

TOSHIBA

HIGH PERFORMANCE TRANSISTOR INVERTER
IGBT DIGITAL SERIES

TOSVERT-130Hz

OPERATION MANUAL

September, 1995
Part #39022-000



IMPORTANT NOTICE

The instructions contained in this manual are not intended to cover all of the details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should additional information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local Toshiba sales office.

The contents of this instruction manual shall not become a part of or modify any prior or existing agreement, commitment, or relationship. The sales contract contains the entire obligation of Toshiba International Corporation's Inverter Division. The warranty contained in the contract between the parties is the sole warranty of Toshiba International Corporation's Inverter Division and any statements contained herein do not create new warranties or modify the existing warranty.

Toshiba International Corporation reserves the right, without prior notice, to update information, make product changes, or to discontinue any product or service identified in this publication.

Any electrical or mechanical modification to this equipment, without prior written consent of Toshiba International Corporation, will void all warranties and may void UL listing and/or CSA certification.

AC ADJUSTABLE SPEED DRIVE

Please complete the Extended Warranty Card supplied with this inverter and return it by prepaid mail to Toshiba. This activates the extended warranty. If additional information or technical assistance is required, call Toshiba's marketing department toll free at (800) 231-1412 or write to: Toshiba International Corporation, 13131 W. Little York Road, Houston, TX 77041-9990.

Please complete the following information for your records and to remain within this equipment manual:

Model Number: _____

Serial Number: _____

Date of Installation: _____

Inspected By: _____

Reference Number: _____

GENERAL SAFETY INSTRUCTIONS

Warnings in this manual appear in either of two ways:

- 1) *Danger warnings* - The danger warning symbol is an exclamation mark enclosed in a triangle which precedes the 3/16" high letters spelling the word "DANGER". The Danger warning symbol is used to indicate situations, locations, and conditions that can cause serious injury or death:



- 2) *Caution warnings* - The caution warning symbol is an exclamation mark enclosed in a triangle which precedes the 3/16" high letters spelling the word "CAUTION". The Caution warning symbol is used to indicate situations and conditions that can cause operator injury and/or equipment damage:



Other warning symbols may appear along with the *Danger* and *Caution* symbol and are used to specify special hazards. These warnings describe particular areas where special care and/or procedures are required in order to prevent serious injury and possible death:

- 1) *Electrical warnings* - The electrical warning symbol is a lightning bolt mark enclosed in a triangle. The Electrical warning symbol is used to indicate high voltage locations and conditions that may cause serious injury or death if the proper precautions are not observed:



- 2) *Explosion warnings* - The explosion warning symbol is an explosion mark enclosed in a triangle. The Explosion warning symbol is used to indicate locations and conditions where molten, exploding parts may cause serious injury or death if the proper precautions are not observed:



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SECTION 1 - Action to Take Upon Receipt of the Drive

CHAPTER 1

Unpack and Examine the Drive:

Read the following Items in Chapter 1:

- 1.1. Introduction
- 1.2. Features
- 1.3. Inspection, Storage, and Disposal
- 1.4. Safety in Installation and Operation
 - 1.4.1 Installation Precautions
 - 1.4.2 Operating Precautions
 - 1.4.3 Confirmation of Wiring
 - 1.4.4 Start-Up and Test
 - 1.4.5 Maintenance
- 1.5. Drive Registration

1. 1 Introduction

Thank you for purchasing the **TOSHIBA Tosvert 130 Model H2**. This variable frequency solid state AC drive features low acoustical noise, pulse width modulation, digital control, and programmability. The very latest microprocessor and insulated gate bipolar transistor technology is used. This, combined with Toshiba's high performance software, gives unparalleled motor control and reliability.

It is the intent of this operation manual to provide a guide for **safely** installing, operating, and maintaining the drive. This manual contains a section of general safety instructions and is marked throughout with warning symbols. **Read this operation manual** thoroughly before installation and operation of this drive. **All safety warnings must be followed** to ensure personal safety. **Follow all precautions** to attain proper equipment performance and longevity.

The manual is divided into major sections of interest.

Section 1 discusses procedures to follow upon receipt of the drive, and how to install and prepare the drive for operation.

All of the initial inspection, storage, installation and operating precautions can be found in Chapter 1. Chapter 2 contains information required to install and properly wire control and power wiring, including standard specifications and information on grounding, wiring, sizing external devices, and cable sizes. Also included are instructions to properly set connectors and jumpers, and explanations of the uses for these devices. Drawings showing the physical location of these devices are also located in this Chapter.

Section 2 explains in the simplest terms how to operate the drive.

Chapter 3 explains simple operation of the drive, ignoring the advanced techniques required for more complex operation.

Section 3 has detailed and advanced explanations of the touchpad, parameters, and their uses.

Chapter 4 shows layout information about the keypad panel and readouts and explains how this device is used to operate the inverter. Chapter 5 contains a list of all drive parameters. Many examples and explanations of the parameters are given. Chapter 6 explains how to use the most common parameters in even greater detail than Chapter 5.

Section 4 explains how to monitor the operation of the drive.

Chapter 7 details drive monitoring, including how to monitor output volts, amps, frequency, special drive signals, and other drive information useful for maintenance and control.

Section 5 discusses drive trips.

Chapter 8 lists and explains drive trips and trouble shooting techniques. A great deal of information is stored in the drive upon the occurrence of a trip. When examined, this information can be of great use to diagnose the reason for a drive trip, and how to correct and prevent a future trip.

Section 6 lists drive options and spare parts.

Chapter 9 includes a detailed list of many of the optional devices used on drive applications. A very complete list of spare parts for the full range of Model H2 drives is included. A sample service request form is shown, detailing the information necessary to request service for a

Toshiba drive.

Section 7 contains technical drawings.

Chapter 10 contains numerous technical reference documents and drawings.

Any problems, questions, or comments about the use of this equipment should be directed to the Inverter Marketing Department @ **(800) 231-1412**.

Again, thank you for purchasing this product.

1.2 Features

- **Multifunctional User-Friendly Operating Panel**

Commands are easily entered via the inverter's keyboard type operating panel. The operating panel enables the user to run/stop the inverter, read/change the operating function settings, and monitor the operating conditions of the inverter. All of these operations are accomplished via the inverter's user-friendly software, keypad, and 7 segment LED display. See Chapter 4 for details on the operating panel.

- **Direct Access of All Functions**

With the Model H2, the user can directly access and change any of the built-in functions. The software was designed to make programming and set-up time extremely fast and easy. There is no need to scroll through a long list of functions or flip numerous dip switches just to set one particular function. See Chapter 5 for a list of all drive parameters.

- **Ability to Change Function Settings Even While Motor is Running**

Accessing and setting the individual functions can be performed with or without a motor being attached. In fact, all but two of the inverter's functions can be accessed and changed while the driven motor is running.

- **One Touch Status Monitoring**

Monitoring the inverter's operating conditions requires the pressing of a single key. Items which can be monitored include the inverter's output current and output voltage. See Chapter 7 for a complete list of items and monitoring details.

- **Remote Operating Panel**

The NEMA 4/12 operating panel can be placed up to 5M (15ft) from the inverter's chassis, without any additional electronics, simply by using an optional cable. This feature allows for the continued ease of operation should the inverter be placed inside an enclosure. See Chapter 4 for operation instructions. See Chapter 10 for dimensions and remote mounting instructions and dimensions.

- **Ability to Reset All Functions to Initial Factory Settings**

In cases where an unknown number of functions may become misadjusted when setting up for a particular application, it is usually easier to reset the inverter to factory settings and start over rather than search for the misadjusted functions. Refer to Chapter 5 for factory default settings of all parameters. See Chapter 6 for instructions to reset the drive to these factory default settings.

1.3 Inspection, Storage and Disposal

1.1 Inspection of the New Unit

Upon receipt of the **TOSHIBA Tosvert 130 Model H2**, a careful inspection for shipping damage should be made.

After uncrating:

- 1) Check the unit for loose, broken, bent or otherwise damaged parts due to shipping.
- 2) Check to see that the rated capacity and the model number specified on the nameplate conform to the order specifications.

1.2 Storage

- 1) Store in a well ventilated location and preferably in the in the original carton if the inverter will not be used immediately after purchase.
- 2) Avoid storage in locations with extreme temperatures, high humidity, dust, or metal particles.

1.3 Disposal


Please contact your state environmental agency for details on disposal of electrical components and packaging in your particular area.

1.4 Safety in Installation and Operation

1.4.1 Installation Precautions



CAUTION



- 1) Install in a secure and upright position in a well ventilated location that is out of direct sunlight. The ambient temperature should be between -10° C and 40° C (up to 50° C when not enclosed in a cabinet).
- 2) Allow a clearance space of 4 inches (10 cm) for the top and bottom and 2 inches (5 cm) on both sides. This space will insure adequate ventilation. Use care not to obstruct any of the ventilation openings.
- 3) Avoid installation in areas where vibration, heat, humidity, dust, steel particles, or sources of electrical noise are present.
- 4) Adequate working space should be provided for adjustment, inspection and maintenance.
- 5) Adequate lighting should be available for troubleshooting and maintenance.
- 6) A noncombustible insulating floor or mat should be provided in the area immediately surrounding the electrical system where maintenance is required.
- 7)  **Always ground the unit to prevent electrical shock and to help reduce electrical noise. A separate ground cable should be run inside the conduit with the input, output, and control power cables (See Grounding Item 2.4). *The metal of the conduit is not an acceptable ground.***
- 8) Connect three phase power of the correct voltage to input terminals L1, L2, L3 (R, S, T) and connect three phase power from output terminals T1, T2, T3 (U, V, W) to a motor of the correct voltage and type for the application. Size the conductors in accordance with *Main Breaker and Wire Sizing Chart* (See Item 2.2).
- 9) If conductors of a smaller than recommended size are used in parallel to share current then the conductors should be kept together in sets i.e. U1, V1, W1 in one conduit and U2, V2, W2 in another. National and local electrical codes should be checked for possible cable derating factors if more than three power conductors are run in the same conduit.
- 10) Install a molded case circuit breaker (MCCB) between the power source and the inverter. Size the MCCB to clear the available fault current of the power source.
- 11) Use separate metal conduits for routing the input power, output power, and control circuits.
- 12) Installation of inverter systems should conform to the *National Electrical Code*, regulations of the *Occupational Safety and Health Administration*, all national, regional or industry codes and standards.
- 13) Do not connect control circuit terminal block return connections marked CC to inverter earth ground terminals marked GND(E). See *Terminal Connections and Functions* (Item 2.5) and *Simple Connection Diagrams* (Item 2.6).

1.4.1 Installation Precautions (cont'd)  **CAUTION**

- 14) If a secondary Magnetic Contactor (MC) is used between the inverter output and the load, it should be interlocked so the ST-CC terminals are disconnected before the output contactor is opened. If the output contactor is used for bypass operation, it must also be interlocked so that commercial power is never applied to the inverter output terminals (U,V,W).

1.4.2 Operating Precautions  **CAUTION**

- 1) Do not power up the inverter until this entire operation manual is reviewed.
- 2) The input voltage must be within +/-10% of the specified input voltage. Voltages outside of this permissible tolerance range may cause internal protection devices to turn on or can cause damage to the unit. Also, the input frequency should be within +/-2 Hz of the specified input frequency.
- 3) Do not use this inverter with a motor whose rated input is greater than the rated inverter output.
- 4) This inverter is designed to operate NEMA B motors. Consult the factory before using the inverter for special applications such as an explosion proof motor or one with a repetitive type piston load.

- 5)  **DANGER**  Do not touch any internal part with power applied to the inverter. First remove the source power and check that the charge and power LED's are out. **A hazard exists temporarily for electrical shock even if the source power is removed.**

- 6)   Do not operate this unit with the cabinet door open.

- 7) Do not apply commercial power to the output terminals T1 (U), T2 (V), or T3 (W) even if the inverter source power is off. Disconnect the inverter from the motor before applying a test or bypass voltage to the motor.
- 8) Use caution when setting output frequency. Overspeeding of the motor can cause serious damage to the motor and/or the driven load equipment.
- 9) Use caution when setting the acceleration and deceleration time. Unnecessarily short times can cause undue stress and tripping of the drive.
- 10) The H2 series of inverters can be operated in a special PWM high carrier frequency mode for low acoustical noise. When operating in this special mode, where the carrier frequency is greater than 3 KHz, special programming procedures and operating precautions must be followed. **Failure to follow these special programming procedures and operating precautions may result in damage to the inverter and can invalidate the factory warranty (Contact Toshiba for additional operating and programming information).**
- 11) Interface problems can occur when this inverter is used in conjunction with some types of process controllers. **Signal isolation may be required to prevent controller and/or inverter damage (Contact Toshiba or the process controller manufacturer for additional information about compatibility and signal isolation).**

1.4.2 Operating Precautions (cont'd) CAUTION

- 12) Do not open and then re-close a secondary magnetic contactor (MC) between the inverter and the load until the inverter has been turned OFF (output frequency has dropped to zero) and the motor has stopped rotating. **Abrupt re-application of the load while inverter is ON or motor is rotating can cause inverter damage.**
- 13) Personnel who have access to the adjustments and operation of this equipment should be familiar with these drive operating instructions and with the machinery being driven.
- 14) The operator of the drive equipment should be properly trained in the operation of the equipment.
- 15) **Follow all warnings and precautions; do not exceed equipment ratings.**

1.4.3 Confirmation of Wiring CAUTION

Make the following final checks before applying power to the unit:


- 1) Confirm that source power is connected to terminals L1, L2, L3 (R, S, T). **Connection of incoming source power to any other terminals will damage the inverter.**
- 2) The 3-phase source power should be within the correct voltage and frequency tolerances.
- 3) The motor leads must be connected to terminals T1, T2, T3 (U, V, W).
- 4) Make sure there are no short circuits or inadvertent grounds and tighten any loose connector terminal screws.

1.4.4 Start-Up and Test CAUTION

Prior to releasing an electrical drive system for regular operation after installation, the system should be given a start-up test by competent personnel. This assures correct operation of the equipment for reasons of reliable and safe performance. It is important to make arrangements for such a check and that time is allowed for it.

When power is applied for the first time the inverter will come up in the factory settings (See section 5.1). If these settings are incorrect for the application trial run then, before activating the run button, the correct settings should be programmed from the control panel. **The inverter can be operated with no motor connected.** Operation with no motor connected or use with a small trial motor is recommended for initial adjustment or for learning to adjust and operate the inverter.

1.4.5 Maintenance CAUTION

- 1) Periodically check the operating inverter for cleanliness.
- 2) Keep the heatsink free of dust and debris.
- 3)  Periodically check electrical connections for tightness **(make sure power is off and locked out).**

1.5 Drive Registration

Please take a moment to **Register the Drive** by completing and returning the enclosed warranty card.

CHAPTER 2

How to Correctly Install and Wire the Drive for Operation:

- 2.1. Standard Specifications**
- 2.2. Main Breaker and Wire Sizing Chart**
- 2.3. Discussion of Applicable Electrical Codes and Code Requirements**
- 2.4. Proper Grounding of the Inverter**
- 2.5. Terminal Connections and Functions**

- 2.6. Simple Connection Diagrams for Control and Power Wiring**
- 2.7. Jumper Details (JP1 and JP2)**
- 2.8. Terminal Block Details for the Control/Driver Board**
- 2.9. JP1/JP2 Jumper/Terminal Connections, Settings, and Functions**
- 2.10. Printed Wiring Board Details and Terminal Connections**

Confirm that the specifications of the drive purchased will meet the application requirements. Note especially the voltage and current ratings of the drive as compared to the motor and driven load (See Item 2.1).

Confirm that all wiring, breakers, and similar devices attached to the drive meets or exceeds the recommendations of the wire size chart (See Item 2.2).

Become familiar with the applicable requirements of the NEC, CEC, NFPA, OSHA, NEMA, ANSI and any state, county, city, or local codes. Comply with these codes to the fullest extent possible during installation and operation (See Item 2.3).

Properly ground the inverter with a separate ground wire. This is critical to proper drive operation (See Item 2.4).

Be sure all control and power wiring is connected to the proper terminals as indicated in the Terminal Connections and Functions section of this manual (See Item 2.5).

Be sure all control and power wiring meets or exceeds the standards and examples shown in the Simple Connection Diagrams (See Item 2.6).

Be sure the jumpers JP1 and JP2 are properly installed for the intended application as shown in the Jumper Connections section of this manual (See Item 2.7 and 2.9).

A drawing showing the details of the Control Terminal Blocks is included in this chapter of the Manual. Drawings showing the location of the terminal blocks and jumpers JP1 and JP2 as they are located on the printed circuit boards are also located in this chapter (See Item 2.8 and 2.10).

2.1 Standard Specifications

RATINGS						
MODEL	RATED KVA	OUTPUT CURRENT AMPS	OUTPUT VOLTAGE 3-PHASE	OVERLOAD CURRENT	MAIN CIRCUIT INPUT VOLTAGE 3-PHASE	CONTROL CIRCUIT SINGLE PHASE
*H2-2035	3.5	9.6	200-230V	120% FOR 60 SEC. 110% CONTINUOUS	200V@50Hz or 200-230V@60Hz VOLT ±10% Hz ±2Hz	NO EXTERNAL CONTROL SOURCE REQUIRED
*H2-2055	5.5	15.2	3-PHASE			
*H2-2080	8	22	(MAX			
*H2-2110	11	28	OUTPUT			
*H2-2160	16	42	VOLTAGE			
*H2-2220	22	56	UNDER NO			
*H2-2270	27	68	LOAD)			
*H2-2330	33	84				
*H2-4055	5.5	7.6	380-460V		380V@50Hz or 400-460V@60Hz VOLT +/-10% Hz +/-2Hz	
*H2-4080	8	11	3-PHASE			
*H2-4110	11	14.5	(MAX			
*H2-4160	16	21	OUTPUT			
*H2-4220	22	28.5	VOLTAGE			
*H2-4270	27	36.5	UNDER NO			
*H2-4330	33	40	LOAD)			
*H2-4400	40	55				
*H2-4500	50	65				
*H2-4600	60	84				
*H2-4800	80	104				
*H2-410K	100	124				
**H2-412K	125	162				
**H2-415K	150	194				
**H2-420K	200	240				

* These units are UL (Underwriters Laboratories Inc.) listed and CSA (Canadian Standards Association) certified.

** These units are UL (Underwriters Laboratories Inc.) listed and CUL (Canadian Underwriters Laboratories Inc.) listed.

2.1 Standard Specifications (cont'd)

ITEM		STANDARD SPECIFICATIONS
Control	Control Method	Sinusoidal PWM control
	Output voltage regulation	Same as power line.
	Output frequency	0.0 to 160.0 Hz (0.0 to 60 Hz setting when shipped); maximum frequency range is 30 to 160 Hz *1
	Frequency setting resolution	0.1Hz: Operating panel input; 0.03 Hz: Analog input; 0.01Hz: Input through computer interface (against a 60 Hz)
	Frequency accuracy	±0.5% (at 25°C; ±10°C) against the maximum frequency
	Voltage/frequency characteristics	Second-order nonlinear mode for variable torque. "Max voltage" frequency adjustment (25 to 160 Hz), torque boost adjustment (0 to 30 %), start-up frequency adjustment (0 to 10 Hz)
	Frequency setting signals	3k ohms potentiometer (a 1k to 10k ohms-rated potentiometer can be connected). 0 to 10 Vdc (input impedance: 30k ohms), 0 to 5 Vdc (15k ohms), 4 to 20 mAdc (250 ohms)
	Output frequency characteristics of IV terminal input signal	Can be set to an arbitrary characteristic by setting 2 points.
	Frequency jump	3-point setting; setting jump frequency and band width
	Upper/lower limit frequencies	Upper limit frequency: 0.0 Hz to maximum frequency Lower limit frequency: 0.0 Hz to upper limit frequency
PWM carrier frequency switching	Adjusted in the range of 5 kHz to 16 kHz (12 kHz setting when shipped)	
Operating functions	Acceleration/deceleration time	0.1 to 1200 seconds, switching of acceleration time 1 or 2, selection of S-shaped 1 or 2, or selection of acceleration/ deceleration patterns
	Electrical braking	DC injection braking Start-up frequency adjustment (0 to 10 Hz), braking voltage adjustment (0 to 20 %), braking time adjustment (0 to 5 seconds)
	Forward or reverse run	Forward run when F-CC closed; reverse run when R-CC closed; reverse run when both F-CC and R-CC closed; coasting stop when ST-CC open; emergency coast stop by a command from operating panel
	Jogging run	Jogging run engaged when N.O. contact is closed. (adjustment range 0.0 to 20.0 Hz)
	Multispeed run	By opening and closing different combinations of CC, SS1, SS2, and SS3, the set speed or seven preset speeds can be selected.
	Automatic fault latch reset	When a protective function is activated, the system checks main circuit devices, and attempts the restart up to 5 times (activated when shipped)
	Soft stall	Sustains a run in overload mode (set at ON when shipped)
	Automatic restart	Smoothly recovers a normal run of a free-running motor utilizing motor speed detection control.
	Programmable RUN patterns	Allows setting of 7 different patterns of automatic operation
Protection	Protective functions	Stall prevention, current limit, overcurrent, overvoltage, short-circuit at load, load-end ground fault, undervoltage, momentary power interrupt, electronic thermal overload, main circuit over-current at start-up, load-end overcurrent at start-up, cooling fin overheat, and emergency stop. Provisions for external fault signal.
	Electronic thermal characteristics	Standard motor/constant torque V/f motor switching, and electronic thermal stall prevention activating level adjustment
	Reset	Resets inverter when N.O. contact is closed.

*1 Consult the factory for applications above 80 Hz.

2.1 Standard Specifications (cont'd)

ITEM		STANDARD SPECIFICATIONS	
Display	(4) 7-segment red LED digits with colon and decimal points (4) discrete green LED's	Output frequency/ OFF	Frequency range 0.0 to 160 Hz and OFF state
		Warning indications	Stall preventive warning, overvoltage limit warning, overload warning, power-end undervoltage warning, DC main circuit undervoltage warning, setting errors, EEPROM abnormality, and data transfer abnormality warnings
		Fault indications	Overcurrent, overvoltage, load-end ground fault, overload, armature overcurrent at start-up, load-end overcurrent at start-up, heat sink overheat.
		Data and status	Inverter status (forward/reverse run, frequency set value, output current, etc.) and each set value
		Speed scaling	An arbitrary unit (revolution speed, linear velocity or the like) as well as output frequency can be displayed by use of an arbitrary multiplication factor
		Data storage	A number is assigned to each inverter (for 0 to 31 inverters).
		(1) discrete red LED (located inside enclosure)	DC charge indicator
Output signals	Fault detection signal	One form C contact (250 AC / 30 Vdc)	
	Low speed/reach signals	Open collector output (24 Vdc, 50 mA maximum)	
	Upper limit/lower limit frequency signals	Open collector output (24 Vdc, 50 mA maximum)	
	Frequency meter output and ammeter output	Ammeter rated at 1mA _{dc} at full scale, or voltmeter rated at 7.5 Vdc, 1mA	
Enclosure type		NEMA Type 1 (standard)	
Cooling method		Convection-cooled H2-2035 and H2-4055 Fan-cooled H2-2055 thru H2-2330 and H2-4080 thru H2-420K	
Color		Sherwin Williams Precision Tan #F63H12	
Service conditions	Service environment	Indoor, altitude 1000m (3,300 ft) maximum. Must not be exposed to direct sunlight, or subjected to corrosive or explosive gas or mists.	
	Ambient temperature	From -10 to 40°C (contact Toshiba about operation above 40°C)	
	Relative humidity	95 % maximum (no condensation allowed)	
	Vibration	Acceleration at 0.5 G maximum (20 to 50 Hz), amplitude at 0.1 mm maximum (50 to 100 Hz)	

2.2 Main Breaker and Wire Sizing Chart

Inverter	*Molded case circuit breaker (MCCB)	Ampacity (FLA x 1.25)	**Typical cable size (AWG)			
Type form	Amp rating (A)	(A)	Main power and motor load	230Vac and 460Vac control power source	Frequency command input, frequency meter, ammeter	Other signal circuits
H2-2035	20	13.8	#14	#14	3-core shield cable (speed reference) 2-core shield cable #20	#18
H2-2055	30	21.9	#12			
H2-2080	50	31.6	#10			
H2-2110	70	40	#8			
H2-2160	90	60	#6			
H2-2220	100	78	#4			
H2-2270	125	98	#3			
H2-2330	150	115	#2			
H2-4055	15	10.9	#14			
H2-4080	30	15.8	#14			
H2-4110	30	20.1	#12			
H2-4160	40	30.2	#10			
H2-4220	50	38.8	#8			
H2-4270	70	48.8	#8			
H2-4330	90	57.5	#6			
H2-4400	100	74.8	#4			
H2-4500	100	93.4	#3			
H2-4600	125	110.7	#2			
H2-4800	175	138	#1/0			
H2-410K	200	178.3	#3/0			
H2-412K	225	223	#4/0			
H2-415K	300	268	*** 2(#2/0)			
H2-420K	350	330	*** 2(#4/0)			

See next page for notes and cautions.

2.3 Discussion of Applicable Electrical codes and Requirements

- * The customer supplied Molded Case Circuit Breaker (MCCB) or Magnetic Circuit Protector (MCP) should be coordinated with the available short circuit current. The units are rated for output short circuit faults of 5000A (1 - 50 HP), 10,000A (51 - 200 HP), and 18,000A (201 - 400 HP) according to the UL 508C "Power Conversion Equipment", Table 58.2 or CSA Standard C22.2 No.14-M1987 "Industrial Control Equipment" Table 24. The selection of breakers for this table is in accordance with 1990 NEC Article 430. The selection of these breakers takes into consideration motor starting at the low end of the output voltage specifications but does not consider the use of high efficiency motors.
- * For multiple motor applications, the magnetic only MCP should be replaced by a thermal magnetic MCCB. The MCCB should be sized according to 1.25 X (largest motor Full Load Amps) + (sum of all other motor Full Load Amps) to meet National Electric Code (NEC) or Canadian Electrical Code (CEC) requirements. An individual overload relay must be provided for each motor in multiple motor applications.
- ** Wire sizing is based upon NEC table 310-16 or CEC Table 2 using 75 deg C cable, an ambient of 30deg C, cable runs for less than 200 FT., and copper wiring for not more than three conductors in raceway or cable or earth (directly buried). The customer should consult the NEC or CEC wire Tables for his own particular application and wire sizing.
- ** For cable runs greater than 200 FT. between the motor and inverter, consult the factory before installing.
- *** Use two parallel conductors instead of a single conductor (this will allow for the proper wire bending radius within the cabinet). Use separate conduits for routing parallel conductors. This prevents the need for conductor derating (see note 3 this page).



CAUTION

Use separate conduits for routing incoming power, power to motor, and control conductors. Use no more than three power conductors and a ground conductor per conduit.

Notes:

- 1.) Auxiliary relays used to switch inverter signals should be capable of switching low current signals (i.e. 5mA).
- 2.) The inverter has internal overload protection, but the Local, National, or Canadian Electrical Codes may require external motor overload protection.
- 3.) When wiring with parallel conductors, the conductors should be kept together in phase sets with U1, V1, W1 in one conduit and parallel conductors U2, V2, W2 in another conduit. The ground conductor should be in one of these conduits.
- 4.) Twisted pair wiring should be used for external meters connected to AM and FM terminals.

2.4 Proper Grounding of the Inverter


The inverter should be grounded in accordance with Article 250 of the National Electrical Code or Section 10 of the Canadian Electrical Code, Part I and the grounding conductor should be sized in accordance with NEC Table 250-95 or CEC, Part I Table 16.




CAUTION

Conduit is not a suitable ground for the inverter.

2.5 Terminal Connections and Functions

Terminal name	Terminal functions	Terminal location
L1, L2, L3 (R, S, T)	Input power terminals. Connect to either a 3-phase 50Hz, 200Vac power supply or to a 3-phase 60Hz, 200 to 230Vac power supply for models H2-2035 to H2-2330.	Bus bar or power terminal block 
	Input power terminals. Connect to either a 3-phase 50HZ, 380Vac power supply or to a 3-phase 60HZ, 400 to 460Vac power supply for models H2-4055 to H2-420K.	
T1, T2, T3 (U, V, W)	Output load terminals. Connect these terminals to a 3-phase induction motor of the proper voltage.	
OH	Input terminal for external fault signal.	Terminal block
OV	This is the return terminal for OH.	
FLA, FLB, FLC	Output terminals of form C contact changes state when a protective function has been activated (250Vac - 2A).	Control PWB terminal block
P24	Output terminal for unregulated 24Vdc power supply (100mA maximum output current).	
RCH(UL)	Output terminal (open collector). Provides an output signal ground (50 mAdc max) when the upper limit frequency is reached, when an acc/dec is complete, or when the output frequency is within a specified range. The choice is determined by settings of the Output Terminal Selection function (:0.tb). (See page 7-5)	
LOW(LL)	Output terminal (open collector). Provides an output signal ground (50 mAdc max) when a preset low speed or a preset lower limit is reached. The choice is determined by settings of the Output Terminal Selection function (:0.tb). (See page 7-5)	
FM	Output terminal for an external analog frequency meter. Use either an ammeter rated at 1mAdc at full scale or a voltmeter rated at 7.5Vdc at full scale.	
AM	Output terminal for an external analog ammeter. Use either an ammeter rated at 1mAdc at full scale or a voltmeter rated at 7.5Vdc at full scale.	
PP	Regulated 10Vdc power supply to be used with terminal RR for remote terminal input.	
RR	Analog input terminal for a 0 - 5Vdc (JP2 @ 5V) or 0 - 10Vdc (JP2 @ 10V) external reference signal. Also used for wiring a 1k - 10k ohm (3k ohm recommended) potentiometer to allow for remote speed control operation.	
IV	Analog input terminal for a 0 - 5Vdc (JP1 @ V) or 4 (0) - 20mAdc (JP1 @ I) external reference signal.	
CC (one of three)	This is the common return for PP,RR, and IV terminals. Do not connect to GND(E).	

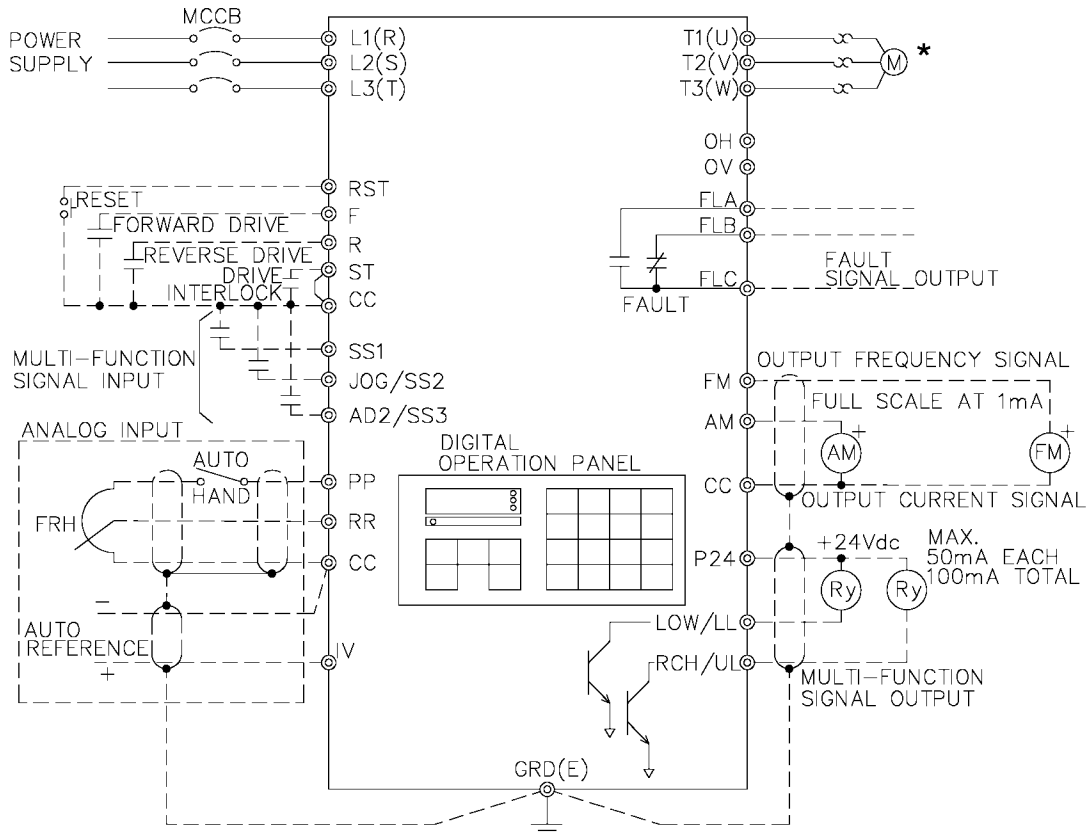
2.5 Terminal Connections and Functions (cont'd)

Terminal name	Terminal functions	Terminal location
ST	Input terminal for run interlock. When ST is shorted to CC, the inverter is ready to run. With ST-CC open the unit will not run and if opened while running a coasting stop begins.	Control PWB terminal block
F	Input terminal for forward run. When F is shorted to CC, a forward run starts. With F-CC open, the unit decelerates to a complete stop.	
R	Input terminal for reverse run. When R is shorted to CC, a reverse run starts. With R-CC open, the unit decelerates to a complete stop. <i>If terminals F-CC and R-CC are shorted simultaneously, a reverse run occurs.</i>	
CC (one of three)	This is the common return for ST terminal. <i>Do not connect to GND(E).</i>	
SS1	Input terminal for multi-speed run frequencies. Depends on setting of function [1.tb], JOG/SS2 and AD2/SS3 terminals. (See Page 6-12)	
JOG(SS2)	Input terminal for jogging run or multi-speed run frequencies. Depends on setting of function [1.tb], SS1, AD2(SS3) terminals. (See Page 6-9)	
AD2(SS3)	Input terminal for multispeed run frequencies. Depends on setting of function [1.tb], SS1, JOG/SS2 terminals. (See Page 6-9 through 6-12)	
RST	With RST-CC shorted, the inverter's protective function resets.	
CC (one of three)	This is the common return for ST, F, R, SS1, JOG(SS2), AD2(SS3), and RST terminals. <i>Do not connect to GND(E).</i>	
GND(E) (three provided)	The inverter earth ground terminal. <i>Do not connect to common return terminal (CC).</i>	Frame screw or lug
R41/46 *	Jumper to RJ when using 415V-50Hz/460V-60Hz incoming power. <i>Do not jumper to R40/44 or R38.</i>	Terminal block 
R40/44 *	Jumper to RJ when using 400V-50Hz/440V-60Hz incoming power. <i>Do not jumper to R41/46 or R38.</i>	
R38 *	Jumper to RJ when using 380V-50Hz incoming power. <i>Do not jumper to R41/46 or R40/44.</i>	
RJ *	Common for input power selection. Jumper to either R41/46, R40/44, or R38. <i>Do not jumper to more than one terminal at a time.</i>	
R20/22 *	Output power terminal. Supplies 1-phase 200V-50Hz or 1-phase 220V-60Hz @ 40VA maximum.	
R10/11 *	Output power terminal. Supplies 1-phase 100V-50Hz or 1-phase 110V-60Hz @ 40VA maximum.	
T10/11 T20/22 *	Output power return terminal for either 1-phase 200V-50Hz/220V-60Hz @ 40VA or 1-phase 100V-50Hz/110V-60Hz @ 40VA.	

* Supplied only on the H2-4055 through H2-420K units.

2.6 Simple Connection Diagrams for Control and Power Wiring

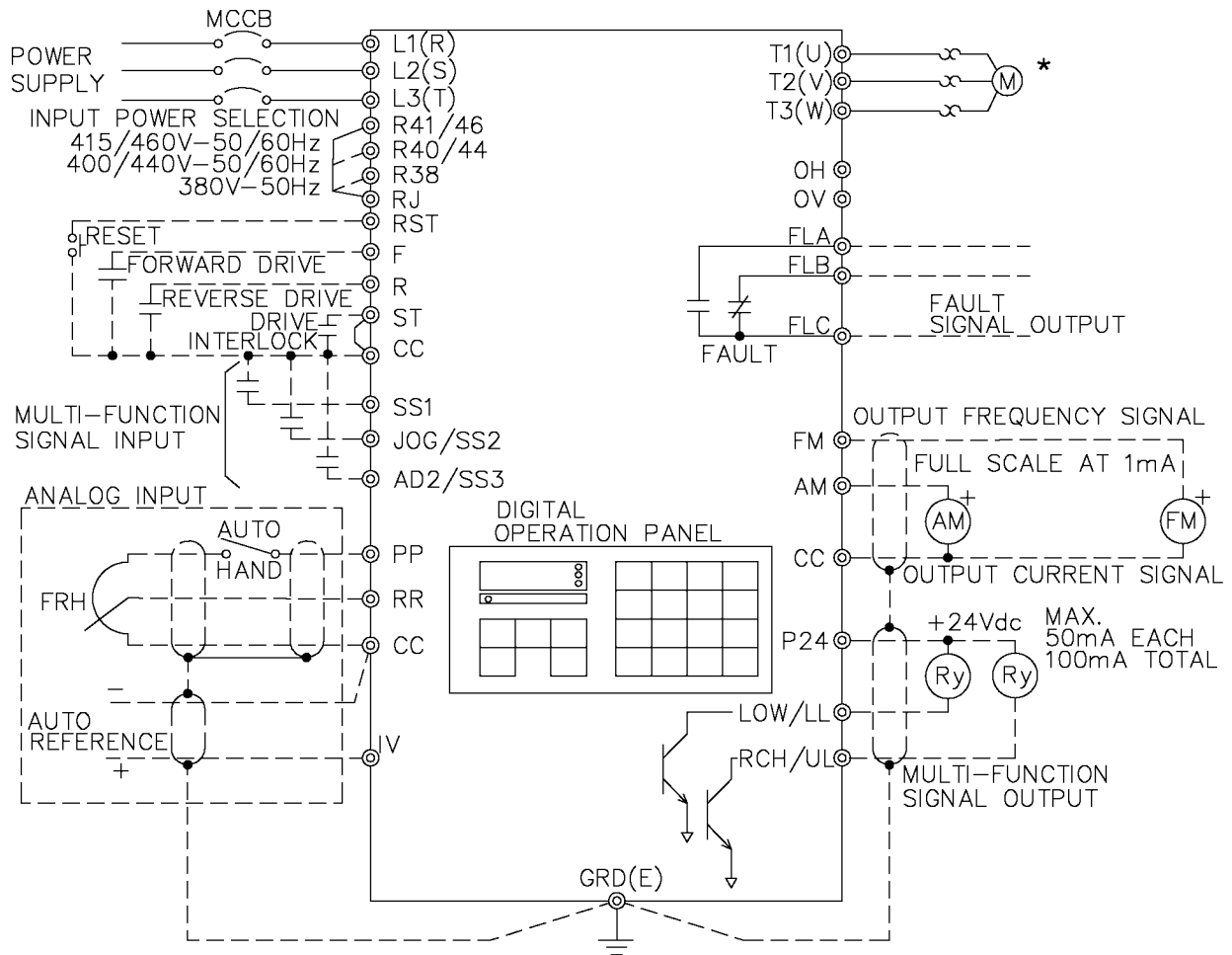
TOSVERT MODEL H2
STANDARD CONNECTION
MODEL 2035 TO 2330



* A motor overload relay is not required per the latest version of the NEC. Check local code requirements, which may vary.

2.6 Simple Connection Diagrams (Cont'd)

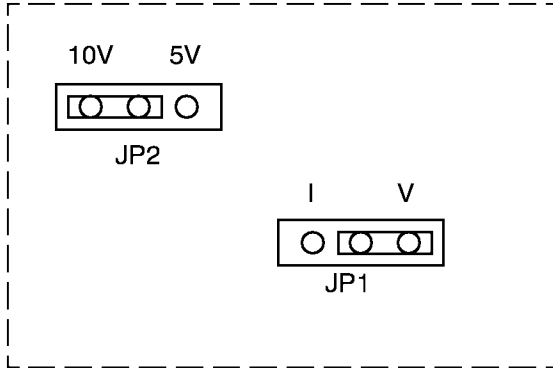
TOSVERT MODEL H2
STANDARD CONNECTION
MODEL 4055 TO 420K



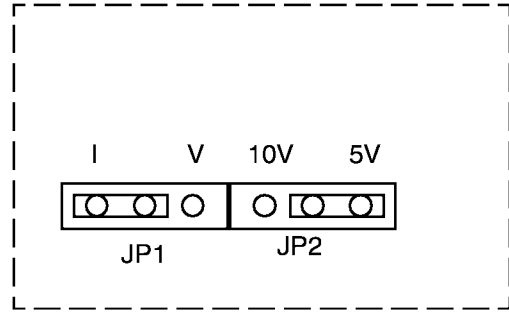
* A motor overload relay is not required per the latest version of the NEC. Check local code requirements, which may vary.

2.7 Jumper Details

The jumper connections for each of the printed wiring boards on Pages 2-13 through 2-15 are shown in the enlarged details below. **Only jumpers JP1 and JP2 should be adjusted by the user.** See Page 2-12 for jumper adjustments.



Detail 1 (Reference pages 2-13 and 2-14)



Detail 2 (Reference page 2-15)

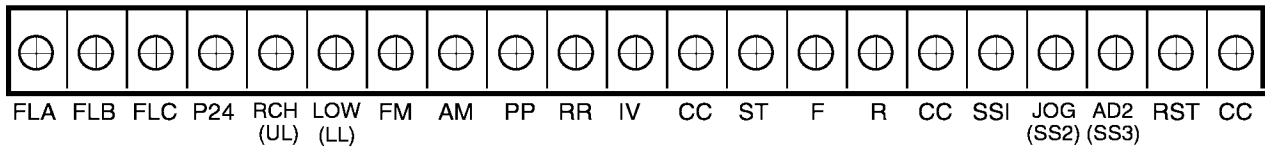
Note:

Jumper settings as shown in these illustrations are for reference purposes only and do not necessarily reflect factory settings nor correct settings for a particular application.

2.8 Control/Driver Board Terminal Block Details

The control/driver board terminal block is shown in detail below. Each of the twenty-one terminals is functionally labeled. See Pages 2-7 and 2-8 for a list of terminal functions.

Control/Driver Board Terminal Block Detail (Reference pages 2-13, 2-14, and 2-15)



2.9 JP1 / JP2 Jumper/Terminal Connections, Settings, and Functions

The following table illustrates the connections required for receiving the different analog input signals. Please take note of the relationship between the settings of JP1 and JP2, and how these jumpers select speed reference inputs of either volts, amps, speed potentiometers, or any combination of these devices. In combination with terminal IV and RR, these devices provide powerful, flexible tools to control the speed of the drive, and determine which of these several possible devices actually sets the running speed of the load.

These functions are prioritized by parameter [rr.CC] (RR Terminal Priority) in First Function Number 5. See page 5-2 for details.

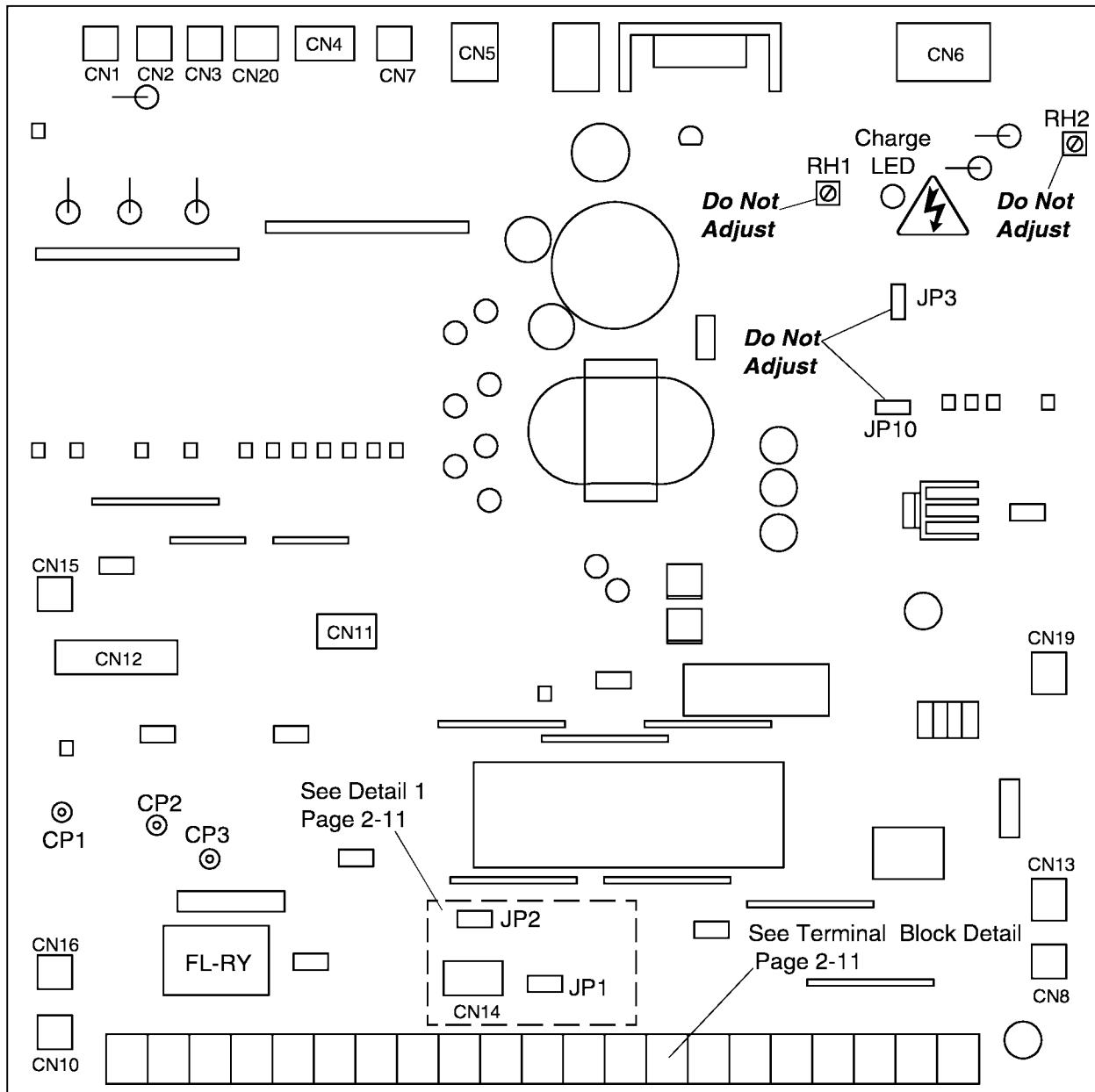
Terminal/Jumper Connections for Input Reference Signals

	JP1	JP2	Terminal Connections	Function
1			NO CONNECTIONS, JP1 & JP2 should be set as shown for normal panel operation.	Required for normal panel operation.
2				Required for standard 0~5Vdc input reference signal. Function No. 5 RR terminal priority should be set to 1 "on" when using this feature. See Ref. pages 5-3 and 5-7.
3	N/A			Required for standard 0~10Vdc input reference signal. Function No. 5 RR terminal priority should be set to 1 "on" when using this feature. See Ref. page 5-3.
4				Required when using a 3k ohm pot. 1K to 10K ohm pot can also be used but the pot adjustments will be more critical.
5		N/A		Required for standard 0~5Vdc input reference signal. Function No. 5 RR terminal priority should be set to the normal setting of 0 "off" when inputting a signal to the IV terminal. See Ref. page 5-3.
6		N/A		Required for standard 0~20mA, 4~20mA input reference signal. Function No. 5 RR terminal priority should be set to the normal setting of 0 "off" when inputting a signal to the IV terminal. See Ref. page 5-3.
7				When switch is closed (ON), the remote pot will override the 0~20/4~20mA input reference signal. Function No. 5 RR terminal priority should be set to the normal setting of 0 "off".

2.10 Printed Wiring Board Details and Terminal Connections

2.10.1 Control/Driver Board for H2-2035 through H2-2330

The following pictorial shows a layout of the major components located on the control/driver board VF3B-0100.

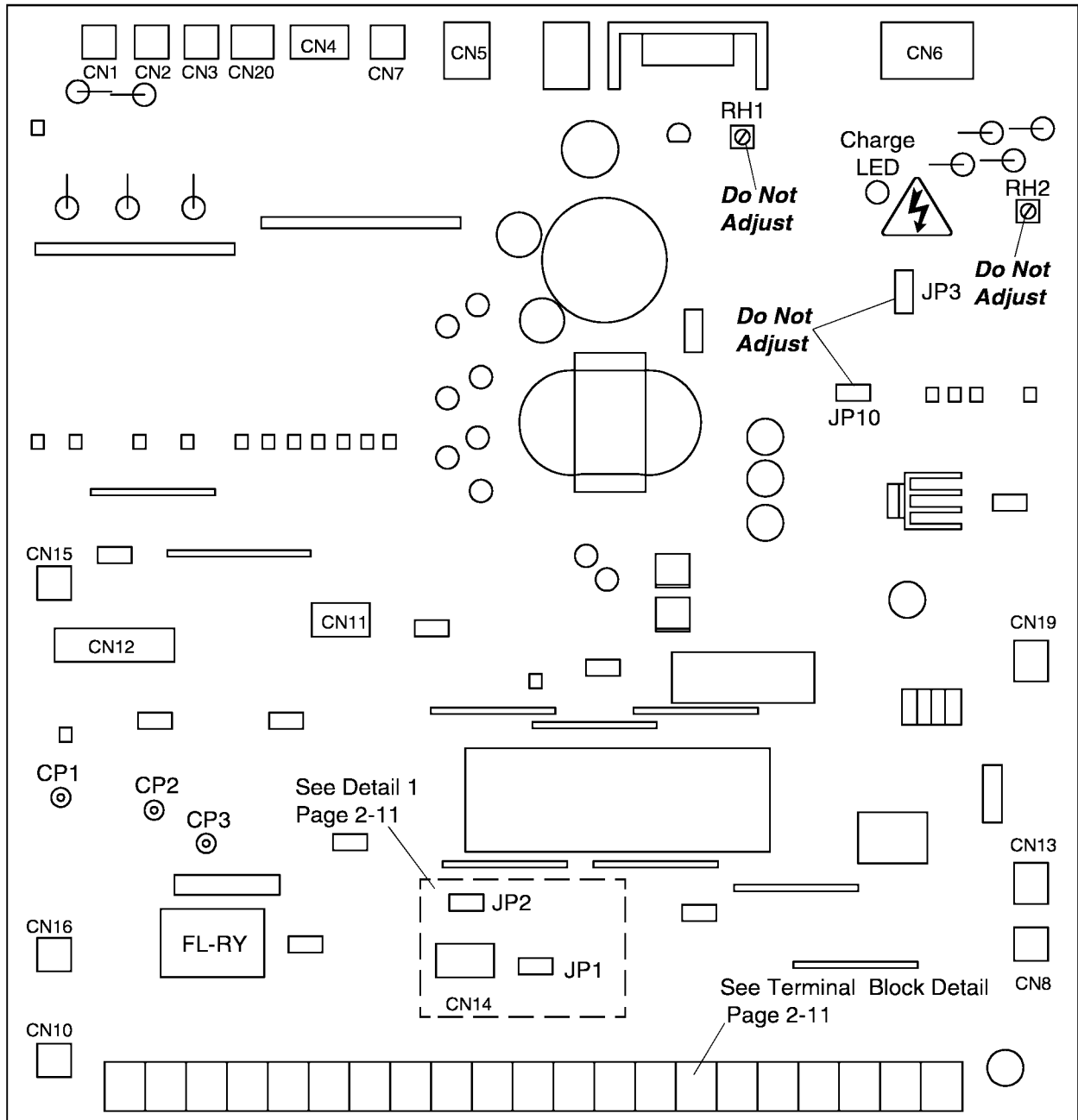


Note:

- 1) Potentiometer **RH1** is used for control power supply stabilization. This adjustment is factory set and any **ADJUSTMENT BY THE USER SHOULD NOT BE ATTEMPTED.**
- 2) Potentiometer **RH2** is used for voltage detection level bias. This adjustment is factory set and any **ADJUSTMENT BY THE USER SHOULD NOT BE ATTEMPTED.**
- 3) CP1, CP2, and CP3 are service testpoints.
- 4) **Do not adjust JP3 and JP10.**
- 5) Charge LED indicates charged capacitors. **DO NOT TOUCH internal parts if lighted.**

2.10.2 Control/Driver Board for H2-4055 through H2-4330

The following pictorial shows a layout of the major components located on the control/driver board VF3B-0101.

