Schlumberger

Reda Production Systems

SPEEDSTAR 2000

OPERATION MANUAL
VARIABLE SPEED DRIVE

January 2001
Revision F

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 SCHLUMBERGER 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 SCHLUMBERGER's entire obligation. The warranty contained in the contract between the parties is the sole warranty of SCHLUMBERGER and any statements contained herein do not create new warranties or modify the existing warranty.

SCHLUMBERGER 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 SCHLUMBERGER, will void all warranties.

For your records, complete the following information about the drive and keep this information with the drive.

KVA Rating _____ Input Voltage _____

Type Form _____

Serial# _____

Date of Installation _____

INTRODUCTION

Thank you for purchasing the SPEEDSTAR 2000 Flux Vector variable speed drive (VSD). This adjustable frequency solid-state AC drive features a user friendly operator interface, durable oilfield packaging, and the latest in PWM drive technology. These features, combined with built-in special control features, make the SPEEDSTAR 2000 suitable for a wide variety of applications that require 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 operation manual contains a section of general safety instructions and is marked throughout with warning symbols. Read this operation manual thoroughly before installing and operating this electrical equipment.

All safety warnings must be followed to ensure personal safety.

Follow all precautions to attain proper equipment performance and longevity.

We hope that you find this operation manual informative and easy to use. For assistance with your VSD, for information on drive application schools, or for information on SCHLUMBERGER's complete line of products for pumping applications, please contact your local SCHLUMBERGER representative.

Again, thank you for your purchase of this product.

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:

 **DANGER**

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:

 **CAUTION**

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 lighting 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 and or exploding parts may cause serious injury or death if the proper precautions are not observed:

For the purpose of this manual and product labels, a Qualified Person is one who is familiar with the installation, construction, operation and maintenance of the equipment and the hazards involved. This person must:

1) Carefully read the entire operation manual.

2) Be trained and authorized to safely energize, de-energize, clear faults, ground, lockout and tag circuits and equipment in accordance with established safety practices.

3) Be trained in the proper care and use of protective equipment such as safety shoes, rubber gloves, hard hats, safety glasses, face shields, flash clothing, etc. in accordance with established safety practices.

4) Be trained in rendering first aid.

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CONTENTS (cont'd)

SECTION 1: Inspection/Storage/Disposal

Inspection of the New Unit

1) Upon receipt of the SPEEDSTAR 2000, a visual inspection for damage should be made after uncrating.

2) Check the unit for loose, broken, bent or otherwise damaged parts due to shipping.

3) Check to see that the rated capacity and the model number specified on the nameplate conform to the order specifications.

Storage

1) Store in a clean, dry, and well ventilated location; preferably in the original carton if the VSD will not be used immediately after purchase.

2) Avoid storage in locations with high humidity and dust.

3) Storage at temperatures between -25°C (-13°F) and 65°C (145°F) are permissible.

Disposal

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

Never dispose of electrical components via incineration.

SECTION 2 : Installation and Operation Safety Precautions

Installation Safety Precautions

1) Install in a secure and upright position in a well ventilated location. NEMA 3R enclosures are used in outdoor applications. If mounted in direct sun, a derating factor may be required. Temperature should be between -10° C and 50° C.

2) For NEMA 3R units, allow a clearance space of 8 inches (20 cm) for the top and 6 inches (10 cm) on both sides. Do not obstruct any of the ventilation openings. Rear ventilation requires free air flow for proper cooling. Rear access is required for fan maintenance. NEMA 1 units maybe mounted directly to wall and no side clearance is required.

3) Avoid installation in areas where high vibration, extreme heat, 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 trouble shooting 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 page 4-4).

THE METAL OF CONDUIT IS NOT AN ACCEPTABLE GROUND.

8) Use lockout/tagout procedures before connecting 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 *Selection of Main Circuit Wiring Equipment and Standard Cable Sizes* page 4-2.

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) Use separate metal conduits for routing the input power, output power, and control circuits.

11) Installation of drive systems should conform to the *National Electrical Code*, regulations of the *Occupational Safety and Health Administration*, all national, regional or industry codes and standards when installed in the United States. Other codes may apply if installed outside of the U.S.e

CAUTION

Installation Safety Precautions (cont'd)

13) Do not connect control circuit terminal block return connections marked CC to VSD earth ground terminals marked GND(E). See *Standard Connection Diagrams* page 4-5 and *Terminal Connections and Functions* page 5.3.

14) If a secondary Magnetic Contactor (MC) is used between the VSD 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 drive output terminals (U,V,W).

15) Power factor improvement capacitors or surge absorbers must not be installed on the VSD's output.

16) Only qualified personnel should install this equipment.

Operating Safety Precautions

1) Do not power up the VSD 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 +/-3 Hz of the specified input frequency.

3) Proper coordination of the motor and VSD is required. For submergible and surface motor applications, consult with REDA when utilizing this VSD for a new application.

4) This VSD is designed to operate both standard NEMA B and REDA submergible pump motors. Consult the factory before using the VSD for special applications such as an explosion proof motor or one with a repetitive type piston load.

5) Do not touch any internal part with power applied to the VSD; first remove the power supply from the drive and wait until charge LED (see page 4-5 for location) is no longer illuminated. Charged capacitors can present a hazard even if source power is removed.

6)  DO NOT OPERATE THIS UNIT WITH ITS CABINET DOOR OPEN.

7) Do not apply commercial power to the output terminals T1 (U), T2 (V), or T3 (W) even if the VSD source power is off. Disconnect the VSD from the motor before using a megger or applying bypass voltage to the motor.


CAUTION

Operating Safety Precautions (cont'd)

8) Interface problems can occur when this drive is used in conjunction with some types of process controllers. Signal isolation may be required to prevent controller and/or drive malfunction (contact REDA or the process controller manufacturer for additional information about compatibility and signal isolation).

9) Do not open and then re-close a secondary magnetic contactor (MC) between the drive and the load unless the drive is OFF (output frequency has dropped to zero) and the motor is not rotating. Abrupt reapplication of the load while the drive is on or while the motor is rotating can cause drive damage.

10) Use caution when setting output frequency. Overspeeding a motor can decrease its torque-developing ability and can result in damage to the motor and/or driven equipment.

11) Use caution when setting the acceleration and deceleration time. Unnecessarily short times can cause tripping of the drive and mechanical stress to loads.

12) Only qualified personnel should have access to the adjustments and operation of this equipment. They should be familiar with the drive operating instructions and with the machinery being driven.

13) Only properly trained and qualified personnel should be allowed to service this equipment. See page iii.

14) Follow all warnings and precautions. Do not exceed equipment ratings.


CAUTION

Confirmation of Wiring

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 drive.

2) The 3-phase source power should be within the correct voltage and frequency tolerances.

3) The output 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.

CAUTION

Start-Up and Test 

Prior to releasing an electrical drive system for regular operation after installation, the system should be given a start-up test by qualified 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 drive's parameters are set to start-up values that may or may not be appropriate for your application. If these settings are not optimal for the application, program the desired settings before initiating a run. The drive 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 drive.

Maintenance  

1) Use lockout/tagout procedures in accordance with local electrical codes before performing any drive maintenance.

2) Periodically check the operating drive for cleanliness.

3) Do not use liquid cleaning agents.

4) Keep the exposed heatsinks free of dust and debris.

5) Periodically check electrical connections for tightness (with power off, locked out, and with charge LED out (see page 4-5 for location)).

SECTION 3: Specifications

NEMA 3 - 6 PULSE - SPEEDSTAR 2000 VSD							
KVA @ 480 VOLTS	KVA @ 380 VOLTS	CONT. OUTPUT AMPS	REDA PART NUMBER	HEIGHT IN. (mm)	WIDTH IN. (mm)	DEPTH IN. (mm)	WEIGHT Lbs. (Kg)
66	52	79	7026644	81 (2057)	25 (635)	30.3 (770)	800 (363)
83	66	100	7026651	81 (2057)	25 (635)	30.3 (770)	850 (386)
111	88	133	7026669	81 (2057)	25 (635)	30.3 (770)	900 (408)
130	103	156	7026677	81 (2057)	35 (889)	30.3 (770)	1000 (454)
163	129	196	7026685	81 (2057)	35 (889)	30.3 (770)	1100 (499)
200	158	241	7026537	81 (2057)	35 (889)	30.3 (770)	1100 (499)
260	206	313	7026693	81 (2057)	47 (1194)	39 (991)	1300 (590)
325	257	391	7026594	81 (2057)	47 (1194)	39 (991)	1500 (681)
390	309	469	7026545	81 (2057)	47 (1194)	39 (991)	1700 (771)
454	359	546	7026602	81 (2057)	47 (1194)	39 (991)	1900 (862)
518	410	624	7026610	81 (2057)	98 (2489)	44 (1123)	2300 (1044)
600	475	722	7026628	81 (2057)	98 (2489)	44 (1123)	2400 (1089)
700	554	843	7026636	81 (2057)	98 (2489)	44 (1123)	2500 (1134)
815	645	981	7026552	81 (2057)	98 (2489)	44 (1123)	2600 (1180)
932	738	1122	7026560	81 (2057)	118 (2997)	44 (1123)	2800 (1270)
1000	792	1203	7026578	81 (2057)	118 (2997)	44 (1123)	2900 (1316)
1200	950	1445	7026586	81 (2057)	118 (2997)	44 (1123)	3000 (1361)

NEMA 3 - 12 PULSE -SPEEDSTAR 2000 VSD							
KVA @ 480 VOLTS	KVA @ 380 VOLTS	CONT. OUTPUT AMPS	REDA PART NUMBER	HEIGHT IN. (mm)	WIDTH IN. (mm)	DEPTH IN. (mm)	WEIGHT Lbs. (Kg)
66	52	79	7013907	81 (2057)	25 (635)	30.3 (770)	800 (363)
83	66	100	7013915	81 (2057)	25 (635)	30.3 (770)	850 (386)
111	88	133	7013923	81 (2057)	25 (635)	30.3 (770)	900 (408)
130	103	156	7013931	81 (2057)	35 (889)	30.3 (770)	1000 (454)
163	129	196	7013949	81 (2057)	35 (889)	30.3 (770)	1100 (499)
200	158	241	7013956	81 (2057)	35 (889)	30.3 (770)	1100 (499)
260	206	313	7013964	81 (2057)	47 (1194)	39 (991)	1300 (590)
325	257	391	7013972	81 (2057)	47 (1194)	39 (991)	1500 (681)
390	309	469	7013980	81 (2057)	47 (1194)	39 (991)	1700 (771)
454	359	546	7013998	81 (2057)	47 (1194)	39 (991)	1900 (862)
518	410	624	7014004	81 (2057)	98 (2489)	44 (1123)	2300 (1044)
600	475	722	7014012	81 (2057)	98 (2489)	44 (1123)	2400 (1089)
700	554	843	7014020	81 (2057)	98 (2489)	44 (1123)	2500 (1134)
815	645	981	7014038	81 (2057)	98 (2489)	44 (1123)	2600 (1180)
932	738	1122	7014046	81 (2057)	118 (2997)	44 (1123)	2800 (1270)
1000	792	1203	7014053	81 (2057)	118 (2997)	44 (1123)	2900 (1316)
1200	950	1445	7014061	81 (2057)	118 (2997)	44 (1123)	3000 (1361)

SECTION 3: Specifications

NEMA 1 - 6 PULSE - SPEEDSTAR 2000 VSD							
KVA @ 480 VOLTS	KVA @ 380 VOLTS	CONT. OUTPUT AMPS	REDA PART NUMBER	HEIGHT IN. (mm)	WIDTH IN. (mm)	DEPTH IN. (mm)	WEIGHT Lbs. (Kg)
66	52	79	7014079	81 (2057)	25 (635)	30.3 (770)	800 (363)
83	66	100	7014087	81 (2057)	25 (635)	30.3 (770)	850 (386)
111	88	133	7014095	81 (2057)	25 (635)	30.3 (770)	900 (408)
130	103	156	7014103	81 (2057)	25 (635)	30.3 (770)	1000 (454)
163	129	196	7014111	81 (2057)	25 (635)	30.3 (770)	1100 (499)
200	158	241	7014129	81 (2057)	25 (635)	30.3 (770)	1100 (499)
260	206	313	7014137	81 (2057)	37 (941)	39 (991)	1300 (590)
325	257	391	7014145	81 (2057)	37 (941)	39 (991)	1500 (681)
390	309	469	7014152	81 (2057)	37 (941)	39 (991)	1700 (771)
454	359	546	7014160	81 (2057)	37 (941)	39 (991)	1900 (862)
518	410	624	7014178	81 (2057)	72 (1829)	44 (1123)	300 (1044)
600	475	722	7014186	81 (2057)	72 (1829)	44 (1123)	400 (1089)
700	554	843	7014194	81 (2057)	72 (1829)	44 (1123)	500 (1134)
815	645	981	7014202	81 (2057)	72 (1829)	44 (1123)	600 (1180)
932	738	1122	7014210	81 (2057)	84 (2134)	44 (1123)	800 (1270)
1000	792	1203	7014228	81 (2057)	84 (2134)	44 (1123)	900 (1316)
1200	950	1445	7014236	81 (2057)	84 (2134)	44 (1123)	000 (1361)

NEMA 1 - 12 PULSE - SPEEDSTAR 2000 VSD							
KVA @ 480 VOLTS	KVA @ 380 VOLTS	CONT. OUTPUT AMPS	REDA PART NUMBER	HEIGHT IN. (mm)	WIDTH IN. (mm)	DEPTH IN. (mm)	WEIGHT Lbs. (Kg)
66	52	79	7014244	81 (2057)	25 (635)	30.3 (770)	800 (363)
83	66	100	7014251	81 (2057)	25 (635)	30.3 (770)	850 (386)
111	88	133	7014269	81 (2057)	25 (635)	30.3 (770)	900 (408)
130	103	156	7014277	81 (2057)	25 (635)	30.3 (770)	1000 (454)
163	129	196	7014285	81 (2057)	25 (635)	30.3 (770)	1100 (499)
200	158	241	7014293	81 (2057)	25 (635)	30.3 (770)	1100 (499)
260	206	313	7014301	81 (2057)	37 (941)	39 (991)	1300 (590)
325	257	391	7014319	81 (2057)	37 (941)	39 (991)	1500 (681)
390	309	469	7014327	81 (2057)	37 (941)	39 (991)	1700 (771)
454	359	546	7014335	81 (2057)	37 (941)	39 (991)	1900 (862)
518	410	624	7014343	81 (2057)	72 (1829)	44 (1123)	300 (1044)
600	475	722	7014350	81 (2057)	72 (1829)	44 (1123)	400 (1089)
700	554	843	7014368	81 (2057)	72 (1829)	44 (1123)	500 (1134)
815	645	981	7014376	81 (2057)	72 (1829)	44 (1123)	600 (1180)
932	738	1122	7014384	81 (2057)	84 (2134)	44 (1123)	800 (1270)
1000	792	1203	7014392	81 (2057)	84 (2134)	44 (1123)	900 (1316)
1200	950	1445	7014400	81 (2057)	84 (2134)	44 (1123)	000 (1361)

Standard Specifications

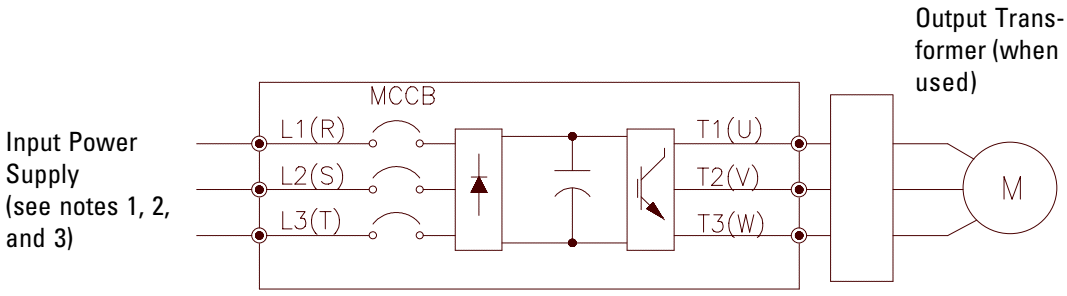
ITEM		STANDARD SPECIFICATIONS
Principal Control Specification	Control System	Flux Vector control PWM
	Input Voltage Supply	380/415/460 Volts, 50/60Hz +/- 10% tolerance
	Output Voltage Regulation	Same as power line
	Frequency Setting	0.01 to 120Hz output (10 to 90Hz default setting). 0.01Hz resolution Input frequency tolerance +/- 5%
	Carrier frequency	Auto adjusted between 0.5 and 3KHz (default is 2.2 KHz)
	Transistor type	Insulated Gate Bipolar (IGBT)
	Inverter Efficiency	98%
	Power Factor	96% at all loads and speeds
	Dynamic braking	Optional
Operating functions	Accel/Decel time	Freq./Time (0.1-20.0 Hz) over (1 to 10000 secs)
	Forward and Reverse	Programmable
	Soft Stall	Automatic load reduction during overload (Default setting: ON)
	Frequency jumps	3 jump frequency settings, set by frequency and bandwidth
	HMI	Direct control of VSD
	Automatic Restart	A coasting motor can be smoothly restarted (Default setting: OFF)
	Upper/Lower limit	Limits frequency between minimum and maximum values
	Coast stop / Controlled stop / Emergency stop	ST to CC on VSD terminal board alternate coast to stop, Programmable coast to stop and controlled stop from operator interface. S4 to CC on VSD terminal board sets Emergency stop
	Applications	Setup for Electrical Submergible Pumps, Horizontal Pumping Systems, and Progressive Cavity Pumps
Operator Interface	Interface	4 line, 20 character per line LCD, Letters are 5/16" high, 24 keys, multi-lingual, circuit boards conformal coated, password protection
	Fault Display	Overcurrent, overvoltage, heatsink overheat, load-side short circuit, load side ground fault, inverter overload, load-side overcurrent during startup, EEPROM error, RAM error, ROM error, communication error, emergency stop, undervoltage, low current, open
	Monitor functions	Forward/reverse, frequency setting value, output frequency, output current, output voltage, input power, output power, cumulative run time, past faults, excitation current, inverter overload ratio, motor overload ratio, PID feedback value, DC voltage.
	LED charge indicator	Indicates that the main circuit capacitors are charged

Standard Specifications (cont'd)

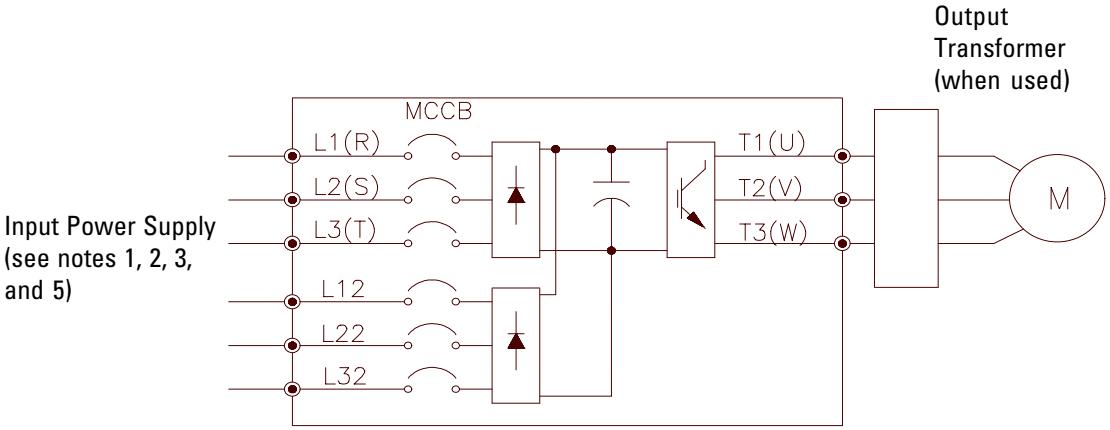
ITEM		STANDARD SPECIFICATIONS
Inverter / Motor	Protective functions	Soft-stall, current limit, overcurrent, overvoltage, short-circuit at load, load-side ground fault, undervoltage, momentary power failure, regeneration power ride-through, electronic thermal overload protection, main circuit overcurrent at startup, heatsi
	Electronic thermal characteristics	Drive's motor overload protection for motor can be adjusted for motor rated amperage. Motor overload has adjustable speed sensitivity. Soft stall on/off. Motor 120% time programmable.
Input signals	Digital	8 auxiliary digital inputs, user programmable
	Analog	2 analog inputs, 4 to 20mA or 0 to 10VDC, user programmable
	Serial Ports	1 RS-485, 1 RS-232, and 1 configurable (allocated for Modbus RTU)
Output	Digital Relays	4 digital relays, user programmable
	Serial Ports	1 RS-485, 1 RS-232, and 1 configurable (allocated for Modbus RTU)
Enclosure	Type	NEMA Type 1 or 3R
	Cooling method	Forced air cooling. Internal and external fans are automatically stopped when not necessary for extended fan life.
	Color	ANSI gray #61 polyurethane textured finish
	Service environment	Indoor and Outdoor ratings. Consult factory for elevations above 1500m. For example at 2000m derate drive FLA by 11%. Some derate may be required for direct sunlight. Avoid corrosive and/or explosive gases or mists. Consult factory for sunlight derat
	Ambient temperature	From -30°C to 50°C (-22°F to 122°F).
	Relative humidity	20 to 100% maximum (non-condensating)
	Vibration	5.9m/s² (0.5G) maximum (10 to 55 Hz)
	Climate class	3K3
	Pollution degree	2
	IP rating	53 for outdoor units
	Disconnect	Circuit breaker disconnect with 100 KAIC current limiting fuses

SECTION 4: Wiring

Standard Connection Diagram For 6 Pulse Input



Standard Connection Diagram For 12 Pulse Input



NOTES

1. Properly ground the drive cabinet with a copper conductor to meet local and national codes. For VSD application, metal conduit is not an acceptable ground.
2. Motor should be grounded to the same point in the drive cabinet with copper wire to meet Codes. Do not mix input and output conductors in the same conduit.
3. An optional junction box is available to facilitate the installation of input and output cables. Terminals are marked the same and accessible from a separate box outside the enclosure.
4. Output transformers have numerous taps for different motors and cable lengths. Contact REDA before starting a new application to ensure correct sizing and wiring.
5. 12 pulse input requires an input transformer with a polygon winding secondary. This type of input reduces harmonics reflected to the power line.

Selection of Main Circuit Wiring Equipment and Standard Cable Sizes						
	*Molded case circuit breaker (MCCB)	Ampacity (VSD FLA x 1.25)	** Typical cable size			
KVA	Amp rating (A)	AMPS	Digital Control Inputs	Input Lug Wire Capacity	Output Lug Wire Capacity	Ground Lugs
66	100	99	#14	1(#14 AWG~1/0)	1(#4 AWG~500 MCM)	2 AWG~4/0
83	150	125	#14	1(#6 AWG~350 MCM)		
111	250	166	#14			
130	250	195	#14			
163	250	245	#14			
200	400	301	#14	1(#2 AWG~500 MCM)		
260	800	391	#14		2(#6 AWG~350 MCM)	
325	800	489	#14	2(#2 AWG~500 MCM)		
390	800	586	#14			
454	800	683	#14	4(4/0~500 MCM)		
518	800	780	#14		4(#2 AWG~600 MCM)	
600	1000	903	#14			
700	1200	1054	#14			
815	1200	1226	#14			
932	800 x 2	1403	#14	4(1/0~750 MCM)	4(1/0~750 MCM)	1/0~350 MCM
1000	800 x 2	1504	#14			
1200	1000 x 2	1806	#14			

See page 4-3 for notes.

Selection of Main Circuit Wiring Equipment and Standard Cable Sizes (cont'd)

* Any customer supplied Molded Case Circuit Breaker (MCCB) or Magnetic Circuit Protector (MCP) external to the VSD cabinet should be coordinated with the available short circuit current. The drives are rated for output short circuit fault currents of 100,000A (in all ratings). The selection of breakers for this table is in accordance with 1987 NEC Article 430.

** Wire sizing is based upon NEC table 310-16 or CEC Table 2 using 75 deg. C cable, an ambient of 30 deg C, cable runs for less than 300 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.

*** 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 2 this page).

Notes:

1.) Contacts used to connect drive terminals should be capable of switching low current signals (i.e. 5 MA).

2.) 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.

3.) Twisted pair wiring should be used for pressure feedback signal wiring terminals.

4.) Pressure Feedback Input: 4-20 mA or 1-5 V signal 2 wire twisted pair #20; Other signal circuits, use #18.

CAUTION

Turn off power to the drive before making any wiring changes to the analog output circuits.

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.

Grounding

The VSD 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. See Installation Safety Precautions notes 7 and 13. Local grounding codes may apply. Ground lug is provided inside the VSD on the Ground bus.

CAUTION

Conduit is not a suitable ground for the inverter.

Motor Selection

Exceeding the peak voltage rating or the rise time allowable of a surface motor insulation system will reduce motor life expectancy. To insure good motor insulation life, consult with the motor supplier as to the peak voltage and rise time withstand level of the motor.

NEMA MG-1-1993 SECTION IV PART 30 PARAGRAPH 30.02.2.9:

When operated under usual service conditions for a surface motor (MG-1-14.02 or 20.80.2) the following limit values at the motor terminals should be observed: Voltage (peak) = 1kV or less (where peak voltage is single amplitude) Rise Time = 2 microseconds or greater

NEMA MG-1-1994 SECTION IV PART 31 PARAGRAPH 31.81.2:

When operated under usual service conditions (MG-1-31.20) stator winding insulation systems for definite purpose adjustable speed drive-fed motors shall be designed to operate under the following limits at the motor terminals: Voltage (peak) = 1600 volts with a rise time of more than 0.1 microseconds (where peak voltage is single amplitude).

