Publication #890020-02-03

BENSHAW
ADVANCED CONTROLS & DRIVES

RSi SX Series

Sensorless Vector Drive
Parameter Configuration Manual

1 to 30HP - 230V CT/VT
1 to 150/200HP - 460V CT/VT
1 to 150/200HP - 600V CT/VT

The Leader In

Solid State Motor Control

Technology

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SAFETY PRECAUTIONS

WARNING

1. *This inverter contains high voltage which can cause electric shock resulting in personal injury or loss of life.*
2. *Be sure all AC power is removed from the inverter before servicing.*
3. *Wait at least 5 minutes after turning off the AC power for the bus capacitor to discharge. Measure the DC Bus charge between B+ and B- terminals, ensure DC voltage is below 45V before proceeding.*
4. *Do not connect or disconnect the wires to or from inverter when power is applied.*

CAUTION

1. *Service only by qualified personnel.*
2. *Make sure power-up restart is off to prevent any unexpected operation of the motor.*
3. *Make sure ground connection is in place.*
4. *Make certain proper shield installation is in place.*
5. *Never connect the input power leads to the output terminals of inverter.*

TABLE OF CONTENTS

1 Introduction

USING THIS MANUAL

Layout

This manual is divided into 7 sections. Each section contains topics related to the section. The sections are as follows:

- Introduction
- Technical Specifications
- Installation
- Connection
- Troubleshooting & Maintenance
- Interference Suppression Measures
- Appendices

Symbols

There are 2 symbols used in this manual to highlight important information. The symbols appear as the following:

Electrical Hazard that could result in injury or death.

Caution that could result in damage to the inverter.
Highlight marking an important point in the documentation.

BENSHAW SERVICES

General Information

Benshaw offers its customers the following:

- Start-up services
- On-site training services
- Technical support
- Detailed documentation
- Replacement parts

⌘ **NOTE:** Information about products and services is available by contacting Benshaw.

Start-Up Services

Benshaw technical field support personnel are available to conduct on-site training on RSi SX operations and troubleshooting.

On-Site Training Services

Benshaw technical field support personnel are available to conduct on-site training on RSi SX operations and troubleshooting.

Technical Support

Benshaw technical support personnel are available (at no charge) to answer customer questions and provide technical support over the telephone. For more information about contacting technical support personnel, refer to Contacting Benshaw on page 4.

Documentation

Benshaw provides all customers with:

- Hardware Manual - Production # 890020-01
- Parameter Configuration Manual - Production # 890020-02
- Quickstart Reference Guide - Production # 890020-03
- Specification Guide - Production # 890020-04
- Enhanced Keypad Manual - Production # 890020-05
- DeviceNet Manual - Production # 890020-06
- VFD Application Questionnaire - Production # 890020-07
- Reflash Tool Manual - Production # 890020-11
- NEMA 12 Manual - Production # 890020-12
- VFD Start up Questionnaire - Production # 890020-13
- Standard Keypad Mounting Manual - Production # 890020-14
- Application Specific Software Manual - Production # 890020-15

On-Line Documentation

All RSi SX documentation is available on-line at **http://www.benshaw.com**.

Replacement Parts

Spare and replacement parts can be purchased from Benshaw.

Software Number

This manual pertains to the software version number 1.23 and 1.23 MAP.

Publication History

See page 189.

CONTACTING BENSHAW

Contacting Benshaw

Information about Benshaw products and services is available by contacting Benshaw at one of the following offices:

Benshaw Inc. Corporate Headquarters
1659 E. Sutter Road
Glenshaw, PA 15116
United States of America
Phone: (412) 487-8235
Fax: (412) 487-4201

Benshaw Canada Controls Inc.
550 Bright Street
Listowel, Ontario N4W 3W3
Canada
Phone: (519) 291-5112
Fax: (519) 291-2595

Benshaw West
7820 E. Evans Drive, Suite 900
Scottsdale, AZ 85260
United States of America
Phone: (480) 905-0601
Fax: (480) 905-0757

Technical support for RSi SX Series is available at no charge by contacting Benshaw's **Technical Support Center, for USA 1-800-203-2416, Canada 519-291-5112** customer service department at one of the above telephone numbers. A service technician is available Monday through Friday from 8:00 a.m. to 5:00 p.m. EST.

⌘ **NOTE:** An on-call technician is available after normal business hours and on weekends by calling Benshaw and following the recorded instructions.

To help assure prompt and accurate service, please have the following information available when contacting Benshaw:

- Name of Company
- Telephone number where the caller can be contacted
- Fax number of caller
- Benshaw product name
- Benshaw model number
- Benshaw serial number
- Name of product distributor
- Approximate date of purchase
- System Voltage
- FLA of motor attached to Benshaw product
- A brief description of the application

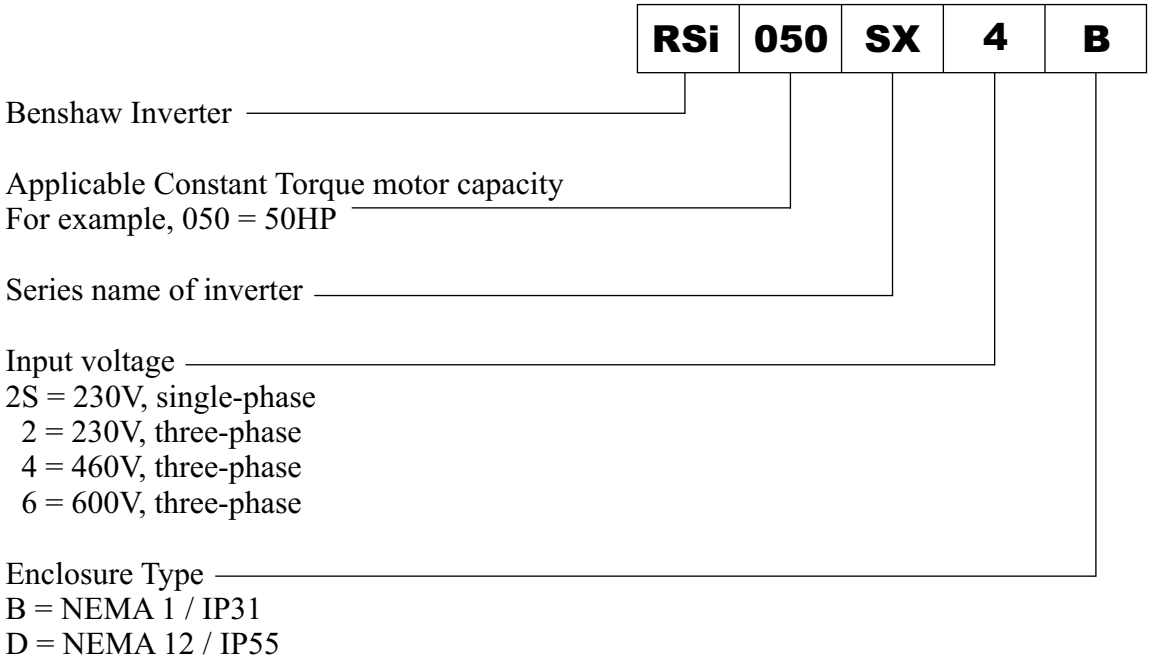
INTERPRETING MODEL NUMBERS

Inspection

Before storing or installing the RSi SX drive, thoroughly inspect the device for possible shipping damage. Upon receipt:

- Remove the drive from its package and inspect exterior for shipping damage. If damage is apparent, notify the shipping agent and your sales representative.
- Remove the cover and inspect the drive for any apparent damage or foreign objects. Ensure that all mounting hardware and terminal connection hardware is properly seated, securely fastened, and undamaged.
- Read the technical data label affixed to the drive and ensure that the correct horsepower and input voltage for the application has been purchased. The numbering system for a Benshaw inverter is as below.

Figure 1: RSi SX Drive Model Numbers



Notes:

2 Operation

INTRODUCTION

2.1 Introduction

The RSi SX drive provides a comprehensive set of parameters to allow you to use the drive in nearly any industrial application. While the drive can meet the requirements of many applications right out of the box, customization of parameter values to better suit your particular application is easily accomplished with the standard keypad, with the enhanced keypad (see Options chapter on page 163), or via serial communication.

This section describes the standard keypad and remote communication as well as setting up security for the RSi SX drive and programming control paths.

DESCRIPTION OF THE STANDARD KEYPAD

2.2 Description of the Standard Keypad

2.2.1 Overview

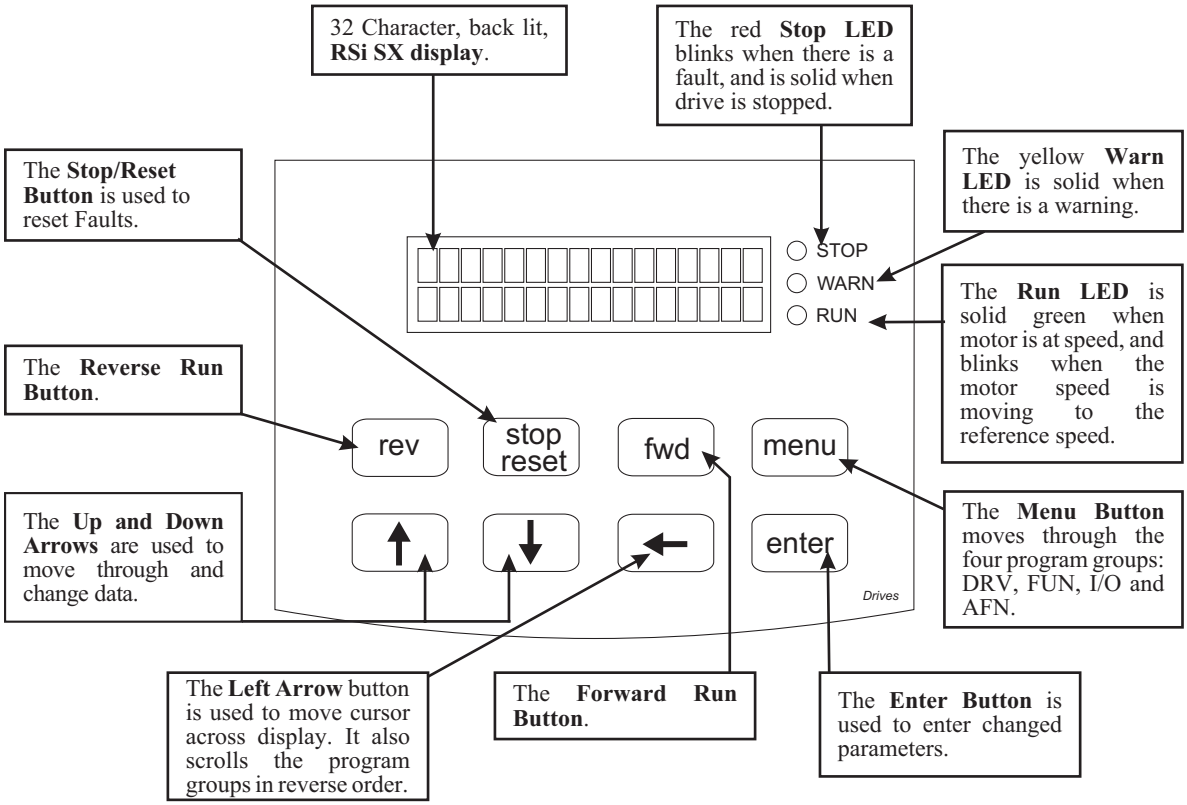
The standard keypad is located on the face of the RSi SX drive, and provides local control and programming of the drive. Figure 2 shows the keypad.

This keypad provides access to a comprehensive set of parameters that allow the RSi SX drive to meet the needs of almost any application.

2.2.2 Display

The RSi SX keypad can display up to 32 alphanumeric characters. Various settings can be checked directly from the display. The following is an illustration of the keypad.

Figure 2: The Standard Keypad for RSi SX Drives



ALPHA-NUMERIC DISPLAY

2.3 Alpha-Numeric Display

The RSi SX uses a 32-character alpha-numeric LCD display for its human-machine interface. All drive functions can be accessed by the keypad. The keypad allows easy access to drive programming with parameter descriptions on the LCD display.

The following three figures are examples of what is shown in the display window of the Standard Keypad during Drive (DRV), Function (FUN), Input/Output (I/O), Advanced Function (AFN) and Fault Modes (AF/FH).

Figure 3: Operate Mode

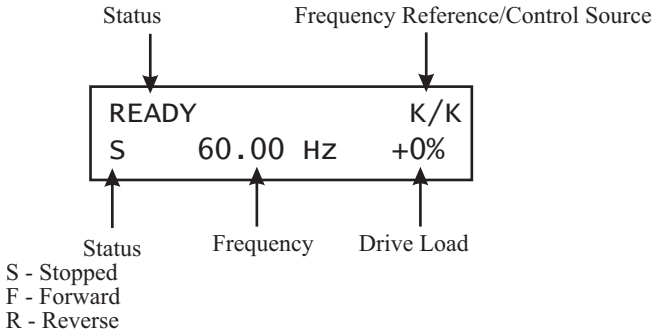


Figure 4: Function, I/O & AFN Modes

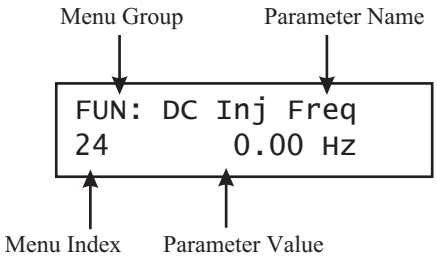
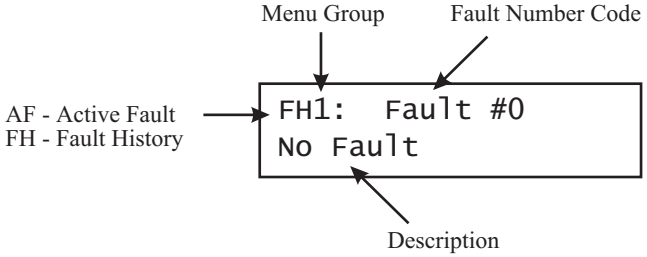


Figure 5: Fault Mode



PROCEDURE OF SETTING DATA

2.4 Procedure of Setting Data

To change command frequency from 0.00Hz to 4.50Hz:

Ready K/K S 0.00Hz +0%	enter	Press [ENTER] key and the display shows Reference screen.
Enter Reference 0.00 Hz	◀	Press [LEFT] key once to move cursor.
Enter Reference 0.50 Hz	▲	Press [UP] key 5 times to increment highlighted digit.
Enter Reference 0.50 Hz	◀	Press [LEFT] key to shift the cursor to next digit.
Enter Reference 4.50 Hz	▲	Press [UP] key 4 times.
Ready K/K S 4.50Hz +0%	enter	Press [ENTER] key to store new value.

The same procedure is applied to all other parameters. While the drive is running, the output frequency can be changed to a new command frequency.

⌘ **NOTE:** Some parameters cannot be changed while the VFD is running.

2.4.1 Jump Code:

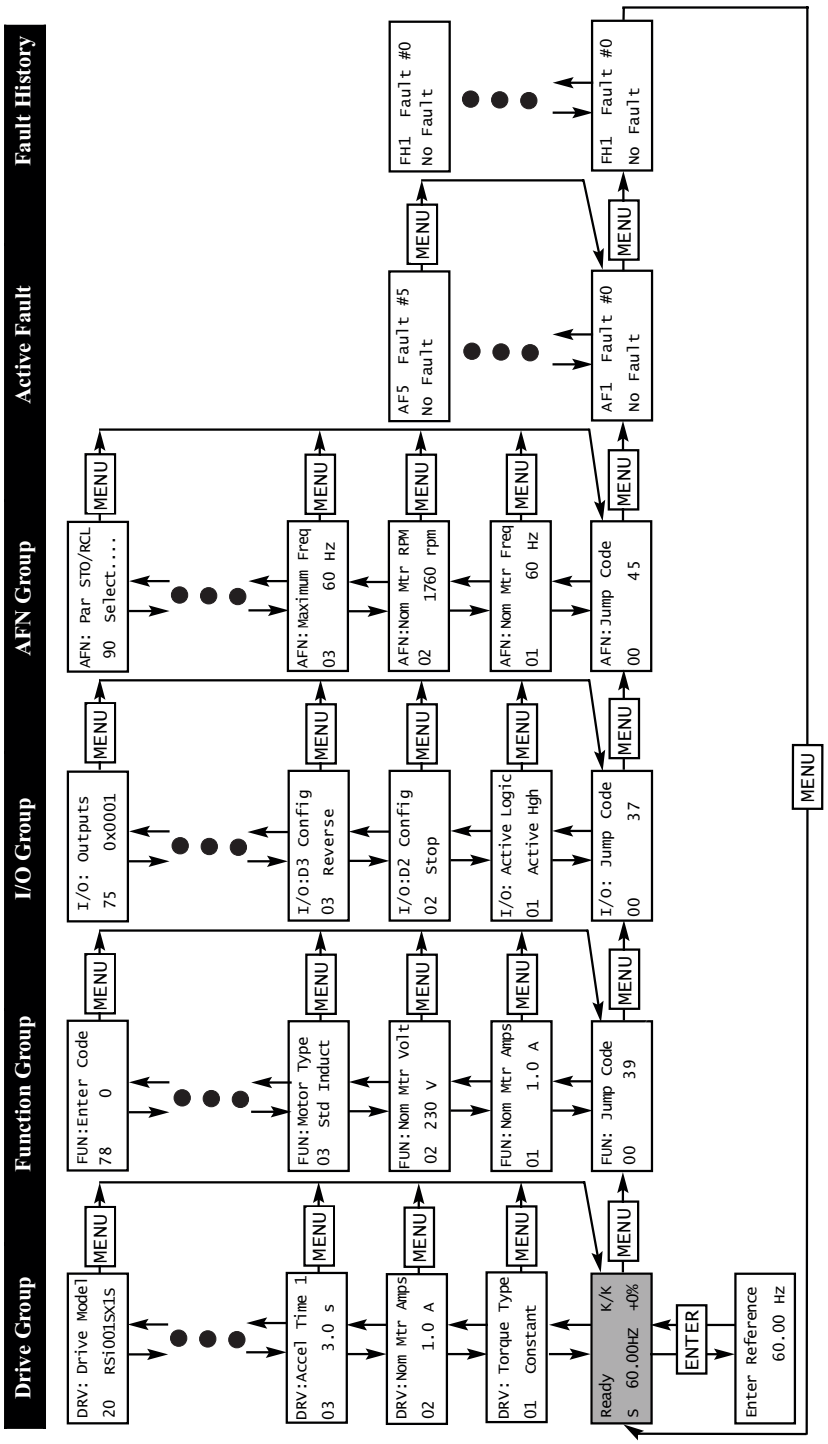
Any program code may be accessed quickly by entering the desired program code number. Jump to any menu parameter by pressing the [MENU] key, scrolling with the [ARROW] keys, then pressing the [ENTER] key.

```
AFN:  Jump Code
00          45
```

PARAMETER NAVIGATION

2.5 Parameter Navigation

Figure 6



In any of the parameter groups, the user can jump to a specific parameter code by following these steps:

- Select a parameter group that requires a change.
- At the beginning of each program group the menu will read [Jump Code]. Press the [MENU] key.
- Enter the code number of the parameter needed to be changed then press [ENTER].
- There is no jump code for [Drive Group].

2.6 Control Method

The RSi SX has several methods to control the operation of the drive. Figure 7 shown on page 13 illustrates the control methods.

2.6.1 Hand/Auto

The drive can be configured to have start/stop control from more than one source. In order for this to be accomplished, A digital input must be configured to control the selection of the source. The source for the control can come from the keypad (simple or enhanced), terminal strip or serial link (ModBUS or any attached field bus network).

FUN 04 (Run/Stop Source) and AFN 20 (Alternate Run/Stop Source) determines the selection of the source and are controlled by the digital input Hand/Auto. Refer to FUN 04 and AFN 20 description for more information.

2.6.2 Local/Remote

The drive can be configured to have the reference source come from more than one source. In order for this to be accomplished, A digital input must be configured to control the selection of the source. The source for the control can come from the keypad (simple or enhanced), terminal strip or serial link (ModBUS or any attached field bus network).

FUN 06 (Reference Source) and AFN 21 (Alternate Reference Source) determines the selection of the source and are controlled by the digital input Local/Remote.

In this manner the Run/Stop command and the Frequency Reference sources can separately be controlled. If a single point of selection is required, Control / Reference Override can be used.

Refer to FUN 06 (Reference Source) and AFN 21 (Alternate Reference Source) description for more information.

2.6.3 Control/Reference Override

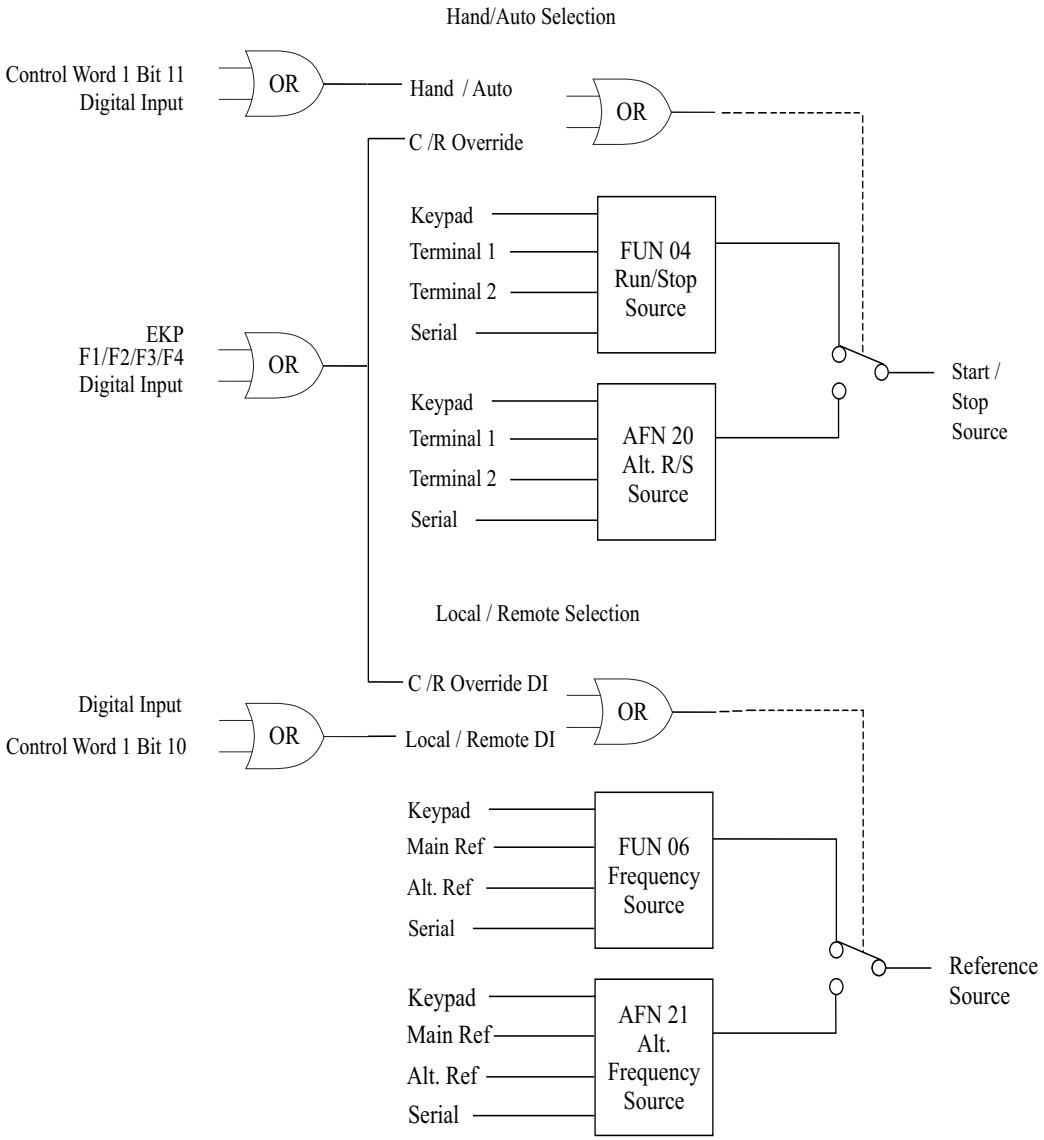
The Control/Reference Override controls both the Run/Stop and Frequency reference sources at the same time with a single point of control, either from a digital input or a function key (F1-F4) on the Enhanced Keypad. The Function Keys are programmed in I/O 70 - I/O 73. All other control points remain the same.

2.6.4 Serial Link Control of Start/ Stop Frequency Reference

The digital input for controlling Local/Remote and Hand/Auto does not have to be configured if the controlling point is to be from the serial link/field bus.

Control Word 1, bit 10, controls Local/Remote and bit 11, controls Hand/Auto. Refer to remote communication for more detail.

Figure 7: Selection Between Run/Stop Source (Hand/Auto) and Reference Source (Local/Remote) and Control/Reference Override



DESCRIPTION OF THE KEYS ON THE STANDARD KEYPAD

2.7 Description of the Keys on the Standard Keypad

The following table describes the keys found on the keypad:

Table 1: Description of the Keys on the Standard Keypad

Key	Function
fwd	This key causes the drive to begin spinning the motor in the Forward direction if this direction is enabled (see AFN 17, Run Prevent) and if the keypad is the active control source (see FUN 04, Run/Stop Set). ⌘ **NOTE:** Drive enable (EN) terminal input must be active.
rev	This key causes the drive to begin spinning the motor in the Reverse direction if this direction is enabled (see AFN 17, Run Prevent) and if the keypad is the active control source (see FUN 04, Run/Stop Set). ⌘ **NOTE:** Drive enable (EN) terminal input must be active.
⇧	The UP arrow key is used in a variety of ways: • Increase the value of a numeric parameter (including drive speed). • Select the next value of an enumerated parameter. • It scrolls forward through a list of parameter groups or parameters within a group (When the last group or parameter is displayed, it scrolls to the beginning of the list). • When a list of faults is displayed, it moves from one fault to the next. After the last fault is displayed, it returns to the first fault.
⇩	The DOWN arrow key, is used in a variety of ways: • Decrease the value of a numeric parameter (including drive speed). • Select the previous value of an enumerated parameter. • It scrolls backward through a list of parameter groups or parameters within a group (When the first group or parameter is displayed, it scrolls to the end of the list). • When a list of faults is displayed, it moves from one fault to the previous fault. After the first fault is displayed, it returns to the last fault.
⇦	When editing a numeric parameter, the LEFT arrow key moves the cursor one digit to the left. If cursor is already at the most significant digit, it will scroll to the least significant digit on the right. When in Menu mode, the LEFT arrow allows menu groups to be scrolled through in the opposite direction of the Menu Key.
enter	The ENTER key is used in a variety of ways: • When the Drive is in the Operate Mode, pressing [ENTER] will allow you to change the speed reference if the drive is configured to use the keypad for the reference source. • Stores the new value of a parameter.
menu	The MENU key is used in a variety of ways: • Menu scrolls between the operate screen and the available parameter groups. • When viewing a parameter, pressing [MENU] will jump to the top of the menu. For the FUN, I/O and AFN menu groups, it will return you to the Jump Code. • When a Parameter is being edited and [MENU] is pressed, the change is aborted and the parameter's old value is displayed.
stop reset	The STOP/RESET key halts the operation of the RSi SX drive unless it is disabled by parameter AFN 18 (Stop Key). This parameter also determines the type of stop (coast, ramp or DCI) that occurs when [Stop] is pressed. This button works (unless disabled) with any control source. Note that parameter AFN 46 (Man Flt Rst) may be configured to allow the Stop key to be used to manually reset the drive after a fault. To use the Stop key in this way, an active fault/warning display must be shown in the keypad window; the Stop key will only reset the drive if a fault is displayed.