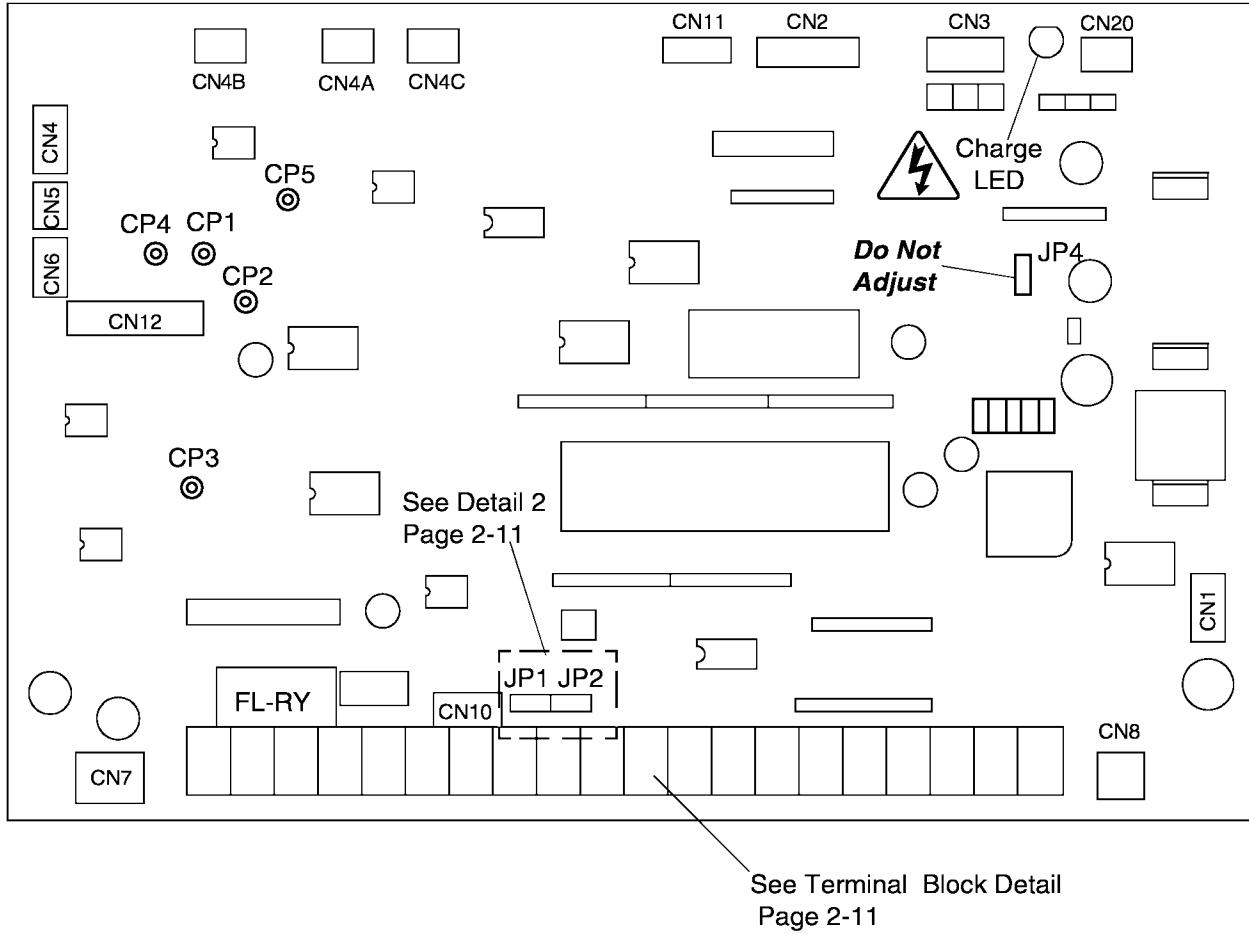


Note:

- 1) Potentiometer **RH1** is used for control power supply stabilization. This adjustment is factory set and any **ADJUSTMENT BY THE USER SHOULD NOT BE ATTEMPTED.**
- 2) Potentiometer **RH2** is used for voltage detection level bias. This adjustment is factory set and any **ADJUSTMENT BY THE USER SHOULD NOT BE ATTEMPTED.**
- 3) CP1, CP2, and CP3 are service testpoints.
- 4) **Do not adjust JP3 and JP10.**
- 5) Charge LED indicates charged capacitors. **DO NOT TOUCH internal parts if lighted.**

2.10.3 Control Board for H2-4400 through H2-420K

The following pictorial shows a layout of the major components located on the control board VF3C-1200.

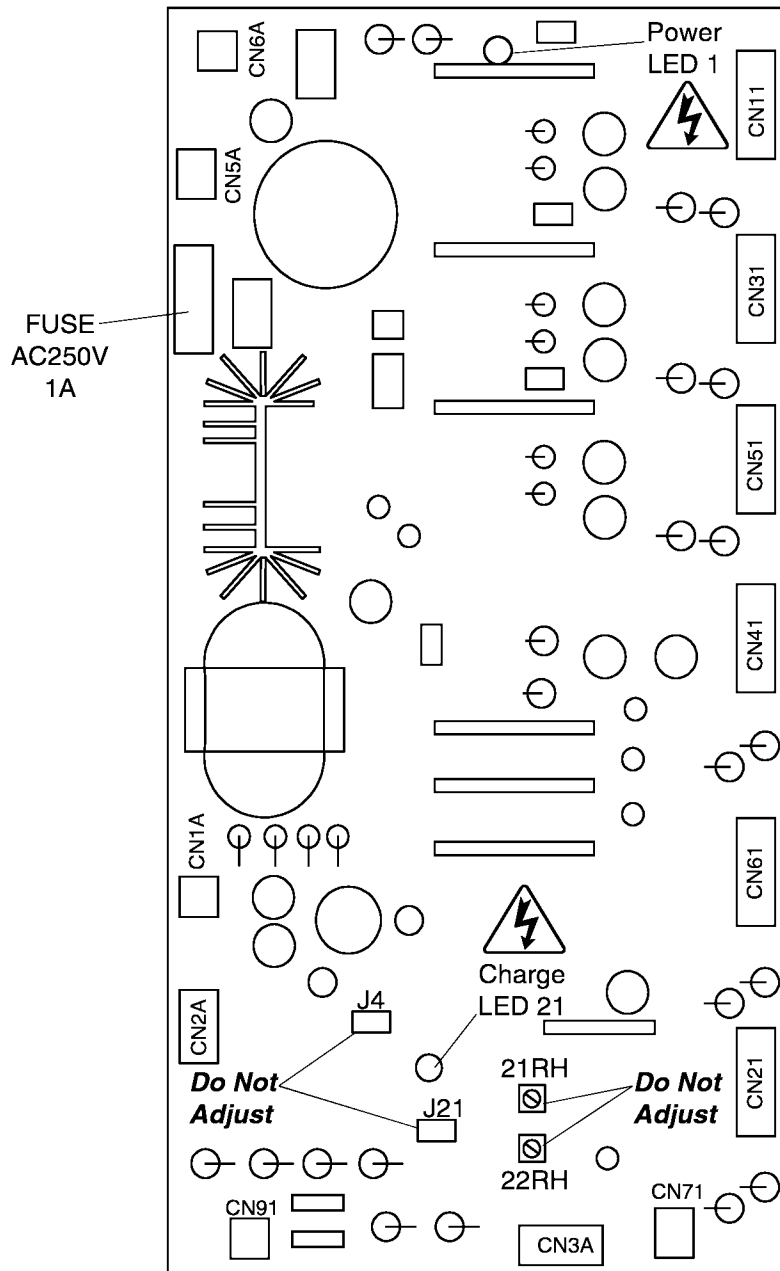


Note:

- 1) CP1, CP2, CP3, CP4, and CP5 are service testpoints.
- 2) **Do not adjust JP4.**
- 3) Charge LED indicates charged capacitors. **DO NOT TOUCH internal parts if lighted.**

2.10.4 Driver Board for H2-4400 through H2-420K

The following pictorial shows a layout of the major components located on the driver board 35589.



Note:

- 1) Potentiometer **21RH (OP)** is the main circuit overvoltage detection trip set. This adjustment is factory set and any **ADJUSTMENT BY THE USER SHOULD NOT BE ATTEMPTED.**
- 2) Potentiometer **22RH (MUV)** is the main circuit undervoltage detection trip set. This adjustment is factory set and any **ADJUSTMENT BY THE USER SHOULD NOT BE ATTEMPTED.**
- 3) **Do not adjust J4 and J21.**
- 5) Charge LED indicates charged capacitors. **DO NOT TOUCH internal parts if lighted.**

***SECTION 2 - How to Operate the Drive -
Basic Instruction and Guidelines***

CHAPTER 3

Simple Drive Operation:

Part 1: BASIC DRIVE OPERATION

- 3.1 Minimum Wire Connections
- 3.2 Methods of Control
- 3.3 Modes of Operation
- 3.4 Review Material - Remote Control and Panel Control

Part 2: REMOTE CONTROL

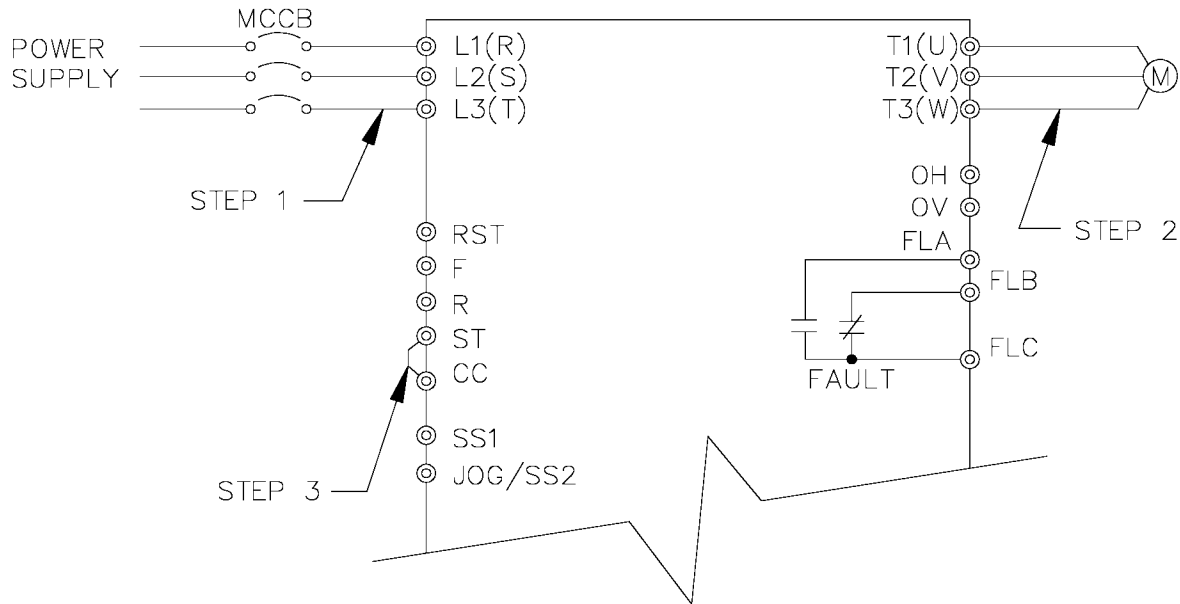
- 3.5 How to Stop and Start the Drive by Remote Control
- 3.6 Other Stopping Methods
 - 3.6.1 Coast-to-Stop
 - 3.6.2 Emergency Stop
- 3.7 Remote Control with a Speed Potentiometer
- 3.8 Remote Control with a 4-20mA Speed Reference Signal

Part 3: PANEL CONTROL

- 3.9 How to Stop and Start the Drive Using the Touchpad
- 3.10 Panel Control - Changing Running Speed

Part 1. BASIC DRIVE OPERATION

3.1 Minimum Wire Connections



Perform the following steps to power the inverter and motor.

- Step 1** Locate terminals L1(R), L2(S), L3(T).
Connect these terminals to the leads of a 3-phase 50 Hz or 60Hz power supply having the proper voltage. Make sure power is not applied.
- Step 2** Locate terminals T1(U), T2(V), T3(W).
Connect these terminals to the leads of a 3-phase induction motor of the proper voltage rating and current rating. See Chapter 2 for drive ratings and specifications.
- Step 3** Locate terminals ST and CC.
Connect a jumper wire between these two terminals if one is not already connected.
- Step 4** (For 10HP and larger 460 volt units **ONLY**.)
Connect a jumper between terminal RJ and R41/46, RJ to 40/44, or RJ to 38, depending on the input voltage and frequency. (These terminals are not shown above.) Refer to the terminal connections and functions information in Chapter 2 for the correct usage of these input power selection terminals.
Do not jumper from RJ to more than ONE terminal at a time.
- Step 5** Apply power to the inverter.

3.2 Methods of Control

There are three (3) methods of control:

1.2.1 REMOTE CONTROL - Frequency is controlled from the terminal strip. (Terminal strip is located on the Control Board). See Chapter 2 for details and location of the terminal strip.

1.2.2 PANEL CONTROL - Frequency is controlled from the touchpad. See Chapter 5 for details on advanced touchpad operation.

1.2.3 HOST (PC) CONTROL - Frequency is controlled through an RS232C or RS485 port and a host system. Applicable only with Option Board #VT130G2-OPTB, its use will not be elaborated on further in this manual.

The **CTRL** key switches control between PANEL and REMOTE CONTROL. User can switch control ONLY when unit is stopped.

3.3 Modes of Operation

There are two (2) modes of operation:

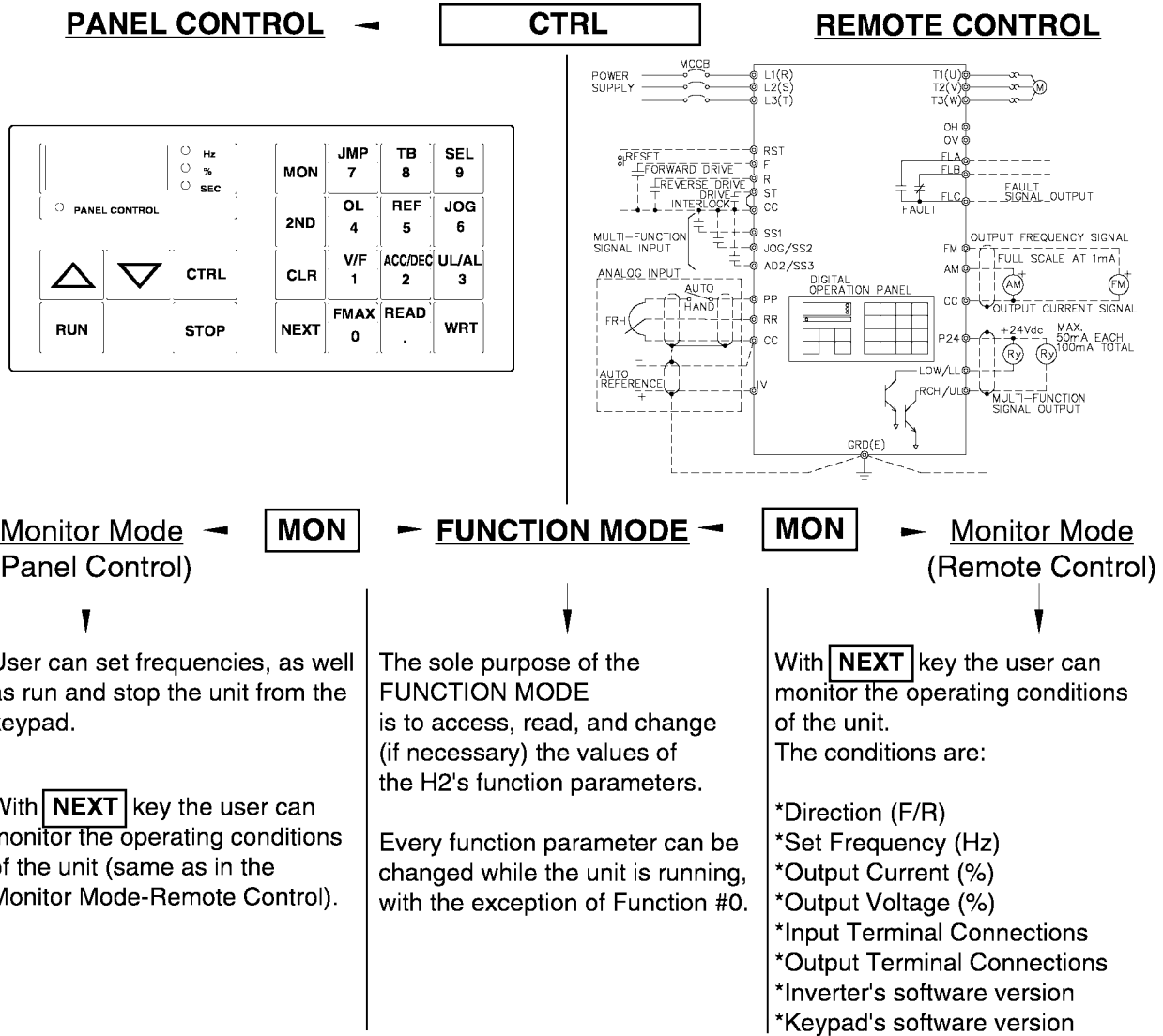
MONITOR MODE (Remote Control) - User is capable of monitoring the operating conditions of the unit (i.e. set output frequency, % output current, % output voltage, etc.)

MONITOR MODE (Panel Control) - Same as above but also enables user to activate special features (i.e. JOG, PRESET SPEEDS, etc.) See Chapter 7 - "How to Monitor Drive Operation" for details.

FUNCTION MODE - User is capable of accessing, reading, and changing the values of the H2's function parameters. See Chapters 4, 5, and 6 for details on advanced drive operation.

The **MON** key switches between the MONITOR and FUNCTION MODE. User can switch mode at any time during operation.

3.4 Review Material - Remote Control and Panel Control

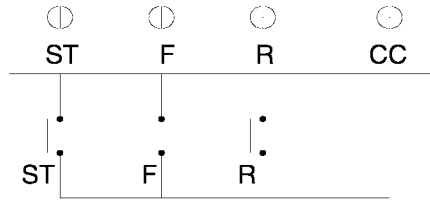


Part 2. REMOTE CONTROL

3.5 How to Stop and Start the Drive by Remote Control

The remote STARTING/STOPPING possibilities are identified in the following figure and table.

START/STOP Terminals Connections



Remote START/STOP Connections Possibilities

Terminal Connection			Action
ST-CC OFF	F-CC ON/OFF	R-CC ON/OFF	The inverter is OFF. OFF will be displayed. If running when ST-CC is broken the motor will coast to a stop.
ON	OFF	OFF	The inverter is ON but not running.
ON	ON	OFF	The inverter is ON and will run in a FORWARD direction if an input speed reference signal is applied.
ON	OFF	ON	The inverter is ON and will run in a REVERSE direction if an input speed reference signal is applied.
ON	ON	ON	Same as REVERSE (R-CC) connection above.

* ON = short circuit, OFF = open circuit

Note: * With ST-CC (ON), switching F-CC or R-CC (OFF) will cause the motor to "ramp down" by decelerating to a stop. (This is the NORMAL stopping method for most applications. Unless the correct drive parameters are changed, this is the DEFAULT STOPPING METHOD for the drive.)

* If input power is turned off (with MCCB) while inverter is running, the motor will coast to a stop. **AVOID USING THE INPUT POWER SWITCH TO START AND STOP THE MOTOR. USE FOR AN EMERGENCY STOP ONLY.**

* Acceleration and Deceleration rates are determined via the preset values of First Function #2 (ACC/DEC).

* When switching from a forward run to a reverse run the motor will decelerate to a stop, then accelerate in the reverse direction.

3.6 Other Stopping Methods

In addition to the "Ramp-to-Stop" feature discussed on the last page, other stopping methods are available. Coast to Stop and Emergency Stop procedures are illustrated below.

3.6.1 Coast to Stop

The H2 is capable of instantly removing power from a rotating motor, allowing it to coast to a stop. This is accomplished without removing power from the inverter. The procedure will override the inverter's normal deceleration pattern. Activation of the coast to stop function is illustrated in the following table.

Activating the Coast to Stop

Key	Action	Display
	Assume the inverter is operating at 60HZ as shown in the previous table and is in the monitor mode .	60.0
<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-bottom: 2px;">2ND</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">STOP</div>	Engages the COAST to STOP command. The inverter releases it's control of the motor allowing it to "free wheel" and coast to a stop.	0.0

3.6.2 Emergency Stop

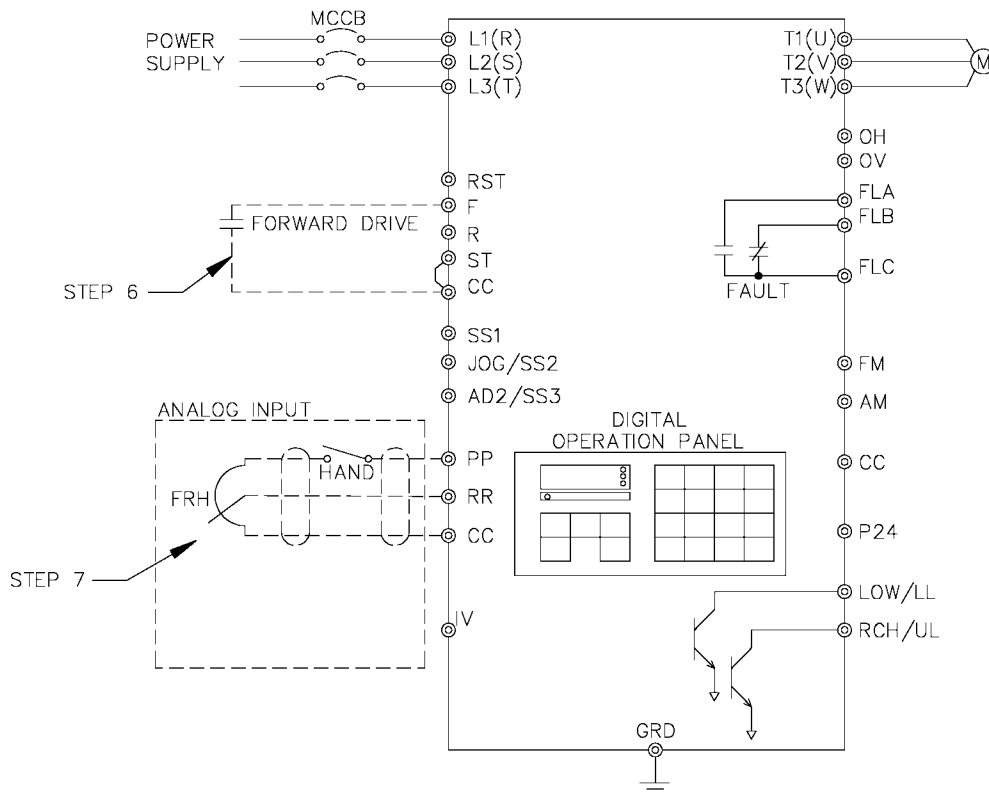
The emergency stop function can only be used when operating by remote control. When activated, the inverter can perform the same coast to a stop function as described in above. In an emergency, valuable time can be saved by being able to remove power to the motor from the local inverter instead of from the distant remote control station. Activation of the emergency stop is illustrated in the following table.

Activating the Emergency Stop

Key	Action	Display
	Assume the inverter is operating at 60HZ due to some type of remote input signal (REMOTE CONTROL).	60.0
<div style="border: 1px solid black; padding: 2px; display: inline-block;">STOP</div>	"EOFF" flashes but the unit continues running. Pressing STOP once more will activate the stop, however pressing CLR CLR will cancel the procedure.	EOFF
<div style="border: 1px solid black; padding: 2px; display: inline-block;">STOP</div>	Activates the emergency stop function. A fault detection signal is ouput via terminals FLA, FLB, FLC.	E
<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-bottom: 2px;">CLR</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">WRT</div>	Resets the inverter and its fault detection contacts. The inverter is now ready for normal operation.	0.0

Note: Resetting the inverter from a remote location is accomplished by momentarily short-circuiting terminals RST and CC. These terminals are located on the inverters terminal strip.

3.7 Remote Control with a Speed Potentiometer

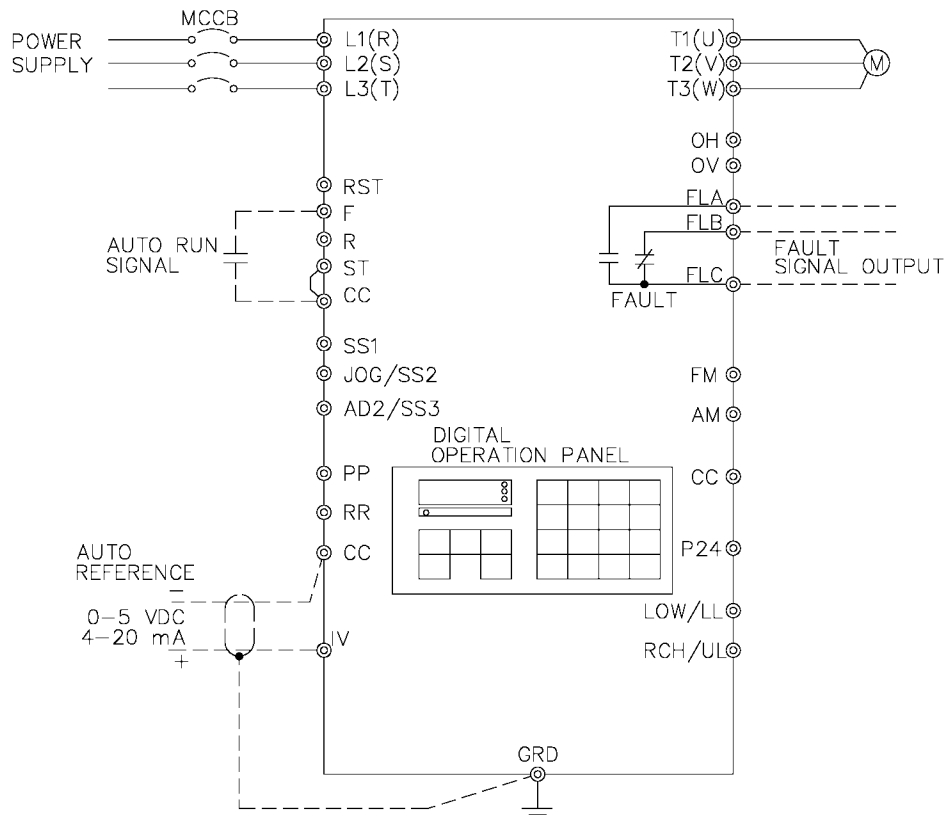


Perform the following steps when using a speed pot.

- Step 1 Apply power to the Inverter.
- Step 2 Be sure no "flashing" trip code is displayed on the LED monitor.
If a trip code is flashing, see Chapter 8 to reset the drive.
- Step 3 Locate terminals PP, RR, and *CC.
Connect a 3-wire, 3K ohm pot to these terminals.
(Positive wire to PP, "Wiper" wire to RR, Common wire to *CC)
- Step 4 Turn speed pot completely counter-clockwise.
- Step 5 Connect terminals ST-*CC.
- Step 6 Locate terminals F and *CC.
Connect a jumper wire between these two terminals.
- Step 7 Press the **CTRL** key until the green "Panel Control" light is off. The drive is now in "Remote Control".
NOTE: The inverter must be at 0.0 Hz before the **CTRL** key is functional.
- Step 8 The motor's forward speed can now be varied by turning the speed pot.

* CC terminals are common.

3.8 Remote Control with a 4-20mA Speed Reference Signal



Perform the following steps when using a 4-20mA control signal to set motor speed:

- Step 1 Apply power to the drive.
- Step 2 Be sure no "flashing" trip code is displayed on the LED monitor.
If a trip code is flashing, see Chapter 8 to reset the drive.
- Step 3 Locate terminals IV and CC. Connect a 4-20mA control signal to these terminals as shown. Correct polarity is important! **NOTE:** An isolated control signal may be required.
- Step 4 Connect terminals ST-CC.
- Step 5 Locate terminals F and CC.
Connect a jumper wire between these two terminals.
- Step 6 Press the **CTRL** key until the green "Panel Control" light is off. The drive is now in "Remote Control".
NOTE: The inverter must be at 0.0 Hz before the **CTRL** key is functional.
- Step 7 The motor's forward speed can now be varied by changing the value of the control signal between 4 and 20 mA.

Part 3. PANEL CONTROL

3.9 How to Stop and Start the Drive Using the Touchpad

The Inverter may be operated only from the touchpad, without any type of remote speed reference signal.

- Step 1. Apply power to the inverter.
- Step 2. Be sure a jumper is present between terminals ST and CC.
- Step 3. Press the **CTRL** button until the green LED indicating Panel Control is "ON". This indicates that the drive is fully controlled by the touchpad.
- Step 4. Enter the desired running frequency. See the example below.
- Step 5. To start the drive, press the **RUN** key. To stop the drive, press the **STOP** key.

3.10 How to Set and Change the Running Speed

Frequency Setting

Key	Action	Display
	Power must first be applied to the inverter.	0.0
CTRL	"PANEL CONTROL" LED lights, signifying the inverter is in the panel control mode. NOTE: Pressing CTRL again will cause the LED to go off signifying the inverter is in the remote control mode.	0.0
<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-bottom: 2px;">6</div> <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-bottom: 2px;">0</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">WRT</div>	Sets the inverter to 60Hz. Pressing the WRT key enters the data into the FC file. The display will flash "60" and "FC" alternately indicating the setting has been made. :60 - FC - :60	:60
RUN	Engages the run command. The inverter's output frequency will accelerate or decelerate to the new set speed designated by "FC".	60.0
<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-bottom: 2px;">1</div> <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-bottom: 2px;">0</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">WRT</div>	Pressing 1 0 WRT sets the inverter's new frequency and begins a deceleration to that frequency. NOTICE the flashing semicolon ":", which signifies the motor is running but that the inverter is not necessarily displaying the actual output frequency. :10 - FC - :10	:10
RUN	Even though the inverter is decelerating, the actual output frequency is not displayed until the RUN key is pressed.	10.0
<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-bottom: 2px;">▲</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">WRT</div>	Pressing the "up" ▲ key increases the value displayed. The output frequency automatically increases. Once 55.4Hz is reached the WRT key can be pressed. The display will flash "55.4" and "FC" indicating the setting has been made. :55.4 - FC - :55.4 Note: Pressing the "down" ▼ key will automatically decrease the inverter's output frequency.	:55.4
RUN	Displays the inverter's actual output frequency. In this case, the actual output frequency will be the same as that displayed because of the incremental changes of the "up" ▲ and "down" ▼ keys.	55.4

Note: Operating frequency can be changed during a run.

***SECTION 3 - How to Operate the Drive -
Advanced Instructions and Guidelines***

CHAPTER 4

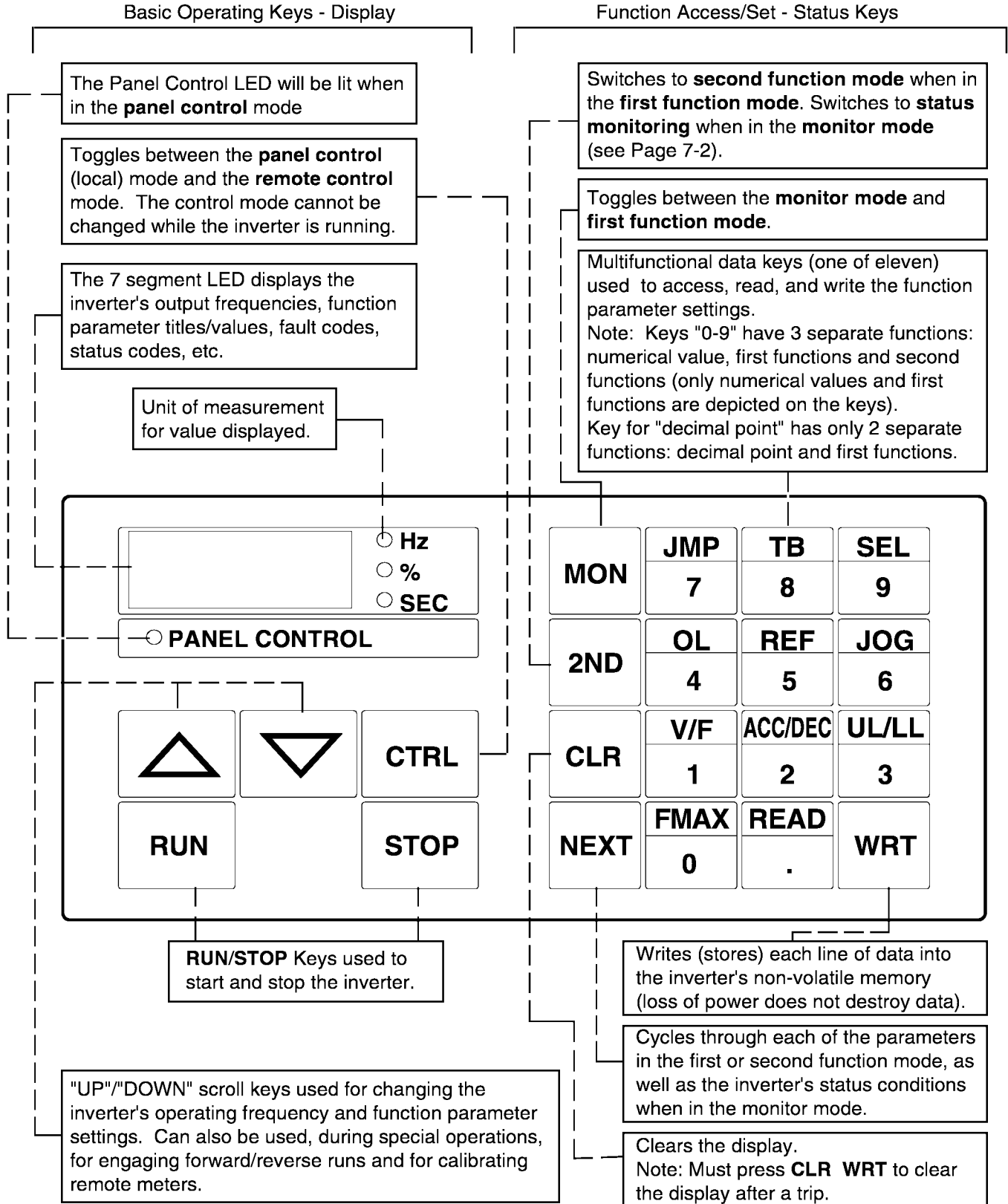
Touchpad Operation - Detailed Theory and Instructions:

- 4.1. Operating Panel (Touchpad) - Details
- 4.2. LED / Monitor Display Details
- 4.3. List of Monitor Display Alphanumerics
- 4.4. Basic Operating Keys
- 4.5. Complete List of Operation Keys and Their Functions
- 4.6. Operating Procedures
- 4.7. Basic Operations - Discussion
 - 4.7.1 Basic Keys
 - 4.7.2 Basic Operation - Example
- 4.8. Invalid Entries

4.1 Operating Panel (Touchpad) - Details

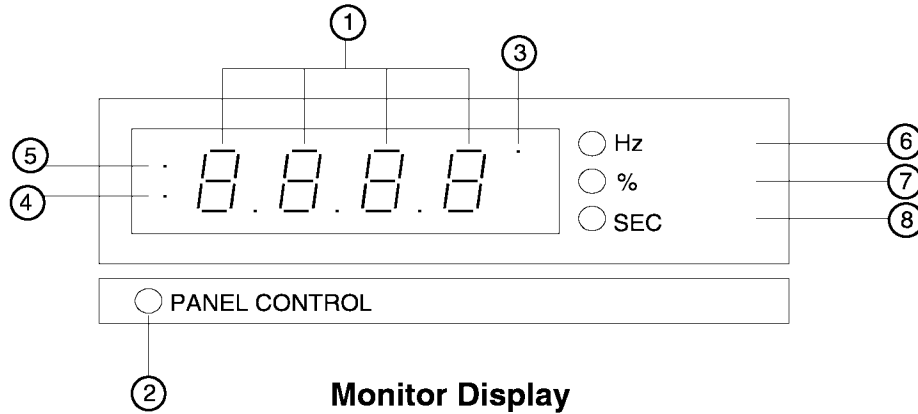
The operating panel enables the user to run or stop (RUN/STOP) the inverter, read and/or change the operating function parameter values (READ/WRT), and monitor (MON/NEXT) the operating conditions of the unit.

Operating Panel



4.2 LED Display

The LED display provides the user with the operating frequency, function settings, and status information necessary to easily monitor and set the operating parameters. The individual LED's are identified and explained in the following chart.



































Item	Name	Function/status
①	Monitor display	7-segment, 4-column LED Displays frequency, title, data, etc.
②	Panel control LED	When ON the unit is in the panel control mode When OFF the unit is in the remote control mode When FLASHING the unit is in the panel control mode and the motor is running
③	Super mode LED	When ON the computer interface option is enabled. (Contact Toshiba for information.)
④ ⑤	Monitor display LED	<div style="display: flex; flex-direction: column; gap: 10px;"> <div> <input type="checkbox"/> <input type="checkbox"/> Normally OFF when displaying operating frequency or unit frequency scaler. </div> <div> <input checked="" type="checkbox"/> <input type="checkbox"/> ON when unit is in a patterned run sequence </div> <div> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> ON when in function setting mode via operating panel and unit is not running. </div> <div> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Flashing when in function setting mode via operating panel and the motor is running. </div> <div> <input type="checkbox"/> <input checked="" type="checkbox"/> ON when function setting mode via operating panel is disabled. </div> </div>
⑥	Hz display LED	Displays the unit of the number displayed
⑦	% display LED	When displaying data units other than Hz, %, or SEC, the LED's are OFF.
⑧	Time display LED	Time in seconds

Note: When the command mode function is set to disable all inputs, LED's [2] and [3] will be flashing and [4] and [5] will be ON.






4.3 List of Monitor Display Alphanumerics

The 7 segment LED display is able to display all of the numerals but is unable to properly form all of the characters of the alphabet. Therefore some characters of the alphabet will appear as special symbols and others are not used at all. The tables below show the numbers and characters that are used and how each appears on the 7 segment display.

Numerics	LED display
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Characters	LED display
A	
b	
C	
d	
E	
F	
G	
H	
I	
J	
L	
M	
n	
O	 or 
P	
r	
S	
t	
U	
v	
y	
-	-

4.4 Basic Touchpad Keys

Key	Function
	Toggles between the Panel Control and Remote Control Modes. Disabled while the inverter is running.
	Increases frequency setting values and various other data values. Engages forward run during special operations (jog, multispeed). Also used for calibrating remote meters (FM, AM).
	Decreases frequency setting values and various other data values. Engages reverse run during special operations (jog, multispeed). Also used for calibrating remote meters (FM, AM).
	Issues a command for starting a normal run, multispeed run, jog run, or pattern run.
	Issues a command for stopping a normal run, multispeed run, jog run, or pattern run, or issues an Emergency Stop when the drive is in the remote control mode, and the button is pressed twice .

4.5 List of All Touchpad Keys and their Functions

Note: Each key (0-9) has three separate functions: numerical value, first function, and second function. See Operating Panel (Page 4-2.)

Key	Function
MON	Toggles between the monitor and function mode.
2ND	Switches to the second function mode. Used to initiate several functions (ie. JOG, Preset Run, Pattern Run).
NEXT	Displays the next item within the function. Also cycles through the inverter's <u>status codes</u> .
CLR	Clears the display. Also clears inverter after a trip. * * Note: MUST PRESS CLR WRT to reset inverter after a trip.
WRT	Stores each piece of data into the inverter's memory (file).
READ .	"." is a decimal point. "READ" displays the inverter's data contents for an individual function.
FMAX 0	"0" is the numerical zero. 1st FUNCTION MODE: Selects the standard setting mode . Also sets the maximum frequency (disabled during a run). 2nd FUNCTION MODE: Sets the start-up frequency and run frequency . Also sets the run frequency hysteresis .
V/F 1	"1" is the numerical one. 1st FUNCTION MODE: Sets the voltage boost , auto torque boost , maximum voltage frequency , and V/F pattern . 2nd FUNCTION MODE: Sets the DC injection starting frequency , DC injection voltage , and DC voltage injection time .
ACC/DEC 2	"2" is the numerical two. 1st FUNCTION MODE: Sets the ACC/DEC time for ACC 1, 2 and DEC 1, 2. Selects the ACC/DEC pattern for 1, 2. Selects ACC/DEC 1 or 2 . 2nd FUNCTION MODE: Sets the multiply factor of display frequency scaler .
UL/LL 3	"3" is the numerical three. 1st FUNCTION MODE: Sets upper and lower frequency limits . 2nd FUNCTION MODE: Sets low speed detection output. Selects speed reach selection output option. Sets speed reach detection range and speed reach reference frequency.
OL 4	"4" is the numerical four. 1st FUNCTION MODE: Sets overload detection level (% of rated current), stall activation level , and also selects the overload detection curve characteristics. 2nd FUNCTION MODE: Sets the output voltage adjustment (% of input voltage). The auto deceleration feature is always on.

4.5 List of All Touchpad Keys and their Functions - (Cont'd)

Key	Function		
<table border="1" style="margin: auto;"> <tr><td style="text-align: center;">REF</td></tr> <tr><td style="text-align: center;">5</td></tr> </table>	REF	5	<p>"5" is the numerical five.</p> <p>1st FUNCTION MODE: Sets output frequencies (F-P1, F-P2) based upon percent of terminal IV input signal. Also sets the percent of the terminal IV input signal (P1, P2). Selects option for IV or RR terminal input to be on.</p> <p>*2nd FUNCTION MODE: Selects option of TG/PG or PID to be on or off. Sets proportional gain, integration gain, differential gain, lag time constant, and TG/PG feedback gain. Selects PG feedback control options.</p> <p>*Note: OPTIONAL BOARD REQUIRED FOR TG/PG selection.</p>
REF			
5			
<table border="1" style="margin: auto;"> <tr><td style="text-align: center;">JOG</td></tr> <tr><td style="text-align: center;">6</td></tr> </table>	JOG	6	<p>"6" is the numerical six.</p> <p>1st FUNCTION MODE: Sets the jog run drive frequency. Selects the jog run stop control options. Sets the 1st~7th speed run frequencies.</p> <p>2nd FUNCTION MODE: Sets the PWM carrier frequency.</p>
JOG			
6			
<table border="1" style="margin: auto;"> <tr><td style="text-align: center;">JMP</td></tr> <tr><td style="text-align: center;">7</td></tr> </table>	JMP	7	<p>"7" is the numerical seven.</p> <p>1st FUNCTION MODE: Sets the jump frequencies (1, 2, 3) and the (1, 2, 3) jump frequency band widths.</p> <p>2nd FUNCTION MODE: Selects communication options (See Table 1 pg. 6-12), selects identification # for the inverter, selects communication baud rate, selects parity check and stop bit (See Table 2 pg. 6-12), and selects inverter to AC line transfer signal to be on or off.</p>
JMP			
7			
<table border="1" style="margin: auto;"> <tr><td style="text-align: center;">TB</td></tr> <tr><td style="text-align: center;">8</td></tr> </table>	TB	8	<p>"8" is the numerical eight.</p> <p>1st FUNCTION MODE: Selects how the multi-function I/O terminals will be used.</p> <p>2nd FUNCTION MODE: Selects the pattern run activation mode, units of time, number of cycles. Sets pattern drive time for Pt.1t~Pt.7t and selects the pattern drive characteristics for the pattern run (i.e.FOR or REV, ACC/DEC 1 or 2).</p>
TB			
8			
<table border="1" style="margin: auto;"> <tr><td style="text-align: center;">SEL</td></tr> <tr><td style="text-align: center;">9</td></tr> </table>	SEL	9	<p>"9" is the numerical nine.</p> <p>1st FUNCTION MODE: Selects FOR or REV run, selects trip retention on or off option, selects retry (auto-reset) on or off option, selects auto-restart after momentary power interrupt on or off option, and selects regeneration power ride through control on or off option.</p> <p>2nd FUNCTION MODE: Selects eight command mode options, selects eight frequency reference setting mode options, and selects four parameter setting mode options.</p>
SEL			
9			

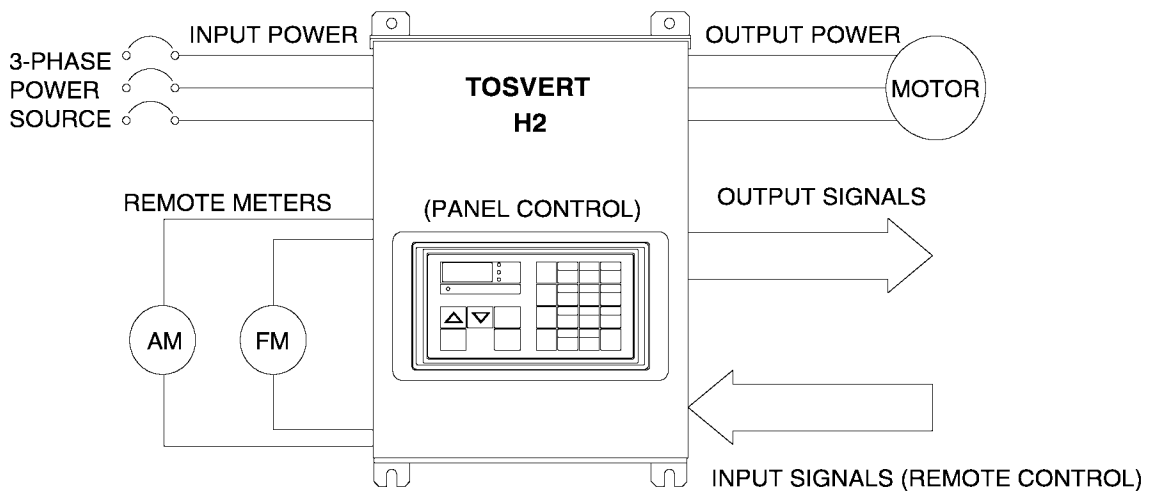
4.6 Operating Procedures

A thorough understanding of the operating procedures and functions is necessary to gain maximum use of the many versatile features of this inverter. This includes understanding the uses for the many available functions, the structure of the software, and the programming techniques used. An understanding of the use of the input and output terminals is also necessary.

Chapter 5 contains a complete list of drive parameters, and a description or example of the function of each parameter. A brief sample of 1st Function # 1 parameters is shown below. A sample "flowchart" showing the programming theory for the drive is shown on the next page.

Chapter 6 describes several of the key parameters in extensive detail. In conjunction with the information in Chapter 5, a working knowledge of the drive parameters can be attained.

The figure and table such as shown below, as well as the flowchart and program sequence on the next page, help to illustrate the basic fundamentals of the H2 drive; its structural software, and its programming format.

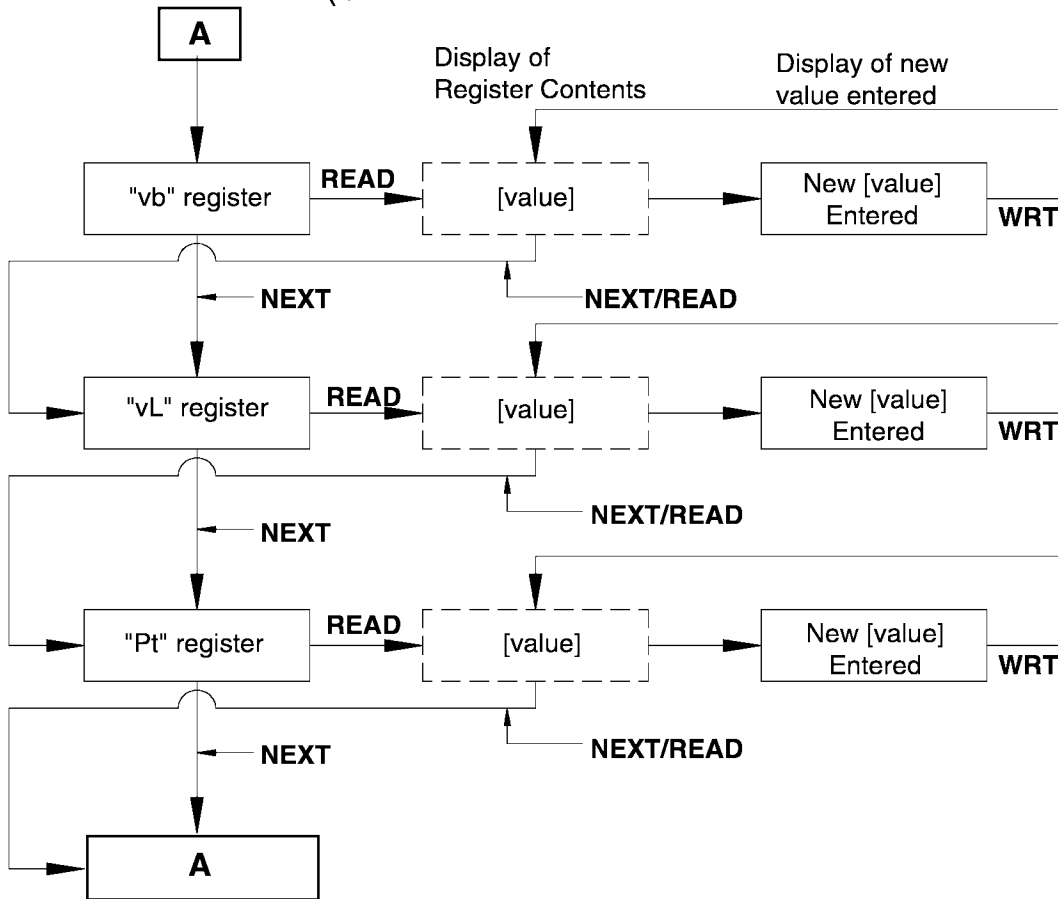


Function Parameters

Function No.	Function Name	Display	Adjustment Range	Unit	Factory Set	Error Message	Ref. Page
1	Voltage Boost	:Ub	0 to 30	%	3	:Err0	5-5
	Auto torque boost (voltage)	:A.Ub	0: Off 1: On		0	:Err0	5-5
	Max. voltage frequency	:UL	25 to 160	Hz	60	:Err0 :ErrU	5-5
	V/f pattern	:PL	1: Variable torque		1	:Err0	5-5

4.6 Operating Procedures (Cont'd)

Function #1 Flowchart (Once function is accessed the flowchart is as follows)



Accessing Function #1

Key	Action	Display
MON	The inverter must always be placed in the function mode before accessing any function.	no.0 → :LSP
V/F 1	Accesses the voltage boost parameter.	:ub
READ	Displays the current "vb" setting.	: [value]
NEXT or READ	Accesses the maximum voltage frequency parameter	:vL
READ	Displays the current "vL" setting.	: [value]
NEW VALUE and WRT	Enter new value followed by the WRT key. The unit will then display the new current "vL" setting.	: [new value]
NEXT or READ	Accesses the V/f parameter.	:Pt
READ	Displays the current "Pt" setting.	: [value]

Note: Current value of each parameter does not have to be read. Press **NEXT** key for next parameter.

4.7 Basic Operations

The H2 inverter's almost unlimited capabilities are made possible by using highly sophisticated software. This software allows keys to be used for more than one function.

Note: The inverter can be operated from either the keypad (**PANEL CONTROL**) or through remote signal inputs (**REMOTE CONTROL**).

4.7.1 Basic Keys

CTRL
▲
▼
RUN
STOP
See Page 4-5.

MON
2ND
NEXT
CLR
WRT
READ
See Pages 4-6 and 4-7.

Every function/feature available with the inverter can be accessed, changed, monitored, and/or activated by using these keys in conjunction with the numerical keys (0 thru 9).

As shown in Page 4-2, each numerical key has three (3) separate functions assigned to it: numerical value, 1st Function, and 2nd Function. The operating function of this key depends on the key sequence preceding the numerical key data entry.

4.7.2 Basic Operation - Example

The following example illustrates how easy it is to set, change, and run the inverter at different frequencies.

Key	Action	Display
	Power must first be applied to the inverter.	0.0
CTRL	"PANEL CONTROL" LED lights, signifying the inverter is in the panel control mode. NOTE: Pressing CTRL again will cause the LED to go off signifying the inverter is in the remote control mode.	0.0
6 0 WRT	Sets the inverter to 60Hz. Pressing the WRT key enters the data into the FC file. The display will flash "60" and "FC" alternately indicating the setting has been made. <div style="text-align: center; margin-top: 5px;">:60 - FC- :60</div>	:60
▼ WRT	Pressing this key decreases the value displayed. Once 55Hz is reached the WRT key can be pressed. The display will flash "55" and "FC" indicating the setting has been made. <div style="text-align: center; margin-top: 5px;">: 55 → :FC ← : 55</div> <p>Note: Pressing the ▲ key increases the value displayed.</p>	: 55
RUN	Engages the run command. The inverter output frequency will "ramp up" to 55Hz, causing the motor to accelerate to its 55Hz speed. Pressing the STOP key engages the stop command. The inverter's output frequency will "ramp down" to 0Hz, causing the motor to decelerate to a stop.	550

Note: The inverter's operating frequency can be changed during any normal run, without stopping the motor.