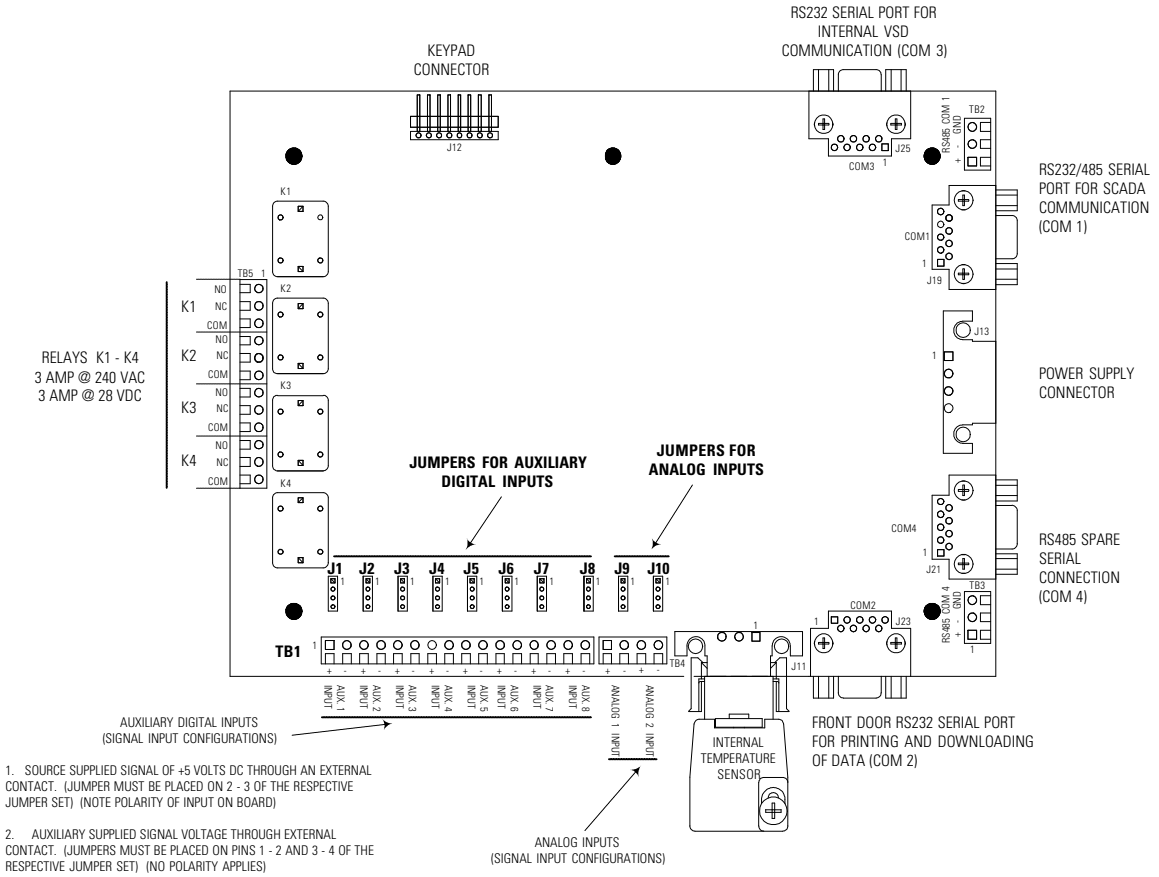
Bearing Considerations

Surface Motors operating from adjustable speed drive power sources tend to operate at higher temperatures which may increase the need for more frequent lubrication cycles.

Operation at higher than 5 kHz carrier frequencies may require shaft grounding or bearing insulation to prevent shaft current caused by capacitance coupling to ground.

Submergible motors with VSD output transformers require special application concerns. Consult with REDA when starting a new application of the VSD.

Control Wire Connections for Human Machine Interface (HMI) Terminal Board

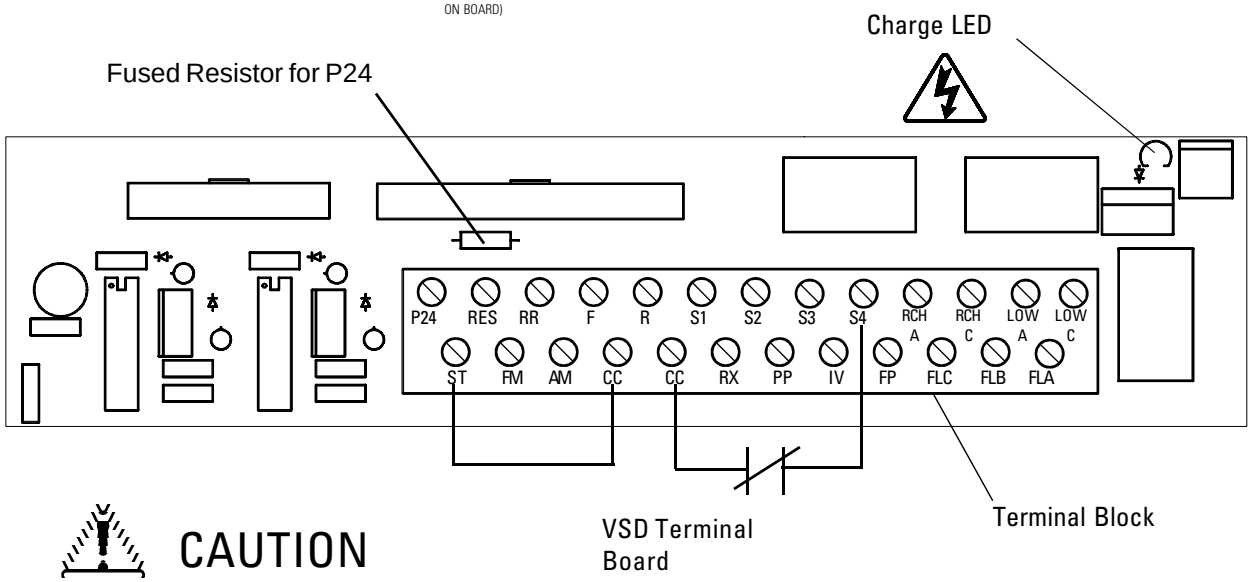


1. SOURCE SUPPLIED SIGNAL OF +5 VOLTS DC THROUGH AN EXTERNAL CONTACT. (JUMPER MUST BE PLACED ON 2 - 3 OF THE RESPECTIVE JUMPER SET) (NOTE POLARITY OF INPUT ON BOARD)

2. AUXILIARY SUPPLIED SIGNAL VOLTAGE THROUGH EXTERNAL CONTACT. (JUMPERS MUST BE PLACED ON PINS 1 - 2 AND 3 - 4 OF THE RESPECTIVE JUMPER SET) (NO POLARITY APPLIES)

1. 0 -10 VOLT DC INPUT. (ALL JUMPERS MUST BE REMOVED FROM RESPECTIVE PINS ON JUMPER SET) (NOTE POLARITY OF INPUT ON BOARD)

2. 4 - 20 MA DC INPUT. (JUMPERS MUST BE PLACED ON PINS 1 - 2 AND 3 - 4 OF THE RESPECTIVE JUMPER SET) (NOTE POLARITY OF INPUT ON BOARD)

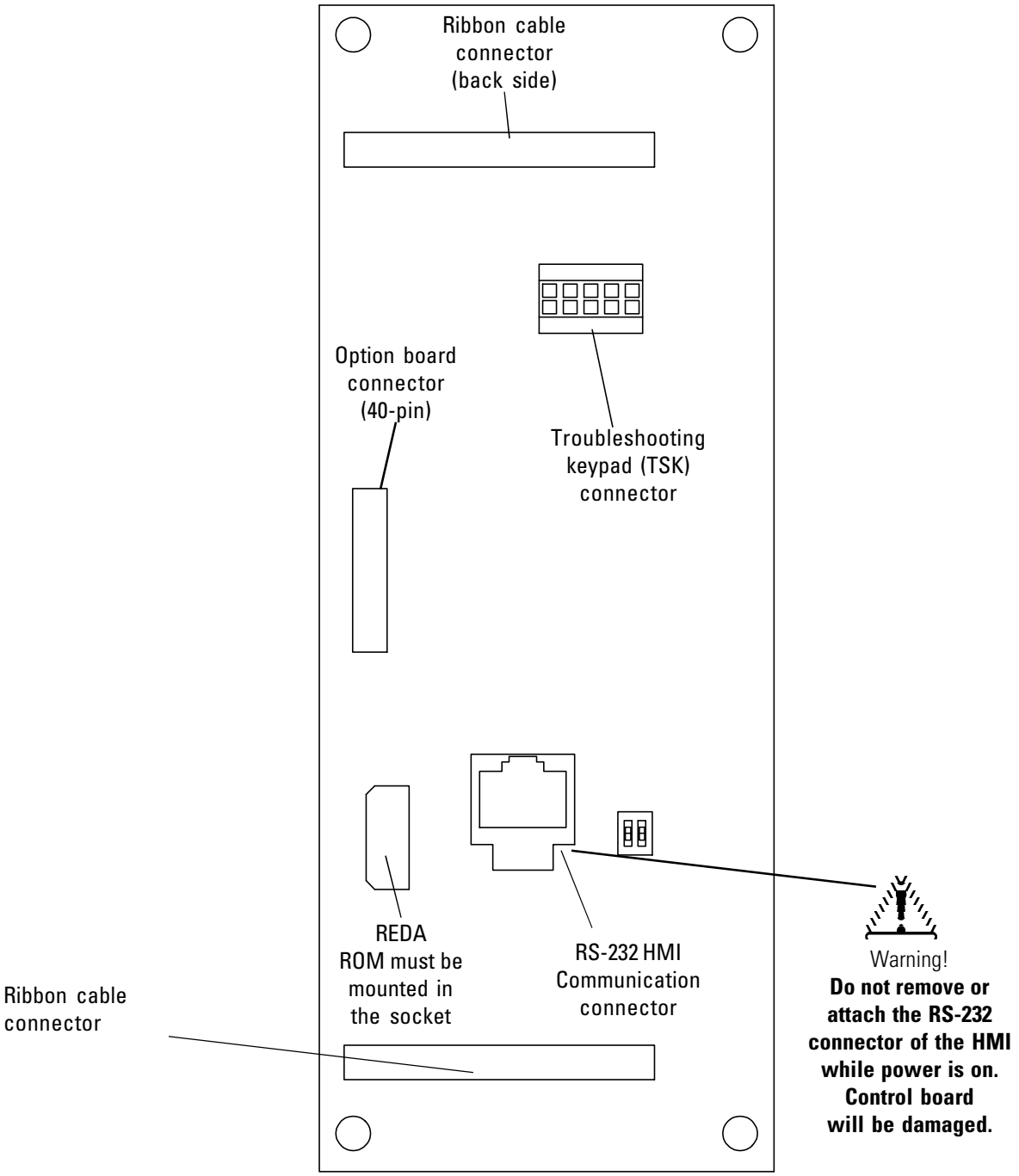


CAUTION

Turn off power to the drive before connecting or disconnecting any wiring to the terminal block.

VSD Terminal Board

1. Opening ST to CC interlock causes coast stop of the inverter. Reconnecting restarts the drive if it was running before it stopped.
2. Opening S4 to CC interlock causes an E-stop trip in the drive. It will have to be reset before restart is allowed.

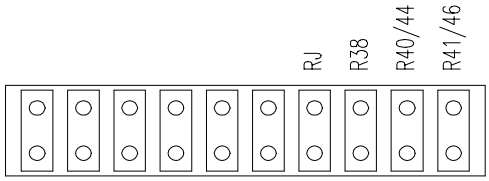


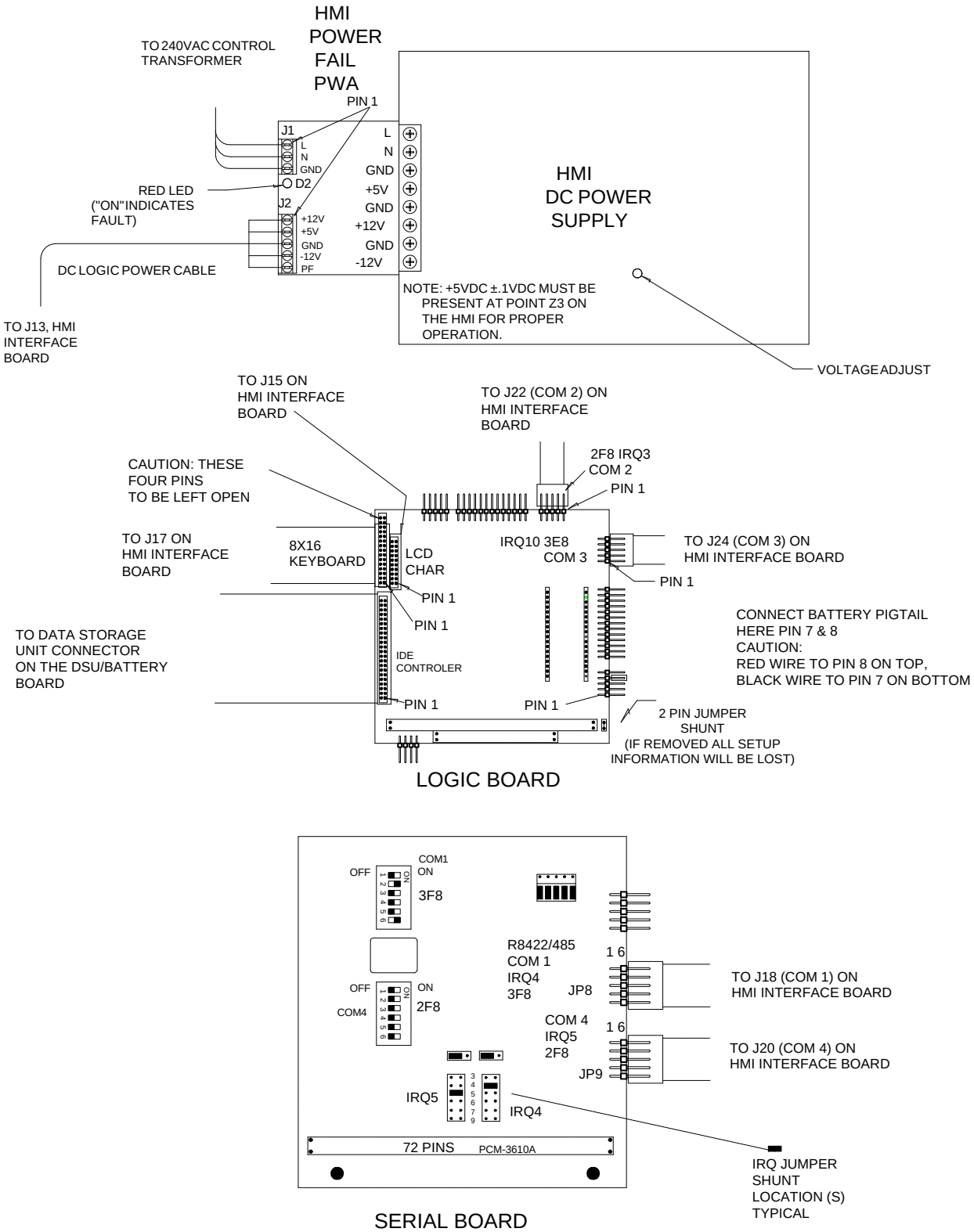
Make connections to this board only with power off.

Terminal Connections and Functions

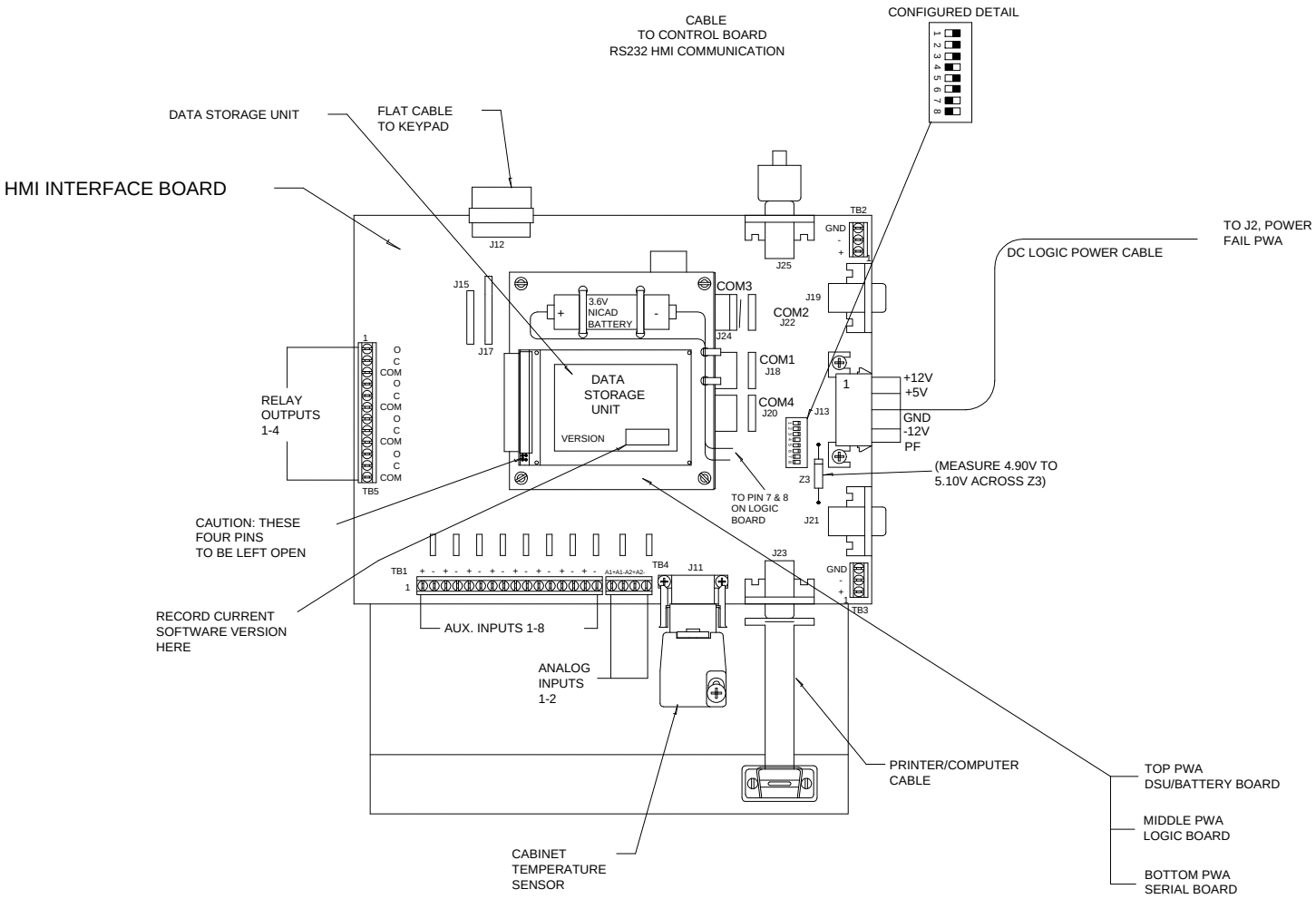
Terminal Name	Terminal Functions	Terminal Location
L1, L2, L3 (R, S, T)	Line input terminals for 6 pulse models: connect to either 3 phase 50Hz 380-400VAC or 3 phase 60Hz 415-460VAC	Terminal block or bus bar 
L1, L2, L3 (R, S, T) L12, L22L L32 (R2, S2, S3)	Line input terminals for 12 pulse models: connect to either 6 phase 50Hz 380-400VAC or 6 phase 60Hz 415-460VAC	
T1, T2, T3 (U, V, W)	Motor output terminals. Connect these terminals to a 3 phase induction motor of the proper voltage, current, and horsepower	
R41/46	CPT Connection for 460V/60Hz and 415V/50Hz	Terminal block (See this page)
R40/44	CPT Connection for 440V/60Hz and 400V/50Hz	
R38	CPT Connection for 380V/50Hz	
RJ	CPT Common	
TB5	Output relays, Contact Ratings: 3A @ 230VAC, 3A @28VDC (Form C - SPDT)	Terminal block (See page 4-5)
TB1	Digital Auxiliary Inputs	
J1-8	Auxiliary Input Discrete Contacts install jumper 2 to 3 for logic level (+5V) external signal applied to the circuit, install jumpers 1 to 2 and 3 to 4 for external switch with operator interface supplying power	
TB4	Analog Inputs	
J9-10	Install jumper 1to 2 and 3 to 4 for 4-20mA input. Remove all jumpers for 0-10V input	
COM2	9 pin D-conn/receptacle standard RS-232 pinout. Printer Default	
TB2	RS-485 two-wire SCADA	
COM4	9 pin D-conn/receptacle RS-485 configurable. Pin1 = Data -, Pin2 = Data +, Pin5 = Ground	
COM1	9 pin D-conn/receptacle RS-485 default. RS-232/RS-422/RS-485. SCADA Default. Pin1 = Data -, Pin2 = Data +, Pin5 = Ground	
TB3	RS-485 default, two wire only.	
COM3	9 pin D-conn/receptacle standard RS-232 pinout. Connection from Operator Interface to VSD	

CPT (CONTROL POWER TRANSFORMER)
TERMINAL BLOCK





REDA HMI P/N 7026495 INTERCONNECT LAYOUT



CAUTION:
INSURE THAT PIN 1
OF ALL INTERCONNECTING
CABLES ALIGN WITH PIN 1
ON ALL MATING PWA
CONNECTORS

REDA HMI P/N 7026495 INTERCONNECT LAYOUT

SECTION 5: Operator Interface

Introduction

The operator interface for the SPEEDSTAR 2000 consists of: an 8 inch x 8 inch keypad with 24 keys; an expandable, embedded controller; extensive I/O points; and flexible, programmable software.

The hardware consists of a membrane tactile keypad, 4 digital output relays, 8 digital input, 2 analog inputs for either 0 to 10 VDC and/or 4 to 20 mA input, and 3 serial ports. All information is displayed on a 4 line, 20 character, liquid crystal display mounted on the keypad. All error messages, status, numeric values, etc. are displayed in one of three languages: English, Spanish or Russian. Programmable software allows for additional languages to be added (consult REDA for additional languages). There are no cryptic numbers or codes to decipher. All inputs to the controller come via the membrane keypad, SCADA I/O, analog inputs, and digital inputs. The contrast of the liquid crystal display can be adjusted using a single key. The same key toggles the backlight for viewing in subdued light.

Main operating keys are: Hand - OFF - Auto - Start, which can be controlled from the keypad or through SCADA. Basic operating mode is set by selecting either the Hand or Auto. In the Hand mode, the restart timer functions are not acknowledged and the VSD may be started or stopped by using either the local keypad or SCADA mode. In the Auto mode, the restart timer functions are acknowledged and the VSD may be started or stopped by using either the local keypad or SCADA mode. OFF will always stop the VSD regardless of the present mode. The present mode is indicated by the lighting of LED's located just below each key.

Scroll through menu items are provided for set up of the VSD, and help screens are accessible for each menu item. An auto jump function is provided for quicker movement through the parameters by using the SHIFT key. The auto jump will move to the beginning of each menu structure.

Three control modes are available for VSD operation: Speed, Current, and Pressure (see page 5-6 and 5-7 for description of modes).

Two logging files are available: History Log and Data Log. An RS 232 front panel port is provided for downloading history log and data log to a local printer or PC (see page 5-11 and 5-12 for description of operation).

Modbus RTU protocol is available for connection to SCADA systems through an RS485 port that is accessible on the operator interface control board. A 3 pin terminal or a 9 pin D connector is provided for connection. (See section 6 for a description of SCADA)

Selectable stopping mode is available: Coast to stop or controlled stop. Factory default is Coast to stop.

Display Mode

There are three display modes that the HMI may be in: status, help, and menus.

The MENU/ESC key can always be used to get to the status screen. Depending upon which screen is presently being displayed, the MENU/ESC key may need to be pressed more than once to reach the status screen. Once the status screen is displayed, the MENU/ESC key will toggle between the status and menu screens.

The initial status screen display mode is recognizable by the fact the top line of the screen will display the date and time (e.g. “12MAY1998 15:05:21”). As expected from its name, the status screen displays various system status parameters. It displays the time and date, what control mode the VSD is setup for, whether the VSD is running, what speed the VSD is running at, what current the VSD is supplying, and what voltage the VSD is supplying. Pressing the UP/DOWN arrow keys will cause the status screen to page through several other parameters of interest including the drive rated amps, the software version number, the analog input values, the internal temperatures, run times, and other information.

Pressing the HELP key will cause the help text for the presently displayed screen to appear. Pressing the HELP key again will cause the original screen to reappear. Pressing the UP/DOWN arrow keys will allow the help text to be scrolled line by line. Pressing the SHIFT key allows the arrow keys to be used as PAGE UP & PAGE DOWN keys and will scroll the help text screen by screen.

The menu screen is identify by the menu number and a main title located on the first line (e.g. "120 SPEED MENU"), the second and third lines contain additional description (e.g. "MINIMUM SPEED (HZ)"), the fourth line will contain the present value of that menu item (e.g. "20 HZ").

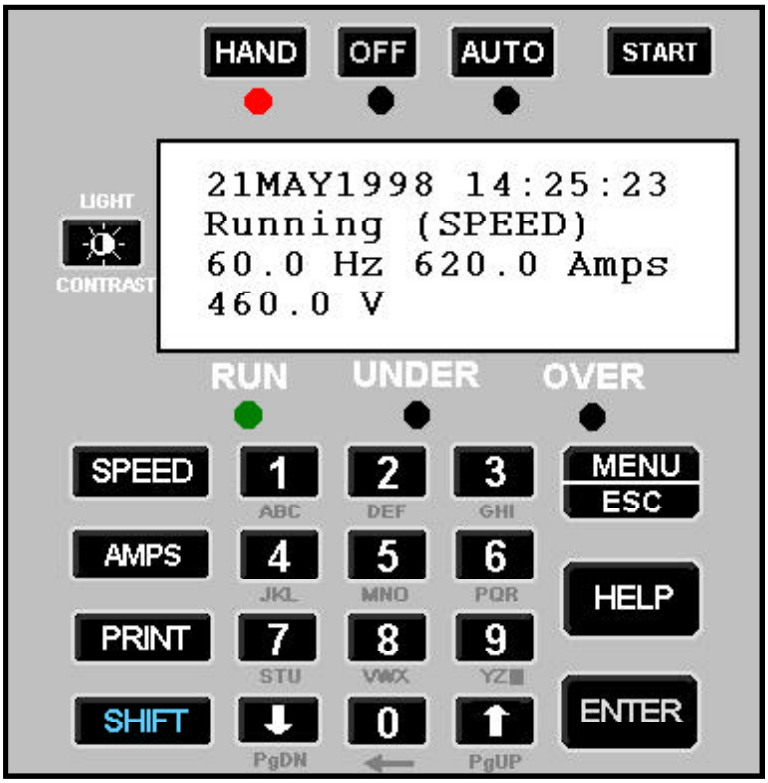
```
120 SPEED MENU
MINIMUM
SPEED (HZ)
20.0
```

From the menu screen the value of a menu item can be changed by pressing the ENTER key. If the value is allowed to be changed, the displayed value will begin flashing otherwise a message such as "PASS-WORD REQUIRED" may momentarily appear. Pressing the ENTER key will finish the data entry. Pressing the MENU/ESC key will abort the data entry.

If the data entry is numeric, the UP/DOWN arrow keys will increment/decrement the displayed value and the numeric (0-9) keys will shift the displayed number one place to the left and place the selected number in the newly vacated position on the right.

