

CHAPTER 9

SERIES 9000 ADJUSTABLE  
FREQUENCY AC DRIVE

DESCRIPTION AND OPERATING  
INSTRUCTIONS

1. SAFETY WARNING

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# INSTRUCTIONS FOR SERIES 9000 Adjustable Frequency AC Drive

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INPUT:	7.5 A	460 V	3 Phase	50/60 Hz
OUTPUT:	9 A, Max.	460 V, Max.	3 Phase	3000 Hz, Max.
MODEL NO.: 72187G1	SERIAL NO.: 219403			
TYPE: 94005H	6.8 KVA/HP AC Drive			

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For technical assistance call or write to:

SHARNOA COMPUTERIZED MACHINES TEL- AVIV LTD.  
25, A. Altalef Street  
Yehud 56235, ISRAEL  
Phone: 03 - 5365999  
Fax: 03 - 5364824

## 1. SAFETY WARNING

### WARNING

Voltage levels exist on this drive which can cause serious or fatal injury. Good electrical practices, the applicable electrical codes and the instructions of this manual must be followed.

Do not touch electrical parts until main input power has been turned off and the red CHARGE light in the upper left corner of the drive is off. The CHARGE light will stay on for a while after the power is turned off, indicating that the capacitors are still charged with high, lethal voltage. The main board (20030) contains high voltages in an area clearly marked.

Installation and other work on the drive should only be done by qualified electrical maintenance personnel familiar with high voltages and electrical hazards.

## 2. STORAGE

If the drive is stored before installation, a clean and dry location is required. Oil, water, dust and dirt should not enter the drive. Locations must be avoided where moisture and condensation occur.

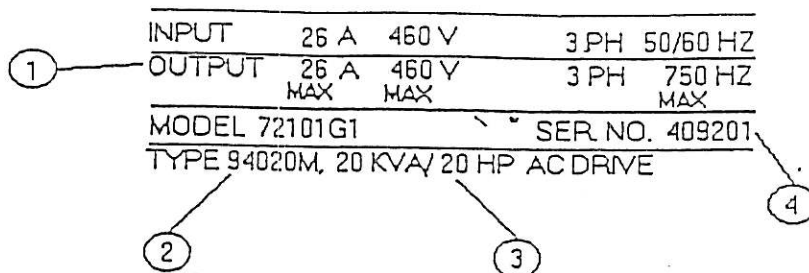
## 3. DESCRIPTION OF DRIVE

The Series 9000 of adjustable frequency AC drives are high performance, pulse width modulated design drives using IGBTs. They are available for low, medium and high motor frequencies and can drive virtually any AC motor. The control is fully digital with very high speed resolution and accuracy. A four line, 80 character LCD display permits simple programming and message display in plain English. The drive is electrically short circuit protected, has input fuses included and has a meter function to display speed, load, current and voltages. A diagnostic (test) screen shows the cause of trips and a help screen displays the corrective action required. Dynamic braking is standard (typically 10%). A large number of drive parameters and features are programmable, providing unusual flexibility for many applications.

The drive consists of the power section, a main board (20030) including all control and IGBT driver functions, a power supply board (20031) and a digital operator station, all in one drive package. The digital operator station can be furnished separately, if desired.

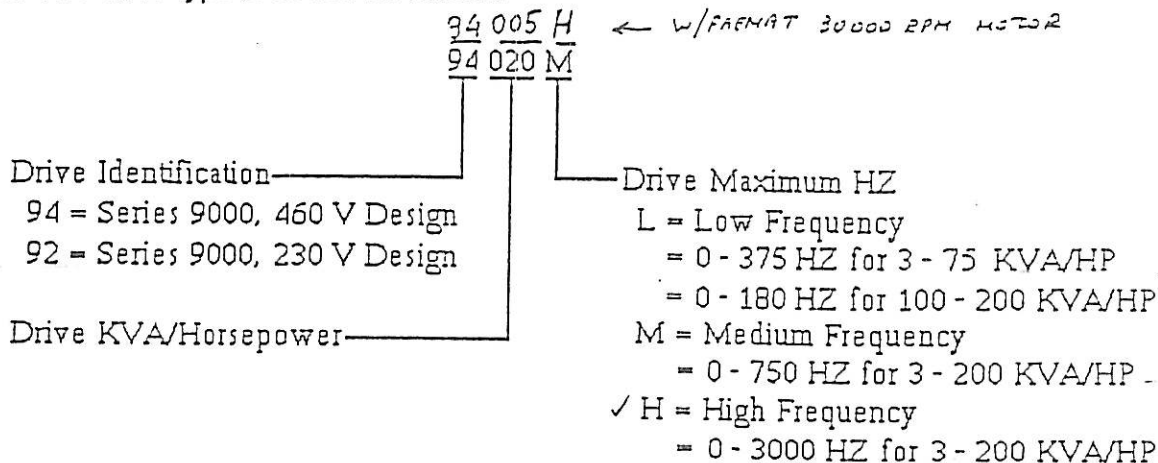
#### 4. DRIVE NAMEPLATE AND IDENTIFICATION

The drive nameplate is located on the outside of the standard drive enclosure. Below is a typical nameplate:



1. The output data shows the maximum limits the drive is designed for. It is important that continuous operation does not exceed maximum output capability. It does not show the maximum programmed limits. Example: A drive with the above nameplate, capable of 26A (20 HP), 460 V, 750 HZ maximum, could be programmed for 14 A (10 HP), 380 V, 500 HZ maximum. The actually programmed output can be seen on the SET-UP BASIC PG2 screen.

2. The drive type is coded as follows:



3. The drive power rating is given here.

4. Serial number - have available when calling for technical assistance.

#### 5. INSTALLATION

For installation of Series 9000 drives, please refer to the following drawings in section 21:

- Connection Diagram
- Power Circuit Diagram
- Installation (mounting)
- Power and Ground Wiring
- Control Wiring

## 6 START-UP

Before applying power, check:

- a) Were installation instructions of section 5 followed?
- b) Is control and power wiring completed as shown in the connection diagram in section 21, DRAWINGS?
- c) Does the line voltage agree with the input voltage shown on the nameplate and front page of this manual? Wrong line voltage may cause drive damage.\*
- d) Most drives were set-up by the factory prior to shipment for the customers application. Look at the drive set-up list of section 21 ("shipped" column) and verify that the factory programmed motor horsepower, voltage and frequency match the nameplate of the motor connected to the drive. Also check the other parameters in this column if they are required. If all parameters are programmed correctly, proceed with section 7, OPERATION. If not, go to section 11 and 12 and set the drive up for the application.




\* If the Multiple Input Voltages option is purchased, check the programmed input voltage in the set-up list of section 21.

## 7. OPERATION

When it is sure that the drive set-up matches the motor nameplate, the drive can be operated as follows:

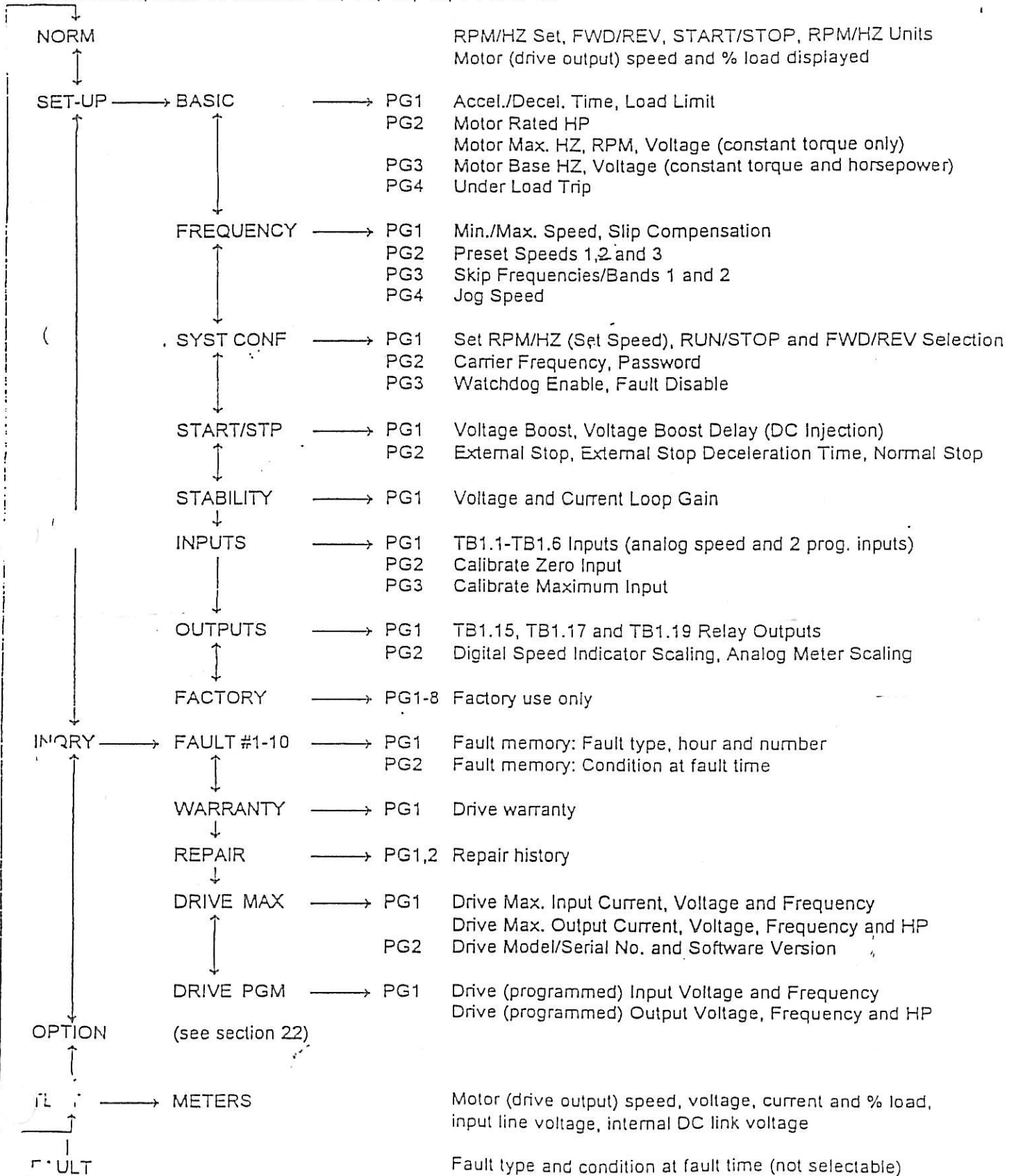
1. Apply power -NORM (normal) screen is displayed
2. Set motor RPM -Press number keys to select desired motor RPM  
-Press ENTER
3. Run motor -Press START key  
-RUN is displayed  
-Motor accelerates to set RPM
4. Stop motor -Press STOP key  
-Motor decelerates to a stop  
-STOP is displayed

If the reverse direction of rotation is desired:



5. Reverse rotation -Press  twice to place the cursor on the FWD/REV field  
-Press  or  to set desired direction  
-If the drive is running, the motor decelerates, changes direction and accelerates to set RPM in the opposite direction  
-Press NORMAL to remove cursor

## 8 MENU QUICK REFERENCE






Below is an abbreviated tree structure of the digital operator station menu. For more detailed information, refer to sections 10, 11, 12, 13, 14 and 15.