4.7.2 Basic Operation - Example (Cont'd)

Key	Action	Display
	Assume the inverter is running at 55Hz.	55.0
<div style="border: 1px solid black; padding: 2px; width: 30px; margin-bottom: 2px; text-align: center;">5</div> <div style="border: 1px solid black; padding: 2px; width: 30px; margin-bottom: 2px; text-align: center;">0</div> <div style="border: 1px solid black; padding: 2px; width: 30px; text-align: center;">WRT</div>	Sets the inverter to 50Hz. The monitor will display "50" and "FC" alternately. The inverter's frequency and motor's speed is decreased to 50Hz, at the selected deceleration rate. Note the flashing semi-colon ":". It signifies the motor is running but that the frequency displayed is not necessarily the inverter's actual output frequency. : 50 → : FC ↔ : 50	: 50
<div style="border: 1px solid black; padding: 2px; width: 30px; text-align: center;">RUN</div>	Displays the actual output frequency.	50.0
<div style="border: 1px solid black; padding: 2px; width: 30px; text-align: center;">△</div> <div style="border: 1px solid black; padding: 2px; width: 30px; text-align: center;">WRT</div>	Press the △ key to raise the frequency to 60Hz. If the WRT key is not pressed the 60Hz frequency will not be retained in memory should the inverter lose power.	: 60.0
<div style="border: 1px solid black; padding: 2px; width: 30px; text-align: center;">RUN</div>	Displays the actual output frequency.	60.0
<div style="border: 1px solid black; padding: 2px; width: 30px; text-align: center;">STOP</div>	The inverter's output frequency will "ramp down" to 0 Hz, causing the motor to decelerate to a stop.	0.0

4.8 Invalid Entries - Example

When an invalid entry is attempted, an error message and the "entered data" are alternately displayed. For example, if a set frequency entered (FC) is higher than the maximum frequency (FH) then the error message "FH" and the "entered data" are alternately displayed. In this case, the set value entered will not be accepted therefore a new value must be set.

Key	Action	Display
	Assume the maximum frequency parameter (FH) is set to 80Hz, the inverter is in the monitor mode , and the unit is not running.	0.0
<div style="border: 1px solid black; padding: 2px; width: 30px; margin-bottom: 2px; text-align: center;">9</div> <div style="border: 1px solid black; padding: 2px; width: 30px; margin-bottom: 2px; text-align: center;">0</div> <div style="border: 1px solid black; padding: 2px; width: 30px; text-align: center;">WRT</div>	Attempted to set inverter frequency to 90Hz (FC=90) but instead of displaying :90 - FC- :90 the unit will display :90 - FH- :90 This signals a conflict between the value entered and the maximum frequency FH.	:90
<div style="border: 1px solid black; padding: 2px; width: 30px; margin-bottom: 2px; text-align: center;">8</div> <div style="border: 1px solid black; padding: 2px; width: 30px; margin-bottom: 2px; text-align: center;">0</div> <div style="border: 1px solid black; padding: 2px; width: 30px; text-align: center;">WRT</div>	The unit will accept this value since there is no conflict between the value entered and FH. :80 - FC- :80	:80

CHAPTER 5

DRIVE PARAMETERS, DESCRIPTIONS AND EXPLANATIONS:

5.1 List of All Drive Parameters

First Function Parameters:

5.2. List of First Function Parameters

5.3. Descriptions and Examples of First Function Parameters

Second Function Parameters:

5.4. List of Second Function Parameters

5.5. Descriptions and Examples of Second Function Parameters

5.1 List of All Drive Parameters

FUNCTION NUMBER	FUNCTION DISPLAY	FUNCTION DESCRIPTION	FACTORY SETTING	FUNCTION NUMBER	FUNCTION DISPLAY	FUNCTION DESCRIPTION	FACTORY SETTING
-	:Ff	Frequency setting *	0Hz		:F-5t	Start-up frequency	0Hz
0	:tYP	Standard setting mode	3	2ND 0	:F.run	Run frequency	0Hz
	:FH	Maximum frequency	60Hz		:FHYS	Run frequency histerisis	0Hz
1	:ub	Voltage boost	3%	2ND 1	:dbf	DC injection braking start frequency	0.0Hz
	:A.ub	Auto torque boost	0		:dbv	DC injection braking voltage	0%
	:uL	Max. voltage frequency	60Hz		:dbt	DC injection braking time	0.00 sec.
	:Pt.	V/f pattern	1	2ND 2	:dSP.2	Multiplication factor of display frequency scaler	0.00
2	:ACC 1,2	Acceleration time 1 or 2	90 sec.	2ND 3	:LF	Low speed detection	0.5Hz
	:DEC 1,2	Deceleration time 1 or 2	120 sec.		:rEH	Speed reach selection	0
	:Pt.1,2	Pattern of acc./dec. 1 or 2	0		:rrEH	Speed reach detection range	2.5Hz
	:SEL2	Selection of acc./dec. 1 or 2	0		:FrEH	Speed reach reference	0.0Hz
3	:UL	Upper limit frequency	60Hz	2ND 4	:P.OUt	Output voltage adjustment	100%
	:LL	Lower limit frequency	0Hz		:Pb	THIS PARAMETER NOT VALID FOR H2 VFD	0
4	:tHr	Electronic thermal protection level	100%		:OP5.5	Auto deceleration on the :Pb=0	0
	:StL	Stall prevention activation level	120%		:Fb.P1	TG/PG feedback or PID control selection	0
	:SEL4	Electronic thermal protection characteristic selection	1		:GP	Proportional gain	250
5	:P 1,2	IV Terminal point 1 or 2 setting signal	20, 100%	2ND 5	:G1	Integral gain	100
	:F-P 1,2	Output frequency or point 1 or 2	0, 60Hz		:GR	Differential gain	0
	:rrLL	RR terminal priority	0		:GFS	Lag time constant	255
6	:JOG	Jog run frequency	5Hz	2ND 6	:PG	TG/PG feedback select	0
	:JStP	Jog stop pattern	0		:EOnu	PG feedback gain	0
	:S-r1-7	Multispeed run frequencies 1-7	0Hz		:CF	Carrier frequency	12k Hz
7	:FJ1-3	Jump frequency 1-3	0Hz		:OPT	Option selection	0
	:bFJ1-3	Jump width 1-3	0Hz		:l.no.	Memory function	0
8	:I.ttb	Input terminal selection	0	2ND 7	:b.Rt	Baud rate	0
	:O.ttb	Output terminal selection	3		:SNOd	RS232C data bits	0
9	:F.r.	Forward/reverse run selection	1	2ND 8	:SSCr	Parity check and stop bit	0
	:tr.tL	Trip retention selection	0		:CCHG	Inverter to AC line transfer operation signal	0
	:rtrY	Automatic restart selection	0		:P.SEL	Pattern run mode	0
	:ArSt	Selection of automatic restart after instantaneous power failure	0		:Pt.t	Time unit	0
	:Uu.C	Regeneration power ride through control	0		:Pt.n	Cycle times	0
*	This is the frequency setting parameter that the inverter will automatically default to when power is first applied. It is not a part of the first or second functions and is shown for reference.			2ND 9	:Pt.1 to Pt.7	Pattern run 1-7 changeover time (secs.)	0 Sec.
					:Pt.1 to Pt.7	Fwd/Rev and acc/dec sel. of pattern runs 1-7	0
					:CNOd	Command mode select	7
					:F.NOd	Freq. seting mode select	7
					:P.NOd	Parameter setting mode select	3

5.2 First Function Parameters

Function No.	Function Name	Display	Adjustment Range	Unit	Factory Set	Error Message	Ref. Page
-	Frequency setting	:FC	0.1~160	Hz	0	:UL :LL	6-3
0	Standard setting mode	:LTP	1: 50Hz motor 2: 60Hz motor 3: Factory set (Reset to default) (Always 0 display in this mode.)		3	:Err0	6-5
	Maximum frequency	:FH	30 to 160	Hz	60	:Err0:ErrU	5-5
1	Voltage boost	:UB	0 to 30	%	3	:Err0	5-5
	Auto torque boost (voltage)	:A.ub	0: Off 1: On		0	:Err0	5-5
	Max. voltage frequency	:UL	25 to 160	Hz	60	:Err0:ErrU	5-5
	V/f pattern	:PE	0: Constant torque 1: Variable torque		1	:Err0	5-5
2	Acceleration time #1	:ACC1	0.1 to 1200	sec	90	:Err0:ErrU	6-6
	Deceleration time #1	:DEC1	0.1 to 1200	sec	120	:Err0:ErrU	6-6
	Acc/Dec #1 pattern	:PE1	0: Linear 1: S-curve 2: C-curve		0	:Err0	6-7
	Acceleration time #2	:ACC2	0.1 to 1200	sec	90	:Err0:ErrU	6-6
	Deceleration time #2	:DEC2	0.1 to 1200	sec	120	:Err0:ErrU	6-6
	Acc/Dec #2 pattern	:PE2	0: Linear 1: S-curve 2: C-curve		0	:Err0	6-7
	Acc/Dec #1, #2 select	:SEL2	0: Acc/Dec #1 1: Acc/Dec #2		0	:Err0	5-5
3	Upper limit frequency	:UL	0 to Max. frequency	Hz	60	:FH	5-5
	Lower limit frequency	:LL	0 to upper limit frequency	Hz	0	:UL	5-5
4	Overload detection	:THR	10 to 100	%	100	:Err0:ErrU	5-6
	Stall protection	:SEL	10 to 120	%	120	:Err0:ErrU	5-6
	Overload detection curve	:SEL4	0: STD-motor, No soft stall 1: STD-motor, Soft stall 2: VF-motor, No soft stall 3: VF-motor, Soft stall		1	:Err0	5-6
5	IV-ref. setting point #1	:P1	0 to 100	%	20	:Err0	6-24
	#1 output frequency	F-P1	0 to Max. frequency	Hz	0	:FH	6-24
	IV-ref. setting point #2	:P2	0 to 100	%	100	:Err0	6-24
	#2 output frequency	F-P2	0 to Max. frequency	Hz	60	:FH	6-24
	RR terminal priority	:RR.PE	0: IV terminal input "on" 1: RR terminal input "on"		0	:Err0	5-7

* This is the operating frequency setting parameter. It is located within the monitor mode but is not a true first function parameter. It is used to set an operating frequency by scrolling up or down the frequency range, using the "up" or "down" keys until the desired frequency is reached, rather than by entering data for a particular output frequency (see Page 6-3).

5.2 First Function Parameters (Cont'd)

Function No.	Function Name	Display	Adjustment Range	Unit	Factory Set	Error Message	Ref. Page
6	Jog drive frequency	:JOG	0 to 20	Hz	5	:Err0	6-9
	Jog stop control	:JSTP	0: Deceleration stop 1: Coast stop 2: DC injection stop		0	:Err0	6-9
	1st speed	:S1	LL to UL setting value	Hz	0	:LL:UL:FH	6-11
	2nd speed	:S2	LL to UL setting value	Hz	0	:LL:UL:FH	6-11
	3rd speed	:S3	LL to UL setting value	Hz	0	:LL:UL:FH	6-11
	4th speed	:S4	LL to UL setting value	Hz	0	:LL:UL:FH	6-11
	5th speed	:S5	LL to UL setting value	Hz	0	:LL:UL:FH	6-11
	6th speed	:S6	LL to UL setting value	Hz	0	:LL:UL:FH	6-11
7	Jump freq. point #1	:F1	0 to Max. frequency	Hz	0	:FH	5-7
	Jump freq. band #1	:bF1	0 to 30	Hz	0	:FH	5-7
	Jump freq. point #2	:F2	0 to Max. frequency	Hz	0	:FH	5-7
	Jump freq. band #2	:bF2	0 to 30	Hz	0	:FH	5-7
	Jump freq. point #3	:F3	0 to Max. frequency	Hz	0	:FH	5-7
	Jump freq. band #3	:bF3	0 to 30	Hz	0	:FH	5-7
8	Multi-function input	:Ibb	0: SS2, SS3 1: JOG, SS3 2: SS2, AD2 3: JOG, AD2		0	:Err0	5-8
	Multi-function output	:Obb	0: LL, UL 1: LOW, UL 2: LL, RCH 3: LOW, RCH		3	:Err0	5-8
9	Forward/Reverse	:F.r	0: Reverse 1: Forward		1	:Err0	6-4
	Fault trip saving	:trCL	0: Cleared when powered off 1: Data retained when powered off		0	:Err0	5-8
	Retry (Auto-reset)	:trrY	0: Off 1: On		0	:Err0	5-8
	Auto-restart	:ArSt	0: Off 1: On		0	:Err0	5-9
	Regeneration power ride through control	:Rv.r	0: Off 1: On *		0	:Err0	5-9

* Approximately 100 mS (option for over 100 mS).

Warnings:

- 1) For 75-200 horsepower units *only*, the **acceleration time should not be set below 5 seconds**. If the application requires acceleration time settings below 5 seconds please consult the factory before applying.

5.3 First Functions - Descriptions and Examples

FMAX
0

STANDARD SETTING MODE - Sets basic 50 Hz and 60 Hz motor settings. Also resets drive to factory default settings.

MAXIMUM FREQUENCY - Sets the maximum safe frequency (FH) for the motor being run. The drive will never output a higher frequency than this setting.

V/F
1

VOLTAGE BOOST - Increases the start-up torque of the motor being run.

AUTO TORQUE BOOST - Automatically increases the percentage of voltage boost when starting torque requirements are abnormally high.

FREQUENCY at MAXIMUM VOLTAGE - Sets the frequency at which the output voltage is 100%.

V/f PATTERN - Selects a constant or variable torque pattern.

ACC/DEC
2

ACC1, DEC1, Pt1/ACC2, DEC2, Pt2 - Sets the times required to ACC/DEC between 0Hz and the maximum frequency value FH. Also selects the pattern by which the ACC/DEC times are run (see Chapter 6).

SEL2 - Selects which ACC/DEC/Pt will be used (#1 or #2).

Note: ACC/DEC times are the times required to go between 0Hz and the maximum frequency FH.

UL/LL
3

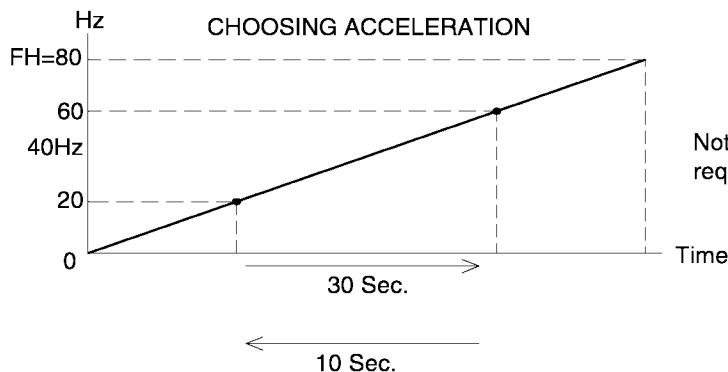
UPPER LIMIT - Sets the upper frequency limit. The inverter will never operate above this upper limit.

Note: The value of FH must always be equal to or greater than the value of UL.

LOWER LIMIT - Sets the lower frequency limit. The inverter will never operate below this lower limit.

Application Example - The inverter is used to control a 50Hz motor which has a safe operating frequency of 80Hz. This motor drives a centrifugal pump which must run according to the following specifications: "tyP=1" "FH=80"

- 1) For this example, a VOLTAGE BOOST OF 10% is needed to move the pump at low start-up speeds. "ub=10"
- 2) Although a 50Hz motor is used, specifications require 100% output voltage at 60Hz. "uL=60"
- 3) This system requires a constant torque. "Pt=0"
- 4) When running the pump the inverter must run no faster than 60Hz and no slower than 20Hz. "LL=20" "UL=60"
- 5) The maximum acceleration and deceleration between 20Hz and 60Hz must be 30 seconds and 10 seconds, respectively. A linear pattern is required.



Note: ACC/DEC times are the times required to go between 0Hz and FH.

5.3 First Functions - Descriptions and Examples (Cont'd)

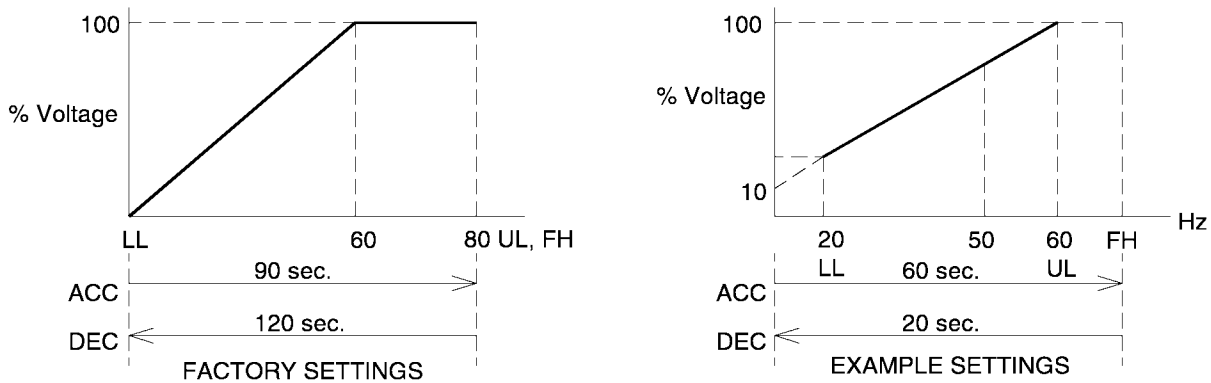
Because ACC/DEC times are based upon the change in Hz/SEC the following formula must be used.

$$\text{FH/Frequency range} \times (\text{ACC/DEC time of frequency range}) = \text{ACC/DEC}$$

$$\text{ACC1} = 80\text{Hz} \div (60-20\text{Hz}) \times 30 \text{ sec.} = 60 \text{ sec.} \quad \text{ACC1}=60$$

$$\text{DEC1} = 80\text{Hz} \div (60-20\text{Hz}) \times 10 \text{ sec.} = 20 \text{ sec.} \quad \text{DEC1}=20$$

Note: Specifications required only one ACC/DEC rate, therefore ACC2/DEC2/Pt2 settings were not needed. SEL2=0
 Setting ACC2/DEC2/Pt2 would be suggested if a different pattern was required.
 Switching between the two patterns would then simply require switching between SEL2=0 and SEL2=1.



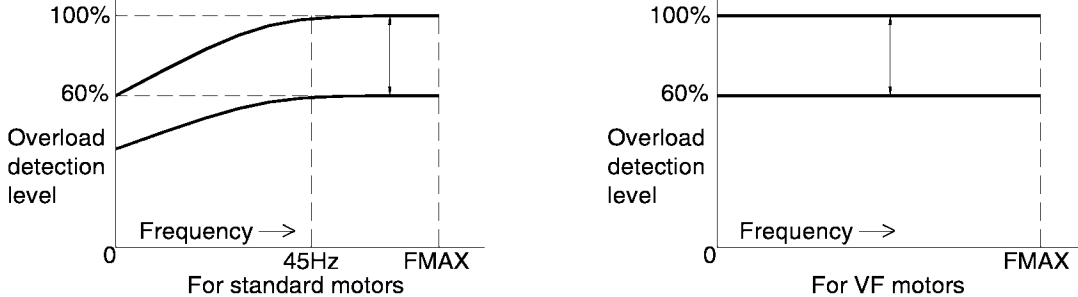
OL
4

OVERLOAD PROTECTION - Sets the thermal overload detection level to match the ratings and characteristics of the motor being used (10% to 100% of rated output current). The inverter will run continuously at 110% of the **overload protection** (i.e. Setting: inverter rated current = 50amps, overload level set at 60% leads to set rated current = 50 X 60% = 30amps and continuous set rated current = 30 X 110% = 33amps).

STALL PROTECTION - Sets the activation level of the stall protection function (10% to 120% of rated output current). When the stall level is reached the inverter will begin stalling by lowering the frequency and voltage to prevent **overcurrent** tripping. Once a soft stall has occurred the output current will be clocked. If output current is not reduced within a specified time a fault will occur. (See Chapter 2 for drive ratings and Chapter 8 for fault codes.)

Note: Instantaneous trip current limits are factory set and are dependent upon inverter size as well as the motor ripple current. The inverter's soft stall function is particularly effective in situations where load current decreases as revolution speed decreases (i.e. wind and hydraulic power machinery).

OVERLOAD DETECTION CURVE - Selects an overload detection curve for a standard motor or a variable frequency motor, with and without soft stall.



5.3 First Functions - Descriptions and Examples (Cont'd)

Note: "100% of overload detection level" refers to the value of the inverter's rated output current.

Setting of SEL4	Function
0	Standard motor without soft stall function
1	Standard motor with soft stall function
2	VF motor without soft stall function
3	VF motor with soft stall function

Application Example - A 3HP 230V H2 inverter is used to drive a 2HP 230V motor rated at 6.8 amps full load. Because the inverter is rated at 9.6 amps there is a danger of burning up the motor. By using the overload features of the inverter the output current can be limited and the stall protection level adjusted accordingly.

•••••

REF
5

IV - REFERENCE POINT #1 - Sets the % of the terminal IV input signal which is used to reference the output frequency designated by F-P1.

#1 OUTPUT FREQUENCY [F-P1] - Sets the output frequency used for reference point #1.

IV - REFERENCE POINT #2 - Same as reference point #1, except makes reference to F-P2.

#2 OUTPUT FREQUENCY [F-P2] - Sets the output frequency used for reference point #2.

See Chapter 6 for details.

RR TERMINAL PRIORITY - Activates the terminal into which the analog reference signal will be input.

•••••

JOG
6

JOGGING DRIVE FREQUENCY - Sets the frequency at which the inverter will operate while in the JOG mode. Used for moving small increments when precise-positioning of motor-driven equipment is required.

JOGGING STOP CONTROL - Selects between three methods of stopping during a jog run.

1ST SPEED ~ 7TH SPEED - Sets the frequencies used in the 7 speed run and the pattern run.

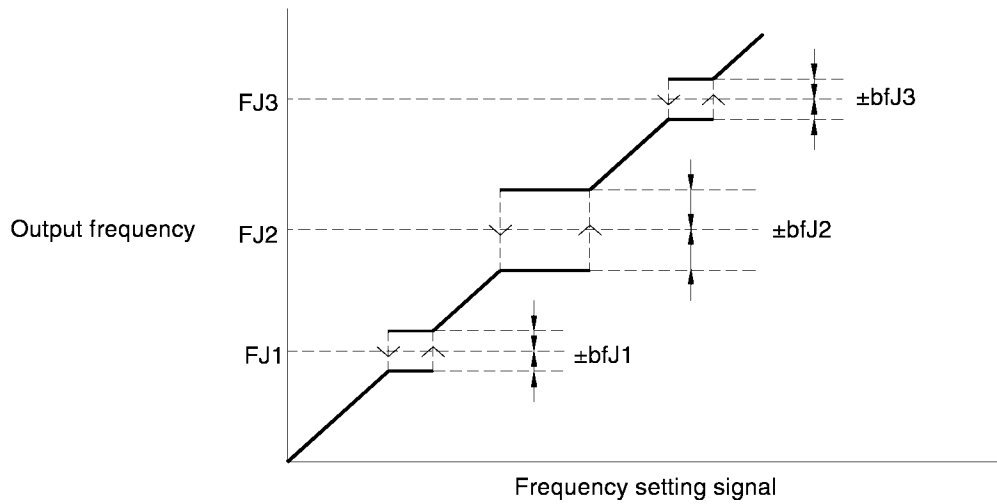
See Chapter 6 for details.

•••••

JMP
7

JUMP FREQUENCY POINT #1 AND BAND #1 - Sets the frequency range to be skipped when running a motor. This function is used when the resonance of the loaded machine must be avoided. Jump frequency ranges 2 and 3 are also available.

5.3 First Functions - Descriptions and Examples (Cont'd)



Note: Frequency jumps cannot be used during preset acceleration/deceleration runs. When a frequency setting signal reaches the jump frequency range, the inverter's output frequency will remain fixed while the display frequency will continue to rise or fall. Once the input signal reaches the opposite end of the jump range the inverter will jump up or down to the allowable frequency.



TB
8

MULTIFUNCTION INPUT - Selects the way in which terminals JOG(SS2) and AD2(SS3) are to be used.

See Pages 6-9 through 6-12 for details.

MULTIFUNCTION OUTPUT - Selects the way in which terminals RCH(UL) and LOW(LL) are to be used.

See Pages 7-5 and 7-6 for details.



SEL
9

FORWARD/REVERSE - Selects between a forward and reverse run.

FAULT TRIP SAVING - Selects between saving or not saving the fault code information when power is removed from the inverter. When this function is set to save fault data (active) the auto reset function will become inactive.

AUTO-RESET - When selected, the inverter will automatically try to restart when a protective function activates an inverter fault trip (unless the fault trip saving function is activated).

Setting on retry	Function
0	OFF - If the inverter trips, the system will retain the tripped condition but will not try to restart.
1	ON - If the inverter trips, the system will automatically try to restart but only under the following conditions (see next page for chart of auto-reset conditions).

5.3 First Functions - Descriptions and Examples (Cont'd)

AUTO RESET CONDITIONS

Cause of fault	Reset Process	Reset Failure Conditions
Overcurrent Overload	Tries to restart 5 times in succession 1st reset: 1 sec. after problem occurs. 2nd reset: 2 sec. after initial restart. 3rd reset: 4 sec. after 2nd restart try. 4th reset: 8 sec. after 3rd restart try. 5th reset: 16 sec. after 4th restart try.	The reset process follows this chart unless a fault, other than those listed, occurs. If this happens the inverter will not try to reset.
Overvoltage	Trips, displays OP, sets fault relay until overvoltage condition is removed. Fault relay will be cleared after reset.	

Notes: The cause of the fault(s) could be from an instantaneous power interrupt.

While preparing for a reset, the auto-reset function causes the fault code "0.0" to be displayed alternately on the monitor display. Fault-detection signals are not output during the inverter's reset process. If the cause of the failure has not been corrected, then the intervals before each attempted reset will be prolonged. See above chart.

If the load exhibits an extremely large amount of inertia (WK)², automatic restart using the procedure described above may not work.

Note: No restart is tried when any of the following messages is displayed on the inverter's monitor display.

- "OCA" Overcurrent (transistor short-circuited at start-up)
- "OCL" Overcurrent (load end short-circuit at start-up)
- "OCr" Overcurrent (overcurrent through the regenerative discharge resistor)
- "EF" Ground fault
- "E" Emergency stop
- "EEP" E²PROM failure

CAUTION: *Before using the inverter's retry (auto-reset) function, check to be certain that the auto-reset procedure will not damage or otherwise cause problems for the load machine system when the inverter's retry operations are being executed.*

AUTO-RESTART - When selected, the inverter will automatically restart into a free-rotating motor. This restart will occur only after an instantaneous power interruption has occurred. The function allows the inverter to sample the speed of the free-rotating motor during the interruptions and output a matching frequency when power is reapplied. This assures smooth restarts of a free-running motor when an instantaneous power loss has occurred such as when the system is switched from a commercial bypass run to an inverter run.

Notes:

- 1) With [ArSt] = 0, the inverter will restart at 0Hz and increase up to the initial running frequency. With [ArSt] = 1, the inverter will restart at the running frequency of the motor and will increase up to the initial frequency of the inverter.

REGENERATION POWER RIDE THROUGH CONTROL - Uses regenerative energy to extend the inverter's power ride through capability during momentary power dropouts.

5.4 Second Function Parameters

Function No.	Function Name	Display	Adjustment Range	Unit	Factory Set	Error Message	Ref. Page
2ND 0	Start-up frequency	FSt	0.0 to 10	Hz	0.0	Err0	5-13
	Run frequency	:Frun	0 to Max. frequency	Hz	0	FH	5-13
	Run frequency hysteresis	:FHY5	0 to Max. frequency	Hz	0	FH	5-13
2ND 1	DC injection starting frequency	dbf	0.0 to 10	Hz	0.0	Err0	5-13
	DC injection voltage	dbu	0 to 20	%	0	Err0	5-13
	DC injection time	dbt	0.0 to 5	sec	0.00	Err0	5-13
2ND 2	Multiplication factor of display frequency scaler	:dSP2	0.00 to 200 (0.00 = OFF)		0.00	Err0	6-7
2ND 3	Low speed detection	LF	0.0 to Max. frequency	Hz	0.5	FH	5-14
	Speed reach selection	rCH	0: Complete ACC/DEC 1: Frequency reach reference		0.0	Err0	5-14
	Speed reach detection range	rrCH	2.5 to 25	Hz	2.5	FH	5-14
	Speed reach reference	FrrCH	0.0 to Max. frequency	Hz	0	FH	5-14
2ND 4	Output voltage adjustment	POUT	0 to 100 (Option: 0 to 120)	%	100	Err0	5-14
	Dynamic brake resistor	Pb	THIS PARAMETER NOT VALID FOR MODEL H2		0	Err0	--
	Auto deceleration on the :Pb=0	:OPS5	0: On		0	Err0	5-15
2ND 5	TG/PG feedback or PID control selection ***	:Fb.PI	0: Off 1: TG/PG feedback 2: PID control		0	Err0	5-14
	Proportional gain	:GP	0 to 9999	1	250		6-17
	Integral gain	:GI	0 to 9999	1	100		6-17
	Differential gain	:GD	0 to 255	1	0	Err0	6-17
	Lag time-constant	:GFS	0 to 255	1	255	Err0	6-17
	TG/PG feedback selection ***	:PG	0: TG 1: PG (500p/r) 2: PG (100p/r)		0	Err0	6-17
	PG feedback gain	:EBnu	0 to 9999	1	0		6-17
2ND 6	PWM carrier frequency	:CF	5 to 16	kHz	12	Err0	5-15

*** TG/PG feedback requires the use of the multi-function option board.

5.4 Second Function Parameters (Cont'd)

Function No.	Function Name	Display	Adjustment Range	Unit	Factory Set	Error Message	Ref. Page										
2ND 7	Option selection	:OPt	0 to 12 (SEE TABLE #1 PG. 5-12)		0	:Err0	5-15										
	Inverter number	:Inv.	0 to 31		0	:Err0	6-7										
	Baud rate	:brAt	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">0: 150</td> <td style="width: 50%;">0: 1200</td> </tr> <tr> <td>1: 300</td> <td>1: 2400</td> </tr> <tr> <td>RS232 2: 600</td> <td>RS485 2: 4800</td> </tr> <tr> <td>3: 1200</td> <td>3: 9600</td> </tr> <tr> <td>4: 2400</td> <td>4: 19200</td> </tr> </table>	0: 150	0: 1200	1: 300	1: 2400	RS232 2: 600	RS485 2: 4800	3: 1200	3: 9600	4: 2400	4: 19200		0	:Err0	5-15
	0: 150	0: 1200															
	1: 300	1: 2400															
	RS232 2: 600	RS485 2: 4800															
3: 1200	3: 9600																
4: 2400	4: 19200																
RS232C data bits	:5n0d	0: 7 bits 1: 8 bits		0	:Err0	5-15											
Parity check and stop bit	:55Cr	0 to 5 (SEE TABLE #2 PG. 5-12)		0	:Err0	5-15											
Inverter to AC line transfer operation signal	:C.CHG	0: Off 1: On		0	:Err0	5-15											
2ND 8	Pattern run activation mode	:P.SEL	0: Off 1: Terminal operation 2: Touch pad operation 3: Computer communication		0	:Err0	6-14										
	Time unit	:PEt	0: Seconds 1: Minutes		0	:Err0	6-14										
	Cycle times	:PE.n	0 to 255 (255: Infinity operating)		0	:Err0	6-14										
	Pattern drive time #1 to 7	:PE.1t to :PE.7t	0 to 8000	secs/ mins	0	:Err0	6-14										
	Pattern drive characteristics #1 to 7 F/R, ACC/DEC	:PE.1 to :PE.7	0: Forward run, #1 ACC/DEC 1: Forward run, #2 ACC/DEC 2: Reverse run, #1 ACC/DEC 3: Reverse run, #2 ACC/DEC		0	:Err0	6-14										
2ND 9	Command mode selection*	:Cn0d	0: Disables all inputs 1: Terminal input only 2: Touch pad only 3: Enable changing of terminal & touch pad 4: Host input only 5: Enable changing of terminal & host input 6: Enable changing of touch pad & host input 7: Enable changing of all input modes		7	:Err0	5-15										
	Frequency reference setting mode selection*	:Fn0d	0: Disable all input 1: Terminal input only 2: Touch pad only 3: Enable changing of terminal & touch pad 4: Host input only 5: Enable changing of terminal & host input 6: Enable changing of touch pad & host input 7: Enable changing of all input modes		7	:Err0	5-15										
	Parameter setting mode selection	:Pn0d	0: Disable all input 1: Touch pad only 2: Host input only 3: Enable changing of touch pad & host input		3	:Err0	5-15										

*See examples showing common uses of these parameters on Pages 6-22 and 6-23.

5.4 Second Function Parameters (Cont'd)

**TABLE 1
OPTION SELECTIONS**

Function No.	Function Name	Display	Adjustment Range	Unit	Factory Set	Error Message	Ref. Page
2ND 7	Option selection	:OPT	0: Off 1: 12 bit binary absolute input 2: 12 bit binary relativity input 3: 3 number BCD input (tenths) 4: 3 number BCD input (units) 5: Pulse frequency reference input 6: Multi-speed input 7: Item 1 with write signal 8: Item 2 with write signal 9: Item 3 with write signal 10: Item 4 with write signal 11: Item 5 with write signal 12: Item 6 with write signal		0	:Err0	5-15

**TABLE 2
COMPUTER COMMUNICATION PARITY CHECK AND STOP BIT SELECTIONS**

Function No.	Function Name	Display	Adjustment Range	Parity Check	Stop Bit	Error Message	Ref. Page
2ND 7	Parity check and stop bit	:55Cr	0: 1: 2: 3: 4: 5:	Even Even N/A N/A Odd Odd	1 2 1 2 1 2	:Err0	5-15

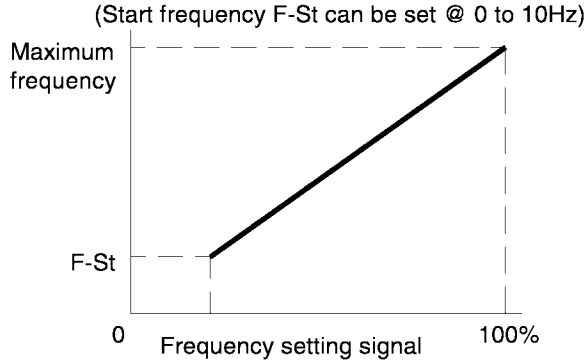
5.5 Second Functions - Descriptions and Examples

2ND

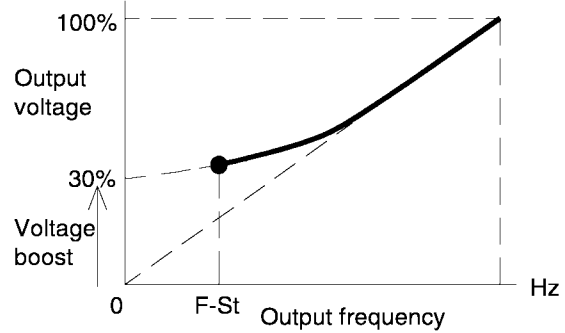
START-UP FREQUENCY - Sets the frequency at which the inverter will begin operating. In the panel control setting mode the frequency display will change as the "up" \triangle and "down" ∇ keys are pressed. However, an actual output does not occur until the startup frequency is reached. In the terminal input mode the display will remain at zero until the start-up frequency is reached. This function, along with the voltage boost function, enables the user to obtain an optimum voltage boost level. See figures below.

FMAX
0

Start-Up Frequency



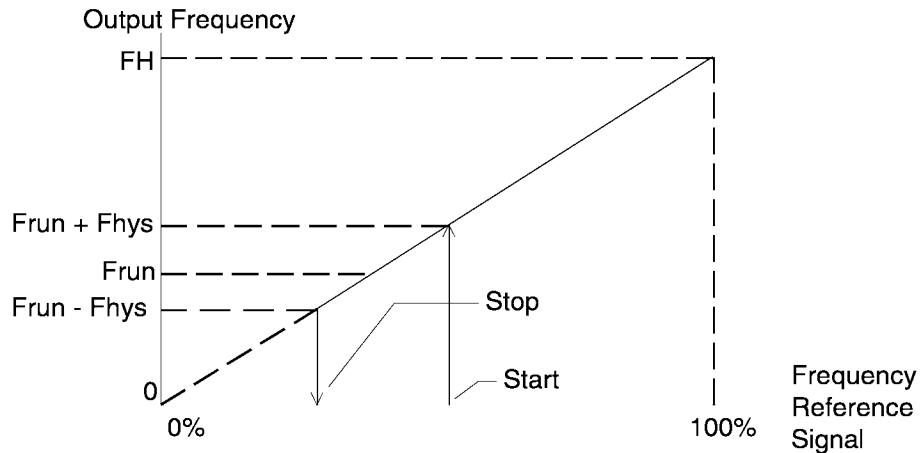
Start-Up Frequency with Voltage Boost



RUN FREQUENCY - Selects a frequency to initiate inverter run/stop control.

RUN FREQUENCY HYSTERISIS - Used to offset inverter run frequency.

When the frequency reference signal reaches the $F_{run} + F_{hys}$ point, the drive will ramp the motor to that speed. The inverter will continue to follow the reference signal until it falls below the $F_{run} - F_{hys}$ at which time the drive will ramp the motor to a stop. See figure below.



.....

2ND

DC INJECTION START FREQUENCY - Specifies the frequency at which DC injection is applied to a motor during a decelerating stop. Used for precise positioning (inching) of the motor driven equipment.

V/F
1

DC INJECTION VOLTAGE - Specifies the percent of voltage applied during the DC injection.

DC INJECTION TIME - Specifies the length of time the DC voltage applied.

See Chapter 6 for details.

5.5 Second Functions - Descriptions and Examples (Cont'd)

2ND	<u>DISPLAY FREQUENCY SCALER</u> - Used to display revolution speed and linear speed.
------------	--

ACC/DEC	See Chapter 6 for details and an example.
----------------	---

2



2ND	<u>LOW SPEED DETECTION</u> - Outputs a signal when the inverter's output frequency is greater than or equal to the selected low speed detection frequency.
------------	--

UL/LL	<u>SPEED REACH SELECTION</u> - Selects the option to output a signal when an ACC/DEC is complete or when the inverter's output frequency is within a selected range. The range is selected by the following two functions.
3	

SPEED REACH DETECTION RANGE - Specifies a range of frequencies, above and below the speed reach reference frequency, which when detected will output a signal.

SPEED REACH REFERENCE - Specifies the speed reach detection frequency. When the inverter's output frequency is within the range specified by the Speed reach reference (\pm speed reach accuracy), a signal will be output.

See Chapter 7 for details and an example.



2ND	<u>OUTPUT VOLTAGE ADJUSTMENT</u> - Specifies the percent of input voltage which is seen as the inverter's output voltage.
------------	---

OL	<u>REGENERATIVE BRAKING SELECTION</u> - NOT VALID WITH MODEL H2 DRIVE.
4	

LENGTHENED DECELERATION (Auto-deceleration on the : Pb=0) - Automatically lengthens the deceleration time to prevent over-voltage trips.



2ND	<u>TG/PG * or PID</u> - Informs the inverter of either tach generator (TG)/pulse generator (PG) feedback, proportional/integral/differential (PID) control, or nothing at all.
------------	--

REF	<u>PROPORTIONAL GAIN</u> - Sets the gain of the TG/PG or PID controlled input signal.
5	

INTEGRATION GAIN - Adjusts the period of integration when comparing the set point to the feed back signal.

DIFFERENTIAL GAIN - Stabilizes the system when hunting occurs.

LAG-TIME GAIN - Adjusts the time of response when a change in the feed back signal is seen.

TG/PG FEEDBACK SELECTION - Selects the type of speed feedback control signal to be used.

PG FEEDBACK GAIN (Coefficient of TG/PG conversion) - Adjusts the drive to respond correctly to the external pulse generator.

* TG/PG requires the use of multi-function option board.

5.5 Second Functions - Descriptions and Examples (Cont'd)

2ND	<u>PWM CARRIER FREQUENCY</u> - Selects the inverter's PWM carrier frequency.
------------	--

JOG
6



2ND	<u>OPTION TERMINAL SELECTION *</u> - Used in conjunction with multi-function option boards binary input.
------------	--

JMP	<u>INVERTER NUMBER *</u> - Allows an inverter identification number to be assigned to the unit.
7	

BAUD RATE * - Selects baud rate.
SEE PAGE 9-2.

RS232C COMMUNICATION DATA BITS * - Used to select the number of RS232C communication bits for host computer control.

PARITY AND STOP BITS * - Used to select the parity check and stop bits for host computer control.

INVERTER TO LINE TRANSFER SIGNAL * - Allows a motor load to be transferred between the inverter and line power by a signal to the inverter.



2ND	<u>PATTERN RUN ACTIVATION MODE</u> - Used to activate a pattern run by determining where the start command will be taken from.
------------	--

TB	<u>PATTERN TIME SELECTION</u> - Sets the run time of each individual preset speed to either seconds or minutes.
8	

PATTERN REPEATABILITY - determines how many times the pattern run will repeat itself.

PATTERN DRIVE TIME (#1~#7) - Sets the run time of each individual preset speed frequency (SR1~SR7) to be used in the patterned run.

PATTERN DRIVE CHARACTERISTIC (#1~#7) - Selects the type of run for reach pre-set speed frequency. The selection can be a forward or reverse run, using either ACC/DEC #1 or ACC/DEC #2.



2ND	<u>COMMAND MODE SELECTION</u> - Determines where the inverter can be started and stopped; (via the touch-pad, terminal strip, or the host computer).
------------	--

SEL	<u>FREQUENCY REFERENCE SETTING MODE SELECTION</u> - Determines where the frequency signal is accepted by the inverter; (via the touch-pad, terminal strip, or the host computer).
9	

PARAMETER SETTING MODE SELECTION - Determines where the parameters can be programmed; (via the touch-pad, or the host computer).

See Chapter 6, Pages 6-22 and 6-23 for details and examples.

* These parameters require the use of multi-function option board

CHAPTER 6

ACCESSING AND CHANGING PARAMETERS:

- 6.1. How to Read the Value of a Parameter -- [MON] and [READ] Keys
- 6.2. How to Change the Value of a Parameter -- [WRT] Key
- 6.3. How to Set the Running Frequency
- 6.4. How to Set Forward and Reverse Operation
- 6.5. How to Set the Drive for 50 Hz or 60 Hz Operation
- 6.6. How to Set the Acceleration and Deceleration Parameters
- 6.7. How to Set the Frequency Scalar
- 6.8. Use of the Memory Function
- 6.9. How to Set the DC Injection Braking Parameter
- 6.10. How to Set the JOG Parameter
- 6.11. How to Set Multiple Preset Speeds
- 6.12. How to Set Pattern Run
- 6.13. How to Set and Fine Tune the PID Parameters
- 6.14. How to Reset the Drive to Factory Default Settings
- 6.15. How to Set Proportional Output Voltage
- 6.16. How to...
 - a.) Set Speed Remotely and Start/Stop from the Touchpad
 - b.) Set Speed from the Touchpad and Start/Stop Remotely
- 6.17. How to Use Terminal IV to Scale Speed Response

6.1 How to Read the Value of a Parameter -- [MON] and [READ] Key

- Step 1. Apply power to the inverter.
- Step 2. Determine which parameter to observe. Use the Parameter List on page 5-2 if necessary.
- Step 3. Push the **[MON]** button, and then push the key which corresponds to the parameter to be observed. If examining a 2ND Function Parameter, push the **[2ND]** button before the parameter key. The **NAME** of the parameter associated with this memory address will be displayed on the LED display.
- Step 4. Use the **[NEXT]** key to "scroll down" to the correct parameter, if necessary.
- Step 5. Press the **[READ]** button. The numerical **VALUE** of the parameter will be displayed.

6.2 How to Change the Value of a Parameter -- [WRT] Key

- Step 1. Follow the 5 steps above to read and examine the value of the parameter stored in memory.
- Step 2: On the Touchpad, use the numerical keys to select a new value for the parameter displayed on the LED display. Enter the numbers in sequence.
- Step 3. Enter the new value into permanent drive memory by pressing the **[WRT]** key on the Touchpad. The new value and the parameter name will alternately flash on the LED display, indicating that the new value has been accepted into drive memory.

NOTES:

1. All parameters except [FH] and [tyP] can be changed while the drive is running. To change these parameters the drive must first be stopped.
2. See Page 4-11 if an invalid value of a parameter is entered. The drive will not confirm or accept numerical values for parameters above or below their preset ranges.
3. Pages 4-8 and 4-9 have an explanation and a sample flowchart of the instructions discussed above. Review these for further documentation, if necessary.

6.3 How to Set the Running Frequency

The inverter's panel control is operational when the inverter is in the **panel control** mode. Press the **CTRL** key until the "PANEL CONTROL" LED is on. The inverter must always be placed in the **monitor mode** before setting the operating frequency and engaging the run command.

6.3.1 Digital

Frequency changes are made by inputting the desired frequency via the numerical keypad, **0 - 9**, followed by the **WRT** and/or **RUN** keys. When running, frequency changes are not made until the **WRT** and/or **RUN** key is pressed.

6.3.2 Scroll

Frequency changes are made by inputting the desired frequency via the "up" \triangle and "down" ∇ keys. The user can scroll through the frequency range until a desired frequency is reached. When running, the scrolled frequency changes are immediate; however, when not running, the **RUN** key must first be pressed (see operating frequency setting parameter on page 6-8).

The following procedure illustrates frequency setting:

Frequency Setting

Key	Action	Display
	Power must first be applied to the inverter.	0.0
CTRL	"PANEL CONTROL" LED lights, signifying the inverter is in the panel control mode. NOTE: Pressing CTRL again will cause the LED to go off signifying the inverter is in the remote control mode.	0.0
<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-bottom: 2px;">6</div> <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-bottom: 2px;">0</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">WRT</div>	Sets the inverter to 60Hz. Pressing the WRT key enters the data into the FC file. The display will flash "60" and "FC" alternately indicating the setting has been made. :60-FC-:60	:60
RUN	Engages the run command. The inverter's output frequency will accelerate or decelerate to the new set speed designated by "FC".	60.0
<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-bottom: 2px;">1</div> <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-bottom: 2px;">0</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">WRT</div>	Pressing 1 0 WRT sets the inverter's new frequency (10 Hz) and begins a deceleration to that frequency. NOTICE the flashing semicolon ":", which signifies the motor is running but that the inverter is not necessarily displaying the actual output frequency. :10-FC-:10	:10
RUN	Even though the inverter is decelerating, the actual output frequency is not displayed until the RUN key is pressed.	10.0
<div style="border: 1px solid black; padding: 2px; display: inline-block; margin-bottom: 2px;">\triangle</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">WRT</div>	Pressing the "up" \triangle key increases the value displayed. The output frequency automatically increases. Once 55.4Hz is reached the WRT key can be pressed. The display will flash "55.4" and "FC" indicating the setting has been made. :55.4-FC-:55.4 Note: Pressing the "down" ∇ key will automatically decrease the inverter's output frequency.	:55.4
RUN	Displays the inverter's actual output frequency. In this case, the actual output frequency will be the same as that displayed because of the incremental changes of the "up" \triangle and "down" ∇ keys.	55.4

Note: Operating frequency can be changed during a run.

6.4 How to Set Forward and Reverse Operation

When wired, make sure the motor rotates in the correct direction selected by the FORWARD/REVERSE function parameter. If it does not, then reverse two (2) of the motor's three (3) leads to change the direction. This will ensure the motor's correct rotation in all possible situations. The FORWARD/REVERSE function is the first parameter in function #9. Accessing this function is illustrated in the following table and uses the programming sequence shown below.

First Function Parameters

Function No.	Function Name	Display	Adjustment Range	Factory Set	Error Message	Ref. Page
9	Forward/Reverse	:F.r.	0: Reverse 1: Forward	1	:Err.0	5-8
	Fault trip saving	:tr.0	0: Cleared when powered off 1: Data retained when powered off	0	:Err.0	5-8
	Retry (Auto-reset)	:rtry	0: Off 1: On	0	:Err.0	5-8
	Auto-restart	:ArSt	0: Off 1: On	0	:Err.0	5-9
	Regen power ride through	:U.r.C	0: Off 1: On	0	:Err.0	5-9

Accessing the FORWARD/REVERSE Function Parameter

Key	Action	Display
MON	The inverter must always be placed in the function mode before accessing any program function.	:no.0 → :tYP
SEL 9	Accesses the First Function #9 parameters.	:F.r.
READ	Displays the current "F.r." setting.	:[value]
new value WRT	Should a new value be necessary, it can be set by entering the new value followed by the WRT command. :[new value] → :F.r. → :[new value]	:[new value]
MON	Returns to the inverter's monitor mode . Assuming the inverter is not running the display will read "0.0".	0.0
6 0 WRT	Starting the inverter via the panel requires first entering a specified run frequency followed by the WRT command. Example 60Hz :60 - FC - :60	:60
RUN	Engages the run command. The inverter's output frequency will "ramp up" to 60Hz, causing the motor to accelerate to its 60Hz speed.	60.0
STOP	Engages the stop command. The inverter's output frequency will "ramp down" to 0Hz, causing the motor to decelerate to a stop.	0.0

6.5 How to Set the Drive for 50 Hz or 60 Hz Input Power

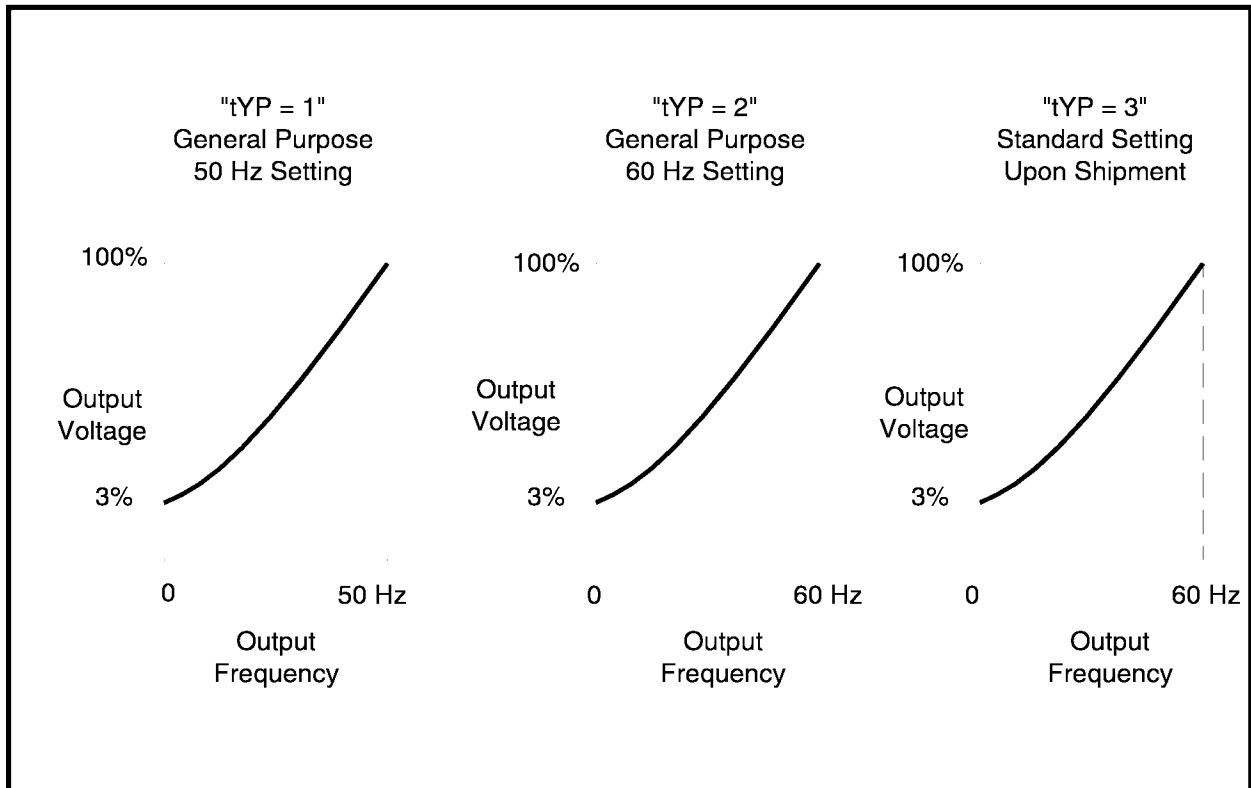
The Model H2 drive can be operated from either 50 Hz or 60 Hz input power. This feature makes the drive very flexible for use in many different countries, and many types of electrical services. The tables below explain how to set up the drive to operate on either input frequency, and describe which parameters change in response to a selection of 50 Hz or 60 Hz input power.