If the data entry is entering text, the UP arrow key will move the cursor one place to the right, the DOWN arrow key will move the cursor one place to the left, the numeric (0-9) keys when pressed repeatedly will cause the character under the cursor to scroll through the characters associated with each numeric key.

SPEEDSTAR 2000 Human Machine Interface (HMI)



Key	Function
1 ABC	The numeric keys 1 - 9 function as follows in text entry mode: By default each keypress cycles through the number and the letters listed below it (1 - A - B - C) and then repeats the sequence. The "SHIFT" key toggles the sequence so that it begins with the first letter listed and cycles through the remaining letters followed by the number (A - B - C - 1) and then repeats the sequence. The numeric entry mode displays the pressed number only. The "0" key is used to display zero. SHIFT toggles the key so it functions as a backspace.
AMPS	Shortcut to the Maximum Current Menu
AUTO	Puts drive in AUTO mode.
ENTER	Pressing ENTER while browsing the menus selects the present item for modification. After modifying pressing ENTER will keep the change made. If no change was made, pressing ENTER will return item to its previous setting.
HAND	Puts drive in HAND mode.
HELP	The "HELP" key at any time will display detailed help information for the present screen.

Key	Function
	Momentarily press the key to toggle the backlight on or off. Press and hold the key down to adjust the contrast until the key is released. If the contrast dims, repeating the procedure will darken it.
	From the status screen, the MENU/ESCAPE key will display the last menu item browsed. If already in the menus the key functions as follows: If an item is being modified, MENU/ESCAPE will discard the change. While browsing the menus, MENU/ESCAPE will return the display to the status screen.
	Stops the drive if it is running.
	Performs the down function throughout the interface except in text entry mode where it moves the cursor back one character.
	Performs the up function throughout the interface except in text entry mode where it moves the cursor forward one character.
	Shortcut to the Print Configuration menu.
	Selects alternate modes for certain keys.
	Shortcut to the Target Speed menu
	Starts the drive if in hand mode, overrides start-up delays and starts drive if in auto mode.

Commissioning/Recommissioning:

Commissioning of the VSD is required to load the defaults for an application.

Commissioning the VSD is accomplished by going to the COMMISSION VSD menu (#101) and entering YES at which point the user will be prompted to confirm. Note - In some cases Master Password level maybe required to enter the recommissioning mode. Entering YES at the confirmation screen will enable the commissioning mode.

Once the commissioning mode is enabled, the only way to exit is to finish the commissioning and accept the entries. Otherwise, even cycling power to the unit cannot bring it out of the commissioning mode. If commissioning was in progress when a power loss occurred, upon restoration of power, the VSD will automatically go to the first commissioning menu.

Upon entering commissioning there are only two menus. The first menu is to enter the language (English, Spanish, Russian) to use and the second menu is to enter the pump application (ESP, PCP, HPS) that the VSD is going to be used for. Once the pump application has been entered, the defaults for that application will be loaded and additional commissioning menus for that application will be available. Note that the defaults are only meant to provide a safe mode so the drive can be run without load to ensure that it is functioning properly, many of the VSD settings will need to be customized for each application.

The commissioning menus work in almost the same manner as the normal operating menus. The menu traversal, help, and data entry all operate the same as the normal operating menus, but menu shortcuts are disabled. When the desired values have been entered for each commissioning item, selecting ACCEPT ENTRIES on the EXIT SCREEN CHOICE menu will exit the commissioning menu and automatically display the status screen. At this point, the VSD is in the normal operating mode.

Passwords:

The two passwords (called 'master' and 'user') each must be a number between 0 to 9999, they cannot be character strings. To enable master access the master password entered in menu 102 must match the master password previously entered in menu 103. If the password entered in menu 102 is correct the display will change to show 0, meaning the master level is enabled. If the number entered changes to 9999 the master level is locked. The user access is similar, to enable it the user password entered in menu 105 must match the user password previously entered in menu 106; menu 105 will change to display 0 or 9999 depending if the password is correct. Each of the security levels will automatically lock after about 30 minutes of keyboard inactivity. If a password of '0' is used for either the master or user password then that level will not automatically lock after keyboard inactivity, so for example the HMI may be left in the user mode without requiring the password to be reentered every day.

If the HMI is not in master or user mode it is effectively 'locked' and a limited number of menus are accessible. These menus, numbers 102, 105, 610, 800, 111, 100, 240, 241, 242, 246, 247, 248, 250, 251, 252, 253 are always available for the operator no matter what the security level of the HMI currently is.

Date/Time:

Time and date are recorded with data and events as they occur for analysis of the information at a later date.

Dates are displayed in the form ddmmmyyyy. To change the system date (#217), the data entry works slightly different: the numbers are entered as text and the month is entered by pressing the numeric keys 1-9 to increases the month, and 0 to decreases the month. Arrow keys move courser to new location for entry.

Times are usually displayed in the form hh:mm:ss. To change the system time (#216), the data entry works as if the time was text.

Speed, Current and Pressure Modes.

The VSD may be programmed to operate in one of three basic control modes; speed, current or pressure (Menu 107 Control Type). Note that these modes will control how the VSD will change speed during running. These modes are completely independent of the shutdown and restart conditions that may be programmed for most conditions. For example, the VSD may stop due to an under pressure condition regardless of whether it is running in speed, pressure or current control mode.

The speed control mode has two ways of controlling the VSD frequency (Menu 120 Speed Source). In the first speed control mode the user programs a frequency for the VSD to operate. Select this mode by programming the 'speed source' menu selection to be 'user'. Once started, the VSD will speed up to the set frequency and maintain the set frequency until the user selects another frequency to run at or the VSD mode is changed. Changes in current or external inputs will not have any effect on the VSD running frequency. It will only run at the user-selected frequency or be stopped due to some other event. If the user changes the set frequency while the VSD is running, it will change to the new frequency by accelerating or decelerating at the programmed ramp rate for frequency control. This speed control mode is the most common mode of VSD operation. The second speed control mode is called the signal follower mode. Select this mode by programming the 'speed source' menu selection to the correct analog input. The VSD will adjust the output frequency directly proportional to an analog signal input, which is supplied by an external control system. During this mode of operation the operator interface will maintain its maximum and minimum limits even if the analog signal should go past these limits. The analog input to be used for the external speed source may be programmed from the operator interface (Menu 800 Analog Inputs Selection).

In current control mode (Menu 140 Target Current) the VSD will continually change the output frequency to try and maintain the output (or motor) current to be the same as the users programmed target current. This may be useful for situations where the motor frequency is not as important as the current, perhaps because the motor is driving a varying load. First the operator interface needs to be programmed to use the VSD output current or the motor current (Menu 108 Amps Display Value). If motor current is to be used, calibration may be required. Then a target current needs to be programmed. Once the VSD is started, or changed to current mode if already running, it will continually monitor the current and compare it to the users programmed target current. If the current is too high or too low the VSD output frequency will be adjusted, at the user's programmed current ramp rate, to maintain target amps. If the current (or any other parameter) is outside of the programmed range for more than the specified time the VSD may stop, then restart if programmed to do so.

The pressure control mode operates through a PID Control. The PID Control can be either disabled or enabled (Menu 182 PID Control). When the PID control is disabled the VSD will operate in a similar mode to the current control. When set to this mode the operator interface continually monitors the pressure signal, compares it to the programmed target pressure, then adjusts the VSD output frequency at the programmed pressure ramp rate. The rate of VSD frequency change will be a constant ramp rate, and will not be proportional to the size of the pressure difference between target pressure and measured pressure. The VSD output frequency may be programmed to increase or decrease when the pressure is higher or lower than the target pressure. Refer to the section on PID control.

Ramp Rates.

Ramp rates are defined as the rate of change of VSD output frequency over time. Separate control ramp rates may be programmed by the user for all of the different control modes of the VSD (Speed, Current, Pressure), plus a separate accel ramp rate for initial acceleration after start-up from minimum speed to target speed (speed control ramp #124 and #125, current control ramp #148 and #149, pressure control ramp #165 and #166, accel ramp #472 and #473). Each of the ramp rates is programmed as an amount of frequency change in Hz versus the time taken to perform that frequency change. From these entered values the operator interface will calculate the actual ramp rate to be used, so for example a 3.0 Hz change every 9 seconds will be the same ramp rate as a 1.0 Hz change every 3 seconds. Any frequency adjustments will actually be calculated every second, and the output frequency will be updated as appropriate. Note that excessively fast ramp rates may not have any noticeable effect, since there is a maximum limit that the VSD may accelerate and decelerate. When the VSD is started the following frequency changes will occur. It will first accelerate to the minimum safe programmed frequency (the VSD should ever run at, for example 20 Hz, which may be set by motor or transformer limitations). The time taken to get to this frequency may not be adjusted by the user. The VSD will then switch to the 'acceleration' ramp rate and will accelerate at this rate until it reaches the initial target frequency of the particular mode. For example, the user target frequency if in frequency control mode. Then the VSD will switch to the corresponding mode control ramp rate (in this case the frequency control ramp rate) and if the target frequency is subsequently changed to a new target frequency the VSD will ramp up or down in frequency at this ramp rate. Typically the ramp rate for frequency control is comparatively fast, whereas the ramp rate for PID Control disabled in the Pressure Mode could be much longer, perhaps as slow as 1.0 Hz per day. Note that the ramp rates will not have any effect on how the VSD stops, for more information on stopping see the section on 'Stop modes'. The only time that the programmed ramp rates will be ignored is when the VSD is in the 'signal follower' mode where an external source is directly controlling the speed, or if it is running under PID control.

Analog Inputs

The operator interfaces analog inputs, allows it to be interfaced to external sources for both monitoring and control. These external signals could typically be from a tank level, downhole pressure sensor or temperature sensors. Each input may be configured for a voltage level of 0 to 10 Volts or for a current level of 4-20 mA by moving jumper blocks on the operator interface board. To configure the inputs for 0 to 10 Volts remove any jumper blocks installed on the board by the relevant input terminal. To set the input for 4-20 mA level install one jumper block, shorting together pins 1 and 2, then install another jumper block shorting together pins 3 and 4. Note that the low input side of the analog inputs is directly connected to ground. Once the hardware has been configured for the signal level the operator interface software also needs to be calibrated for the appropriate input signal. Since all types of transducer have different input parameters corresponding to different output levels they should each be calibrated with the operator interface. For example, a 0 to 1000-PSI pressure transducer may have an output of 4 mA at 0 PSI and 20 mA output at 1000 PSI. Another pressure transducer may have an output of 4 mA at 0 PSI, and an output of 20 mA at 500 PSI. The operator interface needs to be calibrated so that it can operate with correctly scaled units. The ideal way to do this is to connect the transducer, artificially generate a minimum input parameter (such as a pressure of 0 PSI), calibrate the operator interface so that it indicates the appropriate minimum value, then repeat the procedure for the maximum transducer value. From these two calibration points the operator interface can internally generate a calibration slope that corresponds to the measured parameter. After the calibration, each measurement will be internally compensated using this slope before being displayed, stored or used for control purposes by the operator interface. However, many transducers have standard outputs levels and ranges, plus it is often inconvenient to artificially generate external parameters, so the operator interface allows transducers to be easily set up without requiring calibration adjustment. This may be done selecting the transducer type as 4-20 mA or 0-10 Volts and entering a full-scale value. If the transducer is nonstandard or needs to be calibrated for some reason, select the calibration menu then perform the calibration at low and high points, entering the desired readouts at each input level. Note that the most accurate readings will be obtained with calibration points that are as far apart as possible from each other. Each analog input level may be viewed at the bottom of the status screen if the display is enabled in the analog input menu. The readings will be updated approximately every second.

Digital Auxiliary Inputs

The operator interface has several digital auxiliary inputs that may be monitored and used for VSD control (#610). These inputs would typically be used to monitor external sensors such as vibration, tank full levels or ground faults. Before a digital input may be used it needs to be configured on the VSD operator interface terminal board for the correct signal level. Each digital input may be configured in two ways. The first method allows the external source to supply a five-Volt logic level. This logic level is then used to drive an opto-isolator on the operator interface board, so that the signal from the external source is electrically isolated from the operator interface. To configure the hardware, insert a shorting jumper block between pins two and three on the respective configuration jumper pins. The externally applied five-volt signal should be applied with the positive voltage on the input marked 'high' and the negative or lower voltage to the terminal input marked 'low'. A second method of configuration does not require the external device to supply any power, but rather just a standard switch or relay contact, drawing power from the operator interface for operation. To configure for this mode connect one shorting jumper block between pin 1 and pin 2, then connect another shorting block between pins 3 and 4 on the respective input circuit. Polarity has no effect for the contact input. Once the hardware has been configured the digital input may be configured for operation from the operator interface. Shutdowns, restarts and status display all use the term 'Active' or 'Inactive'. These states may be defined by the user so that 'active' may mean that the external supply is on or off if configured for external logic inputs, or the external contacts may be open or closed for an active state. Using this method the various associated timers and control conditions for each digital input do not need to be reprogrammed if the digital input polarity is changed; just the active state.

Output Relays

The operator interfaces four relays that may be configured for several functions (#320, #321, #322, #323). Each relay has a single pole common, a normally closed and a normally open contact brought out to a terminal block on the operator interface. Each relay may be configured for one of the following operations. The first configuration allows the relay to mimic the state of an external digital input that is being supplied to the operator interface. The next allows the relay to echo the state of one of the four status display LED's on the operator interface (Run, Hand, Off and Auto) which allows for easy connection of extension status lights on the VSD cabinet. The next mode will cause the relay to change state when the VSD detects a pending shutdown condition. This could be due to several reasons, such as undercurrent or a digital input that is programmed to shutdown the VSD; it allows an external indicator or alarm to indicate the pending condition. The following selections are all similar, in that they cause the relay to activate when a measured parameter is out of the pre-programmed range. They are over pressure, under pressure, under current, over current and all of the analog inputs being out of the preset ranges. Note that the relay states are internally filtered on the operator interface so that they will not be updated faster than once every second. This is to prevent damage to external devices due to relay 'chattering' on quickly changing inputs or signals that hover around relay trip points.

Timers.

Most of the warning and error conditions that can be detected by the operator interface have associated timers. These timers may be individually programmed for specific functions. Each error or warning condition has its own set of timers that are completely independent from other condition timers.

The first timer is called the "Ignore at Start-up" timer. The main purpose of this is for some monitored parameters (such as well pressure) that may require time to come to a normal state after the VSD starts. Once the particular parameter has had time to stabilize the condition may be monitored for shutdowns, however until the "Ignore at Start-up" timer has expired the condition is ignored. For example, setting the "Ignore at Start-up" timer for a certain condition to 60 seconds means that the condition may or may not exist during the first 60 seconds after the drive starts, during which the operator interface will completely ignore it. There will be no errors or warnings related to this condition displayed on the screen during this time. After this timer has expired the operator interface will start to monitor the condition, and then take any appropriate action.

The next timer is called the "Activation Delay" timer. This corresponds to the time that a condition must continuously exist before the operator interface will stop the VSD. For example, the activation delay time for the undercurrent condition may be set at 30 seconds. If the VSD enters an undercurrent condition the undercurrent must exist continuously for at least 30 seconds before the VSD will stop, reporting "VSD stopped due to undercurrent". However, if the undercurrent condition exists for less than 30 seconds then goes away the VSD will not stop. The condition may come and go, but unless it exists for more than 30 seconds continuously the VSD will keep running. As soon as a condition which can shut down the VSD exists, a warning is displayed on the screen with the time remaining before the VSD stops; if the condition disappears then so will the warning. This "Activation Delay" timer may be set to a minimum time of one second.

The last timer, called the "Automatic Restart Delay" is used by the operator interface to automatically start the VSD after a particular event, such as power being restored or an digital input closing shutdown. To allow the VSD to automatically restart the VSD must first of all be in the "Auto" mode since the VSD will never start automatically if set to the "Hand" or "Off" mode. There are then three parameters which need to be set for an automatic restart to occur. The first enables the automatic start after the relevant condition, and it needs to be set to "Yes" to allow a start; if set to "No" the VSD will never automatically restart after this condition.

This allows automatic starts to be selectively enabled for some conditions and disabled for others; for example perhaps the system needs to automatically start after an under pressure shutdown but remain off after an over pressure shutdown. Next the delay time, called the "Auto Restart Delay" needs to be set. This is the time that the operator interface will wait before an automatic restart attempt occurs. For typical operation this time may be set from 30 minutes to possibly a day or more. The last parameter is the number of automatic restarts of this type that are allowed before the VSD will stop and remain off, changing mode from "Auto" to "Off". For example, an operator may only want a remote VSD to attempt to start twice after an undercurrent condition, but may want the VSD to restart 100 times if the shutdowns were due to low-pressure readings. The maximum number of automatic restarts may be set as the "Number of Auto Restarts". There is one extra setting that may be used for auto starts. The under pressure setting to may be used to initiate an auto start, but rather than waiting for the under pressure restart timer to expire it may be programmed to wait for the measured pressure to reach a certain value. To do this set the under pressure restart type to 'pressure' rather than time, and enter a pressure to exceed that will cause the restart. An under pressure is the only condition that may be used for signal amplitude based auto restarts.

Finally there are two start delays which are similar to the "Auto Restart Delays" The first, called the "Auto Start" timer is invoked when the operator changes from the "Off" or "Hand" mode to the "Auto" mode. The operator interface will wait for this auto delay time, then automatically attempt to start the VSD. This timer allows the operator to start the VSD in a predetermined time, for example allowing the operator time to get to a remote location before the VSD starts. Note that the operator interface will also wait for the pressure to reach the predetermined level, if the pressure restart type is set to "pressure" rather than time.

The last timer is called the "Power Fail" timer. It allows the VSD to automatically restart a certain time after power to the system is restored. When several VSD's are operating from a common power source each power fail restart timer may be set to a different time. Then when power is restored, the power source is not overloaded due to all the drives starting at the same time. The VSD must have been in the "Auto" mode when the power was lost for the power fail timer to operate; however it does not matter whether or not the VSD was running when power was removed. Power fail restarts must also be enabled for them to operate, to do this set the "Power Fail" restarts to "Yes"

Jump Frequencies

A "jump frequency" is a frequency range that the VSD is programmed to avoid (#126 to #131). They may be needed to prevent VSD operation at a frequency that could cause damage to certain equipment combinations, perhaps due to resonance. For example, a jump frequency of 67.0 Hz with a bandwidth of 2.0 Hz may be entered. This will result in a "jump band" from 66.0 Hz to 68.0 Hz. If the VSD is slowly changing frequency from 60 to 70 Hz it will slowly speed up until it reaches 65.9 Hz, where it will pause depending on the ramp rate and mode selected, then it will jump to 66.0 Hz where it will pause before accelerating up to 70Hz. It will avoid running inside the jump frequency bandwidth. The user may enter up to three separate jump frequencies and bandwidths. If jump bands overlap each other they will have the effect of a larger, single band. If the jump frequencies are not needed set them to zero, which will disable them.

PID Control

The VSD operator interface has built in software routines for PID speed control (#182 to #185). PID is an abbreviation for proportional, integral and derivative control, which may be used for special applications or speed control that includes some kind of feedback signal from an external source. A typical application may be using the VSD to control a pump that fills a tank, and automatically adjusting the VSD frequency to maintain a constant volume of fluid in the tank. PID control may only be used while in the 'pressure' speed control mode, although any type of input sensor may be used. A 'target' set point must be established before PID control may be used, this corresponds to the external parameter that the VSD

will try and maintain at a constant level. After setting the target point of the external parameter the VSD also needs to be programmed to speed up or slow down if the parameter rises or falls. For example if the VSD is driving a pump that is filling a tank it will be need to be set in the opposite direction to a VSD that is being used to empty the tank. When the VSD is started in PID mode it will initially ramp up to the users normal 'speed' control setting; if the VSD was already running when the speed control mode is changed to PID it will begin PID control at the present speed. Then the following speed adjustments will take place. The VSD will constantly sample the pressure input, and compare this input to the target 'set' point. From the measured pressure input and the pressure set point it will calculate an error signal, the difference between the two. (Note that the VSD will internally compensate for unit scale and range differences on the input, calculating the error based on the full-scale range of the input). If the signal input is equal to the set point there will be no error, and the VSD will continue to run at the present frequency. If there is an error the VSD will calculate and change the speed depending on the following. The amplitude of the error will be multiplied by the users programmed setting for 'proportional', and this signal will be applied as an offset to the present frequency. The result is that the frequency will change from the present setting in proportion to the size of the error signal. As the error signal reduces in amplitude, the speed will change proportionally. If the error falls to zero the speed will have changed back to the previous speed. Since this does not normally shift the speed point enough to reduce the error signal to zero, another user programmable parameter called the integral is used. The integral (sometimes called resets per minute) essentially 'resets' the running speed point to the present speed periodically. Rather than resetting the running speed every minute, the operator interface continually resets it by a smaller amount, for smoother control. The net effect of the integral is to slowly change the speed over time, to ensure that the users selected parameter is maintained at a constant level. The last parameter is called the 'derivative', and is used to quickly change the VSD frequency to compensate for rapidly changing input signals, such as step changes. For most normal applications the derivative will probably never need to be used. None of the three PID parameters have units associated with them. The smallest value that may be programmed for each parameter is zero, where it will have no effect. When setting up a VSD to use PID control start with small values (for example, less than 5) for the control settings, as it is easy to create an unstable system if large values are used. Many transducers that may be connected will only update outputs periodically, so response to changing conditions may be slow. For a more complete description of setting up PID control routines please consult one of the many books available on the subject.

Data log, history log, configuration:

The data log, when enabled (#244), will check data (frequency, current, and voltage) at 10 second read intervals, and output data at desired write intervals, starting at 1 minute (#245). The output consists of the minimum, maximum, and average values of the data since the last write as well as when the data was written. The only way to view this is to print it (#248).

The history log keeps track of all system events including the user changing parameters as well as starts, stops, faults, and a timestamp of when each occurred. The history log can be viewed (#111) as well as printed (#243). When viewing the history, the UP/DOWN arrow keys are used to scroll UP/DOWN through the recorded events.

The configuration lists all important system settings in a single place for easy reference. The only way to view this is to print it (#240).

Printing:

Printing is usually used to save desired information for later review and is done by connecting a serial printer to the front port of the VSD, then selecting a printout of the desired information (data log, history log, configuration).

Printing the configuration (#240) is the easiest since there are no menu items that affect the configuration printout. Before printing the history log (#243), the amount of history to print must be selected. Whether to print the given number of DAYS or EVENTS must be selected (#241) followed by how many of them (#242) to print. The most recent history events are printed first. For example, if 2 EVENTS are printed, the most recent history event will be printed first, followed by the next most recent history event.

Before printing the data log (#248), the amount of data to print must be selected. Whether to print the given number of DAYS or EVENTS must be selected (#246) followed by how many of them (#247) to print. The most recent data is printed first. For example, if 2 EVENTS are printed, the most recent data event will be printed first followed by the next most recent data event.

Stop Mode

The operator interface may be programmed to stop the VSD in two different modes, called "Controlled" and "Coasting" stop (#212). When the VSD stops in controlled stop, the VSD output frequency and voltage will decelerate towards zero until the motor is stopped. Most applications will typically be set to use the controlled stop method. When the VSD stops in coasting stop, the VSD output frequency and voltage, effectively disconnect from the motor and the motor coasts to a stop. The coast stop method is typically used for motors with large inertia's, such as surface horizontal pumps where the motor is unable to slow down quickly. In abnormal VSD shutdowns, such as emergency stops or power fails, the stop method will usually default to coasting, regardless of the programmed setting.

Internal Temperature

The operator interface has a transducer that is used to continually monitor the VSD cabinet temperature (#213 and #214). High and low trip points may be set to prevent the VSD from operating outside a certain range. Note that the VSD has additional temperature shutdowns to protect the VSD in case of abnormal conditions, these additional shutdowns are not user programmable.

Direct Access

Direct access is a method used to adjust preset operating points in the VSD. They are not normally required for standard applications. For further information contact REDA engineering for direct access assistance.

Motor VSD Current Calibration

The VSD is factory calibrated to measure the current in two output phases and calculate an average of these three currents. This average is then used for all displays, data logging and control purposes. The operator interface may be programmed to use a scaled value of the motor current (after an output transformer) rather than the direct VSD output current (#108). To calibrate the motor current use the following procedure. First the VSD needs to be started and running with a suitable load. While it is running at a constant current use a clamp-on type current meter to measure the current in each of the three phases to the motor, after the output transformer. These three currents may vary somewhat, especially if flat cable is being used, which may cause some imbalance between the phases. Take an average of these three measured currents. At the motor current calibration menu (#109) enter the average motor current just measured. Select current type as 'motor' rather than 'actual amps" in Menu 108 Amps Display Type. Now all measurements, displays and control actions will use the scaled motor current rather than the VSD output current. The selection of actual amps or scaled motor current may be changed without losing the 'scale' factor values stored in the operator interface. Note that the most accurate calculations will be made by the operator interface if the calibration is performed at a reasonable current level such as the normal running current. Calibrations made with very small currents may introduce scaling errors as the current is increased.

Tracking Underload

The HMI now incorporates a "Tracking Underload" feature. Once tracking underload is enabled (menu 151) the HMI will keep a running average of the last few minutes of operation. If the current falls below the preset 'percentage of running' current (menu 152) an underload condition will be triggered and the corresponding 'undercurrent activation' timer will start to count down. If the condition remains for longer than it takes for the undercurrent activation shutdown timer to expire the drive will stop. If in the 'Auto' mode the drive may automatically restart later depending on the standard restart timers and counters. The purpose of the tracking underload shutdown is to protect motors when the normal underload current has to be set low enough so slowly changing currents will not cause nuisance undercurrent trips but relatively fast current drops (such as caused by gas locks) may occur. Note that if tracking underload is enabled then the undercurrent activation delay should not be set to longer than a few minutes, since the average tracking underload level will start to fall during this time and the shutdown condition that triggers the 'activation delay' may be removed. The tracking threshold current level may be monitored in the main status screen, shown in amps. If the VSD speed changes rapidly the tracking threshold current level used for tracking underload will be automatically reset and will start to build up from zero again. This prevents nuisance tracking underload shutdowns if, for example, the user changes the target speed while the VSD is running. Note that setting the tracking underload to a high setting (such as 98%) will result in an almost constant underload on / off condition as the drive current fluctuates above and below the tracking undercurrent level.

