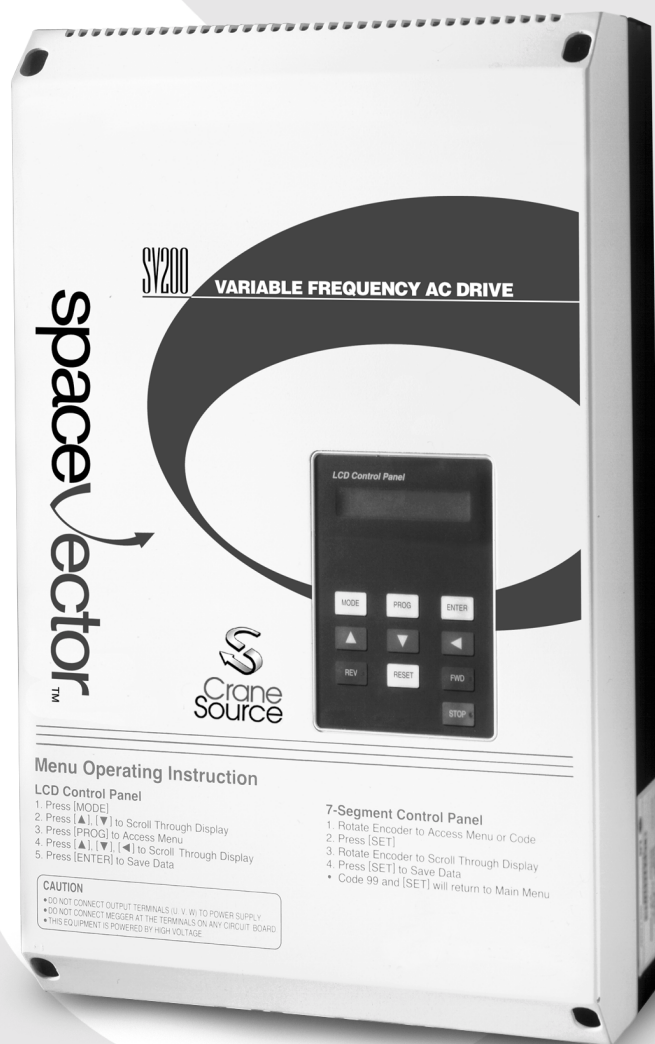


# spacevector™

## SV200

## INSTALLATION, PROGRAMMING & SERVICE MANUAL



Crane  
Source

COLUMBUS MCKINNON CORPORATION

Version 2

# SpaceVector™ Variable Frequency Drives

Congratulations on the purchase of a SpaceVector™ SV200 Series drive. This is the most advanced drive on the market today specifically designed and programmed for the overhead material handling industry by the leader in the industry, Columbus McKinnon Corporation.

SpaceVector™ drives have many advantages and features to meet the very specific and demanding needs of the crane and hoist industry. Features such as:

- An energy efficient drive, resulting in less heating of the motor.
- Cooler running motors last longer saving on downtime and maintenance costs.
- Efficient utilization produces more torque, resulting in better load control.
- Reduced motor harmonics, which improve motor performance and lengthen life.
- Easy macro quick set programming for faster start-up and servicing.
- Plain English programming and service manual saves time.

## **IMPORTANT! PLEASE READ!**

Before proceeding any further, please read the following important information regarding the drive and its proper handling and use:

- **Please read this manual completely before working with the drive.**
- **The drive operates on and contains high voltage that can cause electric shock resulting in personal injury or loss of life. Handle the drive with the same care and caution as all other high voltage electrical components.**
- **Be sure to disconnect all AC input power to the drive before servicing. Lock and tag the main switch in the de-energized position per ANSI Z 244.1.**
- **Wait at least 3 minutes after disconnecting the AC input power to the drive. If the bus capacitor discharge circuit fails, high voltage can remain in the drive for a period of time after the AC power is disconnected.**
- **Do not perform high voltage tests such as Megger testing.**
- **Only qualified personnel should perform service.**
- **Insure unit is properly grounded.**
- **Disconnect drive before performing any welding on the bridge crane structure. Do not weld the hook, to the hook or to a load suspended from the hook.**

On the following pages are specification and selection tables for the drives and dynamic braking resistors. Please check to insure you have the proper equipment for your application.

# SV200

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# **Section 1: Installation**

**Section 1.1: Inspection of Drive**

**Section 1.2: Mounting the Drive**

**Section 1.3: Wiring the Drive**

## Section 1.1: Inspection of Drive



### **WARNING**

**WORKING IN OR NEAR EXPOSED ENERGIZED ELECTRICAL EQUIPMENT PRESENTS THE DANGER OF ELECTRIC SHOCK.**

#### **TO AVOID INJURY:**

- **Disconnect and lockout power to the drive per ANSI Z 244.1**
- **Wait 3 minutes after disconnecting power for capacitor to discharge before entering drive.**

1. Inspect the drive for any physical damage that may have occurred during its shipment. If any parts of the drive are missing or damaged, contact your SpaceVector™ distributor immediately.
2. Verify the nameplate of the SV200 drive. Verify that the drive part number matches your order and packing slip.
3. Verify that the Dynamic Braking Resistor part number matches your order and packing slip.
4. If there are questions, reference Tables 1.1.1, 1.1.2, 1.1.3, 1.1.4 for Drive and Resistor specifications.



Table 1.1.1: SV200 Drive Specifications for 230 Volts

<b>SpaceVector™ Drive Specifications (230 V)</b>									
<b>Inverter Type (446485-XX)</b>		<b>-10</b>	<b>-11</b>	<b>-12</b>	<b>-13</b>	<b>-14</b>	<b>-15</b>	<b>-16</b>	<b>-17</b>
<b>Applicable Motor</b>	[HP] Constant Torque	3	5	7.5	10	15	20	25	30
	[kW] Constant Torque	2.2	3.7	5.5	7.5	11	15	18.5	22
<b>Output Ratings</b>	[kVA] Constant Torque	4.2	6.1	9.1	12.2	17.5	22.5	28.2	33.2
	[FLA] Constant Torque	11	16	24	32	46	59	74	87
	Max. Frequency	120.0 Hz.							
	Voltage	3 Phase, 0 - Input Voltage							
<b>Input Ratings</b>	Input Voltage	3 Phase, 200 - 230 V (± 10%)							
	Input Frequency	50 to 60 Hz (± 5%)							
<b>Control</b>	Control Method	SpaceVector PWM							
	Frequency Resolution	0.01 Hz							
	Frequency Accuracy	Digital Setting: 0.01% of Maximum Frequency Analog Setting: 0.1% of Maximum Frequency							
	V/F ratio	Linear and User programmable							
	Braking Torque	Approximately 20%							
	Overload Capacity	150% for 1 minute							
	Torque Boost	0 - 20% programmable							
<b>Operating</b>	Operation Method	Keypad / Terminal Selective							
	Frequency Selection	Keypad / Analog: 0 ~ 10 VDC, 4 ~ 20 mA							
	Accel. / Decel. time	0.1 to 6,000 sec.							
	Speed Selection	Up to 5 steps, programmable							
<b>Programmable Input</b>	Programmable Input	Six inputs - 2, 3, 4, 5, P, P6 ( P6 is 24 VDC, Sinking to CM)							
<b>Protection</b>	Inverter Fault	Overvoltage, Undervoltage, Overcurrent, Fuse Open, Ground Fault, Inverter Overheat, Motor Overheat, Main CPU Error, Phase Loss							
	Stall Prevention	Overcurrent Prevention							
	Instantaneous Power Failure	Below 15 msec.: Continuous Operation Over 15 msec.: Automatic Restart (selective)							
<b>Environmental Conditions</b>	Ambient Temperature	-10° to 40°C (14° to 104°F)							
	Humidity	Under 90% (Non Condensing)							
	Altitude	Less than 1,000 m (3280 feet)							
	Cooling system	Forced Air							

Table 1.1.2: SV200 Drive Specifications for 460 Volts

<b>SpaceVector™ Drive Specifications (460 V)</b>									
<b>Inverter Type (446485-XX)</b>		<b>-20</b>	<b>-21</b>	<b>-22</b>	<b>-23</b>	<b>-24</b>	<b>-25</b>	<b>-26</b>	<b>-27</b>
<b>Applicable Motor</b>	[HP] Constant Torque	3	5	7.5	10	15	20	25	30
	[kW] Constant Torque	2.2	3.7	5.5	7.5	11	15	18.5	22
<b>Output Ratings</b>	[kVA] Constant Torque	4.2	6.1	9.1	12.2	18.3	22.9	29.7	34.3
	[FLA] Constant Torque	6	8	12	16	24	30	39	45
	Max. Frequency	120.0 Hz.							
	Output Voltage	3 Phase, 0 to Input Voltage							
<b>Input Ratings</b>	Input Voltage	3 Phase, 380 - 460 V (± 10%)							
	Input Frequency	50 to 60 Hz. (± 5%)							
<b>Control</b>	Control Method	SpaceVector PWM							
	Frequency Resolution	0.01 Hz.							
	Frequency Accuracy	Digital Setting: 0.01% of Maximum Frequency Analog Setting: 0.1% of Maximum Frequency							
	V/F ratio	Linear and User programmable							
	Braking Torque	Approximately 20%							
	Overload Capacity	150% for 1 minute							
	Torque Boost	0 - 20% programmable							
<b>Operation</b>	Operation Method	Keypad / Terminal Selective							
	Frequency Selection	Keypad / Analog: 0 ~ 10 VDC, 4 ~ 20 mA							
	Accel. / Decel. time	0.1 to 6,000 sec.							
	Speed Selection	Up to 5 steps, programmable							
<b>Programmable Input</b>	Programmable Input	Six inputs - 2, 3, 4, 5, P, P6 ( P6 is 24 VDC, Sinking to CM)							
<b>Protection</b>	Inverter Fault	Overvoltage, Undervoltage, Overcurrent, Fuse Open, Ground Fault, Inverter Overheat, Motor Overheat, Main CPU Error, Phase Loss							
	Stall Prevention	Overcurrent Prevention							
	Instantaneous Power Failure	Below 15 msec.: Continuous Operation Over 15 msec.: Automatic Restart (selective)							
<b>Environmental Conditions</b>	Ambient Temperature	-10° to 40°C (14° to 104°F)							
	Humidity	Under 90% (Non Condensing)							
	Altitude	Less than 1,000 m (3280 feet)							
	Cooling system	Forced Air							

Table 1.1.3: 230 V Class Dynamic Braking Resistors

H.P.	Class A, B, C or D Service			Class E Service
	Hoist with MLB*	Hoist without MLB*	Traverse	Hoist without MLB*
1	446485-A1 100 w	446485-A1 100 w	446485-A1 100 w	446485-A1 100 w
2	446485-A2 50 w	446485-A8 60 w	446485-A2 50 w	446485-A8 60 w
3				
5	446485-A3 130 w	446485-B3 30 w	446485-A4 33 w	446485-B3 30 w
7.5	446485-A6 20 w	446485-B6 20 w	446485-A9 15 w	446485-B6 20 w
10	446485-A9 15 w	446485-C0 16 w		446485-C0 16 w
15	446485-B4 10 w	446485-C3 10 w	446485-B4 10 w	446485-C3 10 w
20	446485-B5 8 w		446485-B5 8 w	
25	446485-B7 5 w	446485-C4 7 w	446485-B7 5 w	446485-C4 7 w
30				

Table 1.1.4: 460 V Class Dynamic Braking Resistors

H.P.	Class A, B, C or D Service			Class E Service
	Hoist with MLB*	Hoist without MLB*	Traverse	Hoist without MLB*
1	446485-A0 200 w	446485-A0 200 w	446485-A0 200 w	446485-A0 200 w
2		446485-A5 200 w		446485-A5 200 w
3		446485-B0 200 w		446485-B0 200 w
5	446485-A1 100 w	446485-B2 120 w	446485-A3 130 w	446485-B2 120 w
7.5	446485-A2 50 w	446485-B8 80 w	446485-A7 85 w	446485-B8 80 w
10		446485-B9 60 w	446485-A8 60 w	446485-B9 60 w
15		446485-C1 40 w	446485-B1 40 w	446485-C1 40 w
20	446485-A4 33 w	446485-C2 30 w	446485-B3 30 w	446485-C2 30 w
25	446485-A6 120 w	446485-C6 20 w	446485-B6 20 w	446485-C6 20 w
30				

\*MLB = Mechanical Load Brake

## Section 1.2: Mounting the Drive

### 1.2.1 Environmental Conditions

1. Verify the ambient condition of the drive mounting location. The ambient temperature range should be 14° to 104°F (-10° to 40°C) for NEMA 1 and or NEMA 4/12 enclosures.
2. The relative humidity should be less than 90% (non-condensing), below the altitude of 3280 ft. or 1000m.
3. Do not mount the drive in direct sunlight. The drive should also be isolated from excessive vibration.
4. The drive should be protected from moisture, dust, metallic particles, corrosive gases and liquids.
5. Consult Factory for severe environments.

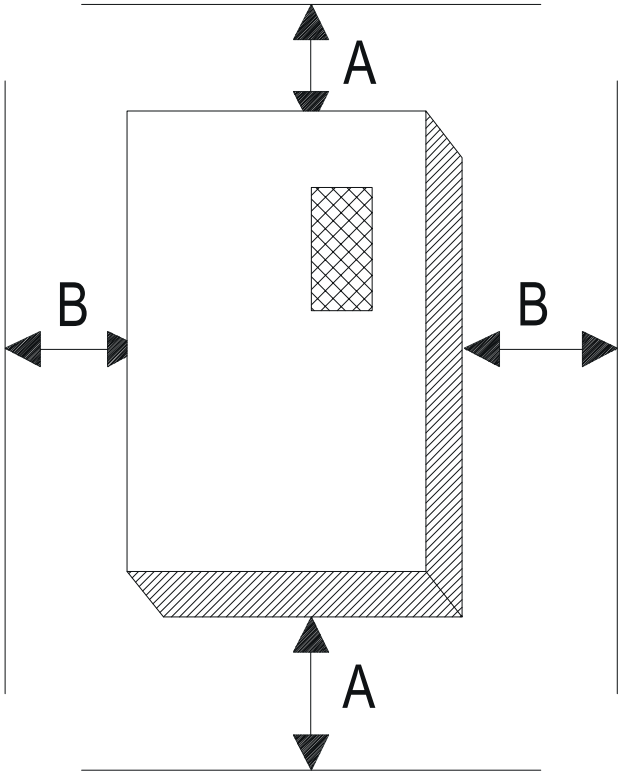
### 1.2.2 Electrical Conditions

1. Verify that Input voltage is within drive nameplate +/- 10%. If input line voltage varies due to sags and or surges input line reactors are recommended.
2. Analog input requires individually shielded twisted pair cable for installations where the cable leaves the control cabinet.
3. If length of motor leads between drive and motor exceed 100 ft. (30 m) a load reactor between drive and motor is recommended.

### Mounting

The SV200 must be mounted vertically with sufficient space (horizontally and vertically) between adjacent equipment to permit proper heat dissipation. See Figure 1.2.1. See Figures 1.2.2 - 1.2.5 for actual drive dimensions.

Fig. 1.2.1: Recommended Clearances for Drive Mounting



A: over 6.0" (15cm)  
B: over 2.0" (5cm)

**Note:** Allow more room between drive and other heat producing components (such as transformers and drive ballast resistors) than shown in Fig. 1.2.1. These components radiate enough heat to damage the drive and its internal components.

## Drive Dimensions and Weights

Fig. 1.2.2: SV200 Part No. - 446485-10 / 446485-11

418.74lbs (8.5kg)

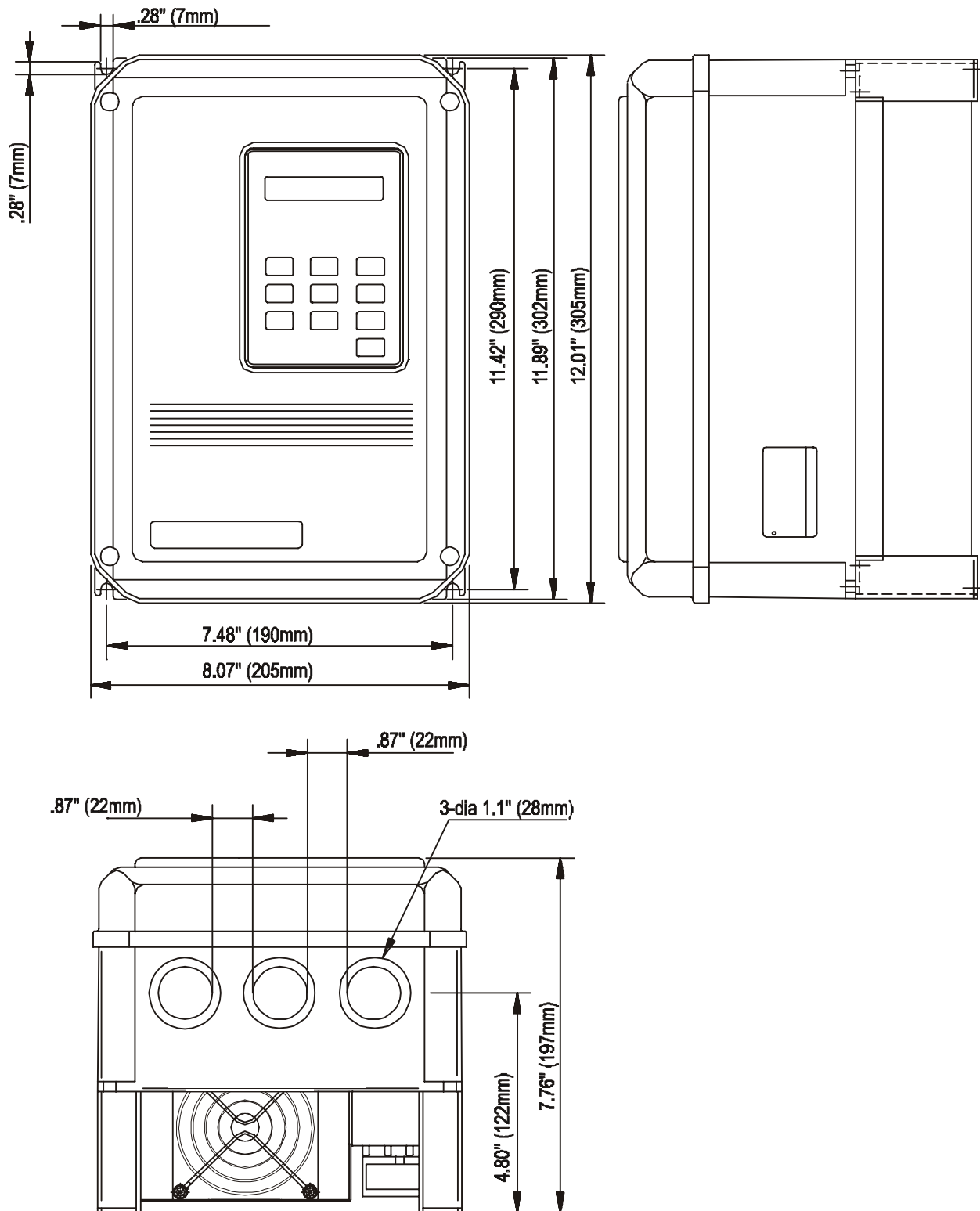


Fig. 1.2.3: SV200 Part Nos. 446485-12 / 446485-13  
 446485-20 / 446485-21 / 446485-22  
 446485-23

22.1lbs / 23.2lbs  
 (10 / 10.5kg)

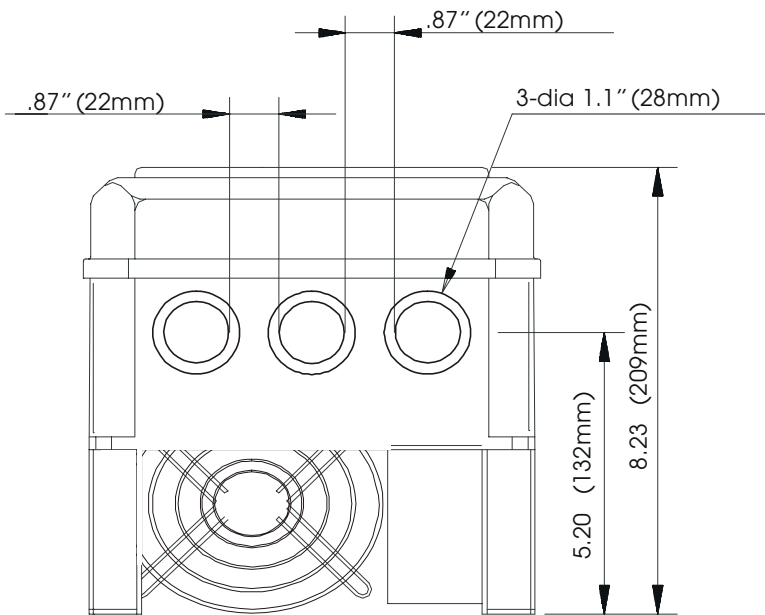
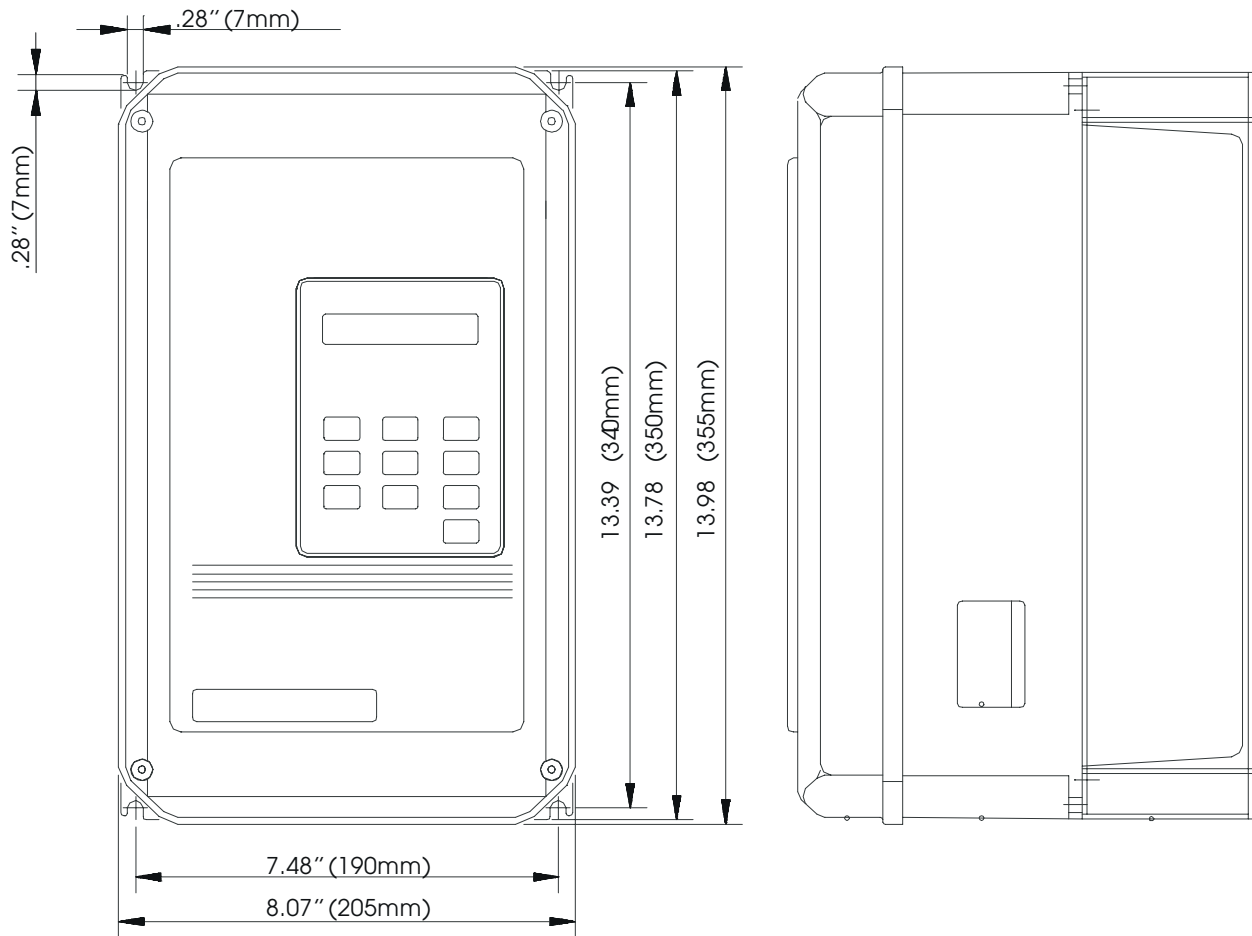


Fig. 1.2.4: SV200 Part Nos. 446485-14 / 446485-15  
 446485-24 / 446485-25

46.3 lbs. / 48.5 lbs.  
 (21kg / 22kg)

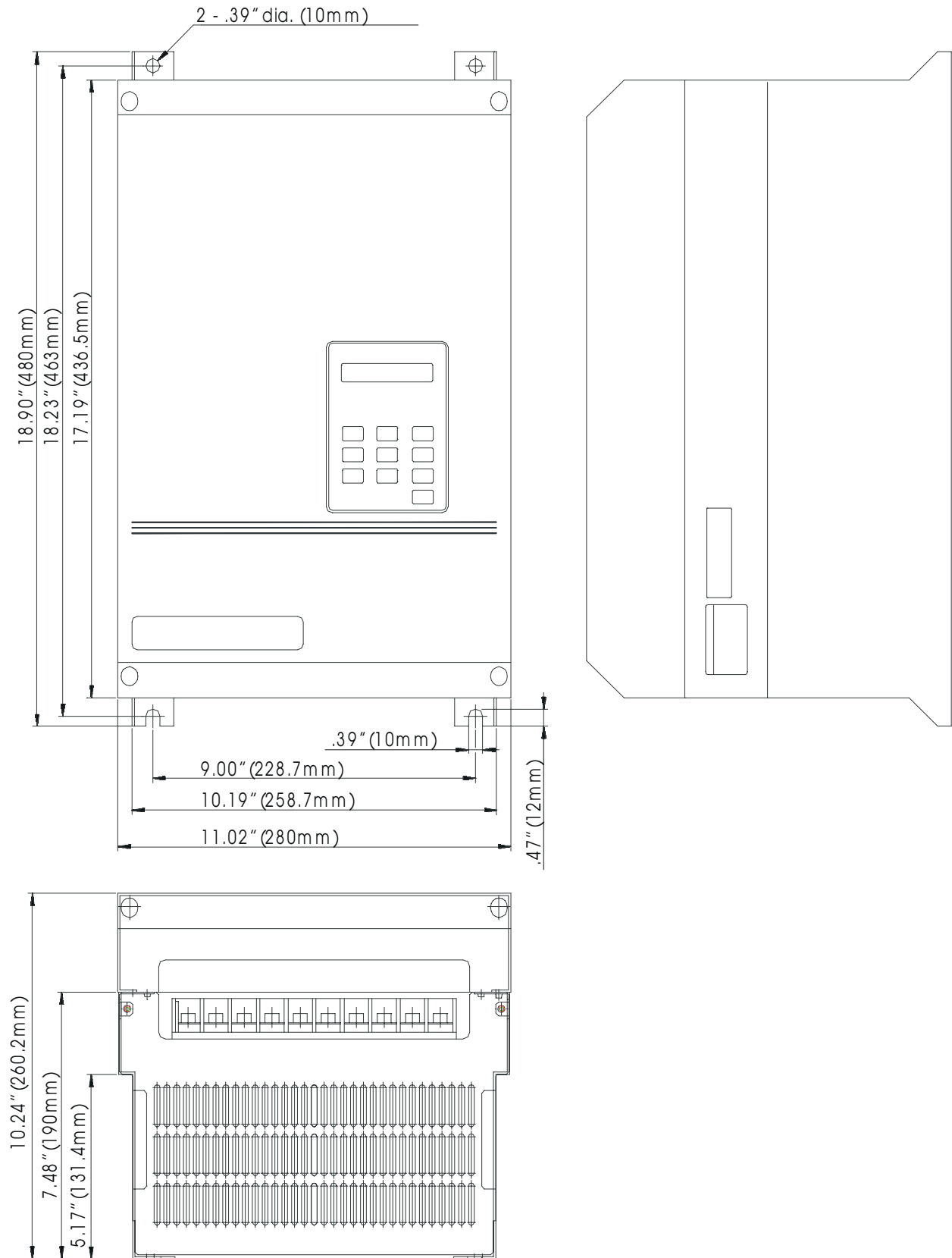
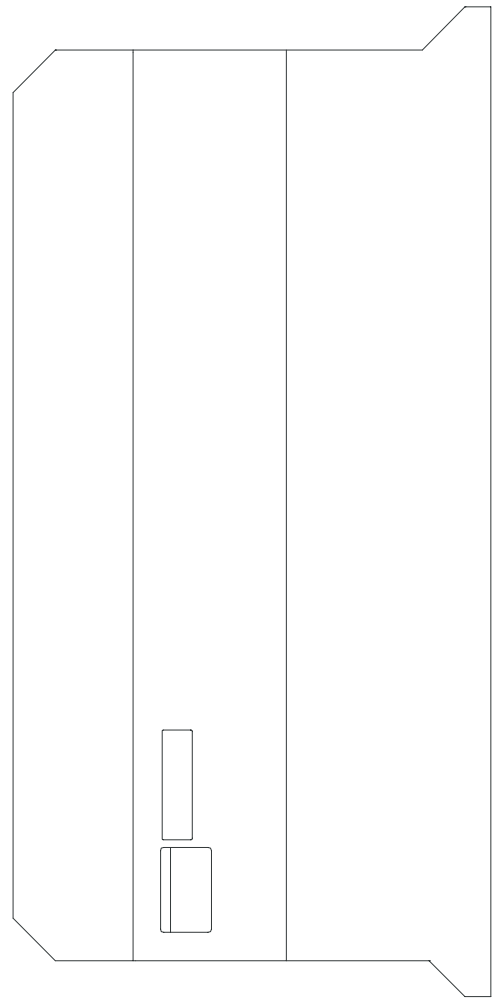
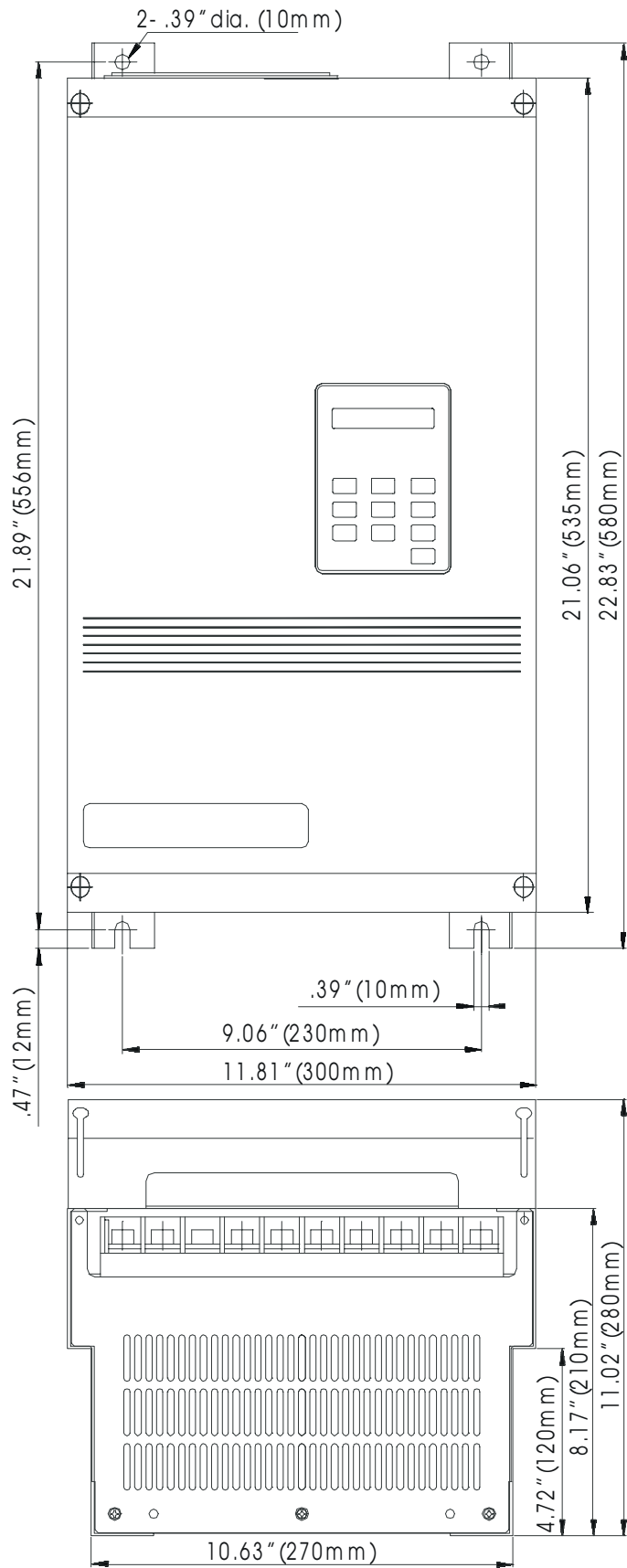




Fig. 1.2.5: SV200 Part Nos. 446485-16 / 446485-17  
 446485-26 / 446485-27

63.9 lbs. / 68.4 lbs.  
 (29kg / 31kg)



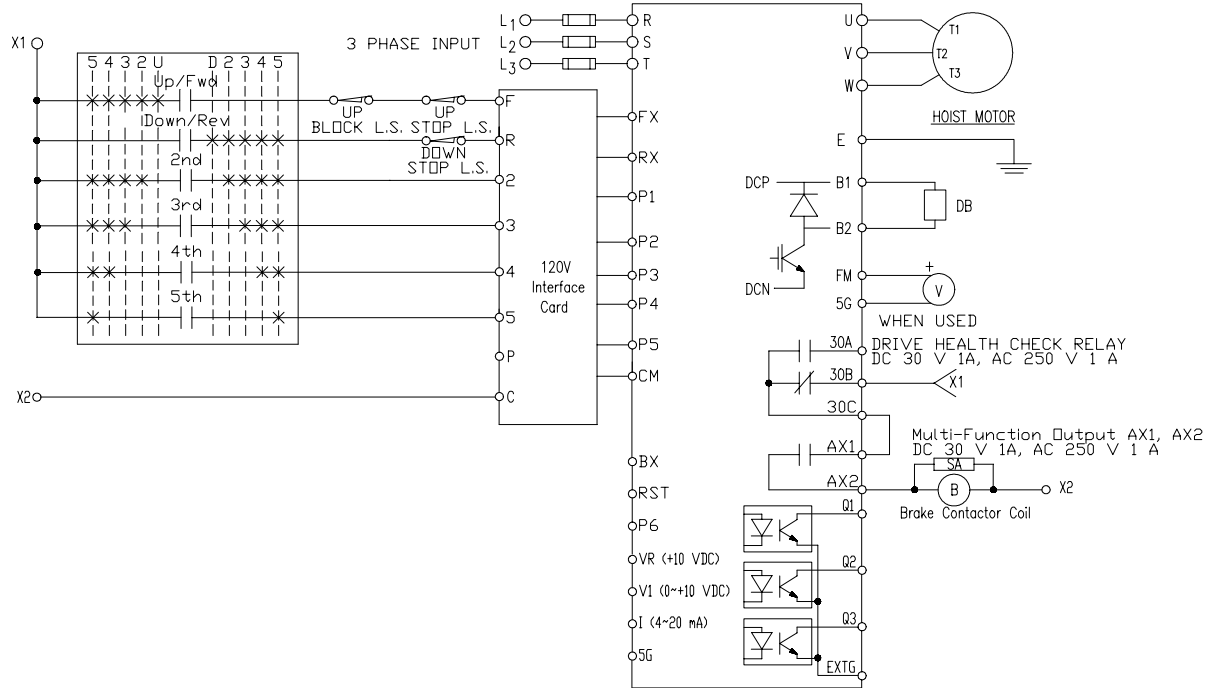
## Section 1.3: Wiring the Drive

### 1.3.1 Remove Cover From Drive

The cover is held on with four screws and must be removed in order to connect the power, motor, and control wires.