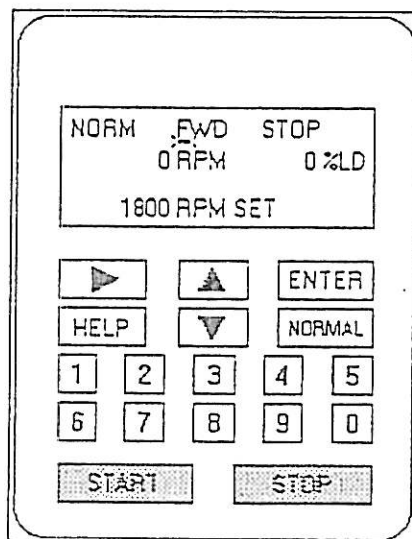



## 9. KEYPAD FUNCTIONS AND PROGRAMMING




All operations of the drive including normal operation, standard and option set-up, inquiries, and test functions can be done from the keypad on the digital operator station. Information is displayed and parameters are entered by moving a cursor (flashing  for cursor movement or  for entering parameters) to the proper location (field) in the menu. Once at the proper field, parameters can be programmed by entering the appropriate number or choosing the correct selection. Section 8 shows the entire menu in abbreviated form.





The keypad has 18 keys which function in the following way:


The  (field) key is used to activate the cursor and move the cursor to successive fields in a screen. For example, if the  key is pressed twice (at the NORM screen), the first press will activate the cursor and the second press will move the cursor to the FWD/REV field on NORM screen. Additionally, the  key can be used as an "escape" key when entering data. If a field is being entered with new data (i.e. cursor as ) , pressing the  key restores the original data and passes the cursor to the next field.





The  keys are used in three ways:

Cursor movement: Pressing the  keys activates the cursor and then moves the cursor vertically through the menu. For example, if the  key is pressed twice (at the NORM screen), the first press will activate the cursor and the second press will change the display to the SET-UP screen. This can also be done by pressing the  key 5 times; once to activate the cursor and 4 times to move upward through the menu.

Data entry: Once at the proper parameter field, pressing the  keys changes the cursor (from  to ) and increments/decrements the value of that parameter. However,  are used primarily to change non-numeric values. To accept the new value, ENTER must be pressed.

Changing Motor Speed: Motor speed be changed by holding down the  keys in the NORM screen at the RPM/HZ set field (section 10.1).

The number keys (0 - 9) are used to enter numeric data once the cursor is at the proper parameter field.

The ENTER key is used to accept data that is being changed (cursor is ) and returns the cursor back to its movable form, . ENTER is also used to exit the Help Menu.

Pressing the HELP key will give a menu of available help. If the digital operator station is in the FAULT or INQRY FAULT screens, the proper corrective action (diagnostic) is given.

Pressing the NORMAL key will display the opening (NORM) screen. The cursor will be removed. This key does not work in HELP or FAULT screens.

Pressing the STOP key will cause the motor to ramp to a stop.

Pressing the START key will cause the drive to go into RUN and ramp up to set speed. This key works in the NORM and TEST screens only.

NOTE: The STOP and START keys on the keypad work only if the RUN/STOP parameter (refer to section 12.8) is set to KEYPAD.

## 10. NORMAL SCREEN

When power is first applied to the drive, the NORM (normal) screen is displayed. Set speed, forward/reverse, speed display units and RUN/STOP can be controlled from the NORM screen. The actual motor speed and motor load are indicated on the second line of the screen. Refer to FIGURE 1.

### 10.1 RPM/HZ Set

Menu Location: NORM

RPM/HZ Set, or speed reference, is the output frequency that the drive accelerates to when started (RT key pressed). RPM/HZ Set can be entered by typing the desired number or by use of the ▲/▼ keys (it is not necessary to move the cursor to this field first if the number keys are used). The range is 0 to Motor Top RPM/HZ (see section 11).

### 10.2 Forward/Reverse

Menu Location: NORM

Forward/Reverse determines the direction of rotation of the motor. Use the ▲/▼ keys to change this field. If not satisfied with the direction that corresponds with forward (or reverse), switch any two of the three motor wires (phases).

### 10.3 START/STOP

Menu Location: NORM

The drive is stopped (at any time) by pressing the STOP key. To start the drive, press START and the drive will accelerate to the set speed. The START key works in the NORM screen only.

### 10.4 RPM/HZ Units

Menu Location: NORM

The RPM/HZ Set parameter and actual speed can be displayed in RPM, KRPM (2 settings) or HZ (2 settings) by changing this field with the ▲/▼ keys.

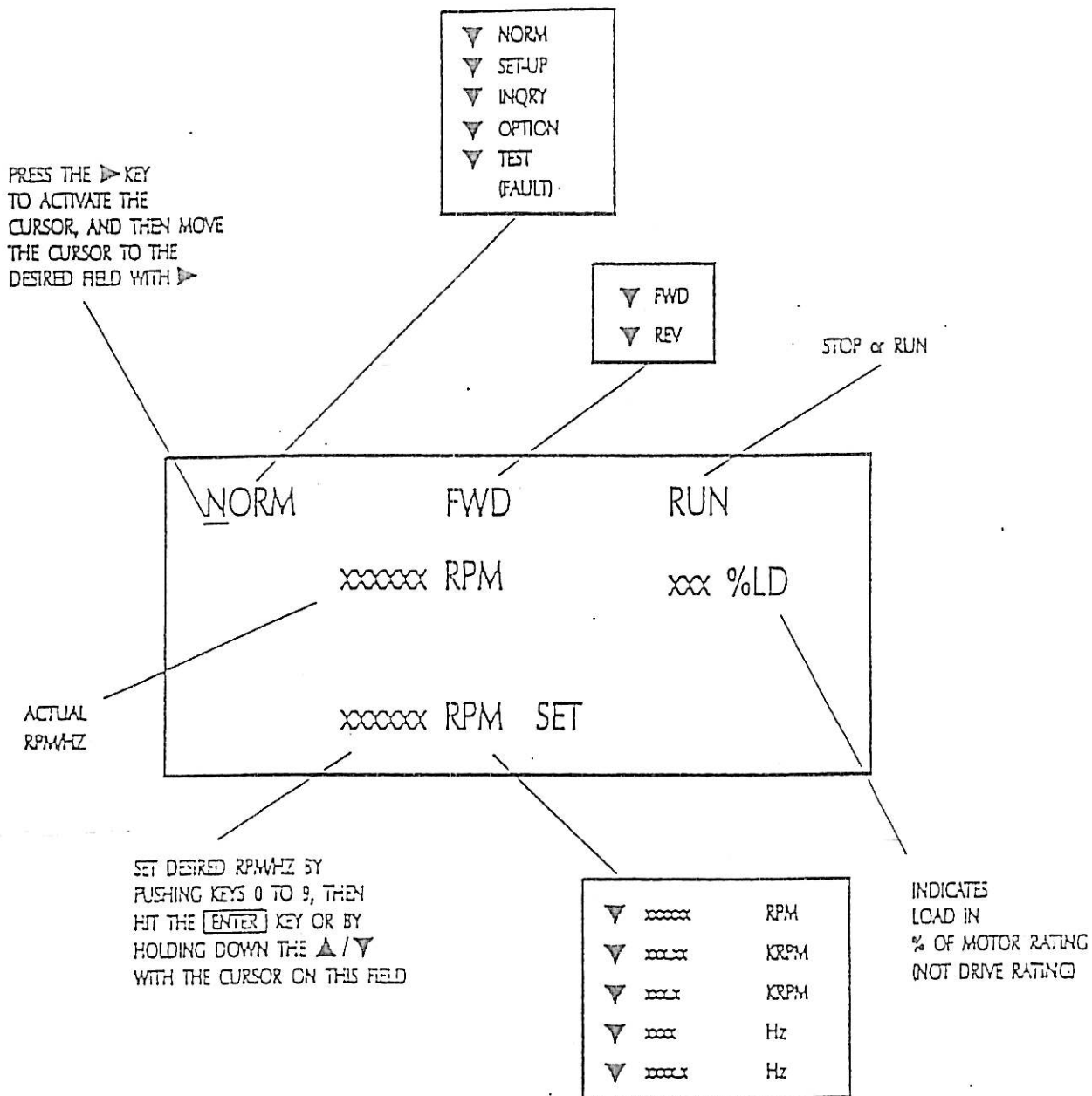


FIGURE 1: The NORMAL Screen

### 3. INQUIRY FUNCTIONS

The INQRY (inquiry) screens on the digital operator station are used to display mostly information which is programmed by the factory. These screens include the following:

- Fault history data (last 10 drive faults)
- Warranty information
- Repair history information
- Drive maximum rating (drive nameplate data)
- Drive programmed rating

The description of each INQRY screen below gives the menu location and a description of the information given on the page(s) of the screen. Refer to FIGURE 13.

#### 13.1 Fault History Screen

Menu Location: INQRY, FAULT #1-10, PG1-2

Every time a fault occurs, the information about the drive operating condition at the instant of the fault is stored in permanent memory (the information will not be lost when power is removed):

Stored Data	Example	Appears on Page
Fault type (FAULT)	200% CURRENT	PG1
Fault hour (HOUR)	12.1	PG1
Fault number (NO.)	21	PG1
Motor RPM/HZ	258 RPM	PG2
Motor voltage	66 VMT	PG2
Motor current	28 AMP	PG2
Motor load	64 %	PG2
Input line voltage	460 VLN	PG2
Internal DC link voltage	645 VDC	PG2

Use the  $\Delta/\nabla$  keys in the # field of this screen to display up to the last ten faults.

The fault type is one of the approximately 35 possible faults described in section 15 (PROTECTION). The fault hour is the value of the internal run time meter at the time of the fault. The fault number is the total number of faults that have occurred in the drive during its life. The stored fault number may not be the same as the number of the fault that is displayed. For example, the last fault that occurred (FAULT #1) may be the 21st stored fault if twenty other faults occurred before the last fault. THE LAST FAULT THAT OCCURRED IS ALWAYS STORED IN FAULT #1. Page 2 of the INQRY, FAULT #1-10 screen lists the operating condition of the drive at the time of the fault including motor speed, voltage, current, load, line voltage and internal DC link voltage for the last ten faults.

#### 13.2 Warranty Screen

Menu Location: INQRY, WARRANTY

The Warranty screen lists drive ship date, drive warranty period from the ship date, and a run time hour meter. The run time hour meter keeps track of the time the drive is in the RUN condition. The run time meter has a 6 minute resolution.

PARAMETER LIST:

"SHARNOA SERIES 9000" ADJUSTABLE FREQUENCY AC DRIVE AND  
 "80 CU S" SPINDLE MOTOR.

SET-UP SCREEN	PARAMETER	RANGE	SHIPPED	
BASIC, PG1	ACCELERATION TIME	0.1-300.0 SEC	10.0	SEC
	DECELERATION TIME	0.1-300.0 SEC	10.0	SEC
	LOAD LIMIT	50-180 %	180	%
BASIC, PG2	RATED POWER	15-100 %DRIVE HP	2.5	HP
	TOP MOTOR HZ	0-DRIVE MAX. HZ	667	HZ
	TOP MOTOR RPM	0-180000 RPM	40000	RPM
	TOP MOTOR VOLTAGE	0-DRIVE MAX.VOLTAGE	230	V
BASIC, PG3	BASE HZ	0-TOP MOTOR HZ	667	HZ
	TOP MOTOR HZ	0-TOP DRIVE HZ	667	HZ
	BASE VOLTAGE	0-TOP MOTOR VOLTAGE	230	V
	TOP MOTOR VOLTAGE	0-DRIVE MAX.VOLTAGE	230	V
BASIC, PG4	UNDER LOAD	0-90(0=DISABLED) %	0	%
FREQUENCY, PG1	MINIMUM SPEED	0- $\frac{1}{2}$ TOP MOTOR RPM/HZ	5000	RPM
	MAXIMUM SPEED	$\frac{1}{2}$ -TOP MOTOR RPM/HZ	40000	RPM
	SLIP COMPENSATION	0.0-10.0 %	0.0	%
FREQUENCY, PG2	PRESET SPEED 1	0-TOP MOTOR RPM/HZ	0	RPM
	PRESET SPEED 2	0-TOP MOTOR RPM/HZ	0	RPM
	PRESET SPEED 3	0-TOP MOTOR RPM/HZ	0	RPM
FREQUENCY, PG3	SKIP FREQUENCY 1	0-TOP MOTOR RPM/HZ	0	RPM
	SKIP BAND 1	6-90/0.1-6.0 RPM/HZ	15	RPM
	SKIP FREQUENCY 2	0-TOP MOTOR RPM/HZ	0	RPM
	SKIP BAND 2	6-90/0.1-6.0 RPM/HZ	15	RPM
FREQUENCY, PG4	JOG SPEED	0-TOP MOTOR RPM/HZ	0	RPM
SYST CONF, PG1	SET SPEED COMMAND SELECT	KEYPAD OR TERMINAL	TERMINAL	
	RUN/STOP COMMAND SELECT	KEYPAD OR TERMINAL	TERMINAL	
	FWD/REV COMMAND SELECT	KEYPAD OR TERMINAL	TERMINAL	
SYST CONF, PG2	CARRIER FREQUENCY	2.25, 4.5, 9, 18 KHZ	18	KHZ
	PASSWORD	0-999999(0=DISABLED)	0	
SYST CONF, PG3	WATCHDOG ENABLE	YES OR NO	YES	
	FAULT DISABLE	YES OR NO	NO	
START/STOP, PG1	VOLTAGE BOOST	0.0-10.0 %	0.0	%
	VOLTAGE BOOST DELAY	0-30 SEC	0	SEC
START/STOP, PG2	EXTERNAL STOP	BRAKE OR COAST	COAST	
	EXTERNAL STOP DECEL.TIME	0.1-300.0 SEC	10.0	SEC
	NORMAL STOP	BRAKE OR COAST	BRAKE	
STABILITY, PG1	VOLTAGE LOOP GAIN	1-99	50	
	CURRENT LOOP GAIN	1-99	50	