Graph Printing

The HMI may directly print graphs using the standard thermal printer. Plug the printer into the HMI front panel connector then use menus 250-253 to access the graph printing functions. Menu 250 is used to select the item (speed, current or pressure) to be printed, note that only one item may be printed at a time. Secondly, the number of days back to print should be selected in menu 251. These will be actual calendar days back from the present date, and will include any days when the drive was not running. The graph may be printed for up to the last 100 days, but note that printing this many will take considerable time. Next the size of the graph scale needs to be entered in menu 253, and this will correspond to the height of the axis. A typical value if graphing speed may be 75 or 100; if graphing pressure it may be 5000. The lower graph axis is fixed at zero. Once these items have been entered the printing may be started by using menu 253. Unlike the data or history printing the HMI keyboard and display may be used for other functions during graph printing, so even though graph printing is slow the operator may perform other functions as the HMI prints. Another selection in menu 253 allows the operator to stop the HMI from printing the present graph. Note that many printers have an internal data buffer that may take quite a while to empty, and even after the HMI has stopped sending data to the printer it may still be printing. If this occurs turning the printer off then on again will empty the printers internal data buffer. The graphs will show the time and date on the X axis with the parameter selected by menu 250 on the Y axis. The parameter will be shown as a solid vertical line between the minimum and maximum values recorded during each 15 minute interval in the day. Somewhere in the line will be a small gap, this is the average value during the 15 minute time interval. If a single dot or line is visible for any 15 minute period then the difference between the minimum, maximum and average value was too small to be shown on the graph.

Catch a Spinning Motor

Menu 454 allows the user to enable or disable the 'catch a spinning motor' feature. Once enabled the VSD it will analyze any voltage present at the output of the VSD before starting, to determine if a connected motor is still spinning. If it appears that a connected motor is still spinning the VSD will attempt to match the motor speed with an active drive signal to gain control of the motor, then continue to control the motor in whatever mode is programmed by the operator. If the motor is spinning opposite to the required direction the VSD will slow down the motor, change direction and accelerate up to the required speed. The primary use for this feature would be to safely start a motor that is being turned backwards due to falling fluid in a pump string that may have stopped pumping. If this feature is used a check valve may no longer be required in some systems or the time delay to wait for back spinning systems to stop before attempting a restart may not be necessary.

Base Frequency Voltage Select

Menu 455 allows the user to select different references for the base frequency output voltage settings. Selecting 'input' causes the output voltage to fluctuate with any changes on the power into the VSD, so if the input voltage dropped by 20% so would the output voltage. Selecting 'auto' causes the VSD to output a fixed base voltage that is determined by the input power voltage to the VSD measured when power is first applied to the VSD. The VSD will try to compensate for any changes in the input voltage to maintain a constant base output voltage. If set to 'fixed' the operator may manually set a base output voltage using menu 456, which will be independent of both the input voltage and changes to the input voltage. If set to 'auto' or 'input' then menu 456 has no effect.

Start Hertz

Menu 458 allows the user to set the starting frequency of the VSD. This will be the initial frequency output by the drive when it starts, and may be used to prevent the drive from starting at frequencies below those specified by the transformer manufacturer. Once started the drive will immediately start to ramp up from the 'Start Hertz' speed to the minimum speed at the rate set by menus 470 and 471.

Start-up Voltage Boost

Here the user may enter a value (up to 30%) which will be the amount above the normal output voltage during starting. It is only active up to a frequency of 12 Hz. This may help some motors start due to supplying additional torque. However, it may it may also cause over current trips during starting if it is set too high. It would not normally be used for most installations.

Volts per Hertz Patterns and Vector Control

This allows the user to change the method used by the VSD to generate the volts per hertz slope during acceleration and speed changes. The standard mode is 'constant torque', however it may also be set to vector control, auto boost and variable modes, several of which also may have energy saving options. Please refer to the Toshiba manual for further details of all the possible settings. Note that the VSD must be stopped before any of these selections may be changed. The number of motor poles (menu 462), the moment of inertia (menu 461) and the motor horsepower (menu 850) must be entered before the vector control modes will operate correctly. Most standard REDA downhole motors are two pole; some surface

inertia; some surface systems such as horizontal pumps may have a large moment of inertia. The VSD will use this information during vector control computations.

Acceleration Rate

Menus 470 and 471 may be used to enter the acceleration ramp rate that the VSD will use to accelerate from the starting hertz (menu 458) to the minimum drive speed (menu 122). It is entered in a similar manner to the other ramp rates, with separate menu entries for the time and frequency change. Once the minimum speed (menu 122) has been reached the VSD will change acceleration rates and use the minimum to target hertz rate (set by menus 472 and 473) until one of the control modes (such as frequency or current) takes control of the speed. These acceleration rates overwrite any settings that may have been entered into the VSD using the handheld keypad.

Deceleration Rate

Menus 474 and 475 may be used to enter the deceleration ramp rate that the VSD will use when stopping if the stop mode (menu 212) is set to 'controlled'. The rate is entered in a similar manner to the other ramp rates, with separate menu entries for the time and frequency change. This deceleration rate is ignored if the drive is set to stop in a 'coasting' mode.

Rocking Starts

Using this feature the VSD to may be able to 'break free' a pump and motor that has become seized downhole. The controller will attempt this by rapidly rocking the motor back and forwards, then trying to bring the motor up to speed. Menu 500 enables or disables rocking starts, menu 501 sets the number of 'rocks' and menu 502 selects the rocking start method. There are three methods which differ in the time the VSD is on in each direction and the way the VSD changes directions during these 'rocks'. Each method may be tried until one is successful, since the size and type of equipment will affect how effectively rocking starts work. It is possible that the VSD may report over currents during rocking start attempts. Normally rocking starts are disabled, since they are only used as a last resort where downhole equipment may have seized. It is possible that equipment may be damaged during a rocking start attempt.

Force Frequencies

The VSD now has the capability of 'forced frequency' control. Menu 510 enables or disables this function. 'Forcing' allows the VSD to change to a preset speed set by the operator when a predefined digital input becomes active, effectively temporarily overwriting any controlled speed mode that is operating. Once the selected input becomes inactive the speed control reverts to the former setting. This may be useful in special circumstances, for example to remotely change the drive speed to fill or empty a tank. Menu 511 sets the force frequency and menu 512 selects the digital input that will be used for forced speed control. The normal drive protection such as under and overloads are not disabled during forced speed control.

G3 Service Routines

Standard Toshiba G3 software routines that may be required during service can now be directly invoked from a new menu 999, such as 'Type 3' and 'Type 7' resets. The Toshiba 'SuperUser' mode may also be turned on here for operating the VSD without any bus voltage. Note that the drive will drop out of 'SuperUser' mode if a trip occurs and the HMI will not report this, since it cannot query the VSD as to the

present 'SuperUser' state. For safety reasons a trip will be forced if current greater than 50% of the VSD's full load output is detected while in 'SuperUser' mode. The power to the system (both the VSD and the HMI) must be cycled to exit 'SuperUser' mode. The VSD must be stopped before any of these routines may be selected. Since these service routines and several drive tuning routines (such as acceleration and deceleration ramp rates) have been added the need to the use the 900-904 menus for writing G3 parameters has diminished. Hence the 'write' capability in the '904 direct access' menus has been restricted and now requires a factory code that has to be entered in menu 905 to enables 'writes' using the 900 menus. It is expected that the 900-905 menus will be removed in the future.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
100 PRIMARY MENU 1=ENGLISH 2=ESPAÑOL	ALL:__1-2	ESP:__1 HPS:__1 PCP:__1

A NUMERICAL VALUE ENTERED HERE WILL CHANGE THE MENUS TO THE LANGUAGE INDICATED. 1=ENGLISH 2=ESPAÑOL.

101 PRIMARY MENU COMMISSION VSD	ALL:__YES, NO	ESP:__YES HPS:__YES PCP:__YES

BY USING THE UP AND DOWN KEYS YOU CAN SELECT YES OR NO TO COMMISSION THE VSD. AFTER YES IS ENTERED THERE WILL BE A WARNING THAT ALL HISTORICAL INFORMATION AND ALL USER SET PARAMETERS WILL BE RESET TO DEFAULT VALUES. YOU MUST SELECT YES AGAIN FOR CONFIRMATION.

102 PRIMARY MENU ENTER MASTER PASSWORD	ALL:__0-9999	ESP:__0 HPS:__0 PCP:__0

THE MASTER PASSWORD WILL GIVE YOU ACCESS TO ALL OF THE PARAMETER SETTINGS. THIS PASSWORD SHOULD NOT BE AVAILABLE TO ALL OPERATORS. TO DISABLE ALL ACCESS, ENTER AN INVALID PASSWORD.

103 PRIMARY MENU CHANGE MASTER PASSWORD	ALL:__0-9999	ESP:__0 HPS:__0 PCP:__0

THE MASTER PASSWORD MAY BE CHANGED IF THE EXISTING MASTER PASSWORD HAS ALREADY BEEN ENTERED. CHANGE THE PASSWORD TO A SPACE IF NO PASSWORD IS DESIRED FOR MASTER ACCESS.

104 PRIMARY MENU ACCESS SELECTION FOR USER BY MASTER	ALL:__0 characters = no password-10 characters	ESP:__ HPS:__ PCP:__

THIS MENU CONTROLS THE USER'S ACCESS TO THE MENUS AND CAN ONLY BE ACCESSED AFTER THE PROPER MASTER PASSWORD HAS BEEN ENTERED. PRESS ENTER TO BEGIN CHANGING THE USER ACCESSES. TO CHANGE THE USER ACCESS, USE THE UP AND DOWN ARROW KEYS TO SCROLL THROUGH THE MENUS AND PRESS THE ENTER KEY TO TOGGLE THE ACCESS LEVEL. PRESS MENU KEY WHEN DONE.

105 PRIMARY MENU ENTER USER PASSWORD	ALL:__0-9999	ESP:__0 HPS:__0 PCP:__0

THE USER PASSWORD ALLOWS ACCESS TO SELECTED PARAMETER SETTINGS. THE DEFAULT PARAMETERS ARE TARGET SPEED, TARGET CURRENT, TARGET PRESSURE, AND PRINTER CONTROL. USER ACCESS PARAMETERS MAY BE CHANGED USING THE MASTER PASSWORD. TO DISABLE ALL ACCESS, ENTER AN INVALID PASSWORD.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
106 PRIMARY MENU CHANGE USER PASSWORD	ALL:__0-9999	ESP:__0 HPS:__0 PCP:__0

ONCE THE USER OR MASTER PASSWORD HAS BEEN ENTERED, THE USER PASSWORD MAY BE CHANGED. CHANGE THE PASSWORD TO A SPACE IF NO PASSWORD IS DESIRED FOR USER ACCESS.

107 PRIMARY MENU CONTROL TYPE	ALL:__SPEED, CURRENT, PRESSURE	ESP:__SPEED HPS:__SPEED PCP:__SPEED

USE THE UP AND DOWN ARROW KEYS TO SCROLL THROUGH THE CONTROL MODES. THE CHOICES ARE: SPEED, CURRENT, OR PRESSURE CONTROL. IN THE SPEED CONTROL MODE, THE VSD WILL ADJUST ITS SPEED TO MAINTAIN THE TARGET SPEED. IN THE CURRENT CONTROL MODE, THE VSD WILL ADJUST ITS SPEED TO MAINTAIN THE TARGET CURRENT. IN THE PRESSURE CONTROL MODE, THE VSD WILL ADJUST ITS SPEED TO MAINTAIN THE TARGET PRESSURE.

108 PRIMARY MENU AMPS DISPLAYED AND USED	ALL:__MOTOR AMPS, ACTUAL AMPS	ESP:__ACTUAL AMPS HPS:__ACTUAL AMPS PCP:__ACTUAL AMPS

PRESS THE UP OR DOWN KEYS TO SELECT HOW THE CURRENT (AMPS) IS DISPLAYED. THE CHOICES ARE ACTUAL AMPS OR MOTOR AMPS. THE ACTUAL AMPS IS THE ACTUAL AMPERAGE OF THE VSD ON THE OUTPUT TERMINALS. THE MOTOR AMPERAGE IS A SCALED MEASUREMENT ENTERED IN THE FOLLOWING PARAMETER TYPICALLY USED TO COMPENSATE FOR VARIOUS LOSSES SO THE DISPLAYED AMPERAGE REFLECTS THE AMPERAGE REACHING THE MOTOR.

109 PRIMARY MENU ENTER MEASURED AMPERAGE	ESP:__0-10000 HPS:__0-4000 PCP:__0-10000	ESP:__0 HPS:__0 PCP:__0

ENTER THE ACTUAL MOTOR CURRENT (AMPS). WHEN MOTOR AMPS IS SELECTED IN THE PREVIOUS PARAMETER, THE MEASURED AMPERAGE WILL BE SCALED TO THE ACTUAL MOTOR AMPERAGE. FOR BEST ACCURACY, ENTER THE VALUE WHILE THE DRIVE IS RUNNING AT 50% OR MORE OF RATED LOAD.

110 PRIMARY MENU WELL IDENTIFICATION	ALL:__0	ESP:__0 HPS:__0 PCP:__0

USE THE KEYPAD TO ENTER AN ALPHANUMERIC NAME. THIS IS A USER DEFINED ENTRY FOR IDENTIFICATION OF THE EQUIPMENT.

111 PRIMARY MENU VIEW HISTORY	ALL:__	ESP:__ HPS:__ PCP:__

AFTER PRESSING ENTER, YOU MAY USE THE UP AND DOWN ARROW KEYS TO SCROLL THROUGH THE HISTORY. PRESSING ENTER WILL EXIT THE VIEW MODE.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
112 PRIMARY MENU RESET USER RUN AND POWER ON TIMER'S	ALL:__YES, NO	ESP:__NO HPS:__NO PCP:__NO

RECORDS ARE KEPT OF THE POWER ON TIME, THE VSD RUNNING TIME AND THE NUMBER OF VSD STARTS. THERE ARE TWO SETS OF THESE RECORDS, ONE WHICH THE USER MAY RESET, TYPICALLY WHEN A NEW PUMP OR MOTOR IS INSTALLED. TO RESET THE RECORDS SELECT 'YES'. THE RECORDS MAY BE SEEN IN THE STATUS SCREEN AND BY PRINTING OUT THE CONFIGURATION.

120 SPEED MENU SPEED SOURCE	ALL:__USER INPUT, ANALOG 1, ANALOG 2	ESP:__USER INPUT HPS:__USER INPUT PCP:__USER INPUT

THIS IS WHERE THE VSD WILL REFERENCE ITS TARGET SPEED WHEN IN THE SPEED CONTROL MODE. PRESS THE UP OR DOWN KEYS TO SCROLL THROUGH THE CHOICES. WHEN AN ANALOG INPUT IS SELECTED THE SPEED IS REFERENCED TO THE SCALED VALUE OF THAT ANALOG INPUT.

121 SPEED MENU TARGET SPEED (HZ)	ESP:__20-90 HPS:__10-70 PCP:__6-70	ESP:__50 HPS:__60 PCP:__45

THE TARGET SPEED IS USED WHEN IN THE SPEED CONTROL MODE. THIS VALUE MUST BE WITHIN THE MINIMUM AND MAXIMUM LIMITS SET IN FOLLOWING PARAMETERS.

122 SPEED MENU MINIMUM SPEED (HZ)	ESP:__20-90 HPS:__10-70 PCP:__6-70	ESP:__20 HPS:__30 PCP:__10

THIS VALUE IS NOT A TRIP POINT. IT IS THE MINIMUM FREQUENCY AT WHICH THE VSD WILL RUN.

123 SPEED MENU MAXIMUM SPEED (HZ)	ESP:__20-90 HPS:__31-70 PCP:__10-70	ESP:__60 HPS:__70 PCP:__60

THIS VALUE IS NOT A TRIP POINT. IT IS THE MAXIMUM FREQUENCY AT WHICH THE VSD WILL RUN.

124 SPEED MENU SPEED CONTROL HZ	ESP:__0.1-20 HPS:__0.1-30 PCP:__0.1-20	ESP:__4 HPS:__2 PCP:__4

THIS PARAMETER AND THE FOLLOWING PARAMETER DEFINE THE SPEED CONTROL RAMP.

125 SPEED MENU SPEED CONTROL SECONDS	ALL:__1-10000	ESP:__1 HPS:__1 PCP:__1

THIS PARAMETER AND THE PREVIOUS PARAMETER DEFINE THE SPEED CONTROL RAMP.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
126 SPEED MENU **JUMP** **FREQUENCY # 1**	ALL:__0-120	ESP:__0 HPS:__0 PCP:__0

THIS PARAMETER AND THE FOLLOWING PARAMETER DEFINE A FREQUENCY RANGE THAT MAY CAUSE PROBLEMS. THE VSD WILL AVOID THIS FREQUENCY RANGE IN ALL CONTROL MODES. THIS VALUE SETS THE CENTER FREQUENCY. SETTING THIS PARAMETER TO ZERO WILL DISABLE THIS FEATURE.

127 SPEED MENU **JUMP** **BANDWIDTH # 1**	ALL:__1-5	ESP:__1 HPS:__1 PCP:__1

THIS PARAMETER AND THE PREVIOUS PARAMETER DEFINE A FREQUENCY RANGE THAT MAY CAUSE PROBLEMS. THE VSD WILL AVOID THIS FREQUENCY RANGE IN ALL CONTROL MODES. THIS VALUE SETS THE BANDWIDTH FREQUENCY. IF THE PREVIOUS PARAMETER IS SET TO 30 AND THIS PARAMETER IS SET TO 4, THE VSD WILL AVOID THE FREQUENCY RANGE OF 28 TO 32 HZ.

128 SPEED MENU **JUMP** **FREQUENCY # 2**	ALL:__0-120	ESP:__0 HPS:__0 PCP:__0

THIS PARAMETER AND THE FOLLOWING PARAMETER DEFINE A FREQUENCY RANGE THAT MAY CAUSE PROBLEMS. THE VSD WILL AVOID THIS FREQUENCY RANGE IN ALL CONTROL MODES. THIS VALUE SETS THE CENTER FREQUENCY. SETTING THIS PARAMETER TO ZERO WILL DISABLE THIS FEATURE.

129 SPEED MENU **JUMP** **BANDWIDTH # 2**	ALL:__1-5	ESP:__1 HPS:__1 PCP:__1

THIS PARAMETER AND THE PREVIOUS PARAMETER DEFINE A FREQUENCY RANGE THAT MAY CAUSE PROBLEMS. THE VSD WILL AVOID THIS FREQUENCY RANGE IN ALL CONTROL MODES. THIS VALUE SETS THE BANDWIDTH FREQUENCY. IF THE PREVIOUS PARAMETER IS SET TO 30 AND THIS PARAMETER IS SET TO 4, THE VSD WILL AVOID THE FREQUENCY RANGE OF 28 TO 32 HZ.

130 SPEED MENU **JUMP** **FREQUENCY # 3**	ALL:__0-120	ESP:__0 HPS:__0 PCP:__0

THIS PARAMETER AND THE FOLLOWING PARAMETER DEFINE A FREQUENCY RANGE THAT MAY CAUSE PROBLEMS. THE VSD WILL AVOID THIS FREQUENCY RANGE IN ALL CONTROL MODES. THIS VALUE SETS THE CENTER FREQUENCY. SETTING THIS PARAMETER TO ZERO WILL DISABLE THIS FEATURE.

131 SPEED MENU **JUMP** **BANDWIDTH # 3**	ALL:__1-5	ESP:__1 HPS:__1 PCP:__1

THIS PARAMETER AND THE PREVIOUS PARAMETER DEFINE A FREQUENCY RANGE THAT MAY CAUSE PROBLEMS. THE VSD WILL AVOID THIS FREQUENCY RANGE IN ALL CONTROL MODES. THIS VALUE SETS THE BANDWIDTH FREQUENCY. IF THE PREVIOUS PARAMETER IS SET TO 30 AND THIS PARAMETER IS SET TO 4, THE VSD WILL AVOID THE FREQUENCY RANGE OF 28 TO 32 HZ.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
140 CURRENT MENU TARGET CURRENT	ESP:__0-5000 HPS:__0-4000 PCP:__0-5000	ESP:__50 HPS:__50 PCP:__50

THE TARGET CURRENT IS USED WHEN IN THE CURRENT CONTROL MODE. THIS VALUE MUST BE WITHIN THE MINIMUM AND MAXIMUM LIMITS SET IN FOLLOWING PARAMETERS. IT IS VERY IMPORTANT TO REMEMBER THAT WHETHER THE AMPERAGE DISPLAY PARAMETER IS THE REAL AMPERAGE OR THE SCALED AMPERAGE, THE NUMBER ENTERED HERE IS BASED AND DISPLAYED ON THAT VALUE.

141 CURRENT MENU MINIMUM CURRENT LIMIT	ESP:__0-5000 HPS:__0-4000 PCP:__0-5000	ESP:__0 HPS:__0 PCP:__0

THIS IS A TRIP POINT IN ALL MODES OF OPERATION TO PROTECT ANY ATTACHED EQUIPMENT. ENTER THE MINIMUM CURRENT ALLOWED DURING OPERATION. IT IS VERY IMPORTANT TO REMEMBER THAT WHETHER THE AMPERAGE DISPLAY PARAMETER IS THE REAL AMPERAGE OR THE SCALED AMPERAGE, THE NUMBER ENTERED HERE IS BASED AND DISPLAYED ON THAT VALUE.

142 CURRENT MENU MAXIMUM CURRENT LIMIT	ESP:__0-5000 HPS:__0-4000 PCP:__0-5000	ESP:__100 HPS:__100 PCP:__100

THIS IS A TRIP POINT IN ALL MODES OF OPERATION TO PROTECT ANY ATTACHED EQUIPMENT. ENTER THE MAXIMUM CURRENT ALLOWED DURING OPERATION (SHOULD NOT EXCEED MAXIMUM OUTPUT CURRENT). IT IS VERY IMPORTANT TO REMEMBER THAT WHETHER THE AMPERAGE DISPLAY PARAMETER IS THE REAL AMPERAGE OR THE SCALED AMPERAGE, THE NUMBER ENTERED HERE IS BASED AND DISPLAYED ON THAT VALUE.

143 CURRENT MENU UNDER CURRENT IGNORE AT STARTUP	ESP:__0-99:59:59 HPS:__0-01:00:00 PCP:__0-99:59:59	ESP:__0 HPS:__0 PCP:__0

ENTER THE ALLOWABLE TIME FOR OPERATION IN AN UNDER CURRENT CONDITION DURING STARTUP. THIS IS HOW LONG AN UNDER CURRENT CONDITION WILL BE IGNORED DURING THE STARTUP. AUTO MODE MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT.

144 CURRENT MENU UNDER CURRENT ACTIVATION DELAY	ESP:__1-01:00:00 HPS:__1-00:10:00 PCP:__1-01:00:00	ESP:__1 HPS:__1 PCP:__1

THIS DELAY ALLOWS OPERATION IN AN UNDER CURRENT CONDITION FOR THE TIME SET. THE ACTIVATION DELAY TIMER WILL CAUSE AN UNDER CURRENT CONDITION TO BE IGNORED FOR THE TIME ENTERED. WHEN THIS TIME IS EXCEEDED A SHUTDOWN WILL OCCUR. AUTO MODE MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT.

145 CURRENT MENU UNDER CURRENT AUTO RESTART	ALL:__YES, NO	ESP:__NO HPS:__NO PCP:__NO

USE THE UP OR DOWN KEYS TO TOGGLE THIS ENTRY. IF AUTO RESTART IS "YES", WHEN AN UNDER CURRENT SHUTDOWN OCCURS, AN AUTOMATIC RESTART WILL BE ATTEMPTED AFTER THE TIME ENTERED IN THE FOLLOWING PARAMETER. AUTO MODE MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
146 CURRENT MENU AUTO RESTART DELAY	ALL:__1-99:59:59	ESP:__20 HPS:__20 PCP:__20

AFTER AN UNDER CURRENT SHUTDOWN OCCURS, AN AUTOMATIC RESTART WILL BE ATTEMPTED AFTER THE TIME ENTERED IN THIS PARAMETER. AUTO MODE AND AUTO RESTART MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT.

147 CURRENT MENU AUTO RESTARTS AFTER UNDER CURRENT	ALL:__1-9999	ESP:__6 HPS:__6 PCP:__6

ENTER THE NUMBER OF AUTO RESTART ATTEMPTS ALLOWED AFTER UNDER CURRENT SHUTDOWNS. THIS VALUE SETS THE NUMBER OF RESTART ATTEMPTS ON UNDER CURRENT SHUTDOWNS. AUTO MODE AND AUTO RESTART MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT. TOGGLING FROM HAND MODE TO AUTO MODE WILL RESET THE INTERNAL COUNT OF ATTEMPTED STARTS.

148 CURRENT MENU CURRENT CONTROL HZ	ESP:__0.1-20 HPS:__0.1-30 PCP:__0.1-20	ESP:__1 HPS:__1 PCP:__1

THIS PARAMETER AND THE FOLLOWING PARAMETER DEFINE THE CURRENT CONTROL RAMP.

149 CURRENT MENU CURRENT CONTROL SECONDS	ESP:__1-10000 HPS:__1-7200 PCP:__1-10000	ESP:__10 HPS:__10 PCP:__10

THIS PARAMETER AND THE PREVIOUS PARAMETER DEFINE THE CURRENT CONTROL RAMP.

150 CURRENT MENU OVER CURRENT ACTIVATION DELAY	ALL:__0-5	ESP:__0 HPS:__0 PCP:__0

THIS DELAY ALLOWS OPERATION IN AN OVER CURRENT CONDITION FOR THE TIME SET. THE ACTIVATION DELAY TIMER WILL CAUSE AN OVER CURRENT CONDITION TO BE IGNORED FOR THE TIME ENTERED. WHEN THIS TIME IS EXCEEDED A SHUTDOWN WILL OCCUR.

151 CURRENT MENU TRACKING UNDERLOAD ENABLE	ALL:__YES, NO	ESP:__YES HPS:__YES PCP:__YES

THIS MENU IS USED TO ENABLE OR DISABLE THE TRACKING UNDERLOAD FUNCTION, WHICH IS TYPICALLY USED TO PREVENT DAMAGE CAUSED BY CONDITIONS SUCH AS GAS LOCKS. MENU 152 SETS THE TRACKING UNDERLOAD LEVEL AS A PERCENTAGE OF THE RUNNING CURRENT. THE TRACKING UNDERLOAD SHUTDOWN SHARES THE SAME SHUTDOWN AND RESTART TIMERS AS THE NORMAL UNDERLOAD SHUTDOWNS.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
152 CURRENT MENU TRACKING UNDERLOAD CURRENT DEVIATION %	ALL:__0.0-98.9	ESP:__85.0 HPS:__85.0 PCP:__85.0

IF TRACKING UNDERLOAD IS ENABLED (MENU 151) THIS MENU SETS THE PERCENTAGE OF THE AVERAGE RUNNING CURRENT THAT WILL START THE UNDERLOAD SHUTDOWN TIMERS TO COUNT DOWN THIS TRACKING UNDERLOAD CURRENT IS BASED ON A RUNNING AVERAGE OF THE LAST FEW MINUTES OF CURRENT. IF THERE ARE ANY SUDDEN SPEED CHANGES THE TRACKING UNDERLOAD CURRENT IS AUTOMATICALLY RESET TO ZERO, AND WILL START TO BUILD BACK UP AGAIN TOWARDS THE SET PERCENTAGE OF NORMAL RUNNING CURRENT AS THE DRIVE RUNS.