MODES AND DISPLAYS OF THE STANDARD KEYPAD

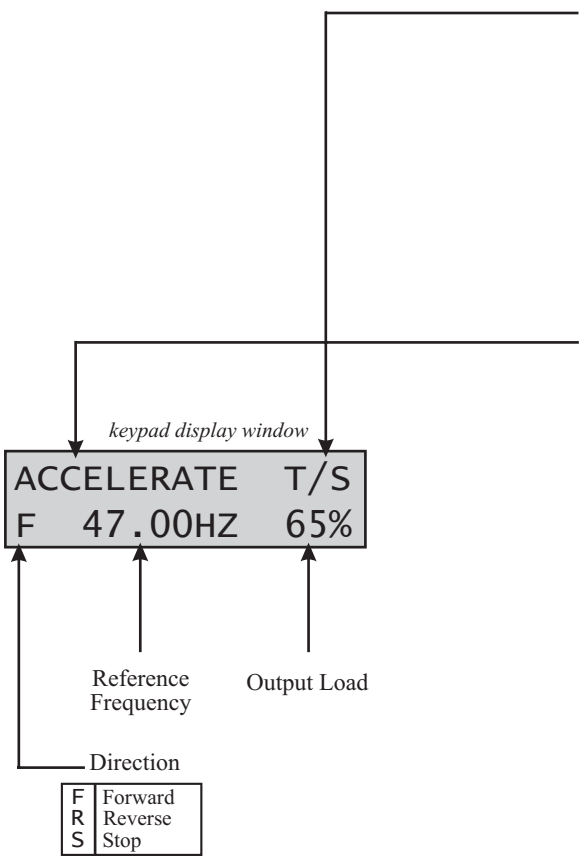
2.8 Modes and Displays of the Standard Keypad

The standard keypad provides a 2 line by 16 character display. The display varies by the mode in which the drive is placed:

- Operate Screen
- Enter Reference Screen
- Menu Screens
- Parameter Screens
- Fault Screens

The displays for these modes will be described in the following sections.

Figure 8: Sample Operate Display and What Information May Be Shown



2-Letter Code for Control Path

K/K	Keypad Reference, Keypad Control.
K/T	Keypad Reference, Terminal Control.
T/K	Terminal Reference, Keypad Control.
T/T	Terminal Reference, Terminal Control.
S/K	Serial Reference, Keypad Control.
S/T	Serial Reference, Terminal Control.
S/S	Serial Reference, Serial Control.
T/S	Terminal Reference, Serial Control.
K/S	Keypad Reference, Serial Control.

Status of the Drive

List in order from highest to lowest priority; if more than one status is active, the higher-priority status is displayed.

FAULTED	Drive is faulted.
AUTO-RESET	A fault occurred that may be auto-reset.
NO DRV EN	No drive enable.
NOT READY	Drive is not ready (drive enable not active).
READY	Drive is ready (drive enable active).
OVERVOLTAGE	Input voltage is too high.
UNDERVOLTAGE	Input voltage is too low.
CURRENT LIM	Drive is in Current Limit.
TORQUE LIM	Drive is in Torque Limit.
HI CURRENT	High-current warning.
HI TEMP	High-temperature warning.
JOG	Jog operation active.
ZERO SPEED	Run command active, but no reference.
ACCELERATE	Drive is accelerating.
DECELERATE	Drive is decelerating.
FORWARD	Drive is at speed in Forward direction.
REVERSE	Drive is at speed in Reverse direction.
DC INJECT	DC injection braking is active.
KPAD STOP	Drive stopped from the keypad.
LS LOCKOUT	Line-start lockout.
Catch on Fly	Spinning motor start in progress.
MAINS LOSS	Power is not being applied to mains input (that is, feeding via the DC bus).

2.8.1 Operate Mode

The Operate mode is entered automatically approximately one second after the power-up display is shown, which provides information about the software version of the drive.

The Operate mode is the principle mode for the standard keypad. The display for this mode provides operational information about the RSi SX drive. Figure 8 on the previous page shows the typical Operate display and notes what the various codes in the display mean. Note that if more than one status is active, the higher-priority status will be shown.

Also note that you may select a different display for the Operate mode. Parameter FUN 70 (Display Mode) allows you to select a display that shows a custom unit instead of output frequency. Alternately, this parameter allows you to choose to display retention time. See page 69 for more information on this parameter.

2.8.2 Programming Mode

As described in Table 1 on page 14, Programming mode is entered by pressing the [MENU] key or [UP] and [DOWN] keys to access QuickStart items.

To program a parameter's value, perform the following steps:

1. Press [MENU] to enter the first parameter group.
2. As you use the arrow keys, the parameters and their values will scroll on the display. If you wish to change the parameter's value, press the [ENTER] key.

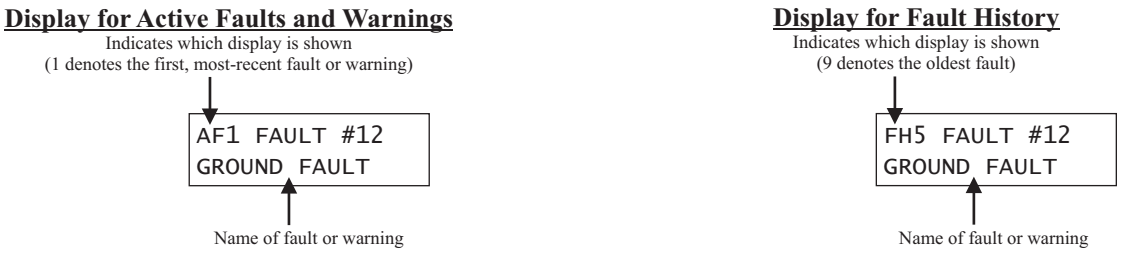
   After the [ENTER] key is pressed, the parameter will enter edit mode, unless it is read-only. The RSi SX drive uses two types of parameters. One type is assigned a numerical value, while the second type is assigned a function.

   For example, parameter AFN 04 (Minimum Freq) may range from 0 to 320Hz, and you may configure any value within that range for the minimum frequency of the drive. This is the first type of parameter, where the parameter is assigned a numerical value. On the other hand, parameter FUN 41 (Stop Mode) only allows you to choose from one of three functions: Ramp, Coast or DCI (DC Injection). This is an example of the second type of parameter.

2.8.3 Active Fault / Warning and Fault History Mode

When a fault or warning occurs, the Operate mode automatically changes to the Active Fault mode. The drive stores up to ten active faults or warnings, and provides a separate display for each. Figure 9 provides a sample display for an active fault.

Figure 9: Display for Active Faults and Warnings



Once the active fault display is shown, you must correct the condition causing the fault and then reset the drive to return to the Operate mode.

In addition to the active faults, the drive maintains a history of faults. The nine most recent faults are kept in the fault history log. As shown Figure 9, the display is the same as for active faults, except that an FH (Fault History) is shown in the upper left corner. (See Table 22 on page 155 for a description of fault codes.)

After viewing the fault history log, return to the Operate mode by pressing [MENU] until the operate screen appears.

DESCRIPTION OF THE LEDS ON THE STANDARD KEYPAD

2.9 Description of the LEDs on the Standard Keypad

The display window on the digital keypad has three LEDs. The LEDs provide information about the drive 's operating condition as shown in the table below.

Table 2: LEDs on Standard Keypad

LED Name	State	Operating Condition
STOP	Flashing	The drive has detected a fault and has stopped the motor.
	Steady-On	The drive has stopped operation.
RUN	Flashing	The drive is moving to frequency.
	Steady-On	The drive is at frequency.
WARNING	Flashing	Abnormal operation is detected, but the abnormality is not severe enough to cause a fault.

UPGRADING FIRMWARE BY REFLASHING

2.10 Upgrading Firmware by Reflashing

The firmware of the RSi SX Sensorless Vector Drive can be upgraded by a process called "reflashing." This allows the latest features to be implemented in existing hardware.

The procedure for upgrading firmware by reflashing is as follows:

- Stop the drive, and clear any faults
- Press [STOP/RESET] +[MENU]
- Connect the reflash cable to the RJ45 jack on the TSP board
- Connect the other end of the cable to the PC
- Open the reflash software on the PC
- Open the new code file
- Click the reflash button
- When reflashing is complete press [STOP/RESET] and load the new factory defaults. See parameter AFN 90: (Par STO/RCL) on page 135.

QUICKSTART

2.11 Quick Start

These QuickStart Up instructions are for those applications where:

- The user wants to get the RSi SX Series inverter started quickly
- The factory default values are suitable for the user application

The factory default values are shown on page 24 'Chapter 3 - Parameter Groups' of this manual. The factory setting is for the drive to run a typical NEMA B induction motor to a maximum speed of 60.00Hz with acceleration and deceleration times of 3s. The jog frequency is set for 5.0Hz. If the application requires co-ordinated control with other controllers, it is recommended the user become familiar with all parameters and features of the inverter before applying AC power.

1. Mounting the VFD (mount the VFD as described in Installation Precautions, and Mounting Considerations in the RSi SX Series Hardware Manual).
   - Install in a clean, dry location.
   - Allow a sufficient clearance around top and sides of VFD, (see Hardware manual, section 3.3.
   - The ambient temperature should not be below -10°C (-50°F) and must not exceed +55°C (+131°F).
   - If two or more VFDs are installed in an enclosure, additional cooling may be required.

2. Wiring the VFD (connect wiring as described in Chapter 4 of the Hardware Manual)
   - AC power should be turned OFF.
   - Verify the AC power matches the nameplate voltage of the VFD.

2.11.1 Easy Start Up (Drive Control Through Keypad)

1. Please read Chapters 3 and 4 in Hardware Manual for proper mounting and installation procedures. Please be aware of all precautions, wiring practices and application considerations. Mount VFD in accordance with these instructions.

WARNING: The QuickStart Guide is not meant to be a substitute for the Parameter Configuration and Hardware Manuals. It is meant to be a supplement to the manual.

2. Connect incoming power leads to terminals L1/R, L2/S, and L3/T. Connect the Ground conductor to the GND Terminal.

3. Connect the motor leads to terminals T1/U, T2/V, and T3/W. Connect the Ground conductor to the GND Terminal.

4. Verify motor and power connections.

WARNING: Connecting input power to terminals T1/U, T2/V, and T3/W will cause severe damage to the VFD.

5. Apply power to the VFD.

6. Verify power up. The display should read as follows:

```
READY              K/K
S    60.00 HZ   +0%
```

7. If the application has a quadratic load characteristic, select variable torque mode. Common applications include most pumps and fans. Variable torque mode is not recommended for compressors, conveyors, positive-displacement pumps and high duty cycle applications.

⌘ **NOTE:** If you are uncertain of the application's load characteristics, leave the DRV 01 (Torque Type) parameter at it's defautl value: Constant.

```
DRV: Torque Type
01   Constant
```

8. Enter the motor's rated full load amps by pressing the up arrow key to change the display to read:

```
DRV: Nom Mtr Amps
02       1.0A
```

Press the [ENTER] key to edit the parameter, you will see a flashing cursor. Use the arrow keys to select the motor's rated full load Amperage. Press the [ENTER] key again to write the data to memory.

9. Set the desired Acceleration Time by pressing the up arrow key to change the LCD screen to:

```
DRV: Accel Time 1
03       3.0 s
```

Press the [ENTER] key to edit the parameter You will see a flashing cursor, use the arrow keys to select the desired acceleration time. Press the [ENTER] key to write the value to memory.

WARNING: Setting the Acceleration Time too low can cause OVERCURRENT faults.

10. Set the desired Deceleration Time by pressing the up arrow key to change the LCD screen to:

```
DRV: Decel Time 1
04       3.0 s
```

Press the [ENTER] key to edit the parameter. You will see a flashing cursor, use the arrow keys to select the desired deceleration time. Press the [ENTER] key to write the value to memory.

WARNING: Setting the Deceleration Time too low can cause OVERVOLTAGE faults.

11. Press the [MENU] button to return to the Operate screen:

```
READY            K/K
S  60.00 HZ      +0%
```

Press the [ENTER]key to access the output frequency parameter. Use the arrow keys to select to the desired output frequency. Press the [ENTER] key to write the frequency to memory.

12. Press the [FWD] button. The Green Run LED should blink and turn solid when the motor has reached the desired speed. If the motor is turning in the wrong direction, push the [STOP] button, wait for the VFD to stop, remove power, (wait at least 5 min. after turning off the AC power to allow the bus capacitor to discharge), and switch two of the output leads for proper motor rotation.

2.11.2 Easy Start Up (Operation from a Two Wire Start/Stop Circuit)

1. Press [MENU] key until the following screen appears:

```
FUN: Jump Code
00       39
```

2. Using the up arrow key scroll to the following parameter:

```
FUN: Run/Stop Src
04   Keypad
```

3. Press [ENTER] key to select.

4. Using the up arrow key select Terminal 1.

5. Press the [ENTER] key to save the setting.

6. The VFD can now start and stop via a dry contact closure. This contact closure should be between the terminals D1 and +24 on the terminal strip processor board.

7. Press [MENU] button until the following screen is displayed:

```
READY            K/T
S  60.00 HZ      +0%
```

2.11.3 Easy Start Up (Operation from Remote Analog Signal)

1. Press the [MENU] key until the following screen appears:

```
FUN: Jump Code
00      39
```

2. Using the up arrow key scroll to the following menu:

```
FUN: Ref. Source
06   Keypad
```

3. Press the [ENTER] key.

4. Using the up arrow key change the parameter to Analog In.

5. Press [ENTER] to accept the value.

6. Connect the analog input signal to the terminals A11 and A12. The positive input should be set to the A11 terminal and the negative input should be connected to A12.

7. The VFD can accept several analog input signals. There are DIP switches located on the main control board. The user must set the DIP switches to the proper settings for their use. Please refer to the table 3.

Table 3: DIP Switch Settings PC653

Type of Input Signal and Range	SW1-1	SW1-2	SW1-3	SW1-4	SW1-5	SW1-6
Analog Input 1 (A11)						
0-10VDC			Off	Off	Off	Off
0-5VDC			On	Off	Off	Off
10VDC			Off	Off	Off	Off
0/4 to 20mA (50Ω)			Off	On	On	Off
0/4 to 20mA (250Ω)			On	Off	Off	On
Analog Input 2 (A21)						
0-10VDC	Off	Off				
0-5VDC	On	Off				
0/4 to 20mA (250Ω)	On	On				

SECURITY

2.12 Security

2.12.1 Access Levels

The RSi SX drive allows you to configure access levels to prevent unauthorized access. Two levels of access are available:

- **Configure Access** - a user may read all RSi SX parameters, and configure the non read only parameters, provided the drive is stopped. This is the default setting for access.
- **Configure Run Access** - a user may read all RSi SX parameters, and configure the non read-only parameters whether the drive is running or stopped (although some parameters may only be configured if the drive is stopped).

An access level is assigned by setting the value of parameter FUN 76 (Access Level) found in the Function parameter group; see page 70 for more information on this parameter. The pass code (actually, a four-digit "pass-number") for the security level is set by parameter FUN 77 (Set Code); see page 71.

2.12.2 Gaining Access

When security is enabled and the [MENU] key is pressed to enter programming mode, all parameters, except FUN 78 (Enter Code, see page 71) will be locked.

To unlock the parameters that are available at the configured security level, press [MENU] to initiate programming and then navigate to parameter FUN 78 (Enter Code) , which is in the Security group.

Once this parameter is displayed, use the arrow keys to set the displayed value to the value of the pass code, and then press the [ENTER] key.

After the [ENTER] key is pressed, the drive compares the value of FUN 78 (Enter Code) with that in FUN 77 (Set Code) parameter. If they match, the user is granted access at the level set by the FUN 76 (Access Level) parameter. (If they do not match, access is granted, but with Read-Only status.)

Note that if the RSi SX drive is power-cycled while the parameters are unlocked, the parameters will revert to their locked state. You must enter the passcode again to configure the settings of the accessible parameters.

2.12.3 Disabling Security

To disable security, perform the following steps:

1. Unlock all available parameters.

   This is accomplished by pressing [MENU] to initiate programming and then navigating to the FUN 78 (Enter Code) parameter. Once the parameter is displayed, use the up or down arrow keys to set the displayed value to the value of the passcode, and then press the [ENTER] key. If the correct passcode is entered, all parameters at the configured security level will be available.

2. Navigate to the FUN 77 (Set Code) parameter, which is also in the Function group. Set the displayed value of this parameter to zero, and then press the [ENTER] key.

3. Navigate to the FUN 78 (Enter Code) parameter, which is also in the Function group. Set the displayed value of this parameter to zero, and then press the [ENTER] key.

4. Security is now disabled. All parameters, not just those of the configured Security Level, will be available for programming.

Notes:

3 Parameter Groups

INTRODUCTION

3.1 Introduction

The RSi SX drive incorporates a large number of parameters that allow you to configure the drive to meet the special requirements of your particular application. The parameters are organized into groups of related functionality, and within the groups the parameters are identified by a short, descriptive name.

As described in the previous chapter, the parameters may be broadly grouped into two types: those assigned a value (such as the minimum frequency) and those assigned a function (such as the type of stop to be performed, either ramp, coast or brake). The manner in which these three types are displayed is slightly different.

This chapter describes the available parameters, the groups in which they are located, and the values or functions that may be assigned to them. Appendix D (starting on page 178) provides a summary of all parameters including their ranges and default values. Appendix C (starting on page 172) also notes the ModBUS address of each parameter, which is useful for serial communication.

PARAMETER GROUPS

3.2 Parameter Groups

The RSi SX drive provides 4 parameter groups, all of which are accessible with the standard keypad (provided security conditions are met).

Table 4: Drive Group

Code [DRV]	Description Drive Group	Setting Range	Set Unit	Factory Default	
01	Torque Type	Constant / Variable		Constant	36
02	Nominal Motor Amperage	Varies	A	90% of nominal	36
03	Acceleration Time 1	0.1 to 3200.0	s	3.0 s	37
04	Deceleration Time 1	0.1 to 3200.0	s	3.0 s	37
05	Meter Resets	No Action MWH Meter Op.Hrs. Meter MWH & Op.Hrs		No Action	38
06	Output Current	0.0 to 999.9	A	View-Only	38
07	Output Voltage	0 to 1000	V		38
08	Out Power (kW)	0.0 to 999.9	kW		39
09	Output Power	0 to 250	%		39
10	Ressetteable MWH Meter	0.0 to 99999	MWH		39
11	MWH Meter (Lifetime)	0.0 to 99999	MWH		40
12	Ressettable Operation Hours Meter	0.0 to 99999	h		40
13	Operate Days (Lifetime)	0.00 to 320.00	Hz		40
14	Output Frequency	0 to 320	Hz		41
15	Drive Load	0 to 250	%		41
16	Drive Temperature	0 to 125	℃		41
17	Motor Temperature	0 o 250	%		42
18	DC Bus Voltage	0 to 1000	V		42
19	Sotware Manual	890020-20-02			42
20	Drive Model	RSihhhSXv			43
hhh = Drive horsepower v = Drive Voltage					

Table 5: Function Group

Code [FUN]	Description Function Group	Setting Range	Set Unit	Factory Default	Page
00	Jump Code	Jump Code		-	
01	Nominal Motor Amperage	Model Dependent	A	90% of nominal	44
02	Nominal Motor Voltage	100 - 690V	V	Varies by model	44
03	Motor Type	No Thrm Pr / Std Induct / Blwr Coold		Std Induct	44
04	Run/Stop Source	Keypad Terminal 1 Terminal 2 Serial		Keypad	45
05	2-Wire / 3-Wire Start-Stop	2-wire / 3-wire		2-wire	46
06	Reference Source	Keypad Main Spd Ref Alt. Spd Ref Serial		Keypad	46
07	Main Speed Reference	Spd-Fixed S-R1+k*R2 Spd-Rf 1 Spd-R1-R2 Spd-Rf 2 Spd-Rf 3 Spd-R1+R2 S-R1+R2-R3		Spd-Rf 2	47
08	Jog Reference Configure			Spd-Fixed	48
09	Torque Curve	V/Hz Linear SVC Linear V/Hz Lin. 2pc SVC Lin. 2pc V/Hz Quad. SVC Quad.		V/Hz Linear	49
10	Start Mode	LS Lockout / Auto Start		LS Lockout	50
11	Acceleration Time 1	0.1 to 3200.0	s	3.0 s	50
12	Deceleration Time 1	0.1 to 3200.0	s	3.0 s	50
13	Jog Mode	No Jogging Run / Jog DI Jog Pshbut		No Jogging	51
14	Jog Acceleration Time	0.0 to 3200.0	s	1.0 s	51
15	Jog Deceleration Time	0.0 to 3200.0	s	1.0 s	51
16	EMOP Configure	None TS no Mem TS w/ Mem TS w/MemP T/K no Mem T/K w/ Mem T/K MemP		None	52
17	EMOP Ramp-Time	0.1 to 3200.0	s	30.0 s	52
18	EMOP @ Stop	Disabled / Enabled		Disabled	
19	DB Configure	Internal DBR External DBR Custom DB Disabled	Hz	Internal DBR	53
20	DB Resistor Value	0 to 3276.6	Ω	Varies by Model	54
21	DB Rth Value	0 to 16383			54
22	DB Cth Value	0 to 65535			54

Code [FUN]	Description Function Group	Setting Range	Set Unit	Factory Default	Page
23	DC Injection Configure	None DCI on Frq DCI by DI DCI-DI/Frq		None	56
24	DC Injection Frequency	0.00 to 25.00	Hz	0.00	56
25	DC Injection Time Frequency	0.00 to 60.00	s	0.20 s	57
26	DC Injection Time Stop	0.00 to 60.00	s	0.20 s	57
27	DC Injection Level	1 to 150	%	50%	58
28	Current Limit	1 to 200	%	150%	58
29	Torque Limit Type	Disabled Fixed Lvls By DI Follow AI On Freq		Disabled	59
30	Torque Limit Analog Input	AI #1 / AI #2 / AI #A / AI #B / AI #C		AI #1	59
31	Torque Limit M/F	1 to 200	%	150%	59
32	Torque Limit M/R	1 to 200	%	150%	60
33	Torque Limit R/F	1 to 200	%	80%	60
34	Torque Limit R/R	1 to 200	%	80%	61
35	Torque Limit Frequency	0.00 to 320.00	Hz	0.0 Hz	61
36	Regenerative Timeout	1 to 60	s	1.0 s	61
37	Acceleration Ramp Shape	Linear / S-Curve		Linear	62
38	Acceleration Rounding	0.0 to 10.0	s	0.0 s	62
39	Deceleration Ramp Shape	Linear / S-Curve		Linear	62
40	Deceleration Rounding	0 to 10.0	s	0.0 s	62
41	Stop Mode	Rmp to Stp Cst to Stp DCI to Stp		Rmp to Stp	63
42	Allow Skips	On / Off		Off	63
43	Skip 1 Low Frequency	0.0 to Maximum Freq.	Hz	0.00 Hz	64
44	Skip 1 High Frequency	0.0 to Maximum Freq.	Hz	0.00 Hz	
45	Skip 2 Low Frequency	0.0 to Maximum Freq.	Hz	0.00 Hz	
46	Skip 2 High Frequency	0.0 to Maximum Freq.	Hz	0.00 Hz	
47	Skip 3 Low Frequency	0.0 to Maximum Freq.	Hz	0.00 Hz	
48	Skip 3 High Frequency	0.0 to Maximum Freq.	Hz	0.00 Hz	
49	Skip 4 Low Frequency	0.0 to Maximum Freq.	Hz	0.00 Hz	
50	Skip 4 High Frequency	0.0 to Maximum Freq.	Hz	0.00 Hz	
51	Skip 5 Low Frequency	0.0 to Maximum Freq.	Hz	0.00 Hz	
52	Skip 5 High Frequency	0.0 to Maximum Freq.	Hz	0.00 Hz	
53	Fault Lockout Number	0 to 8		0	64
54	Auto Reset Time	0 to 3600	s	0 s	64
55	Current Level 1	0 to 200	%	0%	65
56	Current Level 2	0 to 200	%	0%	65
57	Torque Level 1	0 to 200	%	0%	65
58	Torque Level 2	0 to 200	%	0%	65

Code [FUN]	Description Function Group	Setting Range	Set Unit	Factory Default	Page
59	Frequency Level 1	0.0 to Maximum Freq.	Hz	0.0 Hz	65
60	Frequency Level 2	0.0 to Maximum Freq.	Hz	0.00 Hz	65
61	Frequency Level 3	0.0 to Maximum Freq.	Hz	0.00 Hz	65
62	Low Frequency Threshold	0.0 to Maximum Freq.	Hz	0.00 Hz	66
63	Timer 1 Type	On Delay Off Delay On/Off Delay		On Delay	66
64	Timer 1 Time	0.00 to 320.00	s	0.10 s	66
65	Timer 2 Type	On Delay Off Delay On/Off Delay		On Delay	67
66	Timer 2 Time	0.00 to 320.00	s	0.10 s	67
67	Heatsink Temperature Warning	0 to 100	%	100 %	67
68	Heatsink Temperature Trip	0 to 125	°C	Varies	68
69	Fault Stop Mode	Rmp to Stp / Cst to Stp		Rmp to Stp	68
70	Display Mode	Std Disply User Units Reten Time		Std Disply	69
71	User Unit Multiplier	1 to 32767		30	69
72	User Unit Divisor	1 to 32767		1	70
73	User Label 1	Alpha-Numeric		r	70
74	User Label 2			p	
75	User Label 3			m	
76	Access Level Configure	Config / Config Run		Config	70
77	Set Code	1 to 9999		0	71
78	Enter Code	1 to 9999		0	71

Table 6: I/O Group

Code [I/O]	Description I/O Group	Settings Range	Set Unit	Factory Default	Page
00	Jump Code	-		-	
01	Active Logic	Active Hgh / Active Low		Active Hgh	72
02	Digital Input 2 (D2) Configure	Not Assign Forward Reverse Stop Jog Jog Revers Flt Reset Ext. Flt (NC) Ext. Flt (NO) PS In #1 PS In #2 PS In #3 Alt Rmp #1 Alt Rmp #2 Torque Lim DC Inject C/R Override Hand/Auto Local/Remote PID Enable EMOP+Spd EMOP-Spd Timer 1 Timer 2		Stop	73
03	Digital Input 3 (D3) Configure			Reverse	
04	Digital Input 4 (D4) Configure			Jog	
05	Digital Input 5 (D5) Configure			Jog Revers	
06	Digital Input 6 (D6) Configure			PS In #1	
07	Digital Input 7 (D7) Configure			PS In #2	
08	Digital Input 8 (D8) Configure			PS In #3	
09	Digital Input 9 (D9) Configure			Flt Reset	
10	Digital Input 10 (D10) Configure			Ext. Fault (NC)	
11	Digital Output 1 (DQ1) Configure	Not Assign / Drive Run / Run Fwd / Run Rev / Drive Rdy / At Speed / Drv Flted / Drv NotFlt / Kpd in Ctl / Drv in Rem / Jogging / Curr Lvl 1 / Curr Lvl 2 / Trq Lvl 1 / Trq Lvl 2 / Frq Lvl 1 / Frq Lvl 2 / Frq Lvl 3 / Temp Lvl / In Cur Lim / In Trq Lim / Loss Ref / SL in Ctrl / SL Ovrride / Zero Speed / Frq Low Th / PID High / PID Low / Active Warn. / Timer 1 / Timer 2		Drive Rdy	74
12	Digital Output 2 (DQ2) Configure	Same as I/O 11		At Speed	
13	Digital Output 3 (DQ3) Configure			Run Rev	
14	Relay 1 (R1) Configure			Drv Flted	75
15	Relay 2 (R2) Configure			Drive Run	75
16	Optional Relay A (RA) Configure			Not Assign	76
17	Optional Relay B (RB) Configure			Not Assign	76
18	Set Fixed Speed	0.00 to Maximum Freq.	Hz	5.00 Hz	76
19	Set k-factor	0 - 100.0	%	10.0%	76
20	Preset Speed 1	0.00 to Maximum Freq.	Hz	5.00 Hz	77
21	Preset Speed 2		Hz	10.00 Hz	
22	Preset Speed 3		Hz	20.00 Hz	
23	Preset Speed 4		Hz	30.00 Hz	
24	Preset Speed 5		Hz	40.00 Hz	
25	Preset Speed 6		Hz	50.00 Hz	
26	Preset Speed 7		Hz	60.00 Hz	