The Model H2 drive, when set for 50 Hz or 60 Hz operation, can also operate on a variety of input voltages as well. Refer to the connection diagrams on pages 2-9 and 2-10. These pages show how to set and revise voltage taps to properly prepare the drive for operation on any one of several possible input voltages.

Function Parameters

Function No.	Function Name	Display	Adjustment Range	Unit	Factory Set	Error Message	Ref. Page
-	Frequency setting	:FE	0.1~160	Hz	0	:UL :LL	6-3
0	Standard setting mode	:EYP	1: 50Hz motor 2: 60Hz motor 3: Factory set		3	:Err0	3
	Maximum frequency	:FH	30 to 160	Hz	60	:Err0:ErrU	5-5

V/f Characteristics of the Standard Default Settings







6.6 How to Set Acceleration and Deceleration Parameters

The table below illustrates the factory settings of the ACC/DEC file, which is located in First Function #2. The example below the table shows how to read the values and reset them to a different setting, if necessary.

Function Parameters

Function No.	Function Name	Display	Adjustment Range	Unit	Factory Set	Error Message	Ref. Page
2	Acceleration time #1	:ACC1	0.1 to 1200	sec	90	Err0:ErrU	5-5
	Deceleration time #1	:DEC1	0.1 to 1200	sec	120	Err0:ErrU	5-5
	Acc/Dec #1 pattern	:Pt1	0: Linear 1: S-curve 2: C-curve		0	:Err0	5-5
	Acceleration time #2	:ACC2	0.1 to 1200	sec	10	Err0:ErrU	5-5
	Deceleration time #2	:DEC2	0.1 to 1200	sec	10	Err0:ErrU	5-5
	Acc/Dec #2 pattern	:Pt2	0: Linear 1: S-curve 2: C-curve		1	:Err0	5-5
	Acc/Dec #1, #2 select	:SEL2	0: Acc/Dec #1 1: Acc/Dec #2		0	:Err0	5-5

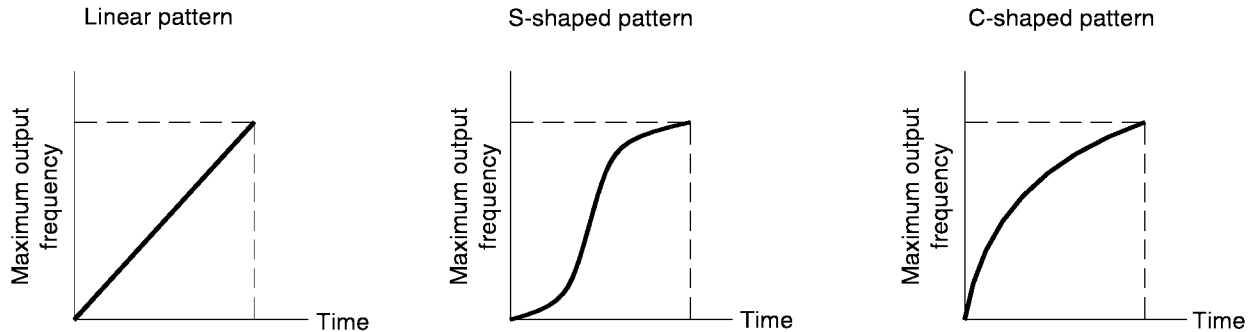
Accessing First Functions

Key	Action	Display
MON	The inverter must always be placed in the function mode before accessing any function.	no.0 → :tYP
ACC/DEC 2	The function parameter ACC1 will be displayed. This means that the ACC1 parameter has been accessed.	no.2 → :ACC1
READ	The previous setting for ACC1 was 10 seconds.	: 10.0
5 . 5 WRT	The ACC1 parameter is set to 5.5 seconds. The display will flash "5.5" and "ACC1" indicating the setting has been made.	: 5.5
  WRT	The parameter can also be changed by using the scroll keys "up"  or "down"  . When 7.5 has been reached the WRT key should be pressed to set the new value.	: 7.5
NEXT	The next parameter within the ACC/DEC file is accessed (dec1)	:dec1
NEXT	The next parameter within the ACC/DEC file is accessed (Pt.1)	:Pt.1
MON	Returns to the monitor mode .	0.0

Continued "pressing" or "holding down" of the NEXT key causes the inverter to cycle through the entire function currently accessed. For the above example the inverter would cycle through and display the following parameters: ":ACC1", ":dec1", ":Pt.1", ":ACC2", ":dec2", ":Pt.2", and ":Sel2".

6.6 How to Set Acceleration and Deceleration Parameters (Cont'd)

- ACC/DEC time can be set in the range of 0.1~1200 seconds.
- ACC/DEC time 1 or 2 can be selected either through the keypad (Panel Control) or an input terminal (Remote Control).
- ACC/DEC characteristics can be selected from the linear, S-shaped, or C-shaped pattern.



The S-shaped pattern gradually accelerates a motor in a range where the motor provides a low torque, and is suited for material handling machinery. The C-shaped pattern quickly accelerates a motor in a range where the motor provides a low torque, and is suited for a high speed run.

6.7 Display Frequency Scaler

This versatile unit indication system permits the indication of not only the output frequencies, but also revolution speeds, linear velocities, or other linear multiples of the frequencies.

[Contents of digital displays]=Constant X [Output frequency]

The constant can be set within the range 0.01~200; also the unit measure (Hz) LED turns off when the Display Frequency Scaler function is activated.

Example:

When a 4 pole motor is driven at 0~60Hz, the setting "dSP.2=30" makes the monitor display indicate 0~1800 (rpm).

For linear speed of 6m/sec at 60Hz, set "dSP.2=0.1". When speed scaling is used, the unit of measure LED is turned off.

6.8 Memory Function

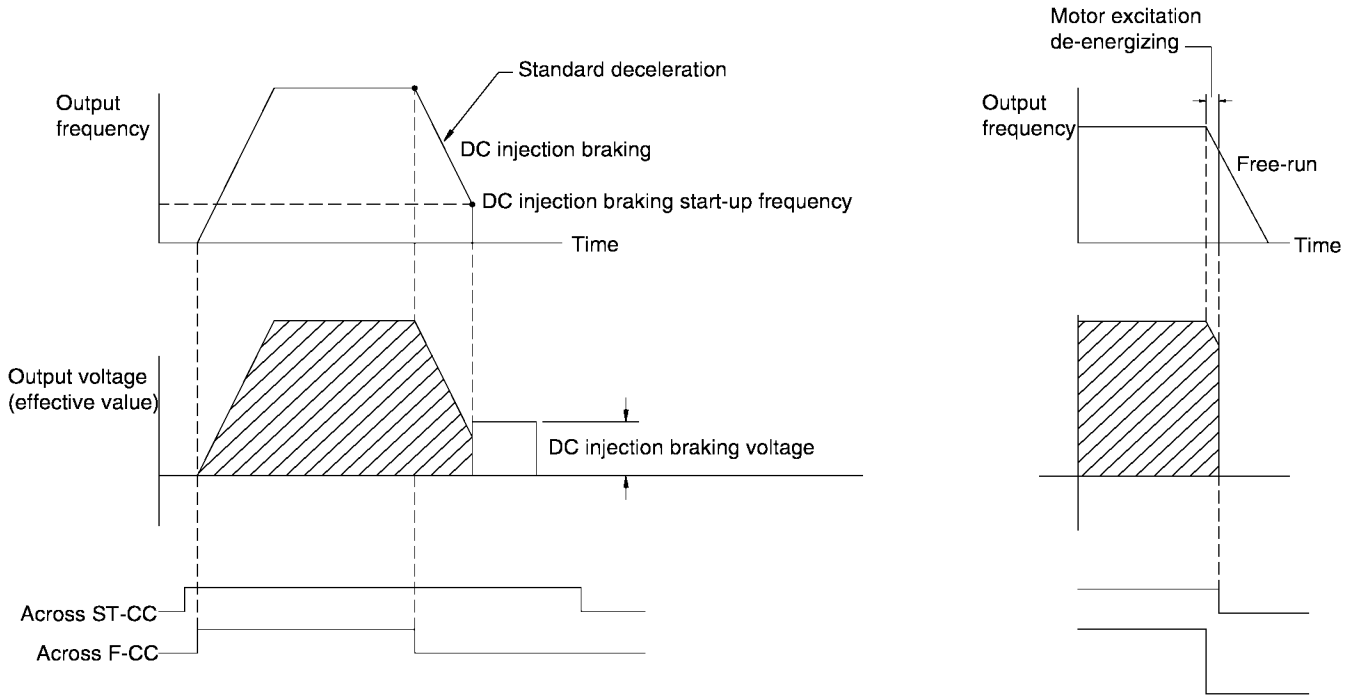
A number from 0 to 31 can be assigned to and stored in the non-volatile memory of the inverter. This allows electronic tagging and on-line identification of each unit.

This function can be utilized for sorting of inverter unit numbers and various set data through the optional computer interface.

6.9 How to Set DC Injection Braking Parameter

6.9.1 DC Injection

The DC injection braking function creates smooth operating characteristics with continuous phase control. It is used primarily for alignment applications. It controls the final coast of the motor by injecting DC voltage into the motor. This allows the capability of starting and stopping at the same point every time when used in conjunction with a position sensor. The amount of DC energy that is available for injection is limited by the current limiting feature of the inverter. Care should be taken when using DC injection because of additional motor heating.



Note: See standard specifications (page 2-3) for adjustment ranges.

6.9.2 Dynamic Braking

The Model H2 drive does NOT have dynamic braking capability.

6.10 How to Set the Jog Parameter

The jog frequency is immediately output regardless of the predetermined acceleration time. The jog frequency (JOG) and the type of jog stop pattern (J.StP) must be pre-selected. The table below shows the direction that the motor will run when the terminals are energized.

Terminal Inputs and Actions



Terminal Connections				Action
ST	JOG (SS2)	F	R	
ON	ON	OFF	OFF	Jogging Stop
ON	ON	OFF	ON	Reverse Jogging Run
ON	ON	ON	OFF	Forward Jogging Run
ON	ON	ON	ON	Reverse Jogging Run

The following table identifies the STOP pattern and the next table illustrates a JOG RUN in which the parameters "JOG" and "J.Stp" equal 5Hz and 1, respectively.

Jogging Stop Pattern

:J.StP	Pattern
0	Motor will decelerate to a stop at the rate of DEC1, or DEC2, (dependent upon SEL2).
1	Motor will coast to a stop.
2	Motor will have DC injection applied based upon the DC injection parameters located in the 2nd Function #1.

Activating the JOG Feature

Key	Action	Display
MON	The inverter must be placed in the monitor mode and stopped before activating the jog feature .	0.0
2ND 0	Engages the jog feature .	JOG
	Sets a forward run jog.	JOG
	Sets a reverse run jog.	JOG-
RUN	When held down the inverter will run at the preset jog speed.	5
RUN	When released the motor coasts to a stop (J.StP=1).	JOG
CLR or STOP	Disables the jog feature . The inverter returns to the monitor mode .	0.0

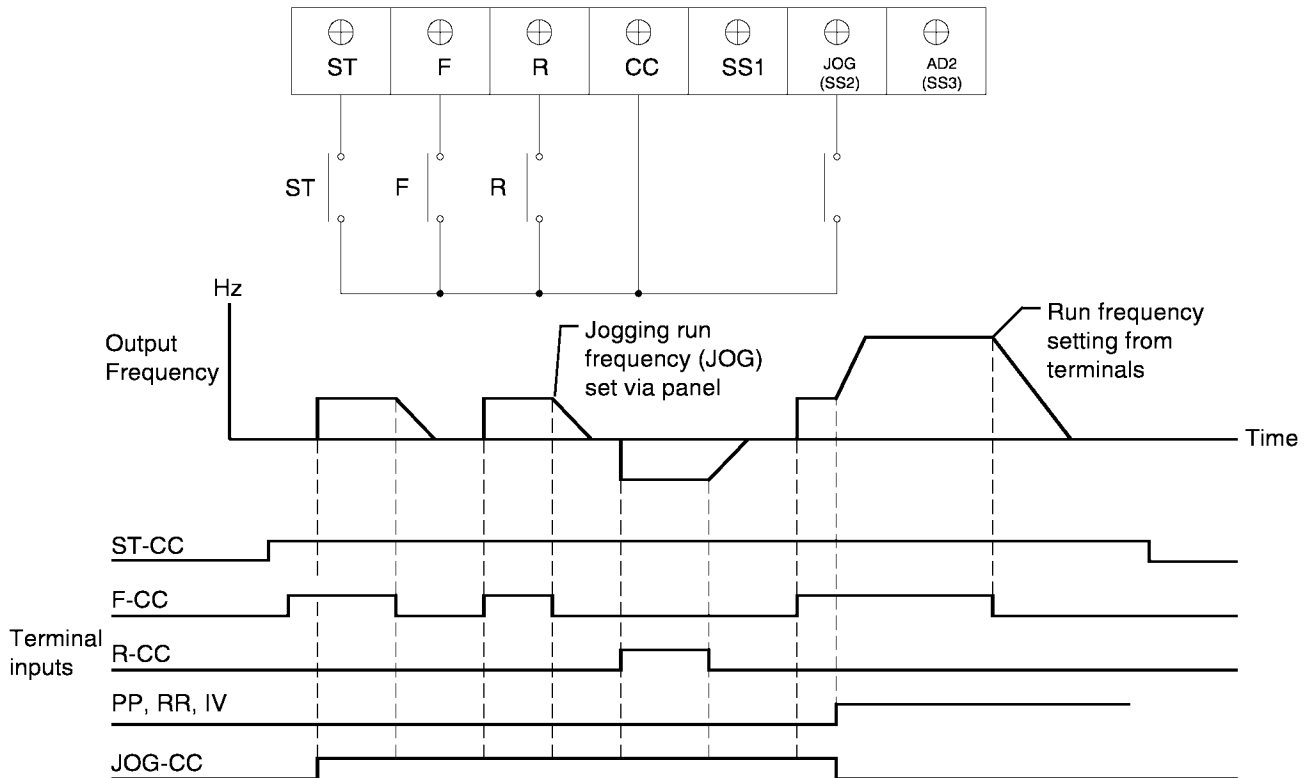
6.10 How to Set the Jog Parameter (Cont'd)

The JOG(SS2) terminal must be set for "JOG". This is accomplished by setting the function parameter "1.tb" to 1 or 3. Use function key #8 to access this function. The terminal connections are shown below:

Function Parameters

Function No.	Function Name	Display	Adjustment Range	Unit	Factory Set	Error Message	Ref. Page
6	Jog drive frequency	:JOG	0 to 20	Hz	5	:Err.0	5-7
	Jog stop control	:JSTEP	0: Deceleration 1: Coast stop 2: DC injection stop	Hz	0	:Err.0	5-7
8	Multifunction input	:1.tb	0: SS2, SS3 1: JOG, SS3 2: SS2, AD2 3: JOG, AD2		0	:Err.0	5-8
2ND 1	DC injection starting frequency	:dbF	0.0 to 10	Hz	0	:Err.0	5-13
	DC injection voltage	:dbU	0 to 20	%	0	:Err.0	5-13
	DC injection time	:dbT	0.0 to 5	sec	0	:Err.0	5-13

Terminal Connections Required For Remote Jog

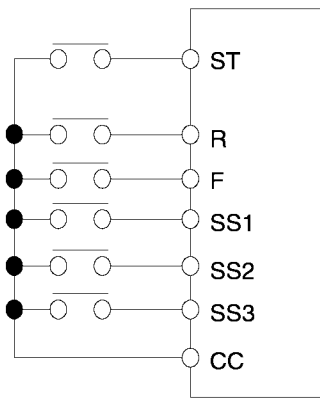
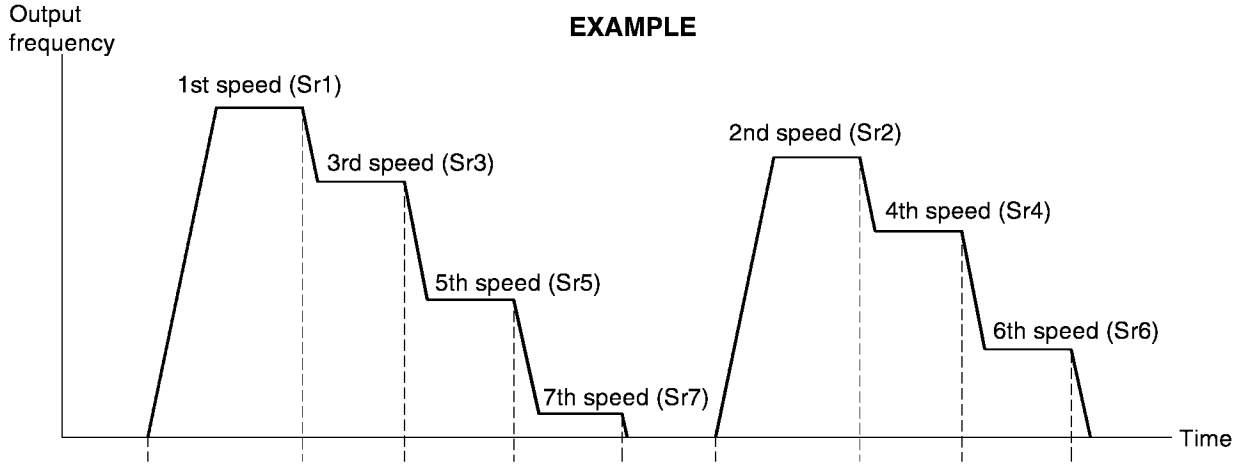


Notes:

- 1) A jogging run cannot be engaged by closing the JOG switch during a run.
- 2) The inverter will decelerate at the selected rate during: deceleration stop, coast to stop, and DC injection stop.
- 3) F-CC must be broken for DC injection to be applied; breaking only JOG(SS2)-CC allows the inverter to accept other input signals and is not a "true" off.
- 4) See table on the previous page for terminal inputs and actions.

6.11 How to Set Multiple Preset Speeds

- Up to 7 different preset speeds can be executed without any external potentiometers.
- These 7 preset speed frequency values can be accessed either through the terminal input (Remote Control) or through the keypad (Panel Control). Also note that an 8th speed can be executed when the inverter has an operating frequency set through the terminal input reference signal.
- The preset frequencies are set to particular frequencies via Function #6 - parameters SR1 thru SR7.



ST-CC	F/R-CC	SS3-CC	SS2-CC	SS1-CC	Operating Frequency Selection
ON	ON	OFF	OFF	OFF	Operating Frequency set via PP, RR, IV terminal
		OFF	OFF	ON	1st Operating Speed Frequency
		OFF	ON	OFF	2nd Operating Speed Frequency
		OFF	ON	ON	3rd Operating Speed Frequency
		ON	OFF	OFF	4th Operating Speed Frequency
		ON	OFF	ON	5th Operating Speed Frequency
		ON	ON	OFF	6th Operating Speed Frequency
		ON	ON	ON	7th Operating Speed Frequency

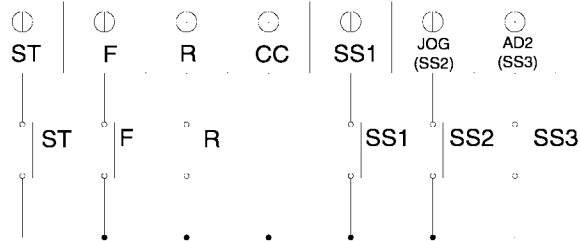
Preset Functions Required To Run the Preset Speeds

Function No.	Function Name	Display	Adjustment Range	Unit	Factory Set	Error Message	Ref. Page
6	1st speed	:Sr1	LL to UL setting value	Hz	0	:LL:UL:FH	5-7
	2nd speed	:Sr2	LL to UL setting value	Hz	0	:LL:UL:FH	5-7
	3rd speed	:Sr3	LL to UL setting value	Hz	0	:LL:UL:FH	5-7
	4th speed	:Sr4	LL to UL setting value	Hz	0	:LL:UL:FH	5-7
	5th speed	:Sr5	LL to UL setting value	Hz	0	:LL:UL:FH	5-7
	6th speed	:Sr6	LL to UL setting value	Hz	0	:LL:UL:FH	5-7
	7th speed	:Sr7	LL to UL setting value	Hz	0	:LL:UL:FH	5-7
8	Multi-function input	:.tb	0 : SS2, SS3 1 : JOG, SS3 2 : SS2, AD2 3 : JOG, AD2		0	:Err0	5-8

6.11 How to Set Mutiple Preset Speeds (Cont'd)

For remote operation the following preset functions, terminals, and chart must be used. Follow the procedure as on Page 6-13 for setting all required preset speed frequencies.

Terminal Connections Required for Remote Preset Speeds



Terminals SS2 and SS3 have dual functions, however only one function can be used at a time. Enabling the other functions (JOG, AD2) disables functions SS2 and SS3, thus limiting the number of accessible preset frequencies. The following chart identifies the functions of the 3 terminals (SS1, SS2, SS3) and their corresponding accessible preset frequencies.





Terminal Inputs

Setting selection of parameter 1.tb	Terminal Selection 1.tb			Frequency setting via terminals
	AD2/SS3-CC	JOG/SS2-CC	SS1-CC	
0 (SS2) (SS3)	OFF	OFF	OFF	Operating frequency set via PP, IV, RR terminals
	OFF	OFF	ON	1st operating frequency
	OFF	ON	OFF	2nd operating frequency
	OFF	ON	ON	3rd operating frequency
	ON	OFF	OFF	4th operating frequency
	ON	OFF	ON	5th operating frequency
	ON	ON	OFF	6th operating frequency
1 (JOG) (SS3)	OFF	OFF	OFF	Operating frequency set via PP, IV, RR terminals
	OFF	ON	OFF	Jogging
	OFF	OFF	ON	1st operating frequency
	ON	OFF	OFF	2nd operating frequency
2 (SS2) (AD2)	ON	OFF	ON	3rd operating frequency
	*ON/OFF	OFF	OFF	Operating frequency set via PP, IV, RR terminals
	*ON/OFF	OFF	ON	1st operating frequency
3 (JOG) (AD2)	*ON/OFF	ON	OFF	2nd operating frequency
	*ON/OFF	ON	ON	3rd operating frequency
	*ON/OFF	OFF	OFF	Operating frequency set via PP, IV, RR terminals
3 (JOG) (AD2)	*ON/OFF	ON	OFF	Jogging
	*ON/OFF	OFF	ON	1st operating frequency

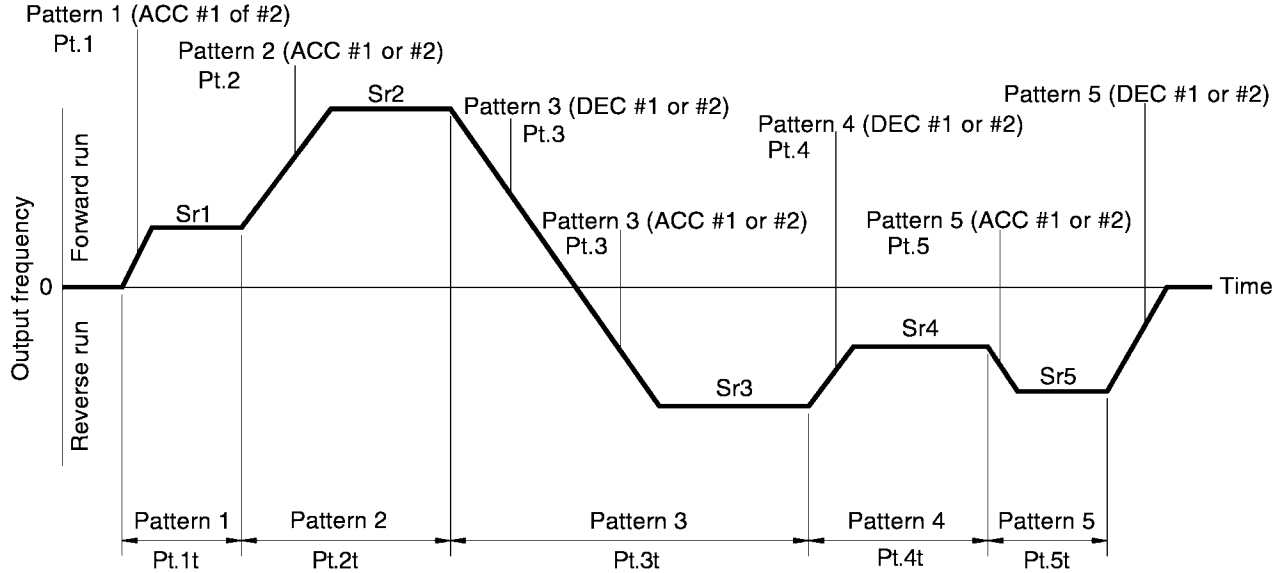
Note: When "1.tb" (accessible by **TB KEY #8**) is set to 2 or 3 the AD2 function is activated. This function enables the user to remotely switch between the ACC/DEC patterns 1 and 2, provided SEL2=0. If SEL2=1 then the only pattern available is given by ACC2, DEC2, Pt.2. With AD2-CC terminals shorted (ON) all ACC/DEC patterns are run using the settings of the ACC2, DEC2, Pt.2 parameters.

6.11 How to Set Multiple Preset Speeds (Cont'd)

Activating the Preset Speed Function

Key	Action	Display
MON	The inverter must be placed in the monitor mode and stopped (0.0Hz) before activating any of the preset speeds.	0.0
2ND 1 thru 7	Engages the preset speed feature . Pressing a key 1-7 selects the respective preset speed frequency (Sr1~Sr7).	2nd Sr1-7
 	 Sets a forward run  Sets a forward run	Sr1-7 Sr1-7-
RUN	The inverter's output frequency increases to the selected preset frequency. The attached motor will accelerate to that frequency.	[:value]
STOP	The inverter's output frequency decreases to zero (0Hz). The attached motor will decelerate to a stop.	0.0

6.12 Programmable Run Patterns



- Up to 7 different preset speed patterns can be automatically executed to produce what is known as a Pattern Run.
- Each speed can be set to operate in the range of 0 to 8000 seconds or minutes.
- Each pattern can be set to accelerate/decelerate using either one of the two acceleration/deceleration functions.
- Each pattern can be set to operate in either the forward or reverse direction.
- Pattern may be repeated 0 to 254 times or repeat infinitely.

Preset Functions Required To Perform the Pattern Run

Function No.	Function Name	Display	Adjustment Range	Unit	Factory Set	Error Message	Ref. Page
6	1st speed	:Sr1	LL to UL setting value	Hz	0	:LL:UL:FH	5-7
	2nd speed	:Sr2	LL to UL setting value	Hz	0	:LL:UL:FH	5-7
	3rd speed	:Sr3	LL to UL setting value	Hz	0	:LL:UL:FH	5-7
	4th speed	:Sr4	LL to UL setting value	Hz	0	:LL:UL:FH	5-7
	5th speed	:Sr5	LL to UL setting value	Hz	0	:LL:UL:FH	5-7
	6th speed	:Sr6	LL to UL setting value	Hz	0	:LL:UL:FH	5-7
	7th speed	:Sr7	LL to UL setting value	Hz	0	:LL:UL:FH	5-7
2ND 8	Pattern run activation mode	:PSEL	0: Off 1: Terminal operation 2: Touch pad operation 3: Computer communication		0	:Err0	5-15
	Time unit	:Pt.t	0: Seconds 1: Minutes		0	:Err0	5-15
	Cycle times	:Pt.n	0 to 255 (255: Infinity operating)		0	:Err0	5-15
	Pattern drive time #1 to 7	:Pt.1t to :Pt.7t	0 to 8000	sec min	0	:Err0	5-15
	Pattern drive characteristics #1 to 7 F/R, ACC/DEC	:Pt.1 to :Pt.7	0: Forward run, #1 ACC/DEC 1: Forward run, #2 ACC/DEC 2: Reverse run, #1 ACC/DEC 3: Reverse run, #2 ACC/DEC		0	:Err0	5-15

6.12 Programmable Run Patterns (Cont'd)

The pattern run enables the user to run up to seven (7) different speeds automatically, in either forward or reverse directions. It is an extension of the 7 Preset Speeds described on Page 6-11. Unlike the Preset Speed Function, the user can pre-select the length of time in which the inverter will operate at each frequency (Sr1-Sr7), as well as the acceleration/deceleration pattern used to reach each frequency.

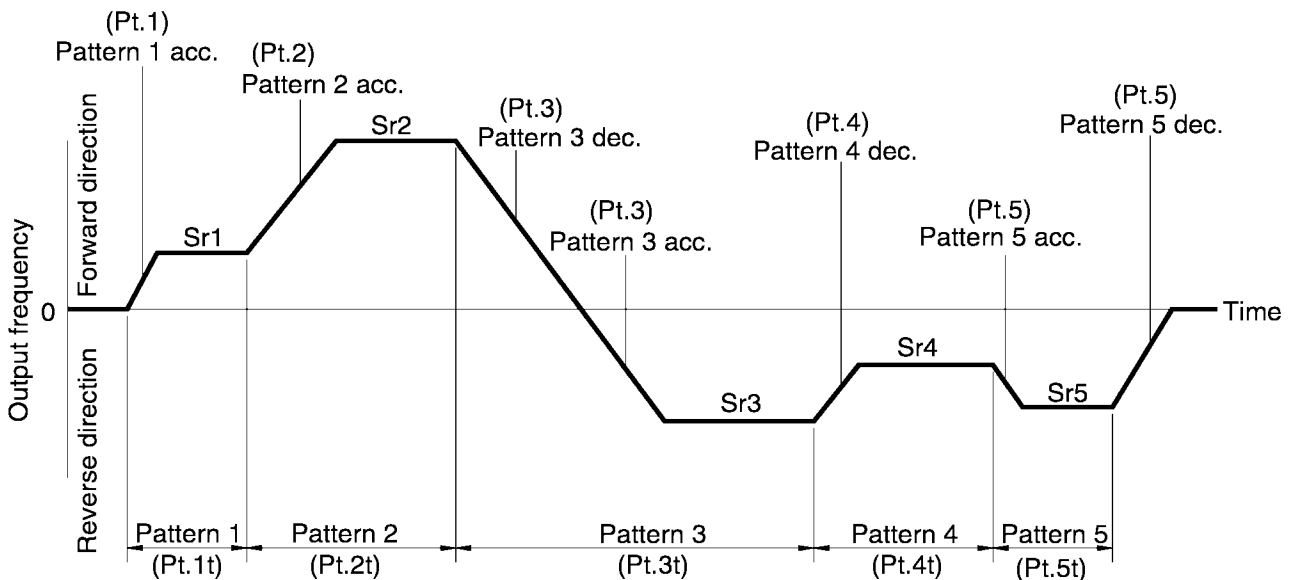
The required preset function parameters are as follows:

- 1) Actual run frequencies (Sr1~Sr7) are located in Function No. 6.
- 2) The run time for each of these frequencies in the pattern (Pt.1t~Pt.7t) is located in Function No. 2ND 8.
- 3) The particular ACC/DEC drive characteristics to be used, as well as the run direction (Pt.1~Pt.7) located in Function No. 2ND 8.

Function Parameters

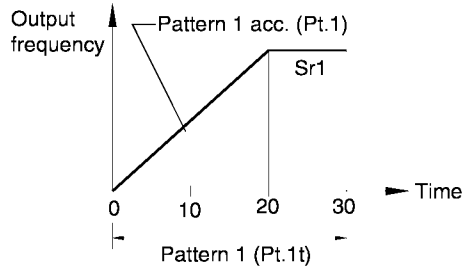
Function No.	Function Name	Display	Adjustment Range	Unit	Factory Set	Error Message	Ref. Page
2ND 8	Pattern run activation mode	:P.SEL	0: Off 1: Terminal operation 2: Touch pad operation 3: Computer communication		0	:Err0	5-15
	Time unit	:Pt.t	0: Seconds 1: Minutes		0	:Err0	5-15
	Cycle times	:Pt.n	0 to 255 (255: Infinite operating)		0	:Err0	5-15
	Pattern drive time #1 to 7	:Pt.1t to :Pt.7t	0 to 8000	sec min	0	:Err0	5-15
	Pattern drive characteristics #1 to 7 F/R, ACC/DEC	:Pt.7 to :Pt.1	0: Forward run, #1 ACC/DEC 1: Forward run, #2 ACC/DEC 2: Reverse run, #1 ACC/DEC 3: Reverse run, #2 ACC/DEC		0	:Err0	5-15

The following graph shows a sample of a typical pattern run:



6.12 Programmable Run Patterns (Cont'd)

The run time set for each pattern includes the ACC/DEC time required to reach that particular run frequency. Therefore, care must be taken when choosing run times. For example, if the pattern run time is set for 30 seconds and the acceleration time required to reach the preset frequency is 20 seconds, then the actual run frequency would last only 10 seconds.



Activating the Pattern Run

Key	Action	Display
MON	The inverter must be placed in the monitor mode and stopped (0.0Hz) before activating the pattern run. <i>no.0 → :tYP</i>	:tYP
2ND 8	Engages the pattern run feature. <i>no.18 → :P.SEL</i>	:P.SEL
READ	Reads the standard factory default setting "off".	0
2 WRT	Writes the new touchpad operation adjustment "2" to memory. <i>:P.SEL ↔ 2</i>	2
MON	Takes the inverter out of function setting mode.	0.0
CLR	Resets the microprocessor.	CLR
WRT	Engages pattern run.	• 0.0

Notes:

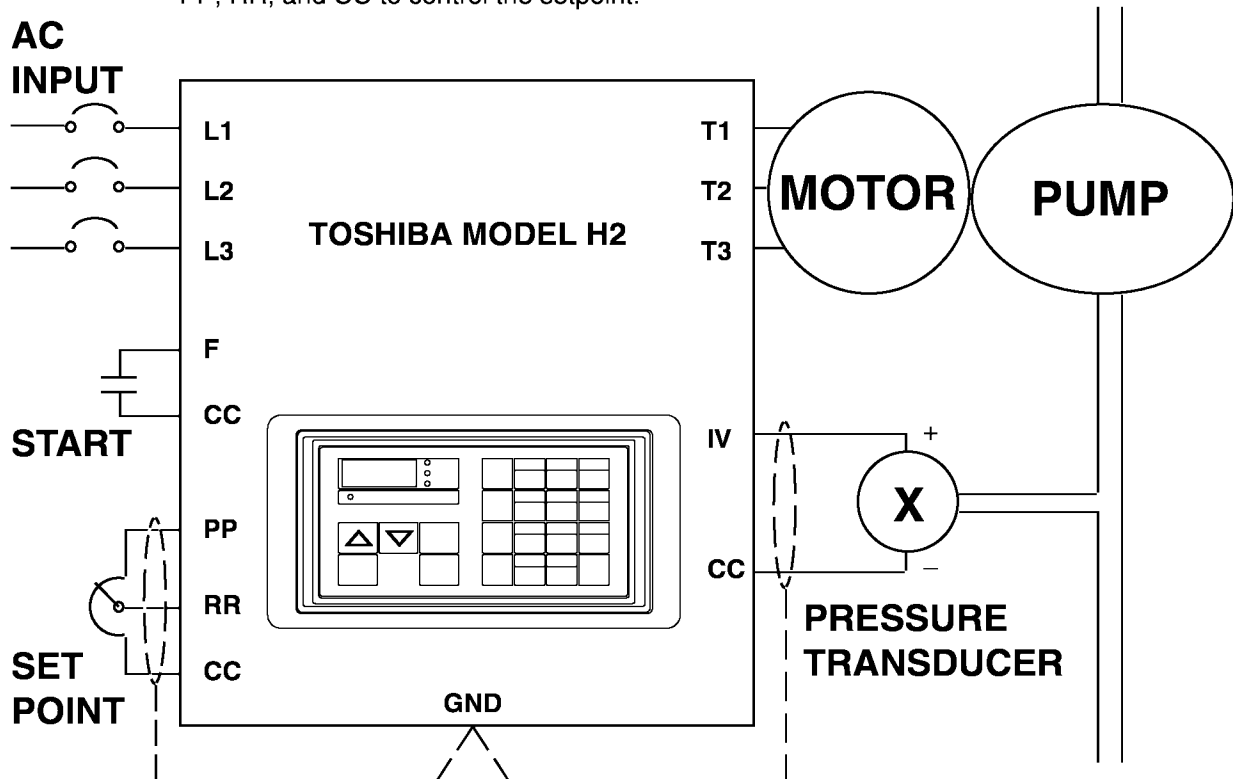
- 1.) Pressing the **STOP** key at any time during the pattern run will cause a deceleration to a stop.
- 2.) Pressing **2ND** and then **STOP** will cause a coast to a stop.
- 3.) Resuming the pattern run is accomplished by pressing **RUN**, however be aware that the run proceeds from the point of interruption unless **2ND** is pressed before **RUN** is pressed.
- 4.) In order to deactivate the pattern run function the above procedure should be followed in the same order except that 0 should be stored for P.SEL at step 4.

6.13 How to Set and Fine Tune the PID Parameters

All TOSVERT-130 Model H2 inverters come standard with set point control. The following information shows how to install and adjust the inverter using set point control.

Connection Diagram

The connection diagram below for TOSVERT-130 Model H2 shows the connections for setpoint control. The feedback signal should be 0-5V or 4-20mA, and is connected to terminals IV and CC. Setpoint may be adjusted by either a potentiometer or the touchpad. This diagram shows how a potentiometer should be connected to terminals PP, RR, and CC to control the setpoint.



Use the following procedures to adjust the setpoint control parameters.

1. Set acceleration and deceleration times to 5 seconds. (1st Function # 2)
2. Set the maximum frequency (1st Function # 0) to the fastest running frequency desired. (Normally 60 Hz.)
3. Set the upper limit (1st Function # 3) to the same value as the maximum frequency.
4. Adjust the bias and gain parameters for proper system feedback control. With the setpoint control activated the inverter slows down when the feedback signal exceeds the setpoint. For example, in a pumping application with a 4-20mA feedback which increases as pressure increases, set 1st Function # 5 parameters as follows:

P1 = 20%
F-P1 = 0 Hz
P2 = 100%
F-P2 = 60 Hz

6.13 How to Set and Fine Tune the PID Parameters (Cont'd)

If feedback decreases as pressure increases, set 1st Function # 5 as follows:

P1 = 20%
F-P1 = 60 Hz
P2 = 100%
F-P2 = 0 Hz

5. Turn on the set point control. (2nd Function # 5)
6. Set proportional gain to 100. (2nd Function # 5)
7. Set integral gain to 50. (2nd Function # 5)
255 / GI = Integral time in seconds
8. Set anti-hunting (differential) gain to 0. (2nd Function # 5)
9. Set lag-time constant to 255. (2nd Function # 5)
10. Place the terminal/jumper connections (JP1 and JP2) in the correct positions for the type of feedback used.
11. Run system.

READJUSTMENT AND SPECIAL ADJUSTMENTS

1. For faster response time set larger proportional and integral gain and/or shorter acceleration and deceleration times.
2. For slower response time set smaller proportiona and intergral gains.
3. To stabilize the system increase anti-hunting gain, decrease lag-time constant and/or slow the response time.
4. Use the touchpad to adjust the setpoint by changing the frequency reference setting mode selection to "Touchpad Only". (2nd Function # 9) The frequency command will then become the setpoint. (0 Hz - maximum Hz = 0 - 100%)
5. Use the touchpad to start and stop the drive by changing the command mode selection to touchpad only. (2nd Function # 9)

HAVING TROUBLE?

1. **FEEDBACK** - Be sure the feedback signal has the correct polarity. Be sure JP1 and JP2 are set correctly. See Chapter 2 for reference settings for these jumpers.
2. **SETPOINT** - Be sure the setpoint potentiometer is connected correctly or the touchpad has been selected to adjust the setpoint.
3. **START** - Be sure the drive has a run command, either by contact closure or the touchpad start button.
4. **LAG TIME CONSTANT** - If the lag time constant is set to "0" the lag time is infinite, and the PID function cannot work.

IF YOU HAVE ANY PROBLEMS OR QUESTIONS ABOUT PID CONTROL PLEASE CONTACT THE INVERTER MARKETING DEPARTMENT AT (800) 231-1412.

6.14 How to Reset the Drive to Factory Default Settings

The following table illustrates how to reset all drive parameters back to the original factory default settings. These settings are shown on Page 5.2. The inverter must be stopped to perform this function.

KEY	ACTION	DISPLAY
	Assume the inverter is in the monitor mode and not running.	0.0
MON	The inverter is now in the function mode and has accessed Function #0.	:tYP
READ	Displays the value currently set for "tYP". When reading this function and only this function the value displayed will always be zero.	:0
3	Resets all 95 built-in functions back to factory settings.	0.0
WRT	Used in cases where starting over is easier than searching for misadjusted functions.	

6.15 How to Set Proportional Output Voltage

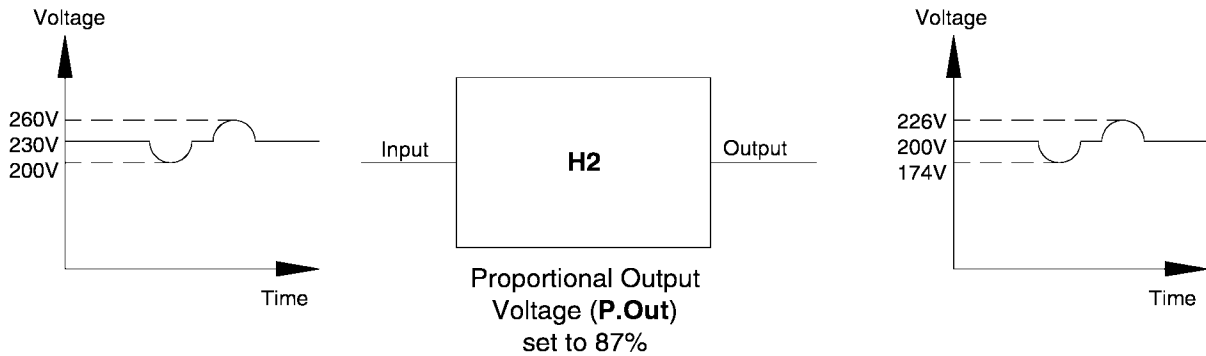
16.15.1 Proportional Output Voltage (Standard)

This feature allows programming the inverter to deliver an output voltage that is an exact percentage of the input voltage. The output voltage can range from 0% to 100% of the input voltage. The word "proportional" comes from the fact that if the input voltage level rises or falls during operation, the output voltage follows in direct proportion. The following examples illustrate this feature.

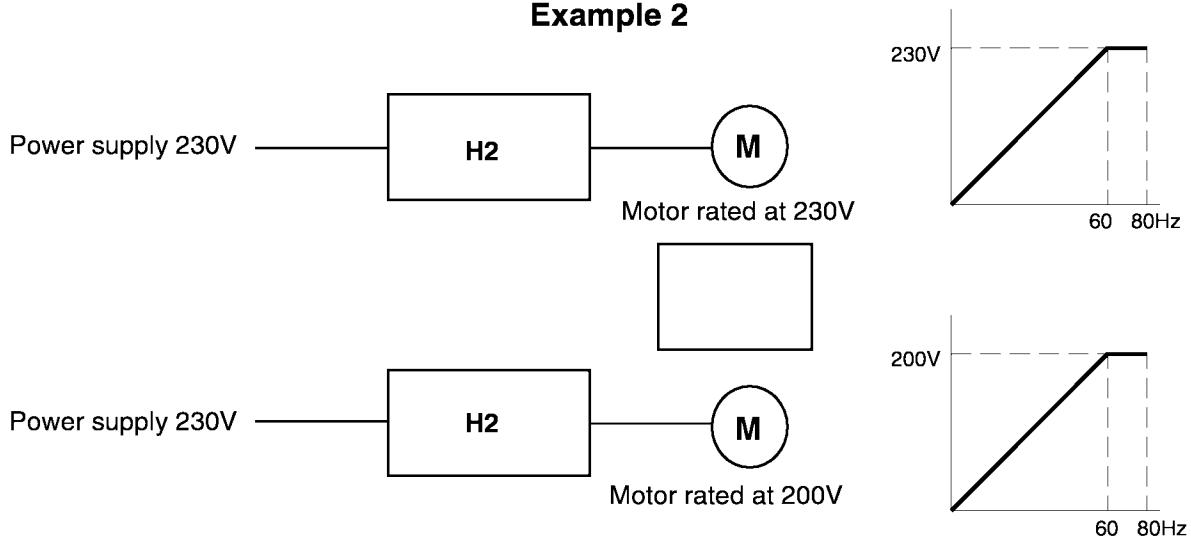
Function Parameters

Function No.	Function Name	Display	Adjustment Range	Unit	Factory Set	Error Message	Ref. Page
2ND 4	Output voltage adjustment	:P.O.U.T	0 to 100 (Option: 0 to 120)	%	100	:Err0	5-14
	Dynamic brake resistor	:Pb	THIS PARAMETER NOT VALID FOR MODEL H2		0	:Err0	--
	Auto deceleration on the : Pb=0	:0P5.5	0: On		0	:Err0	5-14

Example 1



Example 2



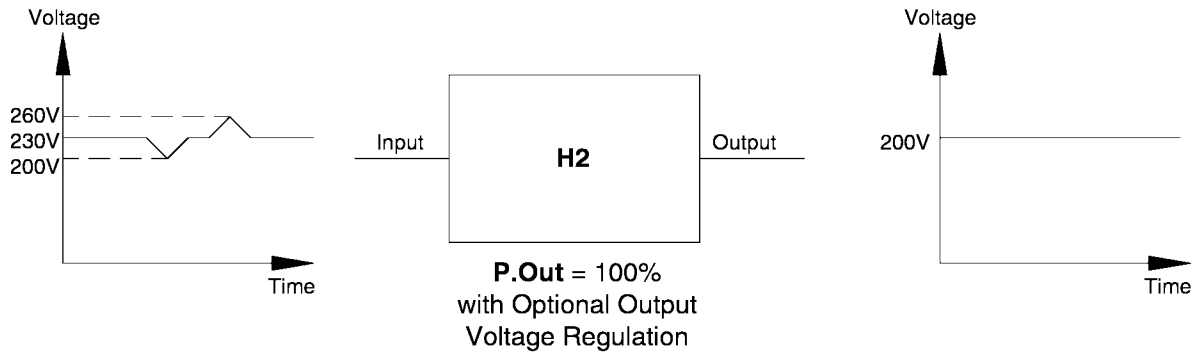
16.15.1 Proportional Output Voltage (Standard) (Cont'd)

Note: For ease of identification the inverters are listed in horsepower. However the real determining factor, when sizing an inverter, is the rated current capability. Therefore, the user must be aware that a reduction in motor voltage means higher currents will be required.

Be sure that the inverter's rated current capability is always greater than the total current required.

16.15.2 Output Voltage Regulation (Optional)

This optional feature enables the user to maintain a constant output voltage even if voltage fluctuations occur at the input. For minimal fluctuations, the V/F characteristics can be maintained at a constant level by automatically regulating the output voltage. Instantaneous fluctuations should be minimized by the use of an input AC line reactor. The use of this feature insures that the proper V/F characteristics will be applied in critical applications. Also this minimizes the danger of motor over excitation due to an elevated input voltage.



6.16.a How to Set Speed Remotely and Start/Stop from the Touchpad

The three (3) parameters in **2nd** function **9** on the H2 allow the user to do a number of different setups. The access to the inverter can be totally locked out, or select functions can be locked out. By using these three parameters the inverter can be programmed to function in a number of different ways.

The following example shows how to **Start-Stop** the unit via the touch-pad only and have the **frequency** set by an external source only by changes to the parameters located in **2nd** function **9**.

Key	Action	Display
MON	The inverter must always be placed in the function mode before accessing any function. <i>no.0 → :tYP</i>	:tYP
2ND	When this key is pressed the inverter is placed into the second function files.	:2nd
9	When this key is pressed the inverter is placed into the second function file number 9.	:CnOd
READ	When this key is pressed the standard factory adjustment range setting of 7 is displayed.	7
2 WRT	When the keys 2 and WRT are pressed in order then the factory adjustment range setting of 2 is written into memory replacing the factory setting of 7. <i>:CnOd → 2</i>	2
NEXT	When this key is pressed the second menu item under the 2nd 9 functions is displayed.	:FnOd
READ	When this key is pressed the standard factory adjustment range setting of 7 is displayed.	7
1 WRT	When the keys 1 and WRT are pressed in order then the factory adjustment range setting of 1 is written into memory replacing the factory setting of 7. <i>:FnOd → 1</i>	1
MON	Returns the inverter to the original monitor mode.	0.0

This setup accepts an external signal (4-20 mA, 0-5 VDC, & etc.) through the terminal strip and allows the user to start and stop the unit via the touch-pad.

6.16.b How to Set Speed from the Touchpad and Start/Stop Remotely

The following example shows how to **Start-Stop** the unit remotely and have the **frequency** set via the touch-pad. To do this, set the parameters on **2nd** function **9** as follows.

Key	Action	Display
MON	The inverter must always be placed in the function mode before accessing any function. <i>no.0 → :tYP</i>	:tYP
2ND	When this key is pressed the inverter is placed into the second function files.	:2nd
9	When this key is pressed the inverter is placed into the second function file number 9.	:cNoD
READ	When this key is pressed the standard factory adjustment range setting of 7 is displayed.	7
1 WRT	When the keys 1 and WRT are pressed in order, the factory adjustment range setting of 1 is written into memory replacing the factory setting of 7. <i>:cNoD → 1</i>	1
NEXT	When this key is pressed the second menu item under the 2nd 9 functions is displayed.	:fNoD
READ	When this key is pressed the standard factory adjustment range setting of 7 is displayed.	7
2 WRT	When the keys 2 and WRT are pressed in order, the factory adjustment range setting of 2 is written into memory replacing the factory setting of 7. <i>:fNoD → 2</i>	2
MON	Returns the inverter to the original monitor mode.	0.0

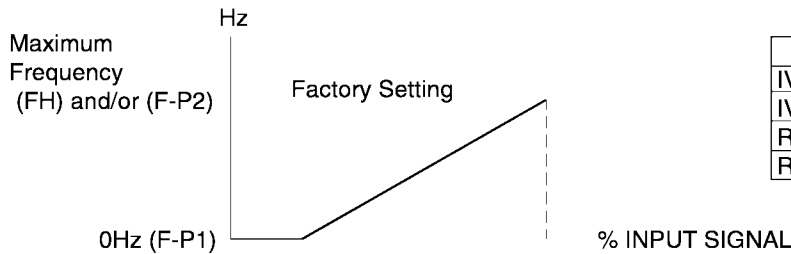
In order to run the inverter, simply enter the desired frequency followed by the **WRT** key. The remote start/stop switch will be put between F (forward) or R (reverse) and CC terminals on the terminal strip. Closing the connection will make the inverter run, opening the connection will make the inverter decelerate to a stop at the programmed deceleration time.

6.17 How to Use Terminal IV to Scale Speed Response

Terminal IV (IV^{\oplus} CC^{\oplus}) is a special terminal which is used in conjunction with function key #5 to output exact frequencies based upon specific input reference signals. These output frequencies do not necessarily have a one-to-one ratio with the input reference signals. The following graphs and examples illustrate how this function can be adjusted.