160 PRESSURE MENU TARGET PRESSURE (PSI)	ALL:__1-10000	ESP:__2500 HPS:__5000 PCP:__2500

THE TARGET PRESSURE IS USED WHEN IN THE PRESSURE CONTROL MODE. THIS VALUE MUST BE WITHIN THE MINIMUM AND MAXIMUM LIMITS SET IN FOLLOWING PARAMETERS.

161 PRESSURE MENU MINIMUM PRESSURE (PSI)	ALL:__0-9999	ESP:__0 HPS:__0 PCP:__0

THIS IS A TRIP POINT IN ALL MODES OF OPERATION TO PROTECT ANY ATTACHED EQUIPMENT. ENTER THE MINIMUM PRESSURE ALLOWED DURING OPERATION.

162 PRESSURE MENU MAXIMUM PRESSURE (PSI)	ESP:__1-20000 HPS:__1-15000 PCP:__1-20000	ESP:__5000 HPS:__10000 PCP:__5000

THIS IS A TRIP POINT IN ALL MODES OF OPERATION TO PROTECT ANY ATTACHED EQUIPMENT. ENTER THE MAXIMUM PRESSURE ALLOWED DURING OPERATION.

163 PRESSURE MENU PRESSURE INPUT SELECTION	ALL:__ANALOG 1,ANALOG 2,NONE	ESP:__NONE HPS:__NONE PCP:__NONE

ENTER THE ANALOG INPUT NUMBER CONNECTED TO PRESSURE SENSING DEVICE. THIS SETTING INDICATES THE ANALOG INPUT TO BE USED IN PRESSURE CONTROL MODE.

164 PRESSURE MENU SPEED UP OR DOWN WITH PRESSURE RISE	ALL:__SPEED UP, SLOW DOWN	ESP:__SPEED UP HPS:__SPEED UP PCP:__SPEED UP

USE THE UP OR DOWN ARROW KEYS TO TOGGLE ENTRIES. THIS SETTING DEFINES THE ACTION ON A PRESSURE INCREASE. "SPEED UP" WILL CAUSE THE MOTOR SPEED TO INCREASE. "SLOW DOWN" WILL CAUSE THE MOTOR SPEED TO DECREASE. THE AMOUNT OF CHANGE IS SET IN THE FOLLOWING PARAMETERS. THIS PARAMETER IS USED ONLY IN PRESSURE CONTROL MODE.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
165 PRESSURE MENU **PRESSURE CONTROL** **HZ**	ESP:__0.1-20 HPS:__0.1-30 PCP:__0.1-20	ESP:__0.5 HPS:__0.5 PCP:__0.5

THIS PARAMETER AND THE FOLLOWING PARAMETER DEFINE THE PRESSURE CONTROL RAMP.

166 PRESSURE MENU **PRESSURE CONTROL** **SECONDS**	ESP:__1-10000 HPS:__1-7200 PCP:__1-10000	ESP:__1 HPS:__1 PCP:__1

THIS PARAMETER AND THE PREVIOUS PARAMETER DEFINE THE PRESSURE CONTROL RAMP.

167 PRESSURE MENU **UNDER PRESSURE** **SHUTDOWN ENABLE**	ALL:__YES, NO	ESP:__NO HPS:__NO PCP:__NO

USE THE UP OR DOWN ARROW KEYS TO ENABLE OR DISABLE THE UNDER PRESSURE SHUTDOWN OPTION. AUTO MODE MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT.

168 PRESSURE MENU **UNDER PRESSURE** **IGNORE AT STARTUP**	ALL:__0-24:00:00	ESP:__0 HPS:__0 PCP:__0

ENTER THE ALLOWABLE TIME FOR OPERATION IN AN UNDER PRESSURE CONDITION DURING STARTUP. THIS IS HOW LONG AN UNDER PRESSURE CONDITION WILL BE IGNORED DURING THE STARTUP. AUTO MODE MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT.

169 PRESSURE MENU **UNDER PRESSURE** **ACTIVATION DELAY**	ALL:__0-24:00:00	ESP:__0 HPS:__0 PCP:__0

ENTER THE UNDER PRESSURE ACTIVATION DELAY TIME. THIS DELAY ALLOWS OPERATION IN AN UNDER PRESSURE CONDITION FOR THE TIME SET. THE ACTIVATION DELAY TIMER WILL CAUSE AN UNDER PRESSURE CONDITION TO BE IGNORED FOR THE TIME ENTERED. WHEN THIS TIME IS EXCEEDED A SHUTDOWN WILL OCCUR. AUTO MODE MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT.

170 PRESSURE MENU **AUTO RESTART AFTER** **UNDER PRESSURE**	ALL:__YES, NO	ESP:__NO HPS:__NO PCP:__NO

USE THE UP OR DOWN KEYS TO TOGGLE THIS ENTRY. IF AUTO RESTART IS "YES", WHEN AN UNDER PRESSURE SHUTDOWN OCCURS, AN AUTOMATIC RESTART WILL BE ATTEMPTED AFTER THE TIME ENTERED IN THE FOLLOWING PARAMETER. AUTO MODE MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
171 PRESSURE MENU AUTO RESTARTS AFTER UNDER PRESSURE	ALL:__1-9999	ESP:__1 HPS:__3 PCP:__1

ENTER THE NUMBER OF AUTO RESTART ATTEMPTS ALLOWED AFTER UNDER PRESSURE SHUTDOWNS. THIS VALUE SETS THE NUMBER OF RESTART ATTEMPTS ON UNDER PRESSURE SHUTDOWNS. AUTO MODE AND AUTO RESTART MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT. TOGGLING FROM HAND MODE TO AUTO MODE WILL RESET THE INTERNAL COUNT OF ATTEMPTED STARTS.

172 PRESSURE MENU UNDER PRESSURE AUTO RESTART TYPE	ALL:__TIME, PRESSURE-TIME, PRESSURE	ESP:__TIME HPS:__TIME PCP:__TIME

USE THE UP OR DOWN KEYS TO SELECT TIME OR PRESSURE AUTO RESTART. IF TIME IS SELECTED, THE VSD WILL WAIT FOR THE AMOUNT OF TIME IN THE FOLLOWING PARAMETER BEFORE AN AUTO RESTART IS ATTEMPTED. IF PRESSURE IS SELECTED, THE VSD WILL WAIT FOR THE PRESSURE INPUT TO RISE ABOVE THE SETTING IN THE FOLLOWING PARAMETER BEFORE AN AUTO RESTART IS ATTEMPTED. PRESSURE CONTROL MODE AND AUTO MODE MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT.

173 PRESSURE MENU UNDER PRESSURE AUTO RESTART PRESS.	ALL:__1-20000	ESP:__1 HPS:__1 PCP:__1

AFTER AN UNDER PRESSURE SHUTDOWN OCCURS, AN AUTOMATIC RESTART WILL BE ATTEMPTED AFTER THE PRESSURE RECOVERS TO THE LEVEL ENTERED IN THIS PARAMETER. (THE LEVEL ENTERED MUST BE ABOVE THE MINIMUM PRESSURE TRIP POINT). AUTO MODE, AUTO RESTART, AND PRESSURE CONTROL MODE MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT. UNDER PRESSURE RESTART TYPE MUST ALSO BE SELECTED TO "PRESSURE" FOR THE FUNCTION TO TAKE EFFECT.

174 PRESSURE MENU UNDER PRESSURE AUTO RESTART DELAY	ALL:__1-99:59:59	ESP:__00:30:00 HPS:__00:30:00 PCP:__00:30:00

AFTER AN UNDER PRESSURE SHUTDOWN OCCURS, AN AUTOMATIC RESTART WILL BE ATTEMPTED AFTER THE TIME ENTERED IN THIS PARAMETER. AUTO MODE, AUTO RESTART, AND PRESSURE CONTROL MODE MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT. UNDER PRESSURE RESTART TYPE MUST ALSO BE SELECTED TO "TIME" FOR THE FUNCTION TO TAKE EFFECT.

175 PRESSURE MENU RESTART DELAY INCREMENT VALUE	ALL:__0-99:59:59	ESP:__0 HPS:__0 PCP:__0

THIS VALUE IS ADDED TO THE AUTO RESTART DELAY TIMER EACH TIME A RESTART OCCURS. THIS FUNCTIONALITY IS USEFUL IN PRESSURE PUMP OFF TESTING. AUTO MODE, AUTO RESTART, AND PRESSURE CONTROL MODE MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT. UNDER PRESSURE RESTART TYPE MUST ALSO BE SELECTED TO "TIME" FOR THE FUNCTION TO TAKE EFFECT. FOR EXAMPLE, WITH THE AUTO RESTART SET AT 60 MINUTES AND THE NUMBER OF ALLOWED RESTARTS SET TO 5 AND THE INCREMENT VALUE WAS SET TO 0 MINUTES, THEN THE TIME BETWEEN RESTARTS WOULD BE 60, 60, 60, 60, AND 60. IF THE INCREMENT VALUE WAS SET TO 30 MINUTES INSTEAD OF 0, THEN THE TIME BETWEEN RESTARTS WOULD BE 90, 120, 150, 180, AND 210.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
176 PRESSURE MENU OVER PRESSURE SHUTDOWN ENABLE	ALL:__YES, NO	ESP:__NO HPS:__NO PCP:__NO

USE THE UP OR DOWN ARROW KEYS TO ENABLE OR DISABLE THE OVER PRESSURE SHUTDOWN OPTION. AUTO MODE MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT.

177 PRESSURE MENU OVER PRESSURE IGNORE AT STARTUP	ALL:__1-99:59:59	ESP:__30 HPS:__30 PCP:__30

ENTER THE ALLOWABLE TIME FOR OPERATION IN AN OVER PRESSURE CONDITION DURING STARTUP. THIS IS HOW LONG AN OVER PRESSURE CONDITION WILL BE IGNORED DURING THE STARTUP. AUTO MODE MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT.

178 PRESSURE MENU OVER PRESSURE ACTIVATION DELAY	ALL:__1-99:59:59	ESP:__1 HPS:__1 PCP:__1

ENTER THE OVER PRESSURE ACTIVATION DELAY TIME. THIS DELAY ALLOWS OPERATION IN AN OVER PRESSURE CONDITION FOR THE TIME SET. THE ACTIVATION DELAY TIMER WILL CAUSE AN OVER PRESSURE CONDITION TO BE IGNORED FOR THE TIME ENTERED. WHEN THIS TIME IS EXCEEDED A SHUTDOWN WILL OCCUR. AUTO MODE MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT.

179 PRESSURE MENU AUTO RESTART AFTER OVER PRESSURE	ALL:__YES, NO	ESP:__NO HPS:__NO PCP:__NO

USE THE UP OR DOWN KEYS TO TOGGLE THIS ENTRY. IF AUTO RESTART IS "YES", WHEN AN OVER PRESSURE SHUTDOWN OCCURS, AN AUTOMATIC RESTART WILL BE ATTEMPTED AFTER THE TIME ENTERED IN THE FOLLOWING PARAMETER. AUTO MODE MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT.

180 PRESSURE MENU AUTO RESTARTS AFTER OVER PRESSURE	ALL:__1-9999	ESP:__1 HPS:__3 PCP:__1

ENTER THE NUMBER OF AUTO RESTART ATTEMPTS ALLOWED AFTER OVER PRESSURE SHUTDOWNS. THIS VALUE SETS THE NUMBER OF RESTART ATTEMPTS ON OVER PRESSURE SHUTDOWNS. AUTO MODE AND AUTO RESTART MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT. TOGGLING FROM HAND MODE TO AUTO MODE WILL RESET THE INTERNAL COUNT OF ATTEMPTED STARTS.

181 PRESSURE MENU OVER PRESSURE AUTO RESTART DELAY	ALL:__1-99:59:59	ESP:__00:30:00 HPS:__00:30:00 PCP:__00:30:00

AFTER AN OVER PRESSURE SHUTDOWN OCCURS, AN AUTOMATIC RESTART WILL BE ATTEMPTED AFTER THE TIME ENTERED IN THIS PARAMETER. AUTO MODE AND AUTO RESTART MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
182 PRESSURE MENU **PRESSURE CONTROL** **METHOD**	ALL:__PID, NORMAL	ESP:__NORMAL HPS:__NORMAL PCP:__NORMAL

WHEN THIS PARAMETER IS SELECTED TO YES IT WILL ENABLE THE PID CONTROL FOR THE VSD. THE TARGET PRESSURE WILL BECOME THE SET POINT, THE INPUT SELECTION WILL BECOME THE PROCESS VARIABLE INPUT, THE SPEED UP OR SLOW DOWN WITH PRESSURE RISE WILL BECOME THE CONTROL ACTION, THE CONTROL RAMP HZ AND SECONDS WILL BE DISABLED.

183 PRESSURE MENU **PID** **PROPORTIONAL**	ALL:__0-10	ESP:__1 HPS:__1 PCP:__1

THIS IS THE PROPORTIONAL SETTING FOR THE PID CONTROL LOOP.

184 PRESSURE MENU **PID** **INTEGRAL**	ALL:__0-100.0	ESP:__0.1 HPS:__0.1 PCP:__0.1

THIS IS THE INTEGRAL SETTING OF THE PID CONTROL LOOP. THE VALUE ENTERED HERE IS IN REPEATS / MINUTE.

185 PRESSURE MENU **PID** **DERIVATIVE**	ALL:__0.0-100.0	ESP:__0 HPS:__0 PCP:__0

THIS IS THE DERIVATIVE SETTING OF THE PID CONTROL LOOP. THE VALUE ENTERED HERE IS IN MINUTES.

200 VSD SETUP MENU **PUMP** **APPLICATION**	ALL:__ESP, HPS, PCP	ESP:__ESP HPS:__HPS PCP:__PCP

USE THE UP OR DOWN KEYS TO SCROLL THROUGH THE SELECTIONS. PRESS ENTER TO ACCEPT THE SELECTED PUMPING SYSTEM. THIS PARAMETER ALLOWS THE VSD TO PRESET CERTAIN PARAMETERS DEPENDING ON THE TYPE OF APPLICATION. THIS SHOULD ONLY BE CHANGED WHEN RECOMMISSIONING.

203 VSD SETUP MENU **AC LINE FREQUENCY** **INPUT HZ**	ALL:__50-60	ESP:__60 HPS:__60 PCP:__60

USING THE KEYPAD YOU MAY ENTER THE LINE FREQUENCY.

204 VSD SETUP MENU **BASE SPEED** **MAX HZ / FULL VOLTS**	ESP:__30-120 HPS:__30-70 PCP:__30-120	ESP:__60 HPS:__60 PCP:__60

BY USING THE KEYPAD YOU MAY ENTER THE BASE SPEED OF THE VSD. THE BASE SPEED IS THE POINT AT WHICH THE VSD WILL REACH ITS MAXIMUM OUTPUT VOLTAGE AT THE FREQUENCY ENTERED. IF 70 IS ENTERED AND THE INPUT VOLTAGE OF THE VSD IS 460 VOLTS, THEN THE VSD WILL OUTPUT 460 VOLTS AT 70 HZ.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
205 VSD SETUP MENU AUTO RESTART AFTER POWER LOSS	ALL:__YES, NO	ESP:__NO HPS:__YES PCP:__NO

USING THE UP OR DOWN KEYS THE OPERATOR WILL SELECT "YES" TO HAVE THE VSD AUTO RESTART AFTER A POWER LOSS OR "NO" TO HAVE THE VSD DO NOTHING AFTER A POWER LOSS HAS SHUTDOWN THE VSD. THE VSD MUST BE IN THE AUTO MODE FOR THIS FUNCTION TO TAKE EFFECT.

206 VSD SETUP MENU POWER LOSS AUTO RESTART DELAY	ALL:__1-99:59:59	ESP:__00:30:00 HPS:__00:30:00 PCP:__00:30:00

AFTER A POWER LOSS OCCURS, AN AUTOMATIC RESTART WILL BE ATTEMPTED AFTER THE TIME ENTERED IN THIS PARAMETER. AUTO MODE AND AUTO RESTART MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT.

207 VSD SETUP MENU AUTO RESTARTS AFTER POWER LOSS	ALL:__1-9999	ESP:__1 HPS:__3 PCP:__1

ENTER THE NUMBER OF AUTO RESTART ATTEMPTS ALLOWED AFTER POWER LOSSES. THIS VALUE SETS THE NUMBER OF RESTART ATTEMPTS AFTER POWER LOSSES. AUTO MODE AND AUTO RESTART MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT. TOGGLING FROM HAND MODE TO AUTO MODE WILL RESET THE INTERNAL COUNT OF ATTEMPTED STARTS.

208 VSD SETUP MENU TIMED AUTOSTART WHEN SWITCHED TO 'AUTO'	ALL:__YES, NO	ESP:__NO HPS:__NO PCP:__NO

THIS ENABLES OR DISABLES THE DRIVE FROM AUTOMATICALLY STARTING AFTER A PRESET TIME (SET BY MENU 209) WHEN THE DRIVE IS SWITCHED FROM THE OFF TO THE AUTO MODE. THIS MENU AND MENU 209 ONLY AFFECT THE AUTO START TIME AS THE DRIVE IS SWITCHED FROM OFF TO AUTO AND THESE TWO MENUS HAVE NO EFFECT ON ANY OF THE OTHER AUTO RESTART ENABLES OR TIMES.

209 VSD SETUP MENU TIMED AUTO START DELAY	ALL:__1-99:59:59	ESP:__00:30:00 HPS:__00:30:00 PCP:__00:30:00

THIS IS THE TIME THAT THE DRIVE WILL WAIT BEFORE MAKING AN AUTOSTART ATTEMPT AFTER THE DRIVE IS SWITCHED FROM OFF TO AUTO, PROVIDED THAT MENU 208, THE 'TIMED AUTOSTART' IS ENABLED. THIS TIME AND MENU 208 ONLY AFFECT THE AUTO START AS THE DRIVE IS SWITCHED FROM OFF TO AUTO. THESE TWO MENUS HAVE NO EFFECT ON ANY OF THE OTHER AUTO RESTART ENABLES OR TIMES.

212 VSD SETUP MENU STOP MODE	ALL:__CONTROLLED, COASTING	ESP:__COASTING HPS:__CONTROLLED PCP:__COASTING

THIS PARAMETER SETS THE VSD TO COAST TO A STOP OR RAMP TO A STOP. (WARNING SETTING THIS PARAMETER INCORRECTLY CAN CAUSE SERIOUS EQUIPMENT DAMAGE IN SOME APPLICATIONS.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
213 VSD SETUP MENU INTERNAL MAXIMUM TEMPERATURE (F)	ALL:__104-170	ESP:__160 HPS:__160 PCP:__160

THIS PARAMETER SETS THE HIGHEST TEMPERATURE AT WHICH THE VSD WILL RUN.

214 VSD SETUP MENU INTERNAL MINIMUM TEMPERATURE (F)	ALL:__-40-50	ESP:__-40 HPS:__-40 PCP:__-40

THIS PARAMETER SETS THE LOWEST TEMPERATURE AT WHICH THE VSD WILL RUN.

215 VSD SETUP MENU RESET STORED TEMPERATURES	ALL:__YES, NO	ESP:__NO HPS:__NO PCP:__NO

SELECTING YES WILL RESET THE MINIMUM/MAXIMUM INTERNAL TEMPERATURES THAT HAVE BEEN RECORDED.

216 VSD SETUP MENU SET TIME	ALL:__	ESP:__ HPS:__ PCP:__

THIS PARAMETER SETS THE TIME OF THE INTERNAL CLOCK.

217 VSD SETUP MENU SET DATE	ALL:__	ESP:__ HPS:__ PCP:__

THIS PARAMETER SETS THE DATE OF THE INTERNAL CLOCK.

218 VSD SETUP MENU SELECT MOTOR DIRECTION	ALL:__1-2	ESP:__1 HPS:__1 PCP:__2

BY USING THE UP AND DOWN KEYS YOU MAY REVERSE THE DIRECTION OF THE MOTOR BY SCROLLING THROUGH THE CHOICES. DIRECTION IS RELATIVE, DEPENDING ON HOW THE MOTOR IS HOOKED UP THEREFORE THE CHOICES ARE 1 AND 2 INSTEAD OF FORWARD AND REVERSE.

219 VSD SETUP MENU TIMEOUT TO CLEAR RESTARTS (HOURS)	ALL:__1-9999	ESP:__24 HPS:__24 PCP:__24

THIS IS THE NUMBER OF HOURS THAT THE UNIT MUST RUN BEFORE THE NUMBER OF RESTARTS WILL BE AUTOMATICALLY CLEARED. THIS IS USED SO FAILURES THAT OCCUR INTERMITTENTLY WILL NOT CAUSE A SHUTDOWN THAT REQUIRES USER INTERVENTION TO RESTART.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
240 PRINT MENU PRESS ENTER TO PRINT CONFIGURATION	ALL:__	ESP:__ HPS:__ PCP:__

BY PRESSING ENTER KEY WHILE IN THIS PARAMETER THE CONFIGURATION WILL BE PRINTED TO THE SERIAL PORT ON THE FRONT OF THE OPERATOR INTERFACE. THE DRIVE WILL SHOW "PRINTING CONFIGURATION" TO CANCEL THIS OPERATION THE MENU/ESC KEY MAY BE PRESSED.

241 PRINT MENU PRINT HISTORY DATA EVENTS OR DAYS	ALL:__EVENTS, DAYS	ESP:__EVENTS HPS:__EVENTS PCP:__EVENTS

BY USING THE UP OR DOWN KEYS YOU MAY SELECT THE EVENTS OR DAYS BACK THAT IS TO BE PRINTED. THE NUMBER OF EVENTS OR DAYS TO BE PRINTED IS ENTERED IN THE NEXT PARAMETER.

242 PRINT MENU NUMBER OF HISTORY EVENTS OR DAYS	ALL:__1-1000	ESP:__20 HPS:__20 PCP:__20

BY USING THE KEYPAD YOU MAY ENTER HERE HOW MANY EVENTS OR DAYS OF HISTORY ARE TO BE PRINTED.

243 PRINT MENU PRESS ENTER TO PRINT HISTORY	ALL:__	ESP:__ HPS:__ PCP:__

BY PRESSING ENTER KEY WHILE IN THIS PARAMETER THE HISTORY FILE BE PRINTED TO THE SERIAL PORT ON THE FRONT OF THE OPERATOR INTERFACE. THE DRIVE WILL SHOW "PRINTING HISTORY" TO CANCEL THIS OPERATION THE MENU/ESC KEY MAY BE PRESSED.

244 PRINT MENU DATA LOGGING	ALL:__YES, NO	ESP:__YES HPS:__YES PCP:__YES

BY USING THE UP AND DOWN KEYS YOU MAY ENABLE OR DISABLE THE DATA LOGGING FUNCTIONS.

245 PRINT MENU DATA LOGGING INTERVAL	ALL:__1-480	ESP:__15 HPS:__15 PCP:__15

BY USING THE KEYPAD YOU MAY ENTER THE AMOUNT OF TIME (IN MINUTES) BETWEEN EACH LOG CYCLE. BY ENTERING A SMALL NUMBER THE DATA IS LOGGED MORE OFTEN AND CAN GIVE MORE INFORMATION WHEN ANALYZED, THIS MAY BE USEFUL FOR TROUBLE SHOOTING WELL PROBLEMS.

246 PRINT MENU PRINT LOG DATA EVENTS OR DAYS	ALL:__EVENTS, DAYS	ESP:__EVENTS HPS:__EVENTS PCP:__EVENTS

BY USING THE UP OR DOWN KEYS YOU MAY SELECT THE EVENTS OR DAYS BACK THAT IS TO BE PRINTED. THE NUMBER OF EVENTS OR DAYS TO BE PRINTED IS ENTERED IN THE NEXT PARAMETER.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
247 PRINT MENU NUMBER OF LOGGED EVENTS OR DAYS	ALL:__1-1000	ESP:__20 HPS:__20 PCP:__20

BY USING THE KEYPAD YOU MAY ENTER HOW MANY EVENTS OR DAYS OF LOGGED DATA ARE TO BE PRINTED.

248 PRINT MENU PRESS ENTER TO PRINT LOGGED DATA	ALL:__	ESP:__ HPS:__ PCP:__

BY PRESSING ENTER KEY WHILE IN THIS PARAMETER THE LOGGED DATA FILE BE PRINTED TO THE SERIAL PORT ON THE FRONT OF THE OPERATOR INTERFACE. THE DRIVE WILL SHOW "PRINTING LOG DATA" TO CANCEL THIS OPERATION THE MENU/ESC KEY MAY BE PRESSED.

250 PRINT MENU SELECT ITEM TO PRINT AS A GRAPH	ALL:__	ESP:__ HPS:__ PCP:__

SELECT THE ITEM THAT WILL BE PRINTED AS A GRAPH AGAINST TIME. MENU 251 SETS THE NUMBER OF DAYS TO GRAPH, MENU 252 THE GRAPH SCALE AND MENU 252 STARTS THE GRAPH PRINTING.

251 PRINT MENU NUMBER OF DAYS BACK TO GRAPH	ALL:__1-100	ESP:__2 HPS:__2 PCP:__2

SELECT THE NUMBER OF DAYS TO GRAPH. MENU 250 SELECTS THE ITEM TO GRAPH, MENU 252 THE GRAPH SCALE HEIGHT AND MENU 253 STARTS THE GRAPH PRINTING.

252 PRINT MENU GRAPH FULL SCALE HEIGHT	ALL:__1.0-9999	ESP:__90.0 HPS:__90.0 PCP:__90.0

THE MAXIMUM HEIGHT OF THE GRAPH SCALE MAY BE SET HERE. THIS ALLOWS THE GRAPH TO BE SCALED IN OR OUT TO SHOW AREAS OF INTEREST.

253 PRINT MENU START / STOP GRAPH PRINTING	ALL:__	ESP:__ HPS:__ PCP:__

ONCE THE GRAPH PRINT SETTINGS HAVE BEEN ENTERED USING MENUS 250,251 AND 252 THIS MENU LETS THE USER START OR STOP THE GRAPH PRINTING.