Code [I/O]	Description I/O Group	Settings Range	Set Unit	Factory Default	Page
27	Analog Input 1 (A11) Configure	Normal Brkn Wire Bipolar 4-20 mA 0-10 Bipol		Normal	78
28	Analog Input 1 (A11) Span	0.0 to 200	%	100.0 %	78
29	Analog Input 1 (A11) Offset	0.0 to 100	%	0.0 %	78
30	Analog Input 1 (A11) Invert	Normal / Inverted		Normal	79
31	Analog Input 1 (A11) Filter Time	1 to 1000	ms	5 ms	79
32	Analog Input 2 (A21) Configure	Normal 4-20 mA Pulse-1kHz Pulse-5kHz Pulse-20k Pulse-100k		Normal	79
33	Analog Input 2 (A21) Span	0.0 to 200.0	%	100.0 %	80
34	Analog Input 2 (A21) Offset	0.0 to 100.0	%	0.0 %	80
35	Analog Input 2 (A21) Invert	Normal / Inverted		Normal	80
36	Analog Input 2 (A21) Filter Time	1 to 1000	ms	5 ms	81
37	Analog Output 1 (A0) Configure	Not Assign Motor Spd Motor Curr Out Torque Out Volt Out Power Out Freq Ref Freq Motor Temp PID Fback Bus Voltage		Motor Spd	81
38	Analog Output 2 (A1) Configure			Out Torque	81
39	Analog Output 1 (A0) Calibrate	0 to 105	%	100.0 %	81
40	Analog Output 2 (A1) Calibrate	0 to 105	%	100.0 %	82
41	Analog Output 2 (A1) Out Type	0-20 / 4-20	mA	0-20 mA	82
42	Analog Output A Configure	Same as I/O 37		Not Assign	82
43	Analog Output A Calibrate	0 to 105	%	100.0 %	83
44	Analog Output A Offset	0 to 100	%	0.0 %	83
45	Analog Output B Configure	Same as I/O 37		Not Assign	82
46	Analog Output B Calibrate	0 to 105	%	100.0 %	83
47	Analog Output B Offset	0 to 100	%	0.0 %	83
48	Analog Input A Span	0.0 to 200.0	%	100.0 %	83
49	Analog Input A Offset	0.0 to 100.0	%	0.0 %	84
50	Analog Input A Invert	Normal / Inverted		Normal	84
51	Analog Input A Filter Time	1 to 1000	ms	0 ms	84
52	Analog Input B Span	0.0 to 200.0	%	100. 0 %	83
53	Analog Input B Offset	0.0 to 100.0	%	0.0 %	84
54	Analog Input B Invert	Normal / Inverted		Normal	84
55	Analog Input B Filter Time	1 to 1000	ms	0 ms	84
56	Analog Input C Span	0.0 to 200.0	%	100 %	83
57	Analog Input C Offset	0.0 to 100.0	%	0.0 %	84

Code [I/O]	Description I/O Group	Settings Range	Set Unit	Factory Default	Page
58	Analog Input C Invert	Normal / Inverted		Normal	84
59	Analog Input C Filter Time	-100 to 1000	ms	0 ms	84
60	Analog Input 1 Level	-100 to 100	%	View-Only	85
61	Analog Input 2 Level	0 - 100	%		85
62	Analog Output 1 Level	0 - 100	%		85
63	Analog Output 2 Level	0 - 100	%		86
64	Analog Input A Level	0 - 100	%		86
65	Analog Input B Level	0 - 100	%		86
66	Analog Input C Level	0 - 100	%		86
67	Digital Input Filter Time	1 to 255	ms	5 ms	86
68	DPQ Scaling	6 / 48 / 96 / 3072 x output frequency		6 x freq	87
69	Keypad Control	SKP / Both / Both NoFlt		SKP	87
70	F1 Key Configure	Disabled PID Enable C/R Override		Disabled	88
71	F2 Key Configure				
72	F3 Key Configure				
73	F4 Key Configure				
74	Input Status	0x0401		View-Only	88
75	Output Status	0x0001			88

Table 7: AFN Group

Code [AFN]	Description AFN Group	Setting Range	Set Unit	Factory Default	Page
00	Jump Code	-		-	
01	Nominal Motor Frequency	25 to 320	Hz	60 Hz	92
02	Nominal Motor RPM	0.0 to 10000	RPM	Varies by Model	92
03	Maximum Frequency	Minimum Freq to 320	Hz	60 Hz	92
04	Minimum Frequency	0.0 to Maximum Freq	Hz	0 Hz	93
05	Auto-Carrier	Disabled / Enabled		Disabled	93
06	Carrier Frequency	1.0 to 16.0	kHz	2.2 kHz	93
07	Slip Compensation	None / Automatic		View-Only	94
08	Voltage Boost Configuration	0.00 to 30.00	%	2.00 %	94
09	Set Voltage Boost	None / Automatic		View-Only	95
10	Boost Taper Frequency	0.0 to Maximum Freq.	Hz	60.0	95
11	Boost Taper Voltage	0.00 to 100.00	%	100.00 %	96
12	DC Pulse Start	None / DC at Strt		DC at Strt	97
13	DC Pulse Time	0.00 to 25.00	s	1.00 s	97
14	Low Speed Compensation	0 to 1280		256	97
15	Supply Voltage	Varies by Model	V	Varies by Model	98
16	Catch on Fly	Disabled / Enabled		Disabled	98

Code [AFN]	Description AFN Group	Setting Range	Set Unit	Factory Default	Page
17	Run Prevent	Allow F/R / No Reverse / No Forward		Allow F/R	99
18	Stop Key	Disabled / Rmp to Stp / Cst to Stp		Cst to Stp	99
19	Enter Key	Disabled		Disabled	99
20	Alternate Run / Stop Source	Keypad / Terminal 1 / 2 / Serial		Terminal 1	100
21	Alternate Reference Source	Keypad Main Spd Ref Alt. Spd Ref Serial		Main Spd Ref	100
22	Alternate Speed Reference	Spd-Fixed Spd-R1+R2 Spd-Rf 1 Spd-R1-R2 Spd-Rf 2 S-R1+R2-R3 Spd-Rf 3 S-R1+k*R2		Spd - Rf 1	102
23	Motor Overload Scale	0.0 to 100.0	%	100.0 %	
24	Motor Overload Time	0.0 to 600.0	s	60.0 s	104
25	Communication Protocol	MBRTU / MBASCII / DeviceNet /Reserved / Metasys N2		MB RTU	106
26	Communication Drop Number	Depends on Protocal		Depends on Protocal	106
27	Communication Baudrate	Disabled / 1200 to 500 k	bps	Depends on Protocol	107
28	Communication Timeout	1 to 60	s	5 s	107
29	Communication Parity	N81 / N82 / E81 / O81		N81	108
30	Alternate Ramp 1 Configure	None AR1 on DI AR1 by Frq AR1-Strt AR1-Fwd / Rv		AR1 on DI	108
31	Acceleration Time 2	0.1 to 3200.0	s	1.0 s	109
32	Deceleration Time 2	0.1 to 3200.0	s	1.0 s	109
33	Alternate Ramp 1 Shape	Linear / S-Curve		Linear	109
34	Alternate Ramp 1 Rounding	0.0 to 10.0	s	0.0 s	110
35	Alternate Ramp 1 Switch Frequency	0.00 to 320.00	Hz	0.00 Hz	110
36	Alternate Ramp 2 Configure	None AR2 on DI AR2 by Frq AR2-Strt AR2-Fwd / Rv		AR2 on DI	110
37	Acceleration Time 3	0.1 to 3200.0	s	10.0 s	111
38	Deceleration Time 3	0.1 to 3200.0	s	10.0 s	111
39	Alternate Ramp 2 Shape	Linear / S-Curve		Linear	111
40	Alternate Ramp 2 Rounding	0 to 10.0	s	0.0 s	112
41	Alternate Ramp 2 Switch Frequency	0.00 to 320.00	Hz	0.00 Hz	112
42	Reference 1 Configure	AI #1 AI #2 AI #A AI #B AI #C		AI #1	112
43	Reference 2 Configure			AI #2	
44	Reference 3 Configure			AI #2	
45	Ramp Reference Frequency	0 to 320	Hz	0 Hz	113

Code [AFN]	Description AFN Group	Setting Range	Set Unit	Factory Default	Page
46	Manual Fault Reset	None By DI By Keypad By Ser Lnk By DI / Kypd By DI / Ser By Kpd / Ser DI / Ser / Kpd		By DI / Kypd	113
47	Dynamic Braking Auto Restart	Disabled / Enabled		Disabled	114
48	Lost Reference Auto Reset	Disabled / Enabled		Disabled	114
49	External Fault Auto Reset	Disabled / Enabled		Disabled	114
50	Motor Thermal Protection	Disabled / Warning / Fault		Fault	115
51	External Fault			Disabled	115
52	Fan Loss Fault			Warning	116
53	Net Timeout Fault			Disabled	116
54	Input Phase Fault	Disabled / Fault		Disabled	117
55	Over Voltage Auto Reset	Disabled / Enabled		Disabled	117
56	Over Current Auto Reset			Disabled	118
57	Over Temperature Auto Reset			Disabled	118
58	Under Voltage Auto Reset	Disable / Enabled		Enabled	119
59	DC Bus Calibration Fault Config.	Disabled / Warning / Fault		Warning	119
60	Auto Reset Type	Ramping / Fly Start		Ramping	120
61	Reference Fault	No Action Retain Spd Preset Lvl Fault		No Action	120
62	Lost Reference Frequency	0.00 to Maximum Freq	Hz	0.00 Hz	121
63	DC Meter Configuration Based	on Nominal/ on Trip Levels		on Nominal	121
64	PID Configure	No PID Feed-Fwd F-fwd DI F-fwd Fkey F-fwd Ser Full-Range Full DI Full Fkey Full Ser		No PID	126
65	PID Active at Stop	Disabled / Enabled		Disabled	126
66	PID Type	Direct / Reverse		Direct	128
67	PID Feedback Source	Ref 1 / Ref 2 / Ref 3		Ref 1	127
68	PID Proportional Gain	0 to 2000		0	128
69	PID Integral Gain	0 to 10000		0	128
70	PID Derivative Gain	0 to 2000		0	128
71	PID Feedback Gain	0 to 2000		1000	129
72	PID High Limit	0.00 to 100.00	%	100.00 %	129
73	PID Low Limit	0.00 to 100.00	%	0.00 %	129
74	PID High Alarm	0.00 to 100.00	%	0.00 %	130
75	PID Low Alarm	0.00 to 100.00	%	0.00 %	130

Code [AFN]	Description AFN Group	Setting Range	Set Unit	Factory Default	Page
76	PID Reference	0 to 100	%	View-Only	130
77	PID Feedback	0 to 100	%		131
78	PID Error	0 to 100	%		131
79	PID Output	0 to 100	%		132
80	PID Proportional Part	0 to 100	%		132
81	PID Integral Part	0 to 100	%		132
82	PID Derivative Part	0 to 100	%		133
83	Application Software Version	N/A			133
84	Motor Control Software Version				133
85	Terminal Strip Processor Sw Ver.				134
86	Serial Number 1				134
87	Serial Number 2				134
88	Program Number	Varies		0	135
89	Application	Varies		Standard	135
90	Parameter Storage / Recall	Select… Factory Rst Store Parm Load Param		Select…	135

Notes:

4 Parameter Description

4.1 Drive Group

DRV 01: TORQUE TYPE

Display:

```
DRV: Torque Type
01   Constant
```

Range: Constant / Variable

Description:

Displayed Name:	Function Assigned:
Constant	Constant torque characteristic Default Linear V/Hz curve, quadratic available 150% overcurrent rating, 200% peak Provides full torque throughout motor speed range
Variable	Variable torque characteristic Default Quadratic V/Hz curve 110% overcurrent rating, 150% peak Reduced power consumption possible below rated speed
⌘ **NOTE**:	Variable torque must only be enabled for quadratic loads (most pumps and fans). Contact factory for more information.

DRV 02: NOM MTR AMPS (nominal motor amperage)

Display:

```
DRV: Nom Mtr Amps
02         1.0 A
```

Range: Model Dependent

Description: This parameter configures the nominal motor current, and is obtained from the nameplate on the attached motor.

⌘ **NOTE:** Incorrectly setting this parameter will affect proper operation of the drive.

DRV 03, 04: ACCEL (DECEL) TIME 1 (acceleration & deceleration time 1)

Display:

```
DRV: Accel Time 1
03         3.0 s
```

```
DRV: Decel Time 1
04         3.0 s
```

Range: 0.1 to 3200.0s

Description:

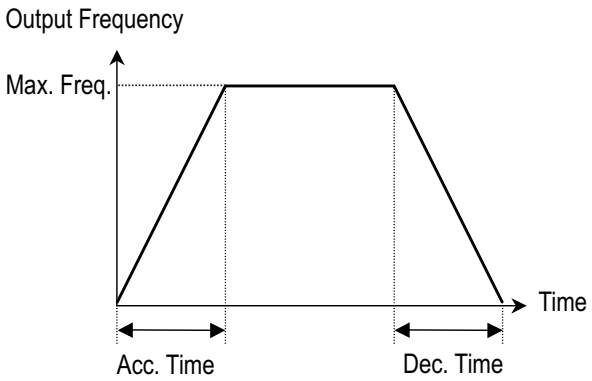
- Acceleration time sets the length of time to accelerate from 0Hz to the maximum frequency (parameter AFN 03, Maximum Freq) for the primary ramp.
- Deceleration time sets the length of time to decelerate from the maximum frequency (parameter AFN 03, Maximum Freq) to 0Hz for the primary ramp. See Figure 10.

Application:

- For faster acceleration and/or deceleration, decrease the accel and/or decel time.
- For slower acceleration and/or deceleration, increase the accel and/or decel time.

⌘ **NOTE:** Accelerating too fast will cause an overcurrent to occur.
Decelerating too fast will cause an overvoltage to occur.

Figure 10: Accel / Decel Operation



DRV 05: METER RESETS

Display:

```
DRV: Meter Resets
05   No Action
```

Range: No Action / MWH Meter / Op. Hrs Meter / MWH & Op. Hrs

Description: This parameter selects which of the resettable meters you wish to reset.

DRV 06: OUTPUT CURR. (output current)

Display:

```
DRV: Output Curr.
06        0.0 A
```

Range: Model Dependant

Description: This parameter displays the RMS value of the current output when the drive is running.

- This is a view-only parameter, it cannot be changed.

DRV 07: OUTPUT VOLTS (output voltage)

Display:

```
DRV: Output Volts
07          0 V
```

Range: 0 to Line Voltage

Description: This parameter shows the voltage being output to the motor.

- This is a view-only parameter, it cannot be changed.

DRV 08: OUT POWER (output power kW)

Display:

```
DRV: Out Power
08        +0.0 kW
```

Range: 0 to 200 kW

Description: This parameter shows the power being delivered to the motor, which is derived from the parameter values of the Motor Setup group and the estimated load on the motor.

- This is a view-only parameter, it cannot be changed.

DRV 09: OUTPUT POWER (output power)

Display:

```
DRV: Output Power
09          +0 %
```

Range: 0 - 250%

Description: This parameter shows the power being delivered to the motor as a percentage of drive load.

- This is a view-only parameter, it cannot be changed.

DRV 10: MWh (resettable MWh meter)

Display:

```
DRV: MWh
10          0.000
```

Range: 0.000 - 99999MWh

Description: Displays the accumulated Mega Watt-Hours since the last meter reset. To reset this meter, see DRV 05 (Meter Reset).

- This is a view-only parameter, it cannot be changed.

DRV 11: MWh LIFETIME (lifetime mwh meter)

Display:

```
DRV: MWh Lifetime
11       0.000
```

Range: 0.000 - 99999MWh

Description: Displays the accumulated Mega Watt-Hours since the drive was manufactured.
- This is a view-only parameter, it cannot be changed.

DRV 12: OPERATE HRS (resettable operation hours meter)

Display:

```
DRV: Operate Hrs
12         0.00
```

Range: 0.00 - 99999h

Description: Displays the number of hours the drive has been running an attached motor since last meter reset. To reset this meter, see DRV 05 (Meter Resets, see page 38).
- This is a view-only parameter, it cannot be changed.

DRV 13: OPERATE DAYS (operation days meter)

Display:

```
DRV: Operate Days
13         0.00
```

Range: 0.00 - 99999

Description: Displays the number of days that the drive has been running an attached motor.
- This is a view-only parameter, it cannot be changed.

DRV 14: OUTPUT FREQ (output frequency)

Display:

```
DRV: Output Freq
14       0.00 Hz
```

Range: 0.00 to 320.00Hz

Description: This parameter contains the frequency currently being output to the motor. It is not modified by slip compensation (parameter AFN 07, Slip Comp, see page 94).

- This is a view-only parameter, it cannot be changed.

DRV 15: DRIVE LOAD

Display:

```
DRV: Drive Load
15          +0 %
```

Range: 0 to 250%

Description: This parameter shows the percentage of maximal load relative to the drive's capacity.

- This is a view-only parameter, it cannot be changed.

DRV 16: DRIVE TEMP (drive temperature)

Display:

```
DRV: Drive Temp
16         +26°C
```

Range: 0 to 125°C

Description: This parameter shows the temperature of the drive's heatsink. Note that an overtemperature fault will be generated when the heatsink temperature reaches the value of parameter FUN 68 (HS Temp Trip). If desired, an over temperature warning may be configured below this level by setting FUN 67 (HS Temp Warn) to an appropriate temperature.

- This is a view-only parameter, it cannot be changed.

DRV 17: MOTOR TEMP (motor temperature)

Display:

```
DRV: Motor Temp
17           0 %
```

Range: 0 to 250%

Description: This parameter shows the estimated temperature of the motor as a percentage of theoretical thermal capacity of the motor. The estimated temperature and the thermal capacity are derived from a thermal model that utilizes the parameter values found in the Motor Setup group and on the estimated load on the motor.

- This is a view-only parameter, it cannot be changed.

DRV 18: BUS VOLTAGE (dc bus voltage)

Display:

```
DRV: Bus Voltage
18         317 V
```

Range: 0 to 1000VDC

Description: This parameter shows the DC bus voltage.

- This is a view-only parameter, it cannot be changed

DRV 19: SW MANUAL (software manual)

Display:

```
DRV: SW Manual
19   890020-02-03
```

Range: N/A

Description: This is the document number for the Parameter Configuration Manual.

- This is a view-only parameter, it cannot be changed.

DRV 20: DRIVE MODEL

Display:

```
DRV: Drive Model
20   RSi001SX1S
```

Range: N/A

Description: This parameter contains the RSi SX model number in the format RSihhhSXv, where hhh is the horsepower rating of the drive and v represents the voltage code.

- 1S - single phase 120VAC
- 2S - single phase 240VAC
- 2 - three-phase 240VAC
- 4 - three-phase 460VAC
- 6 - three-phase 600VAC
- This is a view-only parameter, it cannot be changed.

4.2 Function Group

FUN 01: NOM MTR AMPS (nominal motor amperage)

Display:

```
FUN: Nom Mtr Amps
01         1.0 A
```

Range: Model Dependent (default : 90% of nominal)

Description: This parameter configures the nominal motor current, and is obtained from the nameplate on the attached motor.

⌘ **NOTE:** Incorrectly setting this parameter will affect proper operation of the drive.

FUN 02: NOM MTR VOLT (nominal motor voltage)

Display:

```
FUN: Nom Mtr Volt
02         230 V
```

Range: 100 to 690V (default: varies)

Description: This parameter configures the voltage delivered to the motor terminals by the drive at the field weakening point (100% motor speed).

⌘ **NOTE:** Incorrectly setting this parameter will affect motor torque and heating.

FUN 03: MOTOR TYPE

Display:

```
FUN: Motor Type
03    Std Induct
```

Range: No Thrm Pr / Std Induct / Blwr Coold

Description: This parameter configures what type of motor is attached to the RSi SX drive. This is used for modeling thermal performance, which determines when the drive will trip due to motor overheating. The following functions may be assigned to this parameter:

Displayed Name	Function Assigned
No Thrm Pr	The motor overload trip is disabled.
Std Induct	The attached motor is a standard induction (self-cooled) motor, with a 2:1 turndown ratio.
Blwr Coold	The attached motor uses a constant-speed fan for forced cooling, and is rated for a 10:1 turndown ratio.

⌘ **NOTE:** If the drive is set to "No Thrm Pr" then an external means of motor overload protection must be attached to the motor.

FUN 04: RUN/STOP SRC (run/stop source)

Display:

```
FUN: Run/Stop Src
04   Keypad
```

Range: Keypad / Terminal-1 / Terminal-2 / Serial

Description:

Keypad:
The Fwd/Rev keys on the display control the direction of the motor.

Terminal 1:
Digital inputs configured as “Forward” and/or “Reverse” control the run command as well as the direction.

Terminal 2:
Digital inputs configured as “Forward” controls the run command with reverse input controls direction. If reverse is not active or configured, the drive defaults to forward direction when a run command is indicated.

Serial:
Start/Stop and direction is set via the communication link.

Application:

Figure 11 - Terminal 1 Operation

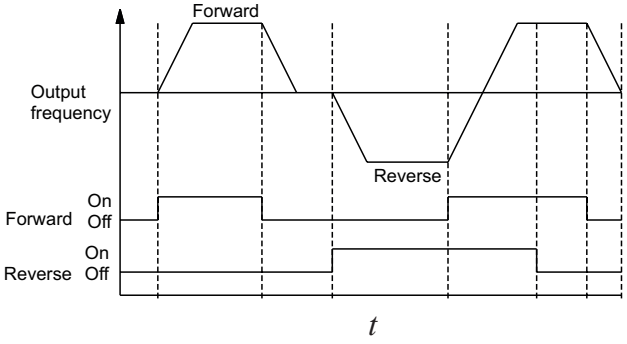
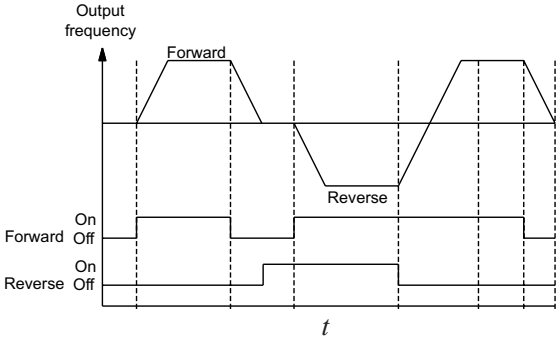


Figure 12 - Terminal 2 Operation



⌘ **NOTE:** The keypad stop button will always stop the drive regardless of this parameter's setting unless disabled through AFN 18 (Stop Key, See page 99).

FUN 05: 2W/3W S-S (2-wire/3-wire start-stop)

Display:

```
FUN: 2w/3w S-S
05   2-wire
```

Range: 2-wire / 3-wire

Description: This parameter allows you to select whether 2-wire or 3-wire control will be used. See RSi SX Hardware Manual for more information on 2-wire and 3-wire control, including sample connection diagrams. Note that if 3-wire control is selected, Digital Input D2 is forced to act as a Stop input; it cannot be configured to perform another function. The following functions may be assigned to this parameter:

Displayed Name	Function Assigned
2-wire	2-wire control is utilized
3-wire	3-wire control is utilized

FUN 06: REF. SOURCE (reference source)

Display:

```
FUN: Ref. Source
06   Keypad
```

Range: Keypad / Main Spd Ref / Alt. Spd Ref / Serial

Description:

Keypad	The Frequency Reference is set via the keypad, (see page 10).
Main Spd Ref	The Frequency Reference is determined by FUN 07 (Main Spd Ref).
Alt. Spd Ref	The Frequency Reference is determined by AFN 22 (Alt. Spd Ref).
Serial	The Frequency Reference is set via the Serial Link.

FUN 07: MAIN SPD REF (main speed reference)

Display:

```
FUN: Main Spd Ref
07   Spd-Rf 2
```

Range: See below

Description: This parameter configures the reference speed for the drive when FUN 06 (Ref. Source) is set to "Main Sped Ref" The reference speed results from inputs on the analog input terminals (A11/A12 and A21/CM) and how parameters AFN 42-44 (Ref1 Config, Ref2 Config, and Ref3 Config) are set; see below for more information about these three parameters. The following functions may be assigned to this parameter: See Figure 22 on page 95 for more information.

Displayed Name:	Reference Speed From:
Spd-Rf1	Reference 1.
Spd-Rf2	Reference 2.
Spd-Rf3	Reference 3.
S-R1+k*R2	Reference 2 is scaled by factor k and then summed with reference 1. The value of k is set by parameter I/O 19 (Set k Factor).
Spd-R1-R2	The difference between references 1 and 2.
S-R1+R2-R3	The summation references 1 and 2 less reference 3.
Spd-Fixed	The speed reference is constant and is set by parameter I/O 18 (Fixed Speed).

FUN 08: JOG REF CONFIG (jog reference configure)

Display:

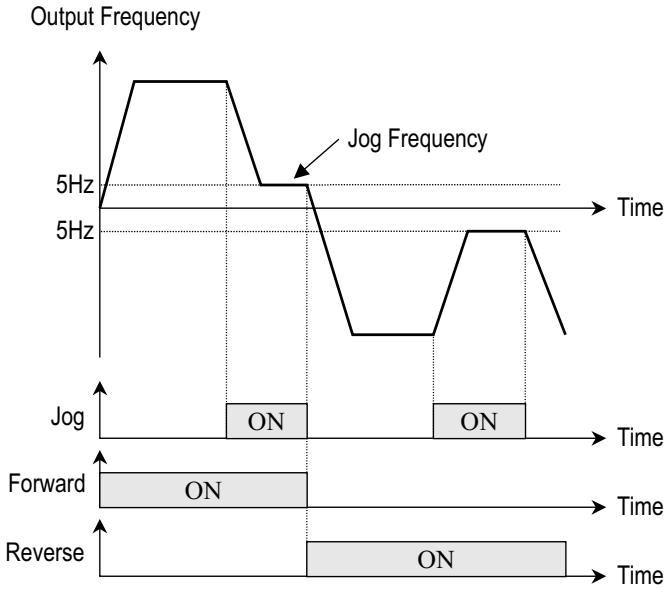
```
FUN: Jog Ref Cfg
08   Spd-Fixed
```

Range: See FUN 07 (Main Spd Ref) parameter on page 47.

Description: This parameter configures the reference speed when jogging. As with the setting of the main reference speed for the drive, an analog input may be used to control jogging speed. The jog feature is often used to inch the load. The functions that may be assigned to this parameter are the same as those for parameter FUN 07 (Main Spd Ref, see page 47).

Example:

Figure 13: Jog Drive



FUN 09: TORQUE CURVE

Display:

```
FUN: Torque Curve
09   V/Hz Linear
```

Range: See below

Description: This parameter selects the control algorithms used by the RSi SX drive. The following functions may be assigned to this parameter (note that all Sensorless Vector Control (SVC) modes require careful setup of motor parameters).

⌘ **NOTE:** CT/VT selections are made in DRV 01 (Torque Type).