Figure 1.3.1 is a reference for the basic Input / Output Terminals of an SV200 drive.

Fig. 1.3.1: SV200 Layout For Basic Wiring



### 1.3.2 Check For Correct Wire Gauges

Insure the correct wire gauges for the input and output power leads are being used before wiring the drive. Use Table 1.3.1 for reference.

Table 1.3.1: Wire Gauge Reference Table

SV200 Drive Class	Drive Rated Amp.	Input AWG	Output AWG	Ground AWG	DB Resistor AWG	Control AWG
230V Class	11.0	12	12	12	12	16
	16.0			10		
	24.0	6	6		6	
	32.0			4		
	46.0	12	12		12	
	59.0			10		
	74.0	10	10		10	
87.0	10			10		10
460V Class		6.0	12		12	
	8.0					
	12.0					
	16.0					
	24.0	10	10	10	10	
	30.0					
	39.0					
45.0						

### 1.3.3 Fuse and Circuit Breaker Selection

Reference Table 1.3.2 to properly apply fuses and circuit breakers to the drive.

Table 1.3.2: Fuse and Circuit Breaker Selection

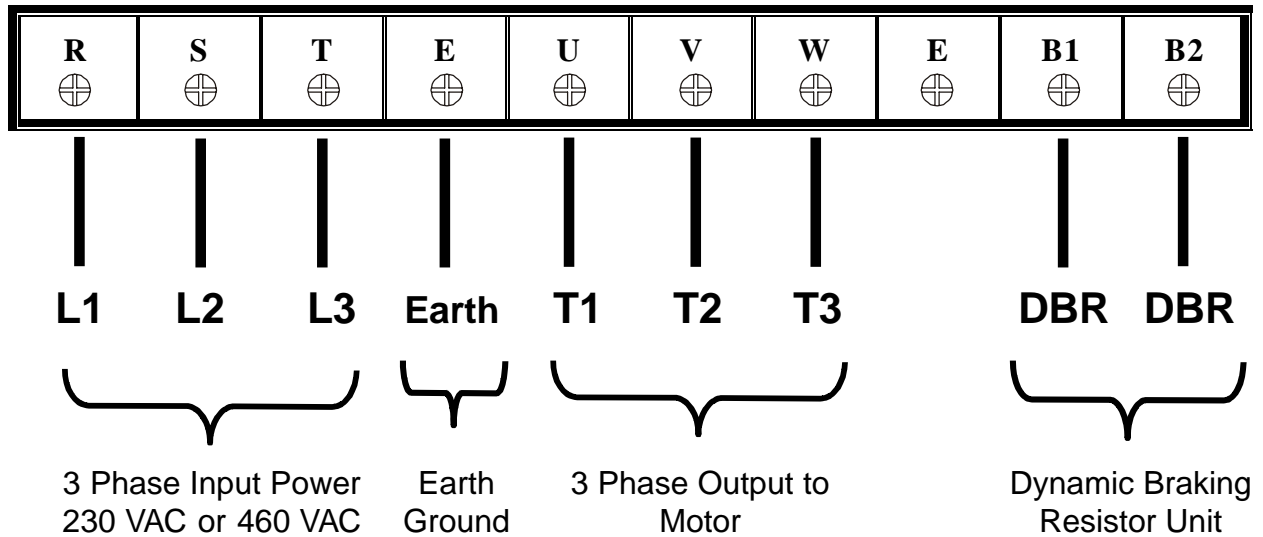
SV200 Drive Voltage	Ref. HP	SV200 Part Number	Fuse Rating Class (J)	Molded Case Circuit Breaker
230V	3	446485-10	20A	25A
	5	446485-11	25A	30A
	7.5	446485-12	35A	50A
	10	446485-13	40A	60A
	15	446485-14	50A	75A
	20	446485-15	80A	100A
	25	446485-16	80A	125A
	30	446485-17	100A	150A
460V	3	446485-20	10A	15A
	5	446485-21	15A	
	7.5	446485-22	20A	30A
	10	446485-23	25A	
	15	446485-24	35A	40A
	20	446485-25	40A	50A
	25	446485-26	50A	60A
	30	446485-27	65A	75A

### 1.3.4 Wire The Power Leads

Use Figure 1.3.2 as shown below to assist in wiring the power leads to the drive.

Fig. 1.3.2: Input / Output Power and Dynamic Braking Resistor Wiring Diagram.

#### Arrangement of Power Terminal Strip

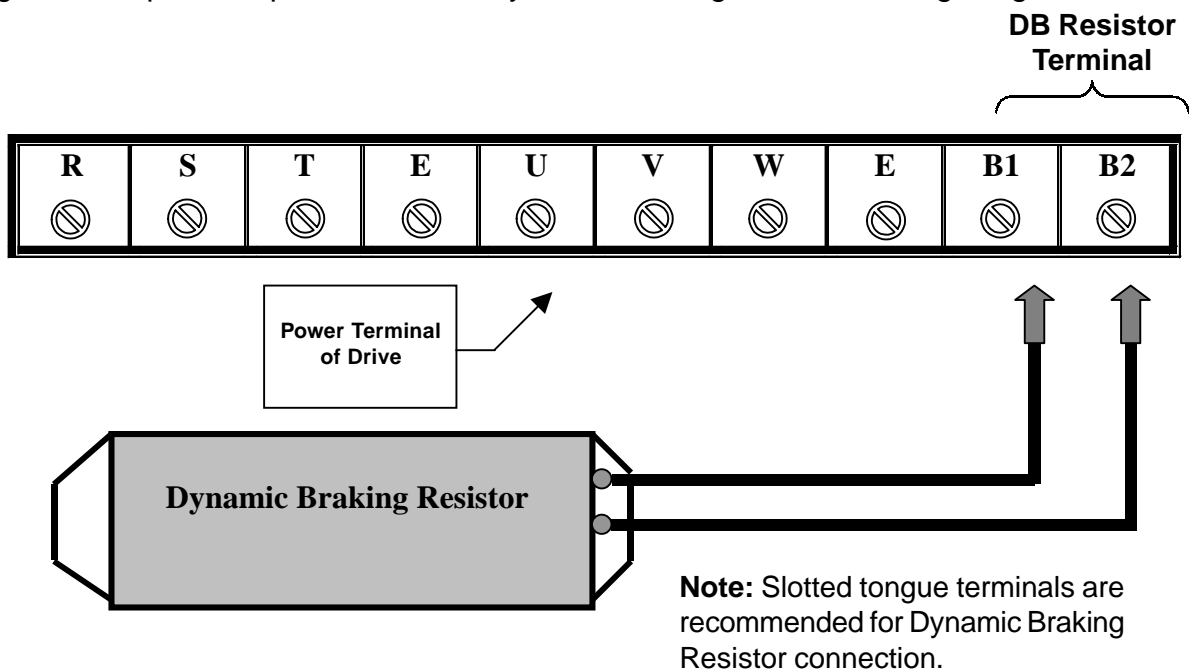


**Note:** Slotted tongue terminals are recommended for connections shown in Figure 1.3.2.

### 1.3.5 Wire The Dynamic Braking Resistor Leads

Use Figure 1.3.3 as shown below to assist in wiring the dynamic braking resistor leads to the drive.

Fig. 1.3.3: Input / Output Power and Dynamic Braking Resistor Wiring Diagram

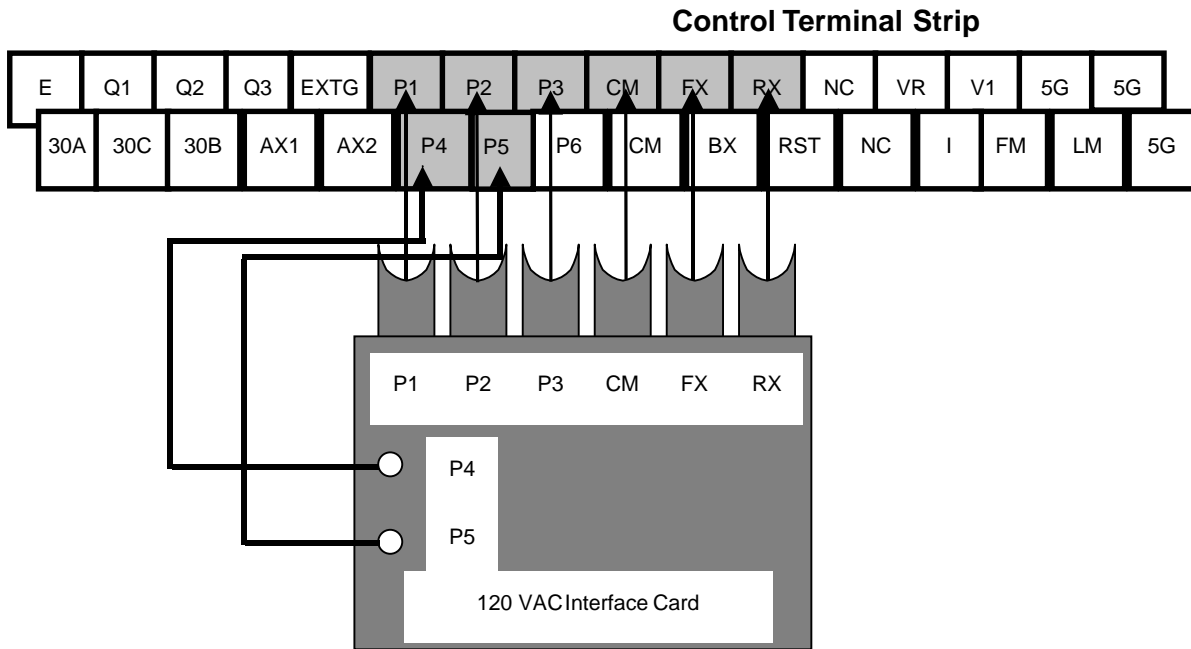


- The Dynamic Braking Resistors dissipate the motor rotational energy in the form of heat. They are required for all hoisting and traverse applications.
- If the dynamic braking resistor has a bad connection or is missing, the drive DC Bus voltage may increase, resulting in an over voltage fault.
- If the dynamic braking resistor generates a lot of heat during its operation. Place the resistor where it may dissipate this energy without damaging other components.

### 1.3.6 Interface Card Connection:

The SV200 SpaceVector™ Drive comes equipped with the 120VAC Interface Card installed. Figure 1.3.4 below shows the connection of the interface card to the control terminal strip.

Fig. 1.3.4: Interface Card Connection to the Control Terminal Strip

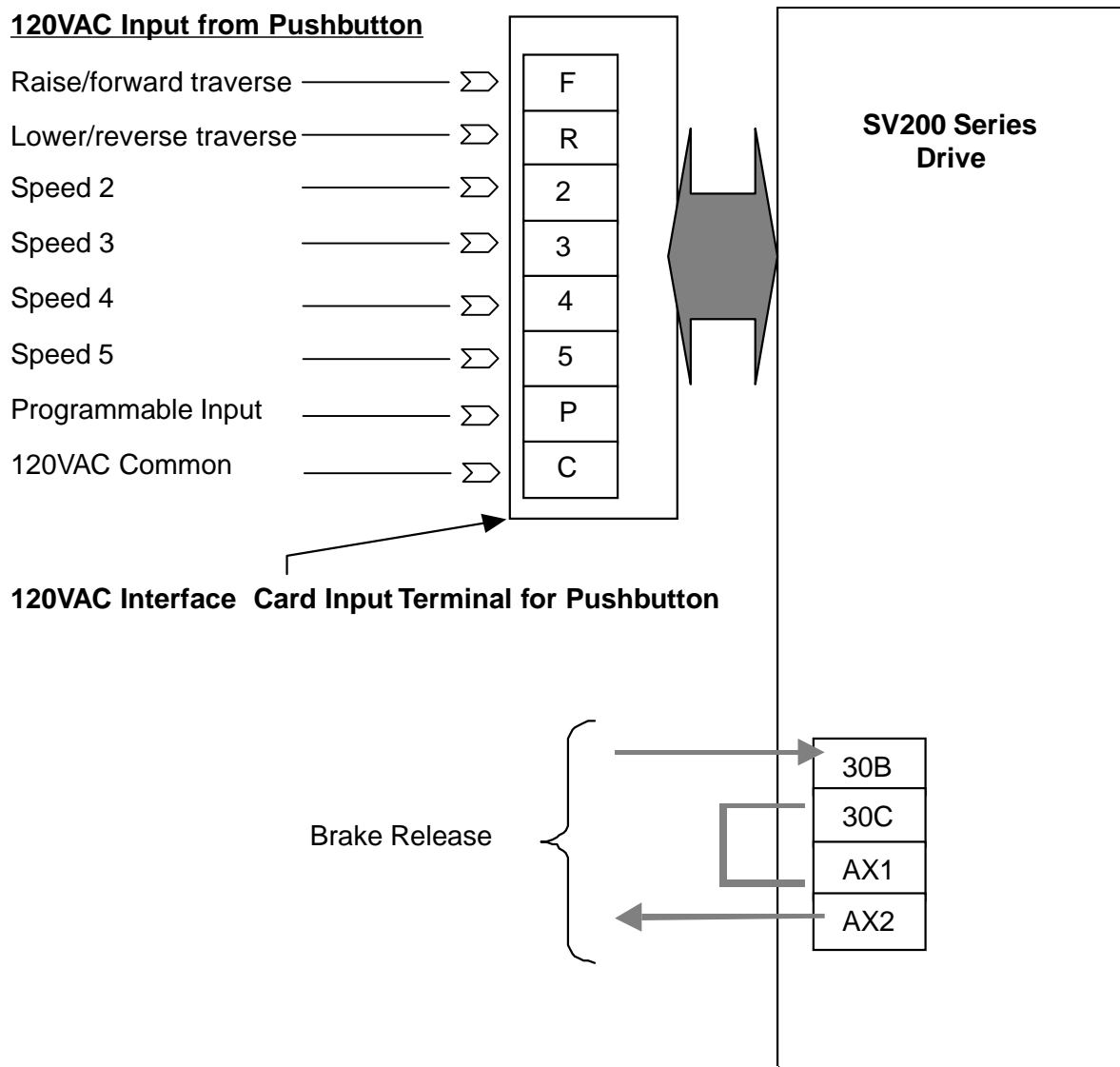


### 1.3.7 Connect the Pushbutton Pendant Control Wires

Wire the pushbutton pendant control to the pendant input terminals. See Figure 1.3.5 below for wiring diagram. Once the pendant is wired, check to determine that the motor turns in the correct direction with respect to the pendant button pressed. Consult Chapter 4, Troubleshooting, for help if there is a problem.

**Note:** The Interface card requires 120VAC input signal from your external push button.

Fig. 1.3.5: Push Button Wiring Diagram



### 1.3.8 Control Wire Description

Reference the control wiring terminal in Figure 1.3.6 below and the descriptions of each terminal listed in Tables 1.3.4 and 1.3.5.

Fig. 1.3.6: Control Wiring Terminal

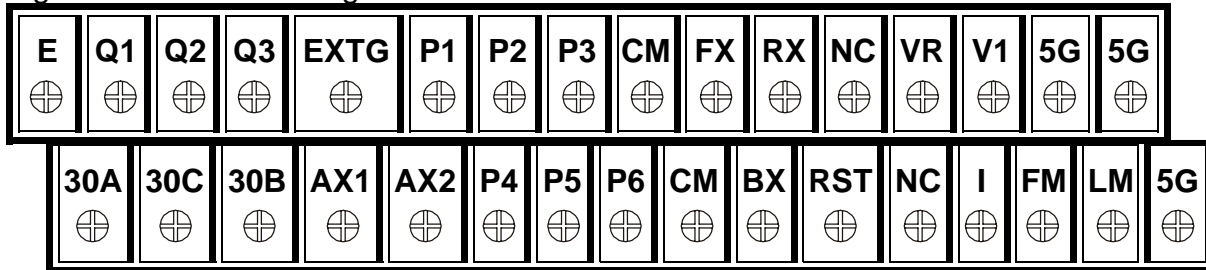


Table 1.3.4: Most common control terminals used

Symbol	Function
FX	Forward / Up direction command terminal Speed 1 [120VAC Interface Card Input Terminal]
RX	Reverse / Down direction command terminal Speed 1 [120VAC Interface Card Input Terminal]
BX	Emergency stop command terminal
RST	Fault reset command terminal
P1	MULTI-FUNCTION INPUT
P2	
P3	
P4	
P5	
P6	
CM	Common terminal for [FX], [RX], [BX], [P1], [P2], [P3], [P4], [P5], [RST] [120VAC Interface Card Input Terminal]
AX1	MULTI-FUNCTION RELAY OUTPUT
AX2	
30A	Relay output terminal (Normal open contact) [DC 30V, AC 250V, 1A]
30B	Relay output terminal (normally closed contact) [DC 30V, AC 250V, 1A]
30C	Relay output terminal (common terminal) [DC 30V, AC 250V, 1A]

Table 1.3.5: Control terminals used for special applications

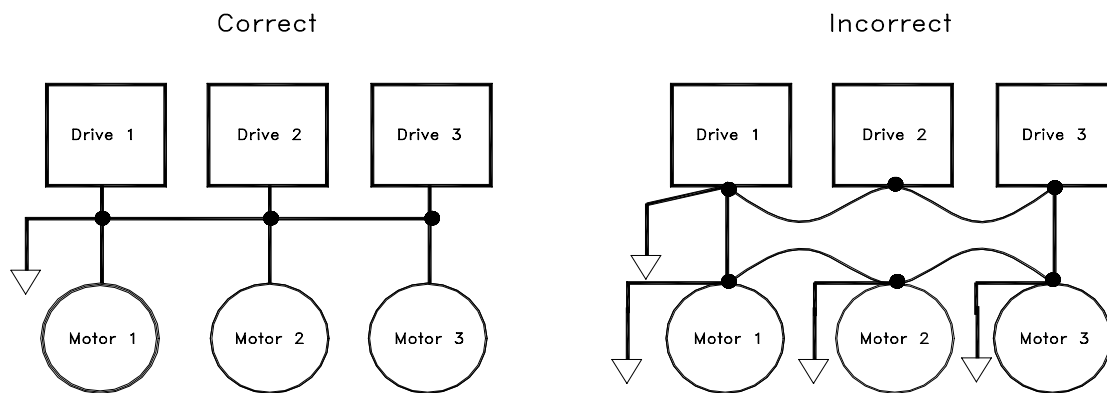
Symbol	Function
Q1	MULTI-FUNCTION OPEN COLLECTOR OUTPUT
Q2	
Q3	
V1	Analog speed reference input terminal (0~+10 VDC) (Potentiometer connection terminal)
VR	Voltage power supply for V1 terminal (+11 VDC)
I	Current speed reference input terminal (4~20 mA)
FM	Output Frequency Meter [+24 VDC Max. 50mA Max.]
LM	Load Meter [+24 VDC Max. 50mA Max.]
5G	Common terminal for [V1], [I], [FM]



### 1.3.9 Make Precautionary Checks Before Operation

1. Make sure the input voltage level to the drive is correct. Refer to the Drive Specification Tables 1.1.1 and 1.1.2.
2. Check the power and control connections. All wires should be connected tightly to the terminal.
3. Check the 120VAC source for the control pushbutton.
4. The length of the output wires between the SV200 and the motor must not exceed 100 feet.
5. Check the drive and motor ground and make sure there is no ground loop problem. Ensure that all motors and drives connected from a common panel are connected to a single ground point. See Fig. 1.3.7 for an example.

Fig. 1.3.7: Ground Connection Comparison



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# **Chapter 2: Start Up Programming**

## **Section 2.1: Keypad Layout**

## **Section 2.2: Keypad Operation**

### **2.2.1: Definitions**

### **2.2.2: Moving through the Program**

### **2.2.3: View a Specific Function using Jump Code Location**

### **2.2.4: View all Functions within a Group Level**

### **2.2.5: Change Control from Pendant to Keypad**

## **Section 2.3: Initial Setup Programming**

### **2.3.1: Programming the Drive for a Specific Application**

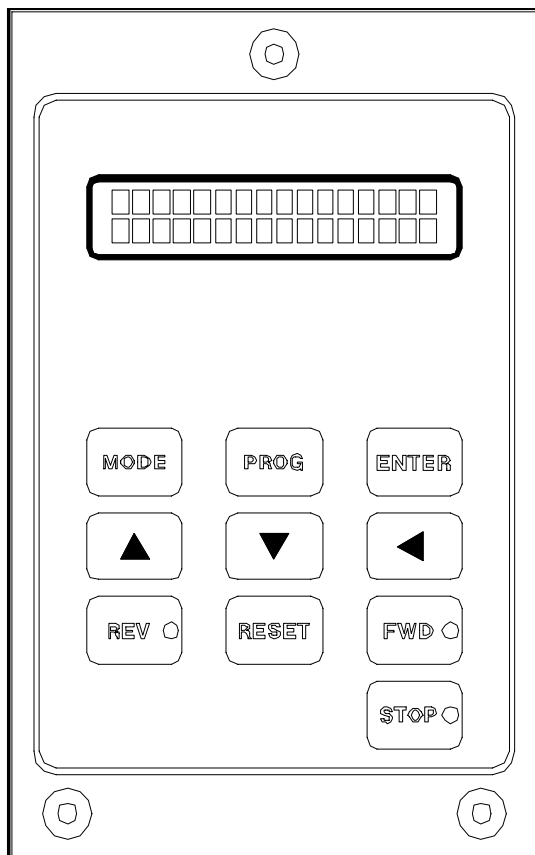
### **2.3.2: Programming the Speed Selection**

### **2.3.3: Drive Operation Checks**

## Section 2.1: Keypad Layout

The SV200 uses a 32 alphanumeric LCD display for easy reading. All drive functions can be accessed via keypad. The keypad has the capability of uploading or downloading data from the drive. Programming is easy when utilizing the parameter descriptions on the LCD display. Fig. 2.1.1 below illustrates the layout of the SV200 keypad. See Fig. 2.1.2 for a description of the alphanumeric display.

Fig. 2.1.1: SV200 keypad layout



**MODE:** Press to access different levels of programming (User, Service, Advance).

**PROG:** Press to begin to change drive parameter data.

**ENTER:** Saves the changed data of the parameter.

**ARROWS:** Used to scroll through parameter function codes in each level. Also used to increment and decrement the parameter data value.

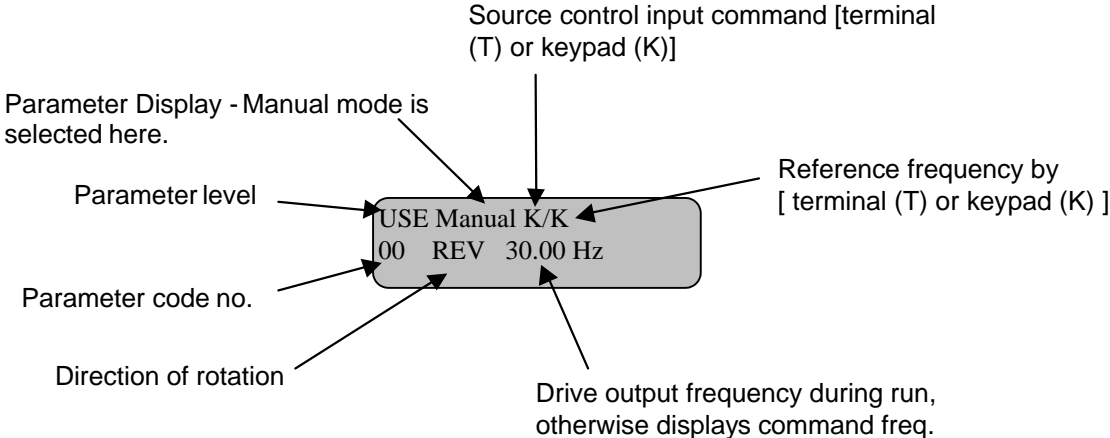
**REV:** No control of drive, LED display function only.

**FWD:** No control of drive, LED display function only.

**STOP:** No control of drive, LED display function only.

**RESET:** Reset drive faults.

Fig. 2.1.2: Alphanumeric Display



## Section 2.2: Keypad Operation

Keypad operation and moving through the parameters of each group access level is a straight forward process. First read the definitions below.

### 2.2.1 Definitions

**Levels** - The SV200 program consists of three group levels. The levels are the User, Service, and Advanced. Each level consists of different function commands which control how the drive operates, senses, and performs.

**User Level** (Use on SV200 Display) - This level allows programming speed, passwords, and the motion application desired. You can also monitor motor current draw and system faults in this level. **You are automatically in the User level upon power up of your drive.**

**Service Level** (Ser on SV200 Display) - The functions within this group primarily set how the drive will perform, sense problems, and set parameters catered to your motor for peak operation.

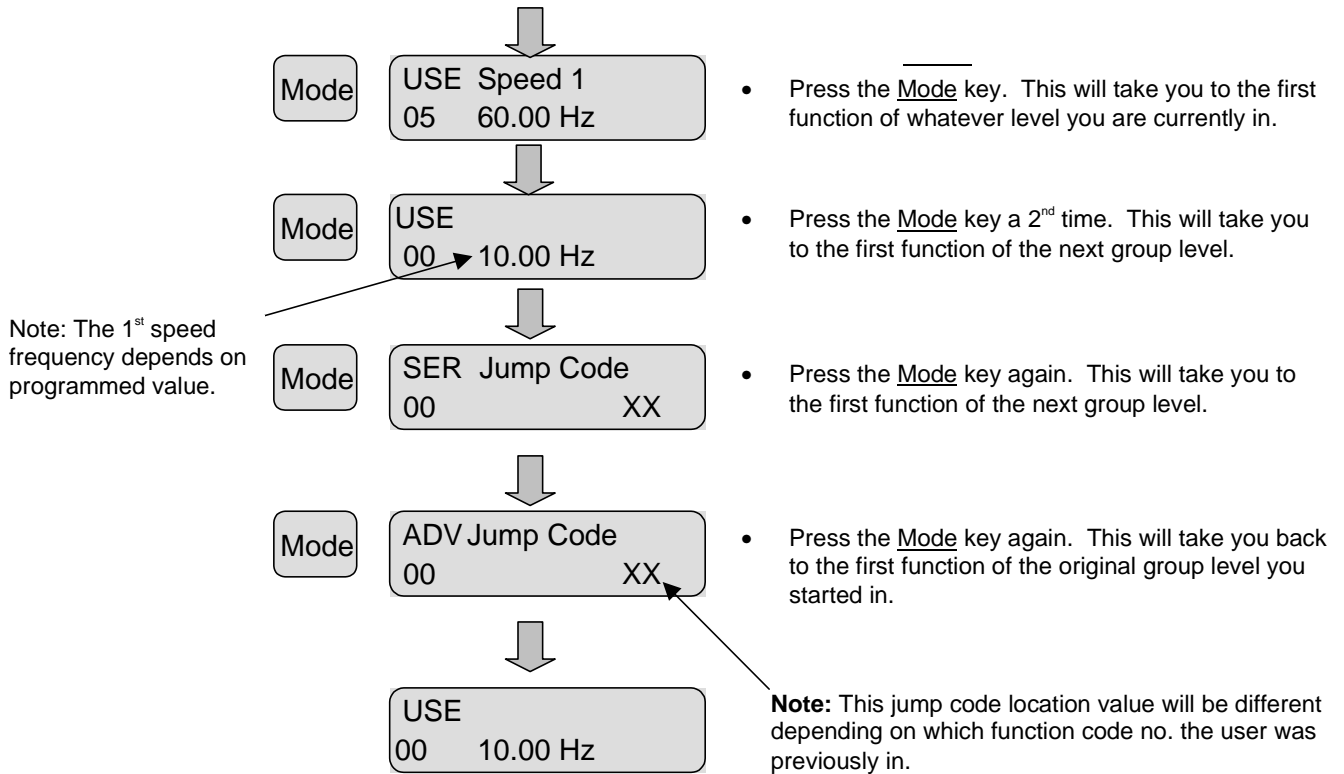
**Advanced Level** (Adv on SV200 Display) - Functions within this level are reserved for special performance characteristics and consists of advanced performance parameters.

### 2.2.2 Moving Through the Program

When the drive is first powered up, the first Function Code of the **User Level** is displayed. Please follow the keypad button prompts illustrated in Figures 2.2.1, 2.2.2 and 2.2.3 and use Table 2.2.1: Function Code List For All Levels to help follow program flow.

Fig. 2.2.1: Programming flowchart showing how to move through each group level.