SET-UP SCREEN	PARAMETER	RANGE	SHIPPED
INPUTS, PG1	TERMINAL BOARD 1.1-4 TERMINAL BOARD 1.5 TERMINAL BOARD 1.6	NOTE 2 NOTE 1 NOTE 1	0-10 Vdc, J9 INTERLOCK REVERSING
INPUTS, PG2	CALIBRATE ZERO	YES OR NO	NO
INPUTS, PG3	CALIBRATE MAX.	YES OR NO	NO
OUTPUTS, PG1	TERMINAL BOARD 1.15 Tb1.15 NO or NC TERMINAL BOARD 1.17 Tb1.17 NO or NC TERMINAL BOARD 1.19 Tb1.19 NO or NC	NOTE 3 NC or NO NOTE 3 NC or NO NOTE 3 NC or NO	AT-SPEED NO FAULT NO RUN NO
OUTPUTS, PG2	TERMINAL BOARD 1.14 TERMINAL BOARD 1.11 TERM. BOARD 1.11 SCALING	1,2,3,6 x MOTOR TOP HZ NOTE 4 2.5-10.0 V	1 LOAD 6.7 V

JUMPERS (ON 20030): (AS SHIPPED, ONLY J9-11 CAN BE CHANGED BY THE CUSTOMER)	J1-6	J7	J8	J9	J10	J11	J12	J13	J14-15	SPARE
	L	L	WS	IN	OUT	OUT	LD	--	O	IN

OPTION SCREEN	PARAMETER	RANGE	SHIPPED
LISTING, PG1-6	(LISTING OF PURCHASED OPTIONS)		THERMISTOR INPUTS/OUT. MULT. VOLT.
SYST CONF, PG1	SPEED LOOP	OPEN OR CLOSED	NP
SYST CONF, PG2	BASE LD SMPLE	AUTO OR MANUAL	NP
START/STP, PG1	RESTART RESTARTS	AUTO OR MANUAL 0-9	NP NP
INPUTS, PG1	TERMINAL BOARD 2.1 TERMINAL BOARD 2.2 TERMINAL BOARD 2.3	NOTE 1 NOTE 1 NOTE 1	PRESET SPD1 PRESET SPD2 PRESET SPD3
INPUTS, PG2	TERMINAL BOARD 2.4 TERMINAL BOARD 2.5 TERMINAL BOARD 2.7	NOTE 1 NOTE 1 NOTE 1	UNUSED UNUSED KEYPAD OVER.
INPUTS, PG3	TERMINAL BOARD 2.8 TERMINAL BOARD 2.9	NOTE 1 NOTE 1	JOG E-STOP

OPTION SCREEN	PARAMETER	RANGE	SHIPPED
INPUTS, PG1	TERMINAL BOARD 2.14	NOTE 3	ZERO-SPD
	TB2.14 NO or NC	NC or NO	NO
	TERMINAL BOARD 2.17	NOTE 3	BRAKING
	TB2.17 NO or NC	NC or NO	NO
OUTPUTS, PG2	TERMINAL BOARD 2.20	NOTE 3	WARNING
	TB2.20 NO or NC	NC or NO	NO
MULT VOLT, PG1	TERMINAL BOARD 2.25 TERM. BOARD 2.25 SCALING	NOTE 4 2.5-10 V	SPEED 10.0 V
MULT VOLT, PG2	DRIVE INPUT (VOLTAGE)	208, 230, 380, 415, 460 V	460 V
MOTOR#1-32, PG1	OUTPUT TRANSFORMER	YES/NO	NP
	TAP 1	0-DRIVE MAX. VOLTAGE V	NP
	TAP 2	0-DRIVE MAX. VOLTAGE V	NP
	TAP 3	0-DRIVE MAX. VOLTAGE V	NP
MOTOR#1-32, PG2	RATED POWER	10-100 % DRIVE HP	NP
	TOP MOTOR RPM	0-DRIVE MAX. RPM	NP
	ACCELERATION TIME	0.1-300.0 SEC	NP
	DECELERATION TIME	0.1-300.0 SEC	NP
MOTOR#1-32, PG3	PRESET RPM (SPD1 CONTACT)	0-MOTOR TOP RPM/HZ	NP
	GAP ELIMINATOR	OFF or ON	NP
	GAP ELIMINATOR TRIGGER	0.5-20.0 % LD	NP
MOTOR#1-32, PG3	VOLTAGE PT1	0-DRIVE MAX. VOLTAGE	NP
	VOLTAGE PT2	0-DRIVE MAX. VOLTAGE	NP
	VOLTAGE PT3	0-DRIVE MAX. VOLTAGE	NP
	VOLTAGE PT4	0-DRIVE MAX. VOLTAGE	NP
	FREQUENCY PT1	0-DRIVE MAX. HZ	NP
	FREQUENCY PT2	0-DRIVE MAX. HZ	NP
	FREQUENCY PT3	0-DRIVE MAX. HZ	NP
	FREQUENCY PT4	0-DRIVE MAX. HZ	NP

JUMPERS (ON 20030):	J1	J2	J3	J4	J5
(MARKED AS SHIPPED)	IN	IN	OUT	OUT	NO THRM

NP = NOT PURCHASED

NOTE 1

(DIGITAL) INPUTS CAN BE  
ANY OF THE FOLLOWING:

INTERLOCK  
REVERSING  
KEYPAD OVER (KEYPAD OVERRIDE)  
JOG  
E-STOP  
PRESET SPD1  
PRESET SPD2  
PRESET SPD3  
RESET FAULT  
-UNUSED-  
MOTOR SEL.4 \*  
MOTOR SEL.3 \*  
MOTOR SEL.2 \*  
MOTOR SEL.1 \*  
MOTOR SEL.0 \*  
MOT.POT(+) \*  
MOT.POT(-) \*  
BASE LD TRIG. \*

NOTE 3

OUTPUT RELAYS CAN BE  
ANY OF THE FOLLOWING:

FAULT  
AT-SPEED  
RUN  
ZERO-SPD (ZERO SPEED)  
BRAKING  
WARNING  
REVERSING  
MOTOR HOT \*  
GAP ELIMINATOR \*  
LOADLIMIT - M \*  
LOADLIMIT - G \*  
OVERLOAD \*  
OVER SPEED \*  
MOTOR # 1-32 \*  
TAP 1-3 \*

NOTE 2

(ANALOG) INPUTS CAN BE  
ANY OF THE FOLLOWING:

0-5 VDC, J9  
0-10 VDC, J9  
0-5 VDC, J9  
0-2 VDC, J9  
4-20 mA, J10  
-10/+10V, J11

NOTE 4

ANALOG OUTPUTS (METERS) CAN BE  
ANY OF THE FOLLOWING:

LOAD  
SPEED  
VOLTS DC (INTERNAL DC LINK VOLTAGE)

\* AVAILABLE AS OPTIONS ONLY ("OPTION" SCREEN).

PARAMETER LIST:

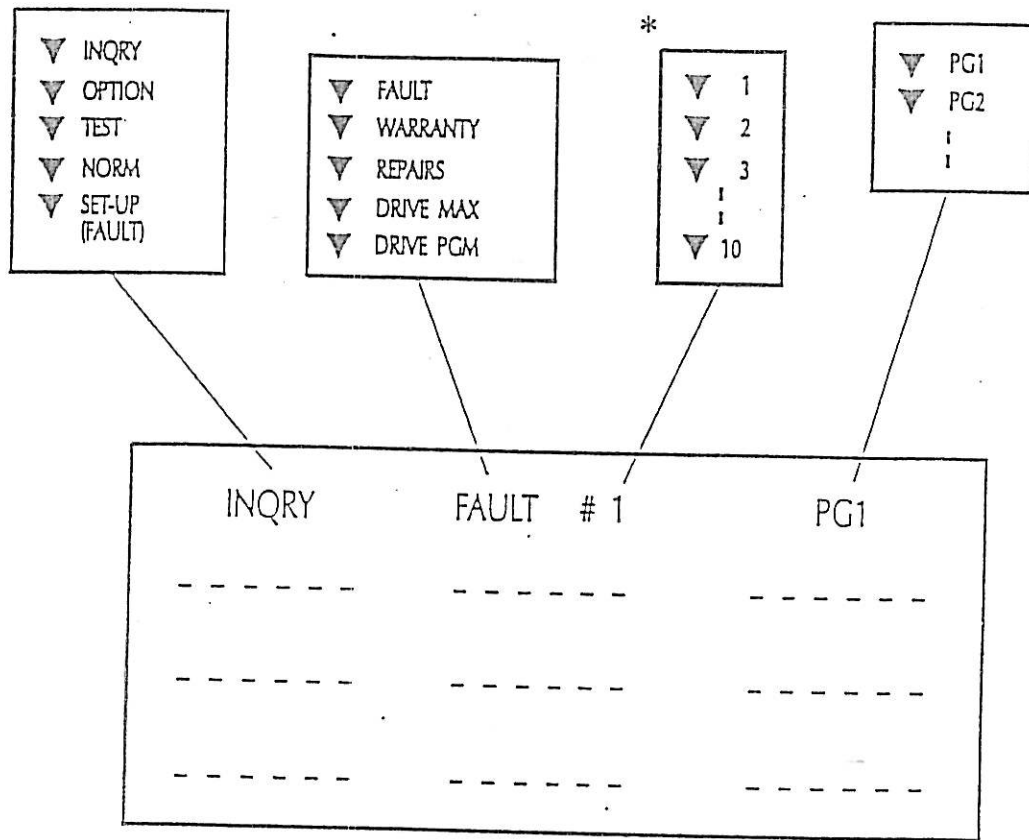
"SHARNOA SERIES 9000" ADJUSTABLE FREQUENCY AC DRIVE AND  
 2" SPINDLE MOTOR.