320 OUTPUT MENU RELAY OUTPUT # 1 ASSIGNMENT	ALL:__NONE, RUNNING, HAND, OFF, AUTO, SHUTDOWN PENDING WARNING, OVER CURRENT SHUTDOWN, UNDERCURRENT SHUTDOWN, OVER PRESSURE SHUTDOWN,	ESP:__HAND HPS:__NONE PCP:__HAND

BY USING THE UP AND DOWN KEYS YOU MAY SCROLL THROUGH THE CHOICES THAT WILL CAUSE A CONTACT CLOSURE ON THIS SPECIFIC RELAY OUTPUT.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
321 OUTPUT MENU **RELAY OUTPUT # 2** **ASSIGNMENT**	ALL:__NONE, RUNNING, HAND, OFF, AUTO, SHUTDOWN PENDING WARNING, OVER CURRENT SHUTDOWN, UNDERCURRENT SHUTDOWN, OVER PRESSURE SHUTDOWN,	ESP:__OFF HPS:__NONE PCP:__OFF

BY USING THE UP AND DOWN KEYS YOU MAY SCROLL THROUGH THE CHOICES THAT WILL CAUSE A CONTACT CLOSURE ON THIS SPECIFIC RELAY OUTPUT.

322 OUTPUT MENU **RELAY OUTPUT # 3** **ASSIGNMENT**	ALL:__NONE, RUNNING, HAND, OFF, AUTO, SHUTDOWN PENDING WARNING, OVER CURRENT SHUTDOWN, UNDERCURRENT SHUTDOWN, OVER PRESSURE SHUTDOWN,	ESP:__AUTO HPS:__NONE PCP:__AUTO

BY USING THE UP AND DOWN KEYS YOU MAY SCROLL THROUGH THE CHOICES THAT WILL CAUSE A CONTACT CLOSURE ON THIS SPECIFIC RELAY OUTPUT.

323 OUTPUT MENU **RELAY OUTPUT # 4** **ASSIGNMENT**	ALL:__NONE, RUNNING, HAND, OFF, AUTO, SHUTDOWN PENDING WARNING, OVER CURRENT SHUTDOWN, UNDERCURRENT SHUTDOWN, OVER PRESSURE SHUTDOWN,	ESP:__RUNNING HPS:__NONE PCP:__RUNNING

BY USING THE UP AND DOWN KEYS YOU MAY SCROLL THROUGH THE CHOICES THAT WILL CAUSE A CONTACT CLOSURE ON THIS SPECIFIC RELAY OUTPUT.

340 COMM MENU **SCADA** **ACCESS**	ALL:__FULL, READ ONLY, NONE	ESP:__FULL HPS:__FULL PCP:__FULL

USE THE UP AND DOWN KEYS TO SELECT THE ACCESS ALLOWED FOR THE SCADA SYSTEM.

341 COMM MENU **SCADA** **ADDRESS**	ALL:__1-247	ESP:__1 HPS:__100 PCP:__1

ENTER THE SCADA ADDRESS THAT HAS BEEN ASSIGNED TO THE VSD FOR COMMUNICATIONS. PRESS ENTER TO ACCEPT THE NEW VALUE.

342 COMM MENU **SCADA** **BAUD RATE**	ALL:__300, 1200, 2400, 4800, 9600, 19200, 33600-300, 1200, 2400, 4800, 9600, 19200, 33600	ESP:__9600 HPS:__9600 PCP:__9600

USE THE UP OR DOWN ARROW KEYS TO SCROLL THROUGH THE BAUD RATE SELECTIONS. PRESS ENTER TO ACCEPT THE DISPLAYED SETTING.

343 COMM MENU **SCADA** **DATA MODE**	ALL:__7N1, 7E1, 7O1, 7N2, 7E2, 7O2, 8N1, 8E1, 8O1, 8N2, 8E2, 8O2-7N1, 7E1, 7O1, 7N2, 7E2, 7O2, 8N1, 8E1, 8O1, 8N2, 8E2, 8O2	ESP:__8N1 HPS:__8N1 PCP:__8N1

USE THE UP OR DOWN ARROW KEYS TO SCROLL THROUGH THE DATA MODE CHOICES TO SET THE DATA BITS, PARITY, AND STOP BITS. FOR EXAMPLE, 8N1 IS 8 DATA BITS WITH NO PARITY AND 1 STOP BIT. PRESS ENTER TO ACCEPT THE DISPLAYED SETTING. 7 DATA BITS CAN ONLY BE SELECTED IF THE PROTOCOL IS SELECTED AS ASCII.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
344 COMM MENU SCADA PROTOCOL	ALL:__ASCII, RTU	ESP:__RTU HPS:__RTU PCP:__RTU

USE THE UP OR DOWN ARROW KEYS TO SCROLL THROUGH THE PROTOCOL SELECTIONS. PRESS ENTER TO ACCEPT THE DISPLAYED SETTING. RTU CAN ONLY BE SELECTED IF THE DATA MODE IS SELECTED TO 8 DATA BITS.

345 COMM MENU SCADA BROADCAST	ALL:__ENABLED, TIME & DATE, DISABLED	ESP:__TIME & DATE HPS:__TIME & DATE PCP:__TIME & DATE

USE THE UP OR DOWN ARROW KEYS TO SCROLL THROUGH THE SELECTIONS. PRESS ENTER TO ACCEPT THE DISPLAYED SETTING. THIS CONTROLS WHAT SCADA BROADCAST MESSAGES WILL BE ACCEPTED. ENABLED WILL ACCEPT ALL BROADCAST MESSAGES, DISABLED WILL ACCEPT NO BROADCAST MESSAGES. TIME & DATE WILL ONLY ACCEPT MESSAGES TO SET THE TIME AND DATE.

346 COMM MENU TRANSFER DATA	ALL:__	ESP:__ HPS:__ PCP:__

THIS PARAMTER IS USED TO ENVOKE THE TRANSFER MODE TO INSTALL A NEW CONFIGURATION INTO THE HMI. ATTACHING A PC WITH THE APPROPRIATE SOFTWARE AND PRESSING ENTER WILL TRANSFER INFORMATION. ONLY QUALIFIED PERSONEL SHOULD USE THIS PARMETER.

347 COMM MENU DOWNLOAD DATA	ALL:__	ESP:__ HPS:__ PCP:__

THIS PARAMTER IS USED TO DOWNLOAD A NEW CONFIGURATION FROM THE HMI. ATTACHING A PC WITH THE APPROPRIATE SOFTWARE AND PRESSING ENTER WILL DOWNLOAD THE INFORMATION. ONLY QUALIFIED PERSONEL SHOULD USE THIS PARMETER. (THIS PARAMETER HAS BEEN COMBINED WITH MENU 346.

450 DRIVE TUNING PWM CARRIER FREQUENCY (kHz)	ALL:__0.5-3.0	ESP:__2.2 HPS:__2.2 PCP:__2.2

THIS IS THE INTERNAL MODULATION FREQUENCY OF THE PWM WAVE FORM PRODUCED BY THE VSD. ** WARNING ** FREQUENCIES ABOVE 2.2 KHZ WILL RESULT IN REDUCED DRIVE CAPACITY. CONTACT IN TOUCH FOR MORE INFORMATION REGARDING THIS ADJUSTMENT.

451 DRIVE TUNING STALL PROTECTION ENABLE	ALL:__YES, NO	ESP:__YES HPS:__YES PCP:__YES

THE DEFAULT VALUE OF "YES" WILL ENABLE STALL PROTECTION ON THE VSD. THE STALL THRESHOLD LEVEL IS SET VIA MENU 452.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
452 DRIVE TUNING STALL THRESHOLD (% OF VSD CAPACITY)	ALL:__10-215	ESP:__120 HPS:__120 PCP:__120

THE DEFAULT VALUE OF 120% IS THE STANDARD THRESHOLD WHERE SOFT STALL AUTO FREQUENCY REDUCTION WILL OCCUR AFTER 1 MINUTE OF OPERATING IN THE OVERLOAD CONDITION, PROVIDED THAT MENU 451 IS SET TO ENABLE SOFT STALL.

454 DRIVE TUNING CATCH A SPINNING MOTOR ENABLE	ALL:__YES, NO	ESP:__YES HPS:__YES PCP:__YES

THE DEFAULT SETTING OF "ENABLED" ALLOWS THE DRIVE TO LOOK FOR A SPINNING MOTOR AND IF FOUND, CATCH THE MOTOR IN THE DIRECTION THAT IS IS SPINNING, AND APPLY DECELERATION AND/OR ACCELERATION AS NEEDED TO RUN THE MOTOR IN THE DESIRED DIRECTION AND AT THE DESIRED FREQUENCY IN THE MINIMUM TIME ALLOWED BY THE CONFIGURATION OF THE DRIVE.

455 DRIVE TUNING BASE FREQUENCY VOLTAGE SELECT	ALL:__INPUT, AUTO, FIXED	ESP:__INPUT HPS:__INPUT PCP:__INPUT

SELECT THE BASE FREQUENCY VOLTAGE REFERENCE USING THIS MENU, WHEN THE DRIVE IS NOT OPERATING. IF THE DRIVE IS RUNNING THEN CHANGES WILL NOT BE ACCEPTED, AND THE ORIGINAL SETTING WILL REMAIN INTACT THIS MENU ALLOWS THE OPERATOR TO SELECT THE REFERENCE VALUE THAT DETERMINES THE VOLTAGE OUTPUT OF THE DRIVE WHEN THE DRIVE IS OPERATING AT THE DESIRED BASE FREQUENCY. THE "INPUT" SETTING REQUIRES THAT THE OUTPUT VOLTAGE FLUCTUATE WITH THE INPUT VOLTAGE CONTINUOUSLY. "AUTO" MODE FIXES THE BASE FREQUENCY OUTPUT VOLTAGE TO THE LEVEL OF THE INPUT VOLTAGE AT THE TIME THAT THE DRIVE IS FIRST POWERED. THE "FIXED" SETTING REQUIRES THAT THE DRIVE USE THE VALUE SET VIA THE NEXT MENU ITEM AS THE DESIRED VOLTAGE WHEN THE DRIVE IS RUNNING AT BASE SPEED.

456 DRIVE TUNING MAXIMUM BASE FREQUENCY VOLTS	ALL:__0-500	ESP:__460 HPS:__460 PCP:__460

THIS IS THE MAXIMUM RMS VOLTAGE THAT IS OUTPUT WHEN THE DRIVE IS RUNNING AT OR ABOVE THE BASE FREQUENCY. IT IS ONLY USED IF MENU 455 IS SET TO FIXED, OTHERWISE IT IS IGNORED.

458 DRIVE TUNING STARTUP FREQUENCY (HZ)	ALL:__0.0-10.0	ESP:__3.0 HPS:__0.0 PCP:__3.0

THIS WILL BE THE INITIAL FREQUENCY OUTPUT BY THE DRIVE WHEN FIRST STARTED. THIS MAY BE USED TO PREVENT THE DRIVE STARTING AT FREQUENCIES BELOW THOSE SPECIFIED BY THE TRANSFORMER MANUFACTURER. ONCE STARTED THE DRIVE WILL RAMP UP FROM THIS SPEED TO THE MINIMUM SPEED AT THE RATE SET BY MENUS 470 AND 471.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
459 DRIVE TUNING STARTUP VOLTAGE BOOST PERCENTAGE	ALL:__0.0-30.0	ESP:__3.0 HPS:__3.0 PCP:__3.0

THIS AJDUSTS THE PERCENT INCREASE IN OUTPUT VOLTAGE WHEN THE DRIVE STARTS. VOLTAGE BOOST CEASES AT A FREQUENCY OF 12.0HZ, AFTER WHICH, THE SELECTED VOLTS PER HERTZ (MENU 460) DETERMINES THE RMS OUTPUT VOLTAGE OF THE DRIVE.

460 DRIVE TUNING V/Hz PATTERN CONTROL SELECTION	ALL:__CONSTANT, VARIABLE, AUTO BOOST, AUTO BOOST ES, VECTOR CONTROL, VECTOR CONTROL ES	ESP:__CONSTANT HPS:__CONSTANT PCP:__CONSTANT

THIS PARAMETER MAY BE CHANGED ONLY WHEN THE DRIVE IS IN THE OFF MODE. USE THIS PARAMETER TO SELECT THE VOLTS PER HERTZ PATTERN USED TO START AND CHANGE THE SPEED OF THE MOTOR. DIFFERENT LEVELS AND PATTERNS OF TORQUE, PERFORMANCE AND ENERGY SAVINGS ARE POSSIBLE. "CONSTANT" TORQUE MODE IS THE DEFAULT SETTING FOR THE SPEEDSTAR 2000 VSD. USE OF THE VECTOR CONTROL MODES WILL REQUIRE THAT THE MOTOR HORSEPOWER BE ENTERED IN THE MENU #850. VERIFY THAT THE NUMBER OF MOTOR POLES MATCHES THE VALUE ENTERED IN MENU #462.

461 DRIVE TUNING VECTOR CONTROL MOMENT OF INERTIA	ALL:__SMALL, MEDIUM, LARGE, VERY LARGE	ESP:__SMALL HPS:__SMALL PCP:__SMALL

THIS SPECIFIES THE RELATIVE MOMENT OF INERTIA FOR THE PUMP / MOTOR COMBINATION. ALL NORMAL REDA ESP EQUIPMENT HAS A SMALL MOMENT OF INERTIA. THIS PARAMETER IS ONLY EFFECTIVE IF MENU 460 IS SET TO 'VECTOR' CONTROL.

462 DRIVE TUNING NUMBER OF MOTOR POLES	ALL:__2-6	ESP:__2 HPS:__2 PCP:__4

ENTER THE NUMBER OF MOTOR POLES 2,4 OR 6 THIS NUMBER IS USED BY VECTOR CONTROL COMPUTATIONS WHEN MENU 460 IS SET FOR VECTOR MODE AND MENUS #461 AND #850 HAVE ALSO BEEN CONFIGURED.

470 DRIVE TUNING STARTING ACCEL RATE HZ	ESP:__0.1-20 HPS:__0.1-30 PCP:__0.1-20	ESP:__4 HPS:__2 PCP:__4

THIS AND MENU 471 DEFINE THE RAMP RATE AS THE DRIVE ACCELERATES FROM THE STARTING FREQUENCY (MENU 458) TO THE MINIMUM RUNNING FREQUENCY (MENU 122). THIS IS THE NUMBER OF HZ THAT THE DRIVE WILL CHANGE BY IN THE TIME DEFINED BY MENU 471.

471 DRIVE TUNING STARTING ACCEL RATE SECONDS	ALL:__1-10000	ESP:__1 HPS:__1 PCP:__1

THIS AND MENU 470 DEFINE THE RAMP RATE AS THE DRIVE ACCELERATES FROM THE STARTING FREQUENCY (MENU 458) TO THE MINIMUM RUNNING FREQUENCY (MENU 122). THIS IS THE NUMBER OF SECONDS THAT THE DRIVE WILL TAKE TO CHANGE BY THE NUMBER OF HZ DEFINED IN MENU 470.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
472 DRIVE TUNING MINIMUM TO TARGET HZ	ESP:__0.1-20 HPS:__0.1-30 PCP:__0.1-20	ESP:__4 HPS:__2 PCP:__4

THIS PARAMETER AND THE FOLLOWING PARAMETER DEFINE THE ACCELERATION RAMP FROM MIN SPEED TO TARGET SPEED.

473 DRIVE TUNING MINIMUM TO TARGET SECONDS	ALL:__1-9999	ESP:__1 HPS:__1 PCP:__1

THIS PARAMETER AND THE PREVIOUS PARAMETER DEFINE THE ACCELERATION RAMP FROM MIN SPEED TO TARGET SPEED. TARGET SPEED MUST BE REACHED BEFORE THE SELECTED CONTROL MODE IS ENTERED. THIS IS TRUE FOR SPEED, CURRENT AND PRESSURE MODES.

474 DRIVE TUNING STOPPING DECEL RATE HZ	ESP:__0.1-20 HPS:__0.1-30 PCP:__0.1-20	ESP:__3 HPS:__3 PCP:__3

THIS AND MENU 475 DEFINE THE RAMP RATE DURING A CONTROLLED STOP. THIS IS THE NUMBER OF HZ THAT THE DRIVE WILL CHANGE BY IN THE TIME DEFINED BY MENU 475. THIS SETS THE DECELERATION RAMP RATE AS THE DRIVE CHANGES FROM RUNNING TO STOP. IT IS ONLY USED WHEN THE STOP MODE (MENU 212) IS SET TO 'CONTROLLED', OTHERWISE IT IS IGNORED.

475 DRIVE TUNING STOPPING DECEL RATE SECONDS	ALL:__1-10000	ESP:__1 HPS:__1 PCP:__1

THIS AND MENU 474 DEFINE THE RAMP RATE DURING A CONTROLLED STOP. THIS IS THE NUMBER OF SECONDS THAT THE DRIVE WILL TAKE TO CHANGE BY THE NUMBER OF HZ DEFINED IN MENU 474. THIS SETS THE DECELERATION RAMP RATE AS THE DRIVE CHANGES FROM RUNNING TO STOP. IT IS ONLY USED WHEN THE STOP MODE (MENU 212) IS SET TO 'CONTROLLED', OTHERWISE IT IS IGNORED.

500 SPECIAL CONTROLS ROCKING START ENABLE	ALL:__YES, NO	ESP:__NO HPS:__NO PCP:__NO

THIS ALLOWS 'ROCKING STARTS' TO BE TURNED ON OR OFF. A 'ROCKING START' MAY BE ATTEMPTED TO FREE A STUCK MOTOR OR PUMP. IT WILL CAUSE THE VSD TO RAPIDLY JERK THE MOTOR BACKWARDS AND FORWARDS BEFORE TRYING TO BRING THE VSD UP TO NORMAL SPEED. THE NUMBER OF JERK ATTEMPTS AND THE SPEED OF THEM MAY ALSO BE SET. FOR NORMAL OPERATION THIS SETTING WOULD BE DISABLED BY BEING SET TO 'NO.

501 SPECIAL CONTROLS ROCKING START NUMBER OF ROCKS	ALL:__1-20	ESP:__4 HPS:__4 PCP:__4

THIS IS THE NUMBER OF TIMES THE MOTOR WILL 'ROCK' BACKWARDS AND FORWARDS WHEN 'ROCKING START' IS ENABLED.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
502 SPECIAL CONTROLS **ROCKING START** **ROCKING FREQUENCY HZ**	ALL:__10.0-20.0	ESP:__10.0 HPS:__10.0 PCP:__10.0

THIS WILL BE THE VSD FREQUENCY THAT ROCKING STARTS WILL BE RUN AT. THE VSD WILL RAPIDLY CHANGE BETWEEN FORWARD AND BACKWARDS, 'JOGGING' AT THIS FREQUENCY. AFTER THE 'NUMBER OF ROCKS' HAVE BEEN EXCEEDED THE VSD WILL ATTEMPT TO RAMP UP AND RUN AT THE NORMAL RUNNING SETTINGS. THIS VALUE MAY BE BETWEEN 10.0 AND 20.0 HZ. A SMALLER SETTING MAY BE MORE EFFECTIVE ON HIGH INERTIA SYSTEMS.

503 SPECIAL CONTROLS **ROCKING START METHOD** **SELECT METHOD**	ALL:__1-3	ESP:__1 HPS:__1 PCP:__1

THERE ARE THREE ROCKING START METHODS THAT MAY BE ATTEMPTED. SOME OPERATE MORE AGGRESSIVELY THAN OTHERS, AND MAY RESULT IN REDUCTION OF ROCKING TORQUE DUE TO DIFFERENT MOTOR AND LOAD CHARACTERISTICS.

510 SPECIAL CONTROLS **INPUT SPEED FORCE** **ENABLE**	ALL:__YES, NO	ESP:__NO HPS:__NO PCP:__NO

THIS ALLOWS THE USER TO ENABLE OR DISABLE SPEED FORCE CAPABILITY. ONCE ENABLED THE DRIVE WILL RUN AT THE SPEED SPECIFIED IN MENU 511 WHENEVER THE AUXILARY INPUT SPECIFIED IN MENU 512 IS ACTIVE. THIS IS ONLY USED FOR SPECIAL APPLICATIONS AND IS NORMALLY DISABLED.

511 SPECIAL CONTROLS **INPUT SPEED FORCE** **FORCE FREQUENCY HZ**	ESP:__20.0-90.0 HPS:__20.0-90.0 PCP:__8.0-70.0	ESP:__55.0 HPS:__60.0 PCP:__20.0

THIS WILL BE THE VSD FREQUENCY THAT THE DRIVE WILL RUN AT IF MENU 510 IS ENABLED AND THE AUX. INPUT SPECIFIED IN MENU 512 IS ACTIVE.

512 SPECIAL CONTROLS **INPUT SPEED FORCE** **AUX INPUT NUMBER**	ALL:__1-8	ESP:__8 HPS:__8 PCP:__8

THIS IS THE DIGITAL AUX INPUT NUMBER THAT WILL BE USED FOR SPEED FORCE IF MENU 510 IS ENABLED.

610 AUX. INPUT MENU **AUXILIARY** **INPUT SELECTION**	ALL:__1-8	ESP:__1 HPS:__1 PCP:__1

BY USING THE KEYPAD YOU MAY SELECT AN INPUT ON WHICH ALL OF THE FOLLOWING AUXILIARY MENUS WILL BE BASED.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
611 AUX. INPUT MENU **AUXILIARY ##** **DISPLAY ON SCREEN**	ALL:__YES, NO	ESP:__NO HPS:__NO PCP:__NO

BY USING THE UP AND DOWN KEYS YOU MAY CHOOSE TO DISPLAY THIS AUXILIARY INPUT ON THE STATUS SCREEN AT THE BOTTOM. IF ANY INPUTS ARE SELECTED TO BE DISPLAYED, THE UP AND DOWN KEYS CAN BE USED ON THE STATUS SCREEN TO PAGE THROUGH THE DIFFERENT INPUTS.

612 AUX. INPUT MENU **AUXILIARY ##** **LABEL**	ALL:__	ESP:__AUXILIARY # HPS:__AUXILIARY # PCP:__AUXILIARY #

BY USING THE KEYPAD YOU MAY ASSIGN AN ALPHANUMERIC NAME TO THIS SPECIFIC INPUT.

613 AUX. INPUT MENU **AUXILIARY ##** **SHUTDOWN ENABLE**	ALL:__YES, NO	ESP:__NO HPS:__NO PCP:__NO

BY USING THE UP OR DOWN KEYS YOU CAN CHOOSE EITHER YES OR NO TO HAVE THE EQUIPMENT SHUTDOWN OR STAY RUNNING IN THE EVENT OF THIS AUXILIARY INPUT BECOMING ACTIVE. AUTO MODE MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT.

614 AUX. INPUT MENU **AUXILIARY ##** **ACTIVE WHEN**	ALL:__OPEN, CLOSED	ESP:__CLOSED HPS:__CLOSED PCP:__CLOSED

BY USING THE UP OR DOWN ARROW KEYS YOU CAN CHOOSE WHAT INPUT STATE WILL BE CONSIDERED ACTIVE. (THE PREVIOUS MENU MUST BE SET TO YES FOR THIS PARAMETER TO WORK.

615 AUX. INPUT MENU **AUXILIARY ##** **IGNORE AT STARTUP**	ALL:__0-99:59:59	ESP:__1 HPS:__1 PCP:__1

ENTER THE ALLOWABLE TIME FOR OPERATION WHILE THIS AUXILIARY INPUT IS ACTIVE DURING STARTUP. THIS IS HOW LONG THIS AUXILIARY INPUT WILL BE IGNORED DURING STARTUP.

616 AUX. INPUT MENU **AUXILIARY ##** **ACTIVATION DELAY**	ALL:__0-99:59:59	ESP:__1 HPS:__1 PCP:__1

THIS AUXILIARY INPUT MUST BE ACTIVE FOR THE TIME ENTERED BEFORE A SHUTDOWN WILL OCCUR.

617 AUX. INPUT MENU **AUXILIARY ##** **AUTO RESTART**	ALL:__YES, NO	ESP:__NO HPS:__NO PCP:__NO

USING THE UP OR DOWN KEYS YOU WILL SELECT "YES" TO HAVE AN AUTO RESTART AFTER THIS INPUT CAUSES A SHUTDOWN OR "NO" TO DO NOTHING AFTER THIS INPUT CAUSES A SHUTDOWN. AUTO MODE MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
618 AUX. INPUT MENU **AUXILIARY ##** **AUTO RESTARTS**	ALL:__1-9999	ESP:__1 HPS:__1 PCP:__1

ENTER THE NUMBER OF AUTO RESTART ATTEMPTS ALLOWED AFTER THIS INPUT HAS CAUSED A SHUTDOWN. THIS VALUE SETS THE NUMBER OF RESTART ATTEMPTS AFTER A SHUTDOWN. AUTO MODE AND AUTO RESTART MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT. TOGGLING FROM HAND MODE TO AUTO MODE WILL RESET THE INTERNAL COUNT OF ATTEMPTED STARTS.

619 AUX. INPUT MENU **AUXILIARY ##** **AUTO RESTART DELAY**	ALL:__0-99:59:59	ESP:__00:30:00 HPS:__00:30:00 PCP:__00:30:00

THE RESTART DELAY TIMER VALUE IS HOW LONG TO WAIT BEFORE ATTEMPTING TO RESTART AFTER THIS INPUT CAUSES A SHUTDOWN. AUTO MODE AND AUTO RESTART MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT.

800 ANALOG IN MENU **ANALOG** **INPUT SELECTION**	ALL:__1-10	ESP:__1 HPS:__1 PCP:__1

BY USING THE KEYPAD YOU MAY SELECT AN INPUT ON WHICH ALL OF THE FOLLOWING ANALOG MENUS WILL BE BASED.

801 ANALOG IN MENU **ANALOG INPUT ##** **DISPLAY ON SCREEN**	ALL:__YES, NO	ESP:__NO HPS:__NO PCP:__NO

BY USING THE UP AND DOWN KEYS THE OPERATOR MAY CHOSE TO DISPLAY THIS ANALOG INPUT ON THE STATUS SCREEN AT THE BOTTOM. IF OTHER INPUTS ARE SELECTED TO BE DISPLAYED THE UP AND DOWN KEYS CAN BE USED TO SCROLL THE BOTTOM LINE OF THE STATUS SCREEN FOR VIEWING OF THE DIFFERENT INPUTS.

802 ANALOG IN MENU **ANALOG INPUT ##** **LABEL**	ALL:__	ESP:__ANALOG INPUT # HPS:__ANALOG INPUT

BY USING THE KEYPAD YOU MAY ASSIGN AN ALPHANUMERIC NAME TO THIS SPECIFIC INPUT.