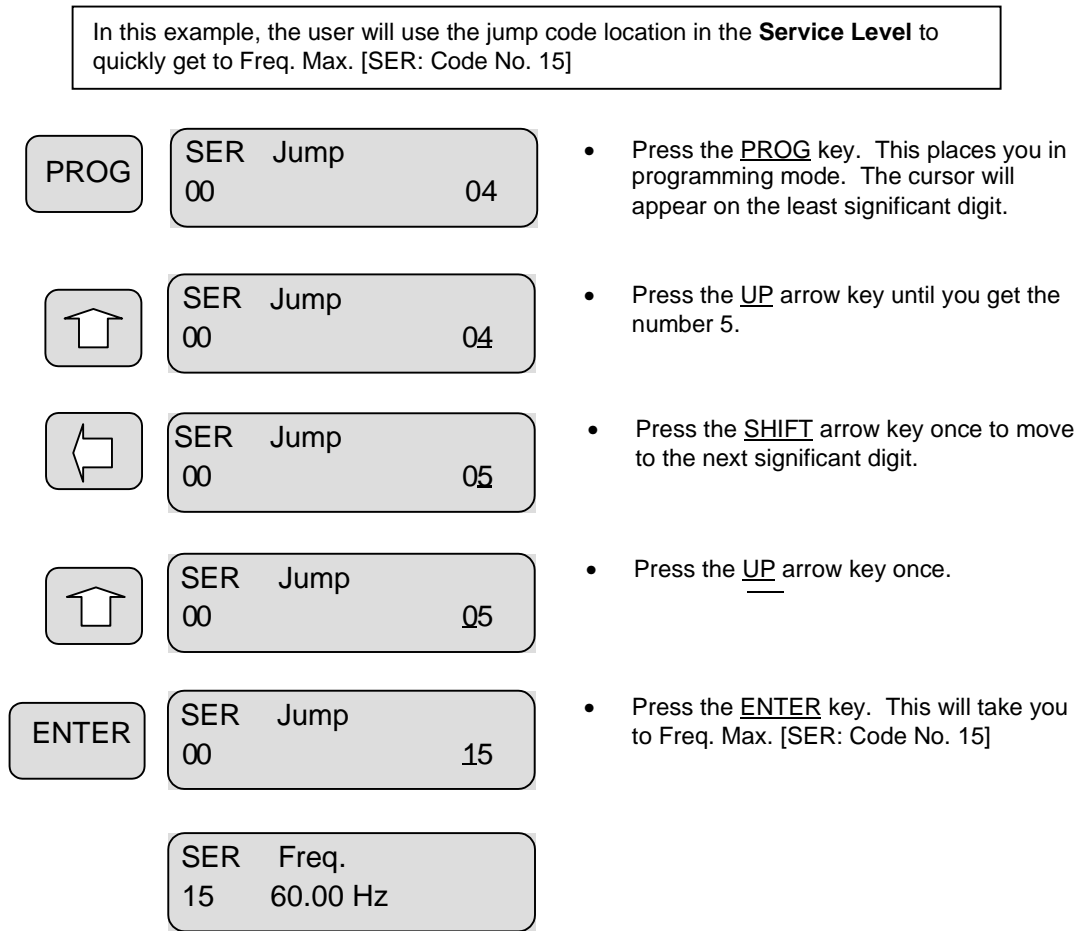
The quickest way to move from group level to group level is by following this procedure. In this example, the user is currently in the **User Level** at Speed 1 [USE: Code No. 05].



• To see how to view each Function Code number in a group level, see Figures 2.2.2 and 2.2.3.

### 2.2.3 View a Specific Function Using Jump Code Location

Fig. 2.2.2: Programming flow chart showing how to view a specific function [Code No.] of a group level.

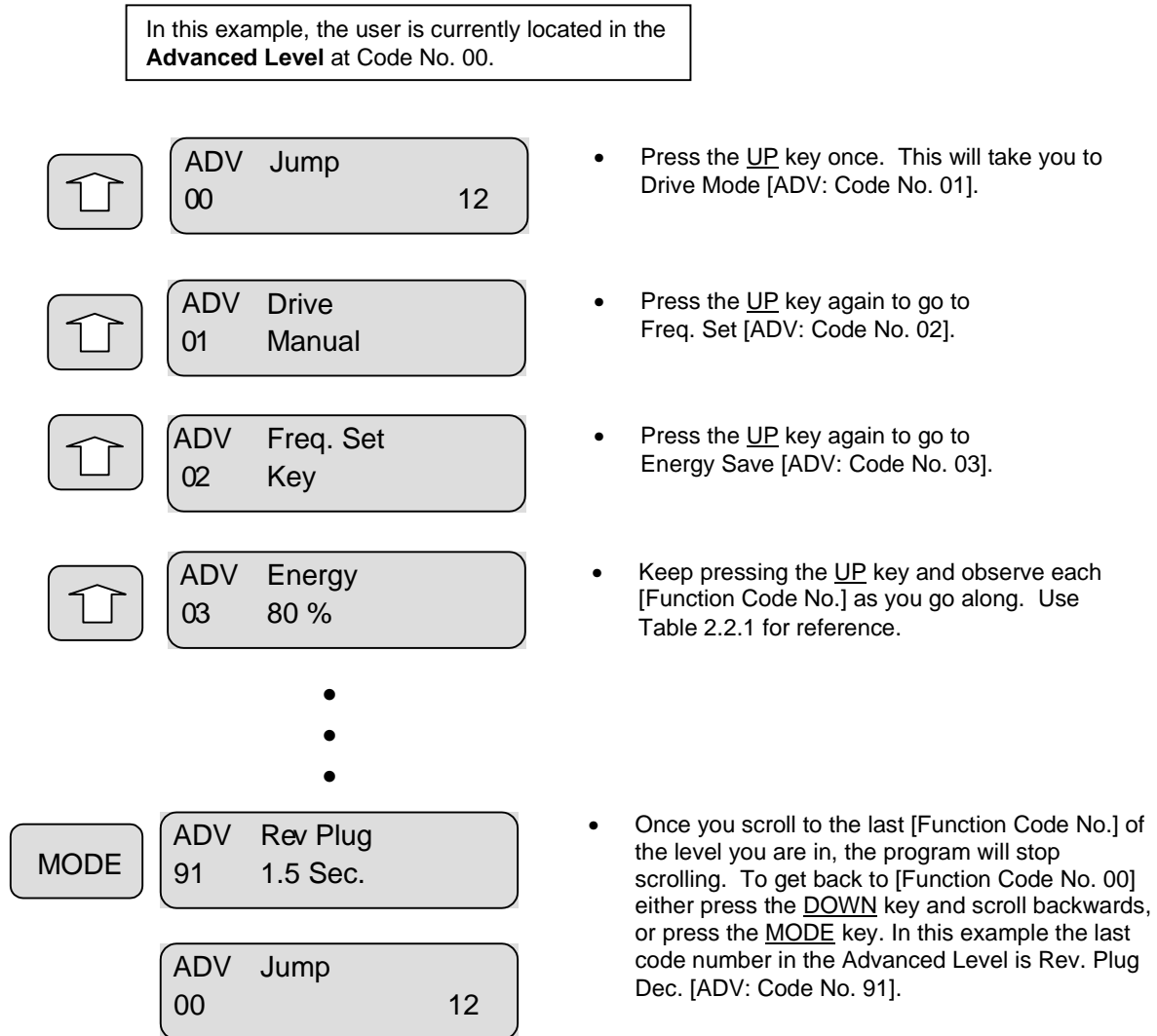


- This procedure is the same for the **Advanced Level**.



## 2.2.4 Viewing all Functions within a Group Level

Fig. 2.2.3: Programming flow chart showing how to view all function [Code No.'s.] of a group level.



- This procedure is the same for the **Service Level**.

## 2.2.5 Change Control from Pendant to Keypad

The SV200 comes preset with pendant control. If the user wishes to change to keypad control, refer to Figure 2.2.4 below. Use Table 2.2.1 Function Table for All Levels for reference.

Fig. 2.2.4: Flowchart showing how to change from pendant control to keypad control

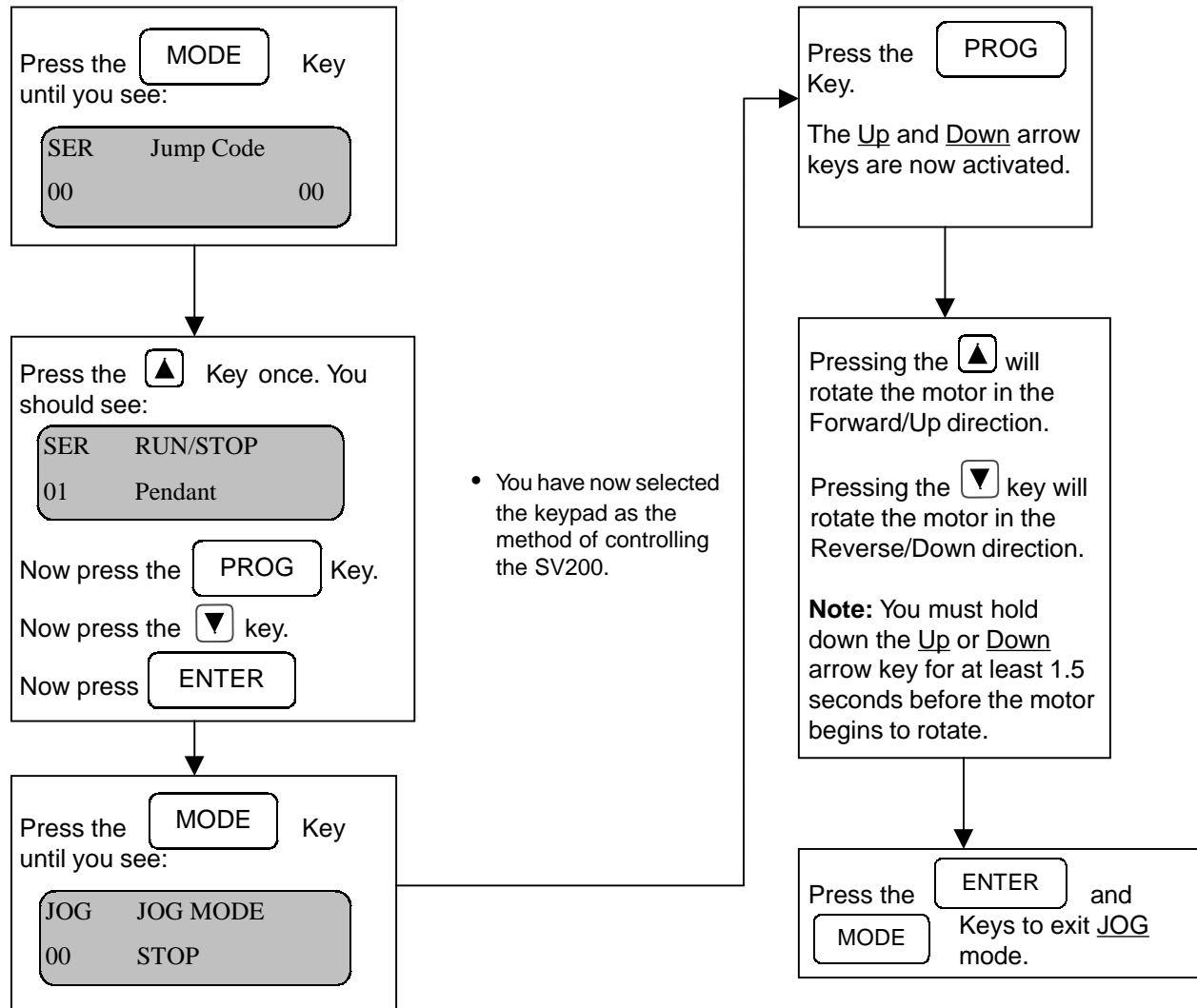


Table 2.2.1: Function Code List For All Levels

Level	Code No.	Display	Description	Range	Default
User	00	10.0	Displays speed 1 frequency during Stop and actual frequency output during Run	0 - SER 15 Hz	10.0 Hz
	01	Motion Def	Define drive application	<ul style="list-style-type: none"> <li>• Traverse</li> <li>• Hoist w LB</li> <li>• Hoist wo LB</li> </ul>	Hoist w LB
	02	Speed Sel	Define speed application	<ul style="list-style-type: none"> <li>• 2 Step</li> <li>• 2Step Inf Var</li> <li>• 3 Step</li> <li>• 3Step Inf Var</li> <li>• 5 Step</li> </ul>	2 Step
	03	Current	Display only: Output current [rms]		
	04	Speed	Display only: Synchronous speed [rpm]		
	05	Speed 2	Multi-Step Speed. Initial Data depends on the Macro programming in USE 02	0 - SER 15 Hz	60.00 Hz
	06	Speed 3			0.00 Hz
	07	Speed 4			
	08	Speed 5			
	09	LSW Speed	Low Speed limit switch speed	0 - SER 15 Hz	5.00 Hz
	10	Acc. time	Acceleration Time	0 - 6000 sec.	1.0sec
	11	Dec. time	Deceleration Time	0 - 6000 sec.	
	12	Ter. input	Status of input terminal display		00000000 See Section 4.4
	13	Ter. output	Status of output terminal display		0001 See Section 4.4
	14	Fault	Current status (normal or fault)		
	15	Last fault 1	Previous faults [current fault-1]		
	16	Last fault 2	Previous faults [current fault-2]		
	17	Access Lev	Current permitted access level		Advanced
	18	Password	Enter password	****	
	19	Ser Lev PW	Change Service Level password	0 - 9999	
	20	Adv Lev PW	Change Advanced Level password		
21	S/W version	Hoist/Crane 02 M = 3 hp - 10 hp L = 15 hp - 30 hp			
Service	00	Jump Code	Get to any code no. in Service Level		
	01	Run/Stop set	Run command source	<ul style="list-style-type: none"> <li>• Key</li> <li>• Pendant</li> <li>• RS485/PLC</li> </ul>	Pendant
	02	Acc. pattern	Acceleration Pattern	<ul style="list-style-type: none"> <li>• Linear</li> <li>• S-Curve</li> <li>• U-Curve</li> </ul>	S-Curve
	03	Dec. pattern	Deceleration Pattern		Linear

Table 2.2.1: Function Code List For All Levels (continued)

Level	Code No.	Display	Description	Range	Default	
Service	04	P1 Input	Define multi-function input 2	<ul style="list-style-type: none"> <li>• Not Used</li> <li>• Spd Sel 2</li> <li>• Spd Sel 3</li> <li>• Spd Sel 4</li> <li>• Spd Sel 5</li> <li>• LSW Imm. Stop</li> <li>• LSW Rmp. Stop</li> <li>• LSW Low Spd</li> <li>• EXT_TRIP</li> </ul>	Spd Sel 2	
	05	P2 Input	Define multi-function input 3		Not Used	
	06	P3 Input	Define multi-function input 4			
	07	P4 Input	Define multi-function input 5			
	08	P5 Input	Define multi-function input P			
	09	P6 Input	Define multi-function input P6			
	10	AUX Output	Define multi-function output	<ul style="list-style-type: none"> <li>• FST_LO</li> <li>• FST_HI</li> <li>• FDT_HI</li> <li>• FDT_PULSE</li> <li>• FDT_BAND</li> <li>• OL</li> <li>• STALL</li> <li>• LV</li> <li>• RUN</li> </ul>	FST_HI	
	11	Q1 Output	Define multi-function output		FST_LO	
	12	Q2 Output	Define multi-function output		FDT_HI	
	13	Q3 Output	Define multi-function output		OL	
		14	Inv Capacity	Drive Model Selection	3hp @ 230V 5hp @ 230V 7.5hp @ 230V 10hp @ 230V 15hp @ 230V 20hp @ 230V 25hp @ 230V 30hp @ 230V 3hp @ 460V 5hp @ 460V 7.5hp @ 460V 10hp @ 460V 15hp @ 460V 20hp @ 460V 25hp @ 460V 30hp @ 460V	
		15	Freq. max	Maximum output frequency	40 - 120 Hz	60.00 Hz
		16	Freq. base	Base Frequency	40 - SER 15 Hz	
		17	Freq. start	Drive Cutoff Frequency	0.5 - 5 Hz	0.50 Hz
		18	Dwell-freq.	Start Dwell frequency Caution: If motor slip is greater than 3 Hz, then see <b>Brake Release Timing</b> section on page 89	0 - SER 15 Hz	3.00 Hz
		19	Dwell time	Start Dwell Time Initial Values: Hoist = 0.5 sec. Traverse = 0.1 sec.	0 - 10 sec.	0.5sec
		20	V/F pattern	V/F pattern selection	<ul style="list-style-type: none"> <li>• Linear</li> <li>• 2.0 - <b>Do not use</b></li> <li>• User</li> <li>• Auto Boost</li> </ul>	Linear
		21	Fwd boost	Forward direction torque boost	0 - 20 %	5 %
		22	Rev boost	Reverse direction torque boost		2 %
		23	Volt control	Maximum drive output voltage	0 - 110 %	100 %
		24	Pole number	Number of motor poles	2 (3600 rpm) 4 (1800 rpm) 6 (1200 rpm) 8 (900 rpm) 10 (720 rpm) 12 (600 rpm)	4

Table 2.2.1: Function Code List For All Levels (continued)

Level	Code No.	Display	Description	Range	Default
Service	25	FST-freq.	Brake Release Frequency	0.50 - SER 15 Hz	3.01 Hz
	26	Para. read	Read all parameters from drive to keypad	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>	No
	27	Para. write	Write all parameters from keypad to drive	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>	No
	28	Para. init	Initialize all parameters with factory default settings	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>	No
	29	Para. lock	Lock on programming all parameters	0 - 255	0
	30	Stop mode	Initial data depends on macro setup	<ul style="list-style-type: none"> <li>• Decel</li> <li>• DCBR</li> <li>• Immediate stop</li> <li>• Acc/Dec Abs</li> </ul>	Immediate stop
Advanced	00	Jump Code	Get to any code no. in Advanced Level		
	01	Drive mode	Only manual mode is available for Hoist/Crane	<ul style="list-style-type: none"> <li>• Manual</li> <li>• Auto - <b>Do Not Use</b></li> </ul>	Manual
	02	Freq. set	Command frequency source	<ul style="list-style-type: none"> <li>• Key</li> <li>• Terminal</li> <li>• RS485/PLC</li> </ul>	Key
	03	Energy save	Value for energy saving mode	50 - 100 %	80 %
	04	User-1f	User V/F pattern data points	0 - SER 15 Hz	60.00 Hz
	05	User-1v		0 - 100 %	100 %
	06	User-2f		0 - SER 15 Hz	60.00 Hz
	07	User-2v		0 - 100 %	100 %
	08	User-3f		0 - SER 15 Hz	60.00 Hz
	09	User-3v		0 - 100 %	100 %
	10	User-4f		0 - SER15 Hz	60.00 Hz
	11	User-4v		0 - 100 %	100 %
	12	V-I mode	Analog input mode	<ul style="list-style-type: none"> <li>• Voltage</li> <li>• Current</li> <li>• Volt + Curr</li> </ul>	Voltage
	13	Filter gain	Analog input filter gain	0 - 100 %	50 %
	14	Analog gain	Analog input scaling	50 - 250 %	100 %
	15	Analog bias	Analog input bias	0 - 100 %	0.00 %
	16	Analog dir	Analog input polarity	<ul style="list-style-type: none"> <li>• Direct</li> <li>• Invert</li> </ul>	Direct
	17	Freq. limit	Setting of frequency limit function	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>	No
	18	F-limit high	Maximum operating frequency	ADV 19 - SER 15 Hz	60.00 Hz
	19	F-limit low	Minimum operating frequency	0.0 - ADV 18 Hz	0.00 Hz
	20	Freq. jump	Selection of frequency jump function	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>	No
	21	Freq-jump 1f	Jump (bypass) frequency 1	0 - SER 15 Hz	10.00 Hz
	22	Freq-jump 2f	Jump (bypass) frequency 2		20.00 Hz
	23	Freq-jump 3f	Jump (bypass) frequency 3		30.00 Hz
24	Freq. band	Jump (bypass) frequency bandwidth	0.00 - 30.00 Hz		5.00 Hz

Table 2.2.1: Function Code List For All Levels (continued)

Level	Code No.	Display	Description	Range	Default
Advanced	25	DC-br freq.	DC brake injection frequency	0.00 - 60.00 Hz.	3.00 Hz
	26	DC-br block	Blocking time before DC brake injection	0.0 - 5.0 sec.	1.0sec
	27	DC-br time	DC brake injection time	0.0 - 25.0 sec.	0.5sec
	28	DC-br value	DC brake injection voltage	0 - 20 %	2 %
	29	Slip compen.	Selection of slip compensation function	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>	No
	30	Rated slip	Rated motor slip	0.00 - 5.00 Hz	0.00 Hz
	31	M-rated cur.	Rated motor current	0.1 - 110 A	0.1 A
	32	No load cur.	No load motor current	0.1 - 50.0 A	
	33	Chk Ph Open	Selection of phase loss check function	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>	Yes
	34	Ph Chk Time	Reference time of checking phase loss	50 - 5000 msec.	50 msec.
	35	Retry number	Number of retries when drive faults	0 - 10	0
	36	Retry time	Waiting time before retrying	0.0 - 10.0 sec.	1.0sec
	37	Retry mode	Mode of fault retry	<ul style="list-style-type: none"> <li>• Retry 0</li> <li>• All TRIPs</li> <li>• LV + Retry 0</li> <li>• LV + All Trips</li> </ul>	Retry 0
	38	Stall mode	Stall prevention mode selection Initial Values: Hoist = None Traverse = Acc  <b>DO NOT USE ON HOIST MOTION.            FOR TRAVERSE MOTION WITH DB            RESISTOR DO NOT USE ANY OF            THE 4 "Dec" OPTIONS.</b>	<ul style="list-style-type: none"> <li>•None</li> <li>•Acc</li> <li>•Steady</li> <li>•Acc+Steady</li> <li>•Dec</li> <li>•Acc+Dec</li> <li>•Dec+Steady</li> <li>•Acc+Dec+Std</li> </ul>	None
	39	Stall level	Stall prevention level	30 - 150 %	150 %
	40	OL level	Overload warning level		
	41	OL time	Overload warning delay time	1.0 - 30.0 sec.	10.0sec
	42	OC lim level	Overcurrent suppression level	30 - 200 %	200 %
	43	OC lim. time	Overcurrent suppression time Initial Values: Hoist = 0.1 sec. Traverse = 60.0 sec.	0 - 3600 sec.	0.1sec
	44	ETH select	Mode of electronic thermal protection	<ul style="list-style-type: none"> <li>• None</li> <li>• Const Torq</li> <li>• Vari Torq</li> </ul>	None
	45	ETH level	ETH level	30 - 150 %	150 %
	46	Motor type	Type of motor	<ul style="list-style-type: none"> <li>• General</li> <li>• Special</li> </ul>	General
	47	IPF select	Instantaneous power failure function	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>	No
	48	SS acc. time	Acceleration time for speed search	0.1 - 25.0 sec.	2.0sec
	49	SS dec. time	Deceleration time for speed search		3.0sec
	50	SS blk. time	Gate blocking time for speed search	0.0 - 10.0 sec.	0.3sec
	51	RST-restart	Selection of reset restart function	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>	No
	52	Power on st	Selection of power-on restart function	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>	No
	53	Carrier Freq	Carrier frequency of PWM modulator	3 - 15 kHz	10 kHz

Table 2.2.1: Function Code List For All Levels (continued)

Level	Code No.	Display	Description	Range	Default	
Advanced	54	Drive Freq 2	Two motor application data (Not Available)	0 - SER 15 Hz.	0.00 Hz	
	55	Acc. time 2		0 - 6000.0 sec.	5.0sec	
	56	Dec. time 2			10.0sec	
	57	Freq. base2		40 - SER 15 Hz.	60.00 Hz	
	58	V/F pattern2		Two motor application data (Not Available)	<ul style="list-style-type: none"> <li>• Linear</li> <li>• 2.0</li> <li>• User</li> <li>• Auto Boost</li> </ul>	Linear
	59	Fwd boost 2			0 - 20%	2%
	60	Rev boost 2			30 - 150%	150%
	61	Stall level2				
	62	ETH level 2				
	63	PI control	Selection on internal PI function	<ul style="list-style-type: none"> <li>• None</li> <li>• Steady-N</li> <li>• Steady-R</li> </ul>	None	
	64	P-gain	P gain of internal PI controller	0 - 30000	10	
	65	I-gain	I gain of internal PI controller		50	
	66	PI-FB Offset	Offset (bias) of PI feedback signal	0 - 50	0	
	67	PI-FB scale	Scaling factor of PI feedback signal	1 - 250	100	
	68	Run Prev.	Prevention of one direction of rotation	<ul style="list-style-type: none"> <li>• None</li> <li>• Reverse Prev</li> <li>• Forward Prev</li> </ul>	None	
	69	Jog freq.	Jogging frequency	0 - SER 15 Hz	30.00 Hz	
	70	Analog meter	Mode of analog meter	<ul style="list-style-type: none"> <li>• Voltage</li> <li>• Current</li> </ul>	Voltage	
	71	Analog adj.	Adjustment of load meter	0 - 120 %	100 %	
	72	FM adj.	Adjustment of frequency meter			
	73	FDT-freq.	Frequency detection level	0.50 - SER 15 Hz	60.00 Hz	
	74	FDT-band	Frequency detection band	0.00 - 30.00 Hz	1.00 Hz	
	75	Mul factor	Scaling factor for User-4 display	0 - 999	100	
	76	Div factor		1 - 999		
	77	LED check	Check 7 segment keypad	N/A	N/A	
	78	Option	Option (Interface) card	<ul style="list-style-type: none"> <li>• None</li> <li>• RS485</li> <li>• PG</li> <li>• DI/DA</li> <li>• PLC</li> <li>• CAN</li> <li>• PMU</li> </ul>	None	
	79	Inv. number	RS 485 Inverter address	1 - 32	1	
	80	Baud-rate	RS 485 baud rate	<ul style="list-style-type: none"> <li>• 1200 BPS</li> <li>• 2400 BPS</li> <li>• 4800 BPS</li> <li>• 9600 BPS</li> <li>• 19200 BPS</li> </ul>	9600 BPS	

Table 2.2.1: Function Code List For All Levels (continued)

Level	Code No.	Display	Description	Range	Default
Advanced	81	PG Slip Freq	Rated slip of motor	0.00 - 5.00 Hz	2.00 Hz
	82	PG. P-Gain	P gain of PG option	1 - 255	100
	83	PG. I-Gain	I gain of PG option		10
	84	Enc signal	Encoder type	<ul style="list-style-type: none"> <li>• A + B</li> <li>• A only</li> </ul>	A + B
	85	Enc pulse	Pulses per revolution	<ul style="list-style-type: none"> <li>• 360 Pulse</li> <li>• 500 Pulse</li> <li>• 512 Pulse</li> <li>• 1000 Pulse</li> <li>• 1024 Pulse</li> <li>• 2000 Pulse</li> <li>• 2048 Pulse</li> <li>• 4000 Pulse</li> <li>• 4096 Pulse</li> </ul>	1024 Pulse
	86	DI Mode	Mode of digital input option card	<ul style="list-style-type: none"> <li>• None</li> <li>• Freq.</li> </ul>	Freq.
	87	DA Mode	Mode of digital output option card	<ul style="list-style-type: none"> <li>• Freq.</li> <li>• Voltage</li> <li>• Current</li> </ul>	Freq.
	88	Remote T.Out	RS485/PLC/CAN option	0.0 - 600.0 sec.	0.0sec
	89	Rev Plug	Reverse Plug enable - <b>DO NOT USE ON HOIST MOTION</b>	Yes No	No
	90	Rev Plug Acc	Acceleration time for reverse plugging	0 - 6000 sec.	1.5sec
91	Rev Plug Dec	Deceleration time for reverse plugging	0 - 6000 sec.	1.5sec	

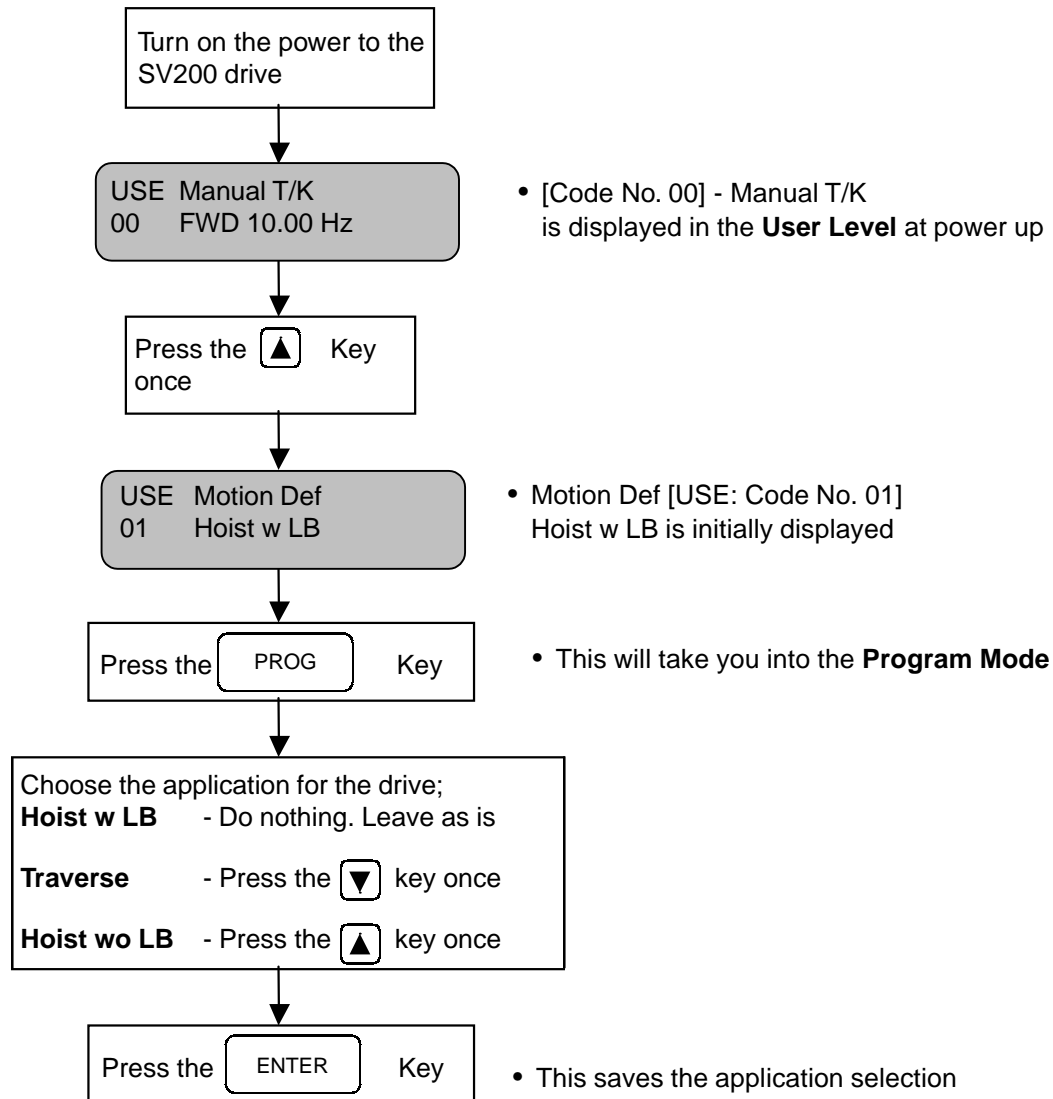


## Section 2.3: Initial Set Up Programming

### 2.3.1 Programming the Drive for a Specific Application

Initial setup programming involves a few easy steps. Follow the Macro Quick Set Programming instructions shown in Figure 2.3.1 below and your drive will be ready for operation.

Fig. 2.3.1: Programming application flowchart



\* The drive has now been programmed for its appropriate application. According to your new selection, other related drive parameters have conveniently changed automatically for quick programming.

Reference Table 2.3.1 below for function parameters affected by the Macro Quick Set Programming procedure in Figure 16. Note: If so desired, these values can be changed individually by entering the respective access level and changing the function data.

