, positions 4, 5, 7, 8, 9, 16, 17 and 18 relate to feedback signals from the master power unit. To measure these same feedback signals for the slave power unit, the Meter Card must be placed in the receptacle L location. (Note, however, that there is no CVF position 5 feedback for the slave power unit location.) Therefore, in the driver troubleshooting notes of GEK-24982, the receptacle K location of the Meter Card is implied, except that when switch position 4, 7, 8, 9, 16, 17 or 18 readings are called for, they should be taken in both the receptacle K and L positions of the Meter Card.

When using the back plane selector probes, there are a few sensitive card terminals which should be avoided when the drive is operating with a motor, since connection of an instrument will cause changes in drive output or could cause a false fault trip shutdown. The following sensitive terminals should be added to those listed in GEK-24982.

- Receptacle M
Paralleling Card
- term. 9 - LVP-S
 - term. 7 - LVN-S
 - term. 8 - L1S-S
 - term. 6 - L2S-S
 - term. 5 - L3S-S

When reference is made in the troubleshooting notes of GEK-24982 to driver wire harnesses APL, BPL, CPL, DPL, and EPL, there will be two of each for the paralleled driver, with -M and -S suffixes to denote master and slave power unit designations. For example, if the notes call for wire harness DPL to be disconnected at the driver, both DPL-M and DPL-S should be disconnected. In addition, when references is made in the GEK-24982 troubleshooting notes to a particular power module, there will be both a master and slave power module to be checked.

The following driver troubleshooting notes, for paralleled drives only, are added to those given in GEK-24982 under the following heading:

B. Drive Shuts Down, or Will Not Start

10. CUV-S (and IFT) Fault lights on.

- a) Check the voltage of the slave +20 volt control power between TB61 and TB62. A CUV-S trip will occur if this voltage falls below 18 volts. If it is near zero, check the fuse FU1 on the slave Power Supply Card in location Q (right hand end of card rack).
- b) Check the input and output voltages of the driver transformer. The voltage between TB56 and TB57 should be between 105 and 125 volts AC and the voltage between TB58 and TB59 should be between 22.5 and 29 volts AC.
- c) If the problem cannot be found, replace the slave Power Supply Card and check operation.

11. VCU Fault Light On

- a) Check voltage boost VB potentiometer adjustment. Use of voltage boost if motor load is less than 25% of rated at low speeds will cause high motor current peaks leading to paralleling reactor saturation. Voltage boost greater than required for higher loads can also produce paralleling reactor saturation at low speeds. (Paralleling reactor saturation will allow a current unbalance causing a VCU shutdown.) Decrease the voltage boost by adjusting the VB potentiometer in the counterclockwise direction. Refer to the Adjustments Section of GEK-24982.
- b) Check minimum frequency MINF potentiometer adjustment. Too low a minimum operating frequency can cause paralleling reactor saturation, with subsequent current unbalance. Increase the minimum frequency by adjusting the MINF potentiometer in

B. (continued)

11. (continued)

b) (continued)

the clockwise direction. Refer to the Adjustments Section of this manual.

- c) If the VCU fault light cannot be reset check that wire harnesses APL-M and -S, BPL-M and -S and CPL-M and -S are all properly plugged in both at the driver and at the six inverter power modules. Also check that the wires are connected to the Current Feedback Card terminals K3 and K4 on all six inverter power modules. Opening of any motor current feed-back lead will produce a VCU indication.

Commutation Power Supply Troubleshooting

The troubleshooting notes contained in GEK-24982 apply to this module in both the master and slave power unit locations. For paralleled drives, it should be noted that FUL1, FUL2 and FUL3 fuses in the master power unit module should be checked if the PS/LOP light in the driver is indicating and these same fuses in the slave power unit module should be checked if the LOP-S light is indicating.