803 ANALOG IN MENU **ANALOG INPUT ##** **SHUTDOWN ENABLE**	ALL:__YES, NO	ESP:__NO HPS:__NO PCP:__NO

BY USING THE UP OR DOWN KEYS YOU MAY CHOOSE EITHER YES OR NO TO HAVE THE EQUIPMENT SHUTDOWN OR STAY RUNNING IN THE EVENT OF THIS ANALOG INPUT EXCEEDING A TRIP POINT.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
804 ANALOG IN MENU **ANALOG INPUT ##** **IGNORE AT STARTUP**	ALL:__0-99:59:59	ESP:__1 HPS:__1 PCP:__1

USING THE KEYBOARD THE OPERATOR MAY SELECT HOW LONG THE VSD WILL IGNORE THE CHANGE OF THIS AUXILIARY ALARM DURING THE STARTUP OF THE VSD. THE VSD MUST BE IN THE AUTO MODE FOR THIS FUNCTION TO TAKE EFFECT.

805 ANALOG IN MENU **ANALOG INPUT ##** **ACTIVATION DELAY**	ALL:__0-99:59:59	ESP:__1 HPS:__1 PCP:__1

THE ACTIVATION DELAY TIMER WILL CAUSE THE VSD TO IGNORE THIS ANALOG INPUT FOR THE AMOUNT OF TIME ENTERED. THE ANALOG INPUT MUST BE OUT OF BOUNDS FOR THE NUMBER SECONDS ENTERED BEFORE THE VSD WILL TAKE SOME SORT OF ACTION TO CURE THE PROBLEM OR SHUTDOWN THE VSD MUST BE IN THE AUTO MODE FOR THIS FUNCTION TO TAKE EFFECT.

806 ANALOG IN MENU **ANALOG INPUT ##** **AUTO RESTART**	ALL:__YES, NO	ESP:__NO HPS:__NO PCP:__NO

USING THE UP OR DOWN KEYS THE OPERATOR WILL SELECT "YES" TO HAVE THE VSD AUTO RESTART AFTER A SHUTDOWN OR "NO" TO HAVE THE VSD DO NOTHING AFTER THIS ANALOG INPUT HAS SHUTDOWN THE VSD. THE VSD MUST BE IN THE AUTO MODE FOR THIS FUNCTION TO TAKE EFFECT.

807 ANALOG IN MENU **ANALOG INPUT ##** **AUTO RESTARTS**	ALL:__1-9999	ESP:__1 HPS:__1 PCP:__1

ENTER THE NUMBER OF AUTO RESTART ATTEMPTS ALLOWED AFTER THIS INPUT HAS CAUSED A SHUTDOWN. THIS VALUE SETS THE NUMBER OF RESTART ATTEMPTS AFTER A SHUTDOWN. AUTO MODE AND AUTO RESTART MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT. TOGGLING FROM HAND MODE TO AUTO MODE WILL RESET THE INTERNAL COUNT OF ATTEMPTED STARTS.

808 ANALOG IN MENU **ANALOG INPUT ##** **AUTO RESTART DELAY**	ALL:__0-99:59:59	ESP:__00:30:00 HPS:__00:30:00 PCP:__00:30:00

THE RESTART DELAY TIMER VALUE IS HOW LONG TO WAIT BEFORE ATTEMPTING TO RESTART AFTER THIS INPUT CAUSES A SHUTDOWN. AUTO MODE AND AUTO RESTART MUST BE SELECTED FOR THIS FUNCTION TO TAKE EFFECT.

809 ANALOG IN MENU **ANALOG INPUT ##** **HIGH LIMIT TRIP**	ALL:__0-9999	ESP:__5000 HPS:__5000 PCP:__5000

THIS IS A TRIP POINT IN ALL MODES OF OPERATION TO PROTECT ANY ATTACHED EQUIPMENT. ENTER THE MAXIMUM ANALOG INPUT ALLOWED DURING OPERATION. IT IS VERY IMPORTANT TO REMEMBER THAT THE NUMBER ENTERED WILL APPLY TO THE CALIBRATED VALUE FOR THIS INPUT (NOT THE RAW VALUE.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
810 ANALOG IN MENU **ANALOG INPUT ##** **LOW LIMIT TRIP**	ALL:__-9999-9999	ESP:__0 HPS:__0 PCP:__0

THIS IS A TRIP POINT IN ALL MODES OF OPERATION TO PROTECT ANY ATTACHED EQUIPMENT. ENTER THE MINIMUM ANALOG INPUT ALLOWED DURING OPERATION. IT IS VERY IMPORTANT TO REMEMBER THAT THE NUMBER ENTERED WILL APPLY TO THE CALIBRATED VALUE FOR THIS INPUT (NOT THE RAW VALUE.

811 ANALOG IN MENU **ANALOG INPUT ##** **CALIBRATION METHOD**	ALL:__AUTO 4-20 MA, AUTO 0-10 V, MANUAL, DISABLED-AUTO 4-20 MA, AUTO 0-10 V, MANUAL, DISABLED	ESP:__DISABLED HPS:__DISABLED PCP:__DISABLED

BY USING THE UP / DOWN KEYS YOU MAY SCROLL THROUGH THE CHOICES FOR THE DIFFERENT CALIBRATION METHODS. THE AUTO METHODS WILL CALIBRATE TO THE SELECTED INPUT RANGE WITHOUT THE NEED TO APPLY A CALIBRATION SIGNAL. THE MANUAL METHOD REQUIRES THE APPLICATION OF A CALIBRATION SIGNAL TO THIS ANALOG INPUT. PROPERLY DONE, THE MANUAL CALIBRATION IS MORE ACCURATE.

812 ANALOG IN MENU **ANALOG INPUT ##** **HIGH VALUE**	ALL:__0-9999	ESP:__100 HPS:__100 PCP:__100

THIS IS USED TO CALIBRATE THE HIGH END VALUE OF THIS ANALOG INPUT. FIRST FIND OUT WHAT THE INPUT IS SETUP FOR (4-20 MA, 1-10V). WHEN THIS IS DETERMINED, USING A CALIBRATION DEVICE PLACE THE MAXIMUM SIGNAL ON THE PROPER INPUT TERMINALS. WHILE THE MAXIMUM SIGNAL IS APPLIED, ENTER THE VALUE THAT IS TO BE DISPLAYED ON THE STATUS SCREEN AS THE MAXIMUM INPUT. FOR EXAMPLE, IF YOU WANT 20 MA TO BE DISPLAYED ON THE STATUS SCREEN AS 1000 THEN 20 MA WOULD BE APPLIED TO THE INPUT TERMINALS FOR THIS ANALOG SIGNAL AND 1000 ENTERED IN THE HIGH VALUE. AFTER DOING THIS WHENEVER A 20 MA SIGNAL IS APPLIED TO THE INPUTS OF THIS ANALOG CHANNEL THE VSD WILL DISPLAY 1000.

813 ANALOG IN MENU **ANALOG INPUT ##** **LOW VALUE**	ALL:__-9999-9999	ESP:__0 HPS:__0 PCP:__0

THIS IS USED TO CALIBRATE THE LOW END VALUE OF THIS ANALOG INPUT. FIRST FIND OUT WHAT THE INPUT IS SETUP FOR (4-20 MA, 0-10V). WHEN THIS IS DETERMINED, USING A CALIBRATION DEVICE PLACE THE MINIMUM SIGNAL ON THE PROPER INPUT TERMINALS. WHILE THE MINIMUM SIGNAL IS APPLIED, ENTER THE VALUE THAT IS TO BE DISPLAYED ON THE STATUS SCREEN AS THE MINIMUM INPUT. FOR EXAMPLE, IF YOU WANT 4 MA TO BE DISPLAYED ON THE STATUS SCREEN AS 10 THEN 4 MA WOULD BE APPLIED TO THE INPUT TERMINALS FOR THIS ANALOG SIGNAL AND 10 ENTERED IN THE LOW VALUE. AFTER DOING THIS WHENEVER A 4 MA SIGNAL IS APPLIED TO THE INPUTS OF THIS ANALOG CHANNEL THE VSD WILL DISPLAY 10.

850 EQUIPMENT MENU **MOTOR NAMEPLATE** **HORSEPOWER**	ALL:__1-1500	ESP:__100 HPS:__1 PCP:__1

THE NAMEPLATE HORSEPOWER OF THE MOTOR IS ENTERED HERE FOR USE DURING VECTOR CONTROL MODE IT IS ALSO RECORDED FOR DISPLAY WITH THE SITE INFORMATION INCLUDED ON THE PRINTOUT WHEN THE CONFIGURATION IS PRINTED.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
851 EQUIPMENT MENU MOTOR NAMEPLATE VOLTAGE	ALL:__100-5000	ESP:__1500 HPS:__460 PCP:__1500

THE NAMEPLATE VOLTAGE OF THE VSD IS ENTERED HERE FOR INFORMATION ONLY.

852 EQUIPMENT MENU MOTOR NAMEPLATE AMPERAGE	ALL:__1-1500	ESP:__30 HPS:__100 PCP:__30

THE NAMEPLATE AMPERAGE OF THE MOTOR IS ENTERED HERE FOR INFORMATION ONLY.

853 EQUIPMENT MENU MOTOR NAMEPLATE RPM	ALL:__1000-5000	ESP:__3500 HPS:__3570 PCP:__3500

THE NAMEPLATE MOTOR RPM IS ENTERED HERE FOR INFORMATION ONLY.

854 EQUIPMENT MENU MOTOR NAMEPLATE SERIES	ALL:__0-9999	ESP:__0 HPS:__100 PCP:__0

THE NAMEPLATE MOTOR SERIES IS ENTERED HERE FOR INFORMATION ONLY.

855 EQUIPMENT MENU MOTOR NAMEPLATE FREQUENCY	ESP:__20-120 HPS:__30-60 PCP:__20-120	ESP:__60 HPS:__60 PCP:__60

THE NAMEPLATE FREQUENCY OF THE MOTOR IS ENTERED HERE FOR INFORMATION ONLY.

856 EQUIPMENT MENU PUMP HORSEPOWER	ALL:__1-2000	ESP:__1 HPS:__100 PCP:__1

THE PUMP HORSEPOWER IS ENTERED HERE FOR INFORMATION ONLY.

857 EQUIPMENT MENU TRANSFORMER PRIMARY VOLTAGE	ALL:__0-999	ESP:__0 HPS:__0 PCP:__0

BY USING THE KEYPAD YOU MAY ENTER THE PRIMARY INPUT VOLTAGE OF THE OUTPUT TRANSFORMER FOR INFORMATION ONLY.

858 EQUIPMENT MENU TRANSFORMER SECONDARY VOLTAGE	ESP:__0-5000 HPS:__0-7000 PCP:__0-5000	ESP:__0 HPS:__0 PCP:__0

BY USING THE KEYPAD YOU MAY ENTER THE SECONDARY VOLTAGE OF THE OUTPUT TRANSFORMER FOR INFORMATION ONLY.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
859 EQUIPMENT MENU TRANSFORMER IMPEDANCE PERCENT	ALL:__0-10	ESP:__0 HPS:__0 PCP:__0

BY USING THE KEYPAD YOU MAY ENTER THE INPUT IMPEDANCE OF THE OUTPUT TRANSFORMER IN PERCENT FOR INFORMATION ONLY.

860 EQUIPMENT MENU TRANSFORMER LOSSES PERCENT	ESP:__0-10 HPS:__0-0 PCP:__0-10	ESP:__0 HPS:__0 PCP:__0

BY USING THE KEYPAD YOU MAY ENTER THE TRANSFORMER LOSSES IN PERCENT FOR INFORMATION ONLY.

861 EQUIPMENT MENU CABLE LENGTH FEET	ALL:__0-20000	ESP:__0 HPS:__0 PCP:__0

BY USING THE KEYPAD YOU MAN ENTER THE TRANSFORMER TO MOTOR CABLE LENGTH FOR INFORMATION ONLY.

862 EQUIPMENT MENU CABLE SIZE WIRE GAUGE	ESP:__0-10 HPS:__0-9999 PCP:__0-10	ESP:__0 HPS:__0 PCP:__0

BY USING THE KEYPAD YOU MAY ENTER THE SIZE OF THE CABLE THAT IS RUNNING TO THE MOTOR FOR INFORMATION ONLY.

863 EQUIPMENT MENU CABLE RATING (KV)	ALL:__1-10	ESP:__4 HPS:__4 PCP:__4

BY USING THE KEYPAD YOU MAY ENTER THE KILOVOLT RATING OF THE CABLE TO THE MOTOR FOR INFORMATION ONLY.

864 EQUIPMENT MENU DOWN HOLE TEMPERATURE (F)	ALL:__0-500	ESP:__100 HPS:__100 PCP:__100

BY USING THE KEYPAD YOU MAY ENTER THE DOWN HOLE TEMPERATURE OF THE WELL IF APPLICABLE FOR INFORMATION ONLY.

900 DIRECT ACCESS BANK	ALL:__0-9	ESP:__0 HPS:__0 PCP:__0

FOR TRAINED PERSONNEL ONLY, DIRECT ACCESS TO THE VSD IS POSSIBLE. THIS IS DANGEROUS TO DO SINCE AN INCORRECT PARAMETER CAN DAMAGE THE VSD.

MENU # AND DESCRIPTION	MENU ITEM RANGE	MENU ITEM DEFAULT
901 DIRECT ACCESS ADDRESS	ALL:__	ESP:__0 HPS:__0 PCP:__0

FOR TRAINED PERSONNEL ONLY, DIRECT ACCESS TO THE VSD IS POSSIBLE. THIS IS DANGEROUS TO DO SINCE AN INCORRECT PARAMETER CAN DAMAGE THE VSD.

902 DIRECT ACCESS MASK	ALL:__	ESP:__0 HPS:__0 PCP:__0

FOR TRAINED PERSONNEL ONLY, DIRECT ACCESS TO THE VSD IS POSSIBLE. THIS IS DANGEROUS TO DO SINCE AN INCORRECT PARAMETER CAN DAMAGE THE VSD.

903 DIRECT ACCESS DATA	ALL:__	ESP:__0 HPS:__0 PCP:__0

FOR TRAINED PERSONNEL ONLY, DIRECT ACCESS TO THE VSD IS POSSIBLE. THIS IS DANGEROUS TO DO SINCE AN INCORRECT PARAMETER CAN DAMAGE THE VSD.

904 DIRECT ACCESS COMMAND	ALL:__READ, WRITE	ESP:__INVALID HPS:__INVALID PCP:__INVALID

FOR TRAINED PERSONNEL ONLY, DIRECT ACCESS TO THE VSD IS POSSIBLE. THIS IS DANGEROUS TO DO SINCE AN INCORRECT PARAMETER CAN DAMAGE THE VSD.

905 DIRECT ACCESS WRITE ENABLE CODE	ALL:__0-9999	ESP:__0 HPS:__0 PCP:__0

FOR EXTENDED DIAGNOSTICS A CODE SUPPLIED BY REDA MAY BE ENTERED HERE WHICH ALLOWS THE 904 MENU TO PERFORM MEMORY WRITES TO THE G3 DRIVE. THIS IS ONLY NORMALLY USED DURING FACTORY SERVICE.

999 G3 SERVICE AND TEST ROUTINES	ALL:__	ESP:__ HPS:__ PCP:__

FOR TRAINED PERSONNEL ONLY. THE DRIVE MUST BE STOPPED BEFORE OPERATING ANY OF THESE TEST ROUTINES. THE DRIVE FUSES, BUS VOLTAGE AND LOAD MUST BE REMOVED BEFORE TURNING ON 'SUPERUSER' MODE. THE DRIVE POWER MUST BE CYCLED TO TAKE THE DRIVE OUT OF 'SUPERUSER' MODE. NOTE THAT THE DRIVE MAY DROP OUT OF 'SUPERUSER' MODE IF A TRIP OCCURS.

SECTION 6: SCADA

Physical Connection

The SPEEDSTAR 2000 Operator Interface has been equipped with an input/output port for the purposes of Supervisory Control and Data Acquisition (SCADA) functions. The port connectors are located in the bottom right hand corner of the HMI Interface board, as you face the back of the unit. Two connectors are provided to facilitate various interfacing options. The signals on both connectors conform to the RS485 standard. Both connectors are wired to the same driver circuit. Independent use of both connectors is not possible.

The lower connector is a three-position screw terminal block designed for direct connection to twisted pair copper wire, either shielded or unshielded. This type of cabling is commonly used for multi-drop communications. The RS485 standard recommends a linear bus topology, which is best implemented by a single cable that is looped at each site. Each loop of cable should have the outer insulation removed over a 4" to 6" length of cable. Pay careful attention not to damage the shielding (if present) or the inner conductors.

If shielded cable is deployed, the shielding and conductor should be severed to produce a complete electrical break in the shielding. The portion of the shielding that extends toward the next device should NOT be connected to the ground contact of the three-terminal connector. The portion of the shielding that extends back to any previously connected device SHOULD be connected to the ground contact of the three terminal connection. Following this procedure from the beginning to the end of the cable will eliminate the possibility of ground currents flowing between devices. Considering the high potentials within the SPEEDSTAR 2000 and other equipment of its type, unexpected ground currents could be high enough to damage connected devices.

Once the outer insulation and shielding (if present) has been removed and/or prepared, the data transmission pair should be separated from one another and their polarity determined. The individual conductors of the data transmission pair are known as "+" and "-" (positive and negative). All devices on the same wire must have their "+" connector connected to the "+" conductor. The same is true for the "-" conductor and connector. To prepare the data transmission conductors for connection to the three terminal screw block, the insulation from the middle of the exposed conductor must be removed. It is recommended that the conductor remain intact to preserve the integrity of the data transmission bus. Remove a length of insulation of approximately ¾ of one inch. Bend (or fold) the conductor 180º, with the bend occurring at the midpoint of the exposed conductor. Align the insulated portions of the conductor to maximize the available exposed conductor. Twist the folded conductor to form a single conductor and connect to the proper terminal ("+" or "-") of the three terminal screw block.

For installations that require temporary connection, or are "point-to-point" in nature, a DB-9F connector can be used to mate with the DB9-M connector provided. Additional handshaking signals are available on the DB-9M connector. These signals include CTS/RTS and DSR/DTR. At the present time, the Modbus Driver software does not support or require the use of these signals. Should your application require the use of one or more of these handshake signaling lines, please contact your service represenative.

Logical Connection

The SPEEDSTAR 2000 Operator Interface SCADA port conforms to the Modbus-RTU Protocol Standard, as defined by the "Modicon Modbus Protocol Reference Guide," publication PI-MBUS-300 Rev. C [January 1991] published by Modicon Inc. This information may also be located at the following web site - http://www.modicon.com/techpubs/TechPubNew/PI_MBUS_300.pdf.

The information contained in the "Modbus Protocol Reference" is sufficient in detail for the task of implementing software drivers that send and receive Modbus Packets. Many off-the-shelf products exist to provide this packet level interface for standard IBM compatible computers under a variety of operating systems. The remainder of this document describes the features of the protocol that have been implemented, and the semantics of what is sent to and from the SPEEDSTAR 2000 by way of the Data Highway provided by the physical and logical layers of the Modbus-RTU protocol.

Modbus Protocol Features

The Modbus protocol requires that each device on a physical network be assigned a unique address. The Modbus Device Address of the SPEEDSTAR 2000 can be changed to any valid value using the keypad interface on the front of the drive. Once configured, the SPEEDSTAR 2000 will respond to that address until that address is changed, SCADA access is suspended by a user at the keypad interface, or SCADA communications are disabled from the SCADA communication port.

The SPEEDSTAR 2000 Operator Interface Modbus Protocol implementation provides full exception response support. In the event that the SPEEDSTAR 2000 receives a request containing an invalid command or an invalid register address, an exception response will be generated by the SPEEDSTAR 2000 and returned to the requesting Modbus Master. In the event that a valid command is received, containing a valid register address but contains an invalid or out of range value, no exception response is generated. The control software in the SPEEDSTAR 2000 performs data validation on any requested parameter change, whether from the front panel keypad or from the SCADA interface. In the event that a requested parameter change is invalid, it is rejected and the original value is retained. On a subsequent request to read the same register that the invalid value was previously sent, the original, unchanged value is reported.

Since the SPEEDSTAR 2000 will automatically reject attempts to change register values outside of their default or user programmed acceptance limits, it is not necessary to range-limit or restrict data values that are requested or manipulated through the use of various Graphic User Interface builders such as Wonderware's "InTouch" product. This speeds the development of the master side of a SCADA system, since customization of individual devices is not needed.

Modbus Request packet processing begins upon receipt of a properly framed packet that is addressed either to the SPEEDSTAR 2000 via its Modbus Device Address, or a packet that is addressed to Device Zero (0x00). Packets that are addressed to Device Zero are broadcast packets, which should be processed by everyone on the physical network. Responses to broadcast packets are not returned to the master via the physical network. Commands received by a specified device always return a response to the master.

In the case that an exception response is generated as the result of a packet arriving at a SPEEDSTAR 2000's SCADA port, the exception response will be generated and transmitted upon detection of an exception condition, and processing of the received request packet is terminated. It is for this reason that "Invalid Value" responses are not generated by the SPEEDSTAR 2000, since one bad value in the middle of a multiple-register write command would result in a partial update being performed. Instead, all writes are attempted, and the HMI control software handles the job of data validation.

Broadcast Acceptance Control

The SPEEDSTAR 2000 Operator Interface allows for operator control of Modbus Broadcast acceptance via the HMI keypad. (Broadcast Acceptance Control may become available via SCADA in a future version.) There are three modes of operation.

Enabled

In this mode, the SPEEDSTAR 2000 will accept and process all commands that are transmitted as a broadcast. In the case that the same parameter on multiple SPEEDSTAR 2000's must be simultaneously changed to the same value (i.e.: Master Shutdown Command or Date/Time Settings) then a packet containing the proper address and data value(s) should be sent with the Device Address set to Zero (0x00). There will be no response by the SPEEDSTAR 2000 to a broadcast.

Time/Date

In this mode, only the ACA compatible Date/Time set command will be accepted if it is sent as a broadcast write command. All other broadcast commands will be rejected and not processed. For the SPEEDSTAR to process an ACA compatible Date/Time set command, it must be a broadcast. If an ACA compatible Date/Time set, or check command is sent specifically to a SPEEDSTAR 2000, it will be rejected as an invalid register address. This is true at all times.

Disabled

This mode is provided for mixed networks, where SPEEDSTAR 2000's are not the only kind of device on the same network. In this situation, a broadcast intended for another kind of device has the possibility of corrupting information, or changing the state of the SPEEDSTAR 2000. To protect against this undesirable effect, the ability to ignore commands sent as broadcasts has been provided.

Modbus Register Addressing - critical information and limitations

The Modbus protocol was designed to accommodate various Processes Controllers, specifically Modicon developed devices. Within the Modicon Memory model, there are four distinct address spaces:

(0xxxx) Coils	(1xxxx) Inputs
(3xxxx) Input Registers	(4xxxx) Holding Registers

Within the context of the manual, the sequence of x's above can be three (xxx) or four (xxxx) digits long, and is noted as (xxx(x)). This notation allows for the ambiguous notation of 40001 and 4001 resulting in the same holding register, which is the fist holding register and is at address 0x0000).

Four command groups are associated with the four address spaces.

Commands 1,5 & 15 refer to coils, and map as follows:
0x0000 -> 00001, 0x0001 -> 00002, ... , 0x270E -> 09999

Command 2 refers to inputs, and maps as follows:
0x0000 -> 10001, 0x0001 -> 10002, ... , 0x270E -> 19999

Command 4 refers to input registers, and maps as follows:
0x0000 -> 30001, 0x0001 -> 30002, ... , 0x270E -> 39999

Commands 3,6 & 16 refer to holding registers, and map as follows:
0x0000 -> 40001, 0x0001 -> 40002, ... , 0x270E -> 49999

With this arrangement, the command implies the Most Significant Nibble of a 19 or 20 bit address, and the remaining sixteen bits are specified in the command's data field. This has the property of allowing a total of 262,140 addresses to be specified in the Modbus address space versus the 39,996 addresses possible with their 'paged decimal' notation.

The side effect of this arrangement is that the address 0x0010 is ambiguous since it specifies any of: coil #17, input #17, and input register #17 or holding register #17.

Address ambiguity does not exist in the REDA SPEEDSTAR product through the practice of limiting the addressed address space to 65536 possible values and assigning unique address ranges to groups of functions, such that the intersection of each set of addresses with the others is the null set.

addresses 101..114 (0x065..0x072) correspond to Modicon aliases 00102..00115
addresses 121..139 (0x079..0x08B) correspond to Modicon aliases 10122..10140
addresses 201..225 (0x0C9..0x0E1) correspond to Modicon aliases 30202..30226
addresses 251..289 (0x0FB..0x121) correspond to Modicon aliases 40252..40290

This would seem to allow for any of the "read" commands to be used to access the data contained in the SPEEDSTAR Addresses, however, there is specific type information associated with each address range, therefore, any Modbus implementation must restrict the allowed address range for a given function.

If properly constructed, it is possible to allow the addresses in the coil segment of memory to overlap into the input segment, since they are distinct commands. That is, if coil addresses need space beyond address 00121, this should not pose a problem from the protocol standpoint.

It does, however, pose a significant issue with regard to internal address or data item assignment. Logic would need to be employed to either resolve the supplied addresses into the Modicon aliases, thus regenerating the leading 0,1,3 or 4, or defining distinct translation tables.

It is the later case that has been deployed in the Modbus protocol handler that was constructed for the SPEEDSTAR 2000 HMI. Starting with version 1.00 and beyond, each command implies a unique address space. Although the present Modbus Register Mapping presently contains no duplicate addresses, future versions of the SPEEDSTAR 2000 HMI Software may contain duplicate address values for separate commands. It is strongly suggested that applications, which can utilize five character aliases, be configured to do so.