SET-UP SCREEN	PARAMETER	RANGE	SHIPPED	
BASIC, PG1	ACCELERATION TIME DECELERATION TIME LOAD LIMIT	0.1-300.0 SEC 0.1-300.0 SEC 50-180 %	5.0 5.0 180	SEC SEC %
BASIC, PG2	RATED POWER TOP MOTOR HZ TOP MOTOR RPM TOP MOTOR VOLTAGE	15-100 %DRIVE HP 0-DRIVE MAX. HZ 0-180000 RPM 0-DRIVE MAX.VOLTAGE	3.0 667 40000 230	HP HZ RPM V
BASIC, PG3	BASE HZ TOP MOTOR HZ BASE VOLTAGE TOP MOTOR VOLTAGE	0-TOP MOTOR HZ 0-TOP DRIVE HZ 0-TOP MOTOR VOLTAGE 0-DRIVE MAX.VOLTAGE	667 667 230 230	HZ HZ V V
BASIC, PG4	UNDER LOAD	0-90(0=DISABLED) %	0	%
FREQUENCY, PG1	MINIMUM SPEED MAXIMUM SPEED SLIP COMPENSATION	0- $\frac{1}{2}$ TOP MOTOR RPM/HZ $\frac{1}{2}$ -TOP MOTOR RPM/HZ 0.0-10.0 %	5000 40000 0.0	RPM RPM %
FREQUENCY, PG2	PRESET SPEED 1 PRESET SPEED 2 PRESET SPEED 3	0-TOP MOTOR RPM/HZ 0-TOP MOTOR RPM/HZ 0-TOP MOTOR RPM/HZ	0 0 0	RPM RPM RPM
FREQUENCY, PG3	SKIP FREQUENCY 1 SKIP BAND 1 SKIP FREQUENCY 2 SKIP BAND 2	0-TOP MOTOR RPM/HZ 6-90/0.1-6.0 RPM/HZ 0-TOP MOTOR RPM/HZ 6-90/0.1-6.0 RPM/HZ	0 15 0 15	RPM RPM RPM RPM
FREQUENCY, PG4	JOG SPEED	0-TOP MOTOR RPM/HZ	0	RPM
SYST CONF, PG1	SET SPEED COMMAND SELECT RUN/STOP COMMAND SELECT FWD/REV COMMAND SELECT	KEYPAD OR TERMINAL KEYPAD OR TERMINAL KEYPAD OR TERMINAL	TERMINAL TERMINAL TERMINAL	
SYST CONF, PG2	CARRIER FREQUENCY PASSWORD	2.25, 4.5, 9, 18 KHZ 0-999999(0=DISABLED)	18 0	KHZ
SYST CONF, PG3	WATCHDOG ENABLE FAULT DISABLE	YES OR NO YES OR NO	YES NO	
START/STOP, PG1	VOLTAGE BOOST VOLTAGE BOOST DELAY	0.0-10.0 % 0-30 SEC	0.0 0	% SEC
START/STOP, PG2	EXTERNAL STOP EXTERNAL STOP DECEL.TIME NORMAL STOP	BRAKE OR COAST 0.1-300.0 SEC BRAKE OR COAST	COAST 5.0 BRAKE	SEC
ABILITY, PG1	VOLTAGE LOOP GAIN CURRENT LOOP GAIN	1-99 1-99	50 50	

SET-UP SCREEN	PARAMETER	RANGE	SHIPPED
TS, PG1	TERMINAL BOARD 1.1-4 TERMINAL BOARD 1.5 TERMINAL BOARD 1.6	NOTE 2 NOTE 1 NOTE 1	0-10 Vdc, J9 INTERLOCK REVERSING
INPUTS, PG2	CALIBRATE ZERO	YES OR NO	NO
INPUTS, PG3	CALIBRATE MAX.	YES OR NO	NO
OUTPUTS, PG1	TERMINAL BOARD 1.15 TB1.15 NO or NC TERMINAL BOARD 1.17 TB1.17 NO or NC TERMINAL BOARD 1.19 TB1.19 NO or NC	NOTE 3 NC or NO NOTE 3 NC or NO NOTE 3 NC or NO	AT-SPEED NO FAULT NO RUN NO
OUTPUTS, PG2	TERMINAL BOARD 1.14 TERMINAL BOARD 1.11 TERM. BOARD 1.11 SCALING	1, 2, 3, 6 x MOTOR TOP HZ NOTE 4 2.5-10.0 V	1 LOAD 6.7 V

JUMPERS (ON 20030): (AS SHIPPED, ONLY J9-11 CAN BE CHANGED BY THE CUSTOMER)	J1-6	J7	J8	J9	J10	J11	J12	J13	J14-15	SPARE
	L	L	WS	IN	OUT	OUT	LD	--	0	IN

OPTION SCREEN	PARAMETER	RANGE	SHIPPED
LISTING, PG1-6	(LISTING OF PURCHASED OPTIONS)		THERMISTOR INPUTS/OUT. MULT. VOLT.
SYST CONF, PG1	SPEED LOOP	OPEN OR CLOSED	NP
SYST CONF, PG2	BASE LD SMPLE	AUTO OR MANUAL	NP
START/STP, PG1	RESTART RESTARTS	AUTO OR MANUAL 0-9	NP NP
INPUTS, PG1	TERMINAL BOARD 2.1 TERMINAL BOARD 2.2 TERMINAL BOARD 2.3	NOTE 1 NOTE 1 NOTE 1	PRESET SPD1 PRESET SPD2 PRESET SPD3
INPUTS, PG2	TERMINAL BOARD 2.4 TERMINAL BOARD 2.5 TERMINAL BOARD 2.7	NOTE 1 NOTE 1 NOTE 1	UNUSED UNUSED KEYPAD OVER.
TS, PG3	TERMINAL BOARD 2.8 TERMINAL BOARD 2.9	NOTE 1 NOTE 1	JOG E-STOP



\* CHOOSE 1-10 IN THIS FIELD  
IN THE INQRY, FAULT SCREEN

FIGURE 13: The INQRY Screen

### 13.3 Repair History Screen

Menu Location: INQRY, REPAIRS, PG1-2

If the drive is sent to the factory for repair, the factory will enter the date and repair type for the repair in the Repair history screen. Up to 5 different repairs (2 on PG1 and 3 on PG2) can be stored.

### 13.4 Drive Maximum Rating Screen

Menu Location: INQRY, DRIVE MAX, PG1-2

The Drive Maximum Rating screen lists the drive nameplate data (PG1) as well as the model number, serial number and software version (PG2).

Drive Input (IN) : The input current, voltage and frequency applied to L1, L2, and L3 are given here.  
Example: 26A, 460V, 50/60 HZ

Drive Output (OUT): The drive maximum output current, voltage, output HZ and KVA/horsepower are given here.  
Example: 26A, 460 V, 375 HZ, 20.0 KVA/HP

Model Number  
(MODEL NO.): Example: 72101G1 (Model number 72101, Group 1)

Serial Number  
(SERIAL NO.): Example: 409201 (40th week of 1992, first drive shipped in the 40th week)

Software Version  
(SOFT. VER.): Example: 1.05G0 (Software version 1.05, Group 0)

### 13.5 Drive Programmed Rating Screen

Menu Location: INQRY, DRIVE PGM, PG1

The Drive Programmed Rating screen lists the drive (programmed) output characteristics.

Drive Input (INPUT) : The input voltage is given here. This is programmable only if the Multiple Input Voltage option is purchased (and is done so in the OPTION MULT VOLT screen, section 22).

Drive Output  
(OUTPUT): The drive programmed output voltage, output HZ and horsepower are given here. These are programmed in the SET-UP BASIC screen section 11.

## 14. TEST FUNCTIONS

The main purpose of TEST screen on the digital operator station is to setup, test and troubleshoot the drive. Refer to FIGURE 14.

The Meters screen displays 6 meters:

- Motor Speed (RPM/HZ)
- Motor Voltage (VMT)
- Motor Current (AMP)
- Motor Load (%LD)
- Line Voltage (VLN)
- Internal DC Link Voltage (VDC)

Voltage readings have an accuracy of +/- 1%; load and current readings have an accuracy of +/- 5%.

## 15. PROTECTION, FAULTS, WARNINGS AND HELP (DIAGNOSTICS)

### 15.1 Protection

The VOLKMANN 9000 drive is equipped with extensive fault protection in order not to stress or damage the drive or attached motor. If an unsafe or fault condition exists, the drive will stop (either by braking or coasting) and the FAULT screen will be displayed (if the RUN/STOP parameter in section 12.8 is set to KEYPAD). To clear the fault when using the keypad, first press the STOP key and then the START key to resume operation. To clear the fault when using the terminal strip (TB1), first call for STOP and then call for RUN to resume operation.

### 15.2 Faults

When a fault condition exists, the FAULT screen is displayed. The FAULT screen lists the type of fault and the drive operating condition at the time of the fault including motor speed, voltage, current, load, line voltage and internal DC link voltage. Refer to FIGURE 15.

Each possible fault is described below. For hardware troubleshooting, refer to section 18, TROUBLESHOOTING.

#### 15.2.1 Current Faults

##### 200% CURRENT

If the drive output current reaches 200% (of drive rated current), the drive will trip instantaneously.

##### TIMED O-CURRT

If the motor is operated above 105% load, the drive will trip (on TIMED O-CURRT) in accordance to the (inverse) time-overload curve shown below (i.e. if the motor runs with 150% load for more than one minute, the drive will trip).

- ▼ TEST
- ▼ NORM
- ▼ SET-UP
- ▼ INQRY
- ▼ OPTION (FAULT)

TEST	METERS
xxxxxx RPM	xxx %LD
xxx VMT	xxx VLN
xxx AMP	xxx VDC

FIGURE 14: The TEST Screen

PRESSING THE STOP  
KEY EXITS THE FAULT  
SCREEN AND DISPLAYS  
THE SCREEN PRIOR TO  
THE FAULT.

FAULT

200% CURRENT  
TIMED O-CURRT  
UNDER CURRENT  
PH1 FAULT  
PH2 FAULT  
PH3 FAULT  
DB TRANSISTOR  
LOW LINK VOLT  
HI LINK VOLT.  
HI LINE VOLT.  
LOW LINE VOLT  
DRIVE OVERTMP  
DB OVERTMP.  
THERMST SHORT (option)  
MOTOR OVERTMP (option)  
EXTERNAL STOP  
INTERLOCK OPN  
CONTACTR OPEN  
CHARGING FLT.  
COMM. FAULT 0-5  
DATA FAULT (1-4)  
SOFTWARE FAULT  
MEMORY(EPROM)  
MEMORY (RAM)  
INVERTER/GA  
PROGRAMMING  
MISC FLT

FAULT

200% CURRENT

xxxxxx RPM

xxx %LD

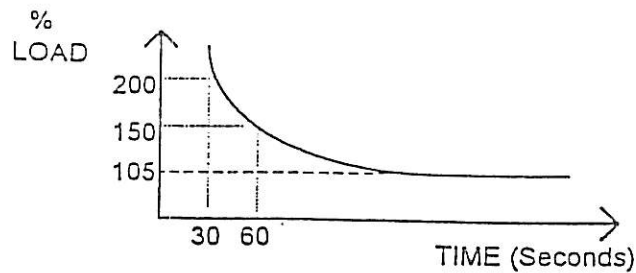
xxx VMT

xxx VLN

xxx AMP

xxx VDC

FIGURE 15: The FAULT Screen



The current faults can occur due to heavy motor overload, too high V/Hz, stalled motor, too fast acceleration time for a given inertia and torque available, too high voltage boost or motor current rating too high. Check motor rating and set-up and be sure motor is turning freely and is properly lubricated.

PH1 FAULT (T1/T4)  
 PH2 FAULT (T2/T5)  
 PH3 FAULT (T3/T6)  
 DB TRANSISTOR

Motor wire, winding or ground shorts, shorted transistors (inverter or dynamic braking) and defective main board (20030) circuits can cause these faults. Check all motor wiring and motor winding insulation.

#### UNDER LOAD

If the drive output load drops below the selected value of Under Load Trip parameter (refer section 11.10) for more than 1 second after reaching the set speed, the drive will trip.

Check the Under Load parameter and make appropriate change in its setting.

### 15.2.2 Voltage Faults

#### LOW LINK VOLT

Open fuse FU4, defective diode bridge D1 or open charge resistors R1 and/or R2 can cause this fault.

#### HI LINK VOLT.

Too fast deceleration for load inertia or too high overhauling load can cause this fault.