Table 2.3.1: Macro Quick Set Programming values for motion application selection

### Macro Set-Up for Traverse

Access Level	Code No.	Description	Initial Data	
User	00	Speed 1	10.00 Hz.	
	02	Speed Selection	2 Step	
	05	Speed 2	60.00 Hz.	
	06	Speed 3	0.00 Hz.	
	07	Speed 4	0.00 Hz.	
	08	Speed 5	0.00 Hz.	
	10	ACC Time	3.0 sec.	
	11	DEC Time	3.0 sec.	
	Service	02	ACC Pattern	S Curve
		03	DEC Pattern	S Curve
04		2 Input	Spd Sel 2	
05		3 Input	Not Used	
06		4 Input	Not Used	
07		5 Input	Not Used	
08		P Input	Not Used	
30		Stop Mode	Decel	
Advance	38	Stall Prevention	Acc	
	43	Overcurrent Limit Operation Time	60.0 sec	
	89	Reverse Plugging Enable	Yes	
	90	Reverse Plugging Acceleration Time	1.5 sec	
	91	Reverse Plugging Deceleration Time	1.5 sec	

### Macro Set-Up for Hoist with Load Brake

Access Level	Code No.	Description	Initial Data	
User	00	Speed 1	10.00 Hz.	
	02	Speed Selection	2 Step	
	05	Speed 2	60.00 Hz	
	06	Speed 3	0.00 Hz	
	07	Speed 4	0.00 Hz	
	08	Speed 5	0.00 Hz	
	10	Acceleration Time	1.0 sec	
	11	Deceleration Time	1.0 sec	
	Service	02	Acceleration Pattern	S Curve
		03	Deceleration Pattern	Linear
04		P1 Input	Spd Sel 2	
05		P2 Input	Not Used	
06		P3 Input	Not Used	
07		P4 Input	Not Used	
08		P5 Input	Not Used	
21		Forward Torque Boost	5 %	
22		Reverse Torque Boost	2 %	
30		Stop Mode	Immediate Stop	
Advance	38	Stall Prevention	None	
	43	Overcurrent Operation Time	0.1sec	
	89	Reverse Plugging Enable	No	

Table 2.3.1: Macro Quick Set Programming values for motion application selection (continued)

**Macro Set-Up for Hoist without Load Brake**

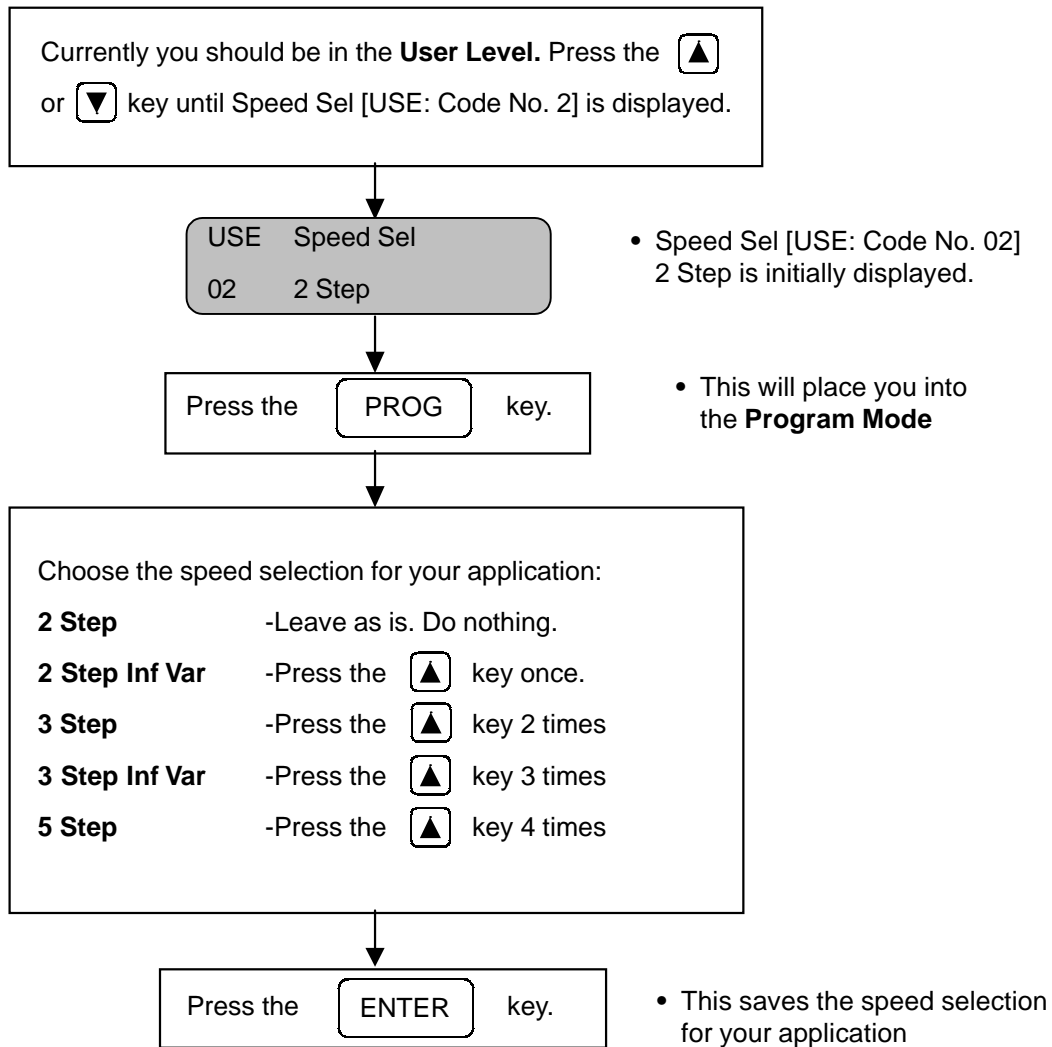
User	00 02 05 06 07 08 10 11	Speed 1 Speed Selection Speed 2 Speed 3 Speed 4 Speed 5 Acceleration Time Deceleration Time	10.00 Hz 2 Step 60.00 Hz 0.00 Hz 0.00 Hz 0.00 Hz 1.0sec 1.0sec
Service	02 03 04 05 06 07 08 21 22 30	Acceleration Pattern Deceleration Pattern P1 Input P2 Input P3 Input P4 Input P5 Input Forward Torque Boost Reverse Torque Boost Stop Mode	Linear Linear Spd Sel 2 Not Used Not Used Not Used Not Used 5 % 2 % Immediate Stop
Advance	38 43 89	Stall Prevention Overcurrent Operation Time Reverse Plugging Enable	None 0.1sec No

**NOTE:** Typically, these settings will be appropriate for most applications however, they may be customized by the using the functions of the user, Service and Advanced Levels.

## 2.3.2 Programming the Speed Selection

The last step for initial setup programming is selecting the speed for the respective application. Diagrams showing how the drive operates in the different speed configurations are in the Appendix. Follow the flowchart shown in Figure 2.3.2 below.

Fig. 2.3.2: Speed selection flowchart.



\* You have now programmed the drive for its push button speed command. According to your new selection, other related drive parameters have also changed automatically for quick programming. See Table 2.3.2 for changes.

Table 2.3.2: Parameters Affected With Speed Selection Programming

• 2 Speed

Access Level	Code No.	Description	Initial Data
<b>User</b>	0	Speed 1	10 Hz
	5	Speed 2	60 Hz
	6	Speed 3	0 Hz
	7	Speed 4	0 Hz
	8	Speed 5	0 Hz
<b>Service</b>	4	P1 Input	Spd Sel 2
	5	P2 Input	Not Used
	6	P3 Input	Not Used
	7	P4 Input	Not Used
	8	P5 Input	Not Used

• 2 Step Infinitely Variable

Access Level	Code No.	Description	Initial Data
<b>User</b>	0	Speed 1	10 Hz
	5	Speed 2	60 Hz
	6	Speed 3	0 Hz
	7	Speed 4	0 Hz
	8	Speed 5	0 Hz
<b>Service</b>	4	P1 Input	Spd Sel 2
	5	P2 Input	Not Used
	6	P3 Input	Not Used
	7	P4 Input	Not Used
	8	P5 Input	Not Used

• 3 Step

Access Level	Code No.	Description	Initial Data
<b>User</b>	0	Speed 1	10 Hz
	5	Speed 2	30 Hz
	6	Speed 3	60 Hz
	7	Speed 4	0 Hz
	8	Speed 5	0 Hz
<b>Service</b>	4	P1 Input	Spd Sel 2
	5	P2 Input	Spd Sel 3
	6	P3 Input	Not Used
	7	P4 Input	Not Used
	8	P5 Input	Not Used

• 3 Step Infinitely Variable

Access Level	Code No.	Description	Initial Data
<b>User</b>	0	Speed 1	10 Hz
	5	Speed 2	30 Hz
	6	Speed 3	60 Hz
	7	Speed 4	0 Hz
	8	Speed 5	0 Hz
<b>Service</b>	4	P1 Input	Spd Sel 2
	5	P2 Input	Spd Sel 3
	6	P3 Input	Not Used
	7	P4 Input	Not Used
	8	P5 Input	Not Used

Table 2.3.2: Parameters Affected With Speed Selection Programming (continued)

**5 Step**

Access Level	Code No.	Description	Initial Data
<b>User</b>	0	Speed 1	10 Hz
	5	Speed 2	20 Hz
	6	Speed 3	30 Hz
	7	Speed 4	45 Hz
	8	Speed 5	60 Hz
<b>Service</b>	4	P1 Input	Spd Sel 2
	5	P2 Input	Spd Sel 3
	6	P3 Input	Spd Sel 4
	7	P4 Input	Spd Sel 5
	8	P5 Input	Not Used

- All speeds can be changed individually in the **User Level** if so desired.
- In the Appendix are timing graphs representing the different speed control options.

\* Your Drive is now ready to run.

**2.3.3 Drive Operation Checks**

1. Test with unloaded hoist.
2. Make sure the hoist electric motor brake is operating properly.
3. Run the hoist or traverse, and verify its correct operation in relation to direction of movement verses pendant button pressed.
4. Check all limit switches for correct operation.

If the drive operates incorrectly please follow the troubleshooting charts of this manual, or contact your SpaceVector™ Dealer for further assistance.

# **Chapter 3: Programming**

## **Section 3.1: Passwords and Group Access Levels**

3.1.1: Passwords

3.1.2: Entering a Password

3.1.3: Changing Passwords

## **Section 3.2: Programming Function Data**

3.2.1: Customizing the Programming

## **Section 3.3: Establishing Motor Parameters**

## Section 3.1: Passwords and Group Access Level

### Section 3.1.1 Passwords

The SV200 allows you to program up to two passwords. The purpose of a password is to prevent people from inadvertently changing important parameters found in the **Service and Advanced Levels**. In order to change parameters in the **Service or Advanced Levels**, you must first enter a password designated to the respective level. The **User Level** does not require a password to change parameters.

When you first receive your drive, the programming permission level is initially setup for the **Advanced Level**. This means you can program any parameter in all levels. The initial password for all levels is (0). To help explain how passwords affect programming permission levels, see Figure 3.1.1.

### Section 3.1.2 Entering a Password

When you first receive the SV200 drive, the initial password for all levels is (0). To help explain how specific passwords affect each permission level of programming, follow Figure 3.1.1. It is assumed that the initial password of (0) has been changed to a (1) for **Service Level** and a (2) for **Advanced Level**. If a password change is desired, see Changing a Password, in Section 3.1.3 of this manual.

### Section 3.1.3 Changing a Password

If a password change is desired in either the **Service Level** or the **Advanced Level**, reference Figure 3.1.2.

**Caution:** Once you change your password, make sure it is written down where it can be referenced at a later time if necessary.



Fig. 3.1.1: Flowchart explanation for entering a password and its affect on programming permissions.

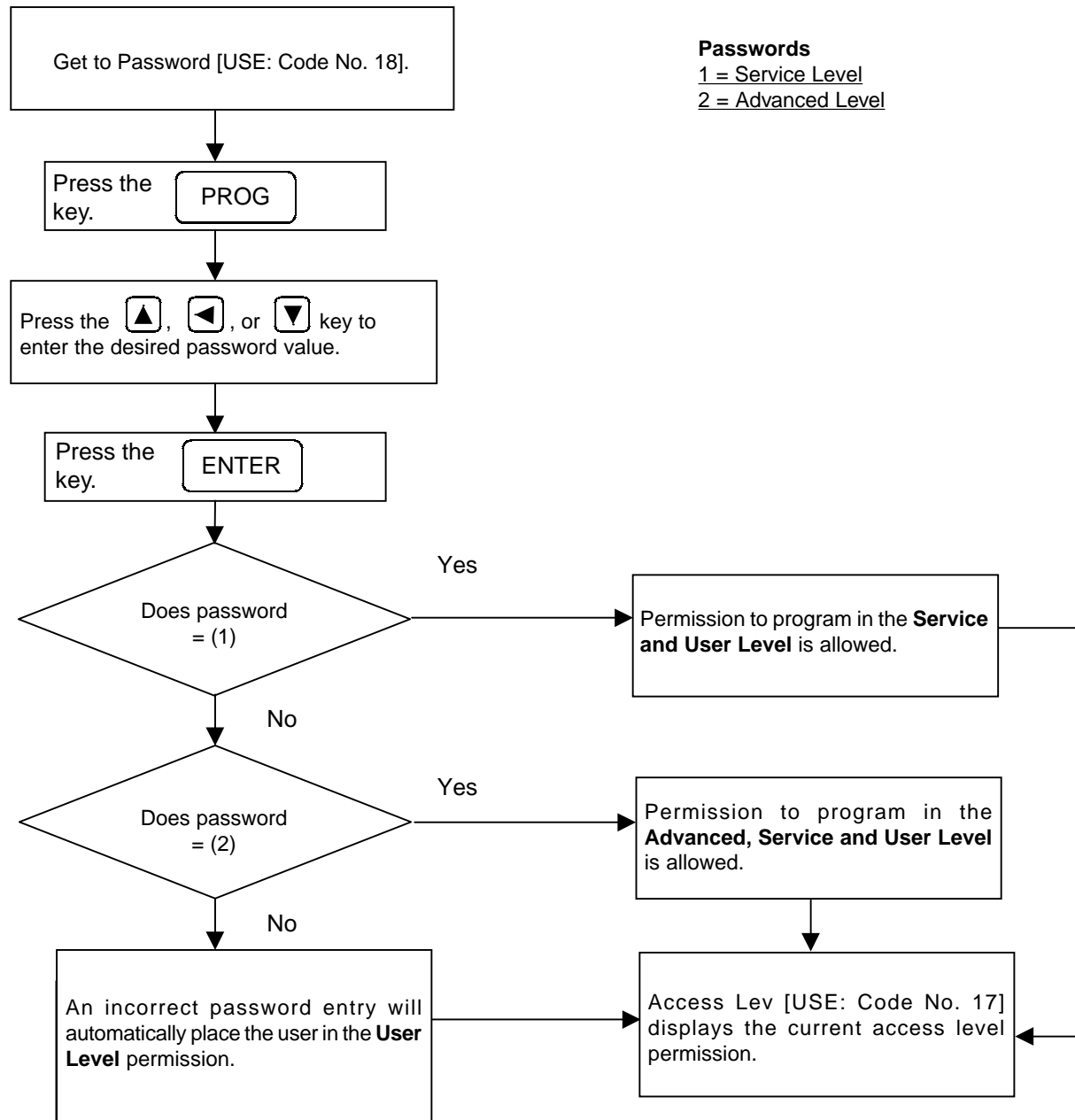
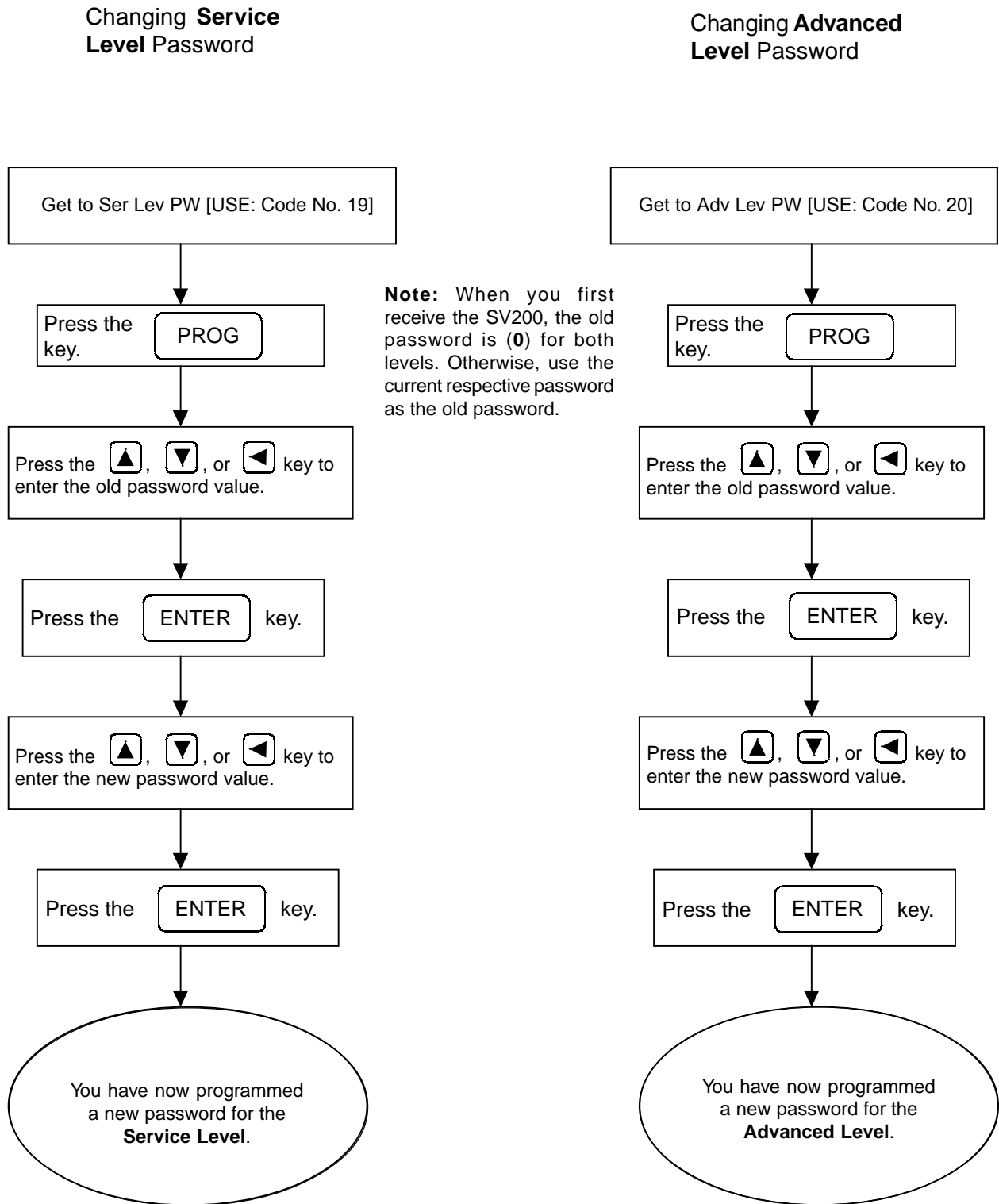


Fig. 3.1.2: Flowchart showing how to change a password in the **Service and Advanced Levels**.

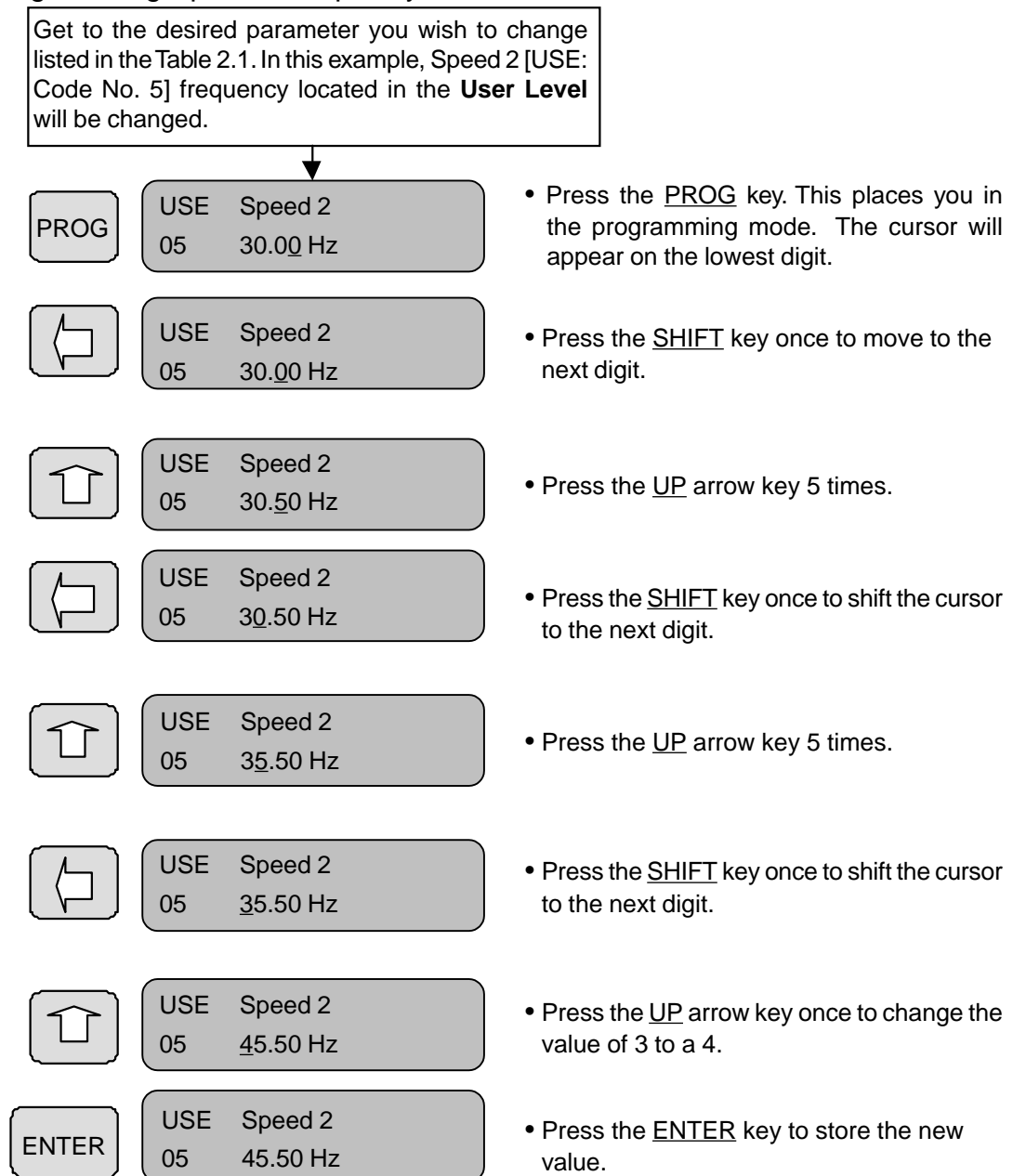


## Section 3.2: Programming Function Data

### 3.2.1 Customizing the Programming

Changing function data requires a few short steps. A password is required for changing any function data in the **Service** or **Advanced Levels**. Changing data in the **User Level** does not require a password. Figure 3.2.1 demonstrates how to change function data in all levels.

Fig. 3.2.1: Programming Speed 1 frequency from 30.00 Hz to 45.50 Hz



Note: In this example, lowering the drive frequency will lower the top speed of the motor.

### Section 3.3: Establishing Motor Parameters

When establishing the motor parameters, assure the motor rated current does not exceed the drive current rating. The default values for the Advanced Level Code numbers 30, 31, and 32 may be set to values more closely representing the motor being used with the drive. This is accomplished as follows:

1. Determine the motor synchronous speed and full load speed in revolutions per minute.
2. Calculate the rated motor slip in Hertz using the following equations.

$$\text{Rated Motor Slip (rpm)} = [\text{motor sync speed (rpm)} - \text{motor rated speed (rpm)}]$$

$$\text{Rated Motor Slip (Hertz)} = \frac{60 \text{ Hz.} \times [\text{rated motor slip (rpm)}]}{\text{motor sync speed (rpm)}}$$

3. Set Rated Slip [ADV: Code No. 30] to the rated motor slip value calculated in Hertz in step 2.
4. Obtain the motor rated current in amperes from the motor nameplate.
5. Obtain the drive current rating in amperes.
6. If the motor rated current obtained in step 4 is greater than the drive current rating obtained in step 5, use a larger drive having a current rating equal to or greater than that of the motor.
7. If the motor rated current obtained in step 4 is less than the drive current rating obtained in step 5, set M-rated cur. [ADV: Code No. 31] to the motor rated current obtained in step 4.
8. Calculate the minimum drive phase loss detection current.

$$\text{Minimum Drive Current (Amperes)} = 0.15 \times [\text{drive rated current (Amperes)}]$$

9. Calculate the motor no load current.

$$\text{Motor No Load Current (Amperes)} = 0.30 \times [\text{motor rated current (Amperes)}]$$

10. If the motor no load current calculated in step 9 is less than the minimum drive phase loss detection current calculated in step 8, the drive cannot detect phase loss and phase loss protection is no longer guaranteed. Consult the factory.

11. If the motor no load current calculated in step 9 is greater than the minimum drive current calculated in step 8, set No-load cur. [ADV: Code No. 32] to the motor no load current value calculated in step 9.

EXAMPLE:

5 HP drive having rated current of 8 ampere used with 1 HP motor having rated current of 1.3 amp

$$\text{Minimum drive current} = 0.15 \times 8 \text{ amp} = 1.2 \text{ amp}$$

$$\text{Motor no load current} = 0.3 \times 1.3 \text{ amp} = 0.39 \text{ amp}$$

The no load motor current is less than the minimum phase loss detection current. If the no load motor current is less than 15% of the drive rated current, the drive may detect an erroneous phase loss and phase loss protection is no longer guaranteed.

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# **Chapter 4: Troubleshooting**

## **Section 4.1: Monitoring Motor Current and Error Codes**

### **4.1.1: Monitoring Frequency**

### **4.1.2: Monitoring Current**

### **4.1.3: Monitoring Speed**

### **4.1.4: Monitoring Fault Trips**

### **4.1.5: Fault Codes**

## **Section 4.2: Problem Flowcharts**

## **Section 4.3: Testing Power Components**

## **Section 4.4: Pushbutton Pendant Test**

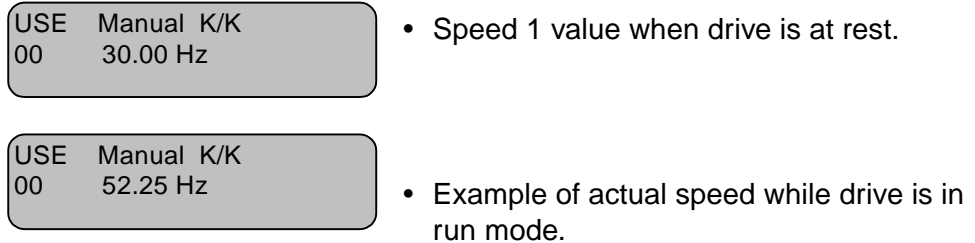
## **Section 4.5: Multi-function Output Test**

## Section 4.1: Monitoring Motor Current and Error Codes

### 4.1.1 Monitoring Frequency

Actual frequency output is displayed at Speed 1 [USE: Code No. 00]. When the drive is not in its running mode, the keypad will display Speed Step 1 Frequency as shown in Figure 4.1.1 below. Once the drive starts to run, the keypad will display actual frequency output.

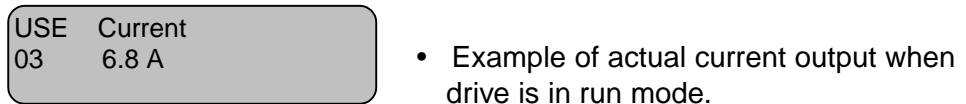
Fig. 4.1.1: Keypad display for drive at rest and in running mode.



### 4.1.2 Monitoring Current

Actual current output is displayed at Current [USE: Code No. 03]. Figure 4.1.2 below shows what the current display will look like.

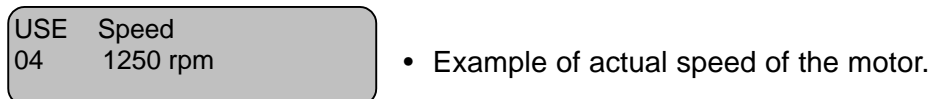
Fig. 4.1.2: SV200 actual current output display



### 4.1.3 Monitoring Speed

Actual motor speed is displayed at Speed [USE: Code No. 04]. Figure 4.1.3 below shows what the motor speed display will look like.

Fig. 4.1.3: Motor speed display

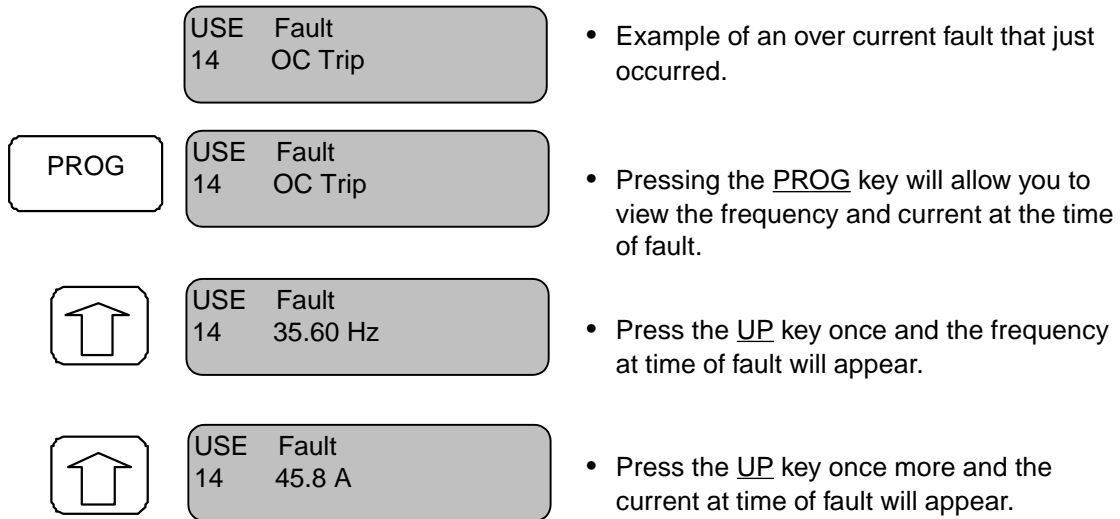




#### 4.1.4 Monitoring Fault Trips

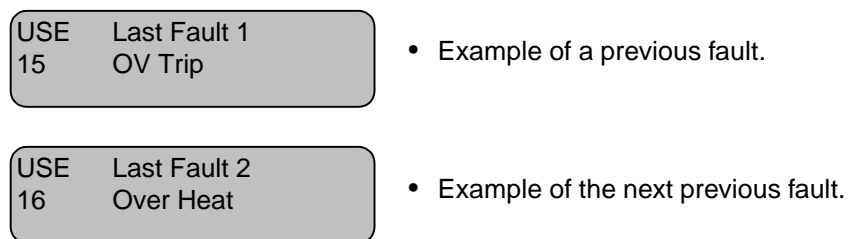
If a fault trip should occur, you can view what the fault is, its frequency and current at time of fault by going to Fault [USE: Code No. 14]. You can also view the previous faults at Last fault 1 [USE: Code No. 15] and Last fault 2 [USE: Code No. 16]. See Figure 4.1.4 below for fault displays.

Fig. 4.1.4: Fault trip and fault trip history displays



**Note:** You may also view the frequency and current at time of Last Fault 1 and Last Fault 2 by following the procedure from Fig. 4.1.4 on [Function Nos. 15 and 16].

Fig. 4.1.5: Last Fault Memory Locations



It is possible to clear the current fault [Function No. 14], by pressing the **RESET** key or by turning power off and back on.

#### 4.1.5 Fault Codes

When a Fault Trip occurs, the inverter cuts off its output and displays the fault status in Fault [USE: Code No. 14]. The last two faults are saved in Last fault 1 [USE: Code No. 15] and Last fault 2 [USE: Code No. 16].