Function Parameters

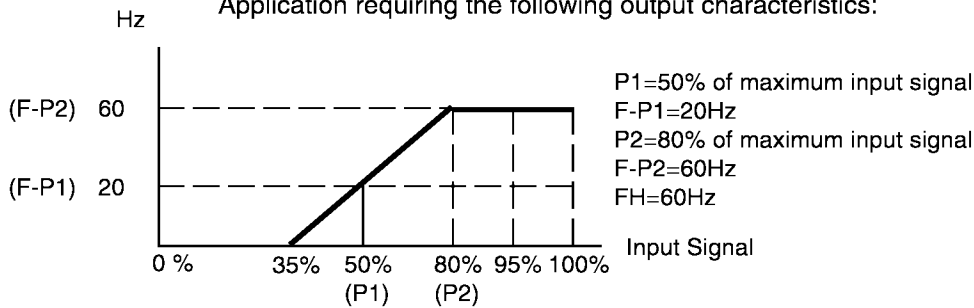
Function No.	Function Name	Display	Adjustment Range	Unit	Factory Set	Error Message	Ref. Page
5	IV-ref. setting point #1	:P1	0 to 100	%	20	:Err0	5-7
	#1 output frequency	:F-P1	0 to Max. frequency	Hz	0	:FH	5-7
	IV-ref. setting point #2	:P2	0 to 100	%	100	:Err0	5-7
	#2 output frequency	:F-P2	0 to Max. frequency	Hz	60	:FH	5-7
	RR terminal priority	:rr.cc	0: IV terminal input "on" 1: RR terminal input "on"			0	:Err0



	0%	20%	100%
IV	0V		5Vdc JP1=V
IV	0mA	4mA	20mAdc JP1=I
REF	0V		5Vdc JP2=5V
REF	0V		10Vdc JP2=10V

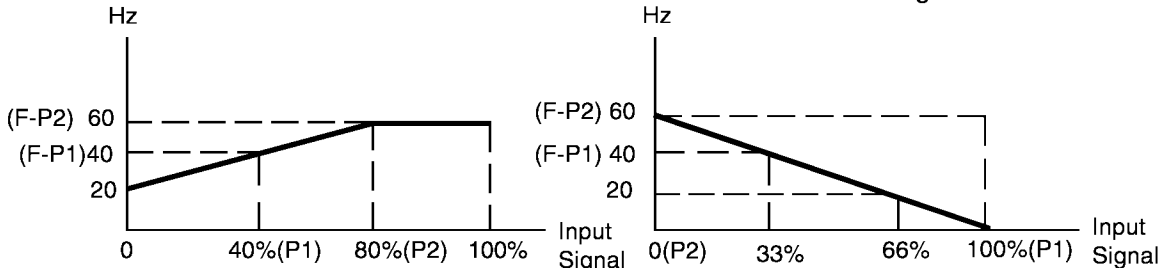
Example:

Application requiring the following output characteristics:



In the above graph the inverter has no output frequency until the input signal has reached 35% of its maximum. This is due to the linear characteristics of the IV Function. Also notice that the maximum frequency is reached before 100% of the input signal is applied.

Note: In most cases the value of UL is less than FH. The value of UL cannot be greater than FH.



In the above graph the inverter has an output frequency of 20Hz even with a 0% input signal. Also notice that the maximum output frequency is never reached unless the input signal goes above 100%. (i.e. a 7Vdc input signal is considered a 140% input signal when using a 0~5Vdc input.

In the above graph the inverter has a negative output. In other words, as the input signal increases the output frequency decreases. Notice that at 0% and 100% input the inverter outputs 60Hz and 0Hz, respectively.

SECTION 4 - How to Monitor Drive Operation

CHAPTER 7

MONITORING THE OPERATION OF THE DRIVE:

- 7.1. How to Monitor Drive Functions from the Touchpad
 - 7.1.1 Normal Status Monitoring
- 7.2. How to Wire, Set Up, and Calibrate Remote Meters (FM and AM)
 - 7.2.1 Frequency Meter (FM) Connection and Procedures
 - 7.2.2 Ammeter (AM) Connection and Procedures
- 7.3. How to Use Output Signals [RCH, LOW, LL, and UL]
 - 7.3.1 Selectable Outputs
- 7.4. How to Wire Relays and PLC Contacts to the Output Terminals
- 7.5. How to Use the Fault Contacts
- 7.6. How to Monitor a Pattern Run Operation

7.1 How to Monitor Drive Functions from the Touchpad

The inverter's current status conditions can be monitored at any time while in the **monitor mode**. In addition, if the inverter were to trip, the status conditions which existed at the time of the trip could also be monitored. This is provided that monitoring is performed before resetting the inverter.

7.1.1 Normal Status Monitoring

The following two tables give examples of what could possibly be seen under normal (no drive trip) conditions. The second table illustrates additional conditions which can be monitored by pressing the **NEXT** key.

Normal Monitoring - Displayed When Drive is Running

Display	Status
OFF	Not ready for run (with ST-CC opened)
0.0	0Hz (ready to run with ST-CC shorted)
60.0	60.0Hz (running at 60.0Hz)
160.0	160Hz (running at 160Hz)
C50.0	Stall prevention activated*
P50.0	Oversvoltage limitation activated*
L50.0	Overload detection activated*
POFF	Power supply undervoltage (The input voltage supplied to the inverter is too low).
NOFF	DC main circuit undervoltage (The inverter's internal DC main voltage is too low).

* Displays a flashing C, P, and L.

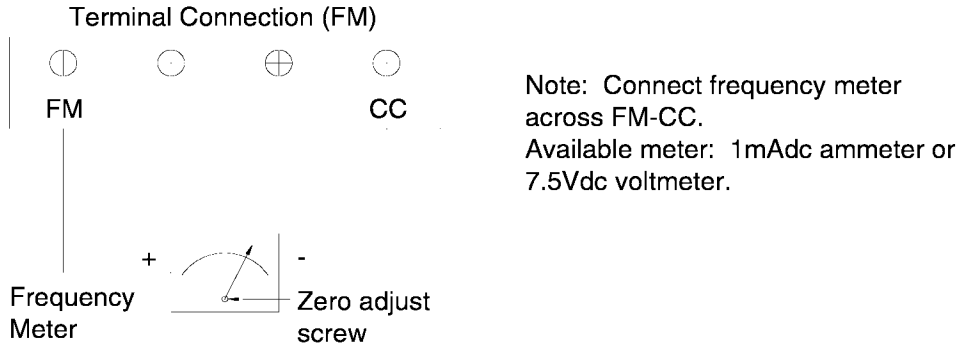
Additional Normal Monitoring - Press [NEXT] Key to Review

Key	Display	Status
		Assume the unit is in the monitor mode and not the function mode .
NEXT	:F. or r.	Indicates a forward (F) or reverse (r) run. If not running, the display refers to the direction the unit would run.
NEXT	: 60.0	Displays the inverter's set output frequency.
NEXT	:C 90	The inverter's output current is 90% (90% of the inverter's rated output current).
NEXT	:P 90	The inverter's output voltage is 90% (90% of the inverter's rated output voltage).
NEXT	:1-40	Input terminal status code. See Page 8-4.
NEXT	:0-33	Output terminal status code. See Page 8-5.
NEXT	:v.5.2	Inverter's software version
NEXT	:v.P2.0	Keypad's software version
NEXT		Returns to the original display.

7.2 How to Wire, Set Up, and Calibrate Remote Meters (FM & AM)

Many times an application requires that a frequency meter or ammeter be remotely located. With the H2 inverter, calibration of the remote meters is very easy. Attachment of the meter between its appropriate terminals is the only wiring necessary. Actual calibrating is performed with the keypad.

7.2.1 Frequency Meter (FM) Connection and Procedures



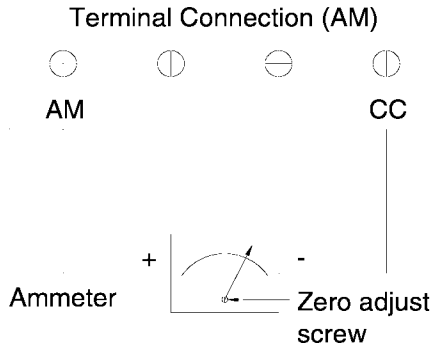
Calibration Procedure (FM)

Key	Action	Display
	For this example the inverter is running at 60Hz, and in the monitor mode .	60.0
2ND MON	Engages the "FM" calibration mode	:FN
RUN	Display indicates the inverter's output frequency	60.0
<div style="border: 1px solid black; padding: 2px; display: inline-block;">▲</div> or <div style="border: 1px solid black; padding: 2px; display: inline-block;">▼</div>	Adjusts the frequency value of the analog meter. Press the "up" ▲ or "down" ▼ key until the meter value equals the displayed inverter value.	60.0
WRT	Calibration of "FM" meter is complete	:FN
MON	Returns to the actual frequency display.	60.0

Notes: The adjustment operation can be interrupted at any time by pressing the **STOP** key.

Although the above example shows calibration of the remote meter at a running frequency of 60Hz; better resolution of the meter can be obtained if the inverter is running at the maximum frequency. The **motor load should be disconnected for FM calibration at the highest frequency.**

7.2.2 Ammeter (AM) Connection and Procedures



Note: Connect ammeter across AM-CC.
 Available meter: 1mAdc ammeter or
 7.5Vdc voltmeter.

Calibration Procedure (AM)

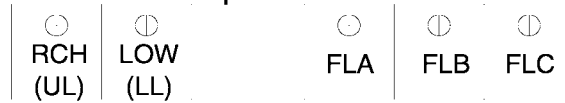
Key	Action	Display
	Adjustments should be made during a run. For this example the inverter is running at 60Hz, and in the monitor mode .	60.0
<div style="border: 1px solid black; padding: 2px; display: inline-block;">2ND</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">MON</div>	Engages the "FM" calibration mode.	: FN
<div style="border: 1px solid black; padding: 2px; display: inline-block;">NEXT</div>	Engages the "AM" calibration mode.	: AN
<div style="border: 1px solid black; padding: 2px; display: inline-block;">RUN</div>	Display indicates the output current values	: [value]
<div style="border: 1px solid black; padding: 2px; display: inline-block; text-align: center;">△</div> or <div style="border: 1px solid black; padding: 2px; display: inline-block; text-align: center;">▽</div>	Adjusts the current value of the analog meter. Press the "up" △ or "down" ▽ key until the meter value equals the displayed inverter value.	: [value]
<div style="border: 1px solid black; padding: 2px; display: inline-block;">WRT</div>	Calibration of "AM" meter is complete	: AN
<div style="border: 1px solid black; padding: 2px; display: inline-block;">MON</div>	Returns to actual frequency display	60.0

Note: The calibration procedure can be interrupted at any time by pressing the **STOP** key.

7.3 How to Use the Output Signals

The H2 inverter provides terminals for outputting signals to external components. A number of selectable "operating" output signals, as well as "fault" output signals, are available. These output signal terminals are located on the terminal board. The terminals and type of selections available are shown below.

Output Terminals



7.3.1 Selectable Outputs

Function Parameters

Function No.	Function Name	Display	Adjustment Range	Unit	Factory Set	Error Message	Ref. Page
8	Multifunction output	:0.tb	0: LL, UL 1: LOW, UL 2: LL, RCH 3: LOW, RCH		3	:Err.0	5-8
2ND 3	Low speed detection	:LF	0.0 to Max. frequency	Hz	0.5	:FH	5-14
	Speed reach selection	:rCH	0: Complete ACC/DEC 1: Frequency reach reference		0	:Err.0	5-14
	Speed reach detection range	:rrCH	2.5 to 25	Hz	2.5	:FH	5-14
	Speed reach reference	:FrCH	0.0 to Max. frequency	Hz	0	:FH	5-14

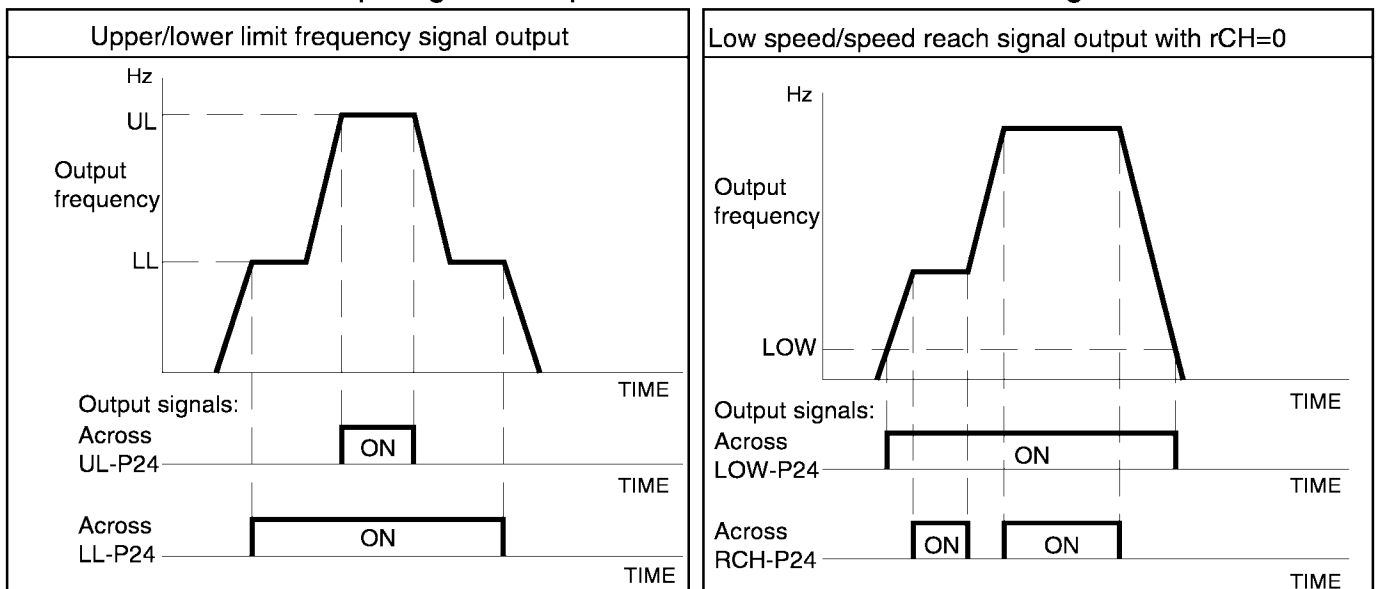
Terminal Output Signal Selections

Setting on 0.tb	Function
0	LL, UL (for lower limit and upper limit frequency signal)
1	LOW, UL (for low speed and upper limit frequency signal)
2	LL, RCH (for lower limit frequency and speed reach signals)
3	LOW, RCH (for low speed and speed reach signals)

Selectable function outputs:

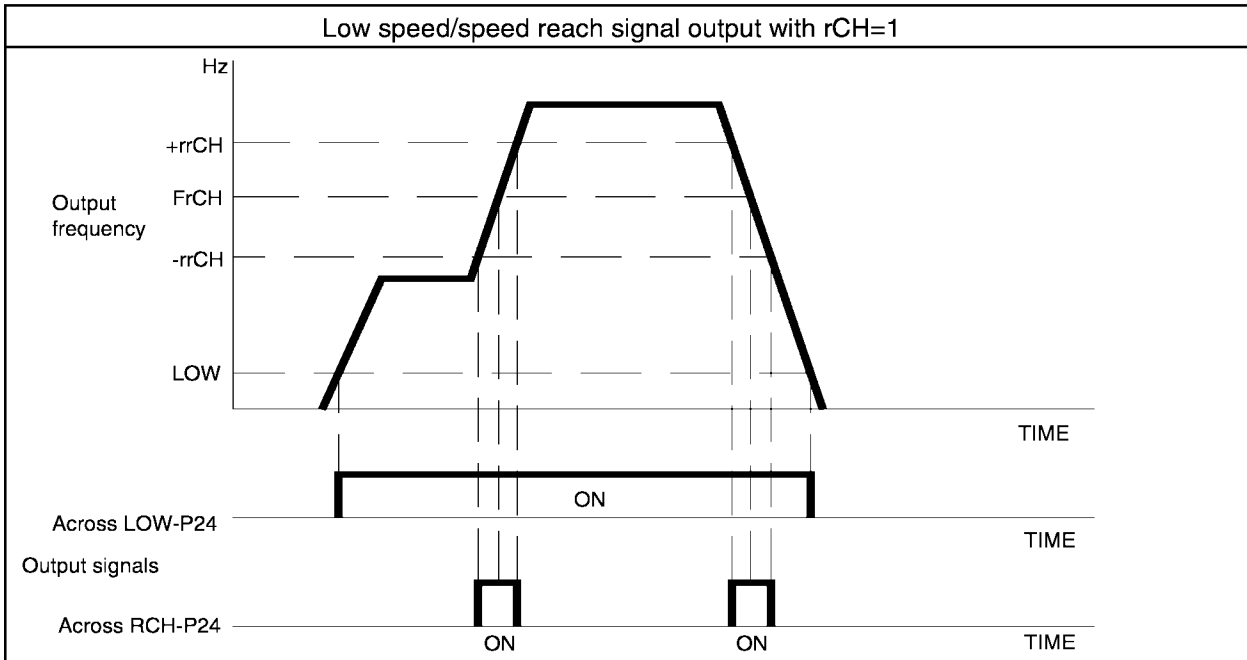
- LL Outputs a signal when frequency is greater than or equal to the LL value.
- UL Outputs a signal when frequency is equal to UL value.
- LOW Outputs a signal when frequency is greater than or equal to the LOW SPEED DETECTION VALUE "LF".
- RCH Outputs a signal based upon the selection of the RCH parameters rCH, rrCH, FrCH.

All output signals are open-collector with 50mA_{dc}~24V_{dc} ratings.



7.3.1 Selectable Outputs (Cont'd) Reach Selection

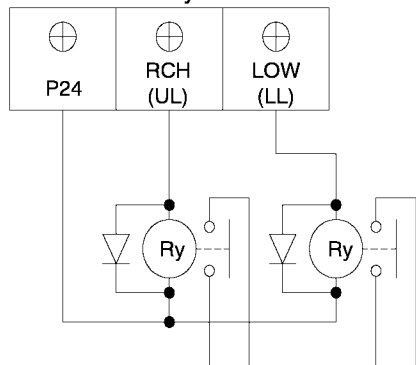
rCH function	Action
0	Outputs a signal when an acc/dec is complete and inverter is at a constant frequency. Note: Output signal is off only during an ACC or DEC.
1	Outputs a signal when the inverter's output frequency is within a range of frequencies specified by parameters FrCH and rrCH.



7.4 Connecting the Output Signals to Relays or PLC's

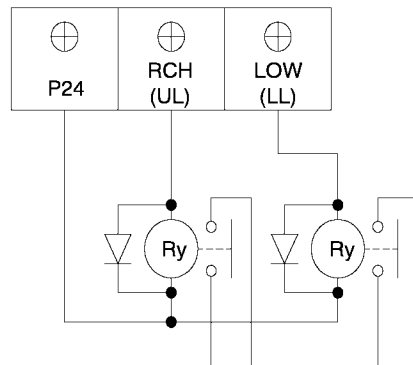
Terminals RCH (UL) and LOW (LL) of the control circuit terminal block are open collector outputs which float in an open state. When the predesignated frequency has been reached the terminals can sink 24Vdc at 50mA dc to ground. P24 supplies 24Vdc through the relay coils to the RCH (UL) and LOW (LL) terminals for relay activation. Connections are shown below for either relay logic or programmable controller inputs. Notice that there is no difference in the circuits except how the relay outputs are utilized.

Inverter-to-relay connections



Relay Logic Outputs

Inverter-to-programmable controller connections

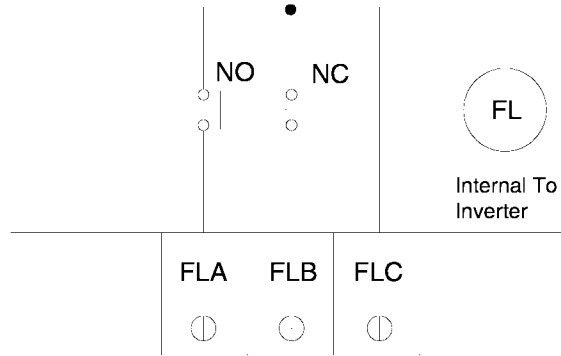


Dry Contact Outputs to PC
(Consult factory for specific applications)

Note: When an output frequency fluctuates in the vicinity of a frequency to be reached, the reach signal may alternately turn on and off because of the lack of hysteresis in the reach signal.

7.5 How to Use the Fault Contacts

When any of the inverter's system protection features are activated and the inverter trips (see list of probable causes in section 8.1), the cause of the problem will be displayed and the fault-detection relay will be activated. This will cause the contacts associated with the Fault-Detection Output Terminals to change state. The three fault-detection terminals FLA, FLB, and FLC are provided as a NO, NC form C contact rated for a 250Vac/30Vdc 2A output.



Terminal Connections



CAUTION

When the inverter trips due to an emergency stop or the activation of one or more of its protective functions, the cause of the fault must be corrected before resetting the inverter. A forced restart with out prior fault correction measures could damage the inverter and connected devices.

7.6 How to Monitor a Pattern Run

Monitoring During a Pattern Run

Use the following procedure to monitor a pattern run. For this example the inverter is running in pattern 1 at 10Hz and there are 12.3 minutes remaining in pattern 1.

Key	Action	Display
	A pattern run frequency is displayed	: 10.0
NEXT	Displays current pattern number	: P 1
NEXT	Displays balance of time remaining in the current run pattern	: 12.3
NEXT	Displays remaining patterns	: P 1 n
NEXT	Displays current forward/reverse status. Continued pressing of the NEXT key provides monitoring of the inverters status information. The items appear in the sequence listed in section 7.5.1	: F or r.
MON MON	Returns to displaying the current patterned run frequency.	: 10.0

7.6 How to Monitor a Pattern Run

Monitoring During a Pattern Run

Use the following procedure to monitor a pattern run. For this example the inverter is running in pattern 1 at 10Hz and there are 12.3 minutes remaining in pattern 1.

Key	Action	Display
	A pattern run frequency is displayed	: 10.0
NEXT	Displays current pattern number	: P1
NEXT	Displays balance of time remaining in the current run pattern	: 12.3
NEXT	Displays remaining patterns	: P1n
NEXT	Displays current forward/reverse status. Continued pressing of the NEXT key provides monitoring of the inverters status information. The items appear in the sequence listed in section 7.5.1	: F. or r.
MON MON	Returns to displaying the current patterned run frequency.	: 10.0

SECTION 5 - What to do if the Drive Trips

CHAPTER 8

Procedures to Follow if the Drive Trips:

- 8.1. List of All Drive Trip Codes
- 8.2. Tripped Status Monitoring
- 8.3. Input Terminal Status Codes
- 8.4. Output Terminal Status Codes
- 8.5. Fault History - Details of Past Trips
- 8.6. Fault-Detection Output Terminals
- 8.7. Resetting After a Trip

8.1 List of all Drive Trip Codes

If a trip should occur, one of the following fault codes could appear.

Fault Codes

Display	Status
OC1	Overcurrent during acceleration (an overcurrent occurred during an acceleration).
OC2	Overcurrent during deceleration (an overcurrent occurred during a deceleration).
OC3	Overcurrent during run (an overcurrent occurred during a run).
OCRA	Overcurrent detected at start-up (suspect inverter damage).
OCL	Overcurrent detected at start-up (suspect short circuit at load side).
OCr	MODEL H2 DOES NOT SUPPORT DYNAMIC BRAKING RESISTORS. THIS TRIP CODE IS NOT VALID FOR MODEL H2.
OP2	Overvoltage during deceleration (an overvoltage was generated during deceleration).
OP	Overvoltage (an overvoltage was generated).
OL	Overload (the motor was overloaded).
OLr	MODEL H2 DOES NOT SUPPORT DYNAMIC BRAKING RESISTORS. THIS TRIP CODE IS NOT VALID FOR MODEL H2.
OH	Overheat (the inverter body was overheated).
EF	Ground fault (a ground fault overcurrent in the load side circuit).
E	Emergency stop (an emergency stop was executed by a command from the panel during an automatic run or a remote control operation).
Err.1	Frequency setting signal error (this is a warning only and is not a trip). Points 1 and 2 of a frequency setting signal are too close together. Correct the setting of points 1 and 2 by providing an adequate distance between them.
Err.2	The main RAM in the main CPU is abnormal (the main RAM must be replaced).
Err.3	The main ROM in the main CPU is abnormal (the main ROM must be replaced).
Err.4	The RAM in the digital operating panel CPU is abnormal (the RAM in the digital operating panel must be replaced).
Err.5	The ROM in the digital operating panel CPU is abnormal (the ROM in the digital operating panel must be replaced).
Err.6	A key in the digital operating panel keypad is defective (the keypad must be replaced).
EEP	Data stored in the EEPROM is abnormal (the EEPROM must be replaced).
EEP2	EEPROM abnormality (abnormalities were found in the "past trip cause" data).
EEP3	EEPROM abnormality (An abnormality was found in a set value).
Err.t	Communication abnormality (an abnormality was found in transmission). *1
P0FF	Power supply undervoltage (the input voltage supplied to the inverter is too low).
n0FF	DC main circuit undervoltage (the internal DC main circuit voltage is too low) .
E0FF	An EMERGENCY STOP procedure has been activated. Caused by pressing STOP while in REMOTE CONTROL (see Pages 3-6 and 8-5 for details).
:Err.0 :Err.U	Not Actual fault codes, however these errors can be seen when attempting to set function parameters with incorrect data values (see Page 4-11 for an example of an invalid entry).

*1 The "Err.t" display involves a trip.

8.2 Tripped Status Monitoring

In the event of a trip, the following statuses could be observed provided monitoring is done prior to resetting the inverter. *These statuses reflect the conditions which existed at the time the inverter tripped.*

Tripped Status Monitoring

Key	Display	Status
NEXT	:20.0	Operating frequency at trip was 20.0Hz.
NEXT	:F.	Rotating direction at trip was in the forward direction.
NEXT	:50.0	The set value of operating frequency at trip was 50.0Hz.
NEXT	:150	The output current at trip was 150% (150% of the inverter's rated output current).
NEXT	:P100	The output voltage at trip was 100% (100% of the inverter's rated voltage).
NEXT	:1-60	Input terminal status code at trip. See Page 8-4.
NEXT	:0-33	Output terminal status code at trip. See Page 8-5.
NEXT	:v.5.2	Inverter's software version
NEXT	:v.P2.0	Keypad's software version
NEXT	Original fault display	Returns to the original display.

8.3 Input Terminal Status Code

If a drive trip should occur, the following combinations of diagnostics are available for review. These are powerful trouble shooting tools, designed to report the status of all input terminals at the instant the trip occurred. When this information is used in combination with the Output Terminal Status Codes shown on Page 8-5, and the Tripped Status Monitoring information on Page 8-3, all drive conditions at the time of the trip can be determined. Use this information to re-create trip circumstances, and to then resolve trip causes.

: 1 - 4 0

Display	RR-CC	ST-CC	F-CC	R-CC	Display	SS1-CC	JOG-CC (SS2)	AD2-CC (SS3)	RST-CC
0	OFF	OFF	OFF	OFF	0	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	ON	1	OFF	OFF	OFF	ON
2	OFF	OFF	ON	OFF	2	OFF	OFF	ON	OFF
3	OFF	OFF	ON	ON	3	OFF	OFF	ON	ON
4	OFF	ON	OFF	OFF	4	OFF	ON	OFF	OFF
5	OFF	ON	OFF	ON	5	OFF	ON	OFF	ON
6	OFF	ON	ON	OFF	6	OFF	ON	ON	OFF
7	OFF	ON	ON	ON	7	OFF	ON	ON	ON
8	ON	OFF	OFF	OFF	8	ON	OFF	OFF	OFF
9	ON	OFF	OFF	ON	9	ON	OFF	OFF	ON
A	ON	OFF	ON	OFF	A	ON	OFF	ON	OFF
b	ON	OFF	ON	ON	b	ON	OFF	ON	ON
c	ON	ON	OFF	OFF	c	ON	ON	OFF	OFF
d	ON	ON	OFF	ON	d	ON	ON	OFF	ON
E	ON	ON	ON	OFF	E	ON	ON	ON	OFF
F	ON	ON	ON	ON	F	ON	ON	ON	ON

ON: Implies a closed contact or short between terminals.
 OFF: Implies an open contact or no connection between terminals.

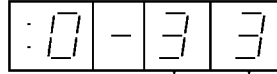
Terminal

- Connections** Inverter's Status when terminal connections are closed (ON).
 RR-CC Connect terminals PP-CC (see terminal connections Page 2-7).
 ST-CC RUN ENABLED
 F-CC FORWARD RUN ENABLED
 R-CC REVERSE RUN ENABLED

If both F-CC and R-CC are on then a REVERSE RUN IS ENABLED.

- SS1-CC MULTI-SPEED RUN ENABLED
 SS2-CC MULTI-SPEED RUN OR JOG RUN ENABLED (Dependent upon SS2's usage)
 SS3-CC MULTI-SPEED RUN OR ACC/DEC 2 ENABLED (Dependent upon SS3's usage)
 RST-CC RESET MODE ENABLED (Reset occurs after momentary contact closure)

8.4 Output Terminal Status Codes



Display	RCH	UL
0	OFF	OFF
1	OFF	ON
2	ON	OFF
3	ON	ON

Display	LOW	LL
0	OFF	OFF
1	OFF	ON
2	ON	OFF
3	ON	ON

- RCH: Output frequency is within the set reach frequency range or accel/decel is complete.
 LOW: Output frequency is equal to or greater than low speed frequency.
 UL: Output frequency has reached the upper limit frequency (UL).
 LL: Output frequency is equal to or greater than the lower limit frequency (LL).

8.5 Fault History - Details of Past Faults

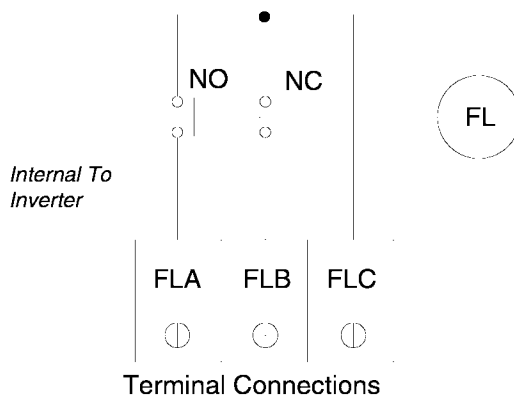
The inverter has the ability to store fault information in the non-volatile memory, therefore it is possible to trace reoccurring faults. Up to four consecutive faults can be stored. This information is available by utilizing the "2nd" and "9" keys while in the **monitor mode**.

Key	Display	Status
2ND	:2nd	Initial key used to activate the inverter's special features. The unit must be in the monitor mode before pressing this key.
9	:1 ↔ OC1	Displays the previous fault (for example, "OC1" or "OP")
NEXT	:2 ↔ OP	The second most recent fault
NEXT	:3 ↔ OH	The third most recent fault
NEXT	:4 ↔ OP	The fourth most recent fault
NEXT	Original display	Returns to the original display

If no previous faults are recorded, the message ":E" alternately flashes. When the inverter functions are reset to the factory's settings ("typ"=3), all of the past fault data will be erased. See Page 6-19 for instructions to reset the drive to the factory default settings.

8.6 Fault-Detection Output Terminals

When any of the inverter's system protection features are activated and the inverter trips (see list of probable causes in section 8.1), the cause of the problem will be displayed and the fault-detection relay will be activated. This will cause the contacts associated with the Fault-Detection Output Terminals to change state. The fault-detection terminals FLA, FLB, and FLC are provided as a NO, NC form C contact rated for a 250Vac/30Vdc 2A output.

**8.7 Resetting After a Trip**

The inverter can be reset after a trip by two methods:

- 1) Pressing the **CLR** and **WRT** keys on the operating panel resets the inverter locally.
- 2) Momentarily closing a normally open contact between terminals **RST** and **COM** resets the inverter remotely.

**CAUTION**

When the inverter trips due to an emergency stop or the activation of one or more of its protective functions, the cause of the fault must be corrected before resetting the inverter. A forced restart with out prior fault correction measures could damage the inverter and connected devices.

SECTION 6 - Options, Spare Parts List, and Service

CHAPTER 9

Options, Spare Parts List, and Service:

- 9.1. Optional Devices for Tosvert-130 H2
 - 9.1.1 3-Component Remote Station
 - 9.1.2 4-Component Remote Station
 - 9.1.3 Multi-Function Option Board
 - 9.1.4 RS232C Board
 - 9.1.5 RS232 Cable
 - 9.1.6 RS485 Multi-Function Option Board
 - 9.1.7 TG/PG Board

- 9.2. Recommended Spare Parts

- 9.3. After Sales Service

9.1 Optional Devices for Tosvert-130 H2

9.1.1 3-Component Remote Station

This remote station includes a speed potentiometer, on/off selector switch, and a analog frequency meter.

9.1.2 4-Component Remote Station

This remote station includes a speed potentiometer, a analog frequency meter, and start and stop push buttons (user must supply relay logic to hold start signal).

9.1.3 Multi-Function Option Board

The Tosvert-130 G2+ Multi-Function Option Board will perform the following ten (10) functions:

- 1.) Computer interface (RS232C)
- 2.) Speed feedback control (TG or PG)
- 3.) Seven pre-set speeds using acceleration/deceleration time one or two.
- 4.) BCD or 12 bit binary input for frequency setting
- 5.) +/- 10Vdc forward/reverse frequency setting signal input
- 6.) Pulse input for frequency setting
- 7.) Control signal output to switch between inverter and bypass contactor
- 8.) Overload detection output proportional to frequency and current
- 9.) 0-1 mAdc analog signal output proportional to frequency and current
- 10.) Ninety six (96) times frequency pulsed output

Although the Multi-Function Option Board performs these ten (10) separate functions, some functions cannot be used simultaneously with other functions. Consult the Toshiba Inverter Marketing department for each individual function to determine what options cannot be used with that corresponding function.

9.1.4 RS232C Option Board

Computer interface (RS232C) only option board

9.1.5 RS232 Cable

Cable connects option board to IBM (*TM*) compatible computer

9.1.6 RS485 Multi-Function Option Board

The Tosvert-130 G2+ RS485 Multi-Function Option Board will perform the following five (5) functions:

- 1.) Computer interface (RS485)
- 2.) PG speed feedback control
- 3.) Pre-set speeds with Accel/Decel 1 & 2
- 4.) BCD or 12 bit binary for frequency setting
- 5.) Pulse input for frequency setting

Although the RS485 Multi-Function Option Board performs these (5) separate functions, some functions cannot be used simultaneously with other functions. Consult the Toshiba Inverter Marketing department for each individual function to determine what options cannot be used with that corresponding function.

9.1.7 TG/PG Option Board

Tach generator or pulse generator speed feedback control only.

9.2 Recommended Spare Parts

RANK	B	B	B	B	B	A	A	A	A	B
INVERTER UNIT	PCB CONTROL	PCB DRIVER	MOV 1-3 SURGE ABSORBER	REC 1-3 BRIDGE RECTIFIER	R21 SOFT START RESISTOR	FU1-1A CONTROL FUSE	FU2 DC SUPPLY FUSE	IGBT 1 - 6	FU R,S,T AC FUSE	DC BUS CAP
H2-2035	QTY 1 VF3B-0100E	NOT USED	QTY 3 TNR 23G561K	QTY 1 20L6P44	QTY 1 20 OHM-20W	NOT USED	*** QTY 1 6JX20	QTY 1 MG25J6ES40	NOT USED	QTY 1 1000 uF 400VDC
H2-2055	QTY1 VF3B-0100E	NOT USED	QTY 3 TNR 23G561K	QTY 1 30L6P44	QTY 1 20 OHM-20W	NOT USED	*** QTY 1 6JX30	QTY 1 MG50J6ES40	NOT USED	QTY 1 1800 uF 400VDC
H2-2080	QTY 1 VF3B-0100E	NOT USED	QTY 3 TNR 23G561K	QTY 1 50L6P43	QTY 1 10 OHM-30W	NOT USED	**** QTY 1 A050F050	QTY 3 MG50J6YS40	NOT USED	QTY 1 2700 uF 400VDC
H2-2110	QTY 1 VF3B-0100F	NOT USED	QTY 3 TNR 23G561K	QTY 1 75L6P43	QTY 1 10 OHM-30W	NOT USED	**** QTY 1 A050F060	QTY 3 MG75J2YS9	** QTY 3 * A025R080	QTY 2 1800 uF 400VDC
H2-2160	QTY 1 VF3B-0100F	NOT USED	QTY 3 TNR 23G561K	QTY 1 75L6P43	QTY 1 6 OHM-40W	QTY 1 AGC3A	**** QTY 1 A050F080	QTY 3 MG100J2YS40	** QTY 3 * A025R100	QTY 2 2700 uF 400VDC
H2-2220	QTY 1 VF3B-0100G	NOT USED	QTY 3 TNR 23G561K	QTY 1 100L6P43	QTY 1 6 OHM-40W	QTY 2 AGC3A	** QTY 1 A050F100	QTY 3 MG150J2YS1	** QTY 3 * A025R150	QTY 3 1800 uF 400VDC
H2-2270	QTY 1 VF3B-0100G2	NOT USED	QTY 3 TNR 23G561K	QTY 1 100L2G43	QTY 2P 10 OHM-30W	QTY 2 AGC3A	** QTY 1 A050F125	QTY 3 MG150J2YS1	** QTY 3 * A025R200	QTY 4 1800 uF 400VDC
H2-2330	QTY 1 VF3B-0100G2	NOT USED	QTY 3 TNR 23G561K	QTY 3 110L2G43	QTY 2P 10 OHM-30W	QTY 2 AGC3A	** QTY 1 A050F150	QTY 3 MG200J2YS1	** QTY 3 * A025R200	QTY 3 3300 uF 400VDC
H2-4055	QTY 1 VF3B-0101E	NOT USED	QTY 3 TNR 23G102K	QTY 3 30U6P42	QTY 1 100 OHM-20W	QTY 2 ATQ 0.8A 500Vac	** QTY 1 A070F020	QTY 1 MG25Q6ES1	NOT USED	QTY 2 680uF 400VDC
H2-4080	QTY 1 VF3B-0101E	NOT USED	QTY 3 TNR 23G102K	QTY 3 30U6P42	QTY 1 100 OHM-20W	QTY 2 ATQ 0.8A 500Vac	** QTY 1 A070F025	QTY 1 MG25Q6ES1	** QTY 3 * A050F040	QTY 2 1000 uF 400VDC
H2-4110	QTY 1 VF3B-0101F	NOT USED	QTY 3 TNR 23G102K	QTY 3 30U6P42	QTY 1 40 OHM-30W	QTY 2 ATQ 1.6A 500Vac	** QTY 1 A070F040	QTY 3 MG50N2YS40	** QTY 3 * A050F040	QTY 2 1800 uF 400VDC
H2-4160	QTY 1 VF3B-0101F	NOT USED	QTY 3 TNR 23G102K	QTY 1 50U6P43	QTY 1 40 OHM-30W	QTY 2 ATQ 1.6A 500Vac	** QTY 1 A070F060	QTY 3 MG50N2YS40	** QTY 3 * A050F060	QTY 2 2700 uF 400VDC
H2-4220	QTY 1 VF3B-0101G	NOT USED	QTY 3 TNR 23G102K	QTY 1 50U6P43	QTY 2S 10 OHM-30W	QTY 2 ATQ 1.6A 500Vac	** QTY 1 A070F060	QTY 3 MG75N2YS40	** QTY 3 * A050F080	QTY 4 1800 uF 400VDC
H2-4270	QTY 1 VF3B-0101G1	NOT USED	QTY 3 TNR 23G102K	QTY 1 75U6P43	QTY 2S 10 OHM-30W	QTY 2 ATQ 1.6A 500Vac	** QTY 1 A070F080	QTY 3 MG100Q2YS1	** QTY 3 * A050F100	QTY 4 2700 uF 400VDC

9.2 Recommended Spare Parts (cont'd)

RANK	B	B	B	B	B	A	A	A	A	B
INVERTER UNIT	PCB CONTROL	PCB DRIVER	MOV 1-3 SURGE ABSORBER	REC 1-3 BRIDGE RECTIFIER	R21 SOFT START RESISTOR	FU1-1A CONTROL FUSE	FU2 DC SUPPLY FUSE	IGBT 1- 6	FU R,S,T AC FUSE	DC BUS CAP
H2-4330	QTY 1 VF3B-0101G2	NOT USED	QTY 3 TNR 23G102K	QTY 1 75U6P43	QTY 2S 10 OHM-30W	QTY 2 ATQ 1.6A 500 Vac	** QTY 1 A070F100	QTY 3 MG100Q2YS1	** QTY 3 * A050F100	QTY 4 2700 uF 400VDC
H2-4400	QTY1 VF3C-1200C	QTY 1 35589X	QTY 3 TNR 23G102K	QTY 1 100U6P43	QTY 2S 6 OHM-40W	QTY 2 ATQ 1.6A 500 Vac	** QTY 1 A070F100	QTY 3 MG150Q2YS1	** QTY 3 * A050F125	QTY 4 2700 uF 400VDC
H2-4500	QTY 1 VF3C-1200C	QTY 1 35589X	QTY 3 TNR 23G102K	QTY 1 100U2G43	QTY 2S 6 OHM-40W	QTY 2 ATQ 2.5A 500 Vac	** QTY 1 A070F150	QTY 6 MG150Q2YS1	** QTY 3 * A050F150	QTY 4 3300 uF 400VDC
H2-4600	QTY 1 VF3C-1200C	QTY 1 35589X	QTY 3 TNR 23G102K	QTY 3 110U2G43	QTY 2S+2P 6 OHM-40W	QTY 2 ATQ 2.5A 500 Vac	** QTY 1 A070F150	QTY 6 MG200Q1US1	** QTY 3 * A050F200	QTY 6 3300 uF 400VDC
H2-4800	QTY 1 VF3C-1200C	QTY 1 35589Q	QTY 3 TNR 23G102K	QTY 3 160U2G43	QTY 2S+2P 6 OHM-40W	QTY 2 ATQ 2.5A 500 Vac	** QTY 1 A070F200	QTY 6 MG200Q1US1	** QTY 3 * A050F250	QTY 8 2700 uF 400VDC
H2-410K	QTY 1 VF3C-1200C	QTY 1 35589Q	QTY 3 TNR 23G102K	QTY 3 160U2G43	QTY 2S+2P 6 OHM-40W	QTY 2 ATQ 2.5A 500 Vac	** QTY 1 A070F300	QTY 6 MG300Q1US1	** QTY 3 * A050F300	QTY 8 3300 uF 400VDC
H2-412K	QTY 1 VF3C-1200C	QTY 1 355891	QTY 3 TNR 23G102K	QTY 6 110U2G43	QTY 2S+2P 6 OHM-40W	QTY 2 ATQ 2.5A 500 Vac	** QTY 1 A070F400	QTY 6 MG400Q1US41	** QTY 3 * A050F400	QTY 10 3300 uF 400VDC
H2-415K	QTY 1 VF3C-1200C	QTY 1 35589Z	QTY 3 TNR 23G102K	QTY 6 160U2G43	QTY 2S 2 OHM-300W	QTY 2 ATQ 6.25A 500Vac	QTY 2 6.6URD32TT F0400	QTY 6+6 MG300Q1US11 MG300Q1US21	** QTY 3 6.6URD32TT F0400	QTY 12 3900 uF 400VDC
H2-420K	QTY 1 VF3C-1200C	QTY 1 35589Z	QTY 3 TNR 23G102K	QTY 6 160U2G43	QTY 2P+2P 2 OHM-300W	QTY 2 ATQ 6.25A 500Vac	QTY 2 6.6URD32TT F0550	QTY 9+9 MG300Q1US11 MG300Q1US21	** QTY 3 6.6URD32TT F0550	QTY 16 3900 uF 400VDC

Notes:

* Optional components

** Semiconductor fuse with 200K amp interrupting capability

*** Semiconductor fuse with 100K amp interrupting capability

**** Semiconductor fuse with 50K amp interrupting capability

Rank A signifies parts of relatively higher necessity.

Rank B signifies parts of relatively lower necessity.

9.2 Recommended Spare Parts (cont'd)

RANK	C	C	C	C	C	C	C	C	C	C
INVERTER UNIT	PCB KEYPAD	PCB 4-4B SNUBBER	PCB 5-5E G - E CIRCUIT	HCT DC BUS	HCT OUTPUT	L1 DC REACTOR	FAN FOR HEAT SINK	FAN FOR CABINET	MS1 CONTACTOR	MSX RELAY
H2-2035	QTY 1 35751A	NOT USED	NOT USED	QTY 1 HC-S100M4P15E 45mV/100A	NOT USED	QTY 1 1 mH 13 A	NOT USED	NOT USED	QTY 1 JH1a-30A	NOT USED
H2-2055	QTY 1 35751A	NOT USED	NOT USED	QTY 1 HC-S100M4P15E 45mV/100A	NOT USED	QTY 1 0.6 mH 21 A	QTY 1 113XN0181	NOT USED	QTY 1 JH1a-30A	NOT USED
H2-2080	QTY 1 35751A	NOT USED	NOT USED	QTY 1 HCS150M4P15N 45mV/150A	NOT USED	QTY 1 0.4 mH 30 A	QTY 2 113XN0181	NOT USED	QTY 1 PC-5	NOT USED
H2-2110	QTY 1 35751A	NOT USED	NOT USED	QTY 1 HC-S100M4P15E 45mV/100A	NOT USED	QTY 1 0.3 mH 38 A	QTY 2 129XR0281	NOT USED	QTY 1 PC-5	NOT USED
H2-2160	QTY 1 35751A	NOT USED	NOT USED	QTY 1 HC-S150M4P15N 45mV/150A	NOT USED	QTY 1 0.2 mH 57 A	QTY 2 129XR0281	NOT USED	QTY 1 C25A	QTY 1 JC1a-10A
H2-2220	QTY 1 35751A	NOT USED	NOT USED	QTY 1 HC-S200M4P15K 45mV/200A	NOT USED	QTY 1 0.2 mH 76 A	QTY 2 129XR0281	NOT USED	QTY 1 C35A	QTY 1 JC1a-10A
H2-2270	QTY 1 35751A	NOT USED	NOT USED	QTY 1 HC-S200M4P15K 45mV/200A	NOT USED	QTY 1 0.15 mH 92 A	QTY 2 129XR0281	NOT USED	QTY 1 C50A	QTY 1 JC1a-10A
H2-2330	QTY 1 35751A	NOT USED	NOT USED	QTY 1 HC-S200M4P15K 45mV/200A	NOT USED	QTY 1 0.1 mH 114 A	QTY 2 129XR0281	NOT USED	QTY 1 C50A	QTY 1 JC1a-10A
H2-4055	QTY 1 35751A	NOT USED	NOT USED	QTY 1 HC-S100M4P15E 45mV/100A	NOT USED	QTY 1 2.5 mH 11 A	NOT USED	NOT USED	QTY 1 JC1aF-15A	NOT USED
H2-4080	QTY 1 35751A	NOT USED	NOT USED	QTY 1 HC-S70M4P15E 45mV/70A	NOT USED	QTY 1 1.8 mH 15 A	QTY 1 113XN0181	NOT USED	QTY 1 JH1a-30A	NOT USED
H2-4110	QTY 1 35751A	NOT USED	NOT USED	QTY 1 HC-S100M4P15E 45mV/100A	NOT USED	QTY 1 1.3 mH 20 A	QTY 1 113XN0181	NOT USED	QTY 1 JH1a-30A	NOT USED
H2-4160	QTY 1 35751A	NOT USED	NOT USED	QTY 1 HC-S70M4P15E 45mV/70A	NOT USED	QTY 1 0.9 mH 29 A	QTY 1, 113XN0181	NOT USED	QTY 1 PC-5	NOT USED
H2-4220	QTY 1 35751A	NOT USED	NOT USED	QTY 1 HC-S100M4P15E 45mV/100A	NOT USED	QTY 1 0.7 mH 39 A	QTY 2 129XR0181	NOT USED	QTY 1 PC-5	NOT USED
H2-4270	QTY 1 35751A	NOT USED	NOT USED	QTY 1 HC-S100M4P15E 45mV/100A	NOT USED	QTY 1 0.5 mH 50 A	QTY 2 129XR0181	NOT USED	QTY 1 C20A	QTY 1 JC1a-10A

TOSHIBA

9.2 Recommended Spare Parts (cont'd)

RANK	C	C	C	C	C	C	C	C	C	C
INVERTER UNIT	PCB KEYPAD	PCB 4-4B SNUBBER	PCB 5-5E G - E CIRCUIT	HCT DC BUS	HCT OUTPUT	L1 DC REACTOR	FAN FOR HEATSINK	FAN FOR CABINET	MS1 CONTACTOR	MSX RELAY
H2-4330	QTY 1 35751B	NOT USED	NOT USED	QTY 1 HC-S100M4P15E 45mV/100A	NOT USED	QTY 1 0.5mH 55 A	QTY 2 129XR0281	NOT USED	QTY 1 C35A	QTY 1 JC1a-10A
H2-4400	QTY1 35751B	NOT USED	NOT USED	NOT USED	QTY 1 NNC-20CAW(AMO) 4V/68A	QTY 1 0.4 mH 75 A	QTY 2 129XR0281	QTY 1 113XN0181	QTY 1 C35A	QTY 1 JC1a-10A
H2-4500	QTY 1 35751B	NOT USED	NOT USED	NOT USED	QTY 1 NNC-20CTW(AMO) 4V/82A	QTY 1 0.3 mH 88 A	QTY 2 129XR0281	QTY 1 113XN0181	QTY 1 C50A	QTY 1 JC1a-10A
H2-4600	QTY 1 35751B	QTY 3 33251A	QTY 6 34557A	NOT USED	QTY 1 NNC-20CAW(AMO) 4V/100A	QTY 1 0.2 mH 114 A	QTY 2 148VK0281	NOT USED	QTY 1 C50A	QTY 1 JC1a-10A
H2-4800	QTY 1 35751B	QTY 3 33251A	QTY 6 34557A	NOT USED	QTY 2 NNC-20CA(AMO) 4V/130A	QTY 1 0.2 mH 141 A	QTY 2 148VK0281	QTY 2 113XN0181	QTY 1 C65A	QTY 1 JC1a-10A
H2-410K	QTY 1 35751B	QTY 3 33251A	QTY 6 34557D	NOT USED	QTY 2 NNC-20CA(AMO) 4V/160A	QTY 1 0.15 mH 175 A	QTY 2 148VK0281	QTY 2 113XN0181	QTY 1 C80A	QTY 1 JC1a-10A
H2-412K	QTY 1 35751B	QTY 3 33251C	QTY 6 34557D	NOT USED	QTY 1 NNC-20CA(AMO) 4V/212A	QTY 1 0.23 mH 220 A	QTY 2 148VK0281	QTY 2 113XN0181	QTY 1 C80A	QTY 1 JC1a-10A
H2-415K	QTY 1 38552B	QTY 3 34465C	QTY 6 40651A	QTY 1 HEC-100A(AMO) 4V/230A	QTY 2 HEC-100A(AMO) 4V/230A	NOT USED	QTY 1 McLean 4B1212-230	QTY 1 148VK0281	QTY 1 C125A-E-A	QTY 1 JC1a-10A
H2-420K	QTY 1 38552B	QTY 3 34465C	QTY 6 40651A	QTY 1 HEC-100A(AMO) 4V/300A	QTY 2 HEC-100A(AMO) 4V/300A	NOT USED	QTY 1 McLean 4B1212-230	QTY 1 148VK0281	QTY 1 C180A-E-A	QTY 1 JC1a-10A

Notes: Rank C signifies parts of relatively lowest necessity.

9.3 After Sales Service

9.3.1 Requesting After Sales Service

When requesting after-sales service, report the contents of the following PROBLEM INFORMATION SHEET, which will help repair the system quickly.