#### HI LINE VOLT.

Incoming line higher than 110% or incorrectly programmed drive line voltage (see INQRY, DRIVE screen) can cause this fault.

#### LOW LINE VOLT

Incoming line lower than 85%, fuse FU2 open or loss of Phase 2 of line (L2) can cause this fault.

### 15.2.3 Over Temperature Faults

#### DRIVE OVERTMP

An ambient temperature that is too high, too much load or defective temperature switch/switch wiring can cause this fault. Check the motor rating and drive rating/set-up to ensure compatibility.

#### DB OVERTEMP.

An inertia too high for furnished dynamic braking, too much overhauling load or too frequent speed changes can cause this fault.

#### THERMST SHORT (option)

A short in the thermistor plug or wiring to the thermistor can cause the fault. Check the resistance of the thermistor with an ohm meter. A reading of 10 ohms or less is considered a thermistor short.

#### MOTOR OVERTMP (option)

An open connection in the thermistor plug or wiring or excessive motor loads can cause this fault. Check the resistance of the thermistor with an ohm meter. A reading of more than 4000 ohms is considered a motor over temperature reading. Check the motor load and rating and also motor set-up (V/HZ).

### 15.2.4 Faults External to Drive

#### EXTERNAL STOP

Drive STOP was initiated by users External Stop contact. Also, check drive programming in the SET-UP, INPUTS screen

#### INTERLOCK OPN

The contact to interlock input is not closed. Also, check programming SET-UP, INPUTS screen.

### 15.2.5 Charging/Contactor Faults

#### CONTACTR OPEN

A defective contactor, contactor coil or relay CR4 on main board 20030 can cause this fault.

#### CHARGING FLT.

Open fuses FU2 or FU4, open charging resistors R1 and/or R2 or defective diode bridge D1 can cause this fault.

### 15.2.6 Communication Faults

#### COMM. FAULT-0

#### COMM. FAULT-1

#### COMM. FAULT-2

#### COMM. FAULT-3

#### COMM. FAULT-4

#### COMM. FAULT-5

Digital operator station wiring that is too close to power wires, lose cable connections, improperly connected operator station, defective main board (20030) or a defecting digital operator station board can cause these faults. Check cabling thoroughly and if fault persists, contact factory.

### 15.2.7 Main Board Faults

#### DATA FAULT (general)

The last parameter programmed caused an internal fault. Return to the last parameter programmed and check its value for correctness. Refer to the parameter descriptions in sections 11, 12 or 22 if necessary.

#### DATA FAULT 1

The current rating of the programmed motor exceeds the current rating of the drive. The Motor Rated HP and Motor Top Voltage must be changed so they do not exceed the capability of the drive. The following relation can be used:

$$\frac{\text{Motor Rated HP (approx. KVA)}}{1.73 \times \text{Motor Top Voltage}} \times 1000 \leq \text{Drive Maximum (output) Current (on nameplate)}$$

#### DATA FAULT 2

The programmable inputs are set-up incorrectly. Two or more inputs have the same setting. Check the SET-UP INPUTS screen and OPTION INPUTS screen (if option board is present) and program duplicate settings with "--unused--".

#### DATA FAULT 3

The last programming change caused the Minimum or Maximum Speed Limit parameters to go out of range. Check the Motor Top RPM and make sure the following holds true:

$$\begin{array}{ll} \text{Minimum Speed Limit} & \leq 1/2 \text{ Motor Top RPM} \quad \text{and} \\ \text{Maximum Speed Limit} & \geq 1/2 \text{ Motor Top RPM} \end{array}$$

#### DATA FAULT 4

The motor V/Hz curve or the Drive Input Voltage are programmed incorrectly. Check the motor set-up and make sure the following relation holds true:

$$PT1 \leq PT2 (\leq PT3 \leq PT4 \text{ for Multiple Motor option, section 22})$$

Also, check that the programmed Drive Input Voltage (Multiple Voltage option, section 22) does not exceed the drive maximum input voltage rating on the nameplate.

#### SOFTWARE FAULT

The software/hardware on main board 20030 is corrupted. This can be caused by component failure or excessive noise. A power off/power on sequence may correct the problem. Consult factory if fault persists.

#### MEMORY(EEPROM)

The programmable memory on main board (20030) is not responding. Reprogram any incorrect parameters.

#### MEMORY (RAM)

The random access memory (RAM) on main board (20030) is not responding. A power off/power on sequence may correct the problem. Consult factory if fault persists.

#### INVERTER/GA

The programmable gate array on main board (20030) is not responding. A power off/power on sequence may correct the problem. Consult factory if fault persists.

#### PROGRAMMING

The last action caused internal (software) fault. A power off/power on sequence may correct the problem. Consult factory if fault persists.

## MISC FLT

The fault that occurred is not recognized by the current software version. Consult factory if fault persists.

### 15.3 Warnings

If a warning condition exists, it is displayed on the third line of the NORM screen. Warning conditions indicate that the drive or motor is approaching a fault condition and will fault unless corrective action is taken. The following warnings may be displayed:

- Dynamic braking over temperature
- Motor over temperature

A WARNING relay contact (see Programmable Relays, section 12.21) will be activated whenever any of the above warning conditions is present.

In addition to warnings, the conditions below may also be displayed:

- Load limit (motoring, output relay also available)
- Load limit - generating (output relay also available)
- Braking (output relay also available)
- Jog speed active
- Maximum speed limiting
- Minimum speed limiting
- Preset speed 1 active
- Preset speed 2 active
- Preset speed 3 active
- Skip frequency active
- Gap eliminator active (option only, output relay also available)

### 15.4 Help

Pressing the HELP key displays the Help Menu unless the FAULT or INQRY FAULT screen are being displayed. In the latter case, diagnostics on the currently displayed fault are given. Refer to section 15.2 for a more extensive explanation of faults and fault diagnostics.

The Help Menu has 9 choices. Pressing the number key of the appropriate choice gives help on that topic. Pressing HELP again returns the display to the Help Menu, pressing ENTER returns to the original screen. The Help Menu topic are:

1. About HELP
2. Using the Keypad
3. NORM Screen
4. SET-UP Screen
5. INQRY Screen
6. OPTION Screen
7. TEST Screen
8. FAULT Screen
9. Factory Address

## 18. TROUBLESHOOTING

To troubleshoot the drive an analog or digital multimeter (such as Simpson, Triplett, Beckman or Fluke) may be used. High voltage megger instrument should be used only for checking ground faults on the motor wires and the motor itself. Do not use a high voltage megger instrument for checking the drive or serious drive damage may occur.

Before any troubleshooting is done it is recommended that you become familiar with the power circuit diagram and component location diagram given in section 21.

It is assumed that the following components are available for troubleshooting and/or replacement. Contact the factory for correct replacement parts.

Component	Reference Designator	Quantity
Main (control) board	20030	1
Power supply board	20031	1
Digital Operator Station board	20033	1
Inverter transistor	T1-T6	4 (or 2 pair)
DB transistor	T7	1
DC link fuse	FU4	1
Input line fuse	FU1-FU3	2
Charge resistor	R1/R2	1
Current sensor	S1/S2	1

**WARNING:** When AC power is applied to the drive, the internal parts of the drive are at high, lethal voltage whether the drive is running or not. Do not touch any internal part of the drive when AC power is applied to the drive.

Before servicing the drive, disconnect the AC (input) line (L1, L2, L3). The input capacitors (C11 and/or C12) will discharge slowly. You may use a resistor with the value 500  $\Omega$ , 50 watt or higher to discharge the capacitors. In both cases, the red CHARGE light in the upper left hand corner of main board tray must be off (capacitors discharged) before servicing the drive.

**WARNING:** Troubleshooting should be done by qualified personnel with experience in drives and electrical instruments.

Most drive circuits are at line potential and are hot to ground. Do not use a grounded scope or any other grounded instrument as serious damage to the drive or instrument may result.

The Volkmann Series 9000 line of drives are equipped with extensive fault protection features. Normally, when a fault or unsafe condition occurs the power will be immediately removed from the motor leads (but not electrically isolated) and the motor will coast to a stop. The FAULT screen is displayed (if the RUN/STOP parameter in section 12.8 is set to KEYPAD; LED3 on main board flashes) listing the type of fault and the drive operating conditions at the time of fault (refer section 15).

**NOTE:** This procedure assumes that all steps in section 15 have been followed and the drive has been correctly programmed for the application. The steps that follow should be used to find hardware failures. The main board is labeled 20030 and has terminal board TB1 and 3 green LED lights on it. The power supply board is the smaller board labeled 20031 with TB3 on it. The digital operator station board is labeled 20033 and has the 4 line x 20 character LCD on it.

If the LCD screen or LED1 does not light when power is applied to the drive go to section 18.1, otherwise, go to section 18.2.

### 18.1 Power Up

#### CHARGE LED DOES NOT LIGHT

- Check input line for good connection.
- Remove fuse FU1-3 and check for continuity. If open, replace the fuse.

#### LCD OR LED1 ON MAIN BOARD DOES NOT LIGHT

- Remove fuse FU2. Check the fuse for continuity, if none replace the fuse.
- Check voltage across CON15.1 and CON15.2 on power supply board. A good power supply board should read between 19.9 and 20.4 VDC when the drive is in STOP. If voltage is not correct, replace power supply board.
- Check voltage across CON1.3 and CON1.4 on main board for above voltage. If it is not correct, check connections between power supply and main board.

### 18.2 Motor Does Not Turn Or Cogs (runs erratically)

- This occurs when motor not connected properly. Check motor connections.
- Check for open wire between drive and motor. Check wires for continuity including all external plugs, terminals and contactors.

### 18.3 Current Faults

#### 200% CURRENT

#### TIMED O-CURRT

- Disconnect motor wires from the drive.
- Check motor V/Hz.
- Check with megger (high voltage insulation tester) for ground faults between each motor phase and ground. Include all plugs, contactors and motor winding. Also check for intermittent shorts.
- Check the power transistors (T1-T7). Refer to section 18.10.
- Measure voltage at test point I1 and I2 with respect to common on main board. (common is located at 3 pin connection in lower right corner). If not zero in STOP, replace corresponding current sensor (S1 or S2).
- Replace the main control board (20030).

### 18.4 Voltage Faults

#### LOW LINK VOLT

- Remove fuse FU4. Check the fuse for continuity, if none replace fuse.
- Check diode bridge D1. Follow the steps given in section 18.10.
- Check the resistance across the charging resistors R1 and R2 (ohmmeter should be placed across 1-2 of K1 and 5-6 of contactor K1 for R1 and R2 respectively). If the resistor is open, replace.

#### HIGH LINK VOLT

- Increase the deceleration time (refer section 11.2).
- Check the resistance across the DB resistor between the collector (C1) and emitter (E1) of DB transistor

#### HI LINE VOLT

- This fault occurs when AC line supply voltage is above 10% of rated voltage. Check the AC line voltage with a multimeter. A good supply should be within +/- 10% of rated voltage.

## LOW LINE VOLT

- Check the AC line supply voltage. A good supply voltage should be no less than 15% of rated voltage.

## 18.5 Over Temperature Faults

### DRIVE OVERTEMP

- This fault occurs when the drive heatsink temperature reaches about 175° F. Let heatsink cool down, reset, and check the motor rating and drive rating/set up to ensure compatibility. Make sure the load is within the rating.
- Remove temperature switch and test for continuity, if none replace the temperature switch.

### DB OVERTEMP.

- Increase the deceleration time. Refer section 11.2 and 15.2.3 for details.
- Check the AC line voltages. If AC line is not symmetric swap the phases in such a way that phase L3 has the lowest phase voltage with respect to ground.