Inverter Module Troubleshooting

The troubleshooting notes contained in GEK-24982 apply to the six modules located in the master and slave power units. For paralleled drives, the inverter phase module operational test, involving interruption of the DC link between P1 and P11, is still applicable as long as the DC links in both the master and slave power units are opened. However, it is not possible in the paralleled configuration to operate just part of the inverter modules by disconnecting some of the APL-M and -S, BPL-M and -S or CPL-M and -S wire harness plugs. If this is tried, the Paralleling Card will produce erroneous fault signals. In order to break down the system to operate just one or two modules at one time, it is first necessary to operate either the master or slave power unit individually. For an explanation of this procedure, refer to Single Power Unit Operation later in this section.

Converter Module Troubleshooting

The troubleshooting notes contained in GEK-24982 apply to this module in both the master and slave power unit locations. Also refer to the Single Power Unit Operation later in this section for information on operating only one of the paralleled modules.

DC Link Filter Troubleshooting

The troubleshooting notes contained in GEK-24982 apply to this assembly in both the master and slave power unit locations. Also refer to Single Power Unit Operation later in this section.

Single Power Unit Operation

In troubleshooting a problem which is difficult to find, it is often helpful to operate only a portion of the drive in order to determine where the problem originates. This drive is designed such that either power unit of the paralleled drive may be operated as a single unit.

To operate the master power unit only, do the following:

1. Disconnect all five plugs of the slave unit wire harnesses APL-S, BPL-S, CPL-S, DPL-S, and EPL-S at the driver.
2. Remove the Paralleling Card and the slave Power Supply Card from receptacles M and Q of the driver.
3. Disconnect the three output cables T1, T2 and T3 of the slave power unit between that power unit and the output paralleling reactors.
4. Either disconnect the motor so that the drive can be operated without the motor, or disconnect or reduce the load from the motor, or operate in a range so that no more than half rated load is obtained so that the single power unit will not be overloaded.

To operate the slave power unit only, do the following:

1. Disconnect all five plugs of the master unit wire harnesses APL-M, BPL-M, CPL-M, DPL-M and EPL-M at the driver.
2. Disconnect all five plugs of the slave unit wire harnesses APL-S, BPL-S, CPL-S, DPL-S and EPL-S at the driver and plug them into their

Single Power Unit Operation (continued)

2. (continued)

like master unit plug receptacle, so that the slave unit now will be controlled as if it were the master unit.

3. Remove the Paralleling Card and the slave Power Supply Card from receptacles M and Q of the driver.

4. Disconnect the three output cables T1, T2 and T3 of the master power unit between that power unit and the output paralleling reactors.

5. Either disconnect the motor so that the drive can be operated without the motor, or disconnect or reduce the load from the motor, or operate in a range so that no more than half rated load is obtained so that the single power unit will not be overloaded.

After the above is accomplished, the single power unit may be operated the same as a non-paralleled drive. The current limit and overcurrent trip levels are now equivalent to the single power unit current rating rather than the paralleled rating. Troubleshooting procedures are now exactly as described in the Troubleshooting section of GEK-24982. Just one Inverter Phase Module may be operated by following the information given in Inverter Phase Module Operational Test under Inverter Module Troubleshooting of GEK-24982.