#### CAUTION

*Risk of Electric Shock - More than one disconnect switch may be required to de-energize the equipment before servicing.*

Table 4.1.1: Fault Code Description

Fault Display	Description	Solutions
USE 14      Fault OC Trip	The output current of the inverter has reached the overcurrent protection level.	<ol style="list-style-type: none"> <li>1. Extended Acc. Time [USE: Code No. 10].</li> <li>2. Reduce Fwd boost [SER: Code No. 21] or Rev boost [SER: Code No. 22].</li> <li>3. Check wiring to motor for possible short circuits.</li> <li>4. If problem persists, the load inertia may be too great for the size of inverter. A larger inverter may be required.</li> </ol>
USE 14      Fault GF Trip	Inverter output terminals (U, V, W) shorted to ground.	<ol style="list-style-type: none"> <li>1. Check the wiring from the inverter to the motor for ground faults.</li> <li>2. Check motor windings for a ground fault.</li> </ol>
USE 14      Fault OV Trip	The DC bus voltage of the inverter is over the voltage protection level.	<ol style="list-style-type: none"> <li>1. Check whether the input voltage is within 10% of the inverter nameplate value.</li> <li>2. Extend Dec. time [USE: Code No. 11] to accommodate a high load inertia. Additional Dynamic Braking resistors may be required to dissipate excessive voltage.</li> <li>3. Eccentric loads and regenerative loads may cause over voltage trips. A larger inverter may be required to accommodate the larger load requirement.</li> </ol>
USE 14      Fault OC Trip	The output current of the inverter has exceeded the value in OL level [ADV: Code No. 40] for longer than OL time [ADV: Code No. 41].	<ol style="list-style-type: none"> <li>1. Check for mechanical failure which may have caused excessive motor current (bearing failure, jam, brake sticking, etc.)</li> </ol>
USE 14      Fault Phase Loss	The current draw from one or more motor outputs (U, V, W) is not high enough for No-load cur. [ADV: Code No. 32]	<ol style="list-style-type: none"> <li>1. Check output terminals at the drive and motor splice box.</li> <li>2. Test motor for open windings.</li> </ol>
USE 14      Fault Fuse Open	The internal fuse is open. This is cause when an IGBT on the output side of the inverter is damaged. The fuse opens to prevent further damage.	<ol style="list-style-type: none"> <li>1. Check to see if IGBT s are damaged. See Section 4.3: Testing Power Components.</li> <li>2. Replace the fuse.</li> </ol>
USE 14      Fault Over Heat	The internal heat sensor sensed the heat sink temperature of the inverter is over 85°C.	<ol style="list-style-type: none"> <li>1. Verify the Cooling Fan is rotating?</li> <li>2. Check to see if the air inlet and outlet are plugged.</li> <li>3. Check the ambient temperature.</li> </ol>
USE 14      Fault ETH	The motor temperature calculated by the ETH has exceeded the value set in ETH level [ADV: Code No. 45].	<ol style="list-style-type: none"> <li>1. Check whether the ETH level is set correctly.</li> <li>2. Check whether the inverter has been operating at a low frequency with a heavy load for along time.</li> </ol>
USE 14      Fault EXT Trip	The multi-function input terminal configured as EXT_TRIP is open.	<ol style="list-style-type: none"> <li>1. Check the multi-function input terminal.</li> </ol>
USE 14      Fault LV Trip	The DC bus voltage of the inverter is under the Low Voltage Protection level.	<ol style="list-style-type: none"> <li>1. Check the input line voltage.</li> </ol>
USE 14      Fault BX	The BX terminal is closed.	<ol style="list-style-type: none"> <li>1. Check the BX terminal</li> </ol>

**Note:** If the problem persists, please contact your local SpaceVector™ distributor for assistance.

## Section 4.2: Problem Flowcharts

Fig. 4.2.1: Motor Does not Run

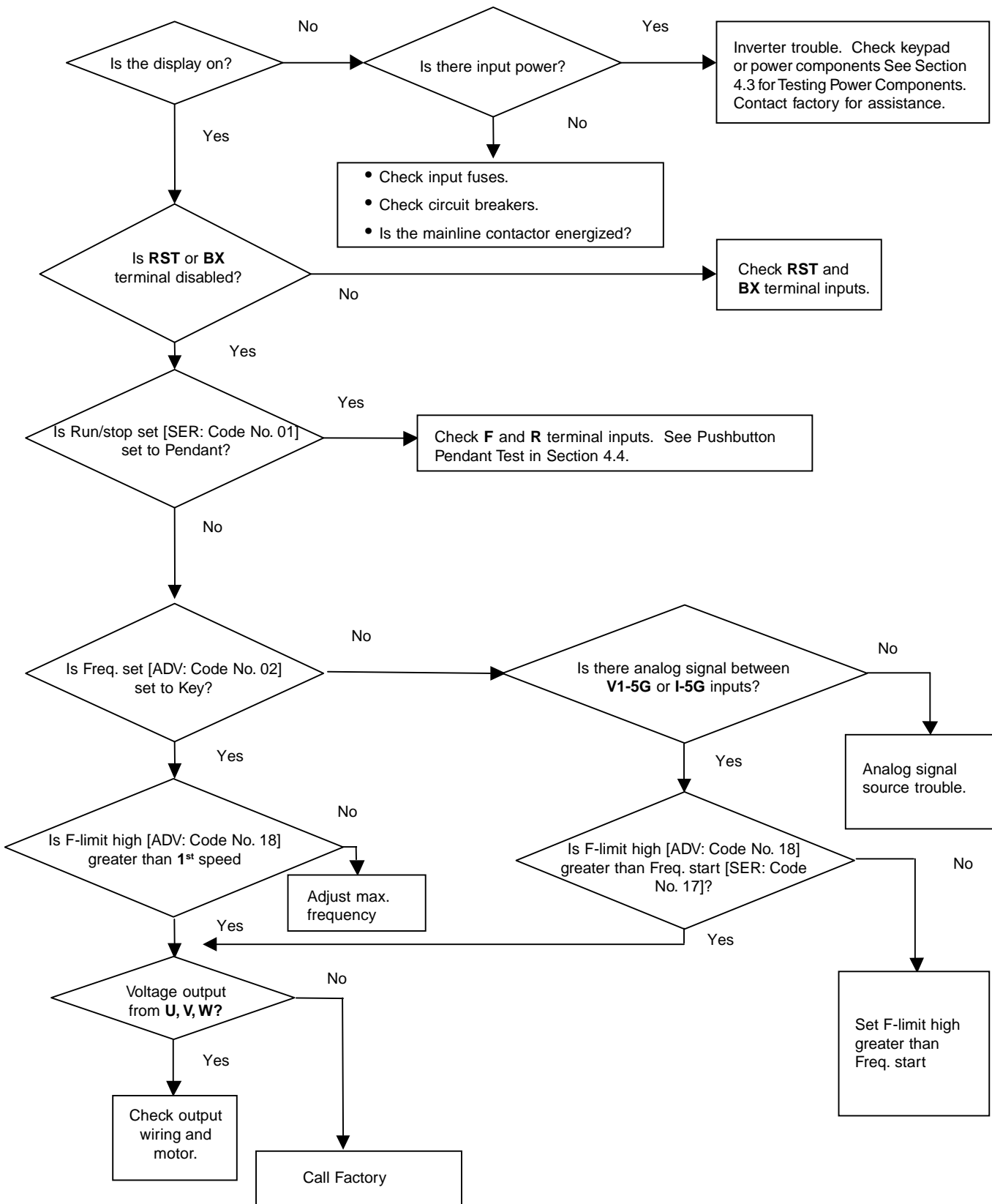


Fig. 4.2.2: Motor Speed is not equal to the Maximum Operational Frequency

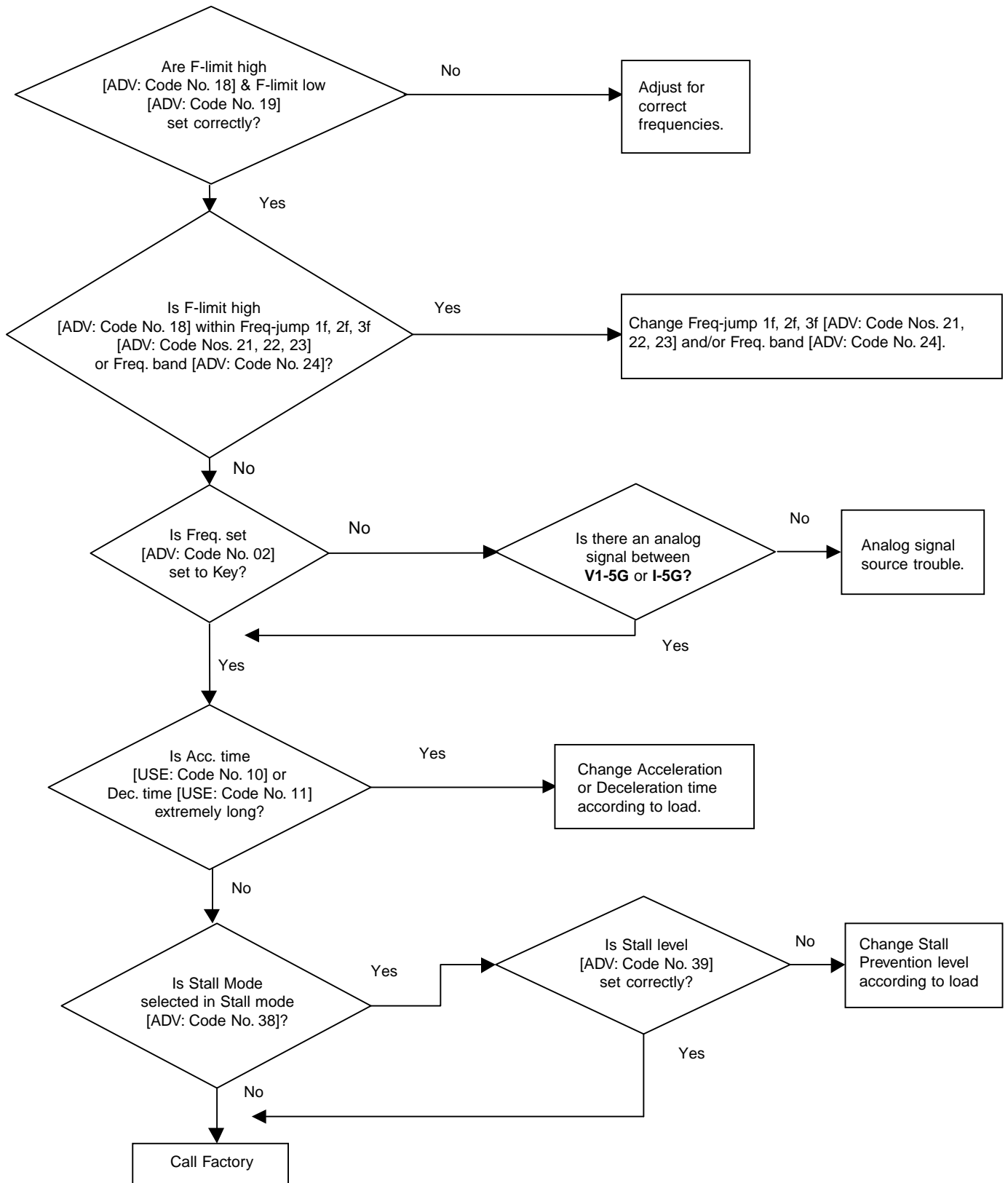
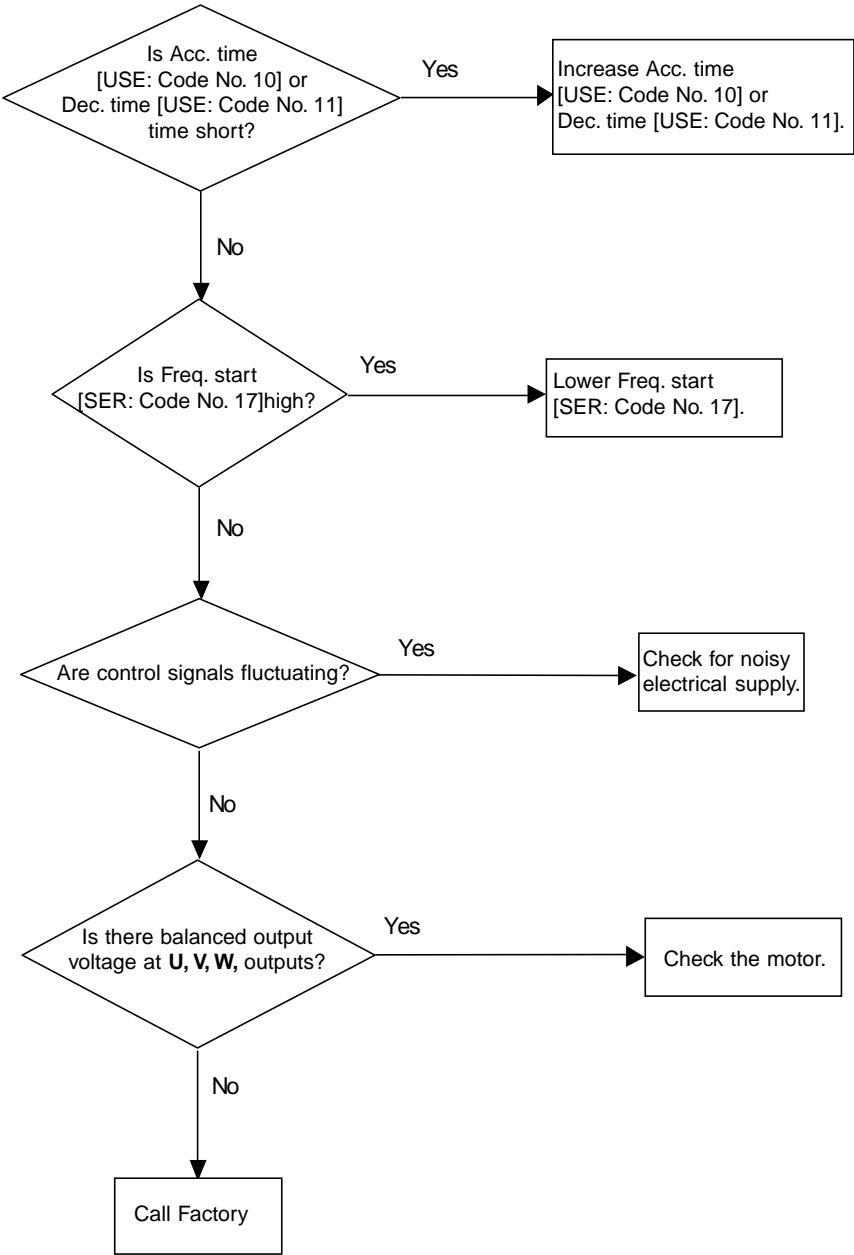
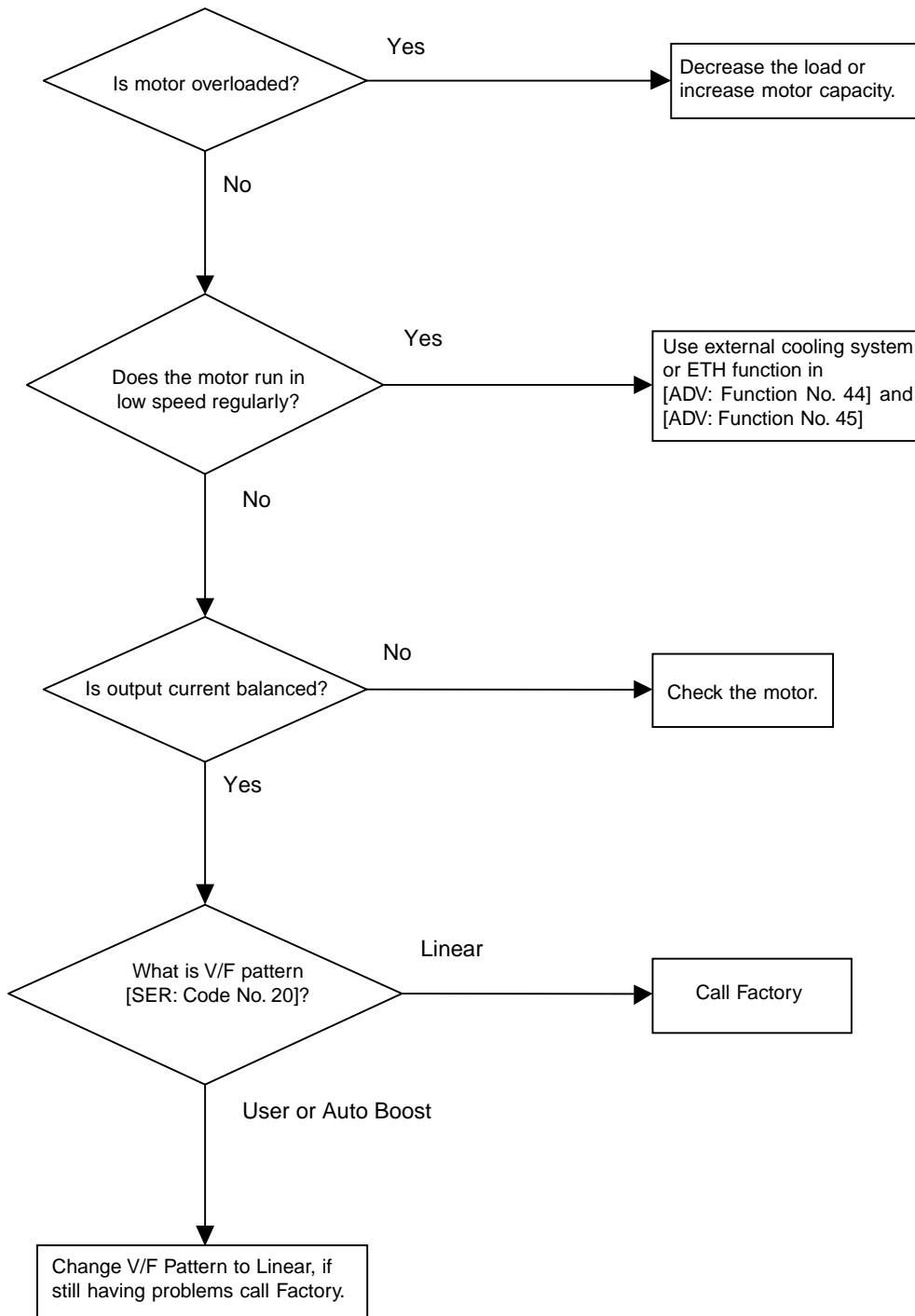


Fig. 4.2.3: Motor does not run smoothly



#### 4.2.4: Motor is abnormally overheating



## Section 4.3: Testing Power Components

### 4.3.1 How to Check Power Components

Before checking the power components, be sure to disconnect the AC input supply and wait until the main electrolytic capacitor (P1-N) discharges. This may take several minutes.

Fig. 4.3.1: SV200 Power Components Functional Diagram

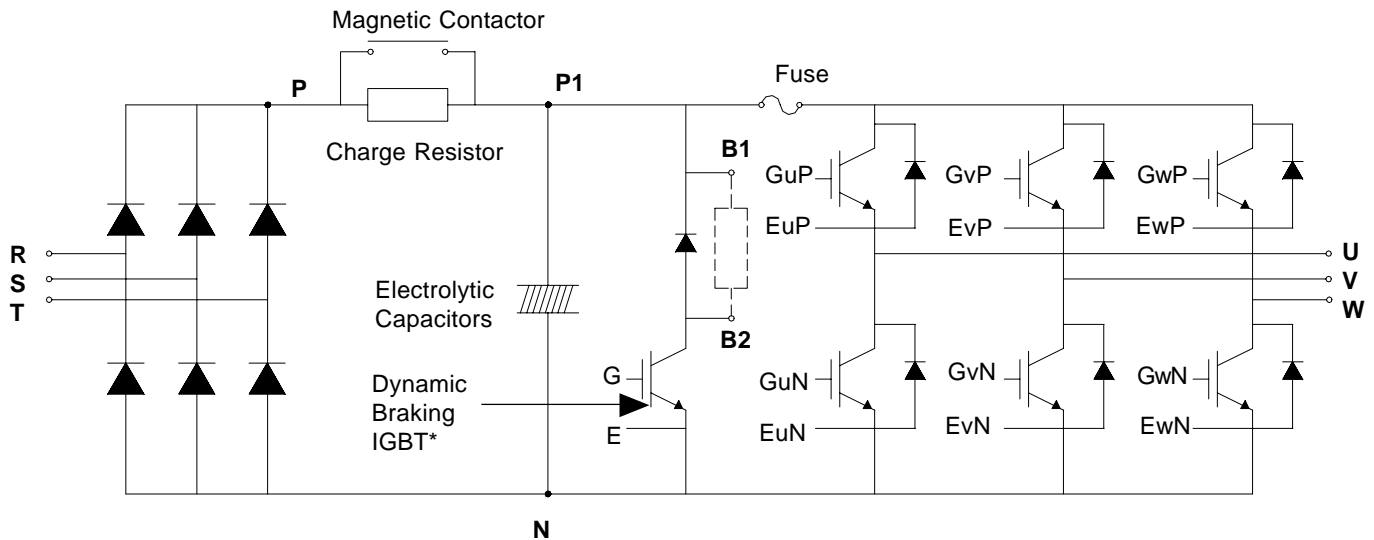


Table 4.3.1: Power Component Test Values - All resistance values measured with multi-meter leads From + to -.

#### Input Diode Module Check

Check Points	Resistance to be Good
From R, S, or T to P	50k ohms or more
From R, S, or T to N	50k ohms or more

#### Charge Resistor Check

Check Points	Resistance to be Good
From P to P1	Resistance depending on Models.

#### DB (Dynamic Braking) IGBT\*

Check Points	Resistance to be Good
From B2 to N	50k ohms or more
From G to N	A few kilo ohms

#### Output Diode Module Check

Check Points	Resistance to be Good
From U, V, or W to P1 and U, V, or W to N	50k ohms or more
Between Gate and Emitter of each IGBT	A few kilo ohms

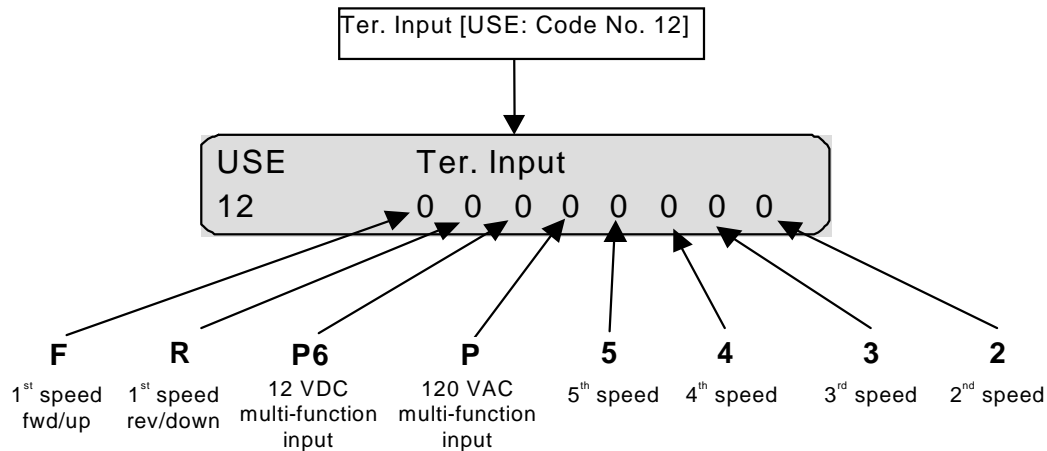
\*IGBT = Isolated Gate Bipolar Transistor



## Section 4.4: Pushbutton Pendant Test

The condition of the interface card can be monitored by using the display. This may be viewed at [Function No. 12] in the **User Level**. Press the PROG key to make the input display active. See Figure 4.4.1 below for reference.

Fig. 4.4.1: Key for interface card pushbutton pendant test



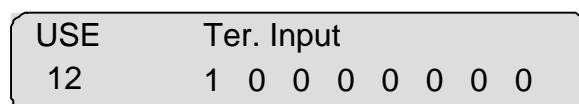
The status of the input display is dependant upon the status of the corresponding input to the interface card. If the test of the interface card fails it is recommended that the status of the inputs to the control board be tested. The relationship between inputs on the interface card and inputs on the control are illustrated in Table 4.4.1. Using a jumper wire between an input on the control board and the “CM” terminal will test the 24 VDC sinking inputs to the control board.

Table 4.4.1: Interface Card versus Control Board inputs

Interface Card	Control Board
F	FX
R	RX
	P6
P	P5
5	P4
4	P3
3	P2
2	P1

Example: Figure 4.4.2 shows the drive display if the “F” input on the interface card is on, and likewise the “FX” terminal on the control board.

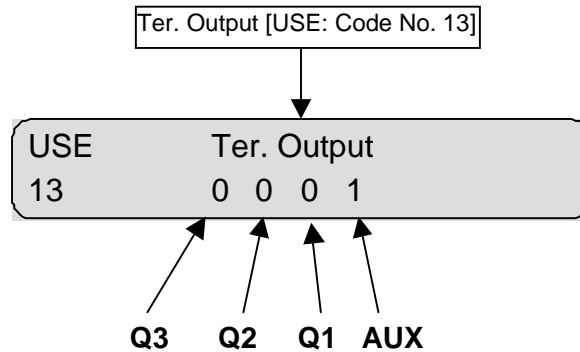
Fig. 4.4.2: Input Status with “F” and “FX” inputs on



## Section 4.5: Multifunction Output Test

The condition of the multifunction and analog outputs can be monitored by using the display. This function is located at [Function No. 13] in the **User Level**. Press the **PROG** key to make the display active. Reference Figure 4.5.1 below for testing procedure.

Fig. 4.5.1: Key for output terminal test



- Whenever an output is true, a 1 is displayed. If an output is false, a 0 is displayed.

Example: Figure 4.5.2 shows the drive display if the AUX and the Q2 outputs are on.

Fig. 4.5.2: Output Status with AUX and Q2 outputs on

USE	Ter. Output			
13	0	1	0	1

- The display in this example shows that **Q2** and **AUX** are currently closed.

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# Chapter 5: Function Code Information

## Section 5.1: User Level Functions

5.1.1: Frequency Output Monitor

5.1.2: Frequency Reference

5.1.3: Accel / Decel

5.1.4: Drive Status Monitoring

## Section 5.2: Service Level Functions

5.2.1: Command Reference (Run / Stop Selection)

5.2.2: Accel / Decel Patterns

5.2.3: Multi-Function Inputs

5.2.4: Multi-Function Outputs

5.2.5: Drive Model Selection

5.2.6: Frequency Settings

5.2.7: Dwell Function

5.2.8: V / F Pattern

5.2.9: Torque Boost

5.2.10: Voltage Control

5.2.11: Motor Poles

5.2.12: Brake Release

5.2.13: Upload / Download from Keypad and Set Factory Defaults

5.2.14: Braking

## Section 5.3: Advanced Level Functions

5.3.1: Drive Mode

5.3.2: Frequency Reference Source

5.3.3: Energy Save

5.3.4: User V / F Pattern

5.3.5: Analog Frequency Control

5.3.6: Maximum / Minimum Operating Frequency

5.3.7: Frequency to Bypass

5.3.8: DC Injection Braking

5.3.9: Motor Data

5.3.10: Drive and Motor Protections

**5.3.11: Stall Prevention**

**5.3.12: Instantaneous Power Failure and Speed Search**

**5.3.13: Restart After Reset**

**5.3.14: Carrier Frequency**

**5.3.15: Two Motor Applications**

**5.3.16: Closed Loop Speed Control**

**5.3.17: Rotation Direction Prevention**

**5.3.18: Jog Frequency**

**5.3.19: Output Current, Voltage and Frequency**

**5.3.20: Frequency Detection**

**5.3.21: Speed Display Scaling Factor**

**5.3.22: LED Check**

**5.3.23: Option Card**

**5.3.24: Reverse Plugging**

## Section 5.1: User Level Functions

### 5.1.1 Frequency Output Monitor

The drive frequency can be monitored via Keypad and Multifunction output terminals.

VIA KEYPAD

**Speed 1** [USE: Code No. 00]: 1st Speed (Factory Default: 10.00 Hz)  
Range: 0.00 - SER 15 Hz

The Keypad displays the drive frequency output to the motor once the RUN command is initiated. When the drive is not in RUN mode, the frequency display indicates the programmed speed 1 frequency.

VIA FREQUENCY METER TERMINAL (See Section 5.3.14)

### 5.1.2 Frequency Reference

**Speed Sel** [USE: Code No. 02]: Speed Sel (Factory Default: 2 Step)  
Range: 2 Step  
2Step Inf Var  
3 Step  
3Step Inf Var  
5 Step

**Speed 2** [USE: Function No. 05]: 2nd Speed (Factory Default: 60.00 Hz)  
Range: 0.00 - SER 15 Hz

**Speed 3** [USE: Function No. 06]: 3rd Speed (Factory Default: 0.00 Hz)  
Range: 0.00 - SER 15 Hz

**Speed 4** [USE: Function No. 07]: 4th Speed (Factory Default: 0.00 Hz)  
Range: 0.00 - SER 15 Hz

**Speed 5** [USE: Function No. 08]: 5th Speed (Factory Default: 0.00 Hz)  
Range: 0.00 - SER 15 Hz

The hoist speed references are set in the **User Level**. **Speed 1** and **2** will be applied when **Speed Sel** is set to 2 Step or 2 Step Infinitely Variable. **Speed 1, 2, and 3** will be applied when **Speed Sel** is set to 3 Step or 3 Step Infinitely Variable and **Speed 1, 2, 3, 4 and 5** will be applied when **Speed Sel** is set to 5 Step. The value of these speed points will be limited to the value of **Maximum Frequency** set in Freq. max [SER: Code No. 15]. Generally, the maximum frequency is set to the maximum motor allowed output speed.

### 5.1.3 Accel / Decel

**ACC Time** [USE: Code No. 10]: Acc. time

Range: 0.0 – 6000.0 sec.

(Factory Default: 1.0sec Hoist  
3.0sec Traverse)

**DEC Time** [USE: Function No. 11]: Deceleration Time

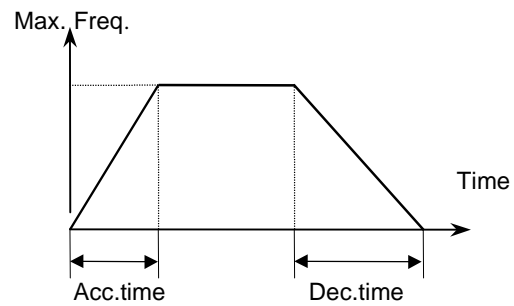
Range: 0.0 – 6000.0 seconds

(Factory Default: 1.0sec Hoist  
3.0sec Traverse)

Operator can program acceleration and deceleration times via keypad of the drive through the above parameters.

Fig. 5.1.1: Acceleration/Deceleration Time

LEVEL: User  
DISPLAY: Acc. time  
Dec. time



### 5.1.4 Drive Status Monitoring

The drive operational status can be monitored via the drive keypad and Multi-Meter output terminal.

#### FAULT HISTORY

<b>Faults</b>	[USE: Code No. 14]	(Display only)
<b>Last Fault 1</b>	[USE: Code No. 15]	(Display only)
<b>Last Fault 2</b>	[USE: Code No. 16]	(Display only)

The drive keeps detailed fault information in three fault history parameters. Each fault history parameter contains the previous fault status such as fault type, drive output current and the frequency output at the time of the fault. These conditions can be viewed by the using up and down arrow keys of the keypad. See Section 4.1.2 for detailed instructions on all fault code locations.

#### RESETTING A FAULT

The SV200 drive fault can be reset either from the keypad by pressing RESET or from the external fault reset terminal RST, or by turning power off and back on after approximately 3 min.

For the keypad reset, please refer to Section 4.1.2.

#### STATUS OF INPUT TERMINAL

Drive input terminal status can be monitored in Ter. Input [USE: Code No. 12]. This feature is a useful tool for drive troubleshooting. The status of each terminal is displayed in binary form. When an input terminal is activated, the display will show High (1), otherwise it will show Low (0). See Section 4.4 for a description of this feature.

#### SOFTWARE VERSION

**S/W Ver.** [USE: Code No. 21]: S/W Version (Display only)  
Hoist/Crane 02  
M = 3 hp - 10 hp  
L = 15 hp - 30 hp

This is the software version of the SV200 drive.

#### PASSWORDS

See Section 3.1 for an explanation of this feature.



## Section 5.2: Service Level Functions

### 5.2.1 Command Reference (Run/Stop Selection)

The drive can receive its command sequence (RUN, STOP, FWD, REV), via external terminals.

**Run/stop set** [SER: Code No. 01]: Run command source (Factory Default: Pendant)

Range: Key  
 Pendant  
 RS485/PLC

#### KEYPAD

The JOG function works via the keypad only. See Section 2.2.3 for instructions on use.