Problem Information Sheet

Item			
	Customer's name		
Refer to	Person in charge		
	Address		
	Telephone No.		
Inverter spec.	Model No.		
	Serial No.		
	Test No.		
Delivery date			
Time in service			
Date when problem arose			
	Use		
Status of Use	Motor rating	Poles, Hp, V, Hz.	
		Made by Toshiba? Made by another company?	
		New? Number of units?	
	Ambient condition	Alternate? Continuous?	
		Indoor? Outdoor? Temperature range?	
		Humidity:	
		Dust composition and size:	
		Presence of salt and extent of corrosion from it:	
		Vibrations, in micrometers:	
		Presence of corrosive gas:	
Phenomenon	Power source	Availability of air conditioning:	
		Number of phases:	
		Voltage between L1 phase and L2 phase:	
		Voltage between L2 phase and L3 phase:	
	State of motor when problem was found	Voltage between L3 phase and L1 phase:	
		Number of Hz:	
		Problem occurred hours after motor had been started. Motor has been stopped for hours.	
		Problem occurred during periodic inspection?	
		Problem occurred when motor was started?	
	Frequency of problem	Problem occurred during acceleration?	
Problem occurred during deceleration?			
Problem occurred while motor was not running?			
First time? Problem occurred times in the past.			
Trouble indicator	Problem occurs sometimes?		
	Problem occurs every time motor is operated?		
	When did problem first occur?		
<input type="checkbox"/> NO DISPLAY <input type="checkbox"/> OC1 <input type="checkbox"/> OC2 <input type="checkbox"/> OC3 <input type="checkbox"/> OCA <input type="checkbox"/> OCL <input type="checkbox"/> OP2 <input type="checkbox"/> OP <input type="checkbox"/> OL <input type="checkbox"/> OH <input type="checkbox"/> EF <input type="checkbox"/> Err.2 <input type="checkbox"/> Err.3 <input type="checkbox"/> Err.4 <input type="checkbox"/> Err.5 <input type="checkbox"/> Err.6 <input type="checkbox"/> EEP <input type="checkbox"/> EEP2 <input type="checkbox"/> EEP3 <input type="checkbox"/> ERR.t			
Detailed description of problem:			
Temporary diagnosis and corrective action:			
Date defective product shipped:		To:	
Deadline for repairs:			

SECTION 7 - Dimensions, Weights, and Drawings

CHAPTER 10

Dimensions, Weights, and Drawings:

- 10.1 Model H2 Drive Dimensions
- 10.2 Model H2 Drive Shipping Weights
- 10.3 Touchpad Mounting Dimensions
- 10.4 Component Layout Drawings
- 10.5 Technical Drawings
 - 10.5.1 Control Board - Details
 - 10.5.2 Schematics - All Drives

10.1 Dimensions/Weights/Component Layouts/Schematics

10.1.1 Basic Dimensions

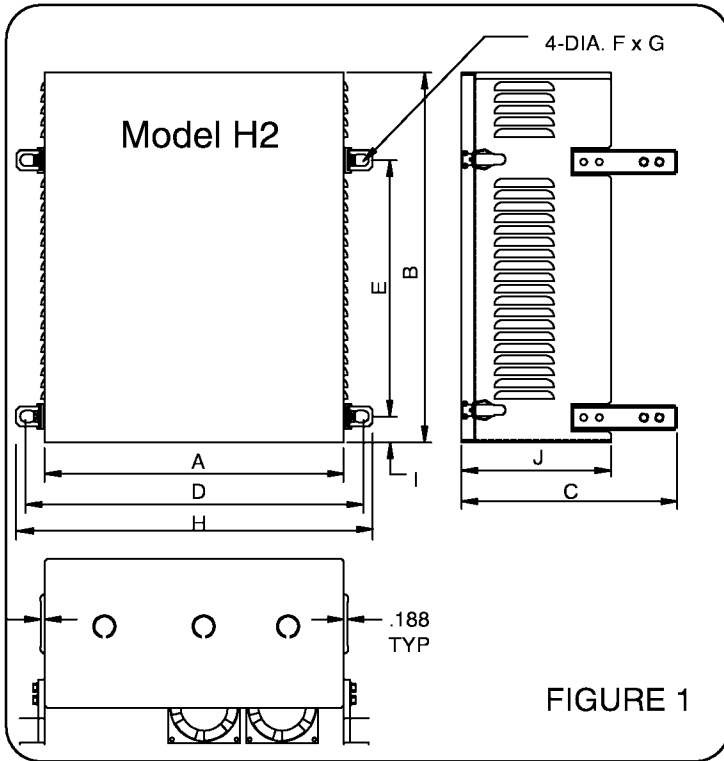


FIGURE 1

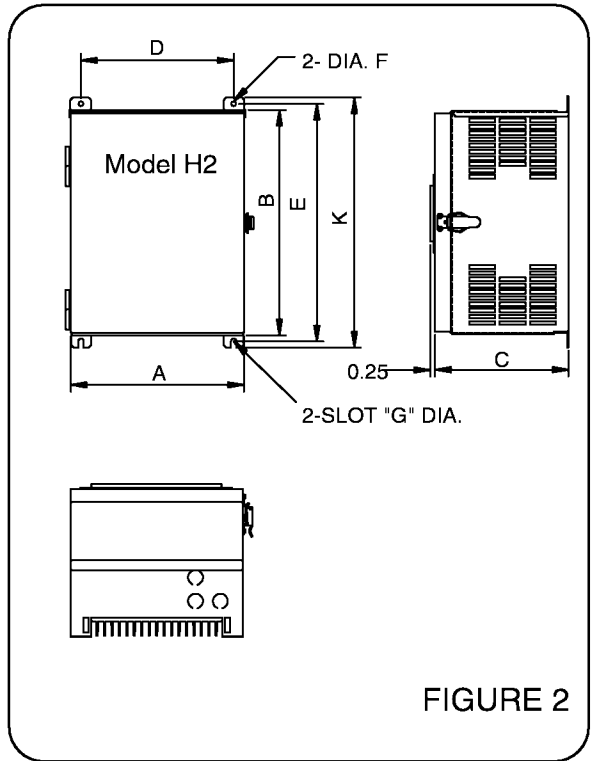


FIGURE 2

DIMENSIONS

ALL DIMENSIONS ARE IN INCHES.

MODEL	FIG	A	B	C	D	E	F	G	H	I	J	K
VT130H2-2035	2	8.72	11.38	8.41	7.69	12.00	0.28	0.28	NA	NA	NA	12.63
VT130H2-2055	2	8.72	11.38	8.41	7.69	12.00	0.28	0.28	NA	NA	NA	12.63
VT130H2-2080	1	15.19	18.63	10.88	16.63	12.88	0.59	0.81	17.81	1.25	7.59	NA
VT130H2-2110	1	15.19	18.63	10.88	16.63	12.88	0.59	0.81	17.81	1.25	7.59	NA
VT130H2-2160	1	15.19	18.63	10.88	16.63	12.88	0.59	0.81	17.81	1.25	7.59	NA
VT130H2-2220	1	17.63	22.38	10.88	19.06	14.75	0.59	0.81	20.25	1.25	7.59	NA
VT130H2-2270	1	17.63	22.38	10.88	19.06	14.75	0.59	0.81	20.25	1.25	7.59	NA
VT130H2-2330	1	17.63	22.38	10.88	19.06	14.75	0.59	0.81	20.25	1.25	7.59	NA
VT130H2-4055	1	13.69	15.66	8.88	14.78	10.81	0.41	0.59	15.59	1.23	7.13	NA
VT130H2-4080	1	15.19	18.63	10.88	16.63	12.88	0.59	0.81	17.81	1.25	7.59	NA
VT130H2-4110	1	15.19	18.63	10.88	16.63	12.88	0.59	0.81	17.81	1.25	7.59	NA
VT130H2-4160	1	15.19	18.63	10.88	16.63	12.88	0.59	0.81	17.81	1.25	7.59	NA
VT130H2-4220	1	17.63	22.38	10.88	19.06	14.75	0.59	0.81	20.25	1.25	7.59	NA
VT130H2-4270	1	17.63	22.38	10.88	19.06	14.75	0.59	0.81	20.25	1.25	7.59	NA
VT130H2-4330	1	17.63	22.38	10.88	19.06	14.75	0.59	0.81	20.25	1.25	7.59	NA
VT130H2-4400	1	20.19	25.56	12.38	21.63	19.03	0.59	0.81	22.81	1.25	8.75	NA
VT130H2-4500	1	20.19	25.56	12.38	21.63	19.03	0.59	0.81	22.81	1.25	8.75	NA
VT130H2-4600	1	20.19	36.19	13.25	22.06	26.00	0.59	0.81	22.81	2.06	8.53	NA
VT130H2-4800	1	20.19	36.19	13.25	22.06	26.00	0.59	0.81	22.81	2.06	8.53	NA
VT130H2-410K	1	20.19	36.19	13.25	22.06	26.00	0.59	0.81	22.81	2.06	8.53	NA
VT130H2-412K	1	20.19	36.19	13.25	22.06	26.00	0.59	0.81	22.81	2.06	8.53	NA

Dimensional chart continued on following page

10.1 Dimensions/Weights/Component Layouts/Schematics

10.1.1 Basic Dimensions

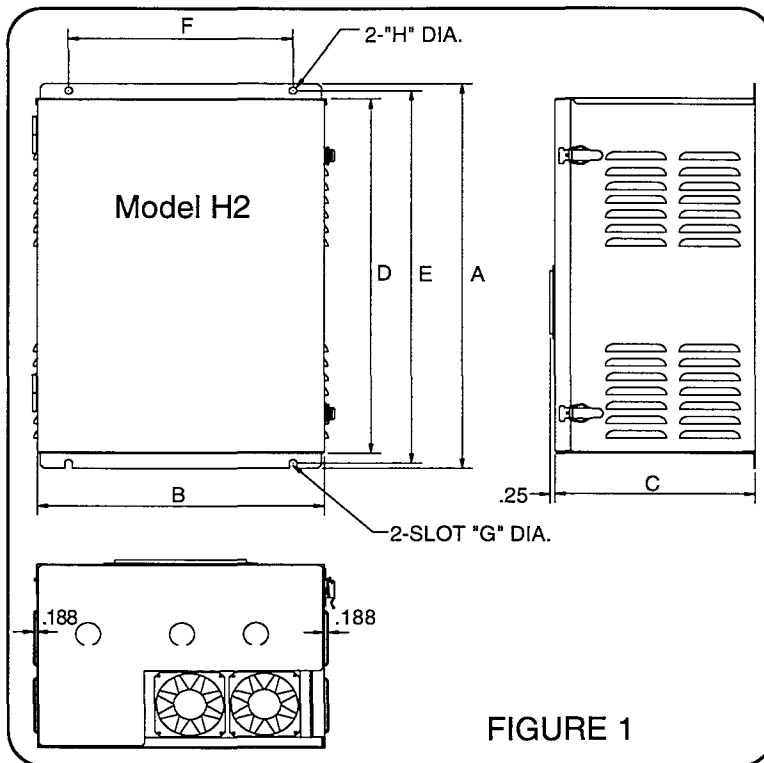


FIGURE 1

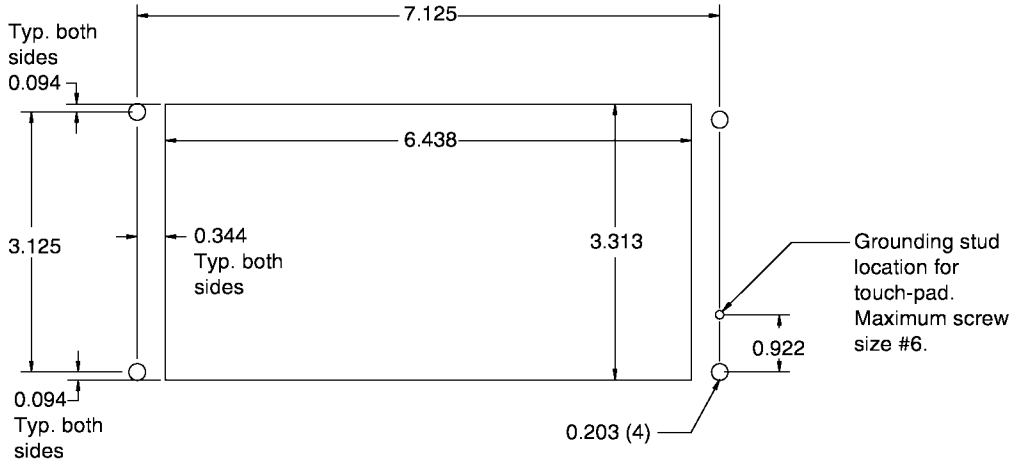
DIMENSIONS

MODEL	FIG	A	B	C	D	E	F	G	H
VT130H2+415K	1	59.94	25.88	14.47	57.00	58.75	11.81	.69	.69
VT130H2+420K	1	59.94	25.88	14.47	57.00	58.75	11.81	.69	.69

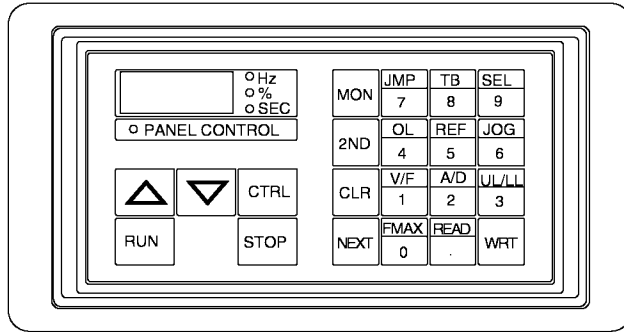
10.2 Model H2 Drive Shipping Weights

Inverter Type	Shipping Weight	
	Pounds	Kilograms
H2-2035	18.0	8.2
H2-2055	19.0	8.6
H2-2080	54.0	24.5
H2-2110	56.0	25.4
H2-2160	58.0	26.3
H2-2220	80.0	36.3
H2-2270	85.0	38.6
H2-2330	88.0	39.9
H2-4055	45.0	20.4
H2-4080	53.0	24.0
H2-4110	56.0	25.4
H2-4160	58.0	26.3
H2-4220	98.0	44.5
H2-4270	100.0	45.4
H2-4330	103.0	46.7
H2-4400	130.0	59.0
H2-4500	130.0	59.0
H2-4600	196.0	88.9
H2-4800	205.0	93.0
H2-410K	207.0	93.9
H2-412K	223.0	101.2
H2-415K	310.0	140.9
H2-420K	440.0	200.0

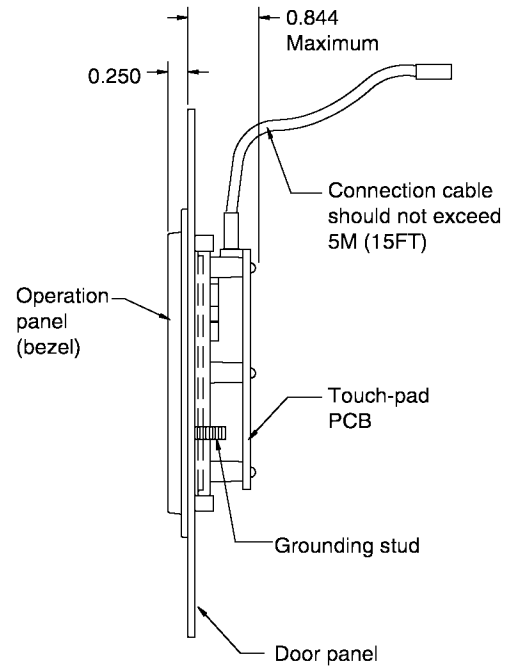
10.3 Touchpad Mounting Dimensions
(NEMA 4/NEMA 12 Operation Panel - Standard)



**CUTOUT FOR TOUCH-PAD
OPERATION PANEL IN DOOR
(FRONT VIEW)**



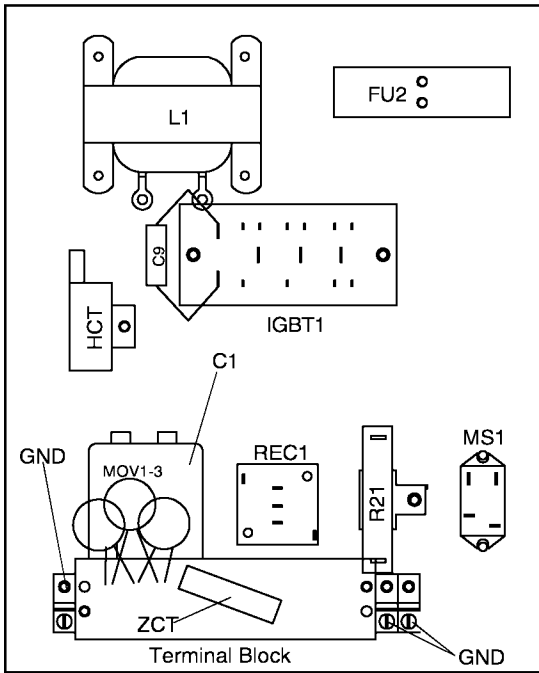
**FRONT VIEW OF
TOUCH-PAD
OPERATION PANEL**



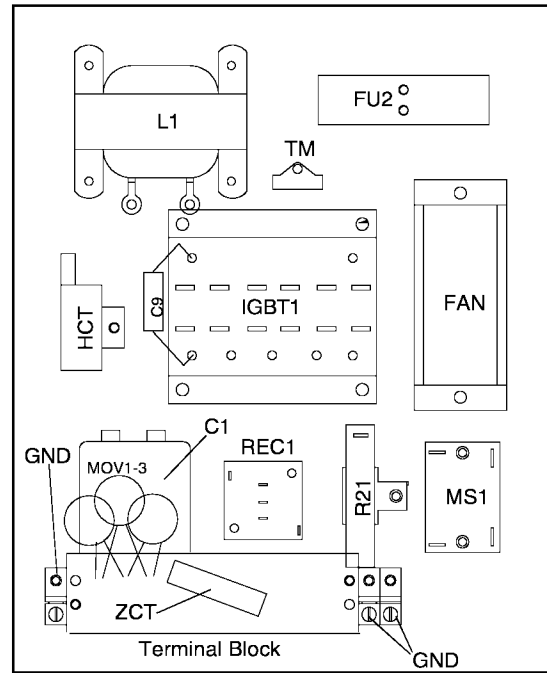
**RIGHT SIDE
VIEW**

10.4 Component Layouts

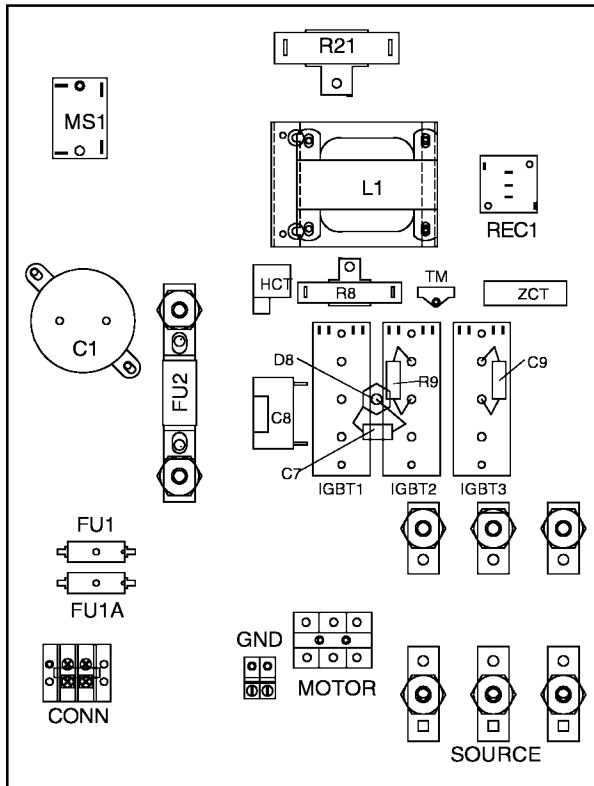
H2-2035 - H2-2110



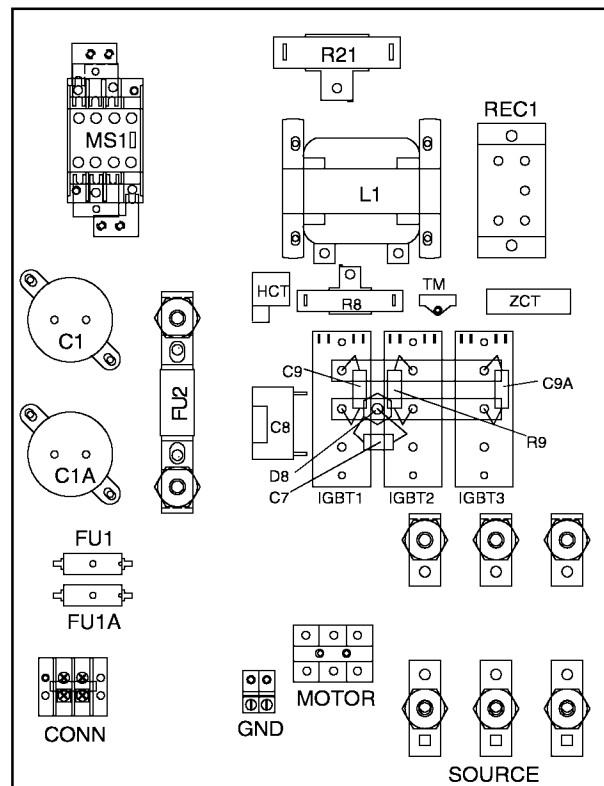
H2-2035



H2-2055

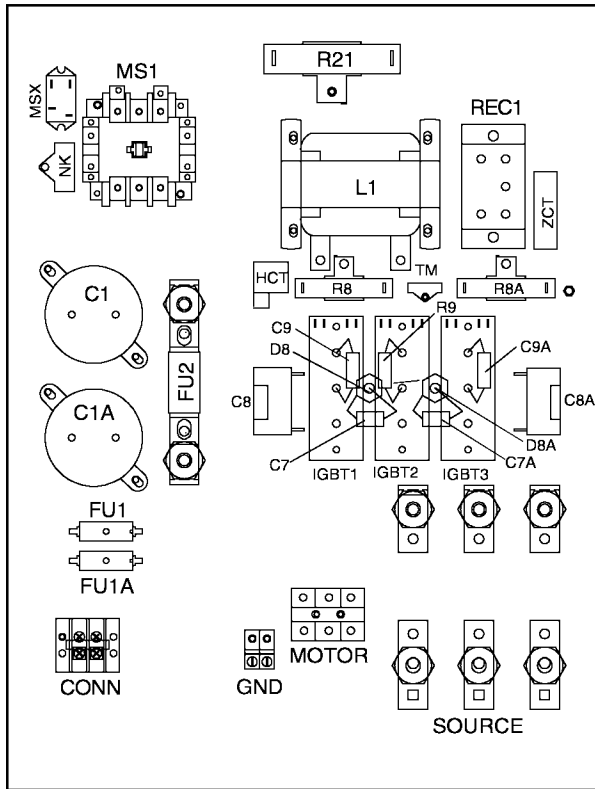


H2-2080

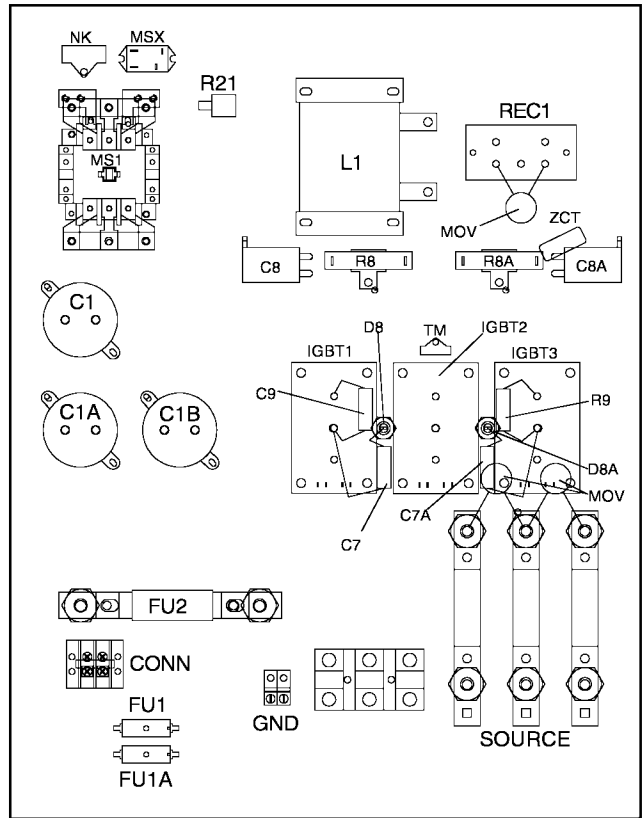


H2-2110

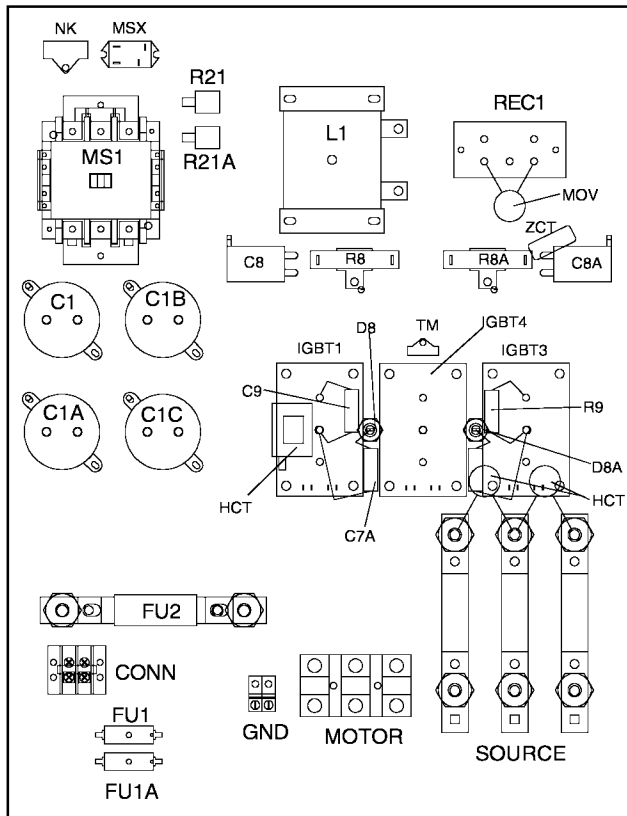
10.4 Component Layouts (cont'd) H2-2160 - H2-2330



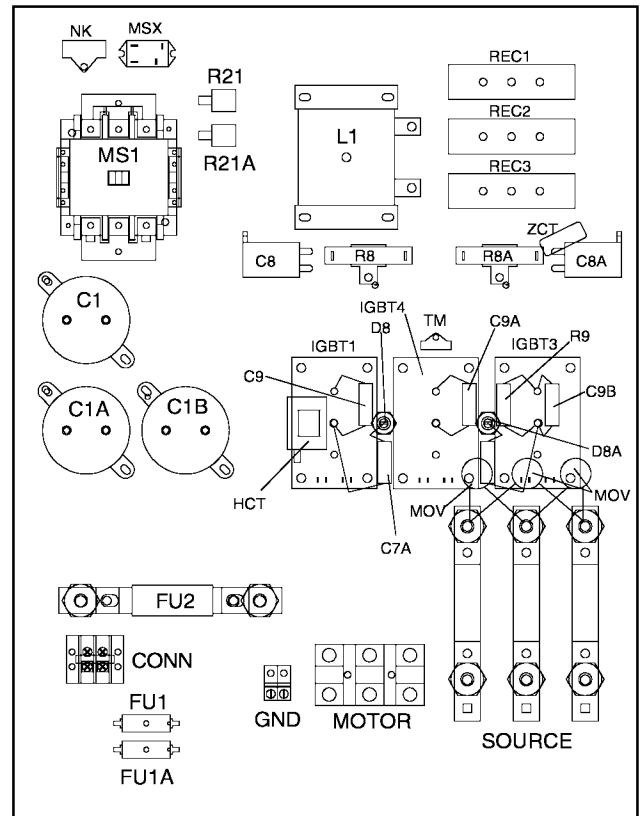
H2-2160



H2-2220

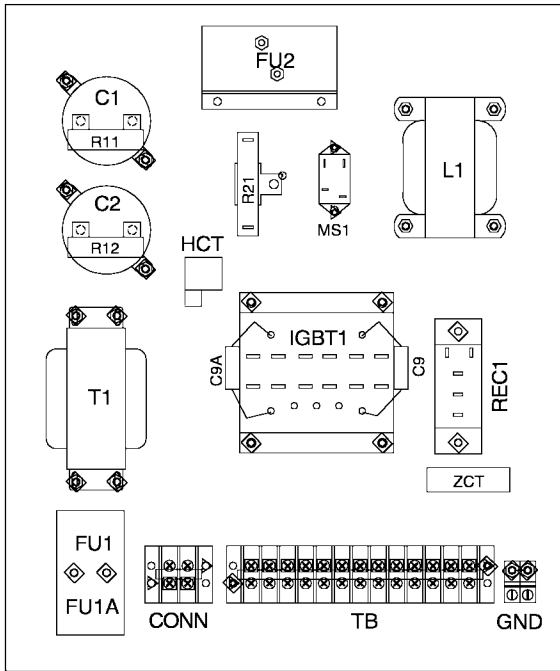


H2-2270

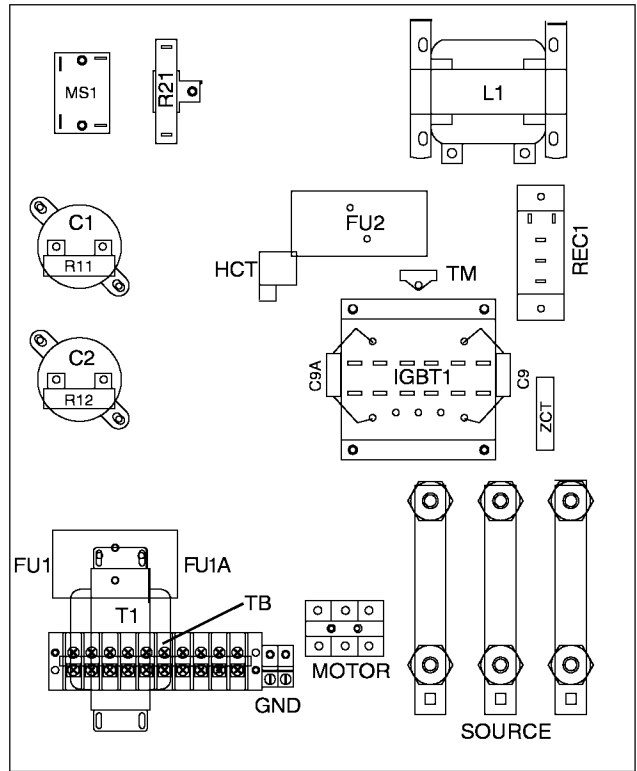


H2-2330

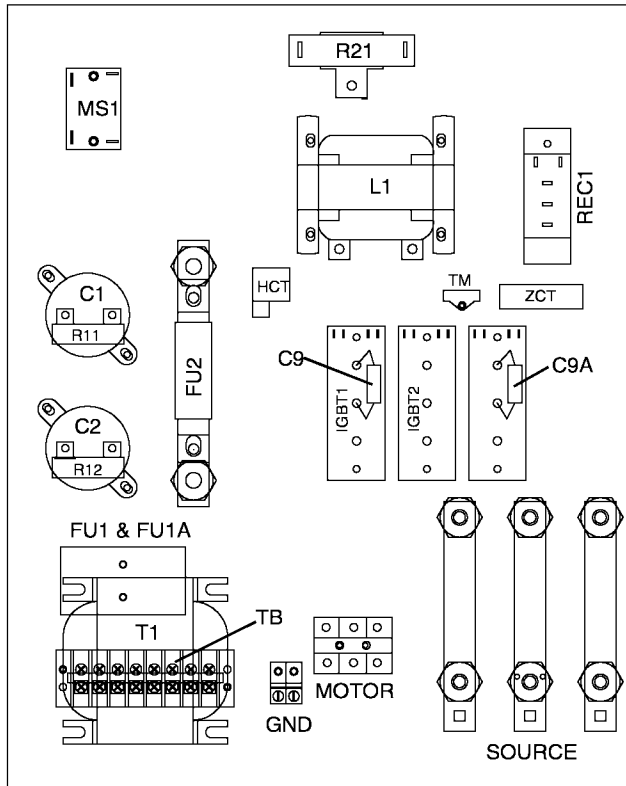
10.4 Component Layouts (cont'd) H2-4055 - H2-4160



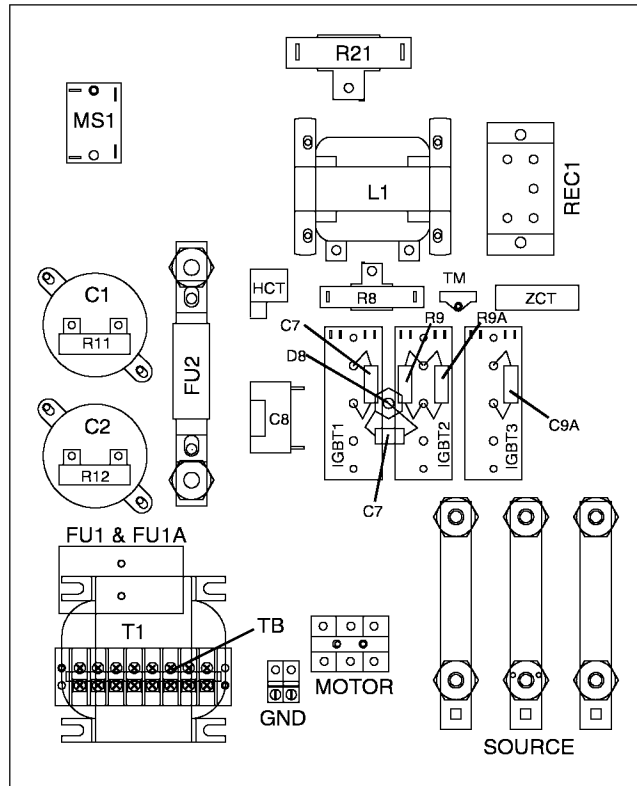
H2-4055



H2-4080

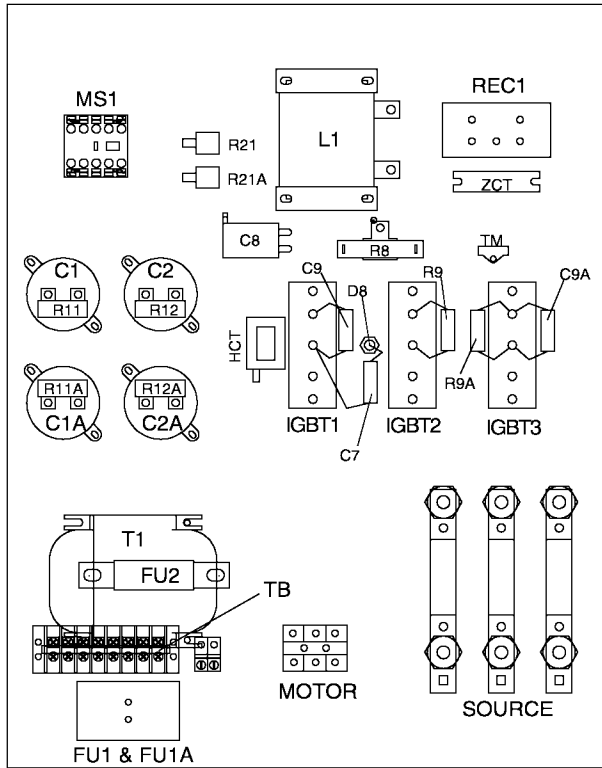


H2-4110

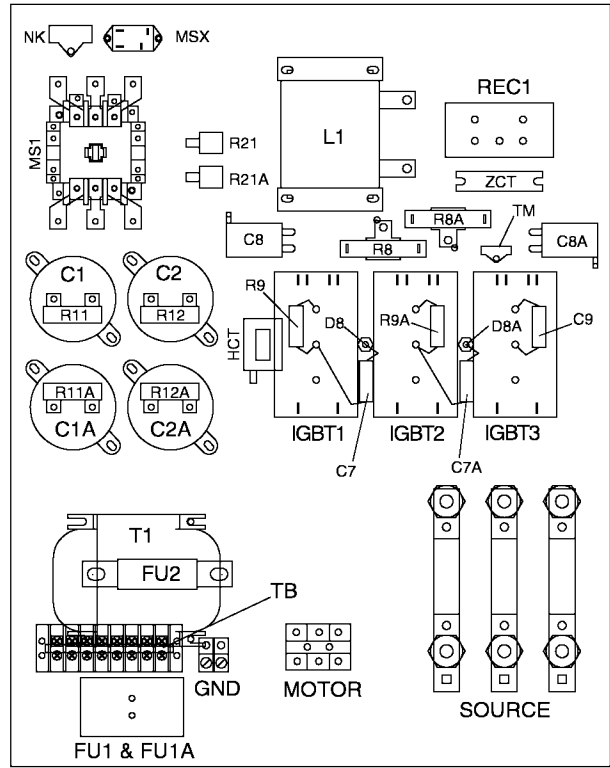


H2-4160

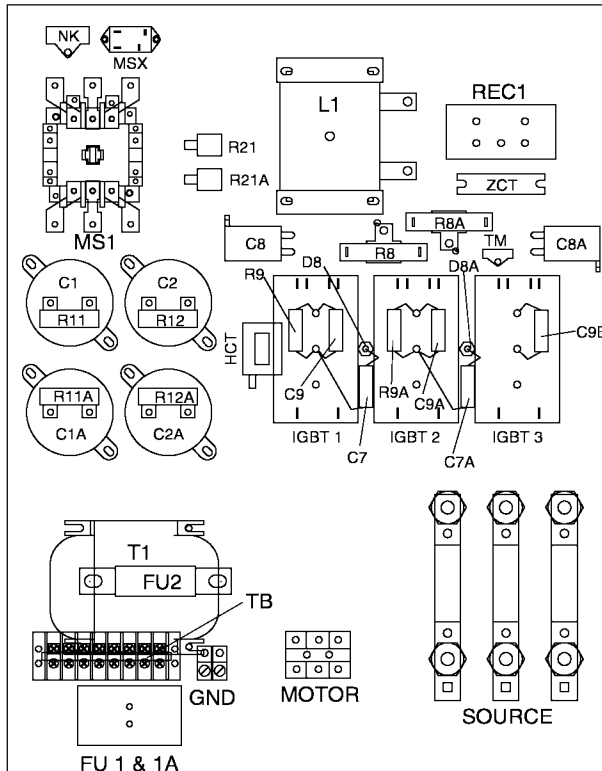
10.4 Component Layouts (cont'd) H2-4220 - H2-4500



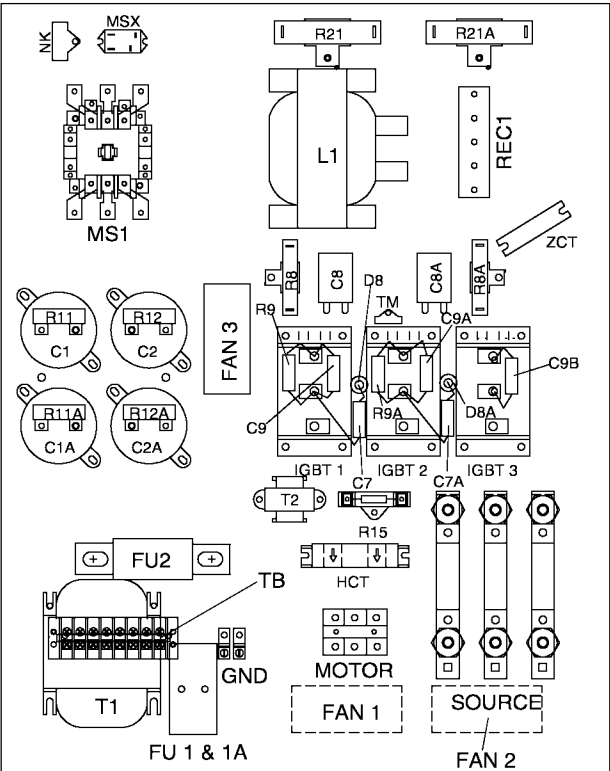
H2-4220



H2-4270

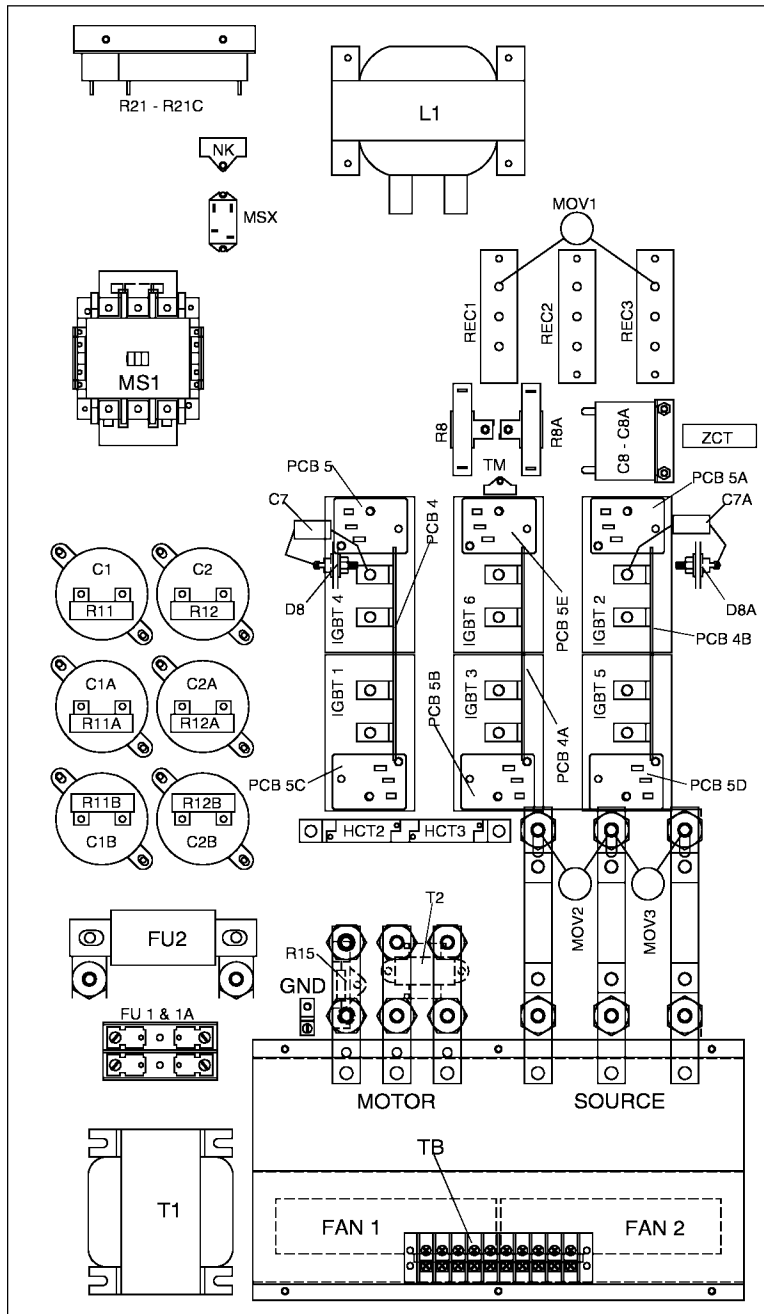


H2-4330



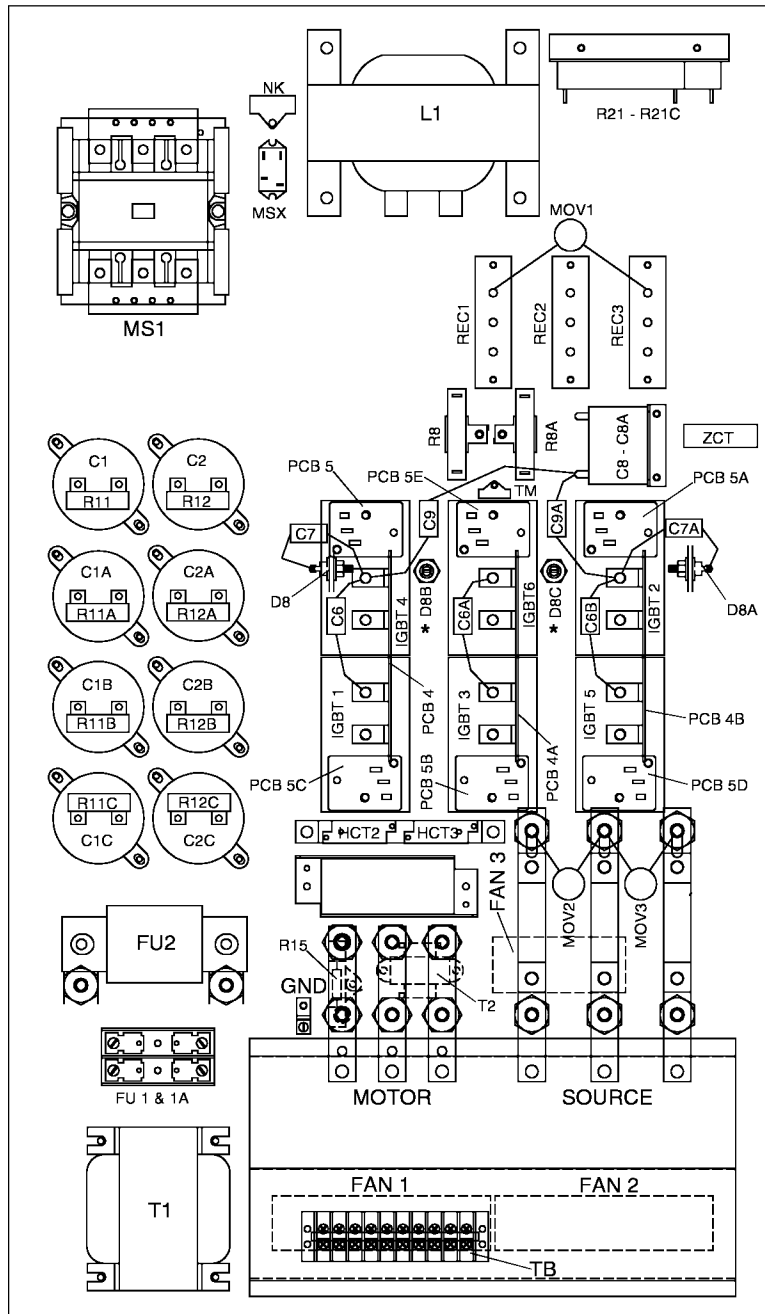
H2-4400 - H2-4500

10.4 Component Layouts (cont'd) H2-4600



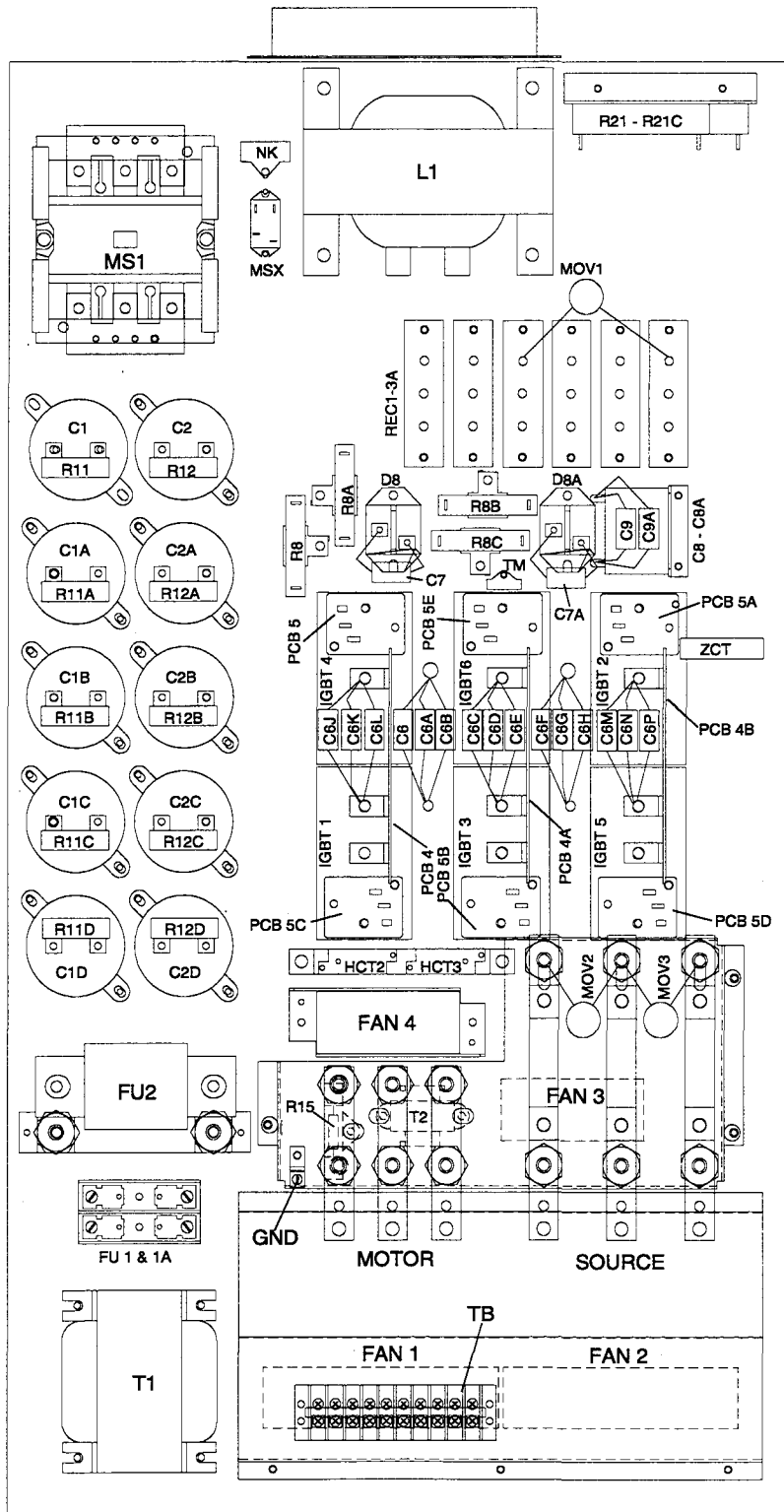
H2-4600

10.4 Component Layouts (cont'd) H2-4800 - H2-410K



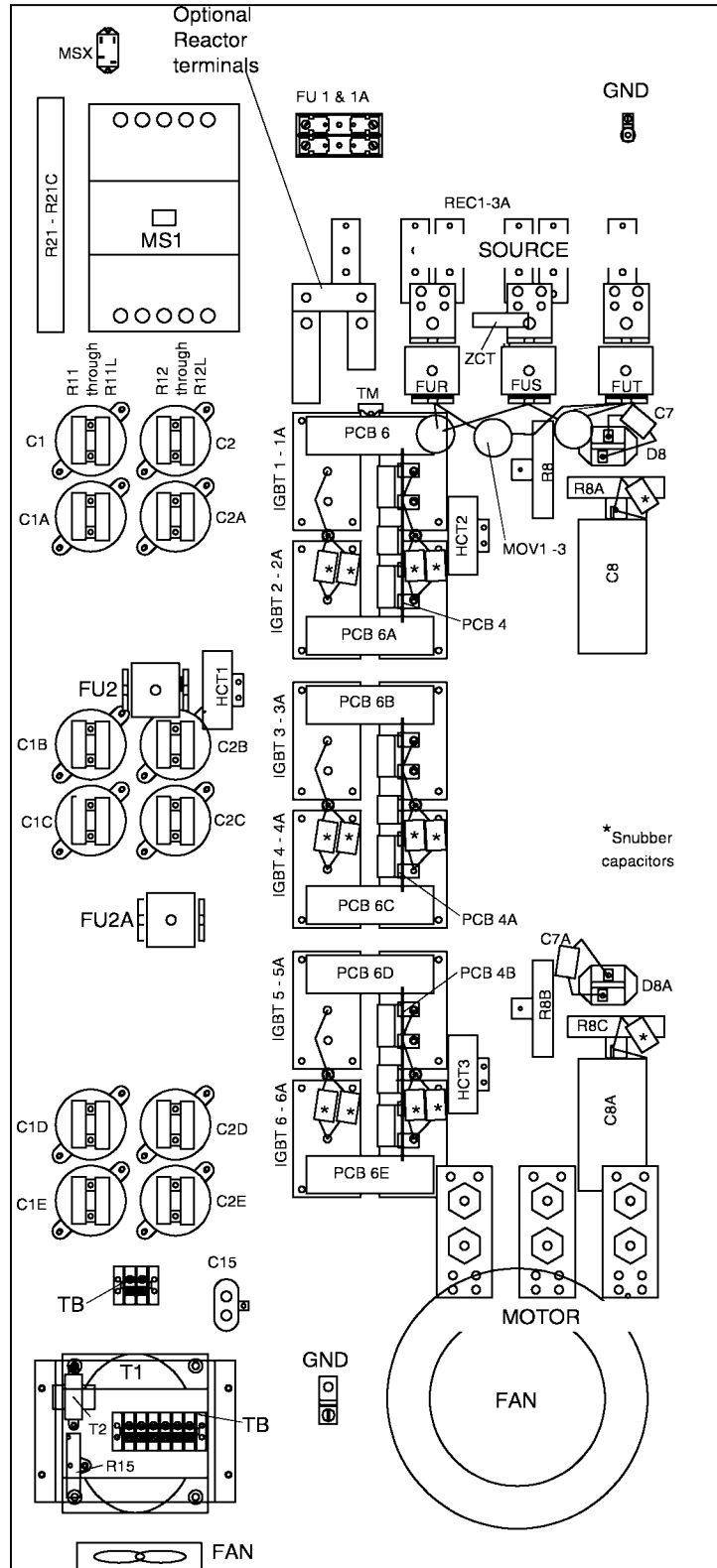
H2-4800 - H2-410K

10.4 Component Layouts (cont'd) H2-412K



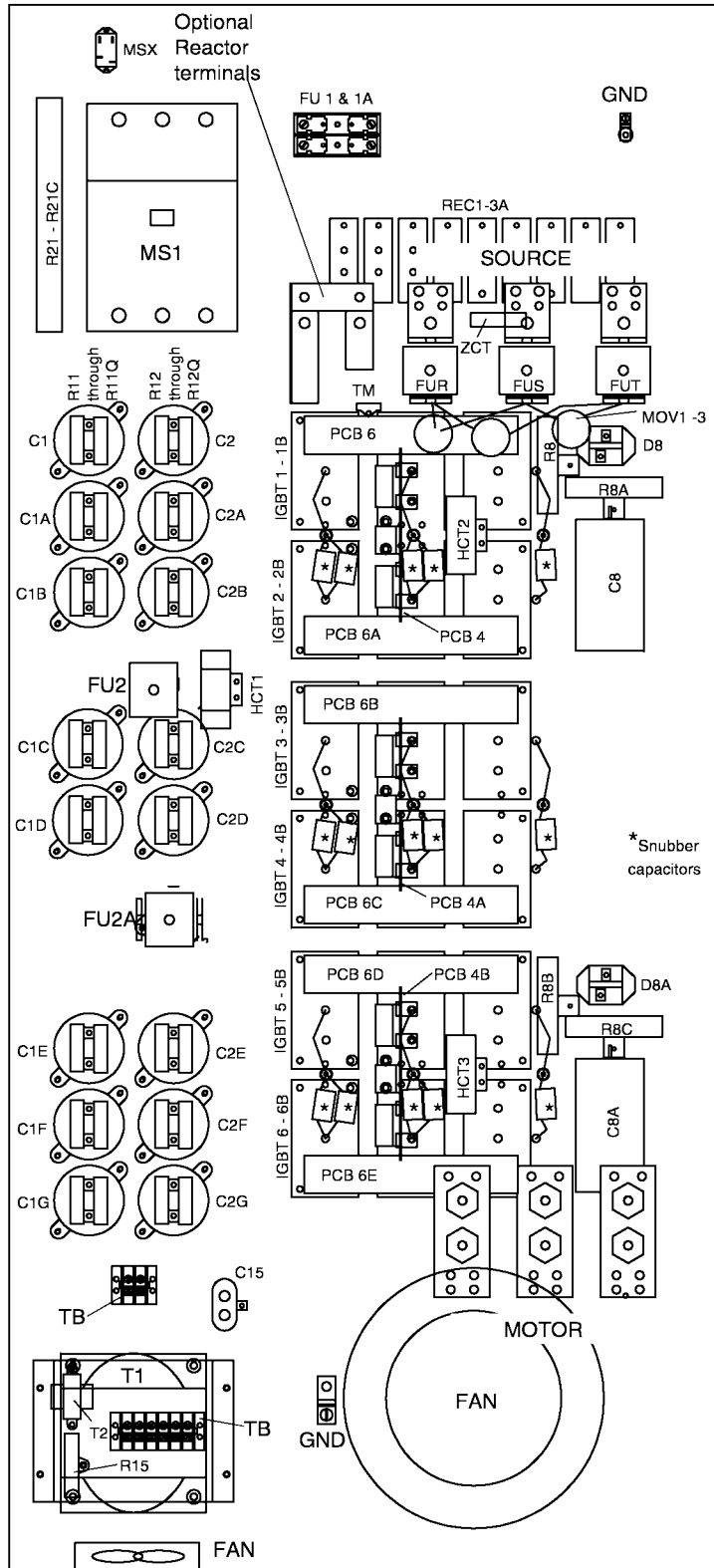
H2-412K

10.4 Component Layouts (cont'd) H2-415K



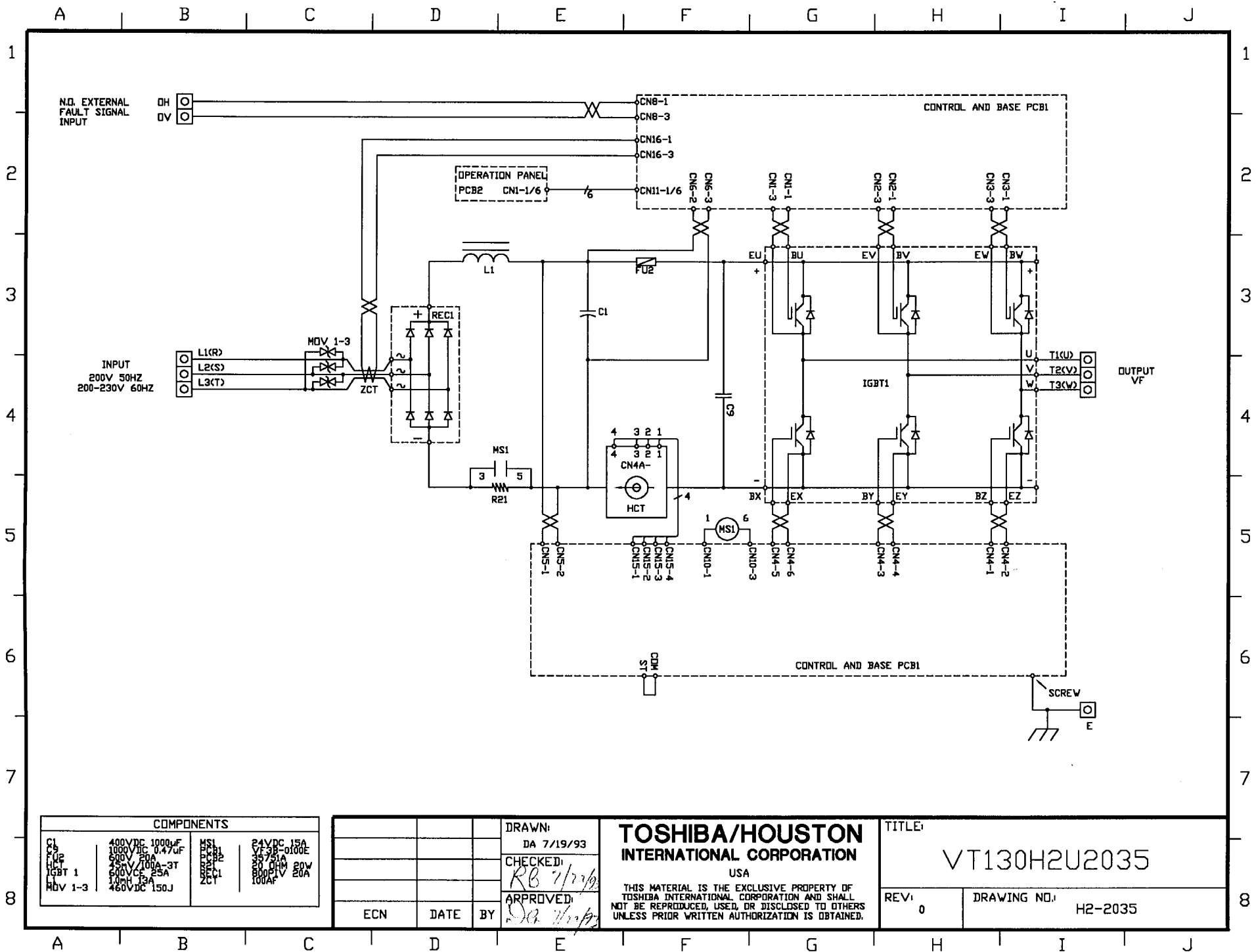
H2-415K

10.4 Component Layouts (cont'd) H2-420K



H2-420K

10.5 Technical Drawings



N.O. EXTERNAL
FAULT SIGNAL
INPUT

DH
OV

OPERATION PANEL
PCB2

CONTROL AND BASE PCB1

INPUT
200V 50HZ
200-230V 60HZ

L1(R)
L2(S)
L3(T)