## 18.6 Charging/Contactor Fault

- Check the resistance across the contactor coil K1 (A1 & A2). A good contactor should read between 100 and 150  $\Omega$ s.
- Remove fuses FU2 and FU4 and check for continuity. If open replace the fuse.
- Check the bridge rectifier D1. Follow the steps given in section 18.10.
- Check the resistance across the charging resistors R1 and R2 (ohmmeter should be placed across 1-2 of K1 and 5-6 of K1 for R1 and R2 respectively). If open, replace the resistor.
- Replace main board.

## 18.7 Faults External to Drive

### EXTERNAL STOP

- Check all connection grounds to External Stop input.
- Check drive programming in the SET UP screen (refer section 12.20).

### INTERLOCK OPN

- Check continuity between TB1.5 and TB1.7 (TB1.10) on main board. If open replace interlock contact.

## 18.8 Communication Faults

- Check for cable connection between the main board and digital operator station. Connection should be clean, dry and tight.
- Communication cables should not be close to power wires (refer to wiring diagram, Section 21).
- If remote operator station is used, make sure it is grounded.
- Replace digital operator station.
- Replace main board.

## 18.9 Main Board Faults

- Follow instructions in section 15.2.7.
- If fault persists, contact factory.

## 18.10 Steps for Checking Power Transistors and Bridge Rectifiers

All measurements should be made with a multimeter with a diode testing setting. Make sure the drive is fully discharged before making any measurement or the multimeter may be damaged.

### Power Transistors

Disconnect the three motor wires. If an output transformer or a high frequency reactor load are used, disconnect them too. Make all measurements between the collector (C1 or C2) and the emitter (E1 or E2) of the transistor.

With positive probe on emitter (E1 or E2) and negative probe on collector (C1 or C2) of a good transistor will indicate between 0.25 and 0.8 VDC. With positive probe on collector and negative probe on emitter of a good transistor will indicate OL (overload) or an increasing number (charging capacitor).

### Bridge Rectifier

Disconnect AC input line.

Connect positive probe to + terminal on rectifier(s). Connect negative probe to each AC input terminal on rectifier(s). The meter should read OL (overload). Reverse the leads and check again. The meter should read between 0.25 and 0.8 VDC.

Repeat above with negative probe on - terminal and then positive probe on - terminal. If readings are not as described above, replace bridge rectifier.

## 18.11 Line Noise and Harmonic Distortion

Line noise/harmonic distortion will appear on the input line of a PWM variable speed drive due to inherent design of the converter (input) stage (current is drawn only in pulses when it is necessary to replenish the DC link capacitors). It is generally not necessary to take any measures to reduce line noise and harmonic distortion. If a specific application or circumstance does require reduction of line noise and harmonic distortion, an input line reactor with a 3% impedance rating is recommended.

## 19. WARRANTY AND SERVICE

The company warrants that the drive furnished will be free from defects in material and workmanship and will be of the kind and quality specified.

This warranty shall apply only to defects appearing within two years (24 months) of shipment by the company.

NOTE: The warranty covering this equipment is void if any modifications are made or repairs attempted without express approval of the company, or the equipment has been disassembled or installed improperly.

For complete information, see separately published Terms and Conditions of Sale document.

## 20. SPECIFICATIONS

### INPUT:

3 Phase, 50/60 HZ, power factor is approx. 1  
460V or 230V, +10/-15% standard  
460V, 415V, 380V, 230V all +10/-15% programmable option

### OUTPUT:

0-460V for 460V Input  
0-415V for 415V Input  
0-380V for 380V Input  
0-230V for 230V Input

0-375 HZ for L, 3-75 KVA/HP  
0-180 HZ for L, 100-200 KVA/HP  
0-750 HZ for M, 3-200 KVA/HP  
0-3000 HZ for H, 3-200 KVA/HP

CURRENT LIMIT: 0-200%

SPEED RESOLUTION:	Digital:	0.011 HZ for 0-375 HZ 0.022 HZ for 0-750 HZ 0.045 HZ for 0-1500 HZ 0.090 HZ for 0-3000 HZ
	Analog:	0.1% for potentiometer, 0-10 V 0.2% for 0-5 V 0.5% for 0-2 V 0.2% for -10 to +10 V 0.6% for 4-20 mA

### AMBIENT TEMPERATURE:

-10° to +40° C maximum for NEMA 12 enclosed  
-10° to +50° C maximum for NEMA 1 enclosed

### HUMIDITY:

95% non-condensing

### ALTITUDE:

Up to 3300 FT (1000 m) without derating

OPTION SCREEN	PARAMETER	RANGE	SHIPPED
OUTPUTS, PG1	TERMINAL BOARD 2.14 TB2.14 NO or NC TERMINAL BOARD 2.17 TB2.17 NO or NC TERMINAL BOARD 2.20 TB2.20 NO or NC	NOTE 3 NC or NO NOTE 3 NC or NO NOTE 3 NC or NO	ZERO-SPD NO BRAKING NO WARNING NO
OUTPUTS, PG2	TERMINAL BOARD 2.25 TERM. BOARD 2.25 SCALING	NOTE 4 2.5-10 V	SPEED 10.0 V
MULT VOLT, PG1	DRIVE INPUT (VOLTAGE)	208,230,380,415,460 V	460 V
MULT VOLT, PG2	OUTPUT TRANSFORMER TAP 1 TAP 2 TAP 3	YES/NO 0-DRIVE MAX.VOLTAGE V 0-DRIVE MAX.VOLTAGE V 0-DRIVE MAX.VOLTAGE V	NP NP NP NP
MOTOR#1-32, PG1	RATED POWER TOP MOTOR RPM ACCELERATION TIME DECELERATION TIME	10-100 % DRIVE HP 0-DRIVE MAX.RPM 0.1-300.0 SEC 0.1-300.0 SEC	NP NP NP NP
MOTOR#1-32, PG2	PRESET RPM (SPD1 CONTACT) GAP ELIMINATOR GAP ELIMINATOR TRIGGER	0-MOTOR TOP RPM/HZ OFF or ON 0.5-20.0 % LD	NP NP NP
MOTOR#1-32, PG3	VOLTAGE PT1 VOLTAGE PT2 VOLTAGE PT3 VOLTAGE PT4 FREQUENCY PT1 FREQUENCY PT2 FREQUENCY PT3 FREQUENCY PT4	0-DRIVE MAX.VOLTAGE 0-DRIVE MAX.VOLTAGE 0-DRIVE MAX.VOLTAGE 0-DRIVE MAX.VOLTAGE 0-DRIVE MAX. HZ 0-DRIVE MAX. HZ 0-DRIVE MAX. HZ 0-DRIVE MAX. HZ	NP NP NP NP NP NP NP NP

JUMPERS (ON 20030):  (MARKED AS SHIPPED)	J1	J2	J3	J4	J5
	IN	IN	OUT	OUT	NO THRM

NP = NOT PURCHASED

NOTE 1

(DIGITAL) INPUTS CAN BE ANY OF THE FOLLOWING:

INTERLOCK  
REVERSING  
KEYPAD OVER (KEYPAD OVERRIDE)  
JOG  
E-STOP  
PRESET SPD1  
PRESET SPD2  
PRESET SPD3  
RESET FAULT  
-UNUSED-  
MOTOR SEL.4 \*  
MOTOR SEL.3 \*  
MOTOR SEL.2 \*  
MOTOR SEL.1 \*  
MOTOR SEL.0 \*  
MOT.POT(+) \*  
MOT.POT(-) \*  
BASE LD TRIG. \*

NOTE 2

(ANALOG) INPUTS CAN BE ANY OF THE FOLLOWING:

0-10 VDC, J9  
0-5 VDC, J9  
0-2 VDC, J9  
4-20 mA, J10  
-10/+10V, J11

NOTE 3

OUTPUT RELAYS CAN BE ANY OF THE FOLLOWING:

FAULT  
AT-SPEED  
RUN  
ZERO-SPD (ZERO SPEED)  
BRAKING  
WARNING  
REVERSING  
MOTOR HOT \*  
GAP ELIMINATOR \*  
LOADLIMIT - M \*  
LOADLIMIT - G \*  
OVERLOAD \*  
OVER SPEED \*  
MOTOR # 1-32 \*  
TAP 1-3 \*

NOTE 4

ANALOG OUTPUTS (METERS) CAN BE ANY OF THE FOLLOWING:

LOAD  
SPEED  
VOLTS DC (INTERNAL DC LINK VOLTAGE)

\* AVAILABLE AS OPTIONS ONLY ("OPTION" SCREEN).

PARAMETER LIST:

"SHARNOA SERIES 9000" ADJUSTABLE FREQUENCY AC DRIVE AND  
"JO CU S" SPINDLE MOTOR.

SET-UP SCREEN	PARAMETER	RANGE	SHIPPED	
BASIC, PG1	ACCELERATION TIME DECELERATION TIME LOAD LIMIT	0.1-300.0 SEC 0.1-300.0 SEC 50-180 %	10.0 10.0 180	SEC SEC %
BASIC, PG2	RATED POWER TOP MOTOR HZ TOP MOTOR RPM TOP MOTOR VOLTAGE	15-100 %DRIVE HP 0-DRIVE MAX. HZ 0-180000 RPM 0-DRIVE MAX.VOLTAGE	4.5 1000 30000 460	HP HZ RPM V
BASIC, PG3	BASE HZ TOP MOTOR HZ BASE VOLTAGE TOP MOTOR VOLTAGE	0-TOP MOTOR HZ 0-TOP DRIVE HZ 0-TOP MOTOR VOLTAGE 0-DRIVE MAX.VOLTAGE	667 1000 460 460	HZ HZ V V
BASIC, PG4	UNDER LOAD	0-90(0=DISABLED) %	0	%
FREQUENCY, PG1	MINIMUM SPEED MAXIMUM SPEED SLIP COMPENSATION	0- $\frac{1}{2}$ TOP MOTOR RPM/HZ $\frac{1}{2}$ -TOP MOTOR RPM/HZ 0.0-10.0 %	300 30000 0.0	RPM RPM %
FREQUENCY, PG2	PRESET SPEED 1 PRESET SPEED 2 PRESET SPEED 3	0-TOP MOTOR RPM/HZ 0-TOP MOTOR RPM/HZ 0-TOP MOTOR RPM/HZ	0 0 0	RPM RPM RPM
FREQUENCY, PG3	SKIP FREQUENCY 1 SKIP BAND 1 SKIP FREQUENCY 2 SKIP BAND 2	0-TOP MOTOR RPM/HZ 6-90/0.1-6.0 RPM/HZ 0-TOP MOTOR RPM/HZ 6-90/0.1-6.0 RPM/HZ	0 15 0 15	RPM RPM RPM RPM
FREQUENCY, PG4	JOG SPEED	0-TOP MOTOR RPM/HZ	10	RPM
SYST CONF, PG1	SET SPEED COMMAND SELECT RUN/STOP COMMAND SELECT FWD/REV COMMAND SELECT	KEYPAD OR TERMINAL KEYPAD OR TERMINAL KEYPAD OR TERMINAL	TERMINAL TERMINAL TERMINAL	
SYST CONF, PG2	CARRIER FREQUENCY PASSWORD	2.25, 4.5, 9, 18 KHZ 0-999999(0=DISABLED)	18 0	KHZ
SYST CONF, PG3	WATCHDOG ENABLE FAULT DISABLE	YES OR NO YES OR NO	YES NO	
START/STOP, PG1	VOLTAGE BOOST VOLTAGE BOOST DELAY	0.0-10.0 % 0-30 SEC	0.0 0	% SEC
START/STOP, PG2	EXTERNAL STOP EXTERNAL STOP DECEL.TIME NORMAL STOP	BRAKE OR COAST 0.1-300.0 SEC BRAKE OR COAST	COAST 10.0 BRAKE	SEC
STABILITY, PG1	VOLTAGE LOOP GAIN CURRENT LOOP GAIN	1-99 1-99	50 50	