#### EXTERNAL CONTROL

Each of the sequence command can be initiated via external controls connected through the interface card, or direct to the control board. See Table 5.2.1.

Tabel 5.2.1: Drive Input terminals

Drive Control Board Input Terminals		Interface Card	
Fx	Up / Forward Direction Command Terminal. 24 VDC Sinking.	F	Up / Forward Direction Command Terminal. 120 VAC Sourcing.
Rx	Down / Reverse Direction Command Terminal. 24 VDC Sinking.	R	Down / Reverse Direction Command Terminal. 120 VAC Sourcing.
RST	Fault Reset Reset. 24 VDC Sinking.		
P1	Multi-Function Input 24 VDC Sinking.	2	Multi-Function Input 120 VAC Sourcing.
P2	Multi-Function Input 24 VDC Sinking.	3	Multi-Function Input 120 VAC Sourcing.
P3	Multi-Function Input 24 VDC Sinking.	4	Multi-Function Input 120 VAC Sourcing.
P4	Multi-Function Input 24 VDC Sinking.	5	Multi-Function Input 120 VAC Sourcing.
P5	Multi-Function Input 24 VDC Sinking.	P	Multi-Function Input 120 VAC Sourcing.
P6	Multi-Function Input 24 VDC Sinking.		
CM	Common Terminal for 24 VDC Sinking Inputs.	C	Common Terminal for 120 VAC Sourcing Inputs

### 5.2.2 Accel / Decel Patterns

**Acc. pattern** [SER: Code No. 02]: Acceleration Pattern (Factory Default: S-Curve)

Range: Linear  
 S-Curve  
 U-Curve

**Dec. pattern** [SER: Code No. 03]: Deceleration Pattern (Factory Default: Linear)

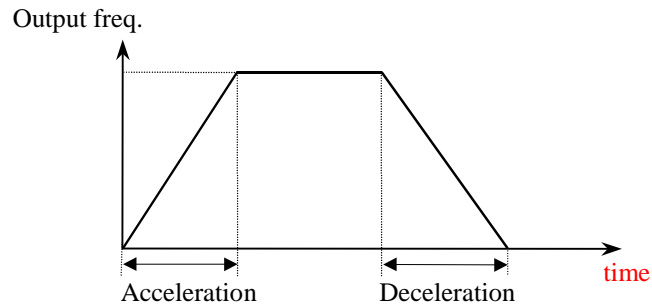
Range: Linear  
 S-Curve  
 U-Curve

These values are set with Motion Def [ USE: Function No. 01], see Table 2.3.1. The user can select different acceleration and deceleration patterns for smoother hoist or traverse ramping.

## LINEAR

The linear pattern is generally good for hoists without a mechanical load brake for sufficient output torque.

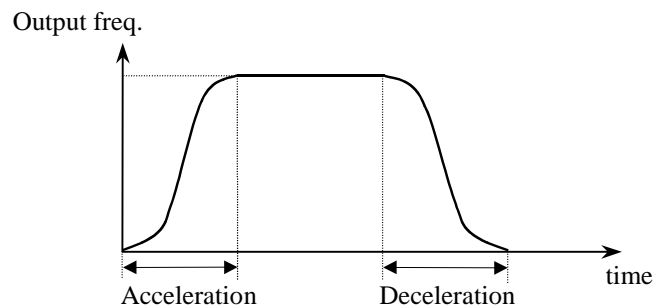
Fig. 5.2.1: Linear Acceleration/Deceleration Curve



## S-CURVE

This pattern is used to initiate smooth ramping during Acceleration or Deceleration sequence. This pattern is suitable for hoists with a mechanical load brake, creating less brake wear.

Fig. 5.2.2: S-Curve Acceleration/Deceleration Curve

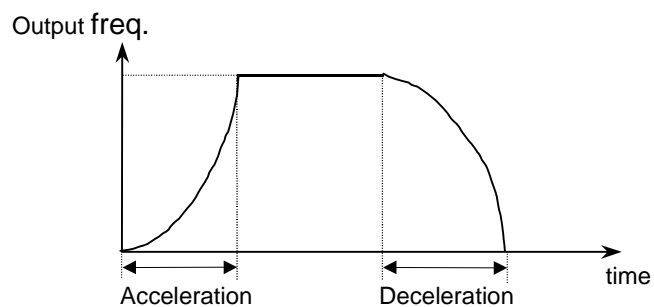


## U-CURVE

This pattern is used for a smooth initial speed change during Acceleration or Deceleration, and still quickly arrive at the set speed.

**Note: This pattern is not suitable for hoist / crane applications.**

Fig. 5.2.3: U-Curve Acceleration/Deceleration Curve



### 5.2.3 Multi-Function Inputs

The SV200 drive is equipped with 6 Multi-Function Inputs, which determine how the drive reacts to inputs from the controls.

<b>P1 Input</b> [SER: Code No. 04]: Multi-Function Input 2	(Factory Default: Spd Sel 2)
<b>P2 Input</b> [SER: Code No. 05]: Multi-Function Input 3	(Factory Default: Not Used)
<b>P3 Input</b> [SER: Code No. 06]: Multi-Function Input 4	(Factory Default: Not Used)
<b>P4 Input</b> [SER: Code No. 07]: Multi-Function Input 5	(Factory Default: Not Used)
<b>P5 Input</b> [SER: Code No. 08]: Multi-Function Input P	(Factory Default: Not Used)
<b>P6 Input</b> [SER: Code No. 09]: Multi-Function Input P6	(Factory Default: Not Used)

Range: Not Used

Spd Sel 2

Spd Sel 3

Spd Sel 4

Spd Sel 5

LSW Imm. Stop

LSW Rmp. Stop

LSW Low Spd

EXT\_TRIP

**SPD SEL 2:** With an input of either run command (F or R) the drive will run at the programmed speed of Speed 2 [USE: Code No. 05].

**SPD SEL 3:** With an input of either run command (F or R) and Multi-Function Input 2 the drive will run at the programmed speed of Speed 3 [USE: Code No. 06].

**SPD SEL 4:** With an input of either run command (F or R) and Multi-Function Inputs 2 and 3 the drive will run at the programmed speed of Speed 4 [USE: Code No. 06].

**SPD SEL 5:** With an input of either run command (F or R) and Multi-Function Inputs 2, 3 and 4 the drive will run at the programmed speed of Speed 5 [USE: Code No. 07].

**LSW IMM. STOP:** When a Multi-Function Input is programmed for this operation and the Normally Closed input opens, the drive output immediately stops. (Default for hoist control).

**LSW RMP. STOP:** When a Multi-Function Input is programmed for this operation and the Normally Closed input opens, the drive output ramps to a stop. (Default for traverse control). **NOT RECOMMENDED FOR HOIST MOTION.**

**LSW LOW SPD:** When a Multi-Function Input is programmed for this operation and the Normally Closed input opens, the drive output ramps to the value in LSW Speed [USE: Code No. 09].

**EXT\_TRIP:** When a Multi-Function Input is programmed for this operation and the Normally Closed input opens, the drive trips out and must be reset before it will operate again.

## 5.2.4 Multi-Function Outputs

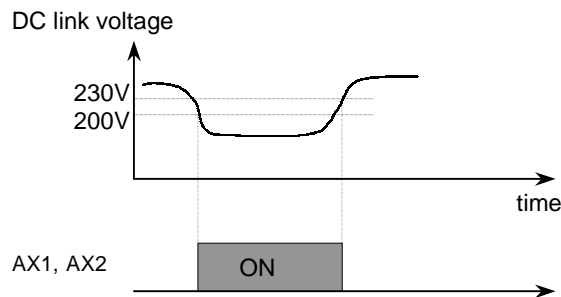
The SV200 drive is equipped 4 Multi-Function Outputs. One is a Normally Open contact between AX1 and AX2 on the control board. The other three are Open Collector 24 VDC outputs at Q1, Q2, and Q3, see Fig. 5.2.4.

<b>AUX Output</b> [SER: Code No.10]: AUX Output	(Factory Default: FST_HI)
<b>Q1 Output</b> [SER: Code No. 11]: Q1 Output	(Factory Default: FST_LO)
<b>Q2 Output</b> [SER: Code No. 12]: Q2 Output	(Factory Default: FDT_HI)
<b>Q3 Output</b> [SER: Code No. 13]: Q3 Output	(Factory Default: OL)
Range: FST_LO	(See Section 5.2.12)
FST_HI	(See Section 5.2.12)
FDT_HI	(See Section 5.3.20)
FDT_PULSE	(See Section 5.3.20)
FDT_BAND	(See Section 5.3.20)
OL	(See Section 5.3.10)
LV	
RUN	

### LOW VOLTAGE SIGNAL

Multi-Function Output terminals AX1 and AX2 programmed to LV will close when the DC Link voltage falls below the low voltage level of the drive (200VDC for 230 VAC, and 400VDC for 460 VAC drives).

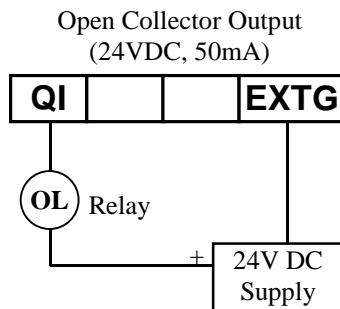
Fig. 5.2.3: Under-voltage Fault Signal



### RUN / STOP SIGNAL

The Multi-Function Output terminals AX1 and AX2 programmed to RUN will close when the drive changes from a stop condition to a run condition.

Fig. 5.2.4: Open Collector Multi-function Output



### 5.2.5 Drive Model Selection

**Inv Capacity** [SER: Code No. 14]

(Factory Default: Depends on Model No.)

Range: See Table 5.2.2

The drive model selection for each drive is preset at the factory. This parameter must be set correctly in order for the drive to calculate its output current. Table 5.2.2 cross references the drive model number, horsepower, and voltage rating, and lists the default values for M-rated cur. [ADV: Code No. 31] and No-load cur. [ADV: Code No. 32].

Table 5.2.2: SV200 Part Number Cross Reference to Drive Model Selection

Model	Description	Part No.	FLA	NLA
3hp@230V	3 HP - 230 V	446485-10	9.6	2.8
5hp@230V	5 HP - 230 V	446485-11	15.2	4.4
7.5hp@230V	7.5 HP - 230 V	446485-12	22	6.6
10hp@230V	10 HP - 230 V	446485-13	28	8.4
15hp@230V	15 HP - 230 V	446485-14	42	12.6
20hp@230V	20 HP - 230 V	446485-15	54	16.2
25hp@230V	25 HP - 230 V	446485-16	68	20.4
30hp@230V	30 HP - 230 V	446485-17	80	24.0
3hp@460V	3 HP - 460 V	446485-20	4.8	1.4
5hp@460V	5 HP - 460 V	446485-21	7.6	2.2
7.5hp@460V	7.5 HP - 460 V	446485-22	11	3.3
10hp@460V	10 HP - 460 V	446485-23	14	4.2
15hp@460V	15 HP - 460 V	446485-24	21	6.3
20hp@460V	20 HP - 460 V	446485-25	27	8.1
25hp@460V	25 HP - 460 V	446485-26	34	10.2
30hp@460V	30 HP - 460 V	446485-27	40	12.0

## 5.2.6 Frequency Settings

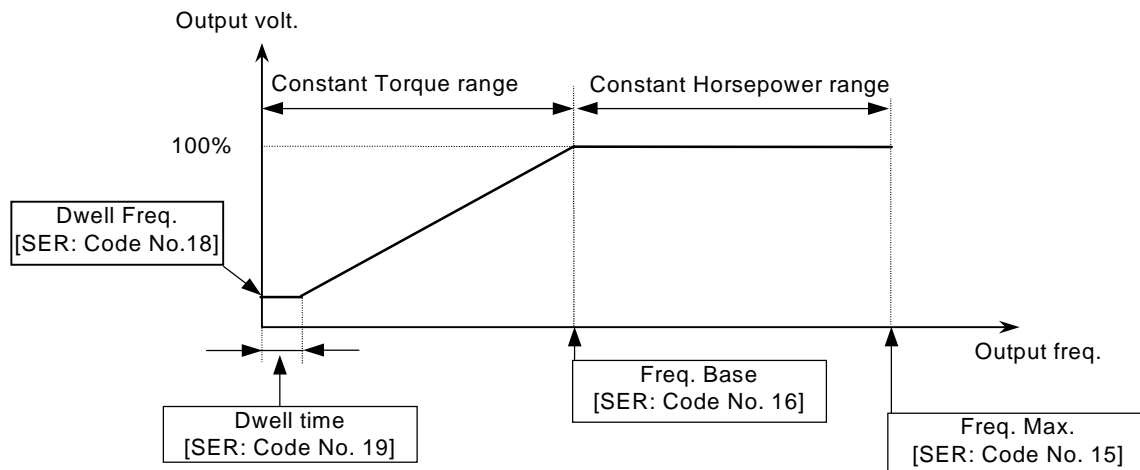
**Freq. max** [SER: Code No. 15]: Maximum output frequency (Factory Default: 60.00 Hz)  
Range: 40.00 - 120.00 Hz

**Freq. base** [SER: Code No. 16]: Base frequency (Factory Default: 60.00 Hz)  
Range: 40.00 - Ser 15 Hz

**Freq. start** [SER: Code No. 17]: Drive Cutoff Frequency (Factory Default: 0.50 Hz)  
Range: 0.50 - 5.00 Hz

The Freq. base [SER: Code No. 16] is the motor rated speed in the constant torque range. This base frequency value should not be set higher than that of Freq. max [SER: Code No. 15]. If the base frequency is set at 40 Hz and the maximum frequency is set at 60 Hz, the motor will accelerate up to 40Hz. in Constant Torque mode and up to 60 Hz in Constant Horsepower mode. The Drive Cutoff Frequency set in Freq. start [SER: Code No. 17] is the frequency at which the drive shuts off when ramping to a stop.

Fig. 5.2.5: Motor Frequency Relationship Diagram



## 5.2.7 Dwell Function

**Dwell-freq.** [SER: Code No. 18]: Start Dwell Frequency (Factory Default: 3.00 Hz)  
 Range: 0 - SER 15 Hz

**Dwell-time** [Ser: Code No. 19]: Start Dwell Time (Factory Default: 0.5 sec)  
 Range: 0 - 10 sec.

The dwell function is used for torque proving before the brake is released. The current is applied to the motor during the Dwell-time [SER: Code No. 19] before releasing the brake.

**Caution:** Dwell frequency should be set to the slip frequency of the motor if the slip is greater than 3 Hz. To calculate slip frequency, see Section 3.3.

Fig. 5.2.6: Brake Release Timing (Hoist)

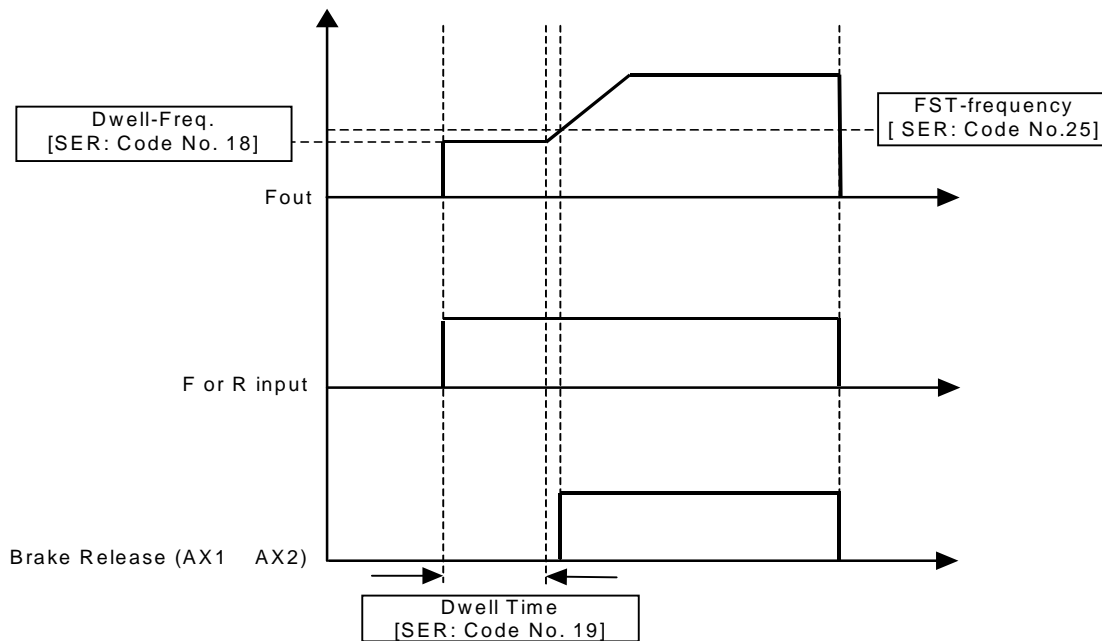
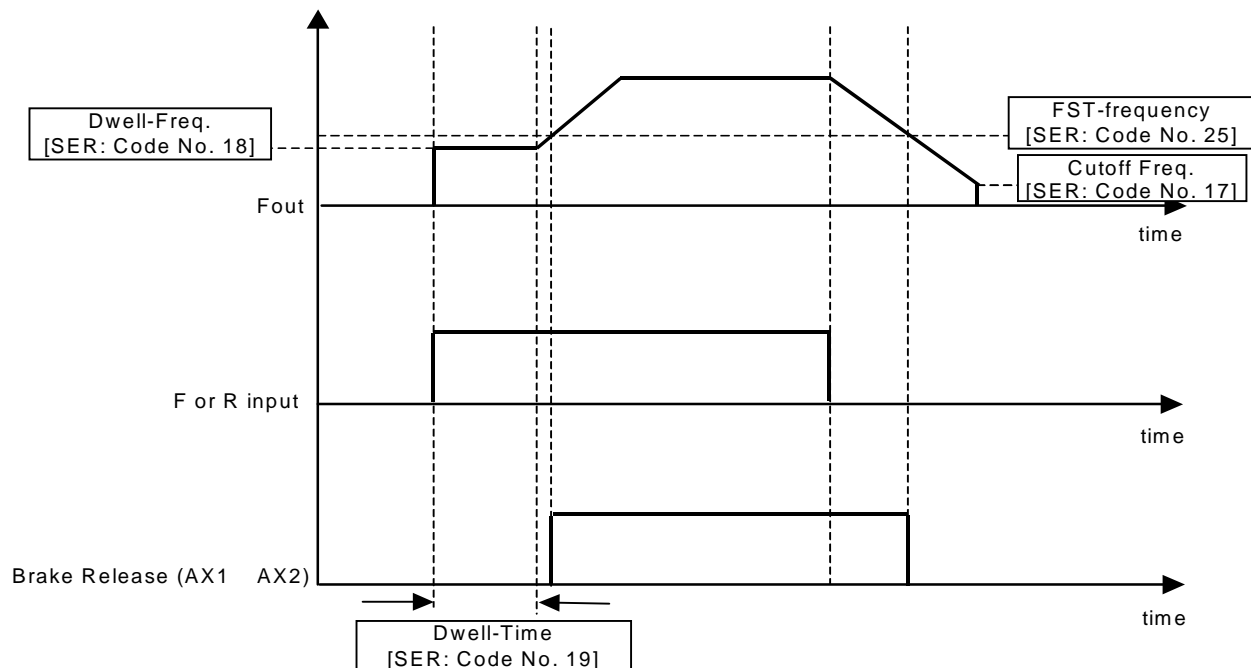


Fig. 5.2.7: Brake release Timing (Traverse)



## 5.2.8 V/F Pattern

**V/F pattern** [SER: Code No. 20]: V/F Pattern Selection

(Factory Default: Linear)

Range: Linear

2.0 (**Do Not Use**)

User

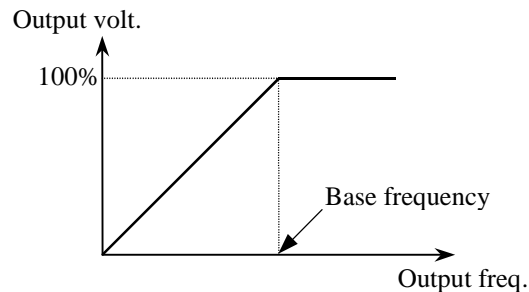
Auto Boost

Depending on the applications, different Volt/Hertz patterns can be selected. In User Define various points of V/F ratios are programmed for the best output result. Please contact the factory for more information.

**LINEAR** [Constant Torque Applications]

This pattern is best suited for Constant Torque applications like Hoist/Crane. This Linear pattern has a V/F ratio that is constant throughout the entire frequency range up to the drive base frequency.

Fig. 5.2.8: Linear V/F Diagram



### USER

The User Pattern can be used for special purpose applications. There are four V/F points that can be programmed between the starting frequency and the base frequency. See Fig. 5.2.9.

**User 1f** [ADV: Code No. 04]: User V/F Set Frequency 1  
Range: 0.0 - Ser 15 Hz.

(Factory Default: 60.00 Hz)

**User 1v** [ADV: Code No. 05]: User V/F Set Voltage 1  
Range: 0 - 100 %

(Factory Default: 100%)

**User 2f** [ADV: Code No. 06]: User V/F Set Frequency 2  
Range: 0.0 - Ser 15 Hz.

(Factory Default: 60.00 Hz)

**User 2v** [ADV: Code No. 07]: User V/F Set Voltage 2  
Range: 0 - 100 %

(Factory Default: 100%)

**User 3f** [ADV: Code No. 08]: User V/F Set Frequency 3  
Range: 0.0 - Ser 15 Hz.

(Factory Default: 60.00 Hz)

**User 3v** [ADV: Code No. 09]: User V/F Set Voltage 3  
Range: 0 - 100 %

(Factory Default: 100%)

**User 4f** [ADV: Code No. 10]: User V/F Set Frequency 4  
Range: 0.0 - Ser 15 Hz.

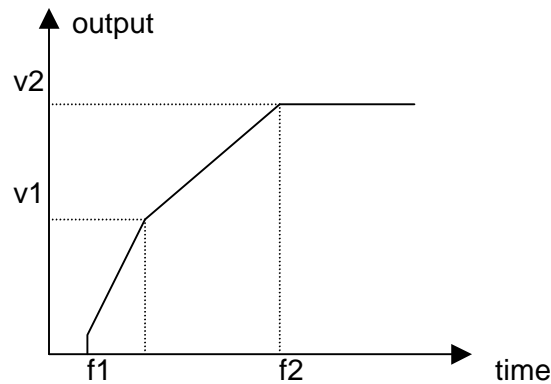
(Factory Default: 60.00 Hz)

**User 4v** [ADV: Code No. 11]: User V/F Set Voltage 4  
Range: 0 - 100 %

(Factory Default: 100%)



Fig. 5.2.9: User V/F Pattern



### AUTO BOOST

When Auto boost is selected the drive senses the output current, and if there is a sudden rise in current, proper torque is automatically given. This only occurs at low frequencies to get the motor started.

**Note:** Manual torque boost settings of Fwd Boost [SER: Code No. 21] and Rev Boost [SER: Code No. 22] are ignored when **Auto Boost** is Selected.

### 5.2.9 Torque Boost

**Fwd Boost** [SER: Code No. 21]: Forward direction torque boost (Factory Default: 5%)  
Range: 0 - 20 %

**Rev Boost** [SER: Code No. 22]: Reverse direction torque boost (Factory Default: 2%)  
Range: 0 - 20 %

The forward and reverse torque boost value can be set separately. This function is used to increase the output voltage to the motor at low speeds for a higher volts/hertz ratio, resulting in a much higher starting current output to the motor. This is for loads that require relatively higher torque than normal starting torque. These parameters are only used if V/F pattern [SER: Code no. 20] is not set to Auto Boost.

**Note:** If the torque boost is set too high an Overcurrent fault may occur. When this occurs reduce the Torque Boost values.

Fig. 5.2.10: Torque Boost in Linear Pattern

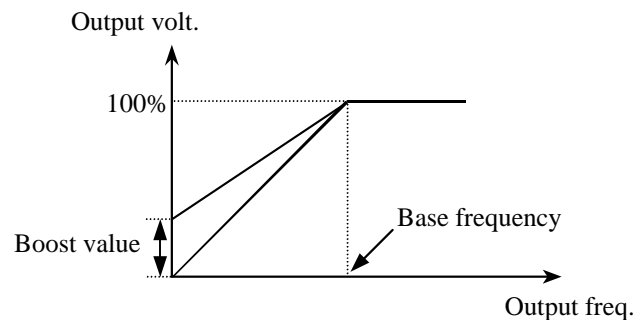
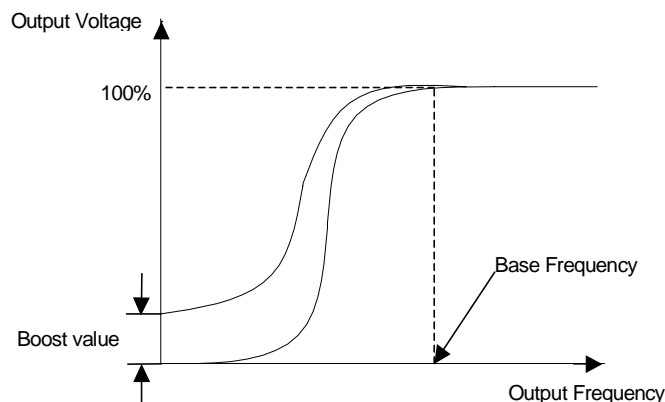


Fig. 5.2.11: Torque Boost in S-Curve Pattern



### 5.2.10 Voltage Control

**Volt Control** [SER: Code No. 23]: Maximum drive output voltage

Range: 0-110%

(Factory Default: 100%)

Inverter output voltage can be adjusted to motor rated input voltage. This function is useful when rated motor voltage is lower than the rated inverter output voltage. 110% means over-modulation in PWM causing a higher output voltage compared to 100% of rated output voltage.

### 5.2.11 Motor Poles

**Pole number** [SER: Code No. 24]: Number of motor poles

(Factory Default: 4)

Range: 2 (3600 RPM)

4 (1800 RPM)

6 (1200 RPM)

8 (900 RPM)

10 (720 RPM)

12 (600 RPM)

Relate the synchronous speed of the motor to the number of poles and adjust the value of Pole number [SER: Code No. 24] to match.

### 5.2.12 Brake Release

**FST-freq.** [SER: Code No. 25]: Brake Release Frequency

(Factory Ddfault: 3.01 Hz)

Range: 0.50 - SER 15 Hz.

This is the frequency at which the drive releases the brake. The drive allows time for the motor to build flux before ramping up the drive output and releasing the brake. See Figures 5.2.5 and 5.2.6 in Section 5.2.7 for a graphical representation.

### 5.2.13 Upload / Download from Keypad and Set Factory Defaults

**Para read** [SER: Code No. 26]: Read all parameters from drive to keypad  
Range: Yes (Factory Default: No)  
No

**Para write** [SER: Code No. 27]: Write all parameters from keypad to drive  
Range: Yes (Factory Default: No)  
No

By setting **Para read** [SER: Code No. 26] to Yes, all drive data, including fault history, will be uploaded to the Electronically Programmable Read Only Memory (EPROM) of the keypad. This can be a useful way to store drive status at the time of fault.

By setting **Part write** [SER: Code No. 26] to Yes, all drive data stored in the keypad will be downloaded to the drive. This can be a useful option when copying a set of parameters from one drive to another.

**Para init** [SER: Code No. 28]: Initialize all parameters with factory default settings  
Range: Yes (Factory Default: No)  
No

If set to Yes, the factory initial parameter settings will be downloaded to the drive.

### 5.2.14 Braking

**Stop Mode** [SER: Code No. 30]: Drive stop mode (Factory Default: Immediate stop)  
Range: Decel  
DCBR  
Immediate stop  
Acc/Dec Abs

#### DECEL

Ramp to Stop is the default value for traverse applications. The drive output ramps down to a stop when the Run command is released. Not recommended for use with worm gear speed reducers. RAMP TO STOP IS NOT ADVISED FOR HOIST MOTION.

#### DCBR

See Section 5.3.8 for an explanation of this feature.

#### IMMEDIATE STOP

Immediate Stop is the default value for hoist applications. The drive output turns off when the Run command is released.

#### ACC/DEC ABS

When ACC/DEC ABS is selected the drive accelerates and decelerates for the amount of time set in Acc.Time [USE: Code No. 10] and Dec.Time [USE: Code No. 11] regardless of the frequency the drive is at. If the drive is running at 60 Hz. it takes Dec. Time to decelerate to 0 Hz. If the drive is running at 30 Hz. it takes Dec. Time to decelerate to 0 Hz.

## Section 5.3: Advanced Level Functions

### 5.3.1 Drive Mode

**Drive mode** [ADV: Code No. 01]: Only Manual mode is available for Hoist/Crane

Range: Manual

Auto

**NOTE: Only Manual should be selected for Hoist / Crane applications.**

### 5.3.2 Frequency Reference Source

**Freq. set** [ADV: Code No. 02]: Command frequency Source (Factory Default: Key)

Range: Key

Terminal

RS485/PLC

In order for the drive to receive its speed reference from an analog source or from a PLC instead of the keypad Freq. set [ADV: Code No. 02] must be adjusted. RS485 input requires an optional input module.

### 5.3.3 Energy Save

**Energy save** [ADV: Code No. 03]: Value for energy saving mode

Range: 50 - 100 %

(Factory Default: 80 %)

For fan and pump applications, not for hoist/crane.

### 5.3.4 User V/F Pattern (See Section 5.2.8 for ADV: Codes 04 - 11)

### 5.3.5 Analog Frequency Control

**V-I mode** [ADV: Code No. 12]: Analog input mode

(Factory Default: Voltage)

Range: Voltage

Current

Volt+Curr

**Filter gain** [ADV: Code No. 13]: Analog input filter gain

(Factory Default: 50 %)

Range: 0 - 100 %

**Analog gain** [ADV: Code No. 14]: Analog input scaling

(Factory Default: 100%)

Range: 50 - 250 %

**Analog bias** [ADV: Code No. 15]: Analog input bias

(Factory Default: 0.00%)

Range: 0 - 100 %

**Analog dir** [ADV: Code No. 16]: Analog input polarity

(Factory Default: Direct)

Range: Direct

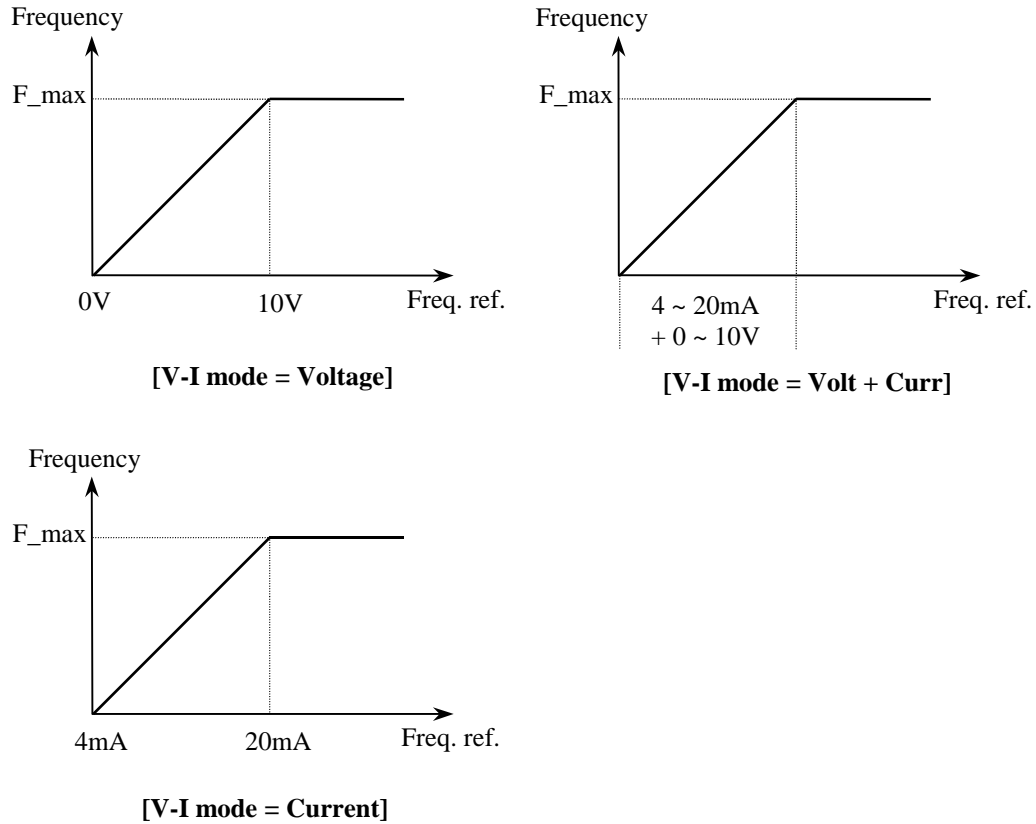
Invert

In order for the drive to receive its speed reference from an external source instead of the keypad Freq. Set [ADV: Code No. 02] must be set to Terminal. V-I Mode [ADV: Code No. 12] is used to select the analog frequency reference method. If a 0 ~ 10 VDC signal is the desired source of reference, then Voltage should be selected. If a 4 ~ 20 mA signal is the source of reference, then Current should be selected. When both of the signals are used, then Voltage+Current should be selected. See Fig. 5.3.1.