MOV 1-3
ZCT

REC1

MS1
R21

CN4A
HCT

EU

BU

EV

BV

EW

BW

IGBT1

T1(U)
T2(V)
T3(W)

OUTPUT
VF

CN5-1
CN5-2

CN5-3
CN5-4

CN5-5
CN5-6

CN5-7
CN5-8

CN4-1
CN4-2

CN4-3
CN4-4

CN4-5
CN4-6

CONTROL AND BASE PCB1

SCREW
E

COMPONENTS

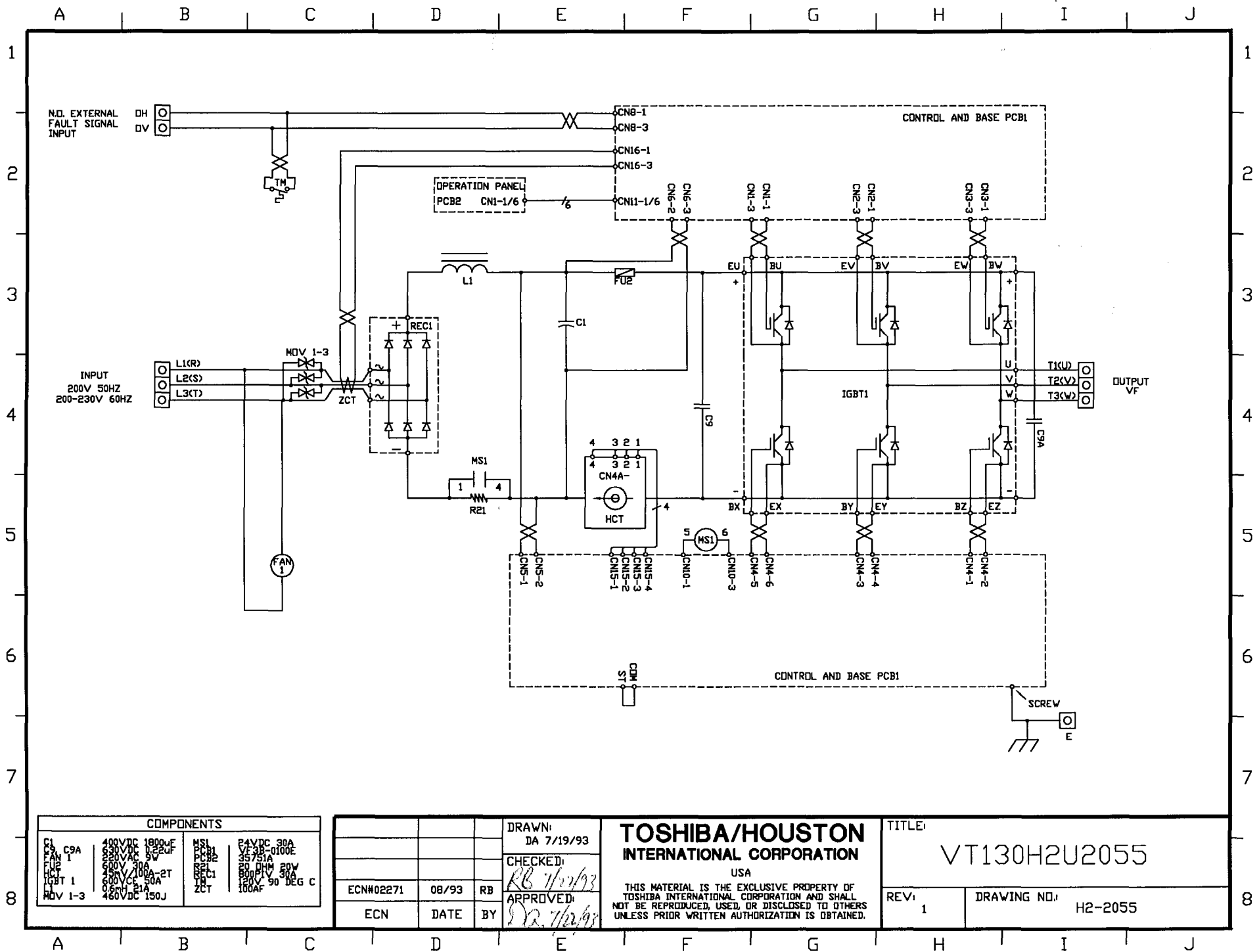
C1	400VDC 1000µF	MS1	24VDC 15A
C5	1000VDC 0.47µF	PCB1	VT-3B-0100E
FU1	600V 20A	PCB2	35751A
FU2	250V 100A-3T	REC1	30 OHM 50W
IGBT 1	600V 25A	ZCT1	600V 20A
MOV 1-3	100V 13A	ZCT1	100µF
	460VDC 150J		

ECN	DATE	BY

DRAWN:
DA 7/19/93
CHECKED:
RB 7/20/93
APPROVED:
DA 7/20/93

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TITLE:
VT130H2U2035
REV: 0
DRAWING NO: H2-2035



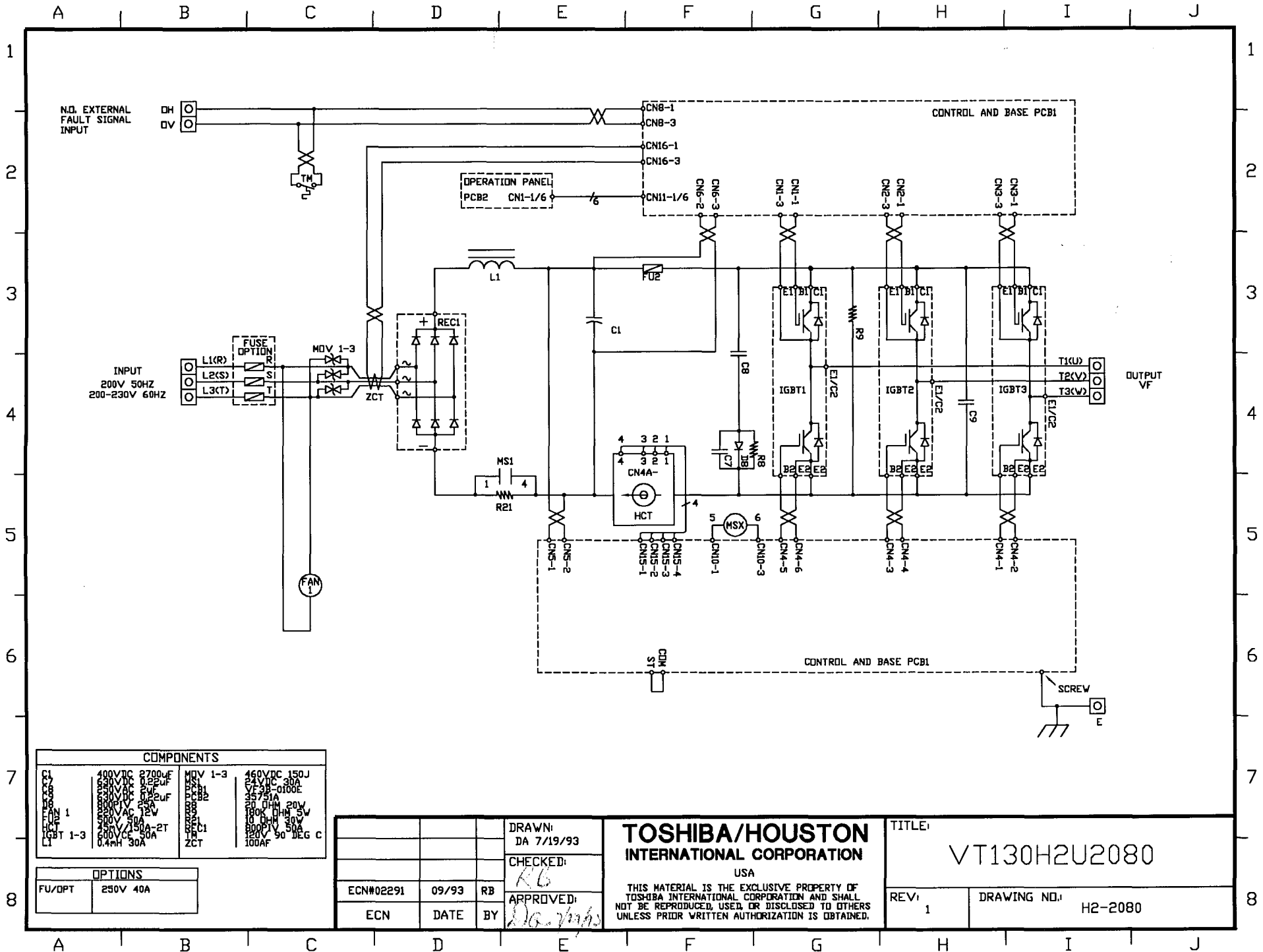
COMPONENTS			
C1	400VDC 1800uF	MS1	24VDC 30A
C9, C9A	630VDC 0.22uF	PCB1	VF3B-0100E
FAN 1	220VAC 9W	PCB2	35751A
FUE	500V 30A	R21	80 OHM 20W
F1	500V 100A-2T	REC1	800PIV 30A
IGBT 1	600VCE 50A	TF	120V 90 DEG C
MOV 1-3	0.66V 21A	ZCT	100AF
	460VDC 150J		

ECN#02271	08/93	RB	DRAWN: DA 7/19/93 CHECKED: <i>RB 7/22/93</i> APPROVED: <i>RB 7/22/93</i>
ECN	DATE	BY	

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TITLE: VT130H2U2055	
REV: 1	DRAWING NO.: H2-2055



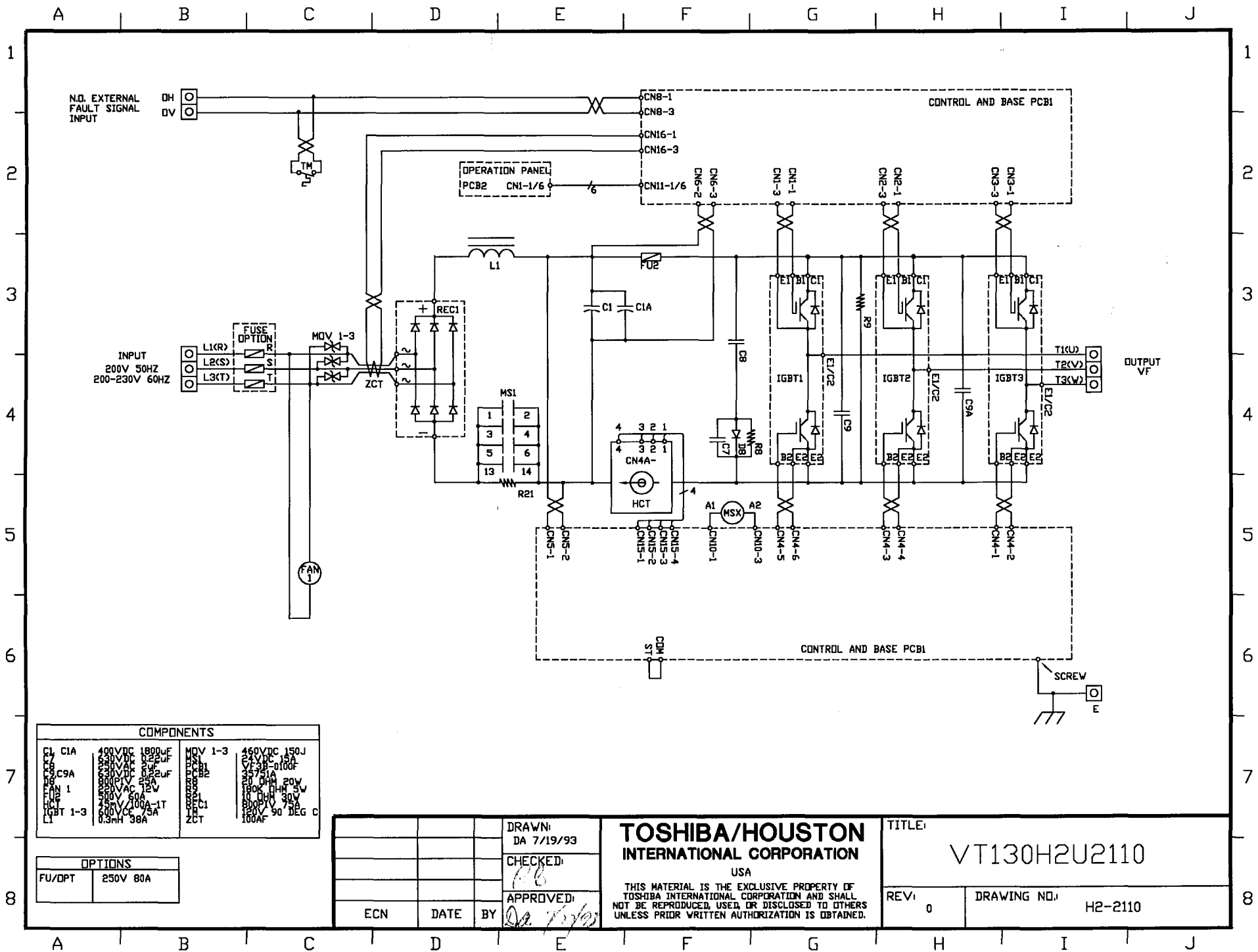
COMPONENTS			
C1	400V/TC 2700µF	MOV 1-3	460V/RC 150J
C8	250V/VC 0.22µF	MS1	24V/DC 30A
C9	250V/VC 0.22µF	MSX	VF 38-0700E
FAN 1	230V/AC 12V	R21	3575A
HCT	120V/DC 20V	R9	30 0HM 20V
IGBT 1-3	500V/VC 30A	R21	100 0HM 30V
L1	200V/VC 50A-2T	R21	800V/DC 30V
	0.4mH 30A	ZCT	150V/DC 50A
		ZCT	100AF

OPTIONS	
FU/DPT	250V 40A

ECN#02291	09/93	RB	APPROVED:
ECN	DATE	BY	<i>DA 7/19/93</i>

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TITLE: VT130H2U2080	
REV: 1	DRAWING NO.: H2-2080



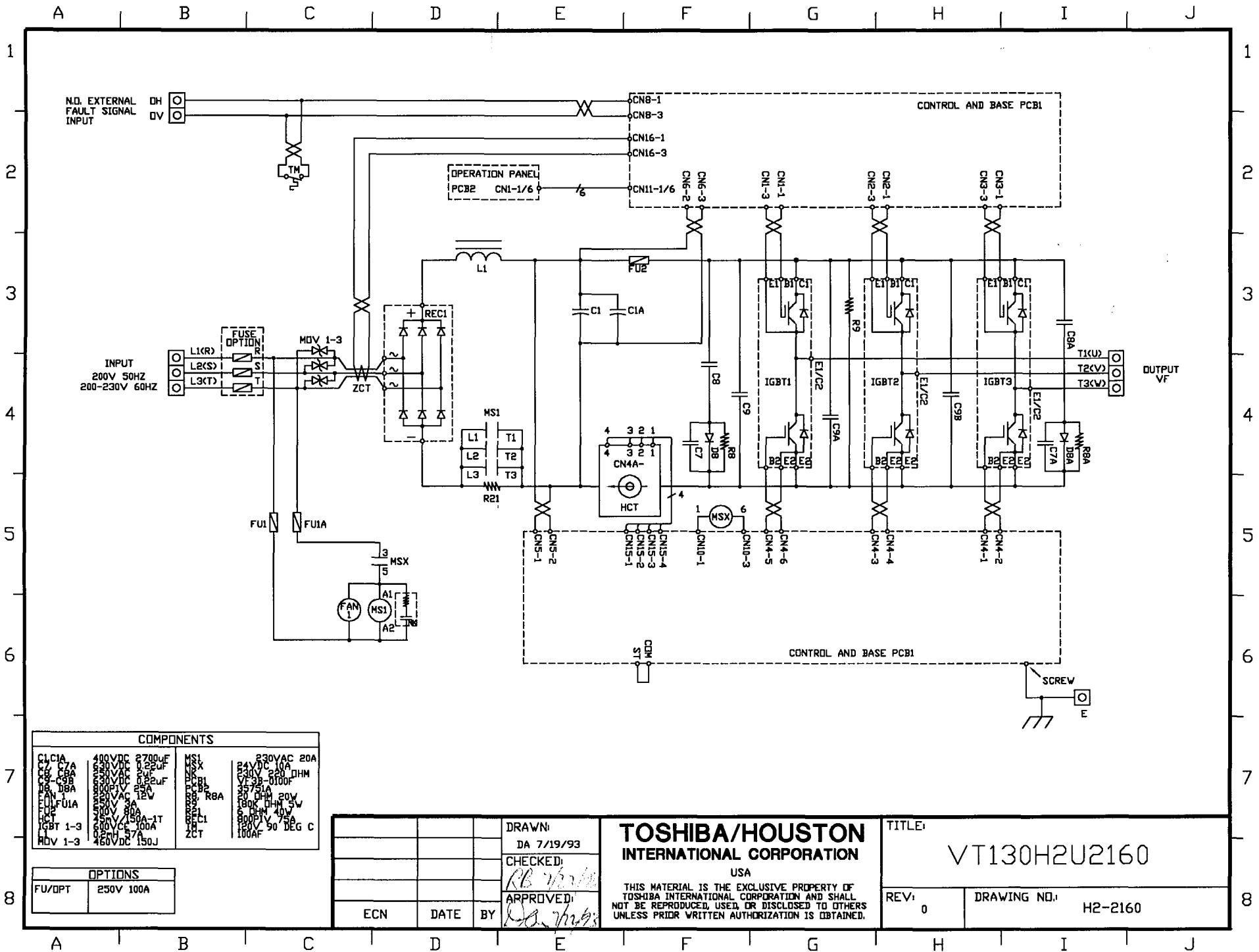
COMPONENTS			
C1, C1A	400VDC 1800µF	MOV 1-3	460VDC 150J
C2	250VDC 1µ2F	MS1	24VDC 150
C3	250VDC 2µF	MSX	VF38-0100
C4	250VDC 2µF	PCB2	35 5A
C5	250VDC 2µF	PCB1	20 5A
C6	250VDC 2µF	PCB1	10 5A
C7	250VDC 2µF	PCB1	10 5A
C8	250VDC 2µF	PCB1	10 5A
C9	250VDC 2µF	PCB1	10 5A
C10	250VDC 2µF	PCB1	10 5A
C11	250VDC 2µF	PCB1	10 5A
C12	250VDC 2µF	PCB1	10 5A
C13	250VDC 2µF	PCB1	10 5A
C14	250VDC 2µF	PCB1	10 5A
C15	250VDC 2µF	PCB1	10 5A
C16	250VDC 2µF	PCB1	10 5A
C17	250VDC 2µF	PCB1	10 5A
C18	250VDC 2µF	PCB1	10 5A
C19	250VDC 2µF	PCB1	10 5A
C20	250VDC 2µF	PCB1	10 5A
C21	250VDC 2µF	PCB1	10 5A
C22	250VDC 2µF	PCB1	10 5A
C23	250VDC 2µF	PCB1	10 5A
C24	250VDC 2µF	PCB1	10 5A
C25	250VDC 2µF	PCB1	10 5A
C26	250VDC 2µF	PCB1	10 5A
C27	250VDC 2µF	PCB1	10 5A
C28	250VDC 2µF	PCB1	10 5A
C29	250VDC 2µF	PCB1	10 5A
C30	250VDC 2µF	PCB1	10 5A
C31	250VDC 2µF	PCB1	10 5A
C32	250VDC 2µF	PCB1	10 5A
C33	250VDC 2µF	PCB1	10 5A
C34	250VDC 2µF	PCB1	10 5A
C35	250VDC 2µF	PCB1	10 5A
C36	250VDC 2µF	PCB1	10 5A
C37	250VDC 2µF	PCB1	10 5A
C38	250VDC 2µF	PCB1	10 5A
C39	250VDC 2µF	PCB1	10 5A
C40	250VDC 2µF	PCB1	10 5A
C41	250VDC 2µF	PCB1	10 5A
C42	250VDC 2µF	PCB1	10 5A
C43	250VDC 2µF	PCB1	10 5A
C44	250VDC 2µF	PCB1	10 5A
C45	250VDC 2µF	PCB1	10 5A
C46	250VDC 2µF	PCB1	10 5A
C47	250VDC 2µF	PCB1	10 5A
C48	250VDC 2µF	PCB1	10 5A
C49	250VDC 2µF	PCB1	10 5A
C50	250VDC 2µF	PCB1	10 5A
C51	250VDC 2µF	PCB1	10 5A
C52	250VDC 2µF	PCB1	10 5A
C53	250VDC 2µF	PCB1	10 5A
C54	250VDC 2µF	PCB1	10 5A
C55	250VDC 2µF	PCB1	10 5A
C56	250VDC 2µF	PCB1	10 5A
C57	250VDC 2µF	PCB1	10 5A
C58	250VDC 2µF	PCB1	10 5A
C59	250VDC 2µF	PCB1	10 5A
C60	250VDC 2µF	PCB1	10 5A
C61	250VDC 2µF	PCB1	10 5A
C62	250VDC 2µF	PCB1	10 5A
C63	250VDC 2µF	PCB1	10 5A
C64	250VDC 2µF	PCB1	10 5A
C65	250VDC 2µF	PCB1	10 5A
C66	250VDC 2µF	PCB1	10 5A
C67	250VDC 2µF	PCB1	10 5A
C68	250VDC 2µF	PCB1	10 5A
C69	250VDC 2µF	PCB1	10 5A
C70	250VDC 2µF	PCB1	10 5A
C71	250VDC 2µF	PCB1	10 5A
C72	250VDC 2µF	PCB1	10 5A
C73	250VDC 2µF	PCB1	10 5A
C74	250VDC 2µF	PCB1	10 5A
C75	250VDC 2µF	PCB1	10 5A
C76	250VDC 2µF	PCB1	10 5A
C77	250VDC 2µF	PCB1	10 5A
C78	250VDC 2µF	PCB1	10 5A
C79	250VDC 2µF	PCB1	10 5A
C80	250VDC 2µF	PCB1	10 5A
C81	250VDC 2µF	PCB1	10 5A
C82	250VDC 2µF	PCB1	10 5A
C83	250VDC 2µF	PCB1	10 5A
C84	250VDC 2µF	PCB1	10 5A
C85	250VDC 2µF	PCB1	10 5A
C86	250VDC 2µF	PCB1	10 5A
C87	250VDC 2µF	PCB1	10 5A
C88	250VDC 2µF	PCB1	10 5A
C89	250VDC 2µF	PCB1	10 5A
C90	250VDC 2µF	PCB1	10 5A
C91	250VDC 2µF	PCB1	10 5A
C92	250VDC 2µF	PCB1	10 5A
C93	250VDC 2µF	PCB1	10 5A
C94	250VDC 2µF	PCB1	10 5A
C95	250VDC 2µF	PCB1	10 5A
C96	250VDC 2µF	PCB1	10 5A
C97	250VDC 2µF	PCB1	10 5A
C98	250VDC 2µF	PCB1	10 5A
C99	250VDC 2µF	PCB1	10 5A
C100	250VDC 2µF	PCB1	10 5A

OPTIONS	
FU/OPT	250V 80A

ECN	DATE	BY	APPROVED:
			<i>[Signature]</i>

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DRAWN: DA 7/19/93		TITLE: VT130H2U2110	
CHECKED: <i>[Signature]</i>		DRAWING NO.: H2-2110	
APPROVED: <i>[Signature]</i>		REV: 0	



COMPONENTS			
C1, C1A	400VDC 2700µF	MS1	230VAC 20A
C7, C7A	630VDC 0.22µF	MSX	24VDC 20A
C8, C8A	230VDC 0.22µF	MSX	24VDC 20A
C9, C9A	230VDC 0.22µF	MSX	24VDC 20A
C6, C6A	800VDC 2µF	MSX	24VDC 20A
C7A	630VDC 0.22µF	MSX	24VDC 20A
C8A	230VDC 0.22µF	MSX	24VDC 20A
C9A	230VDC 0.22µF	MSX	24VDC 20A
FU1	250V 100A	MSX	24VDC 20A
FU2	250V 100A	MSX	24VDC 20A
IGBT 1-3	600V 100A	MSX	24VDC 20A
MOV 1-3	450VDC 150J	MSX	24VDC 20A

OPTIONS	
FU/DPT	250V 100A

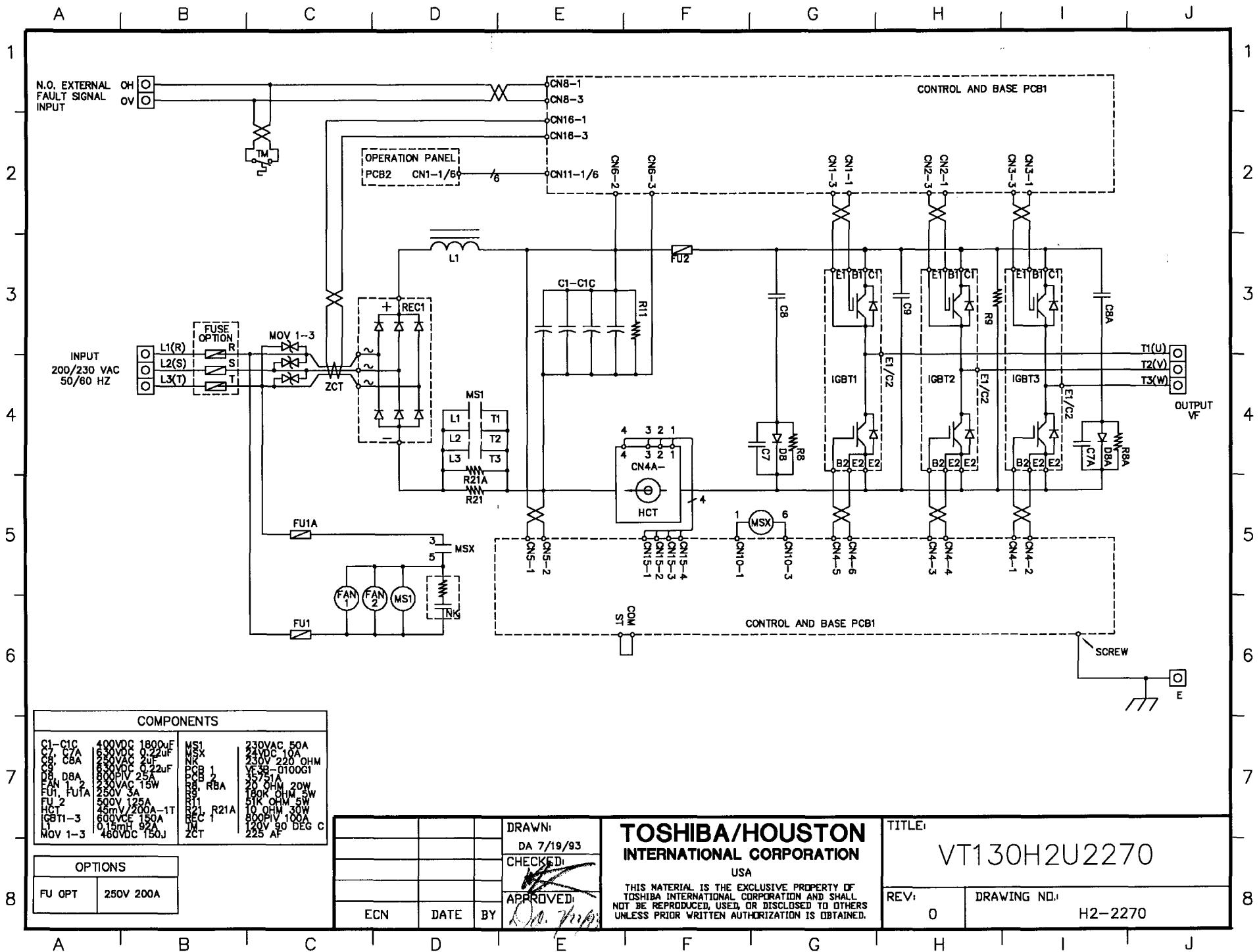
ECN	DATE	BY	DRAWN: DA 7/19/93 CHECKED: <i>RB</i> APPROVED: <i>RB</i>
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TITLE:
VT130H2U2160

REV: 0 DRAWING NO.: H2-2160



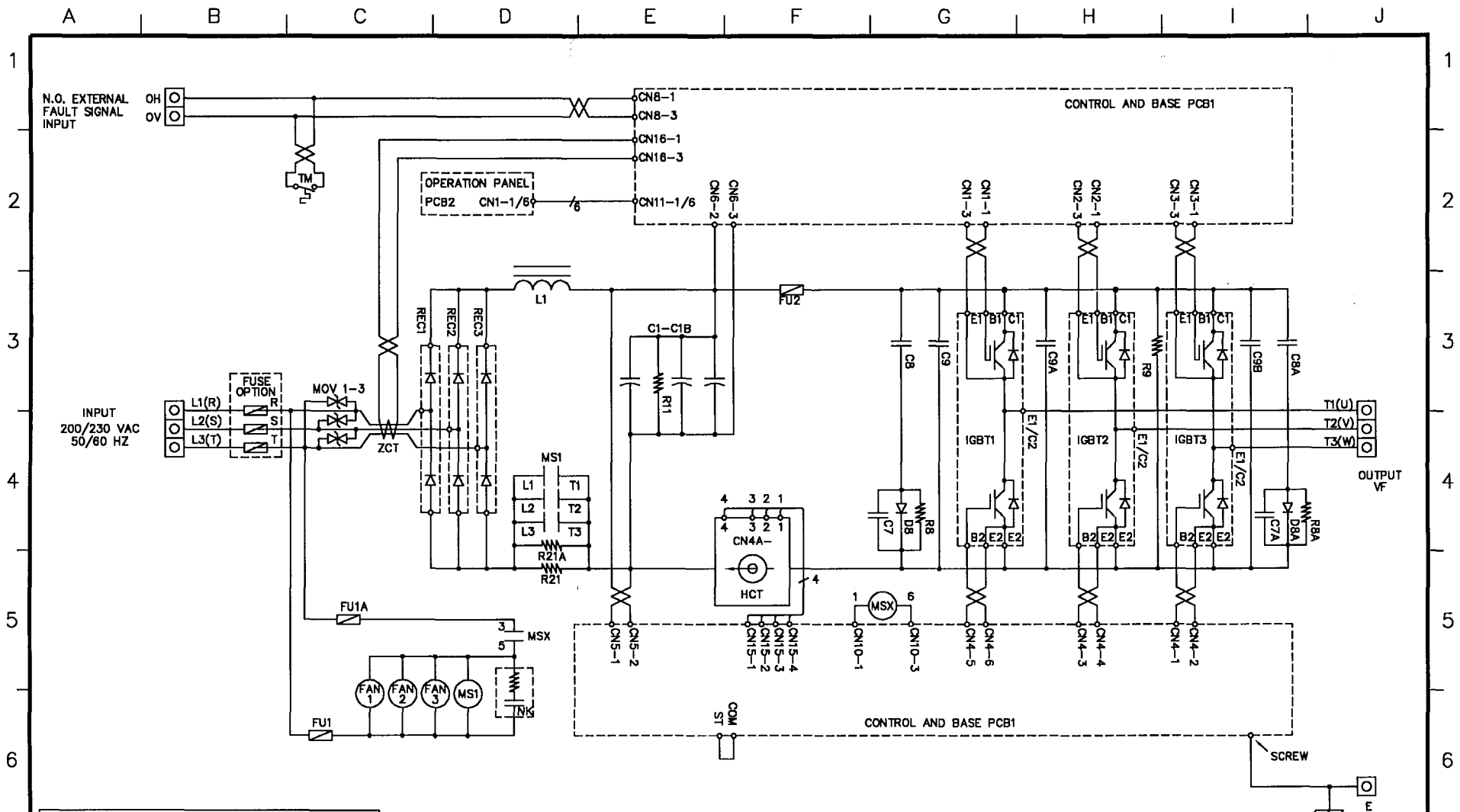
COMPONENTS			
C1-C1C	400VDC 1800µF	MS1	230VAC 50A
C7, C8A	650VAC 0.22µF	MSX	230VDC 10A
C8, C8A	650VAC 2µF	NK	230V 220 OHM
C9	650VDC 0.22µF	PCB 1	VE38-0100G1
DB, DBA	8000DIV 25A	PCB 2	3575-1A
FAN 1, FAN 2	250VAC 15W	R8, RBA	20 OHM 20W
FU1, FU1A	250V 3A	R9	180K OHM 5W
FU2	500V 125A	R11	51K OHM 5W
HCT	45mV/200A-1T	R21, R21A	10 OHM 30W
IGBT1-3	600VCE 150A	REC 1	8000DIV 100A
L1	0.15mH 82A	R	120V 90 DEG C
MOV 1-3	450VDC 150J	ZCT	225 AF

OPTIONS	
FU OPT	250V 200A

ECN	DATE	BY	APPROVED:
			<i>[Signature]</i>

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TITLE:		VT130H2U2270	
REV:	0	DRAWING NO.:	H2-2270



COMPONENTS			
C1-C1B	400VDC 3300uF	MS1	230VAC 50A
C7-C7A	650VAC 0.22uF	MSX	54VDC 10A
C8-C8B	250VAC 2uF	PCB 1	230V 220 OHM
D8-D8A	1000VDC 0.47uF	PCB 2	VE-38-010082
FAN 1, 2	800DIV 25A	R8	35751A
FAN 3	330VAC 12W	R9	70 OHM 20W
FU1, FU1A	330VAC 12W	R21	180K OHM 5W
FU 2	250V 3A	R21A	51K OHM 10W
HCT	500V 150A	REC 1-3	10 OHM 30W
IGBT1-3	45mV 200A-1T	TM	800DIV 110A
MOV 1-3	0.1TH 114A	ZCT	120V 90 DEG C
	480VDC 150J		225 AF

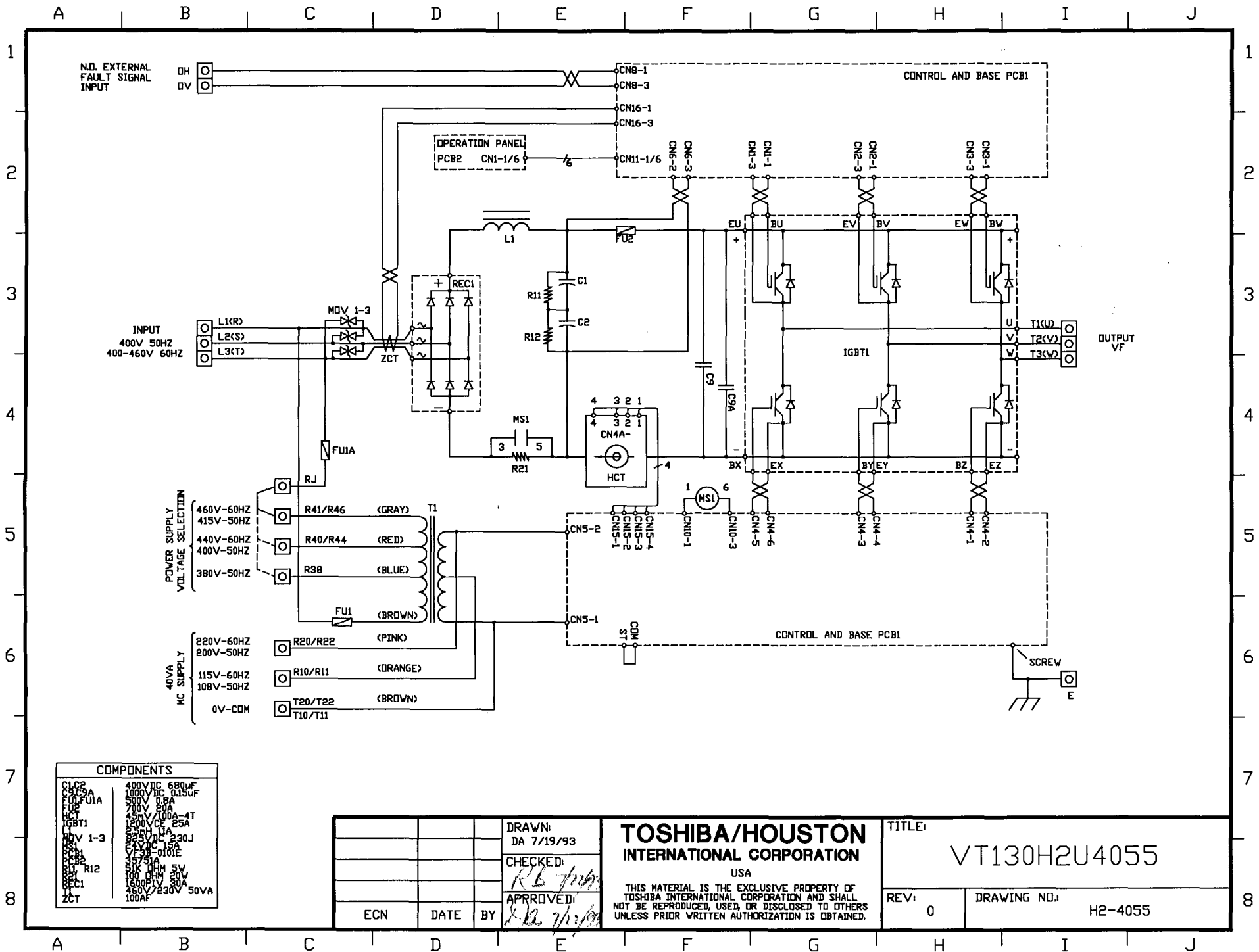
OPTIONS	
FU OPT	250V 200A

ECN	DATE	BY	APPROVED:
			<i>DA 7/29/93</i>

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TITLE:	
VT130H2U2330	
REV: 0	DRAWING NO.: H2-2330



N.D. EXTERNAL
FAULT SIGNAL
INPUT

INPUT
400V 50HZ
400-460V 60HZ

POWER SUPPLY
VOLTAGE SELECTION

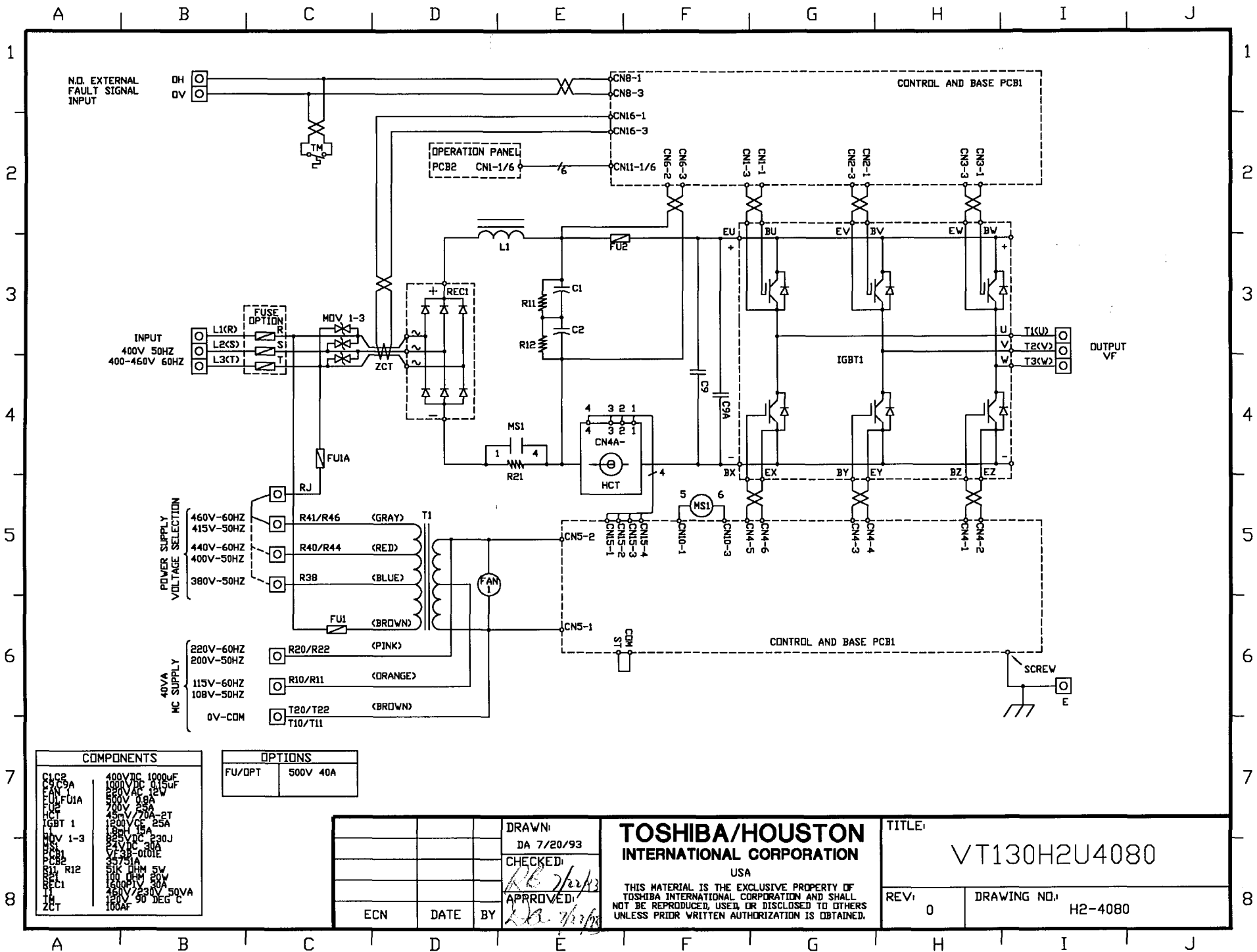
40VA
MC SUPPLY

COMPONENTS	
CLCS	400VDC 680UF
CLCSA	1000VDC 0.15UF
FU1, FU1A	500V 0.8A
FU2	70V 20A
IGBT1	120V 40A 4T
MOV 1-3	825VDC 230J
MS1	24VDC 25A
PCB1	1.5% 010E
PCB2	357 31A
RJ	20K OHM 5V
R1, R12	160V 30A
RECI	450V/230V 50VA
ZCT	100AF

ECN	DATE	BY	DRAWN: DA 7/19/93 CHECKED: <i>R.B. 7/19/93</i> APPROVED: <i>R.B. 7/19/93</i>
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TITLE: VT130H2U4055	
REV: 0	DRAWING NO.: H2-4055



COMPONENTS	
CLC2	400VDC 1000µF
C9	1000VDC 0.15µF
FAN	500V 0.8A
FU1	500V 25A
FU2	700V 25A
HCT	45V/70A-PT
IGBT 1	120V/25A
L1	150V/25A
MOV 1-3	85VDC 230J
R11	5V 0.1W
R12	5V 0.1W
R20	5V 0.1W
R22	5V 0.1W
R38	5V 0.1W
R40	5V 0.1W
R44	5V 0.1W
R46	5V 0.1W
T10	450V/230V 50VA
T11	120V 90 DEG C
T20	100AF
T22	100AF
ZCT	

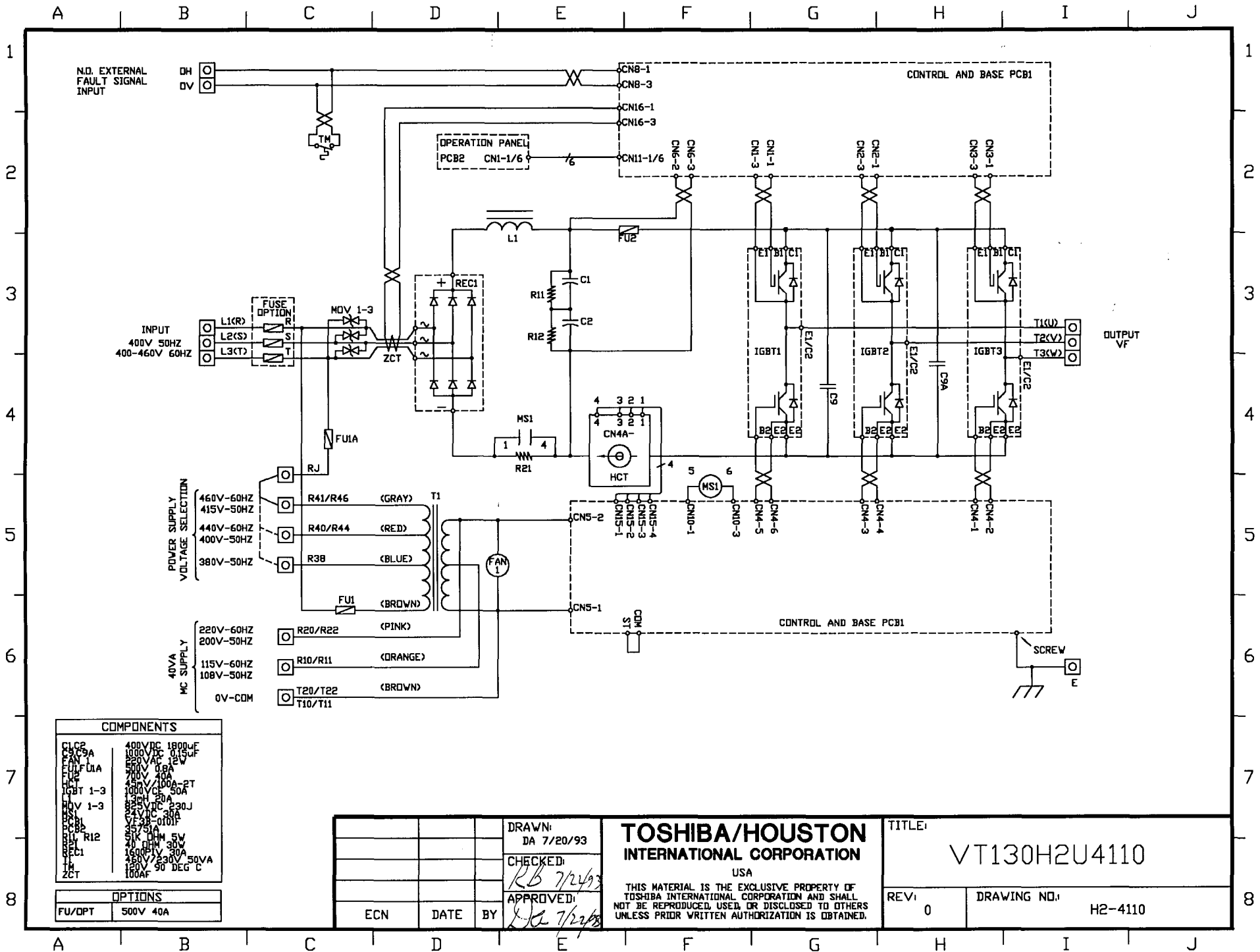
OPTIONS	
FU/DPT	500V 40A

ECN	DATE	BY

DRAWN:
 DA 7/20/93
 CHECKED:
 APPROVED:

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TITLE:	
VT130H2U4080	
REV: 0	DRAWING NO.: H2-4080



COMPONENTS	
CLC2	400VDC 1800uF
CAC3A	1000VAC 0.15uF
FULFU1A	500VAC 12.5A
FU2	720V 40A
IGBT 1-3	1200V 100A-FT
MOV 1-3	150V 25A
MOV 1-3	825VDC 220J
PCB1	45VDC 50A
PCB2	15VDC 0101
R11	3575A
R12	51K OHM 5W
REC1	41TDM 30A
T1	1500V 230V 50VA
T2	450V 90 DEG C
ZCT	100AF

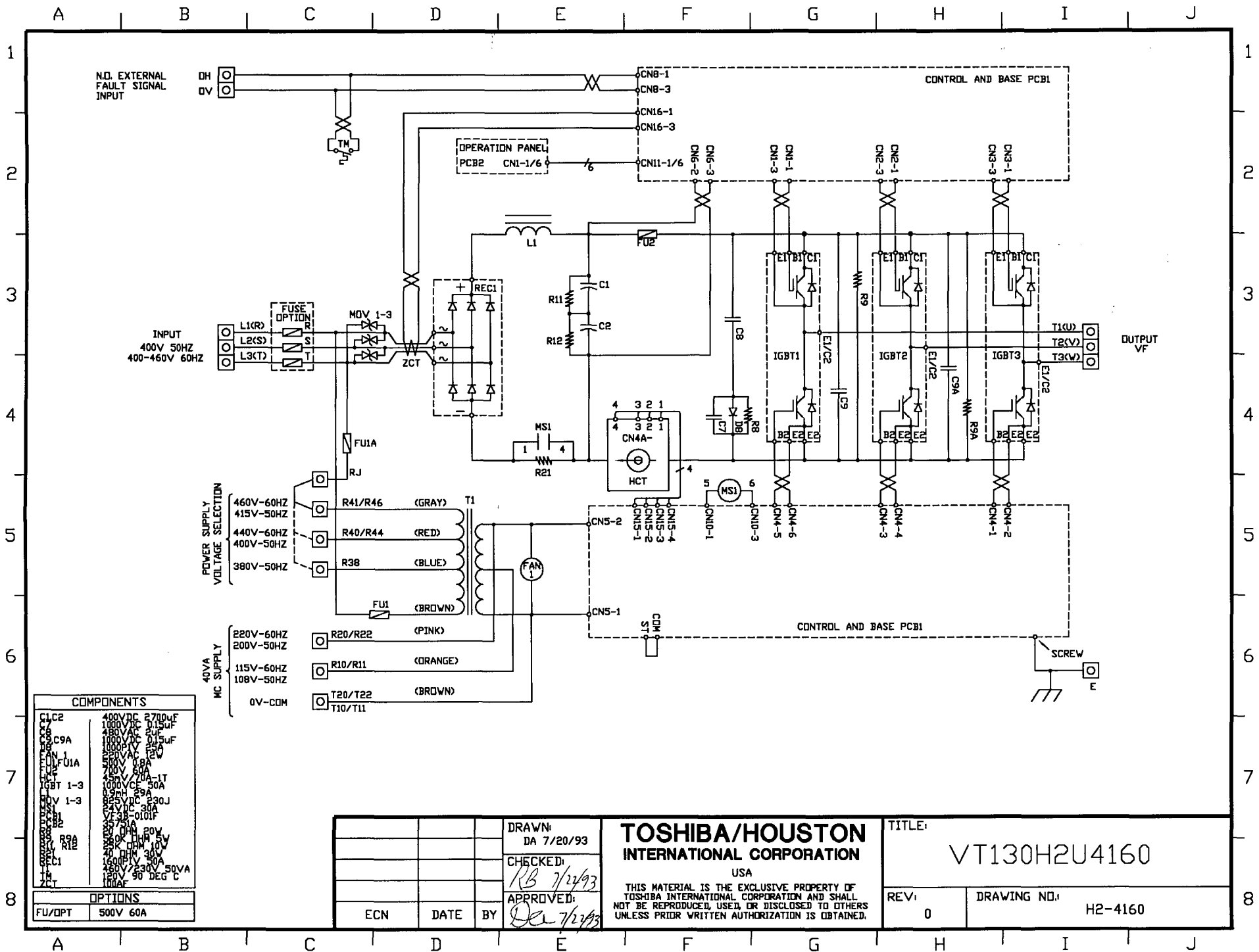
OPTIONS	
FU/DPT	500V 40A

ECN	DATE	BY	DRAWN: DA 7/20/93 CHECKED: RB 7/24/93 APPROVED: 7/24/93
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TITLE: VT130H2U4110	
REV: 0	DRAWING NO.: H2-4110



COMPONENTS	
CLC2	400VDC 2700uF
C1	1000VDC 0.15uF
C2	480VAC 2uF
C8	1000VDC 0.15uF
C9A	1000VDC 0.15uF
C9B	1000VDC 0.15uF
C9C	1000VDC 0.15uF
FAN 1	220VAC 120
FU1A	500V 0.8A
FU1	250V 0.8A
IGBT 1-3	480V 50A-1T
MOV 1-3	1000V 50A
MS1	100V 29
PCB2	24VDC 30A
PCB1	24VDC 30A
R20	20V 0.1W
R22	20V 0.1W
R10	20V 0.1W
R11	20V 0.1W
REC1	1600V 30A
T1	480V 230V 50VA
T10	120V 90 DEG C
T11	100VAC

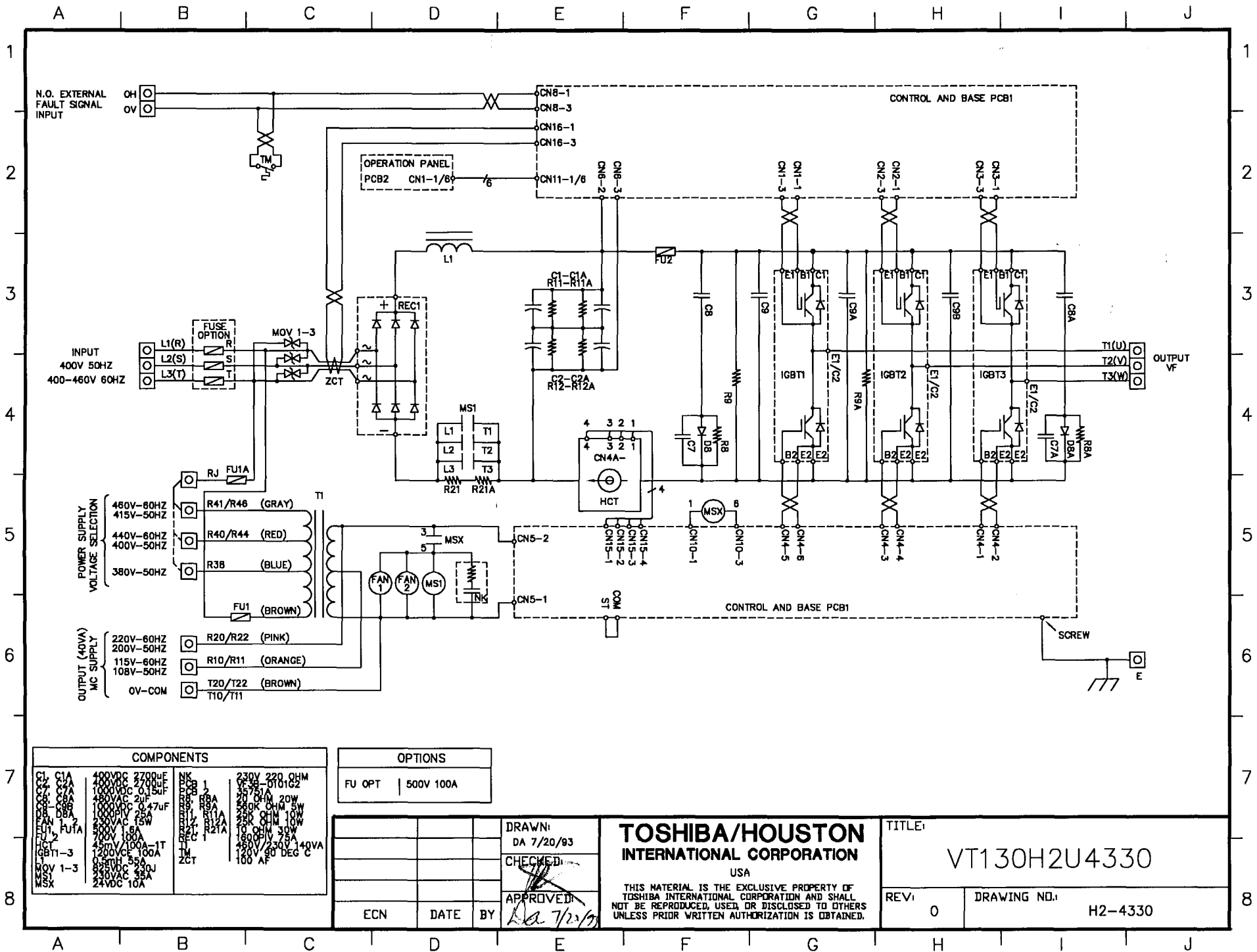
OPTIONS	
FU/DPT	500V 60A

ECN	DATE	BY
		DA 7/20/93
		RB 7/24/93
		DA 7/24/93

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TITLE: VT130H2U4160	
REV: 0	DRAWING NO.: H2-4160



COMPONENTS	
C1, C1A	400VDC 2700uF
C2, C2A	400VDC 0.1uF
C3, C3A	1000VDC 0.15uF
C4, C4A	450VAC 2uF
C5, C5A	1000VDC 0.47uF
C6, C6A	500VAC 15uF
C7, C7A	500VAC 15uF
FU1, FU2	500V 10A
FU1-2	700V 100A
HCT	420V 100A-1T
IGBT1-3	1200VCE 100A
MOV 1-3	0.35uF 50A
MSX	825VDC 32A
	22VDC 10A

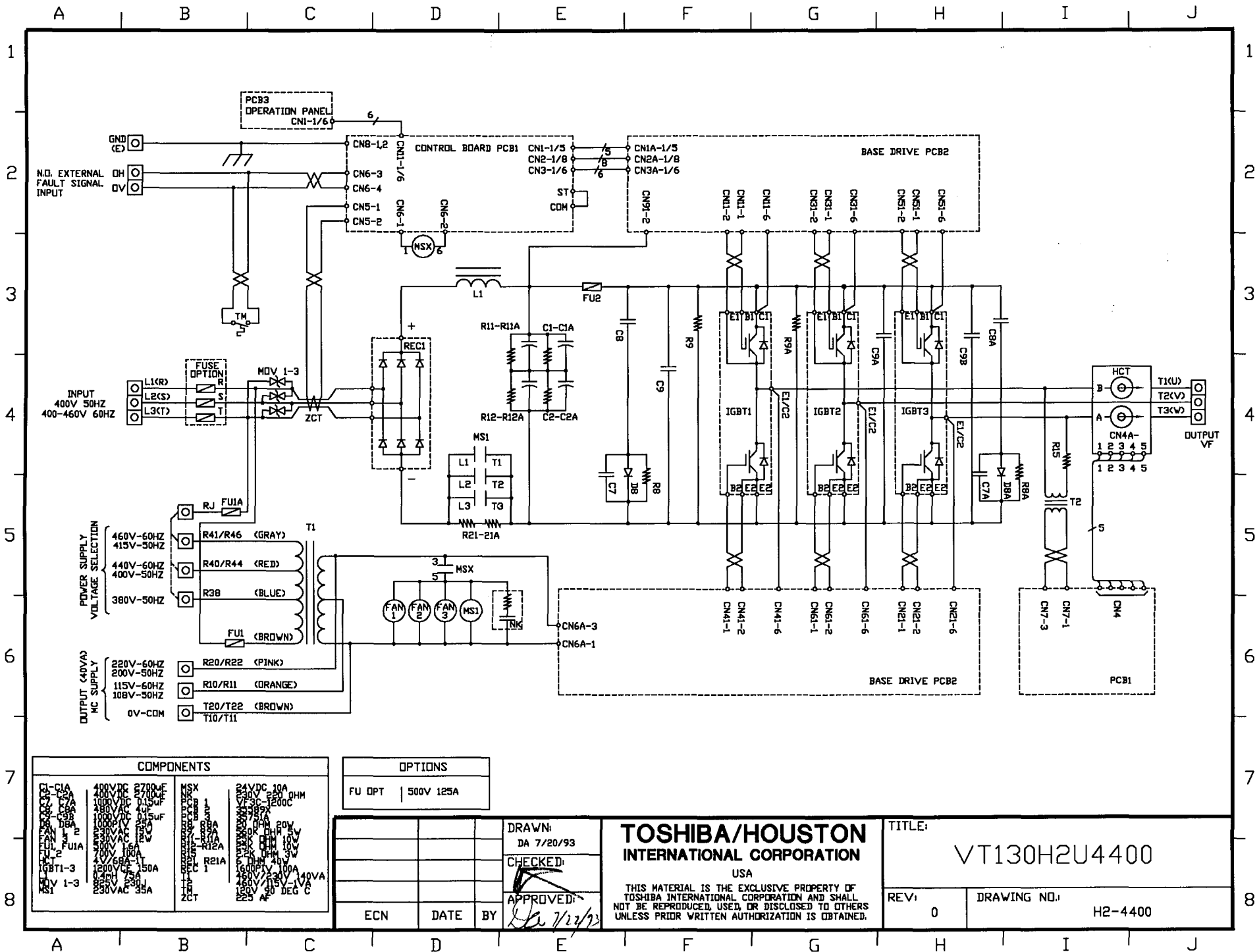
OPTIONS	
FU OPT	500V 100A

ECN	DATE	BY
		DA 7/20/93

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TITLE:	
VT130H2U4330	
REVI: 0	DRAWING NO.: H2-4330



COMPONENTS	
C1-C1A	400VDC 2700µF
C2-C2A	400VDC 2700µF
C8	1000µF 200V
C9	1000µF 200V
C7A	1000µF 200V
C7B	1000µF 200V
C7C	1000µF 200V
FAN 1-3	1200V 150A
MSX	24VDC 10A
R11-R11A	200V 10W
R12-R12A	200V 10W
R20-R22	220V 10W
R10/R11	115V 10W
T20/T22	108V 10W
T10/T11	0V-COM
ZCT	225 AF

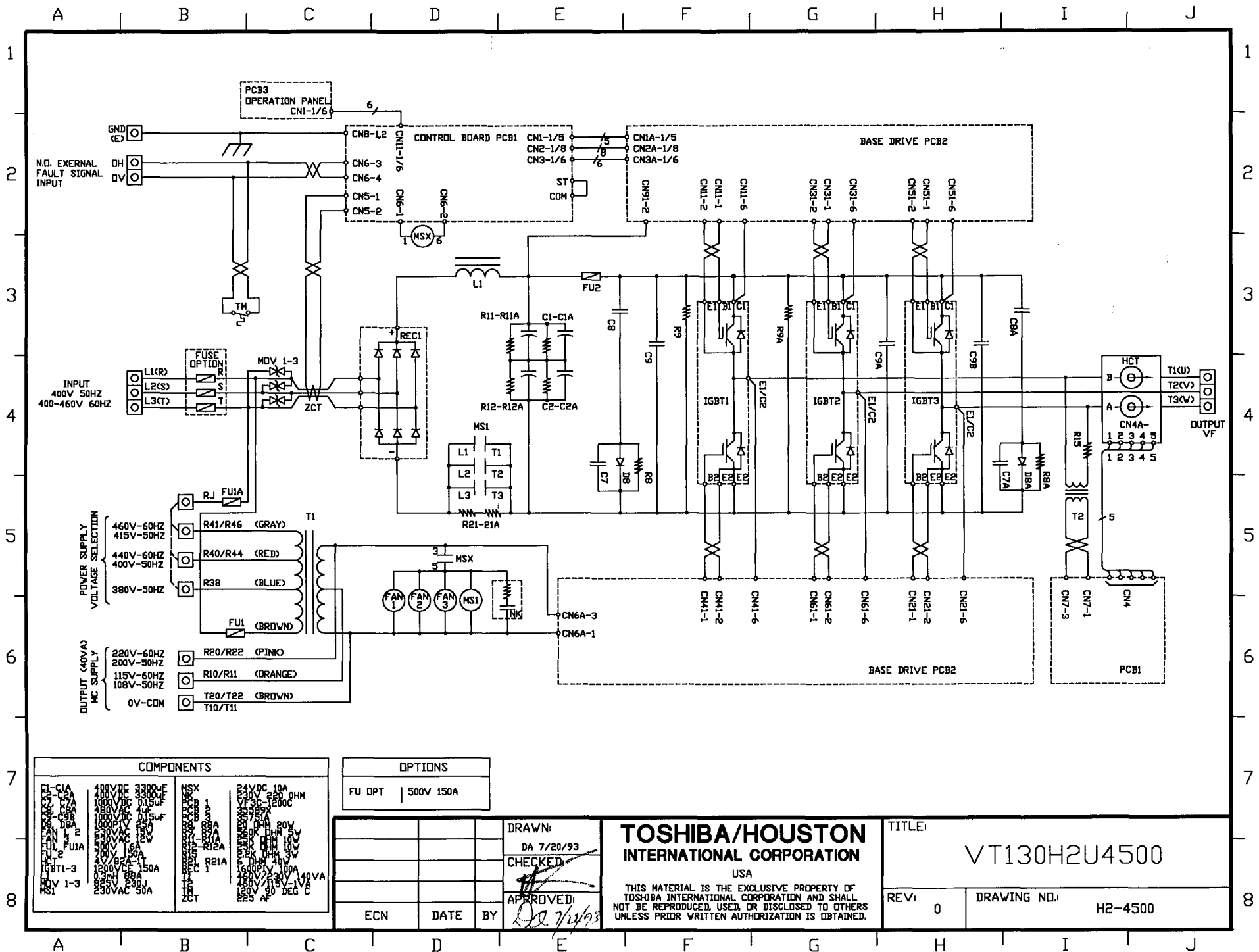
OPTIONS	
FU OPT	500V 125A

ECN	DATE	BY	APPROVED:
			<i>[Signature]</i> 7/27/93

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TITLE:		VT130H2U4400	
REV:	0	DRAWING NO.:	H2-4400



COMPONENTS	
CI-C1A	480VDC 3300UF
CI-C2A	480VDC 3300UF
CI-C1B	480VDC 0.15UF
CI-C2B	480VDC 0.15UF
CI-C1C	3000VAC 0.15UF
CI-C2C	3000VAC 0.15UF
FAN 1-3	230VAC 150W
FU1	230VAC 150A
FU2	230VAC 150A
IGBT1-3	1200VDC 150A
MOV 1-3	825V 230V
MS1	230VAC 50A
ZCT	
MSX	24VDC 10A
R11-R12A	230V 200C OHM
R12-R12A	230V 200C OHM
R20/R22	230V 200C OHM
R10/R11	230V 200C OHM
T20/T22	230V 200C OHM
T10/T11	230V 200C OHM

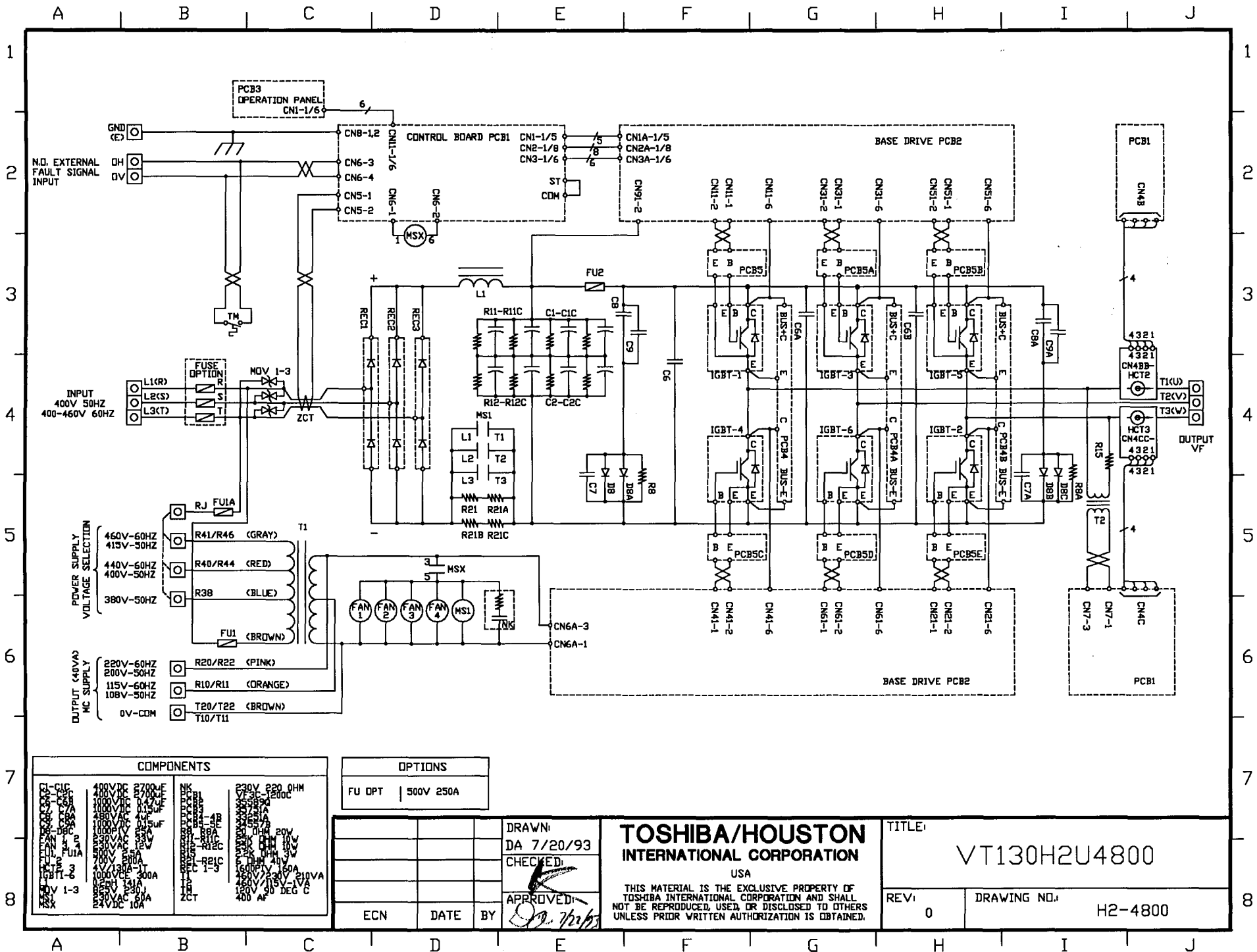
OPTIONS	
FU OPT	500V 150A

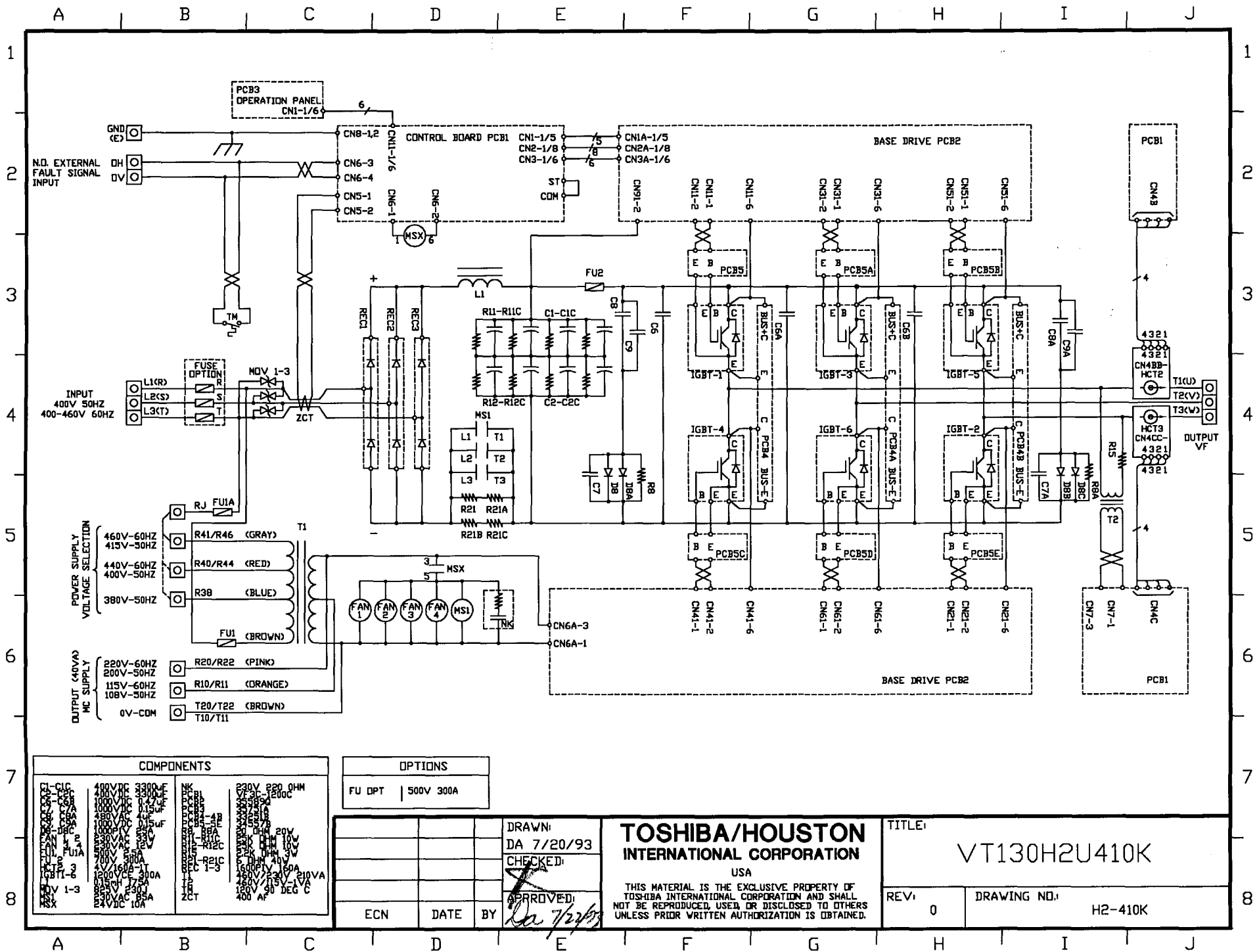
ECN	DATE	BY	APPROVED:
			<i>[Signature]</i>

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TITLE: VT130H2U4500	
REV: 0	DRAWING NO.: H2-4500





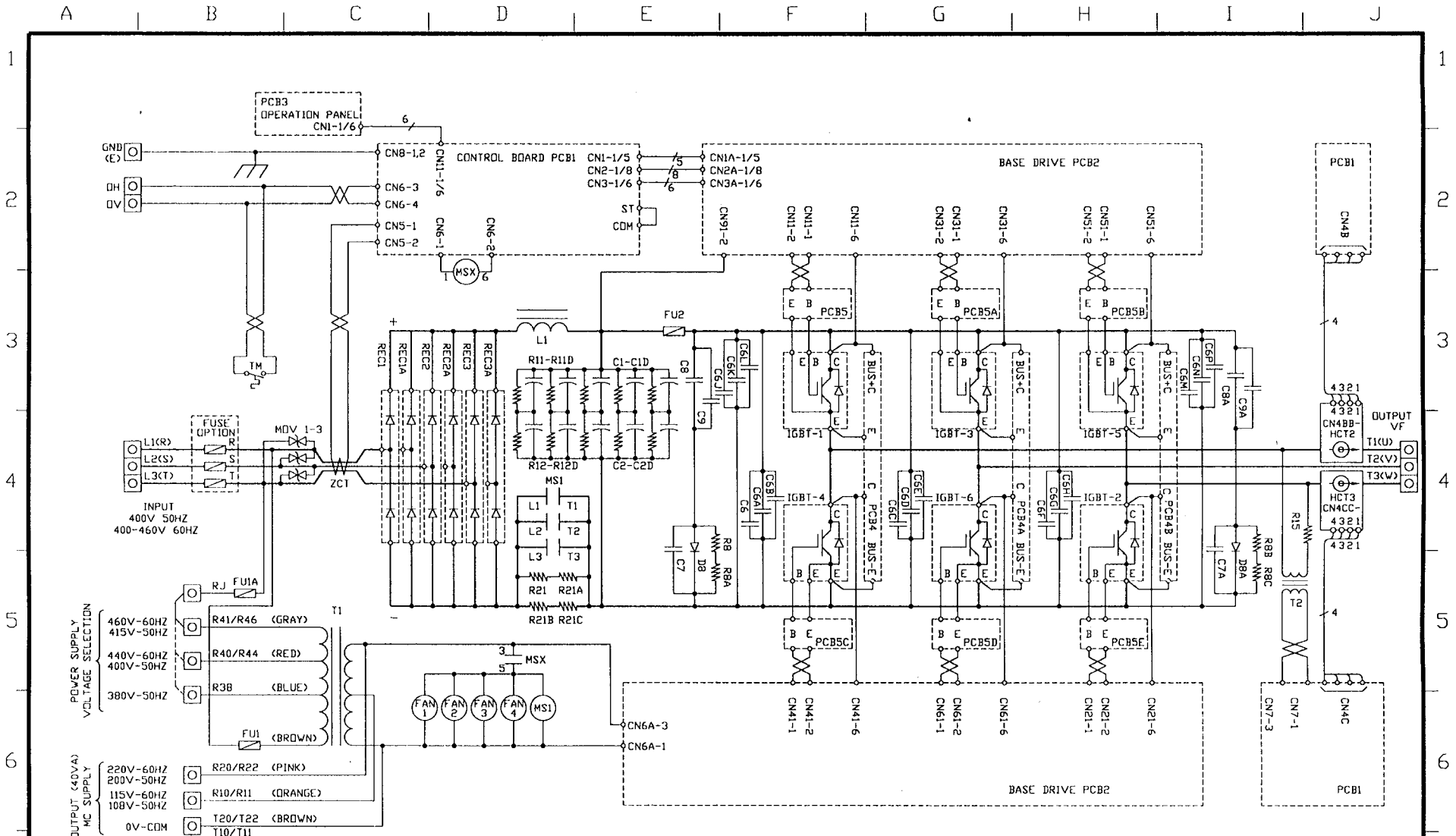
COMPONENTS	
C1	400V 100 3300UF
C2	400V 100 3300UF
C3	400V 100 3300UF
C4	400V 100 3300UF
C5	400V 100 3300UF
C6	400V 100 3300UF
C7	400V 100 3300UF
C8	400V 100 3300UF
C9	400V 100 3300UF
C10	400V 100 3300UF
C11	400V 100 3300UF
C12	400V 100 3300UF
C13	400V 100 3300UF
C14	400V 100 3300UF
C15	400V 100 3300UF
C16	400V 100 3300UF
C17	400V 100 3300UF
C18	400V 100 3300UF
C19	400V 100 3300UF
C20	400V 100 3300UF
C21	400V 100 3300UF
C22	400V 100 3300UF
C23	400V 100 3300UF
C24	400V 100 3300UF
C25	400V 100 3300UF
C26	400V 100 3300UF
C27	400V 100 3300UF
C28	400V 100 3300UF
C29	400V 100 3300UF
C30	400V 100 3300UF
C31	400V 100 3300UF
C32	400V 100 3300UF
C33	400V 100 3300UF
C34	400V 100 3300UF
C35	400V 100 3300UF
C36	400V 100 3300UF
C37	400V 100 3300UF
C38	400V 100 3300UF
C39	400V 100 3300UF
C40	400V 100 3300UF
C41	400V 100 3300UF
C42	400V 100 3300UF
C43	400V 100 3300UF
C44	400V 100 3300UF
C45	400V 100 3300UF
C46	400V 100 3300UF
C47	400V 100 3300UF
C48	400V 100 3300UF
C49	400V 100 3300UF
C50	400V 100 3300UF
C51	400V 100 3300UF
C52	400V 100 3300UF
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C81	400V 100 3300UF
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C85	400V 100 3300UF
C86	400V 100 3300UF
C87	400V 100 3300UF
C88	400V 100 3300UF
C89	400V 100 3300UF
C90	400V 100 3300UF
C91	400V 100 3300UF
C92	400V 100 3300UF
C93	400V 100 3300UF
C94	400V 100 3300UF
C95	400V 100 3300UF
C96	400V 100 3300UF
C97	400V 100 3300UF
C98	400V 100 3300UF
C99	400V 100 3300UF
C100	400V 100 3300UF

OPTIONS	
FU DPT	500V 300A

ECN	DATE	BY	APPROVED:
			<i>Da 7/20/93</i>

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TITLE: VT130H2U410K	
REV: 0	DRAWING NO.: H2-410K



- POWER SUPPLY VOLTAGE SELECTION
- 460V-60HZ
 - 415V-50HZ
 - 440V-60HZ
 - 400V-50HZ
 - 380V-50HZ
- OUTPUT (400VA) MC SUPPLY
- 220V-60HZ
 - 200V-50HZ
 - 115V-60HZ
 - 100V-50HZ
 - 0V-COM

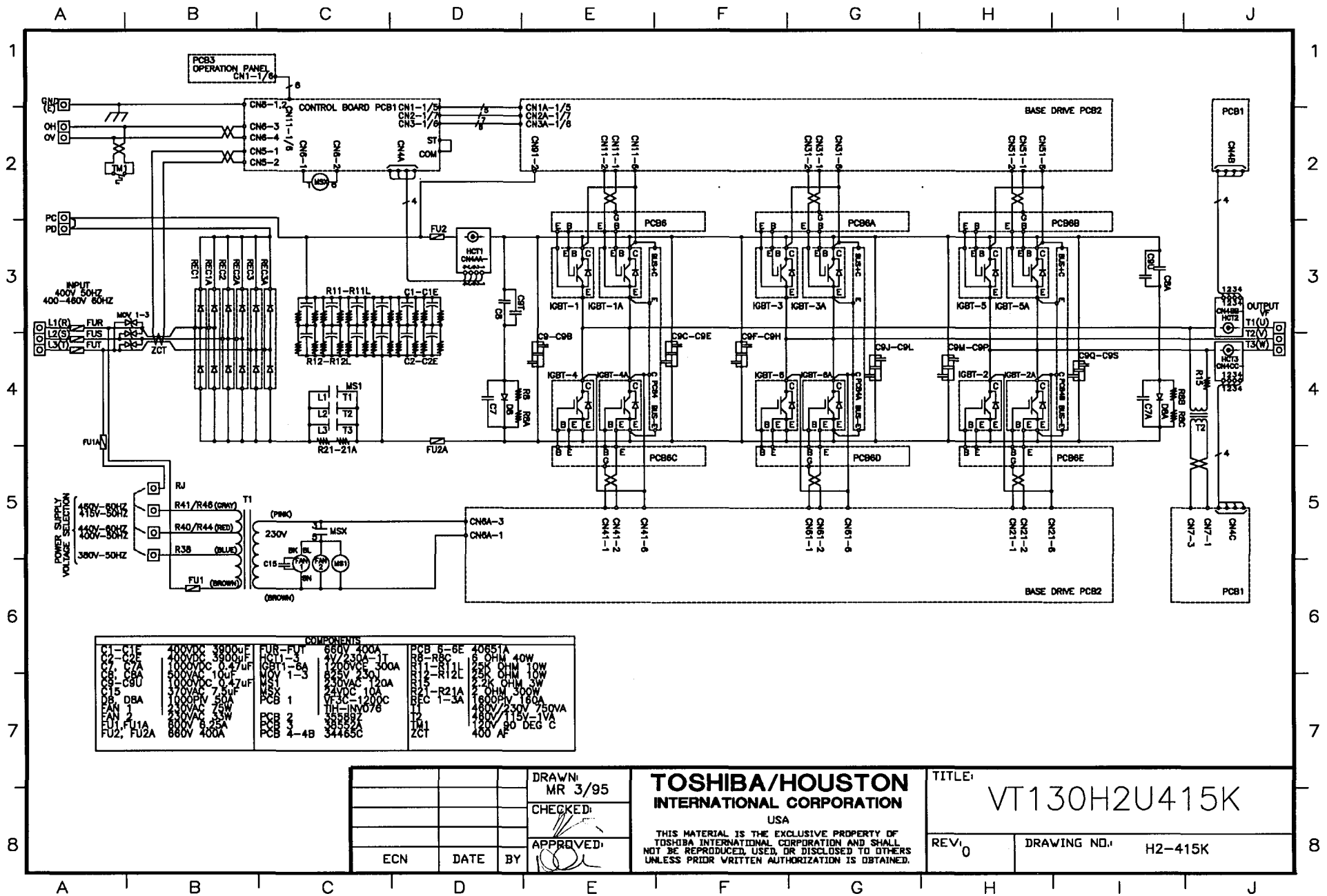
COMPONENTS		
C1-C1D	400VDC 3300uF	PCB1 VF3C-1200C
C2-C2D	400VDC 3300uF	PCB2 T1H-1N076
C6-C6F	1000VDC 0.47uF	PCB3 35289L
C7	1000VDC 0.47uF	PCB4 38552A
C8	480VAC 4uF	PCB4-4B 33251C
C9	1000VDC 0.15uF	PCB5-5B 34557D
CBA	1000PTV 50A	PCB5-5B 34557D
DBA	240VAC 33W	PCB5-5B 34557D
FAN 1, 2	240VAC 12W	PCB5-5B 34557D
FAN 3, 4	240VAC 12W	PCB5-5B 34557D
FU1	500V 25A	PCB5-5B 34557D
FU2	700V 400A	PCB5-5B 34557D
L1C12	4V/212A-11	PCB5-5B 34557D
IGBT1-6	1200VDC 400A	PCB5-5B 34557D
I1	0.25mH 20A	PCB5-5B 34557D
MDV 1-3	825V 230A	PCB5-5B 34557D
MS1	230VAC 85A	PCB5-5B 34557D
MSX	24VDC 10A	PCB5-5B 34557D
ZCT		PCB5-5B 34557D

OPTIONS	
FU OPT	500V 400A

DRAWN:	MR 12/94
CHECKED:	
APPROVED:	<i>[Signature]</i> 12/94
ECN	DATE BY

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TITLE:	VT130H2U412K	
REV:	0	DRAWING NO.: H2-412K

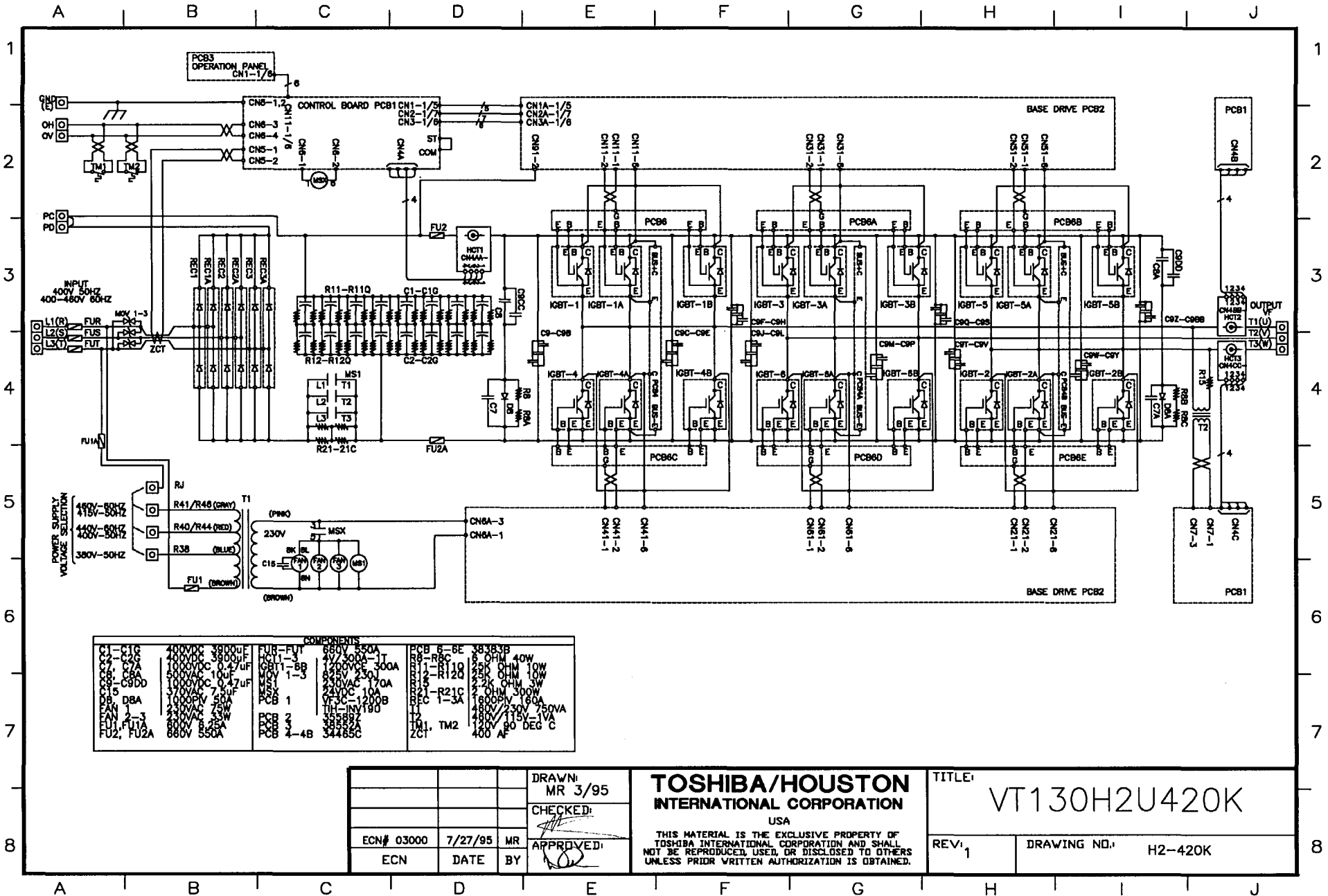


COMPONENTS		
C1 - C1E	400VDC 3900µF	FUR - FU1
C2	400VDC 3900µF	FUR - FU2
C3	400VDC 3900µF	IGBT-1
C4	400VDC 3900µF	IGBT-1A
C5	400VDC 3900µF	IGBT-2
C6	400VDC 3900µF	IGBT-2A
C7	400VDC 3900µF	IGBT-3
C8	400VDC 3900µF	IGBT-3A
C9	400VDC 3900µF	IGBT-4
C10	400VDC 3900µF	IGBT-4A
C11	400VDC 3900µF	IGBT-5
C12	400VDC 3900µF	IGBT-5A
C13	400VDC 3900µF	IGBT-6
C14	400VDC 3900µF	IGBT-6A
C15	400VDC 3900µF	MSK
R11 - R12	660V 400A	PCB 6-6E
R21 - R21A	660V 300A	PCB 6-6E
R38	240VAC 10A	PCB 6-6E
T1	240VAC 10A	PCB 6-6E
FU1, FU2	1000V 25A	PCB 6-6E
FU1A, FU2A	880V 400A	PCB 6-6E

ECN	DATE	BY	APPROVED:
			<i>[Signature]</i>

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DRAWN: MR 3/95		TITLE: VT130H2U415K	
CHECKED:		REV: 0	DRAWING NO: H2-415K
APPROVED:			



COMPONENTS			
C1-C10	4000VDC 3800UF	FUR-FU7	650V 550A
C7-C9A	4000VDC 3800UF	MSK	1 1/2 300V 300A
C7-C9B	1000VDC 0.47UF	MSK	1 1/2 300V 300A
C7-C9C	1000VDC 0.47UF	MSK	1 1/2 300V 300A
C7-C9D	1000VDC 0.47UF	MSK	1 1/2 300V 300A
C15	3700VDC 5UF	MSK	1 1/2 300V 300A
D5	1000VDC 0.47UF	MSK	1 1/2 300V 300A
DBA	230VAC 750VA	MSK	1 1/2 300V 300A
DBB	230VAC 750VA	MSK	1 1/2 300V 300A
DBC	230VAC 750VA	MSK	1 1/2 300V 300A
FU1	800V 550A	MSK	1 1/2 300V 300A
FU2, FU2A	800V 550A	MSK	1 1/2 300V 300A
R11-R110	230VAC 100A	MSK	1 1/2 300V 300A
R12-R120	230VAC 100A	MSK	1 1/2 300V 300A
R21-21C	230VAC 100A	MSK	1 1/2 300V 300A
R38	230VAC 100A	MSK	1 1/2 300V 300A
R40/R44	230VAC 100A	MSK	1 1/2 300V 300A
R41/R46	230VAC 100A	MSK	1 1/2 300V 300A
R7	230VAC 100A	MSK	1 1/2 300V 300A
R8	230VAC 100A	MSK	1 1/2 300V 300A
R9	230VAC 100A	MSK	1 1/2 300V 300A
R10	230VAC 100A	MSK	1 1/2 300V 300A
R11	230VAC 100A	MSK	1 1/2 300V 300A
R12	230VAC 100A	MSK	1 1/2 300V 300A
R13	230VAC 100A	MSK	1 1/2 300V 300A
R14	230VAC 100A	MSK	1 1/2 300V 300A
R15	230VAC 100A	MSK	1 1/2 300V 300A
R16	230VAC 100A	MSK	1 1/2 300V 300A
R17	230VAC 100A	MSK	1 1/2 300V 300A
R18	230VAC 100A	MSK	1 1/2 300V 300A
R19	230VAC 100A	MSK	1 1/2 300V 300A
R20	230VAC 100A	MSK	1 1/2 300V 300A
R21	230VAC 100A	MSK	1 1/2 300V 300A
R22	230VAC 100A	MSK	1 1/2 300V 300A
R23	230VAC 100A	MSK	1 1/2 300V 300A
R24	230VAC 100A	MSK	1 1/2 300V 300A
R25	230VAC 100A	MSK	1 1/2 300V 300A
R26	230VAC 100A	MSK	1 1/2 300V 300A
R27	230VAC 100A	MSK	1 1/2 300V 300A
R28	230VAC 100A	MSK	1 1/2 300V 300A
R29	230VAC 100A	MSK	1 1/2 300V 300A
R30	230VAC 100A	MSK	1 1/2 300V 300A
R31	230VAC 100A	MSK	1 1/2 300V 300A
R32	230VAC 100A	MSK	1 1/2 300V 300A
R33	230VAC 100A	MSK	1 1/2 300V 300A
R34	230VAC 100A	MSK	1 1/2 300V 300A
R35	230VAC 100A	MSK	1 1/2 300V 300A
R36	230VAC 100A	MSK	1 1/2 300V 300A
R37	230VAC 100A	MSK	1 1/2 300V 300A
R38	230VAC 100A	MSK	1 1/2 300V 300A
R39	230VAC 100A	MSK	1 1/2 300V 300A
R40	230VAC 100A	MSK	1 1/2 300V 300A
R41	230VAC 100A	MSK	1 1/2 300V 300A
R42	230VAC 100A	MSK	1 1/2 300V 300A
R43	230VAC 100A	MSK	1 1/2 300V 300A
R44	230VAC 100A	MSK	1 1/2 300V 300A
R45	230VAC 100A	MSK	1 1/2 300V 300A
R46	230VAC 100A	MSK	1 1/2 300V 300A
R47	230VAC 100A	MSK	1 1/2 300V 300A
R48	230VAC 100A	MSK	1 1/2 300V 300A
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R53	230VAC 100A	MSK	1 1/2 300V 300A
R54	230VAC 100A	MSK	1 1/2 300V 300A
R55	230VAC 100A	MSK	1 1/2 300V 300A
R56	230VAC 100A	MSK	1 1/2 300V 300A
R57	230VAC 100A	MSK	1 1/2 300V 300A
R58	230VAC 100A	MSK	1 1/2 300V 300A
R59	230VAC 100A	MSK	1 1/2 300V 300A
R60	230VAC 100A	MSK	1 1/2 300V 300A
R61	230VAC 100A	MSK	1 1/2 300V 300A
R62	230VAC 100A	MSK	1 1/2 300V 300A
R63	230VAC 100A	MSK	1 1/2 300V 300A
R64	230VAC 100A	MSK	1 1/2 300V 300A
R65	230VAC 100A	MSK	1 1/2 300V 300A
R66	230VAC 100A	MSK	1 1/2 300V 300A
R67	230VAC 100A	MSK	1 1/2 300V 300A
R68	230VAC 100A	MSK	1 1/2 300V 300A
R69	230VAC 100A	MSK	1 1/2 300V 300A
R70	230VAC 100A	MSK	1 1/2 300V 300A
R71	230VAC 100A	MSK	1 1/2 300V 300A
R72	230VAC 100A	MSK	1 1/2 300V 300A
R73	230VAC 100A	MSK	1 1/2 300V 300A
R74	230VAC 100A	MSK	1 1/2 300V 300A
R75	230VAC 100A	MSK	1 1/2 300V 300A
R76	230VAC 100A	MSK	1 1/2 300V 300A
R77	230VAC 100A	MSK	1 1/2 300V 300A
R78	230VAC 100A	MSK	1 1/2 300V 300A
R79	230VAC 100A	MSK	1 1/2 300V 300A
R80	230VAC 100A	MSK	1 1/2 300V 300A
R81	230VAC 100A	MSK	1 1/2 300V 300A
R82	230VAC 100A	MSK	1 1/2 300V 300A
R83	230VAC 100A	MSK	1 1/2 300V 300A
R84	230VAC 100A	MSK	1 1/2 300V 300A
R85	230VAC 100A	MSK	1 1/2 300V 300A
R86	230VAC 100A	MSK	1 1/2 300V 300A
R87	230VAC 100A	MSK	1 1/2 300V 300A
R88	230VAC 100A	MSK	1 1/2 300V 300A
R89	230VAC 100A	MSK	1 1/2 300V 300A
R90	230VAC 100A	MSK	1 1/2 300V 300A
R91	230VAC 100A	MSK	1 1/2 300V 300A
R92	230VAC 100A	MSK	1 1/2 300V 300A
R93	230VAC 100A	MSK	1 1/2 300V 300A
R94	230VAC 100A	MSK	1 1/2 300V 300A
R95	230VAC 100A	MSK	1 1/2 300V 300A
R96	230VAC 100A	MSK	1 1/2 300V 300A
R97	230VAC 100A	MSK	1 1/2 300V 300A
R98	230VAC 100A	MSK	1 1/2 300V 300A
R99	230VAC 100A	MSK	1 1/2 300V 300A
R100	230VAC 100A	MSK	1 1/2 300V 300A

ECN#	03000	DATE	7/27/95	MR	
APPROVED					

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TITLE:	VT130H2U420K	
REV:	1	DRAWING NO.:
		H2-420K

TOSHIBA

TOSHIBA INTERNATIONAL CORPORATION

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