SET-UP SCREEN	PARAMETER	RANGE	SHIPPED
INPUTS, PG1	TERMINAL BOARD 1.1-4 TERMINAL BOARD 1.5 TERMINAL BOARD 1.6	NOTE 2 NOTE 1 NOTE 1	0-10 Vdc, J9 INTERLOCK REVERSING
INPUTS, PG2	CALIBRATE ZERO	YES OR NO	NO
INPUTS, PG3	CALIBRATE MAX.	YES OR NO	NO
OUTPUTS, PG1	TERMINAL BOARD 1.15 TB1.15 NO or NC TERMINAL BOARD 1.17 TB1.17 NO or NC TERMINAL BOARD 1.19 TB1.19 NO or NC	NOTE 3 NC or NO NOTE 3 NC or NO NOTE 3 NC or NO	AT-SPEED NO FAULT NO RUN NO
OUTPUTS, PG2	TERMINAL BOARD 1.14 TERMINAL BOARD 1.11 TERM. BOARD 1.11 SCALING	1, 2, 3, 6 x MOTOR TOP HZ NOTE 4 2.5-10.0 V	1 LOAD 6.7 V

JUMPERS (ON 20030): (AS SHIPPED, ONLY J9-11 CAN BE CHANGED BY THE CUSTOMER)	J1-6	J7	J8	J9	J10	J11	J12	J13	J14-15	SPARE
	L	L	WS	IN	OUT	OUT	LD	--	0	IN

OPTION SCREEN	PARAMETER	RANGE	SHIPPED
LISTING, PG1-6	(LISTING OF PURCHASED OPTIONS)		THERMISTOR INPUTS/OUT. MULT. VOLT.
SYST CONF, PG1	SPEED LOOP	OPEN OR CLOSED	NP
SYST CONF, PG2	BASE LD SMPLE	AUTO OR MANUAL	NP
START/STP, PG1	RESTART RESTARTS	AUTO OR MANUAL 0-9	NP NP
INPUTS, PG1	TERMINAL BOARD 2.1 TERMINAL BOARD 2.2 TERMINAL BOARD 2.3	NOTE 1 NOTE 1 NOTE 1	PRESET SPD1 PRESET SPD2 PRESET SPD3
INPUTS, PG2	TERMINAL BOARD 2.4 TERMINAL BOARD 2.5 TERMINAL BOARD 2.7	NOTE 1 NOTE 1 NOTE 1	UNUSED UNUSED KEYPAD OVER.
INPUTS, PG3	TERMINAL BOARD 2.8 TERMINAL BOARD 2.9	NOTE 1 NOTE 1	JOG E-STOP

OPTION SCREEN	PARAMETER	RANGE	SHIPPED
JTPUTS, PG1	TERMINAL BOARD 2.14 TB2.14 NO or NC TERMINAL BOARD 2.17 TB2.17 NO or NC TERMINAL BOARD 2.20 TB2.20 NO or NC	NOTE 3 NC or NO NOTE 3 NC or NO NOTE 3 NC or NO	ZERO-SPD NO BRAKING NO WARNING NO
OUTPUTS, PG2	TERMINAL BOARD 2.25 TERM. BOARD 2.25 SCALING	NOTE 4 2.5-10 V	SPEED 10.0 V
MULT VOLT, PG1	DRIVE INPUT (VOLTAGE)	208,230,380,415,460 V	460 V
MULT VOLT, PG2	OUTPUT TRANSFORMER TAP 1 TAP 2 TAP 3	YES/NO 0-DRIVE MAX.VOLTAGE V 0-DRIVE MAX.VOLTAGE V 0-DRIVE MAX.VOLTAGE V	NP NP NP NP
MOTOR#1-32, PG1	RATED POWER TOP MOTOR RPM ACCELERATION TIME DECELERATION TIME	10-100 % DRIVE HP 0-DRIVE MAX.RPM 0.1-300.0 SEC 0.1-300.0 SEC	NP NP NP NP
MOTOR#1-32, PG2	PRESET RPM (SPD1 CONTACT) GAP ELIMINATOR GAP ELIMINATOR TRIGGER	0-MOTOR TOP RPM/HZ OFF or ON 0.5-20.0 % LD	NP NP NP
MOTOR#1-32, PG3	VOLTAGE PT1 VOLTAGE PT2 VOLTAGE PT3 VOLTAGE PT4 FREQUENCY PT1 FREQUENCY PT2 FREQUENCY PT3 FREQUENCY PT4	0-DRIVE MAX.VOLTAGE 0-DRIVE MAX.VOLTAGE 0-DRIVE MAX.VOLTAGE 0-DRIVE MAX.VOLTAGE 0-DRIVE MAX. HZ 0-DRIVE MAX. HZ 0-DRIVE MAX. HZ 0-DRIVE MAX. HZ	NP NP NP NP NP NP NP NP

JUMPERS (ON 20030): (MARKED AS SHIPPED)	J1	J2	J3	J4	J5
	IN	IN	OUT	OUT	NO THRM

NP = NOT PURCHASED

NOTE 1  
(DIGITAL) INPUTS CAN BE  
ANY OF THE FOLLOWING:

INTERLOCK  
REVERSING  
KEYPAD OVER (KEYPAD OVERRIDE)  
JOG  
E-STOP  
PRESET SPD1  
PRESET SPD2  
PRESET SPD3  
RESET FAULT  
-UNUSED-  
MOTOR SEL.4 \*  
MOTOR SEL.3 \*  
MOTOR SEL.2 \*  
MOTOR SEL.1 \*  
MOTOR SEL.0 \*  
MOT.POT(+) \*  
MOT.POT(-) \*  
BASE LD TRIG. \*

NOTE 2  
(ANALOG) INPUTS CAN BE  
ANY OF THE FOLLOWING:

0-10 VDC, J9  
0-5 VDC, J9  
0-2 VDC, J9  
4-20 mA, J10  
-10/+10V, J11

NOTE 3  
OUTPUT RELAYS CAN BE  
ANY OF THE FOLLOWING:

FAULT  
AT-SPEED  
RUN  
ZERO-SPD (ZERO SPEED)  
BRAKING  
WARNING  
REVERSING  
MOTOR HOT \*  
GAP ELIMINATOR \*  
LOADLIMIT - M \*  
LOADLIMIT - G \*  
OVERLOAD \*  
OVER SPEED \*  
MOTOR # 1-32 \*  
TAP 1-3 \*

NOTE 4  
ANALOG OUTPUTS (METERS) CAN BE  
ANY OF THE FOLLOWING:

LOAD  
SPEED  
VOLTS DC (INTERNAL DC LINK VOLTAGE)

\* AVAILABLE AS OPTIONS ONLY ("OPTION" SCREEN).

CHAPTER 10

PARAMETER LIST

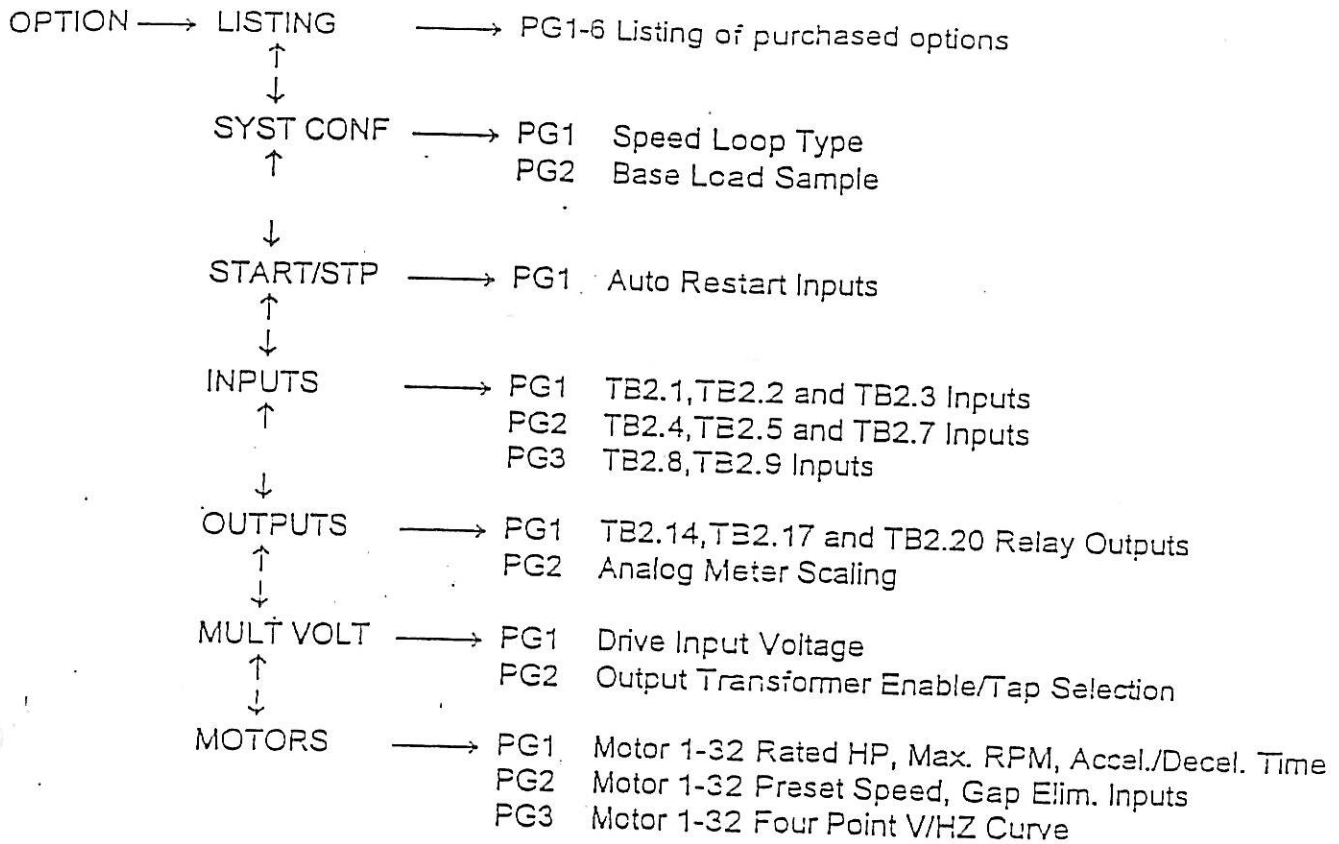
SERIES 9000 DRIVE

## 22. OPTIONS

Any option or modification to the standard drive can be found in this section.

### 2.1 OPTION Screen Menu Quick Reference

Below is an abbreviated tree structure of the digital operator station menu for the OPTION screen. Refer also to standard Menu Quick Reference, section 8.



## 22.2 OPTION Functions

This section describes in detail the set-up steps for optional, programmable parameters. For each parameter its location in the menu, its adjustment range and a short description on the parameter's function is listed. Refer to FIGURE 17. A description of hardware modifications will also be found in this section (if applicable).

NOTE: For a complete list of how the drive options were set-up prior to shipment, see section 21, DRAWINGS.