Displayed Name:	Function Assigned:
SVC Linear	Sensorless Vector Control (SVC). This setting forces AFN 09 (Set V-Boost) and AFN 07 (Slip Comp) parameters to Automatic, and they cannot be set to another function. This option is only available in constant torque mode.
SVC Lin. 2pc	SVC with two-piece voltage characteristic. This setting forces AFN 09 (Set V-Boost) and AFN 07 (Slip Comp) parameters to Automatic. However, parameter AFN 08 (V-Boost Conf) may be adjusted to provide additional starting torque, with parameters AFN 10 (Bst. Tpr Frq) and AFN 11 (Bst. Tpr Vlt) defining the point on the theoretical curve where boost ceases. This option is only available in constant torque mode.
V/Hz Linear	V/Hz control with linear voltage characteristic. Parameter AFN 09 (Set V-Boost) is set to None, but may be changed to Automatic (with boost ceasing at the field weakening point). Parameter AFN 07 (Slip Comp) is set to None, but may be changed to Automatic. This option is only available in constant torque mode.
V/Hz Lin. 2pc	V/Hz linear two-piece voltage characteristic. Parameter AFN 09 (Set V-Boost) is set to Automatic, but it may be changed to None (with parameters AFN 10 (Bst. Tpr Frq) and AFN 11 (Bst. Tpr Vlt) defining the point on the theoretical curve where boost ceases). Parameter AFN 07 (Slip Comp) is set to None, but may be changed to Automatic. This option is only available in constant torque mode.
SVC Quad.	SVC with quadratic voltage characteristic. This settingforces AFN 09 (Set V-Boost) and AFN 07 (Slip Comp) parameters to Automatic, but they cannot be set to another value.
V/Hz Quad.	V/Hz control with quadratic voltage characteristic. Parameter AFN 09 (Set V-Boost) is set to Automatic, but may be changed to none (with boost ceasing at the field weakening point). Parameter AFN 07 (Slip Comp) is set to None, but may be changed to Automatic.

FUN 10: START MODE

Display:

```
FUN: Start Mode
10   LS Lockout
```

Range: See below

Description: This parameter allows you to select whether the drive will automatically start when line power is applied and a Run command is active from the terminal strip. The following functions may be assigned to this parameter:

Displayed Name:	Function Assigned:
LS Lockout	Line Start Lock-Out. The drive will not automatically start when line power applied and a Run command is active. Instead, the run command must be removed and a new Run command given.
Auto Start	The drive will automatically start when line power is applied and a Run command is active on the terminal strip.

FUN 11 & 12: ACCEL (DECEL) TIME 1 (acceleration & deceleration time 1)

Display:

```
FUN: Accel Time 1
11   3.0 s
```

```
FUN: Decel Time 1
12   3.0 s
```

Range: 0.1 to 3200.0 s

Description: Acceleration time sets the length of time to accelerate from 0Hz to the maximum frequency (parameter AFN 03, Maximum Freq) for the primary ramp.

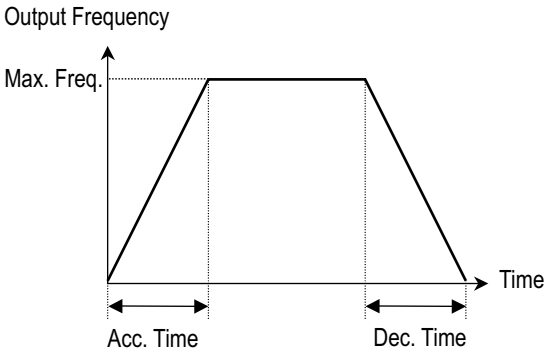
Deceleration time sets the length of time to decelerate from the maximum frequency (parameter AFN 03, Maximum Freq) to 0Hz for the primary ramp. See Figure 14.

Application:

- For faster acceleration and/or deceleration, decrease the accel and/or decel time.
- For slower acceleration and/or deceleration, increase the accel and/or decel time.

⌘ **NOTE:** Accelerating too fast will cause an overcurrent to occur.
Decelerating too fast will cause an overvoltage to occur.

Figure 14: Accel / Decel Operation



FUN 13: JOG MODE

Display:

```
FUN: Jog Mode
13    No Jogging
```

Range: See below

Description: This parameter allows you to configure whether jog operations will be allowed and the type of jog control utilized. Please refer to Section 4.5.3 in the Hardware Manual for connection diagrams. The following functions may be assigned to this parameter:

Displayed Name:	Function Assigned:
No Jogging	Jogging is not configured.
Run/Jog DI	A maintained contact is used to initiate the jog function, but the command to rotate the motor is from the "RUN" input. The run input will not seal in if in 3 wire mode.
Jog Pshbut	A pushbutton is used to both initiate the jog function and command the motor to rotate.

⌘ **NOTE:** Control must come from the terminal strip for jog to operate.
⌘ **NOTE:** See FUN 08 (Jog Ref Config) for further programming option.

FUN 14: JOG ACC TIME (jog acceleration time)

Display:

```
FUN: Jog Acc Time
14       1.0 s
```

Range: 0.0 to 3200.0s

Description: This parameter sets the acceleration time during jogging operations.

FUN 15: JOG DCL TIME (jog deceleration time)

Display:

```
FUN: Jog Dcl Time
15    1.0 s
```

Range: 0.0 to 3200.0s

Description: This parameter sets the deceleration time during jogging operations.

⌘**NOTE** : See FUN13 (Jog Mode) and FUN 14 (Jog Acc Time) for more information

FUN 16: EMOP CONFIG (electronic motorzied operator potentiometer)

Display:

```
FUN: EMOP Config
16    None
```

Range: See below

Description: The RSi SX drive supports a frequency reference control called EMOP. EMOP allows the reference frequency to be adjusted incrementally using a pair of digital inputs or by using the up and down arrow keys on the enhanced keypad. This is useful if you need fine-grained control of reference frequency but a traditional potentiometer is unacceptable (e.g. dirty or corrosive environments). To use a digital input, configure two digital inputs using the parameters in the Digital Inputs group to functions EMOP + Spd and EMOP - Spd. (see page 73).

The EMOP reference frequency may also be configured to stay at the most recent value or reset to zero speed when a stop command is received and/or if line power is lost. If configured to reset the reference speed, the drive reference frequency becomes the minimum frequency upon the next start.

The following functions may be assigned to this parameter:

Displayed Name:	Function Assigned:
None	EMOP is not utilized.
TS no Mem	Digital inputs are used to change EMOP reference speed, and the EMOP reference speed is lost upon Stop or a power-cycle.
TS w/ Mem	Digital inputs are used to change EMOP reference speed, and the reference speed is retained upon Stop but not when power is cycled.
TS w/ MemP	Digital inputs are used to change EMOP reference speed, and the reference speed is retained through a Stop or when power is cycled.
T/K no Mem	Same as TS no Mem except the keypad also may be used to change the EMOP reference speed.
T/K w/ Mem	Same as TS w/ Mem except the keypad also may be used to change the EMOP reference speed.
T/K MemP	Same as TS w/ MemP except the keypad also may be used to change the EMOP reference speed.

⌘ **NOTE:** See FUN 17 (EMOP R-Time) for more information.

FUN 17: EMOP R-TIME (emop ramp-time)

Display:

```
FUN: EMOP R-Time
17        30.0 s
```

Range: 0.1 to 3200.0 s

Description: This parameter sets the length of time for acceleration (0 Hz to EMOP reference speed) and deceleration (EMOP reference to 0 Hz) when EMOP is active.

⌘ **NOTE:** See FUN 16 (EMOP Config) and FUN 18 (EMOP @ Stop) for more progamming options.

FUN 18: EMOP @ Stop

Display:

```
FUN: EMOP @ Stop
18   Disabled
```

Range: Disabled / Enabled

Description: This parameter, when set to "Enabled" allows the Enhanced Keypad to increment and decrement the EMOP reference when the drive is stopped. When disabled, only the digital inputs configured for EMOP speed adjustment will adjust the EMOP reference when the drive is stopped.

⌘ **NOTE:** I/O 69 (Keypad Ctrl) must be set up for Both.

FUN 19: DB CONFIG (dynamic braking configuration)

Display:

```
FUN: DB Config
19   Internal DBR
```

Range: See below

Description: The drive provides an internal dynamic brake resister (DBR) to assist in stopping. If desired, an External Braking Resistor or Bus Control System may be connected to the B-/B+/DB/DB1 terminals on the power board. The following functions may be assigned to this parameter:

Displayed Name:	Function Assigned:
Disabled	The DB transistor is not used to control the DC bus voltage. Instead, the RSi SX will accelerate the motor in an attempt to control the DC bus voltage.
Internal DBR	The internal dynamic brake is enabled, and the DBR parameters are locked.
Custom DB	An external package (e.g a regenerative braking system) is connected to the B+ and B- terminals of the RSi SX. The external system is responsible for keeping the DC bus voltage within acceptable limits. **The RSi SX does not attempt to control DC bus voltage in this setting.**
External DBR	An external resistor is used for additional braking capacity. The characteristics of the external resistor are specified in the following three parameters.

⌘ **NOTE:** See FUN 20 (DB ResValue) to FUN 22 (DB Cth Value) for further programming options.

FUN 20-22: DB RES, RTH, & CTH VALUES

Display:

```
FUN: DB Res Value
20    500.0 ohm
```

Range: 0 to 3276.7Ω

```
FUN: DB Rth Value
21       19
```

Range: 0 to 16383

```
FUN: DB Cth Value
22       65000
```

Range: 0 to 65535

Description: These parameters establish the value of the external resistor used to augment braking capacity, its thermal resistance and its thermal capacitance, respectively.

The value for FUN 20 (DB Res Value) is the actual resistance of the resistor, set to the nearest 0.1Ω.

These values cannot be changed if the Internal DB resistor is selected in FUN 19 (DB Config), as the drive will use its internal configuration values. Similarly, these values have no effect if "Custom DB" or "disabled" is selected in FUN 19 (DB Config).

The default values for these parameters vary by drive model as shown in table 8 on page 55.

⌘ **NOTE:** See FUN 19 (DB Config) for further programming options.

Table 8: Default Values

Model Number	DB Res Value	DB Rth Value	DB Cth Value
RSi001SX2S B/D	250	19	65000
RSi002SX2S B/D	125	60	8000
RSi003SX2S B/D	125	22	5000
RSi001SX2 B/D	250	19	65000
RSi002SX2 B/D	125	60	8000
RSi003SX2 B/D and RSi005SX2 B/D	125	22	5000
RSi007SX2 B/D and RSi010SX2 B/D	60	45	3000
RSi015SX2 B/D and RSi020SX2 B/D	120	87	2200
RSi001SX4 B/D	1000	19	65000
RSi002SX4 B/D	500	60	8000
RSi003SX4 B/D and RSi005SX4 B/D	500	22	5000
RSi007SX4 B/D and RSi010SX4 B/D	120	45	3000
RSi015SX4 B/D and RSi020SX4 B/D	120	150	3000
RSi025SX4 B/D thru RSi040SX4 B/D	60	220	900
RSi050SX4 B/D thru RSi075SX4 B/D	60	250	900
RSi100SX4D thru RSi150SX4D	60	255	900
RSi001SX6 B/D thru RSi005SX6 B/D	500	28	12500
RSi007SX6 B/D thru RSi010SX6 B/D	120	45	3000
RSi015SX6 B/D thru RSi020SX6 B/D	120	150	3000
RSi025SX6 B/D thru RSi040SX6 B/D	60	220	900
RSi050SX6 B/D thru RSi075SX6 B/D	60	250	900
RSi100SX6D thru RSi150SX6D	60	250	900

⌘ **NOTE:** To calculate the DB Rth and DB Cth values, refer to Appendix B on page 169

FUN 23: DC INJ CFG (dc injection configure)

Display:

```
FUN: DC Inj Cfg
23    None
```

Range:

Description: DC injection braking may be used to stop the motor more quickly than possible by either a ramp-to-stop or coast-to-stop. The RSi SX drive allows DC braking to be initiated either when a digital input assigned to DC braking becomes active when commanded by serial link, or when a specified frequency is reached, or when any of these occur.

When using a digital input for DC braking, one of the digital inputs must be used to configured for DC braking. The amount of braking force is set by parameter FUN 27 (DC Inj Lvl). The length of time that the braking force is applied is determined by the time that the selected digital input is active.

The second type of DC injection braking supported by the RSi SX drive is where DC braking occurs below a specified frequency. With this type of DC injection braking, as the drive ramps down after a Stop command, DC braking begins when the frequency reaches the value specified in FUN 24 (DC Inj Freq). (If the frequency at the time of a Stop command is less than that of FUN 24 (DC Inj Freq), DC braking begins immediately). The braking continues for the time period specified by parameter FUN 25 (DC Inj T-Freq). Once the time period elapses, the drive may be re-started.

⌘ **NOTE:** If FUN 25 (DC Inj T-Freq) is set to zero, braking is applied until the enable input, DI EN, is de-activated. To re-start, the enable input must be restored to its active condition and then the Run command re-issued.)

The following functions may be assigned to this parameter:

Displayed Name:	Function Assigned:
None	DC injection braking is not utilized.
DCI on Frq	At the frequency specified by parameter FUN 24 (DC Inj Freq), DC braking is initiated.
DCI by DI	DC braking stops when the input becomes inactive.
DCI-DI/Frq	Either the specified frequency or a digital input initiates DC braking, with digital input taking precedence.

⌘**NOTE:** See FUN 24 for further programming options

FUN 24: DC INJ FREQ (dc injection frequency)

Display:

```
FUN: DC Inj Freq
24      0.00 Hz
```

Range: 0.00 to 25.00Hz

Description: If parameter FUN 23 (DC Inj Config) is set to DCI on Frq or DCI-DI/Frq, a frequency threshold is used for DC braking. This parameter sets the value of the frequency threshold. See parameter FUN 23 (DC Inj Config) for more information.

⌘**NOTE:** See FUN 23 (DC Inj Cfg) , FUN 24 (DC Inj Freq), FUN 26 (DC Inj T-Stp) and FUN 27 (DC Inj Level)for further programming options.

FUN 25: DC INJ T-FRQ (dc injection time frequency)

Display:

```
FUN: DC Inj T-Frq
25       0.20 s
```

|Range: 0.00 to 60.00s

Description: If parameter FUN 23 (DC Inj Config) is set to DCI on Frq or DCI-DI/Frq, a frequency threshold is used for DC braking. Once the threshold is crossed, DC braking is initiated and continues for the amount of time specified by this parameter.

⌘ **NOTE:** If this parameter is set to zero, braking is applied until the enable input, DI EN, is deactivated. To re-start, the enable input must be deactivated and then the Run command must be re-issued.

FUN 26: DC INJ T-STP (dc injection time stop)

Display:

```
FUN: DC Inj T-Stp
26       0.20 s
```

Range: 0.00 to 60.00s

Description: If parameter FUN 41 (Stop Mode) is set to "DCI to Stp", DC (direct current) will be applied to the motor on a stop command. This parameter, determines how long the direct current will be applied, which varies with the speed of the motor. The relationship between the speed of the motor and the length of time that direct current is applied is linear until the output frequency is 10% or less of the maximum frequency. At that point, the length of time that direct current is applied to the motor is always 20% of the setting of FUN 26 (DC Inj T-Stp).

For example, if FUN 26 (DC Inj T-Stp) is set to 20s and the drive is running at maximum frequency, direct current will be applied for the entire 20s when a Stop command occurs. If the drive was only running at half the maximum frequency, direct current would be applied for only one-half of the time specified by FUN 26 (DC Inj T-Stp) (in this example, 10s). Finally, if the drive was running at one-tenth of the maximum frequency, direct current would be applied for only 2 seconds (10% of 20 s).

⌘ **NOTE:** If this parameter is set to zero, direct current will be applied until the enable input, DI EN, is deactivated. To re-start, the enable input must be restored to its active condition and then the Run command reissued.)

This parameter is independent of the FUN 23 (DC Inj Cfg) parameter and the other parameters associated with that parameter. In other words, the time period configured by this parameter, FUN 26 (DC Inj T-Stp), does not determine how long DC injection braking will be active. When DC injection braking is controlled by a digital input or by setting bit 12 of (Cntl Word 1), the braking continues as long as the digital input or bit is true; when it is controlled by frequency, it continues for the length of time set by parameter FUN 25 (DC Inj T-Frq).

FUN 27: DC INJ LEVEL (dc injection level)

Display:

```
FUN: DC Inj Level
27       50.0%
```

Range: 0.0 to 150.0%

Description: This parameter configures the amount of DC current to be injected into the motor windings which acts as a braking force. The amount of current is expressed as a percentage of nominal motor current. The braking force may be applied when starting or stopping.

For starting, see parameter AFN 12 (DC PulsStart) on page 97.

For stopping, see parameter FUN 23 (DC Inj Cfg) on page 56

FUN 28: CURR. LIMIT (current limit)

Display:

```
FUN: Curr. Limit
28       150%
```

Range: 1 to 200%

Description: For some applications, it is beneficial to limit the current output of the drive. This parameter allows you to limit the current output by configuring the maximum motor current from the drive expressed as a percentage of nominal current rating.

For example, if you desire to limit current output to 10 Amps:
FUN 01 is 5A , FUN 28 = 200%
FUN 01 is 10A, FUN 28 = 100%
FUN 01 is 25A, FUN 28 = 40%

⌘ **NOTE:** In variable torque mode, the maximum value for this parameter is 110%.

FUN 29: TRQ LIM TYPE (torque limit type)

Display:

```
FUN: Trq Lim Type
29   Disabled
```

Range: See below

Description: The RSi SX drive provides a Torque Limit feature. When this feature is enabled, the drive's frequency is automatically adjusted to keep the measured torque within acceptable limits.

Note that in addition to the torque limit parameters that activate the Torque Limit mode, two additional torque limits are available. These are FUN 57 (Torque Lvl 1) and FUN 58 (Torque Lvl 2), and you may configure a digital output (I/O 11-17) to become true when either of these limits is exceeded.

This parameter establishes how the feature will be enabled. The following functions may be assigned to this parameter:

Displayed Name	Function Assigned:
Disabled	Torque limiting will not be used.
Fixed Lvls	When the measured torque exceeds the limit set by either FUN 31 (Trq Lim M/F), FUN 33 (Trq Lim R/F), FUN 32 (Trq Lim M/R), or FUN 34 (Trq Lim R/R), (depending on what the motor and drive are doing), torque limiting is enabled.
By DI	Torque limiting is enabled when a digital input is true. (See I/O 2-10)
Follow AI	The analog input identified in parameter FUN 30 (Trq Lim AI) is monitored and as it changes, so does the value of each of the four torque limits named for Fixed Lvls. The values of the limits are found by multiplying the percentage of full-scale being input on the analog input by the configured torque limits. For example, if FUN 31 (Trq Lim M/F) is set to 150% and A2 is at half scale, then the actual torque limit when motoring forward is 75%.
On Freq	When the drive's output frequency is greater than the value set by FUN 35 (Trq Lim Freq), torque limiting is enabled.

FUN 30: TRQ LIM AI (torque limit analog input)

Display:

```
FUN: Trq Lim AI
30     AI #1
```

Range: See below

Description: When parameter FUN 29 (Trq Limit Type) is set to Follow AI, an analog input is used to set the torque limits. This parameter, FUN 30 (Trq Lim AI), sets which analog input will be used. The following values may be assigned to this parameter:

Displayed Name	Function Assigned:
AI#1	Analog input 1 of the Terminal Strip Processor Board.
AI#2	Analog input 2 of the Termianl Strip Processor Board.
AI#A	Analog input A of the Optional Analog Input / Output Board.
AI#B	Analog input B of the Optional Analog Input / Output Board.
AI#C	Analog input C of the Optional Analog Input / Output Board.

FUN 31: TRQ LIM M/F (torque limit motoring/forward)

Display:

```
FUN: Trq Lim M/F
31      150%
```

Range: 1 to 200%

Description: This parameter sets the torque limiting point when the motor is driving the load in the Forward direction. The limit is expressed as a percentage of the torque load.

⌘ **NOTE:** See FUN 29 (Trq Lim Type) for more programming options.

FUN 32: TRQ LIM M/R (torque limit motoring/reverse)

Display:

```
FUN: Trq Lim M/R
32      150%
```

Range: 1 to 200%

Description: This parameter sets the torque limiting point when the motor is driving the load in the Reverse direction. The limit is expressed as a percentage of the torque load.

⌘ **NOTE:** See FUN 29 (Trq Lim Type) for further programming options.

FUN 33: TRQ LIM R/F (torque limit regenerating/forward)

Display:

```
FUN: Trq Lim R/F
33      80%
```

Range: 1 to 200%

Description: This parameter sets the torque limiting point when the load drives the motor (regenerative mode) in the Forward direction. The limit is expressed as a percentage of the torque load.

FUN 34: TRQ LIM R/R (torque limit regenerating/reverse)

Display:

```
FUN: Trq Lim R/R
34      80%
```

Range: 1 to 200%

Description: This parameter sets the torque limiting point when the load drives the motor (regenerative mode) in the Reverse direction. The limit is expressed as a percentage of the torque load.

FUN 35: TRQ LIM FREQ (torque limit frequency)

Display:

```
FUN: Trq Lim Freq
35       0.00 Hz
```

Range: 0.00 to 320.00Hz

Description: When parameter FUN 29 (Trq Limit Type) is set to On Freq, the Torque Limit feature will activate when a certain frequency threshold is exceeded. This parameter, FUN 35 (Trq Lim Freq), sets the threshold frequency.

FUN 36: REG TIMEOUT (regenerative timeout)

Display:

```
FUN: Reg Time-Out
36       1 s
```

Range: 0 to 60s

Description: If a stop is commanded and torque limiting is preventing the drive from stopping the motor, this parameter sets the length of time that the drive will torque limit for. When this time is exceeded and the torque limit condition continues to exist, the drive will disable the torque limit in order to stop the motor.

If the parameter is set to 0, the drive will never override a torque limit operation to stop. Exercise extreme caution if setting this parameter to zero!

FUN 37 & 39: ACC (DCL) SHAPE (acceleration & deceleration ramp shape)

Display:

FUN: Acc Shape 37 Linear	FUN: Dcl Shape 39 Linear

Range: See below

Description: This parameter determines the shape of the primary accel/decel ramp determined by DRV 03 (Accel time 1) and DRV 04 (Decel Time 1). The following functions may be assigned to this parameter:

Displayed Name:	Functions Assigned:
Linear	The shape of the ramp is a straight line.
S-Curve	The shape of the ramp is curved to the beginning and end, with the middle portion linear. The degree of curvature is set by parameter FUN 38 (Acc Rounding) or FUN 40 (Dcl Rounding).

Applications:

Figure 15: S-Curve

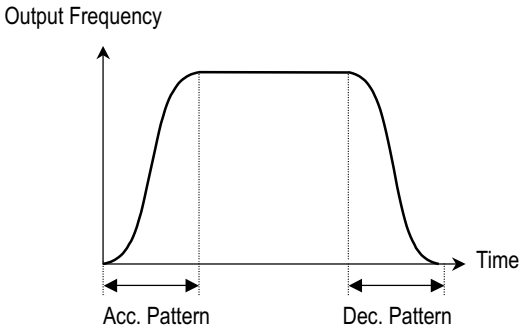
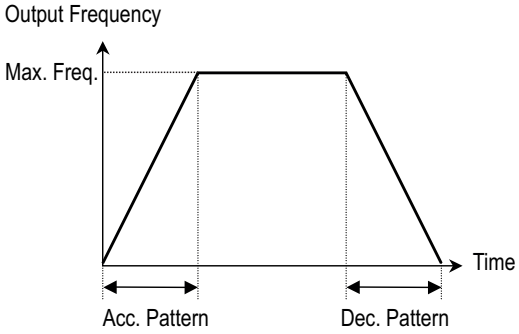


Figure 16: Linear Curve



FUN 38 & 40: ACC (DCL) ROUNDING (acceleration & deceleration rounding)

Display:

FUN: Acc Rounding 38 0.0 s	FUN: Dcl Rounding 40 0.0 s

Range: 0.00 to 10.0s

Description: If parameters FUN 37 (Accel Ramp Shape) or FUN 39 (Decel Ramp Shape) are set to S-Curve, these parameter set the amount of curvature at either end of the respective ramp. A value of 0s produces a linear curve, while a value of 10 produces a maximally rounded S-shaped curve.

FUN 41: STOP MODE

Display:

```
FUN: Stop Mode
41    Rmp to Stp
```

Range: See below

Description: This parameter allows you to configure how the drive stops the motor when a stop is commanded. In a ramp-to-stop, the drive output remains active and may assist in the stopping. In coast-to-stop, the drive output turns off when the Stop command occurs, and the load stops at a rate determined by friction and inertia.

It is also possible to specify that direct current be applied just before the DC Inj Time-Stp. (Note that if FUN 26 (DC Inj Time-Stp) is set to zero, braking continues until the EN (Enable) input is toggled.) This is useful to hold load once stopped but should never be used as a substitute for a safety brake.

The following functions may be assigned to this parameter:

Displayed Name:	Function Assigned:
Rmp to Stp	A ramp-to-stop is performed.
Cst to Stp	A coast-to-stop is performed.
DCI to Stp	A DC pulse is applied.

FUN 42: ALLOW SKIPS

Display:

```
FUN: Allow Skips
42       Off
```

Range: Off / On

Description: The RSi-SX can be programmed to avoid maintaining an output frequency in up to five distinct frequency ranges. The drive will not establish a steady-state at any frequency within a skip band; it will instead ramp through the band. The parameters of this group, FUN 43-52 (Skip Low 1 through Skip 5 High), determine the five frequency ranges which are avoided, and this parameter determines whether these ranges are used.

Applications: Skip bands are typically used to avoid system resonances or points of instability within a particular application. (e.g. vibratory shakers, centerfuges, fans, etc.)

FUN 43-52: SKIP LIMITS

Display:

```
FUN: Skip 1 Low
43      0.00Hz
```

Range: 0.0 to Max. Freq

Description: This parameter sets the lower frequency of the first frequency band to be skipped.

Display:

```
FUN: Skip 5 High
52      0.00Hz
```

Range: Skip 5 Low Lim to Max. Freq

Description: This parameter sets the upper frequency of the fifth frequency band to be skipped.

FUN 53: FAULT LO # (fault lockout number)

Display:

```
FUN: Fault LO #
53        0
```

Range: 0 to 10

Description: This parameter sets the number of faults that may occur before automatic resetting is disabled. Once the number set by this parameter is exceeded, a manual reset of the fault will be required. (A manual reset is accomplished by displaying an active fault display and then pressing the [STOP] key on the keypad, or by using a digital input.)

⌘ **NOTE:** If the parameter is set to 0, no automatic fault resets will occur.

FUN 54: AUTO RST TM (auto restart time)

Display:

```
FUN: Auto Rst Tm
54           0 s
```

Range: 0 to 3600s

Description: When automatic resetting of certain types of faults is enabled by one of the auto-reset parameters AFN 55 (OV Auto-Reset), AFN 56 (OC Auto-Reset), AFN 57 (OT Auto-Reset) or AFN 58 (UVAutoReset), this parameter specifies the time delay before the fault is reset. After the specified time delay elapses, the type of start specified by parameter AFN 60 (Auto Reset Type) will be initiated.

FUN 55 & 56: CURR LVL 1 & 2 (current level 1 & 2)

Display:

FUN: Curr Lvl 1 55 0%	FUN: Curr Lvl 2 56 0%

Range: 0 to 200%

Description: Current Level parameter is a comparator between the nominal drive output current and the value entered into the “Curr Lvl” expressed in percent. When the nominal drive output current exceeds the set level, the associated digital output will be activated. The digital outputs are configured in I/O 11-17.

FUN 57 & 58: TORQUE LVL 1 & 2 (torque level 1&2)

Display:

FUN: Torque Lvl 1 57 0%	FUN: Torque Lvl 2 58 0%

Range: 0 to 200%

Description: Torque Level parameter is a comparator between the nominal drive torque and the value entered into the “Torque Lvl” expressed in percent. When the nominal drive torque exceeds the set level, the associated digital output will be activated. The digital outputs are configured in I/O 11-17

FUN 59-61: FREQ LVL 1 - 3 (frequency level 1-3)

Display:

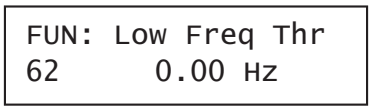
FUN: Freq Level 1 59 0.00 Hz	FUN: Freq Level 2 60 0.00 Hz	FUN: Freq Level 3 61 0.00 Hz

Range: 0.00 to Max Freq

Description: Frequency Level parameter is a comparator between the drive output frequency and the value entered into the “Curr Lvl” expressed in Hertz. When the drive output exceeds the set level, the associated digital output will be activated. The digital outputs are configured in I/O 11-17.