Miscellaneous Troubleshooting Checks

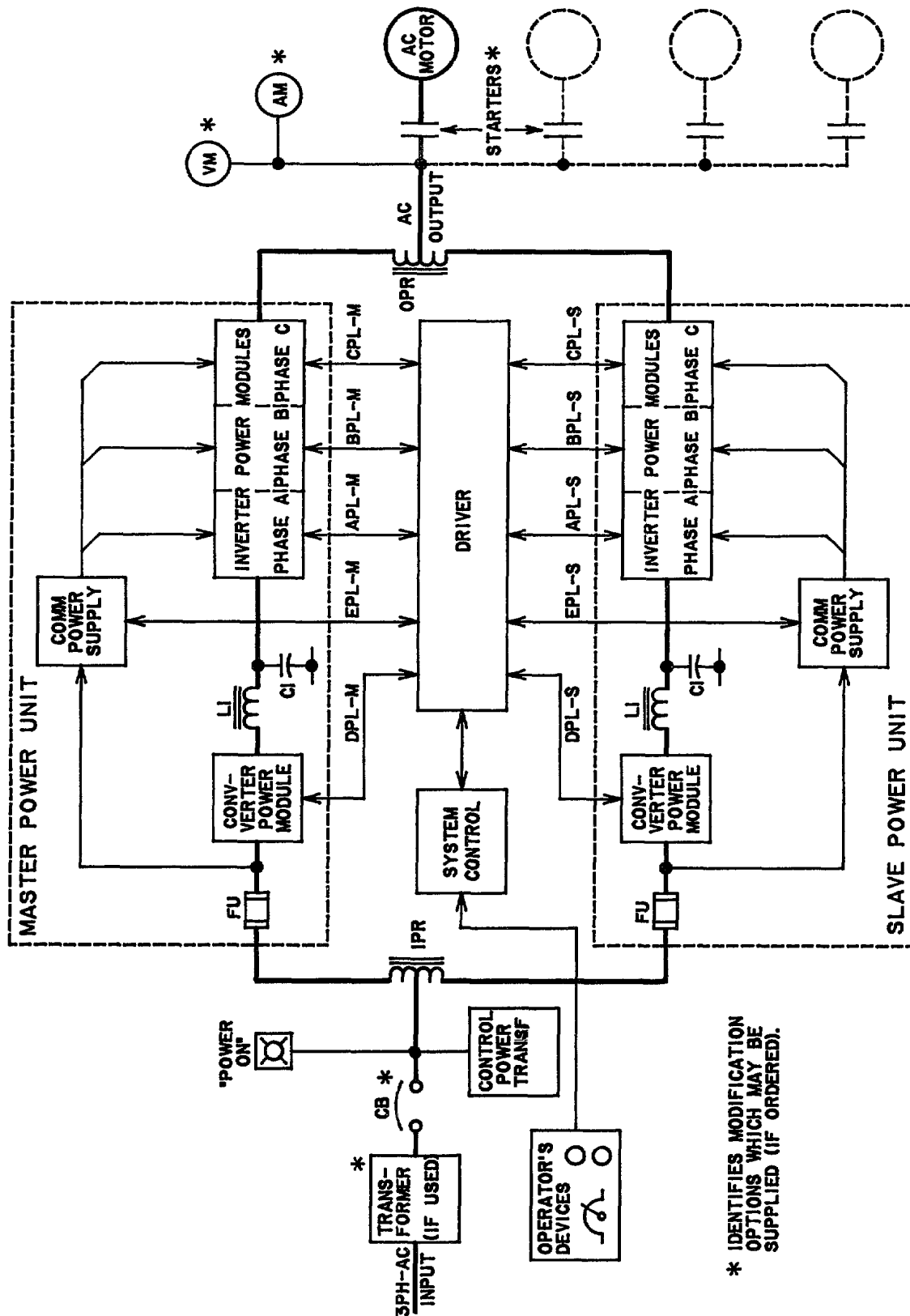
Refer to this heading in the Troubleshooting section of GEK-24982 for a listing of additional directions of investigation.

MAINTENANCE AND REPAIR

Paralleled drives consist of two standard single power unit.

<u>Paralleled Drive Rating</u>	<u>Single Power Unit Rating</u>
500 KVA	300 KVA
600 KVA	300 KVA
700 KVA	400 KVA
800 KVA	400 KVA

The maintenance and repair of these units is accomplished exactly as described in the Maintenance and Repair section of GEK-24982, keeping the above rating information in mind.



* IDENTIFIES MODIFICATION
OPTIONS WHICH MAY BE
SUPPLIED (IF ORDERED).

FIGURE 1. PARALLELED AF-400 SYSTEM BLOCK DIAGRAM

**GENERAL ELECTRIC COMPANY – DIRECT CURRENT MOTOR & GENERATOR DEPARTMENT
ERIE, PENNSYLVANIA 16531**

GENERAL  ELECTRIC

GEK-24983 (7-78) 3M(F)