Filter Gain [ADV: Code No. 13] is used when the analog input source contains a lot of noise. This can result in speed oscillation. If this is the case, then increasing this value will help suppress the noise.

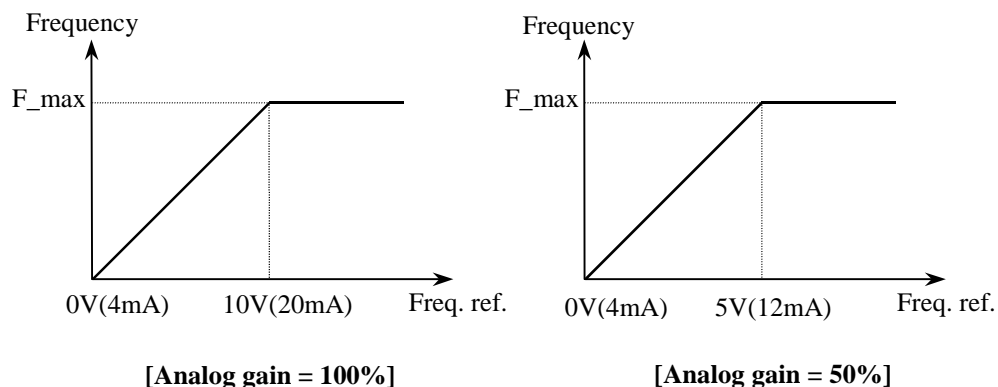
**Note:** The higher this value is, the slower the response.

Fig. 5.3.1: Analog Control Source Daigrams



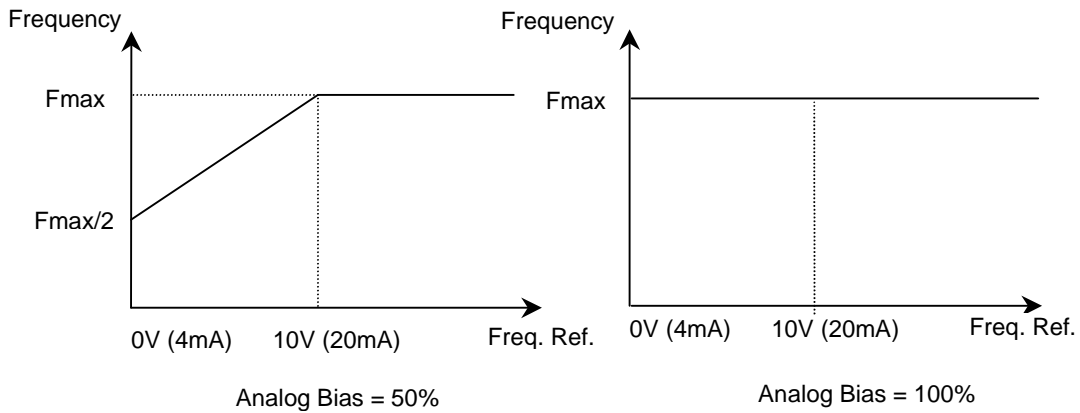
Analog gain [ADV: Code No. 14], establishes the correct ratio between the analog input signal and its maximum speed reference of the drive. For example, if the drive needs to accept +5 VDC analog signal as its maximum speed reference instead of +10 VDC, by setting Analog gain to 50% the drive will calculate its maximum analog input as  $10 \text{ VDC} \times (0.5) = 5 \text{ VDC}$ . This establishes a +5 VDC input signal as the maximum speed reference. See Fig. 5.3.2.

Fig. 5.3.2: Analog Input Gain



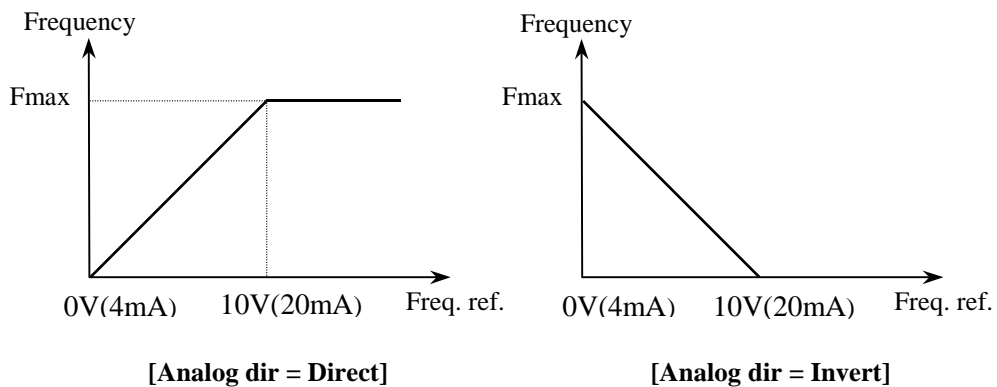
Analog bias [ADV: Code No. 15] is used to set the ratio between the minimum analog input signal and the minimum frequency reference. For example, if Analog bias is set at 50 % and the analog input signal is 0 VDC, then the drive will calculate its minimum speed reference (maximum Speed x Analog bias) which becomes half of the set maximum frequency. See Fig. 5.3.3.

Fig. 5.3.3: Analog Input Bias



Analog dir [ADV: Code No. 16] establishes the analog input versus frequency reference slope that is either a positive or negative slope. When set to Direct the analog command signal (0 ~ 10VDC or 4 ~ 20mA) represents an increasing or positive slope. When set to Invert then the signal (0 ~ 10VDC or 4 ~ 20mA) represents a decreasing or negative slope. See Fig. 5.3.4.

Fig. 5.3.4: Analog Reference Slope



### 5.3.6 Maximum / Minimum Operating Frequency

**F-limit high** [ADV: Code No. 18]: Maximum operating frequency

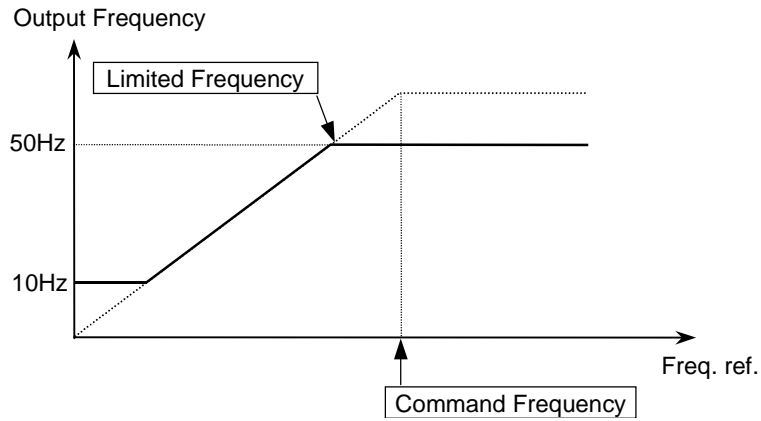
Range: ADV 19 Hz - SER 15 Hz. (Factory Default: 60.00 Hz)

**F-limit low** [ADV: Code No. 19]: Minimum operating frequency

Range: 0.00 - ADV 18 Hz. (Factory Default: 0.00 Hz)

The output frequency range of the drive is limited to the values set in Max Freq limit [ADV: Code No. 18] and Min Freq limit [ADV: Code No. 19]. See Fig. 5.3.5.

Fig. 5.3.5: Operational Maximum Frequency



### 5.3.7 Frequency to Bypass

**Freq.-Jump** [ADV: Code No. 20]: Selection of frequency jump function  
Range: Yes (Factory Default: No)  
No

**Freq.-Jump 1f** [ADV: Code No. 21]: Jump (bypass) frequency 1  
Range: 0 - SER 15 Hz. (Factory Default: 10.00 Hz.)

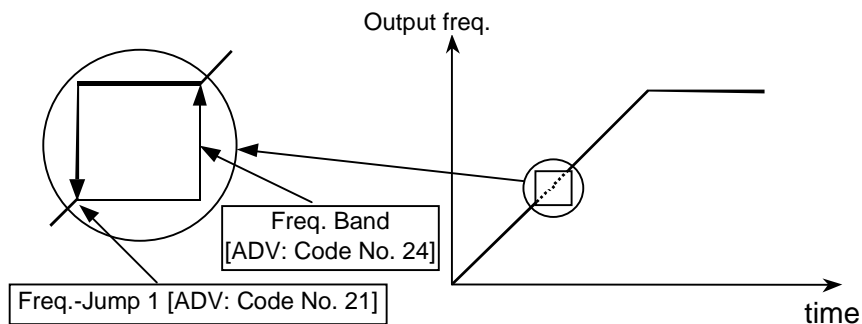
**Freq.-Jump 2f** [ADV: Code No. 22]: Jump (bypass) frequency 2  
Range: 0 - SER 15 Hz. (Factory Default: 20.00 Hz.)

**Freq.-Jump 3f** [ADV: Code No. 23]: Jump (bypass) frequency 3  
Range: 0 - SER 15 Hz. (Factory Default: 30.00 Hz.)

**Freq. band** [ADV: Code No. 24]: Jump (bypass) frequency bandwidth  
Range: 0.00 - 30.00 Hz. (Factory Default: 5.00 Hz.)

Undesirable resonance and vibration on the motor shaft of the hoist or crane could occur within a certain frequency range due to the structure of the machine. This frequency bypass function is used to lock that frequency band out of the operation. Most of the time, this phenomenon occurs only at a specific frequency. The jump frequency also has its own bandwidth. This is a span of the particular bypass frequency selected. See Fig. 5.3.6.

Fig. 5.3.6: Frequency Bypass





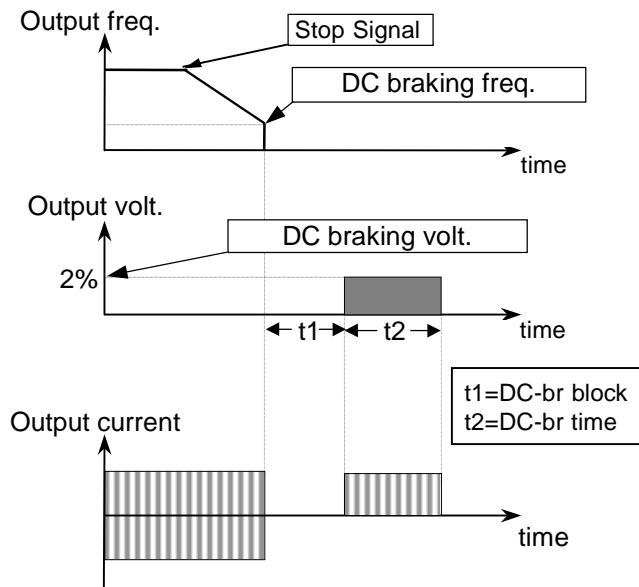
### 5.3.8 D.C. Injection Braking

- DC-br freq.** [ADV: Code No. 25]: DC brake injection frequency  
 Range: 0.00 - 60.00 Hz. (Factory Default: 3.00 Hz.)
- DC-br block** [ADV: Code No. 26]: Blocking time before DC injection  
 Range: 0.0 - 5.0 sec. (Factory Default: 1.0 sec.)
- DC-br time** [ADV: Code No. 27]: DC brake injection time  
 Range: 0.0 - 25.0 sec. (Factory Default: 0.5 sec.)
- DC-br value** [ADV: Code No. 28]: DC brake injection voltage  
 Range: 0 - 20 % (Factory Default: 2 %)

This function can be used to bring the motor to a quick stop without the use of Dynamic Braking Resistors. DC-br freq [ADV: Code No. 25] sets the starting frequency where the DC Injection begins. DC-br block [ADV: Code No. 26] is the time between the DC Injection command and the actual desired moment of DC injection output. DC-br time [ADV: Code No. 27] is the total braking time. DC-br value [ADV: Code No. 28] is the level of DC Injection Voltage Output (% of rated voltage). The DC Injection Braking can be selected by selecting DCBR in Stop mode [SER: Code No. 30]. This method can also be used to build up magnetic flux in the hoist motor for smooth starting motion. See Fig. 5.3.7. **Caution:** Do not set DC-br time to 0.0 seconds.

Fig. 5.3.7: DC Injection Braking

The hoist decelerates down to the DC Braking Frequency level first before DC Braking. Drive stops producing any Output voltage for t1. Drive will produce the DC braking voltage for t2.



### 5.3.9 Motor Data

In order for the drive to operate the motor with slip compensation, the name plate data of the motor must be programmed in correctly. Without this data, the drive output torque can be insufficient and could cause the motor to overheat in some instances.

**Slip compen** [ADV: Code No. 29]: Selection of slip compensation function  
Range: Yes (Factory Default: No)  
No

**Rated slip** [ADV: Code No. 30]: Rated motor slip  
Range: 0.00 - 5.00 Hz. (Factory Default: 0.00 Hz.)

**M-rated cur** [ADV: Code No. 31]: Rated motor current  
Range: 0.1 - 110 A (Factory Default: 0.1 A)

**No load Cur** [ADV: Code No. 32]: No load motor current  
Range: 0.1 - 50.0 A (Factory Default: 0.1 A)

Slip Compen [ADV: Code No. 29] is selected to compensate the motor for inherent slip. By selecting this function, the drive will hold a constant speed range by generating a higher frequency output to the motor. Refer to Section 3.3 for formulas to calculate these motor parameters.

M-rated cur [ADV: Code No. 31] and Noload cur [ADV: Code No. 32] are used by the drive to calculate drive trip values, ETH level and Phase loss.

### 5.3.10 Drive and Motor Protections

**Chk Ph open** [ADV: Code No. 33]: Selection of phase loss check function  
Range: Yes (Factory Default: Yes)  
No

**Ph Chk time** [ADV: Code No. 34]: Reference time of checking phase loss  
Range: 50 - 5000 msec. (Factory Default: 50 msec.)

The SV200 has a Phase Loss Detection feature. If the drive detects that there is not enough current output at one or more of the motor terminals the drive will fault on Phase Loss. Setting the value of Chk Ph open [ ADV: Code No. 33] to No will disable the phase loss detection feature.

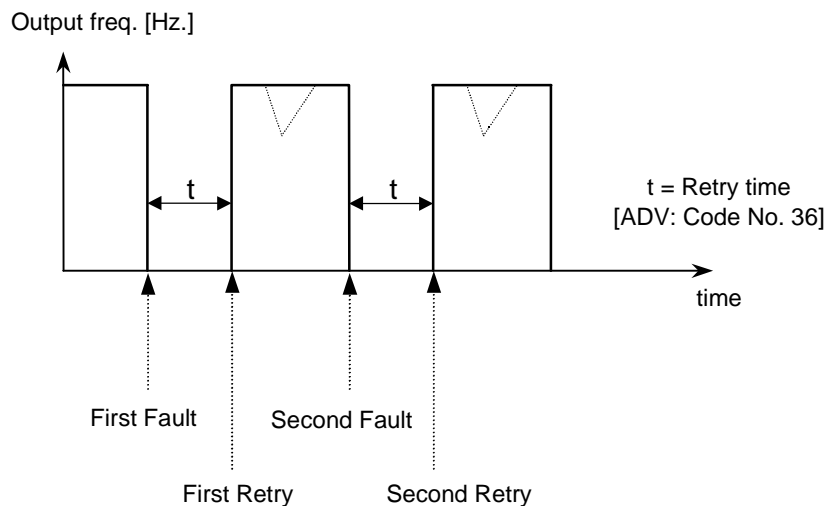
**Retry number** [ADV: Code No. 35]: Number of retries when drive faults  
 Range: 0 - 10 (Factory Default: 0)

**Retry time** [ADV: Code No. 36]: Waiting time before retrying  
 Range: 0.0 - 10.0 sec. (Factory Default: 1.0 sec.)

**Retry mode** [ADV: Code No. 37]: Mode of fault retry  
 Range: Retry 0 (Factory Default: Retry 0)  
 All Trips  
 LV + Retry 0  
 LV + All Trips

These functions are used so the drive can reset itself automatically from various drive faults (Over Voltage, Over Current, Ground Fault, Torque Limit Fault, etc.) except Under Voltage or BX fault. The operator can set the maximum number of auto-restart trials through Retry number [ADV: Code No. 35], and Retry Time [ADV: Code No. 36], see Fig. 5.3.8. The auto-restart works in conjunction with the Speed Search Mode, see Section 5.3.14.

Fig. 5.3.8: Retry Mode



**OL level** [ADV: Code No. 40]: Overload warning level  
 Range: 30 - 150% (Factory Default: 150%)

**OL Time** [ADV: Code No. 41]: Overload warning delay time  
 Range: 1.0 - 30.0 sec. (Factory Default: 10.0 sec.)

This function is used to provide a motor overload warning. When the output current of the drive has reached the value of OL level [ADV: Code No. 40] for an amount of time equal to OL Time [ADV: Code No. 41], a designated multi-function output terminal will be turned on. For an Overload warning to occur, a multi-function output must be set to OL, this function does not cause the drive to fault. See Section 5.2.4.

**OC lim level** [ADV: Code No. 42]: Overcurrent suppression level

Range: 30 - 200%

(Factory Default: 200%)

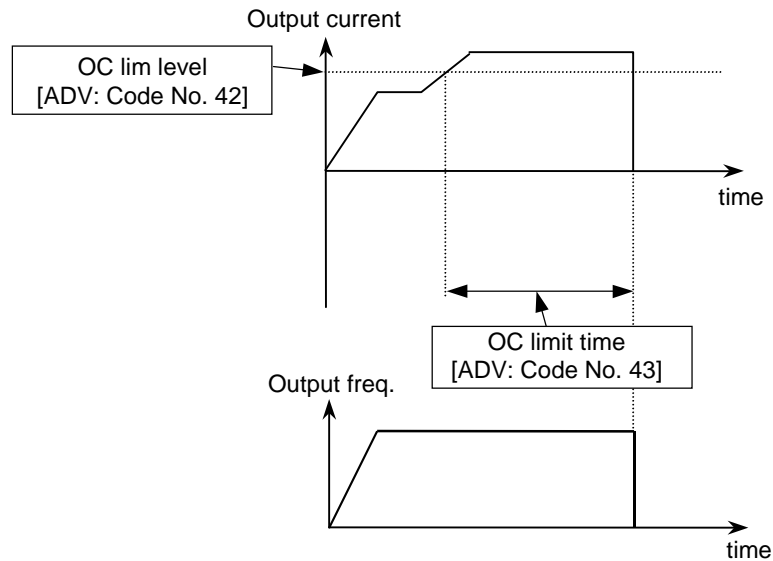
**OC lim Time** [ADV: Code No. 43]: Over-Current Limit Time

Range: 0.0 - 3600.0 sec.

(Factory Default: 0.1 sec. Hoist  
60.0 sec. Traverse)

When output current of the drive reaches OC lim level [ADV: Code No. 42] of rated output current of drive for a continuous time set in OC lim time [ADV: Code No. 43] due to excessive load, the O.C. (Over Current Fault) will occur and the motor will immediately stop. See Fig. 5.3.9.

Fig. 5.3.9: Overcurrent Limit Drive Response.



**ETH Select** [ADV: Code No. 44]: Mode of electronic thermal protection  
Range: None (Factory Default: None)  
Const Torq  
Vari Torq

**ETH level** [ADV: Code No. 45]: ETH Level  
Range: 30 - 150% (Factory Default: 150%)

**Motor Type** [ADV: Code No. 46]: Type of motor  
Range: General (Factory Default: General)  
Special

This function is used to compensate for excessive motor heat generated during long term low frequency operation. This is especially true if the capacity of the hoist motor is lower than that of the inverter. To prevent the motor from overheating, the ETH level [ADV: Code No. 45] must be set according to the provided formula.

$$\text{ETH level(\%)} = K \times (\text{Motor rated current} / \text{Inverter rated current}) \times 100\%$$
  
( K = 1.0 for 50Hz Input Power, K = 1.1 for 60 Hz Input Power)

Once the ETH level is found, then the Motor Type [ADV: Code No. 46] of the hoist must be determined. There are two electronic thermal motor characteristics, one is General pertaining to a standard AC induction motor, the other is Special for a special motor containing a blower. Once the correct values are programmed, the drive will determine the ETH time from a formula using M-rated cur [ADV: Code No. 31] and ETH level.

### 5.3.11 Stall Prevention

**Stall mode** [ADV: Code No. 38]: Stall prevention mode selection  
Range: None (Factory Default: None Hoist  
Acc Traverse)  
Acc  
Steady  
Acc+Steady  
Dec  
Acc+Dec  
Dec+Steady  
Acc+Dec+Steady

**Stall level** [ADV: Code No. 39]: Stall prevention level  
Range: 30 - 150% (Factory Default: 150%)

**NOTE: DO NOT USE STALL PREVENTION ON HOIST MOTION.  
GREAT CARE SHOULD BE EXERCISED WHEN SELECTING DECELERATION,  
“Dec”, AS A STALL PREVENTION MODE WHEN USING A DYNAMIC BRAKING  
RESISTOR.**

These functions are used to prevent the traverse faults that occur due to load fluctuation by reducing the inverter output frequency until the motor current level decreases below Stall level [ADV: Code No. 39]. Once the motor current level satisfies the value of Stall level, then the drive will increase its output frequency to its set point.

## ACCELERATION

If the output current of the drive has reached Stall level during drive acceleration, the drive will stop accelerating until the current level is reduced below Stall level before it resumes acceleration to a set frequency command. See Fig. 5.3.10.

## STEADY SPEED

If the output current of the drive has reached the Stall level during a steady speed period, due to load fluctuation, the drive will then reduce its output frequency until the output current level is reduced below Stall level. The drive will then increase its output frequency to a set frequency command. See Fig. 5.3.11.

## DECELERATION

If the DC BUS voltage reaches the O.V. fault level (800 VDC for the 460 VAC class, 400VDC for the 230 VAC class) during deceleration, the drive will stop further deceleration until DC Bus voltage drops below the fault level. See Fig. 5.3.12.

Fig. 5.3.10: Stall Prevention during Acceleration

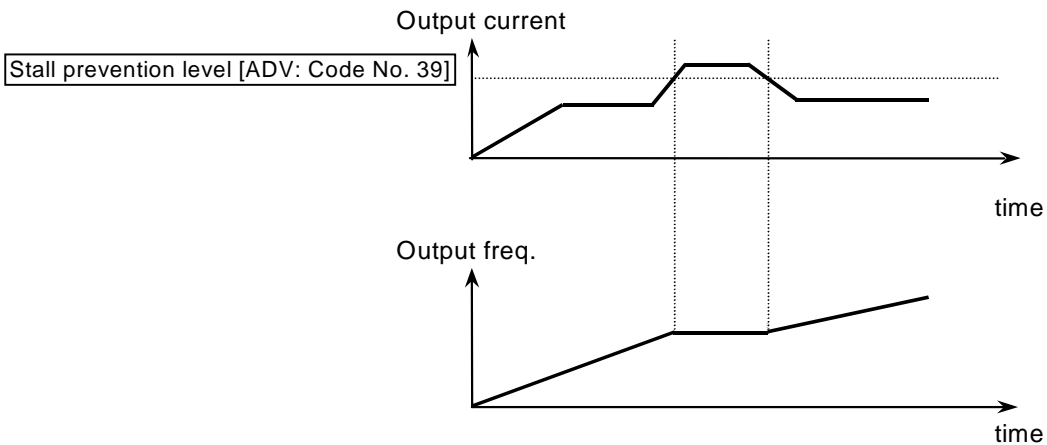
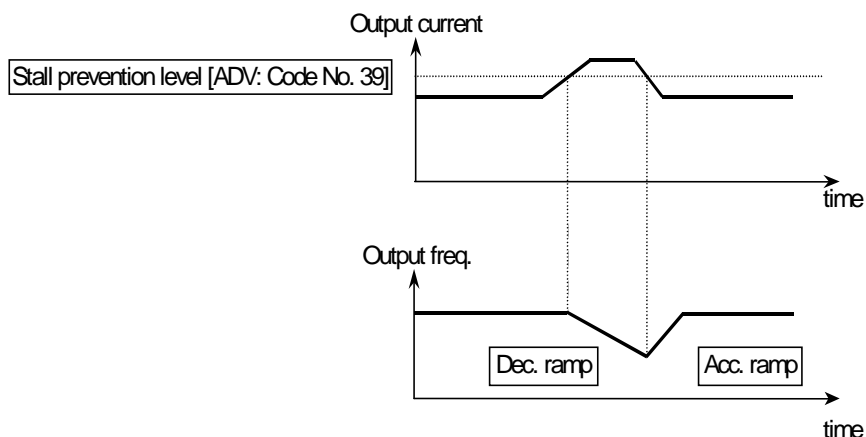
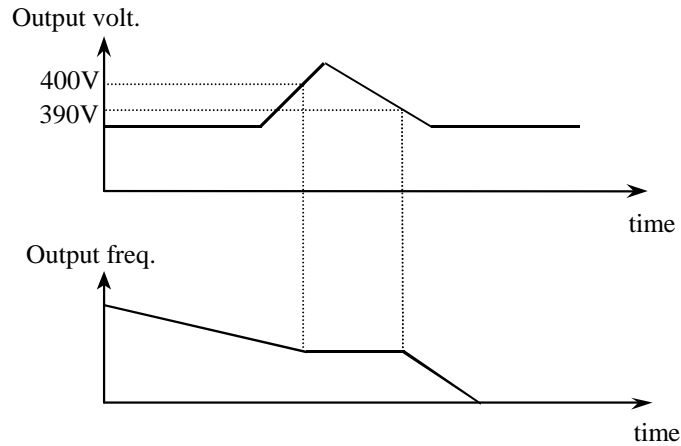


Fig. 5.3.11: Stall Prevention during Steady Speed

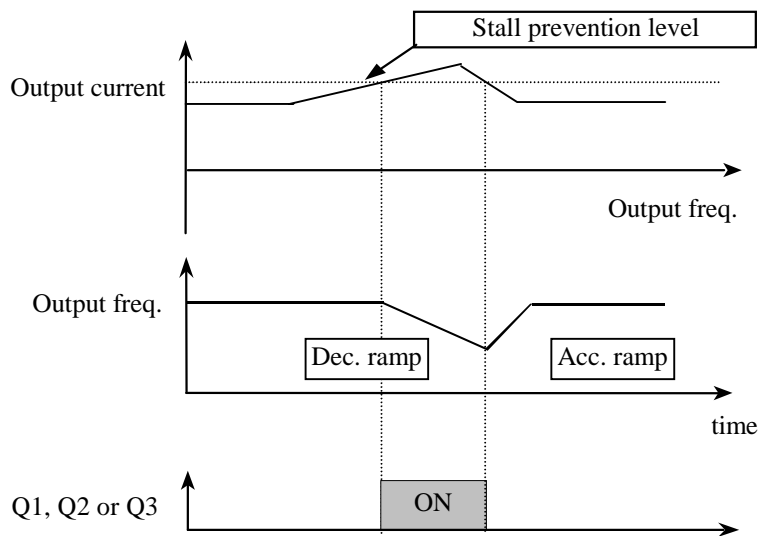


### 5.3.12: Stall Prevention during Deceleration-230V Class



Whenever the drive stalls, if a multi-function output terminal (AX1, Q1, Q2, or Q3) is designated to STALL the multi-function output will change state. This is true throughout the operation during acceleration, deceleration and steady state conditions. See Fig. 5.3.13.

Fig. 5.3.13: Stall Operation and Multi-Function Output Operation



### 5.3.12 Instantaneous Power Failure and Speed Search

**IPF select** [ADV: Code No. 47]: Instantaneous power failure function

Range: Yes

(Factory Default: No)

No

**SS acc. time** [ADV: Function No. 48]: Acceleration time for speed search

Range: 0.1 - 25.0 sec.

(Factory Default: 2.0 sec.)

**SS dec. time** [ADV: Function No. 49]: Deceleration time for speed search

Range: 0.1 - 25.0 sec.

(Factory Default: 3.0 sec.)

**SS blk. time** [ADV: Code No. 50]: Gate blocking time for speed search

Range: 0.0 - 10.0 sec.

(Factory Default: 0.3 sec.)

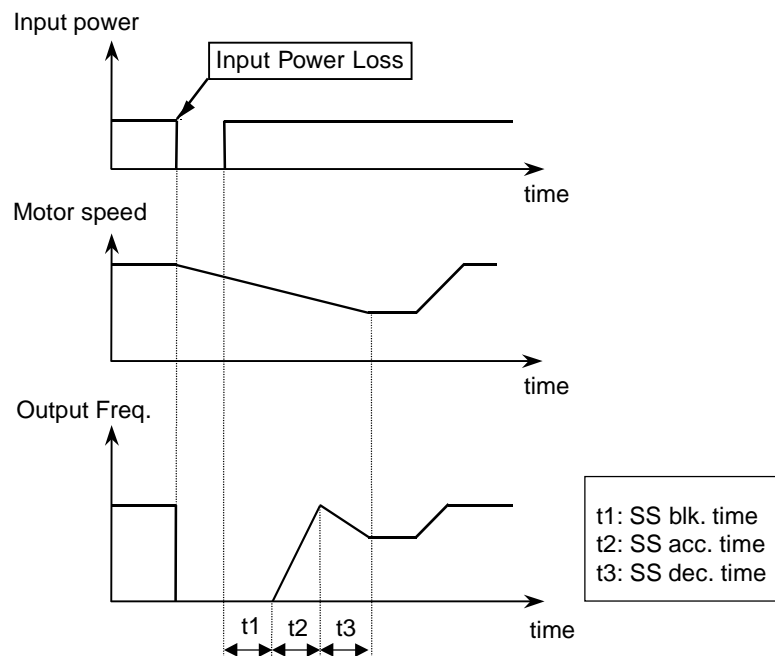
#### INSTANTANEOUS POWER FAILURE (IPF)

This function is used to initiate the automatic restart mode after an IPF of over 15 msec. in duration. After the drive resets itself from an IPF it begins to search for the current speed of the coasting motor following a time period equal to SS blk. time [ADV: Code No. 50]. Once the drive determines the speed of the motor, it then re-accelerates for a time equal to SS acc. time [ADV: Code No. 48]. The drive decelerates for a time equal to SS dec. time [ADV: Code No. 49], to allow the drive output to match the decelerating motor speed. The drive then accelerates to the previous set reference frequency. The SS blk. time, SS acc. time and SS dec. time must be set, considering the moment of inertia and the magnitude of torque demand of the load.

#### SPEED SEARCH

The Speed Search Mode is used when the drive needs to be restarted while a motor is coasting. This function is especially important if the motor has large load inertia. **IMPORTANT:** Without speed search, restarting into a coasting motor can result in overcurrent in the IGBT's.

Fig. 5.3.14: IPF Function





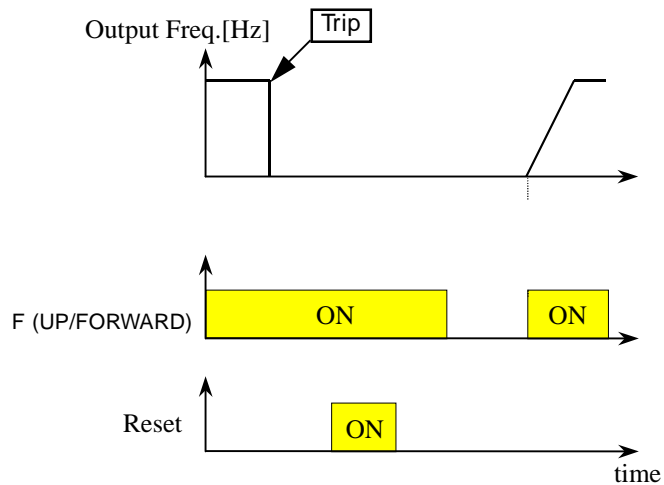
### 5.3.13 Restart After Reset

**RST restart** [ADV: Function No. 51]: Selection of reset restart function  
 Range: Yes (Factory Default: No)  
 No

When RST restart [ADV: Function No. 51] is set to Yes, the drive can be selected to have itself initiate auto-restart mode after the manual reset. If this parameter is set to No, then the drive needs to receive the RUN command after the manual reset.