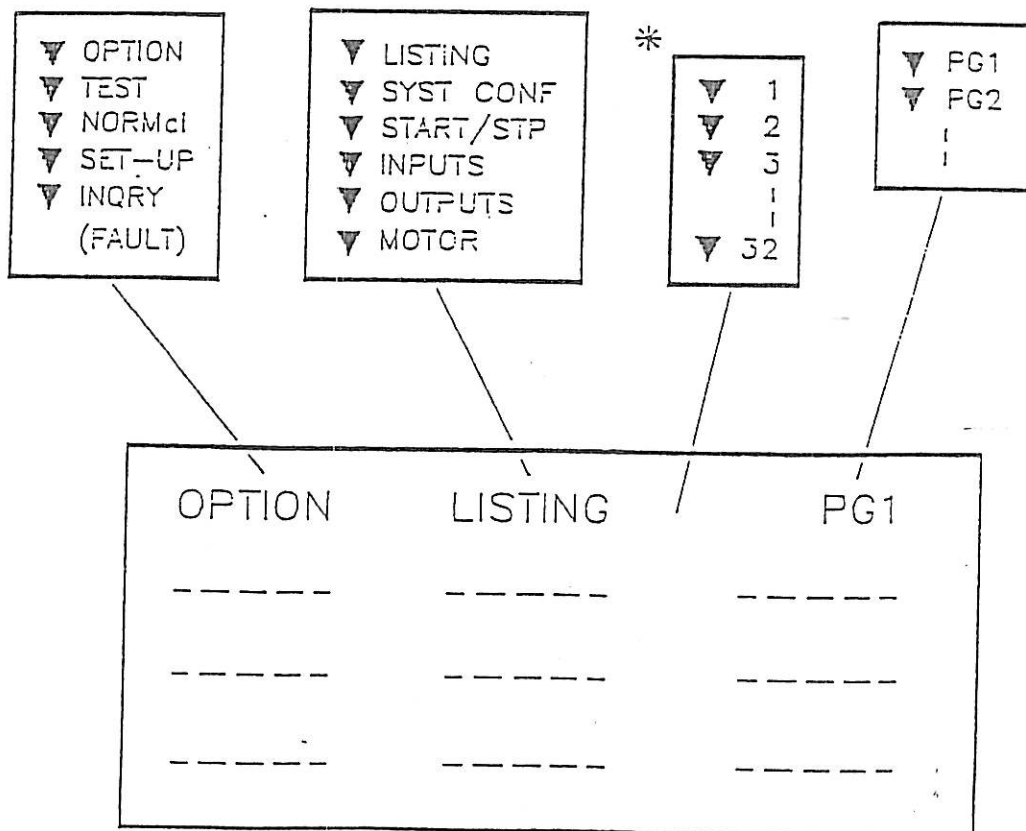
### Option Listing

Menu Location: OPTION, LISTING, PG1-6

These screens list the options that were purchased with the drive. If an option is not purchased, the following is displayed:

OPTION(S)  
NOT PURCHASED

Special hardware modifications will not be listed here.  
For other options available, contact the factory.



\* CHOOSE 1-32 IN THIS FIELD  
IN THE OPTION, MOTOR SCREEN

FIGURE 17: The OPTION Screen

## Motor Thermistor

Motor thermistor input is available on TB2.23 - .24. To enable this function, set J5 on option board .32 to "THERM" and connect motor thermistor between TB2.23 - .24. The following table shows the drive to a given thermistor resistance:

Thermistor Resistance	Drive Action
Less than approx. 11 Ohms	THERMST SHORT fault, drive output disabled
Between approx. 11 - 2300 Ohms	Drive runs normally
Greater than 2300 Ohms	MOTOR HOT warning displayed on NORM screen
Greater than 4000 Ohms	MOTOR HOT fault, drive output disabled

Refer to connection diagram in section 21.

## Inputs/Outputs

There are eight additional inputs, three additional (c-form) relay outputs, and one additional analog output available with the Inputs/Outputs option. The specific parameters for this option are as follows:

### Additional Programmable Inputs

Menu Location: OPTION, INPUTS, PG1-3

Selection: (see table below)

There are eight (6) Programmable Inputs (TB2.1-.5, .7-.9) on the option board (20032G1). The function for each of them can be any of the following described below in addition to the functions described in section 12.17, (Standard) Programmable Inputs. All functions are activated by closing a contact between TB2.6 or .10 (+20V through resistor) and the proper Additional Programmable Input terminal (TB2.1-.5, .7-.9). Refer to connection diagram in section 21.

Parameter TB2.1-.5, .7-.9	Function
MOTOR SEL. 4	4th binary bit for multiple motor (see Multiple Motor option)
MOTOR SEL. 3	3rd binary bit for multiple motor (see Multiple Motor option)
MOTOR SEL. 2	2nd binary bit for multiple motor (see Multiple Motor option)
MOTOR SEL. 1	1st binary bit for multiple motor (see Multiple Motor option)
MOTOR SEL. 0	0th binary bit for multiple motor (see Multiple Motor option)
MOT. POT (+)	Increases speed reference when closed (motorized potentiometer)
MOT. POT (-)	Decreases speed reference when closed (motorized potentiometer)
BASE LD TRIG.	Gap elim. base load sample (see Gap Eliminator option)

Programmable inputs TB1.5,.6 and TB2.1-.5, .7-.9 CANNOT have the same function. If they do, a DATA FAULT 2 fault will occur and one of the inputs will (internally) be set as a –unused– function.

### Additional Programmable Relays/NO or NC

Menu Location: OPTION, OUTPUTS, PG1

Selection: (see table below)/NO or NC

There are three (3) Additional Programmable Relays (TB2.14/TB2.17/TB2.20) on the option board (20032G1). The function can be any of the following described below in addition to the functions described in section 2.18, (Standard) Programmable Relays/NO or NC. The NO or NC parameter is used to set the relay when the function is inactive and the power is on. If the NO or NC parameter is set to NO (Normally Open), the relay will be closed when the function is active and if the NO or NC parameter is set to NC (Normally Closed), the relay will be open when the function is active. Refer to connection diagram in section 21.

Parameter TB2.14-TB2.20	Function
MOTOR HOT	Active if motor thermistor indicated motor over temperature (see below)
GAP ELIM.	Active when load rises above load set point
LOADLIMIT - M	Active in motoring load limit
LOADLIMIT - G	Active in generating load limit
OVER LOAD	Active when motor over load condition exists*
OVER SPEED	Active when motor over speed condition exists*
MOTCF. # 1-32	Active if motor # 1-32 is active (see Multiple Motor below)
T.A.P 1-3	Active if output transformer is selected (see Multiple Voltage below)

### Additional Analog Output Meter

Menu Location: OPTION, OUTPUTS, PG2

Selection: LOAD, SPEED, VOLTS DC

An analog meter can be connected between TB2.25 (+) and TB2.25 (COMMON). The Analog Output Meter (TB2.25) parameter sets the function of the meters as follows:

Parameter TB2.25 -	Function
LOAD	Meter displays motor load
SPEED	Meter displays drive output speed
VOLTS DC	Meter displays internal DC Link voltage

### Additional Analog Output Meter Scaling

Menu Location: OPTION, OUTPUTS, PG2

Adjustment Range: 2.5 - 10 Volts

The Additional Analog Output Meter Scaling (TB2.25) parameter sets the voltage applied to TB2.25 - .26 when the function programmed in the Additional Analog Output Meter parameter reaches 100%. For example, if the meter functions as a speed meter with this parameter set to 9.0 V, TB2.25 - .26 will be 9.0 V if the output speed is 100%, 4.5 V if the output speed is 50%, etc.

\* function not available at the time of writing

## Multiple Voltages

When enabled, the Multiple Voltage option permits the use of different input voltages (proper power supply board must be used), and can automatically take into account the voltage ratio of an output transformer (for purpose of proper motor voltage indication).

### Multiple Input Voltage

The multiple input voltages option allows the drive input voltage to be programmed by the customer. A control transformer jumper on the power supply board (20031) MUST be set as well. If the power supply board you have does not have a jumper for the input voltage to be used, a different power supply board and control transformer is needed, contact factory. Make sure drive CHARGE light in upper left corner of drive is off before removing drive cover. Care must be used when using this function as applying the wrong input voltage to the drive can cause drive damage.

The following steps should be used to change the drive input voltage:

- a) With the power to drive off, set the voltage input jumper on power supply board (20031) to match the desired input voltage. Refer to Component Location Diagram, section 21.
- b) Apply new input voltage.
- c) One of the following drive faults may occur:
  - CONTACTR OPEN
  - LOW LINE VOLT
  - HIGH LINE VOLT.
  - LOW LINK VOLT
  - HIGH LINK VOLT.
- d) Set Drive Input Voltage parameter to match jumper setting.
- e) Reset drive by pressing STOP/START, run normal operation.

### Drive Input (Voltage)

Menu Location: OPTION, MULT VOLT, PG1

Selection: 230, 380, 415, 460 or Volts for 460 V drives / 208 or 230 Volts for 230 V drives.

Drive Input should be set to the input voltage applied to the drive. One of the following voltages should be programmed: 230, 380, 415 or 460 V for 460 V drives / 208 or 230 V for 230 V drives.

**NOTE:** It is important that the set-up voltages for the motors do not exceed the drive input voltage. Always check the motor data after changing the drive input voltage.

**NOTE:** It is important that the input voltage applied to the drive does not exceed the maximum input voltage listed on the drive nameplate.

### Output Transformer

An output transformer is the transformer between the drive and the motor. It can be isolation or autotransformer type. Because of design requirements it is strongly recommended to use only factory supplied transformer. The most common use of an output transformer is to provide the full power on the output at less than rated voltage.

For single output tap transformer (for example 460 Vin, 350 Vout), the output transformer option will permit the the indication to read motor voltage on the TEST screen (transformer secondary), rather than the drive output voltage (transformer primary).

For test stand applications where many different motors are tested, output transformers with suitable taps (multiple secondary) may be used. The output transformer option allows an output transformer with up to three secondary taps to be used with the drive. Once the output transformer option is enabled and the tap voltage(s) are set, the drive output is automatically scaled to the output transformer. Depending on the maximum motor voltage programmed, one of the 3 designated relays on the option board will be energized.

which will energize the corresponding output tap selection contactor. Up to three output relays on the option board can be programmed in order to activate contactors to select the appropriate tap. Refer to Input/Outputs in this section for selecting output relays. Refer to connection diagram for wiring between relays, contactors and transformer. The tap selected is one with equal or closet higher voltage than the maximum motor voltage programmed. The motor voltage indicated on the meter screen will be the voltage selected tap (transformer secondary). Note that output transformer can be used without this option. The meter screen will indicate the drive output (transformer primary), and output taps must be selected manually.

The parameters for the output transformer option are as follows:

### Output Transformer Option

Menu Location: OPTION, MULT VOLT, PG2

Selection: YES/NO

Select YES/NO in this parameter to enable/disable the output transformer option. If the parameter is set to NO, the drive will operate using the Drive Max. Voltage for all scaling. If the parameter is set to YES, then the drive will use the appropriate output transformer tap for all scaling.

### Voltage Taps 1-3

Menu Location: OPTION, MULT VOLT, PG2

Adjustment Range: 0 - Drive Max. Voltage

Voltage Taps 1-3 parameters should be set to the secondary tap voltages of the output transformer. A setting of zero (0) is used to disable the use of that tap.

NOTE: If two or more taps have the same tap voltage then only one tap will be selected. If the Motor Top Voltage (see section 11) is higher than secondary tap(s), the drive will issue Data Fault 4.

NOTE: It is assumed the output transformer primary matches the drive input voltage as shown on OPTION, MULT VOLT, PG1. If the Drive Input Voltage is changed, it is assumed the output transformer will be changed also.

NOTE: Only step down transformers are to be used with this option (i.e., secondary less than or equal to primary).

NOTE: The current display (Amps) on the TEST screen displays drive output current (transformer primary current), not motor current (transformer secondary current).

The following example gives the steps necessary to add a 460 V primary/380 V secondary output transformer to a 460 V drive which is to operate a 2 pole, 45000 RPM, 750 HZ, 350 V motor (spindle).

1. With power off, connect output transformer to drive, and motor.
2. Apply power to drive.
3. Enter motor data (45000 RPM, 750 HZ, 350 V) in the SETUP, BASIC, PG2 screen (this sets proper motor V/HZ).
4. Set the OPTION, MULT VOLT, PG2 screen as:
  - a. Change OUTPUT X-FORMER to YES.
  - b. Set Tap 1 to 380 V. Tap 2 and Tap 3 should be zero (Tap 2 and 3 not used - only single secondary).
5. Press NORMAL to return to NORM screen.

At motor speed (750 HZ), the drive will now output a voltage lower than 460 V ( $(350/380) \times 460 = 424$  V) to the primary of the transformer so that the output of the transformer is 350 V. Note that the maximum (programmed) motor HP can be only  $(350/380) \times \text{Drive Max. KVA}$  (HP).