FUN 62: LOW FREQ THR (low frequency threshold)

Display:

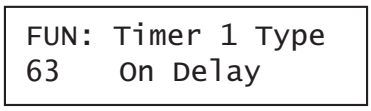


Range: 0.0 to Max Freq

Description: Low Frequency Threshold is a comparator between the drive output frequency and the value entered into the “Low Freq Thr” expressed in Hertz. When the drive output goes below the set level, the associated digital output will be activated. The digital outputs are configured in I/O 11-17.

FUN 63: TIMER 1 TYPE

Display:

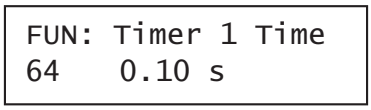


Range: On Delay, Off Delay, On/Off Delay

Description: The timer can be configured for On or Off Delay or for both On/Off Delay. The time value is set by FUN 64 (Timer 1 Time). If configured for both On/Off delay, the time value is the same for On and Off delay.

FUN 64: TIMER 1 TIME

Display:



Range: 0.00 to 320.00 s

Description: The Timer 1 Value is the threshold for the timer. Once the time value is reached the output is turned on if an On Delay, or turned off if an Off Delay.

FUN 65: TIMER 2 TYPE

Display:

```
FUN: Timer 2 Type
65    On Delay
```

Range: On Delay, Off Delay, On/Off Delay

Description: The timer can be configured for On or Off Delay or for both On/Off Delay. The time value is set by FUN 66 (Timer 2 Time). If configured for both On/Off delay, the time value is the same for On and Off delay.

FUN 66: TIMER 2 TIME

Display:

```
FUN: Timer 2 Time
66    0.10 s
```

Range: 0.00 to 320.00 s

Description: The Timer 2 Value is the threshold for the timer. Once the time value is reached the output is turned on if an On Delay, or turned off if an Off Delay.

FUN 67: HS TEMP WARN (heatsink temperature warning)

Display:

```
FUN: HS Temp Warn
67         100%
```

Range: 0.0 to 100%

Description: This parameter sets the temperature threshold at which an overtemperature warning is generated. It is expressed as a percentage of the overtemperature trip point (parameter FUN 68 - HS Temp Trip), which is the temperature at which an overtemperature fault will be generated. 0% corresponds to -20°C (-4°F) and 100% corresponds to parameter FUN 68 (HS Temp Trip).

FUN 68: HS TEMP TRIP (heatsink temperature trip)

Display:

```
FUN: HS Temp Trip
68      105°C
```

Range: View-Only

Description: When the temperature of the heatsink (as found in parameter DRV 05 - Drive Temp) exceeds the value set in parameter FUN 67 (HS Temp Warn), a warning will be given. If the temperature exceeds the value set in parameter FUN 68 (HS Temp Trip), an overtemperature fault will occur and the drive will stop.

FUN 69: FLT STP MODE (fault stop mode)

Display:

```
FUN: Flt Stp Mode
69    Rmp to Stp
```

Range: See below

Description: This parameter allows you to configure how the drive stops the motor when a fault is detected. In a ramp-to-stop, the drive remains operational and may assist in the stopping. In coast-to-stop, the drive turns off when the Stop command occurs, and the load stops at a rate determined by friction and inertia.

The following functions may be assigned to this parameter:

Displayed Name:	Function Assigned:
Rmp to Stp	A ramp-to-stop is performed.
Cst to Stp	A coast-to-stop is performed.

FUN 70: DISPLAY MODE

Display:

```
FUN: Display Mode
70   Std Disply
```

Range: N/A

Description: This parameter configures what information is shown on the standard display in Operate mode. The following functions may be assigned to this parameter:

Displayed Name:	Function Assigned:
Std Disply	The output frequency and drive load is shown in the display.
User Units	A custom unit may be created using the FUN 71 (Usr Unit Mul), FUN 72 (Usr Unit Div), FUN 73-75 (User Label 1- 3) parameters and displayed on the keypad. User Units = $\frac{UUM}{UUD}$ See FUN 71-75 about these parameters.
Reten Time	The display shows retention time, which is a reciprocal function of the normal speed/frequency proportional output. The displayed value for the retention time (RDV) is derived by dividing the value of FUN 71 (Usr Unit Mul) (UUM) by the value of FUN 72 (Usr Unit Div) (UUD), and then multiplying the result by the quotient of the AFN 03 (Maximum Freq) (FMAX) divided by 10 times the operating frequency (FOUT). As an equation, this is represented as follows: RDV= $\frac{UUM}{UUD}$ x $\frac{\text{Max. Frequency}}{(10 \times FOUT)}$ See FUN 71-75 about these parameters.

FUN 71: USR UNIT MUL (user units multiplier)

Display:

```
FUN: Usr Unit Mul
71          30
```

Range: 1 to 32767

Description: This parameter may be used in creating a custom unit that is displayed on the keypad. The value stored in this parameter is multiplied by the displayed frequency. For example, to show speed in revolutions per minute for an 1800rpm motor, the FUN 70 (Display Mode) parameter would be set to User Units and the FUN 71 (Usr Unit Mul) parameter would be set to 30. (The default value for the FUN 72 (Usr Unit Div) parameter is 1, and so it does not need altered for this example.)

FUN 72: USR UNIT DIV (user units divisor)

Display:

```
FUN: Usr Unit Div
72         1
```

Range: 1 to 32767

Description: This parameter may be used in creating a custom unit that is displayed on the keypad. The displayed frequency is divided by the value stored in this parameter. For example, to show speed in revolutions per minute for an 1800rpm motor, the FUN 70 (Display Mode) parameter would be set to User Units and the FUN 71 (Usr Unit Mul) parameter would be set to 30. (The default value for the FUN 72 (Usr Unit Div) parameter is 1, and so it does not need altered for this example.)

FUN 73-75: USR LBL 1-3 (user label 1-3)

Display:

```
FUN: Usr Lbl 1
73    r
```

```
FUN: Usr Lbl 2
74    p
```

```
FUN: Usr Lbl 3
75    m
```

Range:

Description: These custom units created with the above parameters may have a three-character label applied to it. These three parameters specify the first through the third characters, respectively. A character is selected by using the Up or Down arrow keys to scroll to the desired character and then pressing [ENTER]. The characters supported by the RSi SX drive are upper and lower case A through Z, 0 through 9, blank (space), and the symbols # % + - . / : < = > _ , @ ^ &.

FUN 76: ACCESS LEVEL (access level configure)

Display:

```
FUN: Access Level
76    Config
```

Range: See below

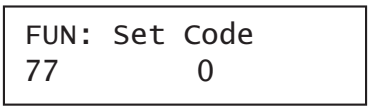
Description: The RSi SX drive provides two levels of access. This parameter sets which access level is enabled, which in turn determines which parameter groups may be accessed and adjusted. See Section 2.1.2 for more information on configuring Drive Security.

The functions that may be assigned to this parameter, and what each signifies, are shown below:

Displayed Value	What is Allowed
Configure	You may read all parameters, and configure the non-read-only parameters, if the drive is stopped.
Config Run	You may read all parameters, and configure the non- read-only parameters, whether the drive is stopped or running, although some parameters (such as those for digital inputs) may only be configured when the drive is stopped.

FUN 77: SET CODE

Display:

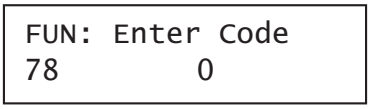


Range: 1 to 9999

Description: If this parameter is set to a non-zero value, security is enabled. A user must enter the value of this parameter in the FUN 78 (Enter Code) parameter to program the parameters that are made available by the FUN 76 (Access Level) parameter. See Section 2.12 for more information on configuring Drive Security.

FUN 78: ENTER CODE

Display:



Range: 1 to 9999

Description: If FUN 77 (Set Code) parameter is set to a non-zero value, security is enabled and a user must enter a passcode to gain entry. The FUN 78 (Enter Code) parameter is set by the user to the value of the passcode, which is then compared to the value in the FUN 77 (Set Code) parameter. If they match, access is granted. See Section 2.12 for more information on configuring Drive Security.

INTRODUCTION

4.3 Introduction

The I/O group configures drive analog and digital I/O. On pages 89 through 91 there are illustration (I/O maps) on how each of the parameters work together.

4.4 I/O Group

I/O 01: ACTIVE LOGIC

Display:

```
I/O: Active Logic
01   Active Hgh
```

Range: See below

Description: This parameter determines whether a high or a low input is regarded as active A “high input” is input voltage between 10 and 24VDC; a “low input” is a voltage between 0 and 3VDC. Any value in between is considered unspecified and is not supported.

Note that the EN (Enable) terminal on the TB4 terminal group is not affected by the setting of this parameter. A high input to the EN terminal is always regarded as active. Thus, if the input to the terminal goes low, the drive will not operate - even if pull-down logic is configured.The following functions may be assigned to this parameter:

Displayed Name	Function Assigned
Active Low	Low input is true (“pull-down logic”).
Active Hgh	High input is true (“pull-up logic”).

WARNING: The digital inputs must be within the specified voltages or unintended operation may result, causing machinery and/or personal damage.

I/O 02-10: D2-D10 CONFIG (digital input 2-digital input 10 configure)

Display:

I/O: D2 Config 02 Stop	I/O: D5 Config 05 Jog Revers	I/O: D8 Config 08 PS In #3
I/O: D3 Config 03 Reverse	I/O: D6 Config 06 PS In #1	I/O: D9 Config 09 Flt Reset
I/O: D4 Config 04 Jog	I/O: D7 Config 07 PS In #2	I/O: D10 Config 10 Ext. Flt (NC)

Range: See below.

Description: I/O parameters 02 -10 configures which functions are performed by the D2 to D10 terminals. The following functions may be assigned to D2 - D10 parameters.

Not Assign	Flt Reset	Alt Rmp #1	Local/Remote
Forward	Ext Fault (NC)	Alt Rmp #2	PID Enable
Reverse	Ext Fault (NO)	Torque Lim	EMOP +Spd
Stop	PS In #1	DC Inject	EMOP -Spd
Jog	PS In #2	C/R Override	Timer 1
Jog Reverse	PS In #3	Hand/Auto	Timer 2

Application:

Displayed Name	Function When Active:
Not Assign	Input has no function.
Forward	Command the Forward direction.
Reverse	Command the Reverse direction.
Stop	Command a Stop remove the seal for a 3 wire control.
Jog	Start jogging operation.
Jog Revers	Start jogging operation in Reverse.
Flt Reset	Resets a fault.
Ext. Flt (NC)	Monitor for an external fault with a NC contact. Note that you must also configure parameter AFN 51 (External Fault) to generate a warning or fault.
Ext. Flt (NO)	Monitor for an external fault with a NC contact. Note that you must also configure parameter AFN 51 (External Fault) to generate a warning or fault.
PS In #1	Set reference to Preset Speed 1.
PS In #2	Set reference to Preset Speed 2.
PS In #3	Set reference to Preset Speed 3.
Alt Rmp #1	Activate Alternate Ramp 1.
Alt Rmp #2	Activate Alternate Ramp 2.
Torque Lim	Activate Torque Limit mode.
DC Inject	Begin DC injection braking.
C/R Override	Switch from terminal strip to keypad control.
Hand/Auto	Switch from Hand to Auto mode.
Local/Remote	Switch from Local to Remote mode.
PID Enable	Enables PID control.
EMOP +Spd	EMOP increase speed.
EMOP -Spd	EMOP decrease speed.
Timer 1	Activates Timer 1.
Timer 2	Activates Timer 2.

⌘ **NOTE:** If FUN 05 (3-wire control) is selected, D2 is set to “STOP” and cannot be changed.

I/O 11-13: DQ1-DQ3 CONFIG (digital output 1-digital output 3 configure)

Display:

I/O: DQ1 Config 11 Drive Rdy	I/O: DQ2 Config 12 At Speed	I/O: DQ3 Config 13 Run Rev

Range: See below.

Description: These parameters configure what actions or states cause the digital outputs (terminals DQ1-DQ3) to become active; note that only Active Low (pull-down) logic is available for the digital outputs. The following functions may be assigned:

Displayed Name	DQ1 Becomes Active When:
Not Assign	Digital output is not used.
Drive Run	Drive enters Run mode.
Run Fwd	Drive is running in Forward.
Run Rev	Drive is running in Reverse.
Drive Rdy	Drive is powered-up and ready.
At Speed	Drive has reached reference speed.
Drv Flted	Drive is in faulted state.
Drv NotFlt	Drive is not in faulted state.
Kypd in Ctl	The keypad is the control and reference source.
Drv in Rem	The drive is in remote control.
Jogging	Jogging operation begins.
Curr Lvl 1	Value of parameter FUN 55 (Current Level 1) is exceeded.
Curr Lvl 2	Value of parameter FUN 56 (Current Level 2) is exceeded.
Trq Lvl 1	Value of parameter FUN 57 (Torque Level 1) is exceeded.
Trq Lvl 2	Value of parameter FUN 58 (Torque Level 2) is exceeded.
Frq Lvl 1	Value of parameter FUN 59 (Frequency Limit 1) is exceeded.
Frq Lvl 2	Value of parameter FUN 60 (Frequency Limit 2) is exceeded.
Frq Lvl 3	Value of parameter FUN 61 (Frequency Limit 3) is exceeded.
Temp Lvl	Value of parameter FUN 67 (HS Temp Warn) is exceeded.
In Cur Lim	Current Limit mode is active.
In Trq Lim	Torque Limit mode is active.
Loss Ref	Loss of 4 to 20mADC follower.
SL in Ctrl	Serial Control in control, control bit SLC set.
SL Ovrride	Control by Serial Link being overridden.
Zero Speed	The drive is in Run mode, but the speed reference is 0Hz.
Frq Low Th	The drive frequency falls below the value set in FUN 62 (Low Freq Thr).
PID High	The PID output rises above the value in AFN 71 (PID High Alarm).
PID Low	The PID output falls below the value in AFN 72 (PID Low Alarm).
Active Warn	Output activates upon warning.
Timer 1	Output of Timer 1 activates.
Timer 2	Output of Timer 2 activates.

I/O 14&15: R1 & R2 CONFIG (r1 & r2 configure)

Display:

I/O: R1 Config 14 Drv Flted	I/O: R2 Config 15 Drive Run

Range: See below.

Description: These parameters configure what actions or states cause output relay 1 and 2 (terminals RC 1/2, NC 1/2, NO 1/2) to become active. The functions that may be assigned to this parameter are the same as those that may be assigned to parameter DQ1 – DQ3.

Displayed Name:	DQ1 Becomes Active When:
Not Assign	Digital output is not used.
Drive Run	Drive enters Run mode.
Run Fwd	Drive is running in Forward.
Run Rev	Drive is running in Reverse.
Drive Rdy	Drive is powered-up and ready.
At Speed	Drive has reached reference speed.
Drv Flted	Drive is in faulted state.
Drv NotFlt	Drive is not in faulted state.
Kypd in Ctl	The keypad is the control and reference source.
Drv in Rem	The drive is in remote control.
Jogging	Jogging operation begins.
Curr Lvl 1	Value of parameter FUN 55 (Current Level 1) is exceeded.
Curr Lvl 2	Value of parameter FUN 56 (Current Level 2) is exceeded.
Trq Lvl 1	Value of parameter FUN 57 (Torque Level 1) is exceeded.
Trq Lvl 2	Value of parameter FUN 58 (Torque Level 2) is exceeded.
Frq Lvl 1	Value of parameter FUN 59 (Frequency Limit 1) is exceeded.
Frq Lvl 2	Value of parameter FUN 60 (Frequency Limit 2) is exceeded.
Frq Lvl 3	Value of parameter FUN 61 (Frequency Limit 3) is exceeded.
Temp Lvl	Value of parameter FUN 67 (HS Temp Warn) is exceeded.
In Cur Lim	Current Limit mode is active.
In Trq Lim	Torque Limit mode is active.
Loss Ref	Loss of 4 to 20mADC follower.
SL in Ctrl	Serial Control in control, control bit SLC set.
SL Ovrride	Control by Serial Link being overridden.
Zero Speed	The drive is in Run mode, but the speed reference is 0Hz.
Frq Low Th	The drive frequency falls below the value set in FUN 62 (Low Freq Thr).
PID High	The PID output rises above the value in AFN 71 (PID High Alarm).
PID Low	The PID output falls below the value in AFN 72 (PID Low Alarm).
Active Warn	Output activates upon warning.
Timer 1	Output of Timer 1 activates.
Timer 2	Output of Timer 2 activates.

I/O 16 & 17: RA & RB CONFIG (ra & rb output relay configure)

Display:

```
I/O: RA Config
16   Not Assign
```

```
I/O: RB Config
17   Not Assign
```

Range: Not Assigned

Description: These parameters configure what action or state causes output relay A or B of the Optional Analog Input/Output Board to become active. The functions that may be assigned to these parameters are the same as those that may be assigned to parameter I/O 14&15 (R1/R2 Configure; see page 75 for the available functions).

I/O 18: FIXED SPEED (set fixed speed)

Display:

```
I/O: Fixed Speed
18    5.00 Hz
```

Range: 0.0 to 320.0Hz

Description: When parameter FUN 07 (Main Spd Ref) or FUN 08 (Jog Ref Cfg, see on page 48) is set to Spd Fixed, this parameter specifies the speed.

I/O 19: SET K-FACTOR (set k-factor)

Display:

```
I/O: Set k-factor
19       10.0%
```

Range: 0.0 to 100.0%

Description: When parameter FUN 07 (Main Spd Ref, see on page 47) is set to S-R1+k*R2, this parameter sets the value of k, which is the scale factor by which reference 2 is multiplied before being added to reference 1.

I/O 20-26: PRESET SPD 1-7 (preset speed groups 1-7)

Display:

```
I/O: Preset Spd 1
20    5.00 Hz
```

```
I/O: Preset Spd 2
21    10.00 Hz
```

```
I/O: Preset Spd 3
22    20.00 Hz
```

```
I/O: Preset Spd 4
23    30.00 Hz
```

```
I/O: Preset Spd 5
24    40.00 Hz
```

```
I/O: Preset Spd 6
25    50.00 Hz
```

```
I/O: Preset Spd 7
26    60.00 Hz
```

Range: 0.00 to Maximum Frequency

Description: These parameters set the seven preset speeds. The preset speed selection is made through a combination of digital inputs (or serial command bits, if serial control is used). PS1, PS2 and PS3 select the active preset speed, as shown in Table 9.

Table 9

PS1	PS2	PS3	Preset Selected
0	0	0	Reference Freq.
1	0	0	Preset 1
0	1	0	Preset 2
1	1	0	Preset 3
0	0	1	Preset 4
1	0	1	Preset 5
0	1	1	Preset 6
1	1	1	Preset 7

If PS1, PS2 or PS3 is not assigned to a digital input it will always be read as '0'. eg. If PS3 is not assigned to a digital input you will only be able to select Preset 1, Preset 2 or Preset 3.

⌘ **NOTE :** Preset speed selection only works when the drive speed reference comes from the terminal strip (analog inputs) or serial frequency reference.

⌘ **NOTE :** If you wish to have preset speed 0 fixed, set the Reference Source to Main Spd Ref, and set Main Speed Reference to come from Spd-fixed. See FUN 06 or 07, see on page 46 and I/O 18 on page 76.

I/O 27: A11 CONFIG (analog input 1 configure)

Display:

```
I/O: A11 Config
27   Normal
```

Range:

Displayed Name:	Function Assigned:
Normal	Signal is not altered. Note that a 4-20mADC signal maybe input with this selection, but parameters A11 Span and A11 Offset may need to be adjusted to provide the desired drive performance.
Brkn Wire	Monitor for broken wire from potentiometer.
Bipolar	Input value can be both positive and negative (+ve is forward, -ve is reverse)
4-20mA	Range is 4 to 20mADC. A fixed offset of 20% and span of 80% are included with this selection. Parameters A11 Offset and A11 Span are inoperative.
0-10 Bipol	Bi-directional speed command from uni-directional reference. 5VDC = zero speed, 0V = reverse full speed,10V = forward full speed

Description: This parameter configures what type of signal is being received on terminals A11 and A12 (analog input 1 and 2). See Section 4.5 in the Hardware Manual for more information.

I/O 28: A11 SPAN (analog input 1 span)

Display:

```
I/O: A11 Span
28       100.0%
```

Range: 0.0 to 200.0%

Description: This parameter is used to alter the range of the input being received at terminals A11 and A12 (analog input 1 and 2). For example, with a 0 to 10VDC input, setting this parameter to a value of 50% alters the range to 0 to 5VDC.

If parameter I/O 27 (A11 Configure) is set to 4-20mA, the setting of this parameter is ignored.

⌘ **NOTE:** The minimum difference between offset and span will be limited to 10%. If offset is set to a value greater than span, zero speed output will result.

I/O 29: A11 OFFSET (analog input 1 offset)

Display:

```
I/O: A11 Offset
29        0.0%
```

Range: 0.0 to 100.0%

Description: This parameter is used to alter the starting value of the input being received at terminals A11 and A12 (analog input 1). For example, with a 0 to 10VDC input, setting this parameter to a value of 10% alters the range to 1 to 10VDC.
If parameter I/O 27 (A11 Configure) is set to 4-20mA, the setting of this parameter is ignored.

I/O 30: A11 INVERT (analog input 1 invert)

Display:

```
I/O: A11 Invert
30   Normal
```

Range:

Displayed Name:	Function Assigned:
Normal	Not inverted; minimum input is minimum frequency.
Inverted	Inverted; minimum input is maximum frequency.

Description: This parameter configures whether the signal being received at terminals A11 and A12 (analog input 1) is inverted - that is, whether the minimum input corresponds to the maximum frequency.

I/O 31: A11 FTR TIME: (analog input 1 filter time)

Display:

```
I/O: A11 Ftr Time
31          5 ms
```

Range: 1 to 32767ms

Description: This parameter sets the low-pass filter time for the analog input signal being received at terminals A11 and A12. Longer filter times better reduce noise disturbances, but may slow the signal response time.

I/O 32: A21 CONFIG (analog input 2 configure)

Display:

```
I/O: A21 Config
32   Normal
```

Range:

Displayed Name:	Function Assigned:
Normal	Signal is not altered. Note that a 4-20mADC signal may be input with this selection, but parameters I/O 33 (A21 Span) and I/O 34 (A21 Offset) may need to be adjusted to provide the desired drive performance.
4-20mA	Range is 4 to 20mADC. A fixed offset of 20% and span of 100% are included with this selection. Parameters I/O 34 (A21 Offset) and I/O 33 (A21 Span) are inoperative.
Pls in 1kHz	Up to 1kHz pulse trains are accepted (1024 pulses per second).
Pls in 5kHz	Up to 5kHz pulse trains are accepted (5120 pps).
Pls in 20k	Up to 20kHz pulse trains are accepted (20400 pps).
Pls in 100k	Up to 100kHz pulse trains are accepted (102400 pps).

Description: This parameter configures what type of signal is being received at terminal A21 (analog input 2). See Section 4.5 in the Hardware Manual for more information.

I/O 33: A21 SPAN (analog input 2 span)

Display:

```
I/O: A21 Span
33       100.0%
```

Range: 0.0 to 200.0%

Description: This parameter is used to alter the range of the input being received at terminal A21. For example, with a 0 to 10VDC input, setting this parameter to a value of 50% alters the range to 0 to 5VDC.

If parameter I/O 32 (A21 Configure) is set to 4-20mA, the setting of this parameter is ignored.

⌘ **NOTE:** The minimum difference between offset and span will be limited to 10%. If offset is set to a value greater than span, zero speed output will result.

I/O 34: A21 OFFSET (analog input 2 offset)

Display:

```
I/O: A21 Offset
34        0.0%
```

Range: 0.0 to 100.0%

Description: This parameter is used to alter the starting value of the input being received at terminal A21. With A21 Config set to “normal”, and a 0-20mA input, setting this parameter to 40% alters the range to 8-20mA.

If parameter I/O 32 (A21 Configure) is set to 4-20mA, the setting of this parameter is ignored.

I/O 35: A21 INVERT (analog input 2 invert)

Display:

```
I/O: A21 Invert
35    Normal
```

Range:

Displayed Name	Function Assigned
Normal	Not inverted; minimum input is minimum freq.
Inverted	Inverted; minimum input is maximum freq.

Description: This parameter configures whether the signal being received at terminals A21 is inverted - that is, whether the minimum input corresponds to the maximum frequency.

I/O 36: A21 FTR TIME (analog input 2 filter time)

Display:

```
I/O: A21 Ftr Time
36          5 ms
```

Range: 1 to 32767ms

Description: This parameter sets the low-pass filter time for the analog input signal received at terminal A21. Longer filter times better reduce noise disturbances, but may slow the signal response time.

I/O 37 & 38: A0/A1 CONFIG (analog output 1 and 2 configure)

Display:

```
I/O: A0 Config
37   Motor Spd
```

```
I/O: A1 Config
38   Out Torque
```

Description: These parameters configure what variable governs the output of analog output 1 (terminal A0) and analog output 2 (terminal A1). A0 is a 0 to 10VDC output, A1 is a 14 to 20mA output. The following functions may be assigned to either of these parameters.

Displayed Name:	Output is Governed by:
Not Assign	Analog output 1 is not used.
Motor Spd	Percent speed of the attached motor.
Motor Curr	Percentage of nominal motor current (see DRV 01 on page 36).
Out Torque	Estimated percentage of torque.
Out Volt	Percentage of full voltage supplied to the motor (see FUN 02 on page 44).
Out Power	Percentage of calculated power.
Out Freq	Percentage of maximum frequency of the drive (see AFN 03 see on page 92).
Ref Freq	Percentage of maximum frequency commanded (seeAFN 03 see on page 92).
Motor Temp	Percentage of maximum motor temperature.
PID Fback	Percentage of full scale PID output (0-100%).
Bus Voltage	Percentage of DC bus level. See AFN 63 on page121 .

I/O 39: A0 CAL (analog output 1 calibrate)

Display:

```
I/O: A0 Cal
39       100.0%
```

Range: 0 to 105%

Description: This parameter is used to calibrate the output being sent from analog output 1 (terminal A0). For example, configuring this parameter to 100% equals a 10V full scale.

I/O 40: A1 CAL (analog output 2 calibrate)

Display:

```
I/O: A1 Cal
40        100.0%
```

Range: 0 to 105 %

Description: This parameter is used to calibrate the output being sent from analog output 2 (terminal A1). For example, configuring this parameter to 100% equals a 20mA full scale.

I/O 41: A1 OUT TYPE (analog output 2 out type)

Display:

```
I/O: A1 Out Type
41    0-20 mA
```

Range:

Displayed Name:	Output From A1 Is Governed By:
0-20mA	The current range output from A1 is 0 to 20mA.
4-20mA	The current range output from A1 is 4 to 20mA.

Description: This parameter determines the current range output from terminal A1.

I/O 42 & 45: AQA & AQB CONFIG (optional analog output a&b configure)

Display:

```
I/O: AQA Config
42    Not Assign
```

```
I/O: AQB Config
45    Not Assign
```

Range:

Description: These parameters configure what variable governs the output of analog output A or B of the Optional Analog Input/Output Board. The functions that may be assigned to this parameter are the same as those for I/O 37 (A0 Configure, see on page 81).

I/O 43 & 46: AQA & AQB CAL (optional analog output a&b calibrate)

Display:

I/O: AQA Cal 43 100.0%	I/O: AQB Cal 46 100.0%

Range: 0 to 200%

Description: These parameters are used to calibrate the output being sent from analog output A or B of the Optional Analog Input/Output Board. For example, configuring this parameter to 100% equals a 10V full scale.