Alias	Addr.	Addr. In Hex	Units	Read	Write	Broadcast Write	Min	Max	Description
00102	101	0065	bit value	1	5	15	0	1	Aux Digital 1 Trip Level (1 open, 0 closed)
00103	102	0066	bit value	1	5	15	0	1	Aux Digital 2 Trip Level (1 open, 0 closed)
00104	103	0067	bit value	1	5	15	0	1	Aux Digital 3 Trip Level (1 open, 0 closed)
00105	104	0068	bit value	1	5	15	0	1	Aux Digital 4 Trip Level (1 open, 0 closed)
00106	105	0069	bit value	1	5	15	0	1	Aux Digital 5 Trip Level (1 open, 0 closed)
00107	106	006A	bit value	1	5	15	0	1	Aux Digital 6 Trip Level (1 open, 0 closed)
00108	107	006B	bit value	1	5	15	0	1	Aux Digital 7 Trip Level (1 open, 0 closed)
00109	108	006C	bit value	1	5	15	0	1	Aux Digital 8 Trip Level (1 open, 0 closed)
00110	109	006D	bit value	1	5	15	0	1	(mom) Start Drive (0 no action, 1 start)
00111	110	006E	bit value	1	5	15	0	1	(mom) Stop Drive (0 no action, 1 stop)
00112	111	006F	bit value	1	5	15	0	1	(mom) Put Drive in Automode (0 no action, 1 automode)
00113	112	0070	bit value	1	5	15	0	1	(mom) Put Drive in Handmode (0 no action, 1 handmode)
00114	113	0071	bit value	1	5	15	0	1	Spare - No Action
00115	114	0072	bit value	1	5	15	0	1	(mom) Disable SCADA Communications
00116	115	0073	bit value	1	5	15	0	1	(mom) Relay 1 Control/Status (1 closed, 0 open)
00117	116	0074	bit value	1	5	15	0	1	(mom) Relay 2 Control/Status (1 closed, 0 open)
00118	117	0075	bit value	1	5	15	0	1	(mom) Relay 3 Control/Status (1 closed, 0 open)
00119	118	0076	bit value	1	5	15	0	1	(mom) Relay 4 Control/Status (1 closed, 0 open)
10122	121	0079	bit value	2	n/a	n/a	0	1	Auxiliary Input 1 (0 open, 1 closed)
10123	122	007A	bit value	2	n/a	n/a	0	1	Auxiliary Input 2 (0 open, 1 closed)
10124	123	007B	bit value	2	n/a	n/a	0	1	Auxiliary Input 3 (0 open, 1 closed)
10125	124	007C	bit value	2	n/a	n/a	0	1	Auxiliary Input 4 (0 open, 1 closed)
10126	125	007D	bit value	2	n/a	n/a	0	1	Auxiliary Input 5 (0 open, 1 closed)
10127	126	007E	bit value	2	n/a	n/a	0	1	Auxiliary Input 6 (0 open, 1 closed)
10128	127	007F	bit value	2	n/a	n/a	0	1	Auxiliary Input 7 (0 open, 1 closed)
10129	128	0080	bit value	2	n/a	n/a	0	1	Auxiliary Input 8 (0 open, 1 closed)
10130	129	0081	bit value	2	n/a	n/a	0	1	Auxiliary Input 9 (0 open, 1 closed)
10131	130	0082	bit value	2	n/a	n/a	0	1	Auxiliary Input 10 (0 open, 1 closed) [spare]
10132	131	0083	bit value	2	n/a	n/a	0	1	Auxiliary Input 11 (0 open, 1 closed) [spare]
10133	132	0084	bit value	2	n/a	n/a	0	1	Auxiliary Input 12 (0 open, 1 closed) [spare]
10134	133	0085	bit value	2	n/a	n/a	0	1	Auxiliary Input 13 (0 open, 1 closed) [spare]
10135	134	0086	bit value	2	n/a	n/a	0	1	Auxiliary Input 14 (0 open, 1 closed) [spare]
10136	135	0087	bit value	2	n/a	n/a	0	1	Auxiliary Input 15 (0 open, 1 closed) [spare]
10137	136	0088	bit value	2	n/a	n/a	0	1	Auxiliary Input 16 (0 open, 1 closed) [spare]
10138	137	0089	bit value	2	n/a	n/a	0	1	Auxiliary Input 17 (0 open, 1 closed) [spare]
10139	138	008A	bit value	2	n/a	n/a	0	1	Auxiliary Input 18 (0 open, 1 closed) [spare]
10140	139	008B	bit value	2	n/a	n/a	0	1	Auxiliary Input 19 (0 open, 1 closed) [spare]
30202	201	00C9	Amps	4	n/a	n/a	0	3000	Drive Current 3-Phase Average RMS
30203	202	00CA	Hz/10	4	n/a	n/a	0	2000	Drive Frequency
30204	203	00CB		4	n/a	n/a	99		Spare
30205	204	00CC		4	n/a	n/a	99		Spare
30206	205	00CD		4	n/a	n/a	0	65535	4-20ma or 0-10 volts ANA-IN-5 [scaled] [spare]
30207	206	00CE		4	n/a	n/a	0	65535	4-20ma or 0-10 volts ANA-IN-4 [scaled] [spare]
30208	207	00CF		4	n/a	n/a	0	65535	4-20ma or 0-10 volts ANA-IN-3 [scaled] [spare]
30209	208	00D0		4	n/a	n/a	0	65535	4-20ma or 0-10 volts ANA-IN-2 [scaled] [pres./temp/other]
30210	209	00D1		4	n/a	n/a	0	65535	4-20ma or 0-10 volts ANA-IN-1 [scaled] [pres./temp/other]
30211	210	00D2		4	n/a	n/a	99		Spare
30212	211	00D3		4	n/a	n/a	0	65535	Reason Stopped [*m*]
30213	212	00D4		4	n/a	n/a	0	65535	Reason Cannot Start [*m*]
30214	213	00D5		4	n/a	n/a	0	65535	Drive Mode [*m*]

Alias	Addr	Address in Hex	Units	Read	Write	Broadcast Write	Min	Max	Description
30216	215	00D7	Amps * 10	4	n/a	n/a	0	65535	Drive Capacity in Amps
30217	216	00D8	hours	4	n/a	n/a	0	65535	Drive Run Hours
30218	217	00D9	minutes	4	n/a	n/a	0	59	Drive Run Minutes
30219	218	00DA	hours	4	n/a	n/a	0	65535	Power on Hours
30220	219	00DB	minutes	4	n/a	n/a	0	59	Power on Minutes
30221	220	00DC		4	n/a	n/a	0	65535	Starts on Drive
30222	221	00DD		4	n/a	n/a	99		Spare
30223	222	00DE		4	n/a	n/a	99		Spare
30224	223	00DF		4	n/a	n/a	99		Spare
30225	224	00E0		4	n/a	n/a	99		Spare
30226	225	00E1		4	n/a	n/a	99		Spare
40252	251	00FB	Hz	3	6	16	0	400	Drive Base Speed
40253	252	00FC	Hz/10	3	6	16	0	900	Target Frequency Set Point
40254	253	00FD	Hz	3	6	16	0	90	Maximum Frequency Set Point
40255	254	00FE	Hz	3	6	16	0	89	Minimum Frequency Set Point
40256	255	00FF	Amps	3	6	16	0	999	Target Current Set Point
40257	256	0100	Amps	3	6	16	0	999	Maximum Current Set Point
40258	257	0101	Amps	3	6	16	0	999	Minimum Current Set Point
40259	258	0102	psia	3	6	16	0	5000	Target Pressure Set Point
40260	259	0103	psia	3	6	16	0	5000	Maximum Pressure Set Point
40261	260	0104	psia	3	6	16	0	5000	Minimum Pressure Set Point
40262	261	0105	sec	3	6	16	99		Spare
40263	262	0106	1/10Hz/amp	3	6	16	99		Spare
40264	263	0107	sec	3	6	16	99		Spare
40265	264	0108	sec	3	6	16	99		Spare
40266	265	0109		3	6	16	0	1	Ramp Direction (0 raise, 1 lower)
40267	266	010A		3	6	16	1	3	Pump Control (1 pressure, 2 current, 3 frequency)
40268	267	010B		3	6	16	99		Spare
40269	268	010C	Hz/psia/10	3	6	16	99		Spare
40270	269	010D	sec	3	6	16	0	9999	Soft Start Time Delay
40271	270	010E	Hz/10	3	6	16	0	10	Soft Start Frequency Increment
40272	271	010F		3	6	16	99		Spare
40273	272	0110		3	6	16	99		Spare
40274	273	0111		3	6	16	99		Spare
40275	274	0112		3	6	16	99		Spare
40276	275	0113		3	6	16	99		Spare
40277	276	0114		3	6	16	99		Spare
40278	277	0115		3	6	16	99		Spare
40279	278	0116		3	6	16	99		Spare
40280	279	0117	c0,c1	3	6	16	0	65535	Well ID Characters (null terminated)
40281	280	0118	c2,c3	3	6	16	0	65535	Well ID Characters (null terminated)
40282	281	0119	c4,c5	3	6	16	0	65535	Well ID Characters (null terminated)
40283	282	011A	c6,c7	3	6	16	0	65535	Well ID Characters (null terminated)
40284	283	011B	c8,c9	3	6	16	0	65535	Well ID Characters (null terminated)
40285	284	011C	c10,c11	3	6	16	0	65535	Well ID Characters (null terminated)
40286	285	011D	c12,c13	3	6	16	0	65535	Well ID Characters (null terminated)
40287	286	011E	c14,c15	3	6	16	0	65535	Well ID Characters (null terminated)
40288	287	011F	c16,c17	3	6	16	0	65535	Well ID Characters (null terminated)
40289	288	0120	c18,c19	3	6	16	0	65535	Well ID Characters (null terminated)
40290	289	0121	0x00,0x00	3	6	16	0	65535	Well ID Characters (null terminated)

Alias	Addr.	Addr. in Hex	Units	Read	Write	Broadcast Write	Min	Max	Description
40538	538	021A	sec	n/a	n/a	16	0	65535	Low-Order portion of above (addr. 537) [see text]
42001	2000	07D0	year	3	6	16	1980	2235	Read/Set current Year of internal calendar
42002	2001	07D1	month	3	6	16	1	12	Read/Set current Month of Year
42003	2002	07D2	day	3	6	16	1	31	Read/Set current Day of Month
42004	2003	07D3	hour	3	6	16	0	23	Read/Set current Time of Day (24hour clock)
42005	2004	07D4	minute	3	6	16	0	59	Read/Set current Time of Day (minutes)
42006	2005	07D5	second	3	6	16	0	59	Read/Set current Time of Day (seconds)

Notes Section
(mom) indicates a momentary contact.
Items with a minimum value of 99 are unused in this implementation. This value will be returned if the item is queried.
Auxiliary Analog and Digital Input queries listed may not correspond to available hardware.
Digital Output sets/queries listed may not correspond to available hardware.
Addresses for which the 'write command' and 'broadcast write command' are listed as "n/a" indicate a fixed (read only) value.
Addresses for which the 'read command' and 'write command' are listed as "n/a" indicate a broadcast update only variable.

Interface/Protocol Information

Physical media for communication to the VSD is Two-Wire cable, as specified by the RS-485 standard.
Line coding (electrical) standards are as specified by the RS-485 standard.
Data Rates are user selectable and can be 300, 1200, 2400, 4800, 9600 and 19,200 bits per second (baud).
Transport Protocol is Modbus RTU, as defined by "Modicon Modbus Protocol Reference Guide" PI-MBUS-300 Rev. C [Jan 1991]

SCADA Messages

Message Number	Description
4802	Manual start.
4803	Automatic start.
4804	Overcurrent
4805	Undercurrent
4806	Manual stop.
4807	Pressure too high
4808	Pressure too low
4809	VSD HMI too hot
4810	VSD HMI too cold
4811	INP1 active
4812	INP2 active
4813	INP3 active
4814	INP4 active
4815	INP5 active
4816	INP6 active
4817	INP7 active
4818	INP8 active
4819	INP9 active
4820	INP10 active
4821	INP11 active
4822	INP12 active
4823	INP13 active
4824	INP14 active
4825	INP15 active
4826	INP16 active
4827	INP17 active
4828	Power failed
4829	ANA 1 out of range
4830	Not Used
4831	ANA 2 out of range
4832	Not Used
4833	ANA 3 out of range
4834	Not used
4835	ANA 4 out of range
4836	Not Used
4837	ANA 5 out of range
4838	Not Used
4839	ANA 6 out of range
4840	Not Used
4841	ANA 7 out of range
4842	Not Used
4843	ANA 8 out of range
4844	Not Used
4845	VSD tripped
4846	Unknown reason
4847	VSD Communication Error - No Packets
4848	VSD Communication Short Packet Came
4849	VSD Communication Bank Packet Error
4850	VSD Communication Address Packet Error
4851	VSD Communication Mask Packet Error
4852	VSD Communication Data Packet Error
4853	Drive tripped; waiting to read error code from drive
4854	Drive tripped; reason in VSD_TRIP_CODE
4855	VSD Trip.

SCADA Messages cont.

Message Number	Description
4856	Overcurrent during acceleration
4857	Overcurrent during deceleration
4858	Overcurrent during constant speed run
4859	Load End Overcurrent
4860	U Phase Armature Short Circuit
4861	V Phase Armature Short Circuit
4862	W Phase Armature Short Circuit
4863	Lost Input Phase
4864	Lost Output Phase
4865	Overvoltage during Accel.
4866	Overvoltage during Decel.
4867	Overvoltage during Constant speed.
4868	Inverter Overload
4869	Motor Overload
4870	Dynamic Braking resistor overload
4871	Inverter Overheat
4872	Emergency Off
4873	EEProm Failure during write
4874	EEProm Failure during read
4875	Unused
4876	RAM Error
4877	ROM Error
4878	CPU Error
4879	RS232 Timeout
4880	Gate Array Error
4881	Output Current Detection Circuit Fail
4882	Option PCB Error
4883	Option ROM Error
4884	Low Current
4885	Main circuit undervoltage
4886	Unused
4887	Over Torque
4888	Earth Fault (Software)
4889	Earth Fault (Hardware)
4890	Open Fuse
4891	Dynamic Braking Resistor overcurrent
4892	Overcurr in DC Sect. while Accel.
4893	Overcurr in DC Sect. while Decel.
4894	Overcurr in DC Sect. while Const. speed
4895	Autotuning Error
4896	Inverter Typeform Error
4897	Power Failed
4898	Power was restored
4899	Exited program
4900	VSD Inverter off Due to Interlock
4901	VSD control voltage low.
4902	VSD bus voltage low.
4903	Drive cannot start because ...
4904	Drive will start in ...
4905	Running (string) XX.X Hz XX.X Amps
4906	XX seconds
4907	Message
4908	SHIFT
4909	END OF HELP

SCADA Messages cont.

Message Number	Description
4910	HELP BUFFER FULL
4911	XXX <EMPTY MENU>
4912	Ready to start
4913	Initialising VSD
4914	Too many auto-starts

SECTION 7: Service

Requesting Service

When requesting service, report the contents of the following problem information sheet.

Problem Information Sheet

Item		
	Customer's name	
Refer to	Person in charge	
	Address	
	Telephone No.	
Drive spec.	Model No.	
	Serial No.	
Delivery Date		
Time in service		
Date when problem arose		
	Use	
Status of use	Motor rating	Poles, HP, V, Hz.
		Made by REDA? Made by another company?
		New? Number of units?
		Alternate? Continuous?
	Ambient Condition	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:
		Availability of air conditioning:
Phenomenon	Power source	Number of phases
		Voltage between L1 phase and L2 phase: L11 and L21
		Voltage between L2 phase and L3 phase: L21 and L31
		Voltage between L3 phase and L1 phase: L31 and L11
		Number of Hz:
	State of motor when problem was found	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?
		Problem occurred during acceleration?
		Problem occurred during deceleration?
		Problem occurred while motor was not running?
	Frequency of problem	First time? problem occurred times in the past.
		Problem occurs sometimes?
		Problem occurs everytime motor is operated?
		When did problem first occur?
	Trouble indicator	Indicate LCD Screen Message:
Detail description of problem:		
Temporary diagnosis and corrective action:		
Date defective product shipped: To:		
Deadline for repairs:		

Only qualified personnel should be allowed to service this equipment.

Parts Service Life

In order to obtain the best performance and to get the maximum service life from the drive it is necessary to perform timely maintenance repairs on some parts of the system even though the equipment may still be functioning with no apparent problems.

Use the following service life chart as a guide for major part periodic replacement when the equipment is used in a standard installation service environment

Service Life Replacement Chart

Part Name	Service Life	Remarks
Large capacity electrolytic capacitor	5 Years	To be electrified semiannually in case of long term disuse.
Cooling Fan	26000 Hours	Internal fans
Contact relays	500,000 operations	
Connectors	100 operations	Replace pin in case of failure.
Cooling Fan	26,000 Hours	External fans

Troubleshooting

If the drive faults, the following questions may help to pinpoint the reason for the trip:
1. Does the drive trip when accelerating, running, decelerating, or when not running ?
2. Can the drive make it to commanded frequency ?
3. Does the drive trip without the motor attached ?
4. Does drive trip with an unloaded motor ?

The control board (with Operator Interface phone jack), and terminal strip board are common to all drive ratings. If a board or keypad is suspect, exchange with a known good board/keypad to verify.

Drive Fault Displays and Explanations.

OVERCURRENT (ACCEL) or DC OVERCURRENT (ACC)
Cause: Drive current exceeded 215% of its rated FLA.
Comments: Check for phase-phase short. ACCELERATION TIME may be too small. VOLTAGE BOOST may be too high. Is motor/machine jammed? Is mechanical brake engaged while drive is running? If there is a contactor between motor and drive, wire so that contactor changes state only when drive is outputting 0.0 Hz.

OVERCURRENT (DECEL) or DC OVERCURRENT (DEC)
Cause: Drive current exceeded 215% of its rated FLA (190% above 100 HP).
Comments: Check for phase-phase short. DECELERATION TIME may be too small. Is motor/machine jammed? Is mechanical brake engaged while drive is running? Adding appropriate braking resistor across OPTIONAL "PA" and "PB" terminals may solve problem.

OVERCURRENT (RUN) or DC OVERCURRENT (RUN)
Cause: Drive current exceeded 215% of its rated FLA.
Comments: Check for phase-phase short. Is motor/machine jammed? Is mechanical brake engaged while drive is running? If there are severe load fluctuations, adding mechanical dampening or an output line reactor may help.

U-PHASE SHORT-CIRCUIT or V PHASE SHORT-CIRCUIT or W PHASE SHORT-CIRCUIT
Cause: Drive detected short-circuit in transistor.
Comments: Replace transistor. Contact REDA for authorized repair.

LOAD-END OVERCURRENT
Cause: Drive detected short-circuit on output.
Comments: Check for phase-phase short. Meg motor/leads with leads disconnected from drive. Remove any power factor correction caps on motor.

OVERVOLTAGE (ACCEL) or OVERVOLTAGE (RUN)
Cause: Bus exceeded 787 VDC.
Comments: Incoming AC may have gone high or spiked; a line reactor or a lower tap on transformer may help. Motor may be mechanically forced to run faster than drive is commanding; install appropriate OPTIONAL dynamic braking resistor. On eccentric cyclic loads like presses or pump jacks, contact REDA for special programming instructions that may make a DBR (Dynamic Braking Resistor) unnecessary.

Drive Fault Displays and Explanations (cont'd)

OVERVOLTAGE (DEC)
Cause: Bus exceeded 787 VDC.
Comments: Incoming AC may have gone high or spike; a line reactor or a lower tap on transformer may help. DECELERATION TIME #1 may be too short. Motor may be mechanically forced to run faster than drive is commanding (due to large load inertias mechanical couplings); install appropriate OPTIONAL dynamic braking resistor. On eccentric cyclic loads like presses or pump jacks, contact REDA for special programming instructions that may make a DBR unnecessary.

INVERTER OVERLOAD
Cause: Drive exceeded 100% of its rated current for too long of a time.
Comments: This trip indicates that the drive output exceeded its rated current for specific amounts of time. Make sure that drive is seeing voltage on all three of its input phases. Drive may be undersized.

MOTOR OVERLOAD
Cause: Motor is in danger of overheating because it required too much current for an excessive period as determined by the drive.
Comments: Check HMI programming manual to ensure overload is set properly.

INVERTER OVERHEAT
Cause: Drive's heatsink exceeded 90° C.
Comments: Check drive's fans (if any). Clear heatsinks of anything blocking airflow. Drive may not have been properly sized for operating altitude. Thermistor on heatsink may be bad.

EMERGENCY OFF
Cause: Drive received one of the following E-STOP commands:
1. Drive was receiving STOP/START command via terminal strip when STOP button on optional TSK keypad was pressed.
2.Input terminal "S4" is being opened/closed to command E-STOP.

EEPROM WRITE FAILURE or EEPROM READ FAILURE
Cause: EEPROM was unable to read/write to peripherals.
Comments: Check for mis-wiring that may be causing noise (such as "CC" connected to ground, an external 10 volt source connected to "PP" etc.) Control board may need to be replaced (see spare parts list page 11-1). See picture of board on page 5-2.

RAM ERROR or ROM ERROR
Comments: Check for mis-wiring that may be causing noise (such as "CC" connected to ground, an external 10 volt source connected to "PP" etc.). Replace control board (see spare parts list on page 11-2). See picture of board on page 5-2.

Drive Fault Displays and Explanations (cont'd)

OPTION ROM ERROR
Comments: Check for mis-wiring that may be causing noise (such as "CC" connected to ground, an external 10 volt source connected to "PP" etc.). If drive is energized with REDA ROM installed and is later energized without REDA ROM installed, this fault will appear. Install REDA ROM and try again. Also check for contamination in the connector and try to read ROM version with the TSK.

CPU ERROR
Comments: If REDA ROM or an option board is installed or removed when drive is powered, this fault will appear. Reset like any fault. Check for mis-wiring that may be causing noise (such as "CC" connected to ground, an external 10 volt source connected to "PP" etc.). If the CPU is truly damaged, the fault will not reset and replacement of the control board is necessary. Spare parts list is on page 11-2. See picture of control board on page 5-2.

COMMUNICATION ERROR (RS-232 Time-out)
Cause: RS232 timer exceeded time limit
Comments: Check wiring to RS232 HMI port. Cable may be broken.

OPTION PCB ERROR
Comments: If drive is energized with an option board installed and is later energized without the board installed, this fault will appear. Check connectors between control board and option board. Use stand-offs to secure board.

LOW CURRENT TRIP
Cause: The drive's output current went below the current value entered in HMI for LOW CURRENT DETECT LEVEL.

EARTH FAULT (SOFT) or EARTH FAULT (HARD)
Cause: Drive detected some current to ground. Depending on rating, drive senses ground fault via ZCT (hard fault) or HCT (soft fault). Comments*:* With leads disconnected from drive, Meg transformer or motor and leads. Look for any moisture that may provide current path to ground. Make sure that control wiring is separated from power wiring. Adding noise suppressors on coils of starters on same line as drive may snub noise picked up by ZCT. RF/EMI filter may help remove noise generated by SCR rectifiers in the vicinity. Make sure drive chassis and motor are grounded.

GATE ARRAY ERROR
Comments: Replace control board.

OUTPUT CURRENT DETECTION CIRCUIT FAIL
Comments: Occurs when drive is stopped but CPU detects current flowing. This fault could be caused by plugging in HMI cable with drive powered (resulting in damage to control board). Adding a RF/EMI filter may remove noise spikes from nearby SCR rectifiers. If the control board is damaged, the drive must be serviced.

INV TYPEFORM ERROR
Cause: Control board is not configured to drive's rating.
Comments: HMI must be reset to factory settings

Superuser Factory Reset (Using G3 keypad)

The Superuser Factory Reset should be used after the following circumstances:

1. The inverter control board has been changed.
2. The gate drive board has been changed.
3. The Option ROM has been changed.
4. The VSD is not operating as per expected in reference to the proper output amperage.
5. The Coordination Board has been changed or the DIP switched have been changed on the Coordination Board (518-1200 KVA only)

The Superuser Factory Reset is used to reset the VSD to the factory settings, this reset will reset all of the programmed parameters in the VSD that are associated with the inverter controls. These include but are not limited to:

Maximum output amperage
Volts per hertz settings (base speed)
Minimum frequency
Maximum frequency
Start frequency
Acceleration rate (ramp frequency)
Deceleration rate

The Superuser Factory Reset should only be performed by qualified SCHLUMBERGER personnel - serious equipment damage may result if not done properly.

To take advantage of the Superuser Reset you must have the following part numbers:

Part # = 1303148
5 Meter Cable for Diagnostic Keypad for SPEEDSTAR 2000 VSD

Part # = 1303130
Diagnostic Keypad for SPEEDSTAR 2000 VSD

Part # = 1303080
Metal Case for Diagnostic Keypad for SPEEDSTAR 2000 VSD

The following page gives detailed instructions on how to use the Keypad to reset the VSD

G3 SUPERUSER GUIDELINE # 3 (Rev. 0)
Superuser Factory Reset (Using G3 keypad)

DESCRIPTION

This is a special function within GROUP: SUPERUSER that will perform a factory reset similar to the standard reset; however, this factory reset will also return all Superuser parameters to their default values.

TO USE

Access the Superuser programming group

To access the Superuser mode, perform the following steps after cycling power to the drive:

1) Press the LOCAL/REMOTE key.

2) Press the READ/WRITE key.

3) Hold down the LOCAL/REMOTE key and press the LOCAL/REMOTE key.

You should now see "GROUP: SUPERUSER displayed on the LCD readout, followed by RAMF if you do not see the, cycle the power to the drive and repeat the steps above.

Perform a "TYPE 255" reset

This is the Superuser reset that will default all parameters (normal and Superuser) back to their original factory settings.

1) With RAMF displayed on the screen, press one of the ARROW keys until TYP is displayed.

2) Press READ/WRITE again to enter TYP mode.

3) Use the ARROW keys to change the current value to "255".

4) Press READ/WRITE to write the new value, the drive should display the word "INITIALIZING" followed by a relay "click", then default to "OUTPUT FREQUENCY=0.0 Hz".

Note: Occasionally the G3 will display an "INVERTER TYPEFORM ERROR" following a Superuser reset. Clear the fault normally as instructed on the screen and proceed with the next step of this guideline.

Perform a typeform reset

After resetting the Superuser mode, it is necessary to perform and "inverter typeform" reset in the standard programming to insure that the software recognizes what type of inverter it is installed in.

1) Go into the UTILITY PARAMETERS program group and scroll to the STANDARD SETTING MODE SELECTION parameter.

2) Write a "7" into this parameter – this will initialize a typeform reset. After the inverter displays INITIALIZING, it will default back to OUTPUT FREQUENCY=0.0 Hz. The entire drive memory is now reset back to factory settings.

EXPLANATION OF RESETS USING TOSHIBA DIAGNOSTIC KEYPAD AND SPEEDSTAR HMI

DESCRIPTION

TYPE 3 RESET - This will reset all of the normal parameters in the VSD to their factory default settings. After this type of reset the power to the VSD should be cycled once to complete the process.

TYPE 7 RESET - This will reset the typeform of the VSD. The CPU will monitor the Gate drive board on smaller VSDs and the Coordination board on 518-1200 KVA units and will reset the output amperage of the VSD to match the board. After this type of reset the power to the VSD should be cycled once to complete the process.

TYPE 255 RESET - This will reset all of the parameters in the VSD to their factory settings and will include any settings that have been changed using the Superuser mode. After this type of reset a type 7 reset must also be performed and then power must be cycled to complete the process. (NOTE: THIS RESET MAY ONLY BE DONE WITH THE DIAGNOSTIC KEYPAD)

ALL OF THESE RESETS SHOULD BE DONE WITH GREAT CARE AND BY QUALIFIED SCHLUMBERGER TECHNICIANS.

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