Fig. 5.3.15: Reset Restart Inactive

When RST restart function is No, F (Forward) or R (Reverse) pendant buttons must be released then pushed again after a manual reset in order to run the drive again.



### INPUT POWER DETECTED AUTO-RESTART

**Power on st** [ADV: Function No. 52]: Selection of power-on restart function  
 Range: Yes (Factory Default: No)  
 No

When either F (UP/FORWARD) input terminal or R (DOWN/REVERSE) input terminal is energized and the input power is restored, the drive will initiate the auto-restart automatically when Power on st is set to Yes. See Figs. 5.3.16 and 5.3.17.

When Power on st is set to No, the drive will not run at the time of the Power Up Sequence. An external or keypad Run Command must be given in order to restart the drive.

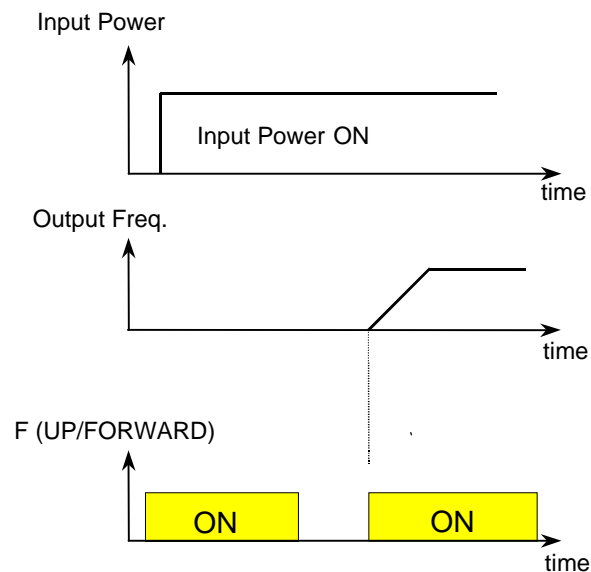
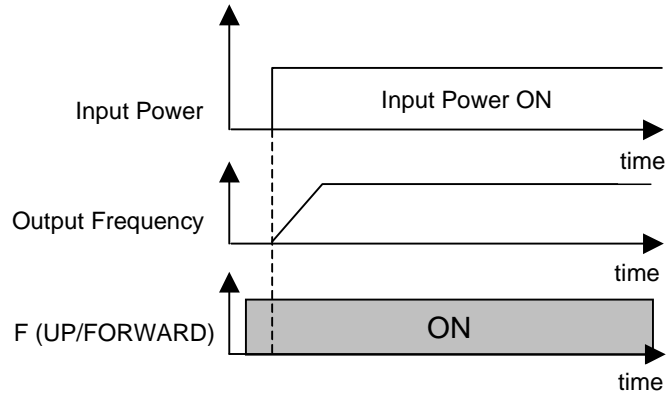


Fig. 5.3.17: Power On Start Active

When Power On Start is set Active, the drive will run at the time of the Power Up sequence.



### 5.3.14 Carrier Frequency

**Carrier freq.** [ADV: Code No. 53]: Carrier frequency of PWM modulator  
Range: 3 - 15 kHz. (Factory Default: 10 kHz.)

This is the Insulated Gate Bi-Polar Transistor (IGBT) switching frequency. This function is generally used to prevent harmonic resonance in machines and motors. If this Pulse Width Modulation (PWM) carrier frequency is set at a high level, the audible noise can be reduced, however the electrical noise, current leakage, and switching loss may increase. Generally, the carrier frequency is set to a lower value in high ambient temperature environments.

### 5.3.15 Two Motor Applications

<b>Drive freq. 2</b> [ADV: Code No. 54]: Motor no. 2 frequency 0 - SER 15 Hz.	Range: (Factory Default: 0 Hz.)
<b>Acc. time 2</b> [ADV: Code No. 55]: Motor no. 2 acceleration time Range: 0 - 6000.0 sec.	(Factory Default: 5.0 sec.)
<b>Dec. time 2</b> [ADV: Code No. 56]: Motor no. 2 deceleration time Range: 0 - 6000.0 sec.	(Factory Default: 10.0 sec.)
<b>Freq. base 2</b> [ADV: Code No. 57]: Motor no. 2 base frequency Range: 40 - SER 15 Hz.	(Factory Default: 60.00 Hz.)
<b>V/F pattern 2</b> [ADV: Code No. 58]: Motor no. 2 V/F pattern Range: Linear 2.0 User Auto boost	(Factory Default: Linear)
<b>Fwd boost</b> [ADV: Code No. 59]: Motor no. 2 forward boost Range: 0 - 20%	(Factory Default: 2%)
<b>Rev boost</b> [ADV: Code No. 60]: Motor no. 2 reverse boost Range: 0 - 20%	(Factory Default: 2%)
<b>Stall level 2</b> [ADV: Code No. 61]: Motor no. 2 stall level Range: 30 - 150%	(Factory Default: 150%)
<b>ETH level 2</b> [ADV: Code No. 62]: Motor no. 2 ETH level Range: 30 - 150%	(Factory Default: 150%)

These functions are for controlling a second motor with the drive and are not available.

### 5.3.16 Closed Loop Speed Control

<b>PI control</b> [ADV: Code No. 63]: Selection of internal PI function Range: None Steady - N Steady - R	(Factory Default: None)
<b>P-gain</b> [ADV: Code No. 64]: P gain of internal PI controller Range: 0 - 30000	(Factory Default: 10)
<b>I-gain</b> [ADV: Code No. 65]: I gain of internal PI controller 0 - 30000	Range: (Factory Default: 50)
<b>PI-FB offset</b> [ADV: Code No. 66]: Offset (bias) of PI feedback signal Range: 0 - 50%	(Factory Default: 0%)
<b>PI-FB scale</b> [ADV: Code No. 67]: Scaling factor of PI feedback signal Range: 1 - 250%	(Factory Default: 100%)

The drive has a built in Proportional - Integral closed loop controller. It requires an analog feedback reference to control the motor speed. Consult the factory for more information.

### 5.3.17 Rotation Direction Prevention

**Run Prev.** [ADV: Code No. 68]: Prevention of one direction of rotation  
 Range: None (Factory Default: None)  
 Reverse Prev.  
 Forward Prev.

This function will prevent the drive from turning the motor in one or the other direction.

### 5.3.18 Jog Frequency

**Jog frequency** [ADV: Code No. 69]: Jogging frequency  
 Range: 0 - SER 15 Hz. (Factory Default: 30.00 Hz.)

The frequency the drive sends to the motor when using the jog command.

### 5.3.19 Output Current, Voltage and Frequency

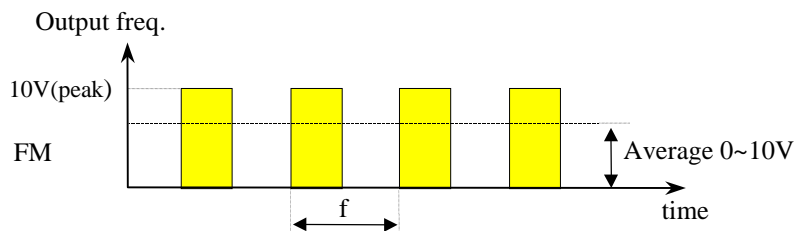
**Analog meter** [ADV: Code No. 70]: Mode of analog meter  
 Range: Voltage (Factory Default: Voltage)  
 Current

**Analog adjust** [ADV: Code No. 71]: Adjustment of analog meter  
 Range: 0 - 120% (Factory Default: 100%)

**FM adjust** [ADV: Code No. 72]: Adjustment of frequency meter  
 Range: 0 - 120% (Factory Default: 100%)

Drive has an LM terminal and an FM terminal which can be programmed to generate either drive voltage or current output (LM terminal) and drive output frequency (FM terminal) measurements in 0 ~ 10VDC pulse signal. See Fig. 5.3.18, which shows frequency meter, but the LM terminal works the same. The measurement selection for drive output voltage or current can be programmed in Analog meter [ADV: Code No. 70]. When a different ratio between LM, or FM, output and actual drive voltage or current measurement is required, the value of Analog adjust [ADV: Code No. 71] for LM and FM adjust [ADV: Code No. 72] for FM can be set at values which will meet the ratio requirements.

See Fig. 5.3.18: Multi-meter Output



<p>Frequency meter frequency(f) =  <math>(\text{Output frequency} / \text{Maximum frequency}) * 1.8 \text{ kHz}</math>          Duty (%) = <math>(\text{Output frequency} / \text{Maximum frequency}) * 2/3</math>          Frequency meter voltage =  <math>(\text{Output frequency} / \text{Maximum frequency}) * 10V</math></p>
--

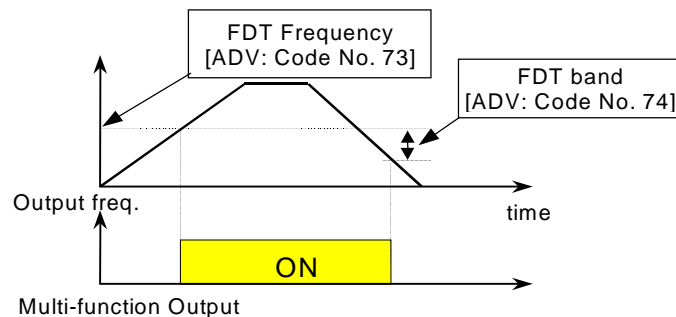
### 5.3.20 Frequency Detection

**FDT-freq.** [ADV: Code No. 73] Frequency detection level  
Range: 0.50 - SER 15 Hz. (Factory Default: 60.0 Hz)

**FDT-band** [ADV: Code No. 74] Frequency detection band  
Range: 0.00 - 30.0 Hz. (Factory Default: 1.00 Hz)

This function is used to operate one of the multi-function outputs. If a Multi-Function Output is programmed for FDT\_HI the output signal is set once the drive reaches FDT frequency [ADV: Code No. 73], and resets when the drive frequency falls below FDT frequency less FDT band [ADV: Code No. 74]. See Fig. 5.3.19. If a Multi-Function Output is programmed for FDT\_PULSE the output pulses as the increasing frequency passes through FDT frequency and again as the decreasing frequency passes through FDT frequency less FDT band. If a Multi-Function Output is programmed for FDT\_BAND the output sets when the drive output is at the requested frequency plus or minus the FDT band. See Section 5.2.4 for more information regarding the Multi-function output.

Fig. 5.3.19 FDT\_HI Functions Diagram



### 5.3.21 Speed Display Scaling Factor

**Mul factor** [ADV: Code No. 75] Scaling factor for USE 04 display  
Range: 0 - 999 (Factory Default: 100)

**Div factor** [ADV: Code No. 76] Scaling factor for USE 04 display  
Range: 1 - 999 (Factory Default: 100)

This function is used to scale the display Speed [USE: Code No. 04]. The values in Mul factor [ADV: Code No. 75] and Div factor [ADV: Code No. 76] can be adjusted to account for gear ratios.

### 5.3.22 LED Check

**LED check** [ADV: Code No. 77] This function is not used.

### 5.3.23 Option Card

**Option** [ADV: Code No. 78]: Option (Interface) card

Range: None (Factory Default: None)

RS485

PG

DI/DA

PLC

CAN

**Inv. Number** [ADV: Code No. 79]: RS 485 Inverter address

Range: 1 - 32 (Factory Default: 1)

**Baud Rate** [ADV: Code No. 80]: RS 485 baud rate

Range: 1200 bps (Factory Default: 9600 bps)

2400 bps

4800 bps

9600 bps

19200 bps

**PG slip freq.** [ADV: Code No. 81]: rated slip of motor

Range: 0.00 - 5.00 Hz. (Factory Default: 2.00 Hz.)

**PG P gain** [ADV: Code No. 82]: P gain of PG option

Range: 1 - 255 (Factory Default: 100)

**PG I gain** [ADV: Code No. 83]: I gain of PG option

Range: 1 - 255 (Factory Default: 10)

**Enc. signal** [ADV: Code No. 84]: Encoder type

Range: A + B (Factory Default: A + B)

A only

**Enc pulse** [ADV: Code No. 85]: Pulses per revolution

Range: 360 (Factory Default: 1024)

500

512

1000

1024

2000

2048

4000

4096

**DI mode** [ADV: Code No. 86]: Mode of digital input option card

Range: None (Factory Default: Freq.)

Freq.

**DA mode** [ADV: Code No. 87]: Mode of digital output option card

Range: Freq. (Factory Default: Freq.)

Voltage

Current

**Remote T. Out** [ADV: Code No. 88]: RS 485/PLC/CAN option

Range: 0.0 - 600.0 sec. (Factory Default: 0.0 sec.)

These functions relate to a set of option cards for the drive. If more information is required about these functions please consult the factory.

### 5.3.24 Reverse Plugging

**Rev Plug** [ADV: Code No. 89]: Reverse Plug enable

Range: Yes  
No

(Factory Default: No)

**Rev. Plug Acc.** [ADV: Code No. 90] Acceleration time for reverse plugging

Range: 0 - 6000 sec.

(Factory Default: 1.5 sec.)

**Rev. Plug Dec.** [ADV: Code No. 91]: Deceration time for reverse plugging

Range: 0 - 6000 sec.

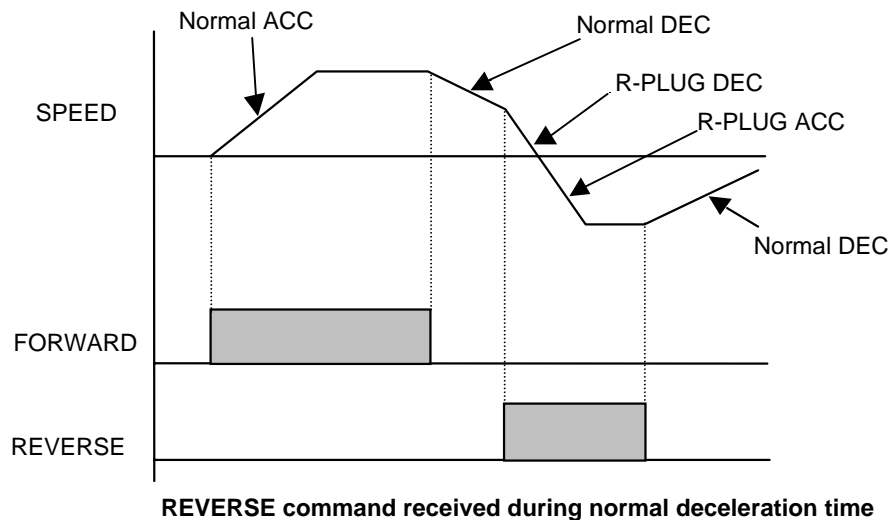
(Factory Default: 1.5 sec.)

Reverse plugging allows for a smooth and quick transition from one direction to the opposite direction with minimal load swing.

**Note: To be used for traversing applications only.**

Motors may need to be oversized from standard motor size calculaions by approximately 50% to be able to handle the extra current required to be able to reverse plug motors with loads near equipment capacity.

Fig. 5.3.20: Reverse Plugging



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# **Chapter 6: Maintenance**

**Section 6.1: Maintenance**

**Section 6.2: Precautions**

**Section 6.3: Routine Inspection**

**Section 6.4: Visual Inspection**

## 6.1 Maintenance

SV200 Series can be influenced by temperature, humidity, and vibration. To avoid any possible uncertainty, the drive must be installed and maintained properly by trained personnel.

## 6.2 Precaution

Only certified personnel familiar with the equipment are permitted to install, operate and maintain the drive.

Observe the Charge LED on the drive to be sure of complete power dissipation.

The output voltage of your SV200 drive can only be measured by a rectifier voltage meter (such as an RMS meter). Other instruments such as a digital meter will read an incorrect value due to the high switching PWM frequency.

## 6.3 Routine Inspection

Check Input-Line Voltage to the drive for any fluctuation.

Check the Cooling Fan. If there is any abnormal noise, replace.

Check for any physical vibration to the drive.

Check the temperature for any overheating.

## 6.4 Visual Inspection

Any loose screws, nuts, or wires?

→ Tighten or replace.

Any deposit of dust or foreign material in the AC Drive or Cooling Fan?

→ Clean off the dust or foreign material.

Are any connectors disconnected from printed circuit boards?

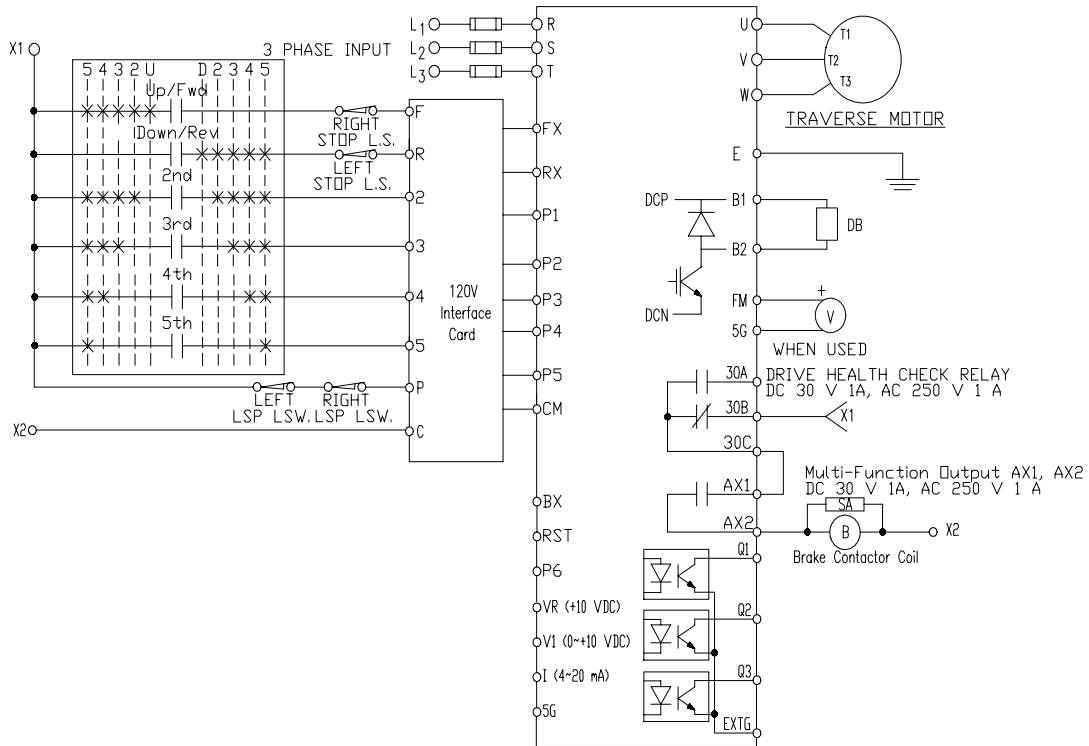
→ Re-insert the connector.

Inspect for corrosion.

→ Clean where possible or replace.

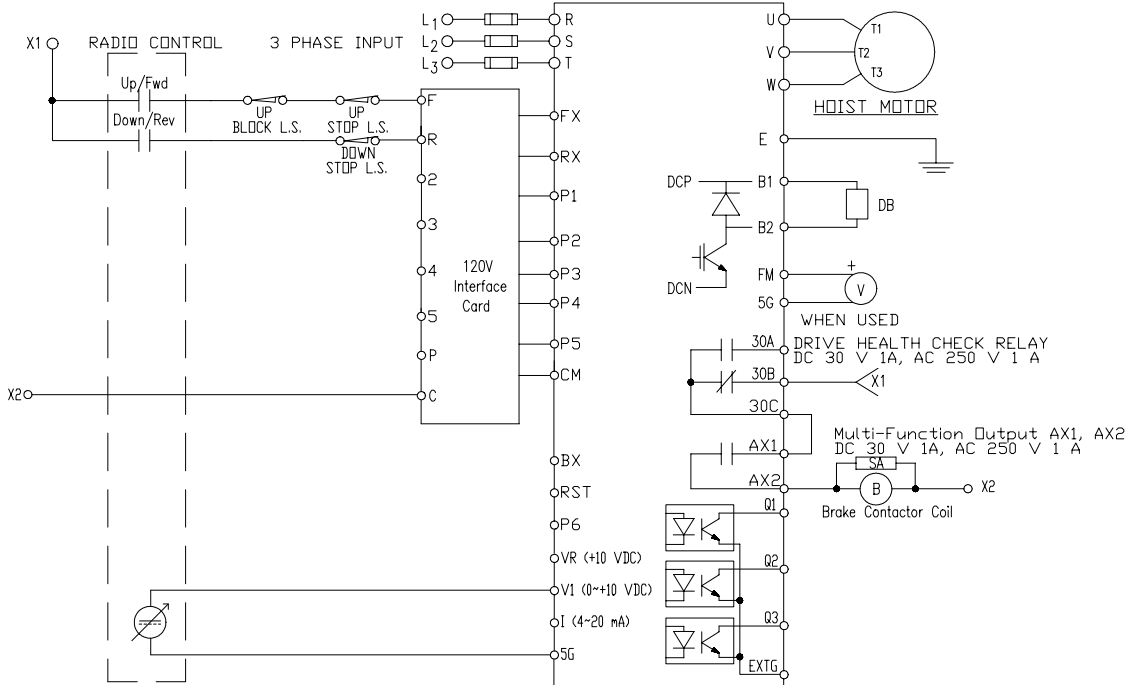
# Appendix

Appendix Fig. 1: Sample Traverse Wiring Diagram



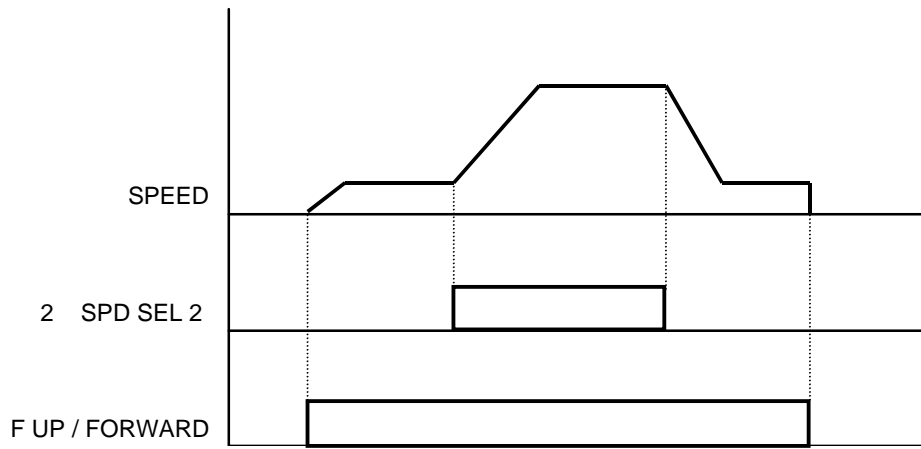
Traverse Wiring Diagram Example: P5 Input [SER: Code No. 08] set for LSW Low Spd.

Appendix Fig. 2: Sample Hoist Wiring Diagram with Analog Control

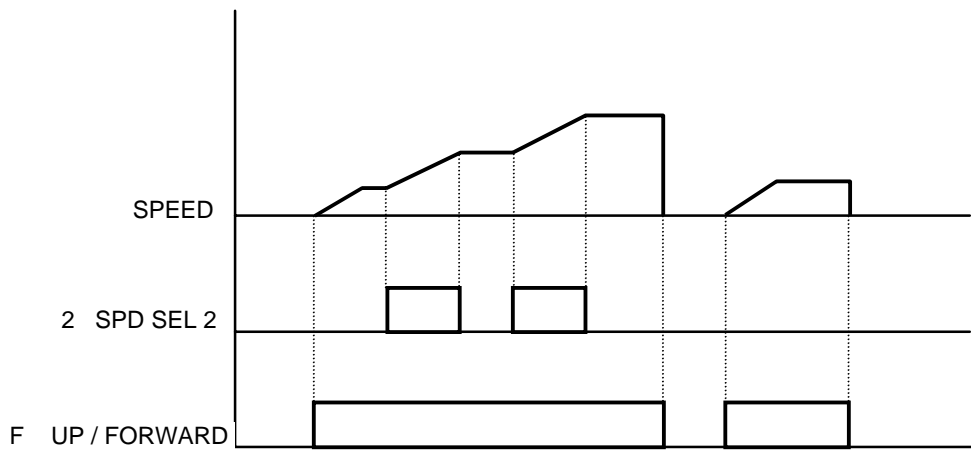


Hoist Wiring Diagram Example: Freq. set [ADV: Code No. 02] set for Terminal.

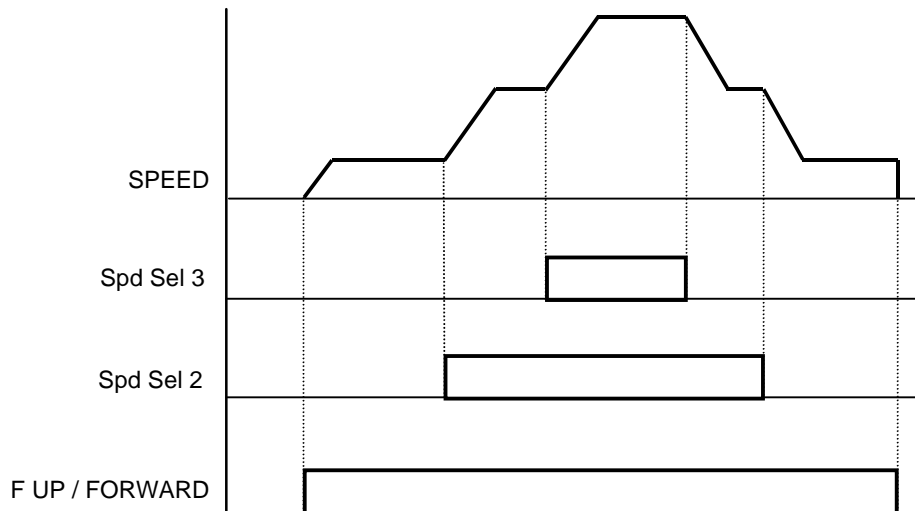
Appendix Fig. 3: 2 Speed Control



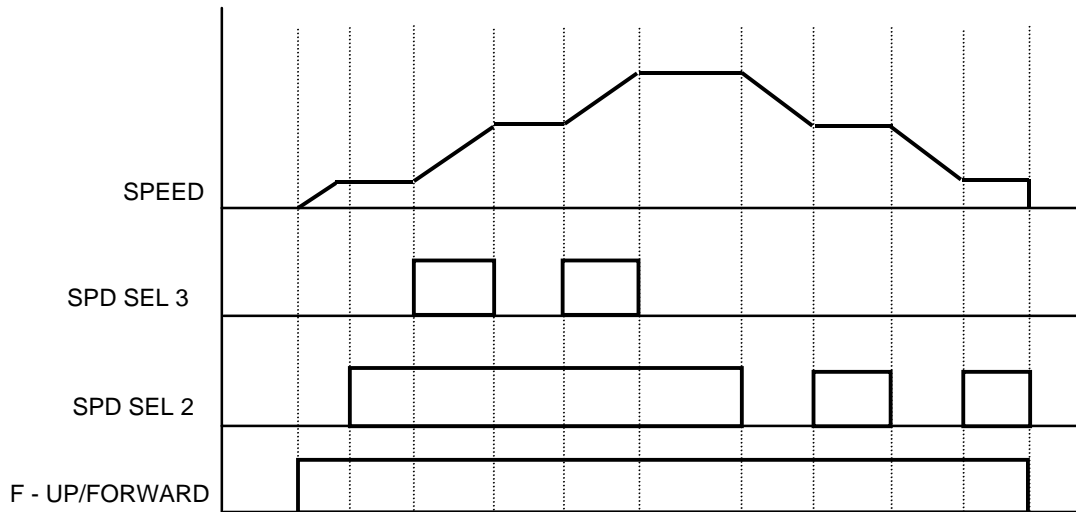
Appendix Fig. 4: 2 Step Infinitely Variable Control



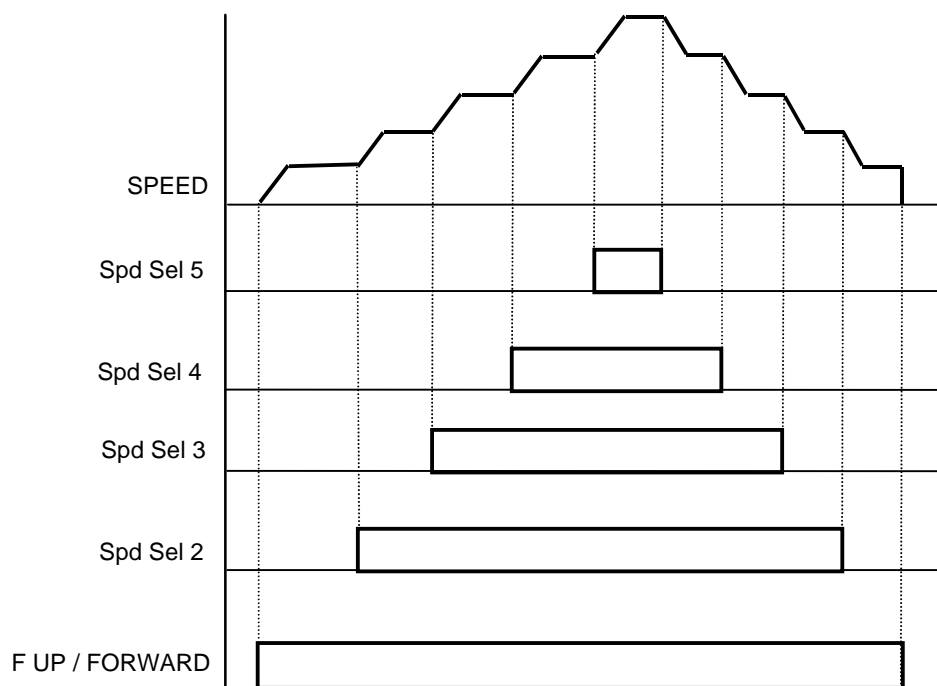
Appendix Fig. 5: 3 Speed Control



Appendix Fig. 6: 3 Step Infinitely Variable Control



Appendix Fig. 7: 5 Speed Control









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# WARRANTY

## WARRANTY AND LIMITATION OF REMEDY AND LIABILITY

A. Seller warrants that its products and parts, when shipped, and its work (including installation, construction and start-up), when performed, will meet applicable specifications, will be of good quality and will be free from defects in material and workmanship. All claims for defective products or parts under this warranty must be made in writing immediately upon discovery and, in any event, within two (2) years (or as otherwise provided) from shipment of the applicable item unless Seller specifically assumes installation, construction or start-up responsibility. All claims for defective products or parts when Seller specifically assumes installation, construction or start-up responsibility, and all claims for defective work must be made in writing immediately upon discovery and, in any event, within two (2) years (or as otherwise provided) from completion of the applicable work by Seller, provided, however, all claims for defective products and parts must be made in writing no later than thirty (30) months after shipment. Defective items must be held for Seller's inspection and returned to the original f.o.b. point upon request. **THE FOREGOING IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES WHATSOEVER, EXPRESS, IMPLIED AND STATUTORY, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS.**

B. Upon Buyer's submission of a claim as provided above and its substantiation, Seller shall, at its option, either (i) repair or replace its product, part or work at either the original f.o.b. point of delivery or at Seller's authorized service station nearest Buyer or (ii) refund an equitable portion of the purchase price.

C. This warranty is contingent upon Buyer's proper maintenance and care of Seller's products, and does not extend to normal wear and tear. Seller reserves the right to void warranty in event of Buyer's use of inappropriate materials in the course of repair or maintenance, or if Seller's products have been dismantled prior to submission to Seller for warranty inspection.

D. The foregoing is Seller's only obligation and Buyer's exclusive remedy for breach of warranty, and is Buyer's exclusive remedy hereunder by way of breach of contract, tort, strict liability or otherwise. In no event shall Buyer be entitled to or Seller liable for incidental or consequential damages. Any action for breach of this warranty must be commenced within two (2) years (or as otherwise provided) after the cause of action has accrued.