I/O 44 & 47: AQA&AQB OFFSET (optional analog output a&b offset)

Display:

I/O: AQA Offset 44 0.0%	I/O: AQB Offset 47 0.0%

Range: 0 to 100%

Description: These parameters adjust the low-end offset for analog output A or B of the Optional Analog Input/Output Board. For example, if the value of this parameter was set to 50%, the range for the output would start at 10mA rather than 4mA.

I/O 48, 52 & 56: AI A,B,C SPAN (analog input a,b,c span)

Display:

I/O: AIA Span 48 100.0%	I/O: AIB Span 52 100.0%	I/O: AIC Span 56 100.0%

Range: 0.0 to 200.0%

Description: These parameters are used to alter the range of the input being sent to the A, B, or C analog input terminal of the Analog Input/Output Option Board. For example, with a 0 to 10VDC input, setting this parameter to a value of 50% alters the range to 0 to 5VDC.

I/O 49, 53 & 57: AI A,B,C OFFSET (analog input a,b,c, offset)

Display:

I/O: AIA Offset 49 0.0%	I/O: AIB Offset 53 0.0%	I/O: AIC Offset 57 0.0%

Range: 0.0 to 100.0%

Description: These parameters are used to alter the starting value of the input being sent to the A, B, or C analog input terminal of the Optional Analog Input/Output Board. For example, with a 0 to 10VDC input, setting this parameter to a value of 10% alters the range to 1 to 10VDC.

⌘ **NOTE**: The minimum difference between offset and span will be limited to 10%. If the offset is set to a value greater than span, zero speed output will result.

I/O 50, 54 & 58: AI A,B,C INVERT (analog input a,b,c invert)

Display:

I/O: AIA Invert 50 Normal	I/O: AIB Invert 54 Normal	I/O: AIC Invert 58 Normal

Range:

Displayed Name:	Function Assigned:
Normal	Not Inverted; minimum input is minimum frequency.
Inverted	Inverted; minimum input is maximum frequency.

Description: These parameters configure whether the signal being sent to the A, B, or C analog input terminal of the Analog Input/Output Option Board is inverted - that is, whether the minimum input corresponds to the maximum frequency.

I/O 51, 55 & 59: AI A,B,C FTR TIME (analog input a,b,c filter time)

Display:

I/O: AIA Ftr Time 51 0 ms	I/O: AIB Ftr Time 55 0 ms	I/O: AIC Ftr Time 59 0 ms

Range: 1 to 1000ms

Description: These parameters set the low-pass filter time for the analog input signal being sent to the A, B, or C analog input terminal of the Analog Input/Output Option Board. Longer filter times better reduce noise disturbances, but may slow the signal response time.

I/O 60: A11 LEVEL (analog input 1 level)

Display:

```
I/O: A11 Level
60   0.00%
```

Range: -100% to 100%

Description: This parameter contains a value representing the measured input signal at the A11 (Analog input 1) terminal as a percentage of the maximum input signal. For example, if A11 was configured to range from 0 to 10VDC and the measured voltage was 2V, then this parameter would show 20% (2/10).

I/O 61: A21 LEVEL (analog input 2 level)

Display:

```
I/O: A21 Level
61     0.00%
```

Range: 0 to 100%

Description: This parameter contains a value representing the measured input signal at the A21 (Analog input 2) terminal as a percentage of the maximum input signal. For example, if A21 was configured to range from 0 to 20mA and the measured current was 15mA, then this parameter would show a value of 75% (15/20).

I/O 62: A0 LEVEL (analog output 1 level)

Display:

```
I/O: A0 Level
62     0.00%
```

Range: 0 to 100%

Description: This parameter contains a value representing the measured voltage at the A0 (Analog output 1) terminal as a percentage of the maximum output voltage. For example, if this parameter showed 50%, then the voltage being output at A0 would be 5VDC (50% of 10VDC, the maximum value).

I/O 63: A1 LEVEL (analog output 2 level)

Display:

```
I/O: A1 Level
63      0.00%
```

Range: 0 to 100%

Description: This parameter contains a value representing the measured current at the A1 (Analog output 2) terminal as a percentage of the maximum output current. For example, if this parameter showed 25%, then the current being output at A1 would be 5mADC (if the current range was 0 to 20mADC) or 8mADC (if the current range was 4 to 20mADC. The current range is selected with parameter A1 Output Type).

I/O 64 - 66: AI A,B, & C LEVEL (analog input a,b,c, level)

Display:

```
I/O: AIA Level
64      0.00%
```

```
I/O: AIB Level
65      0.00%
```

```
I/O: AIC Level
66      0.00%
```

Range: 0 to 100%

Description: These parameters contain a value representing the measured input signal at the A, B, or C terminal of the Analog Input/Output Option Board as a percentage of the maximum input signal. For example, if terminal AC was configured to range from 0 to 20mADC and the measured current was 5mA, then this parameter would show a value of 25% (5/20).

I/O 67: FILTER TIME (digital input filter time)

Display:

```
I/O: Filter Time
67           5 ms
```

Range: 1 to 255ms

Description: This parameter sets the amount of time in which the RSi SX drive will recognize a change in the signal to a digital input. For example, for the default value of 5ms, when a digital input transitions from low to high, a 5ms delay will occur before the digital input is recognized by the drive as having transitioned.

I/O 68: DPQ SCALING:

Display:

```
I/O: DPQ Scaling
68    6x FREQ
```

Range: 6, 48, 96, or 3072 times the output frequency

Description: This parameter selects the multiplier that is used to determine the output frequency at the DPQ terminal. The DPQ output is the product of the drive's output frequency and the value of this parameter

.

I/O 69: KEYPAD CTRL (keypad control)

Display:

```
I/O: Keypad Ctrl
69    SKP
```

Range: See below.

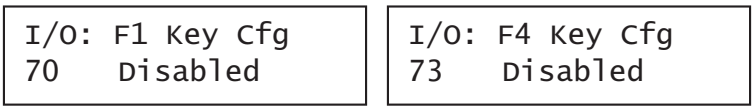
Description: This parameter configures the type of keypad that is connected to the RSi SX drive (either standard, enhanced, or both) and the response of the drive if communication with the keypad is lost. The following functions may be assigned to this parameter:

Displayed Name:	Function Assigned:
SKP	This denotes that the standard keypad is attached to the drive. If communication with the keypad is lost, fault code 40 will be generated.
Both	This denotes that both a standard and an enhanced keypad are connected to the drive. Fault code 40 is generated if communication with either keypad is lost.
Both No Flt[1]	Same as Both, except that if communication is lost with either keypad, a fault will not be generated and the drive will continue to operate.
EKP	This denotes that an enhanced keypad is connected to the drive. Fault code 40 is generated if communication with the enhanced keypad does not occur in the amount of time specified in parameter AFN 28 (COM Timeout,page 107).

[1] ⌘ **NOTE:** When the keypad is the primary control mechanism, if this function is selected and communication is interrupted (that is, temporarily lost and then restored), then the drive may not recognize the pressing of the Stop key even if the keypad is communicating with the drive.

I/O 70-73: F1-F4 Key Cfg (f1-f4 key configure)

Display:



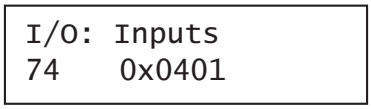
Range: See below.

Description: These parameters allow you to configure the function performed by the function keys found on the enhanced keypad (F1, F2, F3, F4). The following functions may be assigned to these parameters:

Displayed Name:	Function Assigned:
Disabled	The function key does not perform any special functions (although it will, when used with the SHIFT key, navigate to the named mode).
PID Enable	The function key toggles PID control.
C/R Override	This function key switches between run/stop and reference sources. Refer to section 2.6 for a description of the control method operation.

I/O 74: INPUTS

Display:

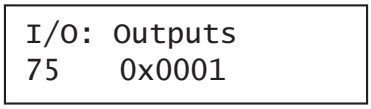


Range: N/A

Description: A Hexadecimal representation of the Input states. This parameter is view-only.

I/O 75: OUTPUTS

Display:

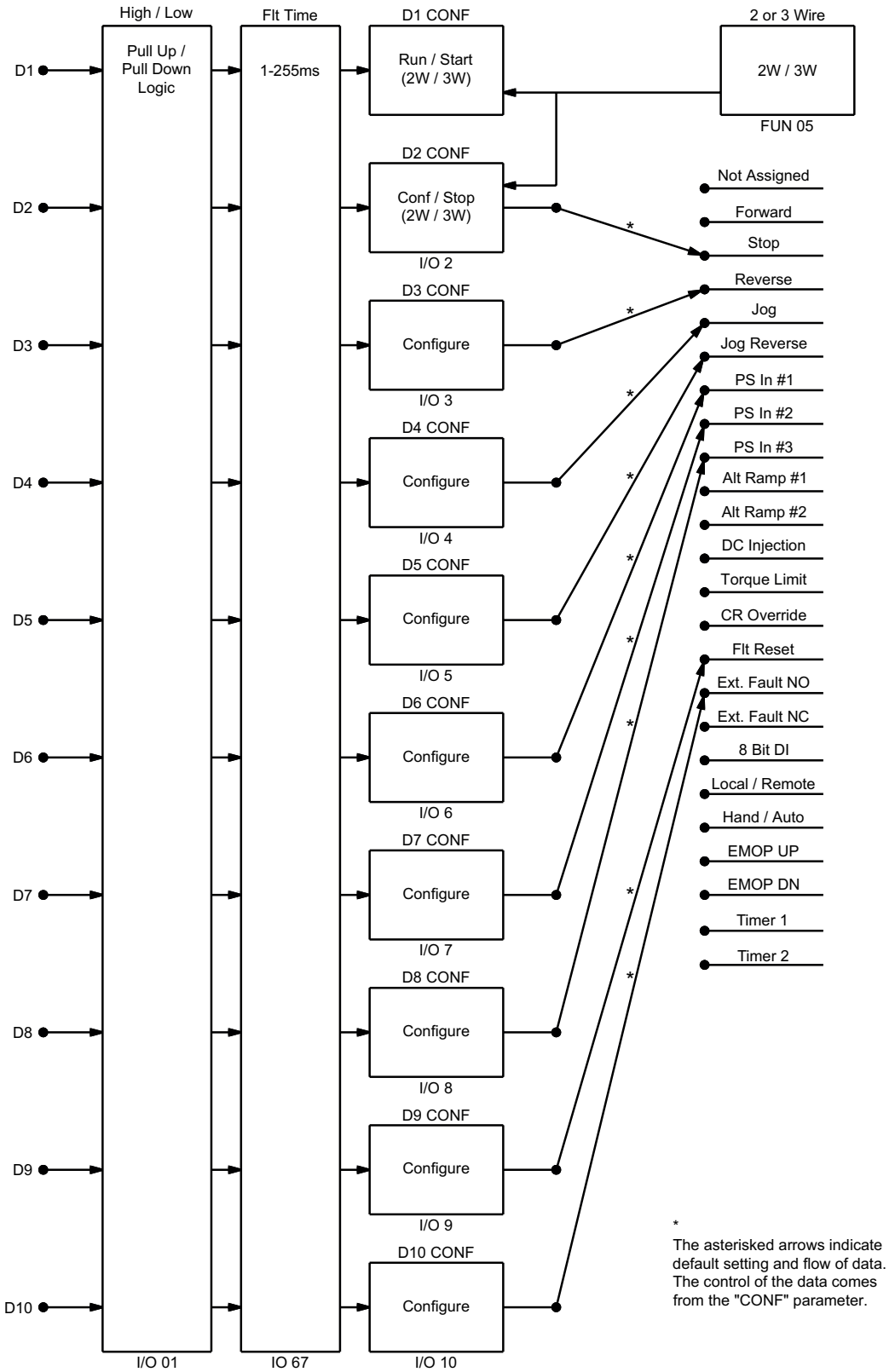


Range: N/A

Description: A Hexadecimal representation of the Output states. This parameter is view-only.

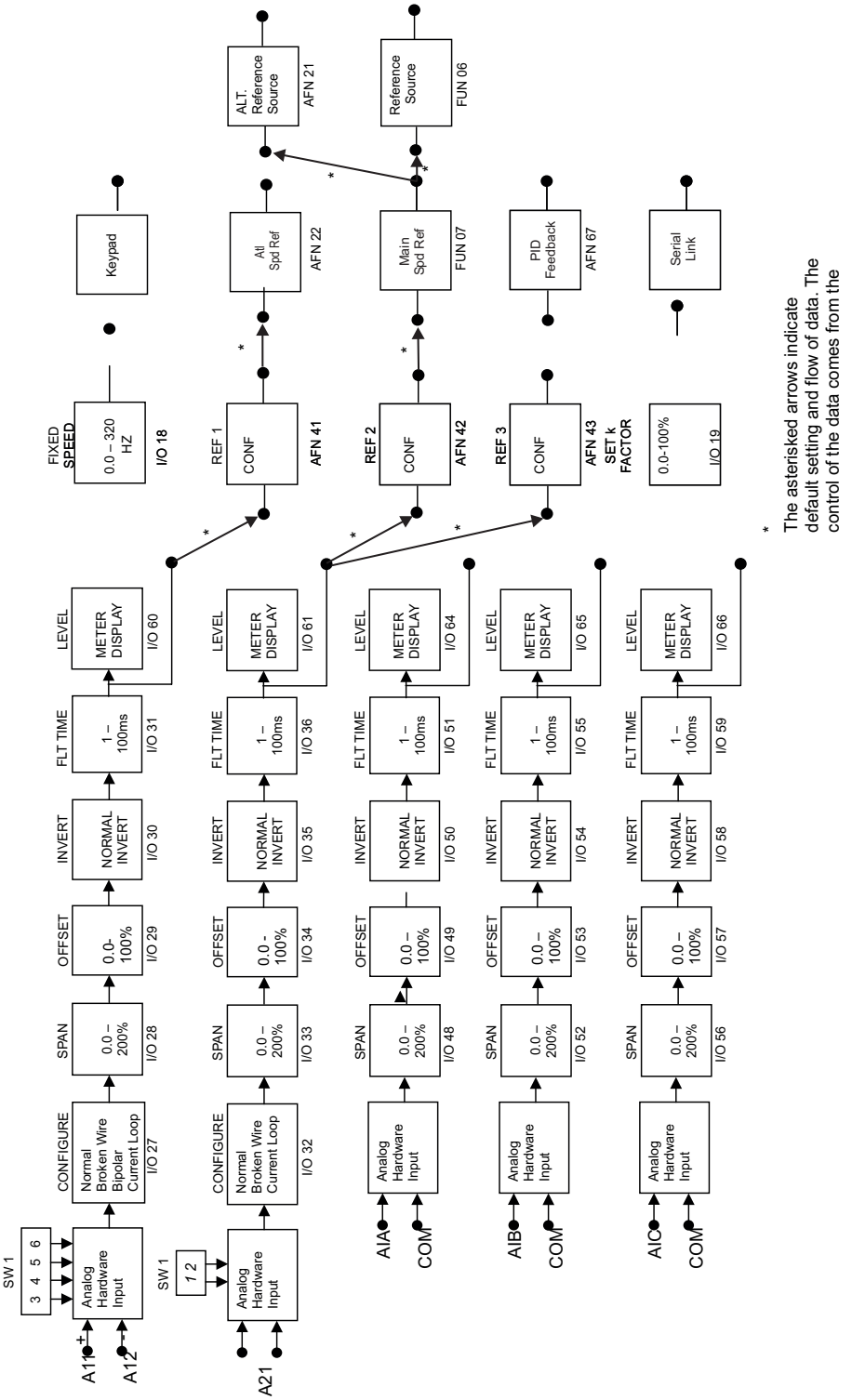
DIGITAL INPUT MAP

Figure 17: Digital Input Map



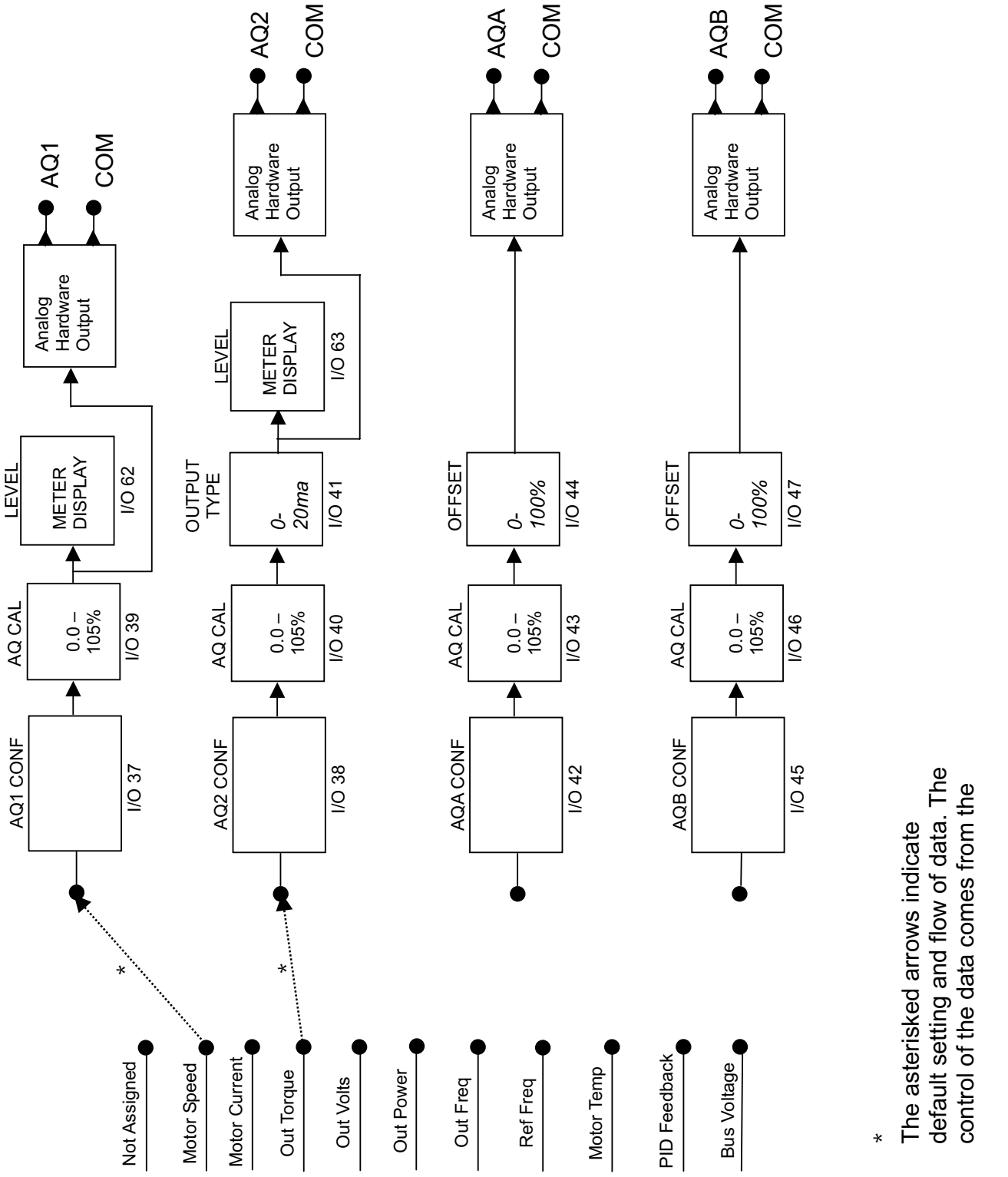
ANALOG INPUT MAP

Figure 18: Analog Input Map



ANALOG OUTPUT MAP

Figure 19: Analog Output Map



4.5 AFN Group

AFN 01: NOM MTR FREQ (nominal motor frequency)

Display:

```
AFN: Nom Mtr Freq
01   60 Hz
```

Range: 25.00 to 320.00Hz

Description: This parameter configures the nominal motor frequency or base frequency, and is obtained from the nameplate on the attached motor.

AFN 02: NOM MTR RPM (nominal motor ramps per minute)

Display:

```
AFN: Nom Mtr RPM
02   1760 rpm
```

Range: 0 to 10000rpm

Description: This parameter sets the nominal motor speed in revolutions per minute, and is obtained from the nameplate of the motor attached to the drive. It is important that this be entered accurately as it is used in sensorless vector control (SVC) calculations and in slip compensation.

For 50Hz power systems, the default is 1450rpm. For 60Hz power systems, the default is 1760rpm.

AFN 03: MAXIMUM FREQ (maximum frequency)

Display:

```
AFN: Maximum Freq
03   60 Hz
```

Range: Minimum Frequency to 320Hz

Description: This parameter sets the maximum frequency that may be output to the motor. Note that the resolution is 1Hz. Check with the motor manufacturer before exceeding the base speed of the motor.

AFN 04: MINIMUM FREQ (minimum frequency)

Display:

```
AFN: Minimum Freq
04    0 Hz
```

Range: 0.00 to Maximum Frequency

Description: This parameter sets the minimum frequency that may be output to the motor. Note that the resolution is 1Hz.

AFN 05: AUTO-CARRIER

Display:

```
AFN: Auto-Carrier
05    Disabled
```

Range: Disabled / Enabled

Description: This parameter allows you to enable or disable the auto-carrier feature. When enabled, the setting of the AFN 06 (Carrier Freq) parameter is ignored. Instead, the drive uses the optimum switching frequency, which is the highest frequency for the load that does not cause drive overheating.

AFN 06: CARRIER FREQ (carrier frequency)

Display:

```
AFN: Carrier Freq
06      2.2 kHz
```

Range: 1.0 to 16.0kHz

Description: This parameter configures the switching (or carrier) frequency for the drive. Lower frequencies produce better torque, but produce more audible noise from the motor. Higher switching frequencies produce less audible noise, but cause more heating in the drive and motor.

⌘ **NOTE:** This parameter is not adjustable during Run mode.

CAUTION

High carrier frequencies and long lead lengths can lead to premature motor and/or drive failure.

Please refer to Section 3.2 (Installation Precautions) in the RSi SX Hardware Manual.

AFN 07: SLIP COMP (slip compensation)

Display:

```
AFN: Slip Comp
07      None
```

Range: See below

Description: This parameter sets the amount of slip compensation, which may help maintain constant motor speed under changing load conditions.

Displayed Name:	Automatic:
None	Slip compensation is not utilized.
Automatic	The drive calculates how much slip compensation is needed depending on the load and motor speed.

AFN 08: V-BOOST CONF (voltage boost configure)

Display:

```
AFN: V-Boost Conf
08      2.00 %
```

Range: 0.00 to 30.00%

Description: This parameter sets the amount of boost (expressed as a percentage of nominal motor voltage) to be applied at zero frequency. The amount configured then tapers linearly as frequency increases, reaching zero at the point specified by parameters AFN 10 (Bst. Tpr Frq) and AFN 11 (Bst. Tpr Vlt).

The default values are model dependent. See Table 10.

Table 10: Voltage Boost Levels Based on Drive

Model Number	Default	Model Number	Default	Model Number	Default
RSi001SX2S_	2.0%	RSi001SX4_	2.0%	RSi001SX6_	2.0%
RSi002SX2S_	1.5%	RSi002SX4_	1.5%	RSi002SX6_	1.5%
RSi003SX2S_	1.5%	RSi003SX4_	1.5%	RSi003SX6_	1.5%
RSi001SX2_	2.0%	RSi005SX4_	1.5%	RSi005SX6_	1.5%
RSi002SX2_	1.5%	RSi007SX4_	1.0%	RSi007SX6_	1.0%
RSi003SX2_	1.5%	RSi010SX4_	1.0%	RSi010SX6_	1.0%
RSi005SX2_	1.5%	RSi015SX4_	1.0%	RSi015SX6_	1.0%
RSi007SX2_	1.0%	RSi020SX4_	1.0%	RSi020SX6_	1.0%
RSi010SX2_	1.0%	RSi025SX4_	0.5%	RSi025SX6_	0.5%
RSi015SX2_	1.0%	RSi030SX4_	0.5%	RSi030SX6_	0.5%
RSi020SX2_	1.0%	RSi040SX4_	0.5%	RSi040SX6_	0.5%
RSi025SX2_	1.0%	RSi050SX4_	0.5%	RSi050SX6_	0.5%
RSi030SX2_	1.0%	RSi060SX4_	0.5%	RSi060SX6_	0.5%
		RSi075SX4_	0.5%	RSi075SX6_	0.5%
		RSi100SX4D	0.5%	RSi100SX6D	0.5%
		RSi125SX4D	0.5%	RSi125SX6D	0.5%
		RSi150SX4D	0.5%	RSi150SX6D	0.5%

AFN 09: SET V-BOOST (set voltage boost)

Display:

```
AFN: Set V-Boost
09    None
```

Range: None / Automatic

Description: This parameter determines whether or not a voltage boost is applied. Voltage boost is the amount of voltage added at zero frequency (expressed as a percentage of nominal motor voltage), at the start of the V/Hz curve. The boost tapers linearly to zero at the point set in parameter AFN 10 (Bst. Tpr Frq) and AFN 11 (Bst. Tpr Vlt).

The following data codes may be assigned to this parameter:

Displayed Name:	Function Assigned:
None	No voltage boost.
Automatic	The RSi SX drive calculates the amount of boost required.

AFN 10: BST. TPR FRQ (boost taper frequency)

Display:

```
AFN: Bst. Tpr Frq
10        60.0 Hz
```

Range: 0.00 to Maximum Frequency

Description: This parameter works with the AFN 09 (Set V-Boost) parameter. When voltage boost is applied at the start of the V/Hz curve, the amount of boost tapers linearly and reaches zero at the point established by the frequency set in this parameter and the voltage set in parameter AFN 11 (Bst. Tpr Vlt).

AFN 11: BST. TPR VLT (boost taper voltage)

Display:

```
AFN: Bst. Tpr Vlt
11    100.00%
```

Range: 0.00 to 100.00%

Description: This parameter works with the AFN 09 (Set V-Boost) parameter. When voltage boost is applied at the start of the V/Hz curve, the amount of boost tapers linearly and reaches zero at the point established by the voltage set in this parameter and the frequency set in parameter AFN 10 (Bst. Tpr Frq, see page 95).

Applications:

Figure 20 - Terminal 1 Linear Operation

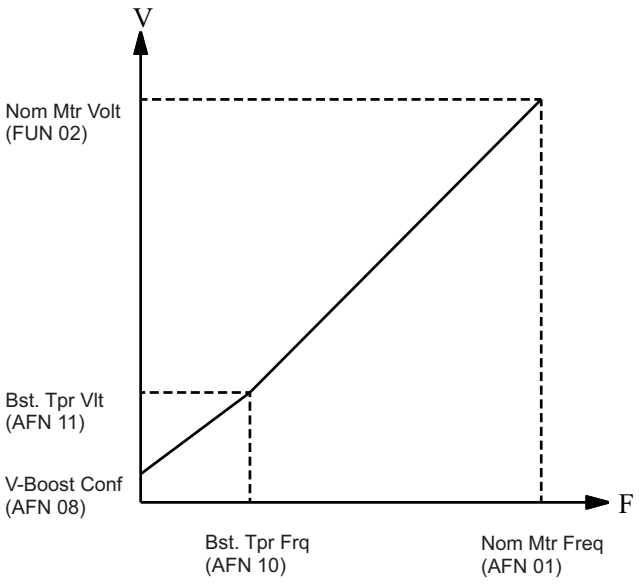
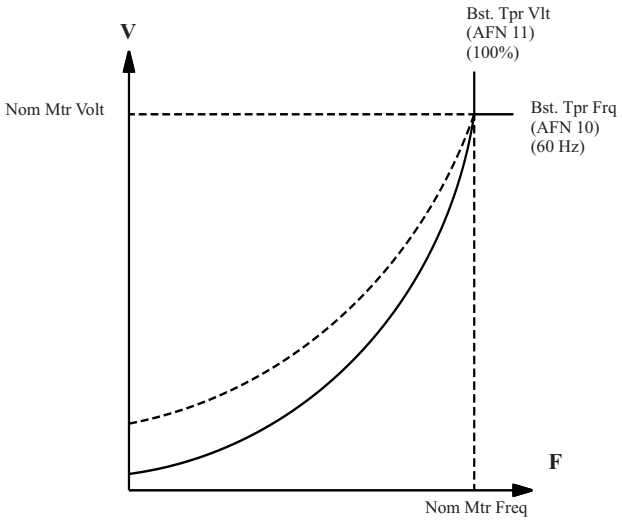


Figure 21 - Terminal 2 Quadratic Operation



NOTE: In variable torque mode, Boost Taper voltage and frequency are locked at 100%

AFN 12: DC PULSSTART (dc pulse start)

Display:

```
AFN: DC PulsStart
12    DC at Strt
```

Range: See below

Description: This parameter selects whether DC pulse will be applied before starting. This pulse is used to determine internal motor parameters before beginning operation. The amount of current to be pulsed is set by parameter FUN 27 (DC Inj Lvl), and the duration of the pulse is set by parameter AFN 13 (DC PulseTime).This may also be used as an anti-wind-milling break.

The following functions may be assigned to this parameter:

Displayed Name:	Function Assigned:
None	No DC pulse before Start.
DC at Strt	DC pulse before Start.

AFN 13: DC PULSETIME (dc pulse time)

Display:

```
AFN: DC PulseTime
13       1.00 s
```

Range: 0.00 to 25.00s

Description: If parameter AFN 12 (DC PulsStart) is enabled, this parameter configures the duration of the pulse at start-up. (Note that motor stator resistance is not calculated for the Sensorless Vector Control if the value of this parameter is less than 1s.)

AFN 14: LOW SPD COMP (sensorless vector low speed compensation)

Display:

```
AFN: Low Spd Comp
14      256
```

Range: 0 to 1280

Description: This parameter provides a compensating factor to enable the drive to more accurately perform sensorless vector control (SVC) at low speeds. Please consult factory for more details on this parameter.

AFN 15: SUPPLY VOLTS (supply voltage)

Display:

```
AFN: Supply Volts
15       115
```

Range: See below

Description: This parameter configures the supply voltage. Only the following values may be assigned to this parameter.

Table 11

230 VAC Models	460 VAC Models	600 VAC Models
180	380	480
200	400	500
208	415	525
220	440	**575**
230	**460**	600
240	480	
250		

⌘**NOTE:** Bold text indicates default settings
⌘**NOTE:** The proper setting of these values greatly influence the proper operation of the drivewhen in the SVC operating mode as well as the accuracy of overload protection.

AFN 16: : CATCH ON FLY (catch on fly)

Display:

```
AFN: Catch on Fly
16     Disabled
```

Range: Disabled / Enabled

Description: This parameter sets whether the catch and fly feature is enabled. When it is enabled, a Run command will cause the drive to attempt to match its output to the speed of a freewheeling load and then begin running. When the feature is disabled, a Run command causes the drive to always start from zero speed.

The following functions may be assigned to this parameter:

Displayed Name:	Function Assigned:
Disabled	The drive will not try to match load speed.
Enabled	The drive will try to match load speed.

⌘**NOTE:** DC Pulse start must be disabled for the Catch on Fly function to work correctly.

AFN 17: RUN PREVENT

Display:

```
AFN: Run Prevent
17   Allow F/R
```

Range: Allow F/R / No Reverse / No Forward

Description: This function is to lock the direction of rotation. To lock the direction, select Reverse or Forward.

AFN 18: STOP KEY

Display:

```
AFN: Stop Key
18   Cst To Stp
```

Range: See below

Description: This parameter sets the type of stop that occurs when the drive is running under terminal strip control and the STOP key on the keypad is pressed. The following function may be assigned to this parameter:

Displayed Name:	Function of the STOP Key:
Disabled	The STOP key is disabled.
Rmp to Stp	A ramp-to-stop is performed.
Cst to Stp	A coast-to-stop is performed.

AFN 19: ENTER KEY

Display:

```
AFN: Enter Key
19   Disabled
```

Range: View-Only

Description: This function is disabled.

AFN 20: ALT. R/S SRC (alternate run/stop source)

Display:

```
AFN: Alt. R/S Src
20   Terminal 1
```

Range: Keypad / Terminal 1 / Terminal 2 / Serial

Description: When Hand/Auto or CR Override (see DI Config on page 73) is activated, this parameter specifies the source of drive Run/Stop control. Refer to FUN 04 (Run/Stop Src) for the descriptions of these control sources.

AFN 21: ALT. REF SRC (alternate reference source)

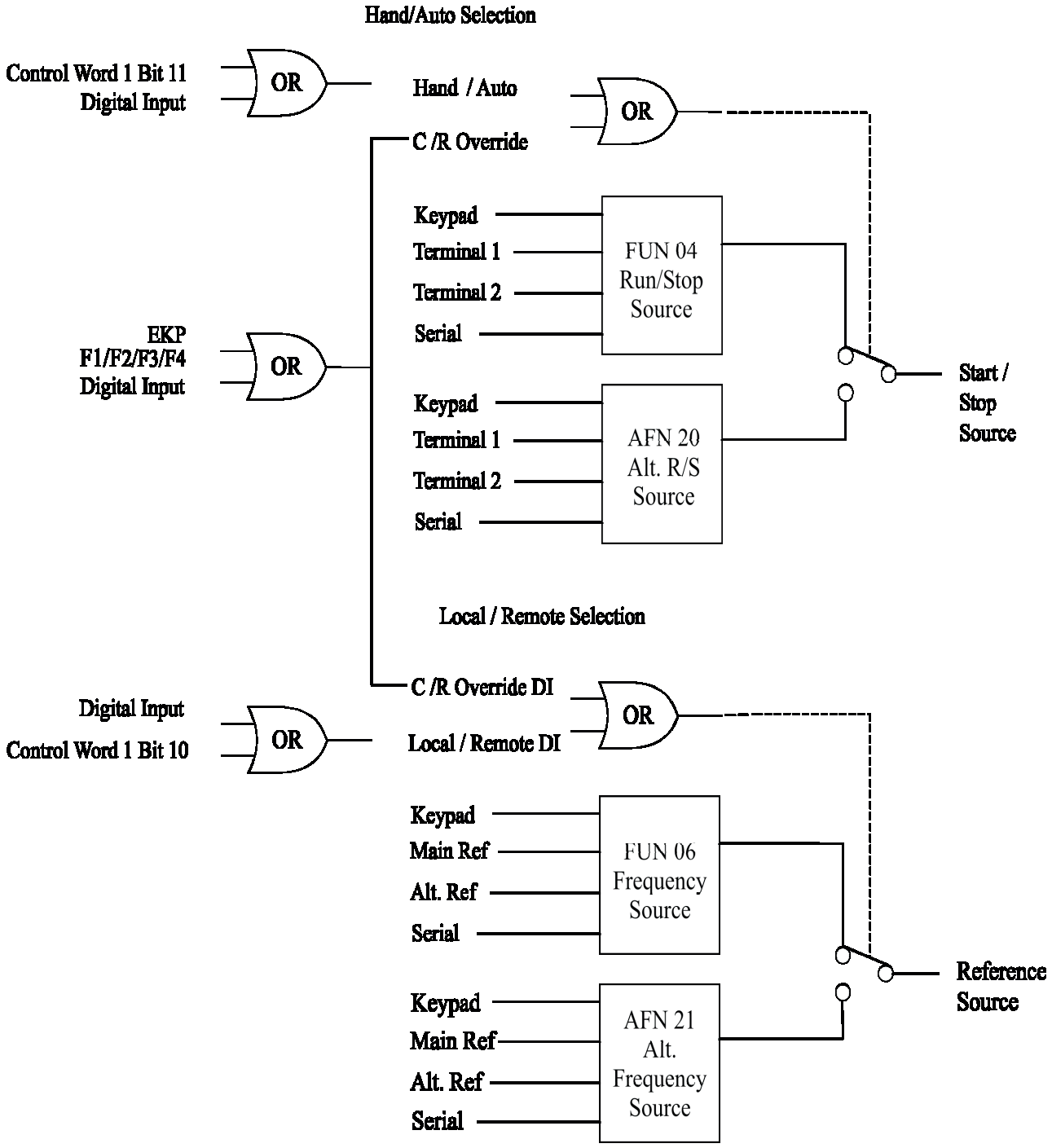
Display:

```
AFN: Alt. Ref Src
21   Main Spd Ref
```

Range: Keypad / Main Spd Ref / Alt Spd Ref / Serial

Description: When Local/Remote or CR Override (see DI Config on page 73) is activated, this parameter specifies the source of frequency reference.

Figure 22: Selection Between Run/Stop Source (Hand/Auto) and Reference Source (Local/Remote) and Control/Reference Override



AFN 22: ALT. SPD REF (alternate speed reference)

Display:

```
AFN: Alt. Spd Ref
22   Spd-Rf 1
```

Range: See below (default: Spd-R1)

Description: This parameter configures the reference speed for the drive when AFN 21 (Atl. Ref. Src) is set to "Alt. Spd Ref". The reference speed results from inputs on the analog input terminals (A11/A12 and A21/CM) and how parameters AFN 42-44 (Ref1 Config, Ref2 Config, and Ref3 Config) are set. The following functions may be assigned to this parameter:

Displayed Name:	Reference Speed Is:
Spd-Rf1	Reference 1.
Spd-Rf2	Reference 2.
Spd-Rf3	Reference 3.
Spd-R1+R2	The summation of references 1 and 2.
S-R1+k*R2	Reference 2 is scaled by factor k and then summed with reference 1. The value of k is set by parameter I/O 19 (Set k-Factor see on page 76).
Spd-R1-R2	The difference between references 1 and 2.
S-R1+R2-R3	The summation references 1 and 2 less reference 3.
Spd-Fixed	The speed reference is constant and is set by parameter I/O 18 (Fixed Speed see on page76).

AFN 23: MTR OL SCALE (motor overload scale)

Display:

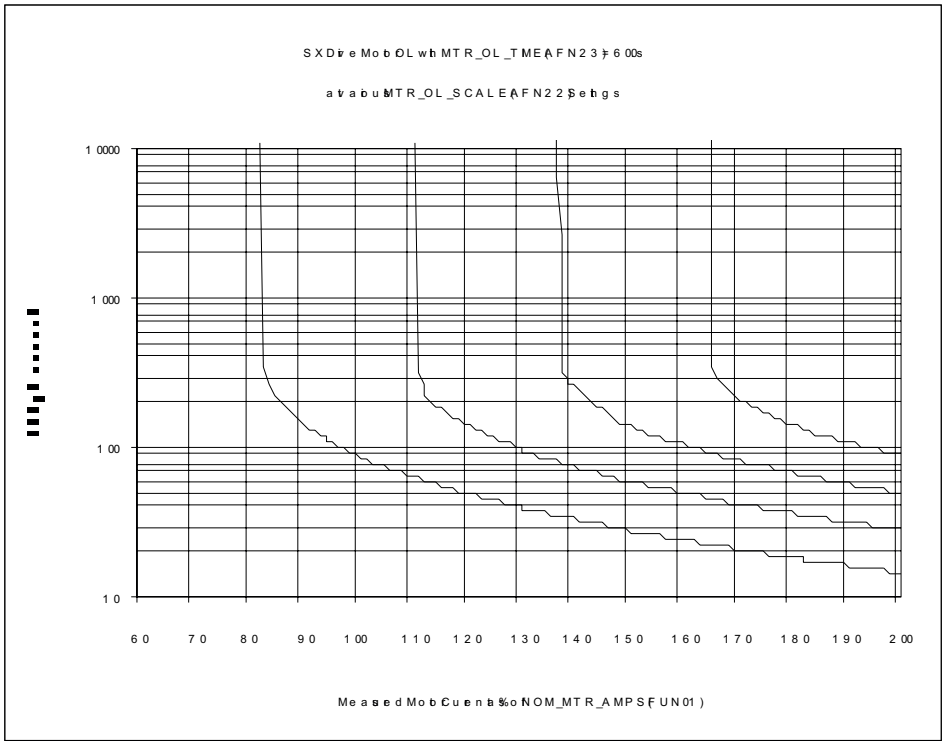
```
AFN: Mtr OL Scale
23    100.0%
```

Range: 0.0 to 100.0%

Description: This parameter adjusts the “pick up point” of the motor overload protection. With the default value of 100% the motor overload will begin accumulating overload content when the measured motor current goes above 110% of the FUN 01 (Nom Mtr Amps).

The effects of the Mtr OL Scale parameter on the OL accumulation and OL trip time is shown in the figure below:

Figure 23



⌘ **NOTE:** This parameter essentially defines the motor service factor where the default 100% setting is equivalent to a motor service factor of 1.10. A 91% setting would be equivalent to a motor service factor of 1.00.

⌘ **NOTE:** This parameter and the motor overload function can also be used to protect sensitive power train components (such as a plastic chain) or to protect sensitive media that may be stretched in a motor overload condition.

⌘ **NOTE:**For the motor overload function to operate correctly all of the following parameters must be properly set based on the motor specifications: FUN 01 (Nom Mtr Amps on page 44), FUN 03 (Mtr Type on page 44), AFN 23 (Mtr OL Scale on page 103) and AFN 24 (Mtr OL Time on page 104).

AFN 24: MTR OL TIME (motor overload time)

Display:

```
AFN: Mtr OL Time
24   60.0 s
```

Range: 0.0 to 600.0s

Description: This parameter defines a motor overload protection curve as shown below. The actual value of the parameter sets the amount of time that the motor can operate at base frequency and at a current level of:

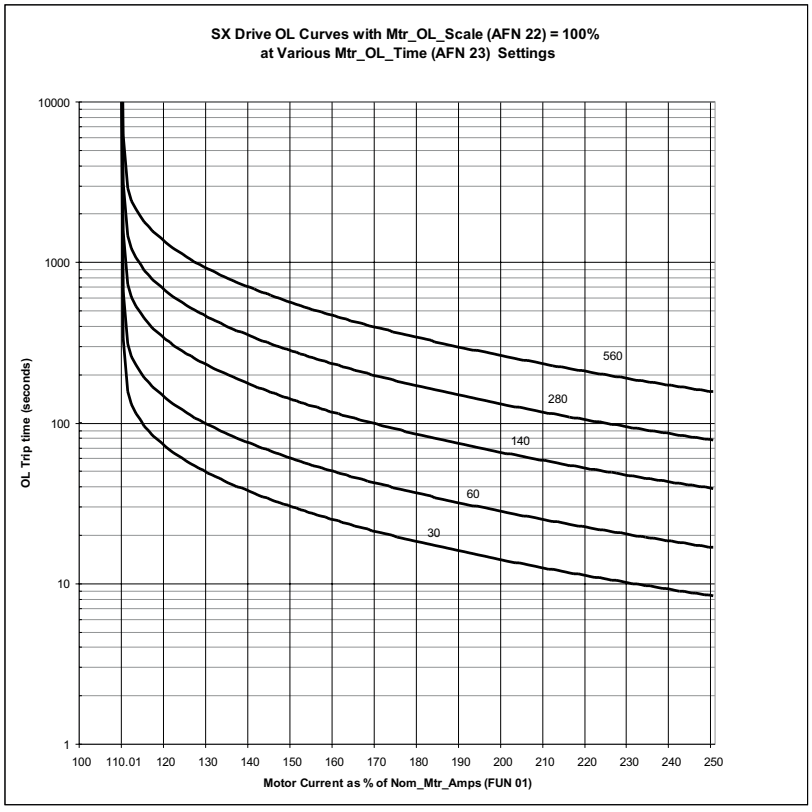
1.5 * (Mtr OL Scale (AFN 23) / 100%) * Nom Mtr Amps (FUN 01 on page 44)

Example:
Motor Type (FUN 03) = "Blwr Coold"
Mtr OL Scale (AFN 23) = 91%
Nom Mtr Amps (FUN 01) = 10 Amps
Mtr OL Time = 60.0 s

Result:
Drive will trip in 60 seconds when the measured motor current is 136.5% (1.5 x 91%) or 13.65 Amps. See curves in the figure below for other trip times at other current values.

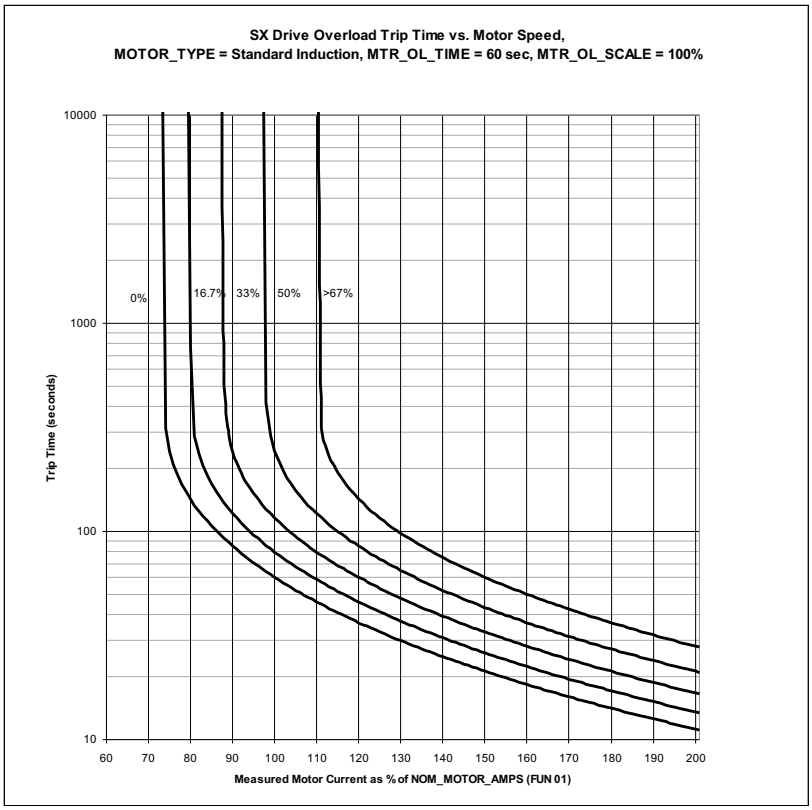
OL curves based on various settings of the Mtr OL Time parameter with the FUN 03 (Motor Type see on page 44) set to "Blwr Coold" or with the FUN 03 (Motor Type) parameter set to "Std Induct" with the motor operating at base frequency are shown in the figure below:

Figure 24



If the FUN 03 (Motor Type see on page 44) is set to "Standard Induct" the motor overload will accumulate at a faster rate and therefore trip faster if the motor is running at less than (<) 67% of AFN 01 (Nom Mtr Freq see on page 92). The effect on the OL trip time is shown in Figure 25.

Figure 25



⌘ **NOTE:** This parameter and the motor overload function can also be used to protect sensitive power train components (such as a plastic chain) or to protect sensitive media that may be stretched in a motor overload condition.
⌘ **NOTE:** For the motor overload function to operate correctly all of the following parameters must be properly set based on the motor specifications: FUN 01 (Nom Mtr Amps see on page 44), FUN 03 (Motor Type see on page 44), AFN 23 (Mtr OL Scale see on page 103) and AFN 24 (Mtr OL Time see on page 104).
⌘ **NOTE:** The following Mtr OL Time settings result in motor OL curves similar to the common Class 5,10, and 20 motor overload curves:

Class	MTR_OL_TIME setting
5	140 s
10	280 s
20	560 s

⌘ **NOTE:** If the value of this parameter is set to 0.0s, the motor overload function is disabled. If this parameter is set to a value of 0.1s, a shear-pin function will be configured. In this case when the measured motor current level exceeds the value set by the AFN 23 (Mtr OL Scale) and the FUN 01 (Nom Mtr Amps) parameters a fault will immediately occur and the drive will stop.
⌘**NOTE:** Depending on the SX drive model and the motor's rated current and thermal capabilities the drive's overload protection may trip before the motor overload protection trips.

AFN 25: COM PROTOCOL (communication protocol)

Display:

```
AFN: Com Protocol
25    MB RTU
```

Range: MB RTU / ASCII / DeviceNet / Reserved / MetaSys N2

Description: This parameter determines whether RTU or ASCII ModBus protocol will be used for remote communications, or whether another fieldbus will be used.

AFN 26: COM DROP # (communication drop number)

Display:

```
AFN: Com Drop #
26          1
```

Range: Varies

Description: This parameter sets the drop number of the serial communication port.

Note that if a protocal other thenModBus is selected, you may change the drop number set in this parameter, but the change will not take effect until power is cycled.

⌘ **NOTE:** Fieldbuses other than ModBus require an option board.

AFN 27: COM BAUDRATE (communication baudrate)

Display:

```
AFN: Com Baudrate
27   9600
```

Range: See below

Description: This parameter sets the baud rate for serial communication. The following baud rates may be assigned:

Displayed Name:	Baud Rate Assigned:
Disabled	Serial communication is not being utilized.
1200	1200 bps.[1]
2400	2400 bps.[1]
4800	4800 bps.[1]
9600	9600 bps (default of ModBus communication).[1]
19.2K	19.2K bps.[1]
125K	125K bps[2]
250K	250K bps.[2]
500K	500K bps.[2]

⌘ **NOTE:** [1] Only available for ModBus communication (parameter Comm Protocol set to RTU or ASCII, AFN 25 see on page106).
[2] Only available for Fieldbus communicatiors. An option board is required.

⌘**NOTE**: The baud rate changes will not take effect until power is cycled, if an option board is used for communications.

AFN 28: COM TIMEOUT (communication timeout)

Display:

```
AFN: Com Timeout
28         5 s
```

Range: 0.0 to 60s

Description: This parameter configures a watchdog timer for communication with an enhanced keypad. If the enhanced keypad does not respond in the configured amount of time fault code 40 will be generated.

AFN 29: COM PARITY (communication parity)

Display:

```
AFN: Com Parity
29   N81
```

Range: See below

Description: This parameter sets the parity and the number of data and stop bits recognized by the serial communication port. This parameter only affects the ModBus RTU and the ASCII Protocols, it has no effect if a different fieldbus is used.

Displayed Name:	Parity Assigned:
N81	No parity, 8 data bits, 1 stop bit.
N82	No parity, 8 data bits, 2 stop bits.
E81	Even parity, 8 data bits, 1 stop bit.
O81	Odd parity, 8 data bits, 1 stop bit.

AFN 30: AR1 CONFIG (alternate ramp 1 configure)

Display:

```
AFN: AR1 Config
30   AR1 on DI
```

Range: See below

Description: This parameter selects when Alternate Ramp 1 (AR1) is invoked. Parameters AFN 31 (Accel Time 2) and AFN 32 (Decel Time 2) configure the slope of the ramp, while AFN 33 (AR1 Shape) determines the shape of the ramp. AFN 34 (AR1 Rounding) determines the amount of curvature at either end of the ramp if AFN 33 (AR1 Shape) is set to S-Curve. The following functions may be assigned to this parameter:

Displayed Name:	Function Assigned:
None	AR1 is not available.
AR1 on DI	A digital input is used to select AR1. While the input is active, AR1 is in use.
AR1 by Frq	When the drive reaches a preset frequency, AR1 is invoked and remains in effect until the frequency drops below the threshold. The frequency is set by parameter AFN 35 (AR1 Sw. Freq).
AR1-Strt	When Start command occurs, AR1 is invoked and remains in effect until the reference speed is reached. once an At Speed condition is attained, the main ramp is used for reference changes. When a Stop command occurs, AR1 is invoked and remains in effect until zero speed is reached.
AR1-Fwd/Rv	When the drive begins operation in Reverse, AR1 is invoked and remains in effect until the direction changes.

AFN 31: ACCEL TIME 2 (acceleration time 2)

Display:

```
AFN: Accel Time2
31         1.0 s
```

Range: 0.1 to 3200.0s

Description: This parameter sets the length of time to accelerate from 0Hz to the maximum frequency (See parameter AFN 03 - Maximum Freq on page 92) for Alternate Ramp 1.

AFN 32: DECEL TIME 2 (deceleration time 2)

Display:

```
AFN: Decel Time2
32         1.0 s
```

Range: 0.1 to 3200.0s

Description: This parameter sets the length of time to decelerate from the maximum frequency (parameter AFN 03 - Maximum Freq) to 0Hz for Alternate Ramp 1.

AFN 33: AR1 SHAPE (alternate ramp 1 ramp shape)

Display:

```
AFN: AR1 Shape
33     Linear
```

Range: See below

Description: This parameter determines the shape of Alternate Ramp 1 (AR1). The following functions may be assigned to this parameter:

Displayed Name:	Function Assigned:
Linear	The shape of the ramp is a straight line.
S-Curve	The shape of the ramp is curved at the beginning and end, with the middle portion linear. The degree of curvature is set by parameter AFN 34 (AR1 Rounding).

AFN 34: AR1 ROUNDING (alternate ramp 1 rounding)

Display:

```
AFN: AR1 Rounding
34          0.0 s
```

Range: 0.0 to 10.0s

Description: If parameter AFN 33 (AR1 Shape) is set to S-Curve, this parameter determines the amount of curvature at either end of the ramp. A value of 0s produces a linear curve, while a value of 10s produces a maximally rounded S-shaped curve.

AFN 35: AR1 SW. FREQ. (alternate ramp 1 switch frequency)

Display:

```
AFN: AR1 Sw. Freq
35         0.00 Hz
```

Range: 0.0 to 320.00Hz

Description: This parameter sets the threshold frequency that activates the AR1 ramp during acceleration and deceleration. AR1 ramp is invoked as long as the output frequency is greater the defined value. Note that it is accurate to the hundredths place (0.01), and that if set to 0.00 the reference frequency defaults to the value of parameter AFN 03 (Maximum Freq see on page 92).

AFN 36: AR2 CONFIG (alternate ramp 2 configure)

Display:

```
AFN: AR2 Config
36    AR2 on DI
```

Range: See below

Description: This parameter selects when Alternate Ramp 2 (AR2) is invoked. Parameters AFN 37 (Accel Time 3) and AFN 38 (Decel Time 3) configure the slope of the ramp, while AFN 39 (AR2 Shape) determines the shape of the ramp. The following functions may be assigned to this parameter:

Displayed Name:	Function Assigned:
None	AR2 is not available.
AR2 on DI	A digital input is used to select AR2. While the input is true, AR2 is in use.
AR2 by Frq	When the drive reaches a preset frequency, AR2 is invoked and remains in effect until the frequency drops below the threshold. The frequency is set by parameter AFN 41 (AR2 Sw. Freq).
AR2-Strt	When Start command occurs, AR2 is invoked and remains in effect until the reference speed is reached. Once an At Speed condition is attained, the main ramp is used for reference changes. When a Stop command occurs, AR2 is invoked and remains in effect until zero speed is reached.
AR2-Fwd/Rv	When the drive begins operation in Reverse, AR2 is invoked and remains in effect until the direction changes.

AFN 37: ACCEL TIME 3 (acceleration time 3)

Display:

```
AFN: Accel Time 3
37       10.0 s
```

Range: 0.1 to 3200.0s

Description: This parameter sets the length of time to accelerate from 0Hz to the maximum frequency (parameter AFN 03 - Maximum Freq see on page 92) for Alternate Ramp 2.

AFN 38: DECEL TIME 3 (deceleration time 3)

Display:

```
AFN: Decel Time 3
38     10.0 s
```

Range: 0.1 to 3200.0s

Description: This parameter sets the length of time to decelerate from the maximum frequency (parameter AFN 03- Maximum Freq see on page 92) to 0Hz for Alternate Ramp 2.

AFN 39: AR2 SHAPE (alternate ramp 2 ramp shape)

Display:

```
AFN: AR2 Shape
39   Linear
```

Range: See below

Description: This parameter determines the shape of Alternate Ramp 2 (AR2). The following functions may be assigned to this parameter:

Displayed Name:	Function Assigned:
Linear	The shape of the ramp is a straight line.
S-Curve	The shape of the ramp is curved at the beginning and end, with the middle portion linear. The degree of curvature is set by parameter AFN 40 (AR2 Rounding.)

AFN 40: AR2 ROUNDING (alternate ramp 2 rounding)

Display:

```
AFN: AR2 Rounding
40          0.0 s
```

Range: 0.0 to 10.0s

Description: If parameter AFN 39 (AR2 Shape) is set to S-Curve, this parameter determines the amount of curvature at either end of the ramp. A value of 0s produces a linear curve, while a value of 10s produces a maximally rounded S-shaped curve.

AFN 41: AR2 SW. FREQ (alternate ramp 2 switch frequency)

Display:

```
AFN: AR2 SW. Freq
41          0.00 Hz
```

Range: 0.0 to 320.00Hz

Description: This parameter sets the threshold frequency that activates the AR2 ramp during acceleration and deceleration. AR2 ramp is invoked as long as the output frequency is greater the the defined value. Note that it is accurate to the hundredths place (0.01), and that if set to 0.00 the reference frequency defaults to the value of parameter AFN 03 (Maximum Freq see on page 92).

AFN 42-44: REF 1,2,3 CONFIG (reference 1,2,3 configure)

Display:

```
AFN: Ref1 Config
42    AI #1
```

```
AFN: Ref2 Config
43    AI #2
```

```
AFN: Ref3 Config
44    AI #2
```

Range: See below

Description: These parameters establish which analog input sets the reference indicated in the parameter name. The values that may be assigned to this parameter are as follows:

Displayed Name:	Reference is Set by:
AI#1	Analog Input 1 of the RSi SX drive.
AI#2	Analog Input 2 of the RSi SX drive.
AI#A	Analog Input A of the Analog Input/Output Option Board.
AI#B	Analog Input B of the Analog Input/Output Option Board.
AI#C	Analog Input C of the Analog Input/Output Option Board.

AFN 45: RAMP REF FREQ (ramp reference frequency)

Display:

```
AFN: Ramp Ref Freq
45          0 Hz
```

Range: 0.00 to 320.00Hz

Description: This parameter sets the frequency reference range during which the acceleration or deceleration time is active. For example, if this parameter is set to 30Hz and the acceleration time is set to 10s, then acceleration ramp will have the slope of a 30Hz increase in 10s.

Note that it is accurate to the hundredths place (0.01), and that if it set to 0.00, the reference frequency range is the difference between parameter AFN 03 (Maximum Freq) and parameter AFN 04 (Minimum Freq, see page 92). For example, if the minimum frequency was 20Hz and the maximum was 60Hz, then the acceleration and deceleration times correspond to the lengths of time to accelerate or decelerate by 40Hz (60 minus 20Hz).

For most applications, it is recommended that this parameter be left at its default value of 0.00Hz.

.

AFN 46: MAN FLT RST (manual fault reset)

Display:

```
AFN: Man Flt Rst
46    By DI/Kypd
```

Range: See below

Description: When a fault occurs and auto-resetting is not enabled, this parameter configures how the fault may be reset manually. Note that if you configure the STOP key to reset faults, a fault menu must be shown on the display for the STOP key to reset a fault. The following functions may be assigned to this parameter:

Displayed Name:	Function Assigned:
None	Faults cannot be reset manually.
By DI	A digital input is configured to act as a fault. See page 73 for information on configuring a digital input for this purpose.
By Keypad	The STOP key on the digital keypad is used to reset faults.
By Ser Lnk	A command via the serial link resets faults.
By DI/Kypd	Either a digital input or the STOP key on the digital keypad is used to reset faults.
By DI/Ser	Either a digital input or a command via the serial link is used to reset faults.
By Kpd/Ser	Either the STOP key on the digital keypad or a command via the serial link is used to reset faults.
DI/Ser/Kypd	Either a digital input, a command via the serial link, or the STOP key on the digital keypad is used to reset faults.

AFN 47: DB FLT A.RST (dynamic braking fault auto restart)

Display:

```
AFN: DB Flt A.Rst
47   Disabled
```

Range: Disabled / Enabled.

Description: Determines if the drive will automatically reset a DC Braking Resistor fault.

AFN 48: L 4-20 A.RST (lost reference auto restart)

Display:

```
AFN: L 4-20 A.Rst
48    Disabled
```

Range: Disabled / Enabled

Description: Determines if the drive will automatically reset a Lost Reference Fault.

AFN 49: XT FLT A.RST (external fault automatic reset)

Display:

```
AFN: Xt Flt A.Rst
49   Disabled
```

Range: Disabled / Enabled

Description: Determines if the drive will automatically reset an external fault. (See DI Configuration on page 73 for more information on the External Fault Input).

AFN 50: MTR THM PROT (motor thermal protection)

Display:

```
AFN: Mtr Thm Prot
50   Fault
```

Range: See below.

Description: This parameter configures whether the drive will monitor for excessive motor temperature, and whether excessive motor temperature is treated as a warning or fault. The following functions may be assigned:

Displayed Name:	Function Assigned:
Disabled	The drive will not detect excessive motor temperature.
Warning	When a motor overtemperature condition is detected, a warning is issued (and the drive continues to operate).
Fault	When a motor overtemperature condition is detected, a fault occurs (and the drive stops).

⌘**NOTE**: If set to disabled, an external means of thermally protecting the motor must be used.

AFN 51: EXT FAULT (external fault)

Display:

```
AFN: Ext Fault
51   Disabled
```

Range: See below.

Description: When a digital input which is configured to be an external fault goes active, this parameter configures whether the fault is treated as a warning or a fault. The following may be assigned:

Displayed Name:	Function Assigned:
Disabled	The drive will not detect external faults.
Warning	When an external fault is detected, a warning is issued (and the drive continues to operate).
Fault	When an external fault is detected, a fault occurs (and the drive stops).

AFN 52: FAN LOSS FAULT

Display:

```
AFN: Fan Loss
52   Warning
```

Range: See below.

Description: This parameter configures what action is taken, if any, when the drive senses the loss of one of its cooling fans (either external or internal). The following functions may be assigned:

Displayed Name:	Function Assigned:
Disabled	The drive will not detect external faults.
Warning	When an external fault is detected, a warning is issued (and the drive continues to operate).
Fault	When an external fault is detected, a fault occurs (and the drive stops).

AFN 53: NET TO FAULT (net timeout fault)

Display:

```
AFN: Net TO Flt
53   Disabled
```

Range: See below.

Description: This parameter configures what action, if any, is taken when the drive is configured for serial link control of either direction or speed and it does not sense a valid serial communication packet within the period of time specified by parameter AFN 28 (Com Timeout, see on page 107) when operating in a ModBus environment. When operating in a DeviceNet environment, the time duration is supplied by the DeviceNet network.

The following data codes may be assigned to this parameter:

Displayed Name:	Function Assigned:
Disabled	The drive does not take any action.
Warning	A warning is generated, but the drive continues to operate.
Fault	A fault is generated and the drive stops.

AFN 54: IP PHASE FLT (input phase fault)

Display:

```
AFN: IP Phase Flt
54   Fault
```

Range: See below.

Description: This parameter configures whether the drive will monitor for an input phase failure.

⌘ **NOTE:** If the drive is fed direct current through the B+ / B- terminals, the message "Mains Missing" will be displayed. This is not a fault; rather it is a message that will cease being displayed if the value of this parameter is set to Disabled.

The following functions may be assigned:

Displayed Name:	Function Assigned:
Disabled	The drive will not detect input phase failure. You must assign this function if a 3-phase 230VAC RSi SX model is used on a 1-phase 230VAC line.
Fault	When an input phase failure is detected, a fault occurs (the drive will stop).

AFN 55: OV AUTORESET (overvoltage auto reset fault)

Display:

```
AFN: OV AutoReset
55   Disabled
```

Range: See below.

Description: When an overvoltage (OV) fault is detected, this parameter configures whether the fault is automatically reset or whether a manual reset will be required.

If you select automatic resetting, after a fault is detected, the drive will stop and wait for the duration configured by FUN 54 (Auto Restart Time, see on page 64).

After pausing for the specified duration, the drive will attempt to perform a ramp-type or a spin type start (depending on the setting of FUN 54 - Auto Reset Time parameter; see page 64). If the attempt is unsuccessful, the process of waiting and attempting a re-start will repeat up to the number of attempts set by parameter FUN 53 (Fault Lockout #, see page 64). Once the number of attempts is exceeded, a manual reset and restart must be performed.

The following functions may be assigned to this parameter:

Displayed Name:	Function Assigned:
Disabled	The drive will not automatically reset and restart; it must be reset manually.
Enabled	The drive will automatically reset and attempt to restart.

AFN 56: OC AUTORESET (overcurrent auto reset fault)

Display:

```
AFN: OC AutoReset
56   Disabled
```

Range: See below.

Description: When an overcurrent (OC) fault is detected, this parameter configures whether the fault is automatically reset or whether a manual reset will be required. See the discussion of automatic resetting and restarting found under parameter AFN 55 (OV AutoReset, page 117) for more information.

The following functions may be assigned to this parameter:

Displayed Name:	Function Assigned:
Disabled	The drive will not automatically reset and restart; it must be reset manually.
Enabled	The drive will automatically reset and attempt to restart.

AFN 57: OT AUTORESET (overtemperature auto reset fault)

Display:

```
AFN: OT AutoReset
57   Disabled
```

Range: See below.

Description: When an overtemperature (OT) fault is detected (that is, the temperature exceeds the value set in parameter FUN 68, HS Temp Trip, see page 68), this parameter configures whether the fault is automatically reset or whether a manual reset will be required. See the discussion of automatic resetting and restarting found under parameter AFN 55 (OV AutoReset, page 117) for more information.

The following data codes may be assigned to this parameter:

Display Name:	Function Assigned:
Disabled	The drive will automatically reset and restart; it be reset manually.
Enabled	The drive will automatically and attempt to restart.

AFN 58: UV AUTORESET (undervoltage autoreset)

Display:

```
AFN: UV AutoReset
58   Disabled
```

Range: See below

Description: When an undervoltage (UV) Fault is detected, this parameter configures whether the fault is automatically reset or whether a manual reset will ne required. See the discussion of automatic resetting and restarting found under parameter AFN 55 (OV AutoReset, page119) for more information.

The following data codes may be assigned to this parameter:

Displayed Name:	Function Assigned:
Disabled	The drive will not automatically reset and restart; it must be reset manually.
Enabled	The drive will automatically reset and attempt to restart.

AFN 59: DC Cal. Cfg. (DC calibration configuration)

Display:

```
AFN: DC Cal.Cfg.
59  Warning
```

Range: Disabled / Warning / Fault

Description: When the drive is stopped and the DC Bus is detected to be out of its allowable limits, a DC Calibration Fault is generated. This parameter configures what the drive does in this situation.

The following data codes may be assigned to this parameter:

Displayed Name:	Function Assigned:
Disabled	The drive does not take any action.
Warning	A warning is generated, but the drive continues to operate.
Fault	A fault is generated and the drive stops.

AFN 60: : AUTORST TYPE (automatic resetting type fault)

Display:

```
AFN: AutoRst Type
60   Ramping
```

Range: See below.

Description: When automatic resetting of certain types of fault is enabled by one of the auto-reset parameters (AFN 55- OV Auto-Reset on page 117, AFN 56- OC Auto- Reset on page 118, AFN 57- OT Auto-Reset, AFN 58-UV Auto-Reset 119), this parameter specifies the type of start to be preformed after the time set by parameter FUN 54 (Auto Restart Time see on page 64).

The following functions may be assigned to this parameter:

Displayed Name:	Function Assigned:
Ramping	The Drive uses the active acceleration range ramps to accelerate from zero speed to the commanded speed.
Flying Start	The drive matches the commanded speed and then enters Run mode.

AFN 61: REF FAULT (reference fault)

Display:

```
AFN: Ref Fault
61   No Action
```

Range: See below.

Description: This parameter configures what action is taken, if any, when the drive loses the Analog Input 2 (A21) signal when it is configured as the reference speed. A11 needs to be configured and wired for broken wire detection. See I/O 38 (Analog Input 1 Configure).

The following functions may be assigned:

Displayed Name:	Action Taken When Signal Is Lost:
No Action	The drive does not take any action to compensate for the lost reference. With the reference gone, the drive sees a zero speed command.
Retain Spd	The last known reference speed will remain in effect.
Preset Lvl	The drive will ramp to the frequency set by parameter AFN 62 (Loss Ref Freq).
Fault	A fault is generated and the drive stops.

AFN 62: LOST REF FRQ (lost reference frequency)

Display:

```
AFN: Lost Ref Frq
62   0.00 Hz
```

Range: 0 to Maximum frequency.

Description: If parameter (Ref Fault) is set to Preset Level then the drive will ramp to the frequency set by this parameter when the A21 signal is lost. A11 needs to be configured and wired for broken wire detection. See I/O 38 (A1 Config, see on page 81).

AFN 63: DC MTR BASED (DC bus meter configuration)

Display:

```
AFN: DC Mtr Based
63   on Nominal
```

Range: See below.

Description: When an analog output is configured to output the DC Bus Voltage as a percentage, this parameter determines what 0% and 100% represent.

Displayed Name	Function Assigned
on Nominal	0% represents Zero Volts, and 100% represents the drive nominal DC voltage.
on Trip Lvl	0% represents the UV trip point (~65% Nominal), and 100% represents the OV trip point (~130% Nominal).

FUNDAMENTALS OF PID CONTROL

Introduction

RSi SX drives have a built-in PID (Proportional-Integral-Derivative) Controller that makes it possible to control a process by adjusting motor speed using a reference input and feedback input. When the drive is configured to operate with feedback from a transducer, the RSi SX drive essentially ceases to be a frequency controller and instead becomes a process controller.

Several RSi SX parameters are specifically designed for PID control. These include:

- **PID Configure**
- **PID Direct Type**
- **PID Feedback Config**
- **PID Feedback Gain**
- **PID P-Gain**
- **PID I-Gain**
- **PID D-Gain**

The function performed by each of these parameters is described in the following section. See figure on page of the RSi SX Parameter Configuration Manual provides a flowchart of PID control and shows the interaction of these parameters.

CONFIGURATION OF PID CONTROL PARAMETERS

4.6 Configuration of PID Control Parameters

This section discusses the parameters used for PI control and provides advice on how best to configure these parameters for your particular application.

4.6.1 Parameter PID Configure

Parameter PID Configure determines whether feed-forward is enabled and whether the loop is operated via digital inputs. The following paragraphs discuss these characteristics in more detail:

- Feed-forward.

  Feed-forward is usually enabled when there is very little difference between the process speed and the feedback signal.

  For example, feed-forward is useful in "speed regulation" situations, such as controlling motor speed in a closed loop. Note that feed-forward should be enabled when attempting to close a speed loop.

  Feed-forward is not suited to applications such as pressure regulation systems because generally the process speed and the process variable are vastly different.

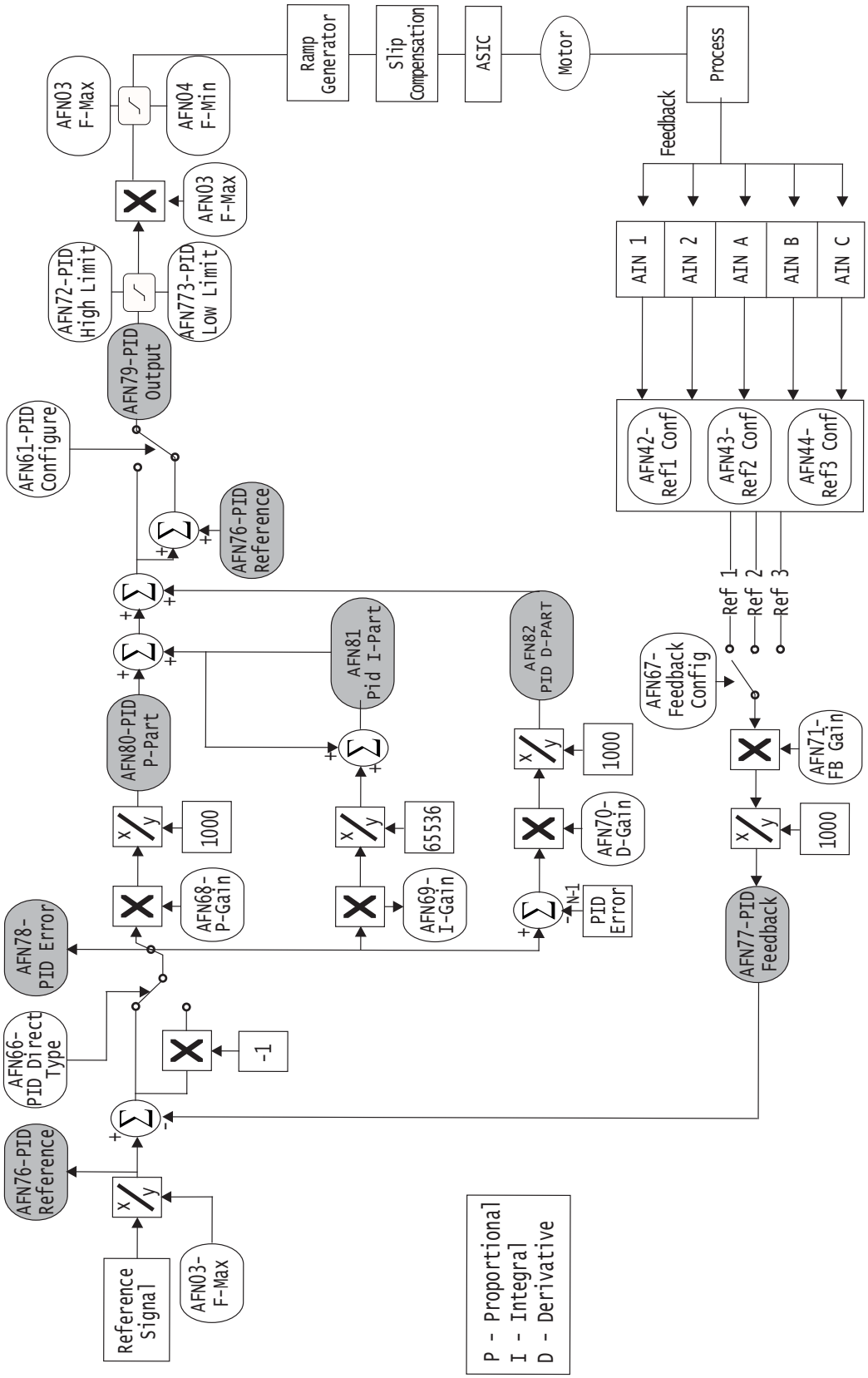
- Enabling PID control via a remote input.

  A digital input may be used to toggle PID control.

  Generally, a remote input is used when the process will be operated are both a closed and an open loop and/orwhen circumstances may arise where you would want to override the process speed as determined by the process variable and reference.

  ⌘**NOTE:** Remember to complete the implementation, you must configure a remote input separately to invoke PID control.

Figure 26 - Controller Functional Diagram



4.6.2 Parameter PID Type

Parameter AFN 66 (PID Type, see page 128) configures another characteristic of PID control - whether the loop is direct-acting or reverse-acting (also known as inverse-acting).

In a direct-acting loop, as the process speed increases, the feedback signal will decrease and cause a corresponding decrease in the process speed as it approaches the regulation point. In other words, as the regulation point is approached, the error between the reference signal and the feedback signal decreases, resulting in a decrease in the process speed. This type is typically employed in pump applications where level control is the process variable.

Conversely, in an inverse-acting loop, as the process speed increases, the feedback signal increases but causes a corresponding decrease in the process speed as it approaches the regulation point. In other words, as the regulation point is approached, if the error between the reference signal and the feedback signal increases due to an increase in the feedback signal, then the process speed will increase. This type is typically employed in supply pump applications where pressure is the process variable.

4.6.3 Parameter Feedback Configure

Parameter AFN 67 (Feedback Conf, see page 127) allows you to configure the source for the feedback signal. This source may be Ref 1, Ref 2, or Ref 3. Each of these sources are configurable to map to either the A11 or A21 analog input of the RSi SX drive or analog inputs A, B, or C of the Analog Input/Output Option Board. By default, Ref 1 maps to the A11 analog input, while Ref2 and Ref 3 map to the A21 analog input. For further information, see discussion of the AFN 42 (Ref1 Config, see on page 112), AFN 43 (Ref2 Config), and AFN 44 (Ref3 Config) parameters on page 112. For further information on the Optional Analog Input/Output Board, see Options on page 163.

4.6.4 PID FB Gain

Parameter AFN 71 (PID FB Gain, see on page 129) is the feedback scaling factor. It is used to scale the signal supplied by the transducer - thereby optimizing the effect of the signal on the drive.

4.6.5 Parameter PID P-Gain

Parameter AFN 68 (PID P-Gain, see on page 128) is the proportional feedback gain for the process control loop. It determines the overall effect on the process for an incremental change in the feedback signal.

Generally, when configuring this parameter, you must observe the drive's response to an incremental change in the feedback input, and then decide if this response is sufficient.

For example, if the feedback input changes 1V (or 1mA), what is the drive's response? Is it enough or too much?

4.6.6 Parameter PID I-Gain

Parameter AFN 69 (PID I-Gain, see on page 128) is the integral feedback gain for the process control loop. This parameter determines the short-term effects of a change in the feedback signal over a certain amount of time. (This is sometimes referred to as the "averaging time").

Generally, when configuring this parameter, you must observe the drive's response to an incremental change in the feedback input over a certain length of time, and then decide if this response is acceptable.

For example, if the feedback input changed 1V (or 1mA) for 5 seconds, what is the drive's response? Is it acceptable? Would you prefer to have the drive ignore a change over such a short time period, but still react to longer time durations (say, 8 to 10 seconds)? (If so, decreasing the integral gain by reducing the value for parameter PID I-Gain would have that effect).

4.6.7 Parameter PID D-Gain

Parameter AFN 70 (PID D-Gain, see on page 128) is the derivative feedback gain for the process control loop. This parameter calibrates the magnitude of a step response to a change in the feedback signal. It is recommended that this parameter be left at zero value this is being configured by a process specialist since derivative gain an easily lead to system instability.

4.6.8 Tuning the PID Control Loop

Once the parameters are initially configured, you should tune them so the process control loop operates as optimally as possible. To make tuning easier, the following recommendations should be observed:

- If your application does not require enabling by digital input, for the duration of tuning you should select a value for parameter PID Configure which does allow a digital input to enable PID control. Once tuning is finished, you can restore the parameter to its original value.
- Install a switch to select closed loop and open loop performance.
- Connect a calibration signal to the drive to stimulate the effects of the transducer's signal. While this is not absolutely required, it can be very helpful.

  Once the preparations for tuning are complete, enable PID control via the digital input and set the switch to open loop. Then operate the drive, utilizing any necessary instrumentation (for example, pressure gauges, meters, etc.) to characterize the range of the signal supplied from the transducer (for example, at 3 PSI, the transducer provides 1V). This will aid in better understanding the operation of the system and make calibration easier.

  Select a mid-range operating point for the system and inject a signal close to that which the transducer would provide at that point. With closed-loop selected, vary the signal by the value determined by the set-up technician and determine whether the proportional response of the system is appropriate. If the questions posed in the previous section are answered correctly and your initial assumptions prove correct, a combination of input scaling and proportional gain should make the performance match the system.

AFN: 64 : PID CONFIG (proportional/integral/derivative configure)

Display:

```
AFN: PID Config
64    No PID
```

Range: See below

Description: This parameter determines what means are used to enable PID control as well as the type of PID control that is enabled. The following values may be assigned to this parameter:

Table 12

Displayed Name	PID Control is Enabled by	Type of PID Control
No PID	PID control is not enabled by anything.	-
Feed-Fwd	When Run condition exists.	Feed-forward
F-fwd DI	Digital input.	Feed-forward
F-fwd Fkey	Function key on enhanced keypad.	Feed-forward
F-fwd Ser	Serial communication.	Feed-forward
Full-Range	When Run condition exists.	Full-range
Full DI	Digital input.	Full-range
Full Fkey	Function key on enhanced keypad.	Full-range
Full Ser	Serial communication.	Full-range

If you select digital input or function key as the means to enable PID control, remember to configure the parameter that sets the function of the digital input or function key to enable PID control to complete the implementation. For further information on using serial communication to enable PID control consult parameter AFN 65 : PID @ STOP (proportional/integral/derivative at stop).

AFN 65: PID @ STOP (proportional / integral / Derivative at stop)

Display:

```
AFN: PID @ Stop
65   Disabled
```

Range: Disabled / Enabled

Description: Normally the PID output is locked at 0% when the drive is stopped. If it is desirable to have the PID controller function while the drive is stopped, setting this parameter to "Enabled" will achieve this functionality.

AFN 66: PID TYPE (proportional/integral/derivative direct type)

Display:

```
AFN: PID Type
66     Direct
```

Range: Direct / Reverse

Description: This parameter sets whether the PID control loop is direct-acting or reverse-acting (inverse-acting). Direct-acting systems are characterized by the process variable (sensed by the transducer) diminishing as the set point is approached. Conversely, reverse-acting systems are characterized by the process variable increasing as the set point is approached. The following values may be assigned to this parameter:

Displayed Name:	Type of PID Control Loop:
Direct	Direct-acting PID control loop.
Reverse	Reverse-acting PID control loop.

AFN 67: FEEDBACK CFG (feedback configure)

Display:

```
AFN: Feedback Cfg
67    Ref 1
```

Range: Ref 1 / Ref 2 / Ref 3

Description: This configures the source of the feedback signal, which may be either Ref 1, Ref 2, or Ref 3. These references are in turn configurable to be set by analog input 1 or 2 of the RSi SX drive or analog input A, B, or C of the Analog Input/Output Option Board. The following sources may be assigned to this parameter:

Displayed Name:	Source of Feedback Signal:
Ref 1	Reference 1.
Ref 2	Reference 2.
Ref 3	Reference 3.

AFN 68: PID P-GAIN (pid proportional gain)

Display:

```
AFN: PID P-Gain
68       0
```

Range: 0 to 2000

Description: This parameter configures the short-term response of the drive to incremental change in the feedback signal. The range of this parameter is 0 to 1000 corresponding to 0.0% to 100.0% of the maximum frequency.

AFN 69: PID I-GAIN (pid integral gain)

Display:

```
AFN: PID I-Gain
69       0
```

Range: 0 to 10000

Description: This parameter sets the long-term response of the drive to a change in the feedback signal. (This is sometimes called "averaging time").

By setting this parameter appropriately, the drive may be calibrated to ignore short-term perturbations seen in the transducer signal (that may be considered either noise or insignificant) - while still responding to longer-term effects reflected in the signal.

The range of this parameter is 0 to 10000, with 0 being inactive and 10000 being the quickest response time.

AFN 70: PID D-GAIN (pid derivative gain)

Display:

```
AFN: PID D-Gain
70       0
```

Range: 0 to 2000

Description:

WARNING - UNSTABLE OPERATION

Changing the value of this parameter to a number greater than 0 may result in unstable operation. Since most applications only require integral feedback conditioning not derivative feedback conditioning, adjustment of this parameter should only be performed by experienced personnel and with great care.

Failure to observe this warning may result in injury or equipment damage.

This parameter sets the gain of the drive's response to changes in the feedback input. The range of this parameter is 0 to 2000, with 0 being inactive and 2000 being maximum derivative gain.

AFN 71: PID FB GAIN (proportional/integral/derivative feedback gain)

Display:

```
AFN: PID FB Gain
71        1000
```

Range: 0 to 2000

Description: This parameter provides a scaling factor for the feedback signal. The range is 0 to 2000 corresponding to 0.0% to 200.0% of the maximum frequency.

AFN 72: PID HIGH LIM (proportional/integral/derivative high limit)

Display:

```
AFN: PID High Lim
72      100.00%
```

Range: 0.00 to 100.00%

Description: This parameter sets the high limit of PID output. The range is 0.00 to 100.00% of the maximum frequency.

AFN 73: PID LOW LIM (proportional/integral/derivative low limit)

Display:

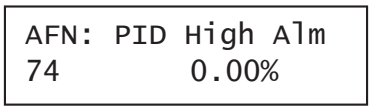
```
AFN: PID Low Lim
73        0.00%
```

Range: 0.00 to 100.00%

Description: This parameter sets the low limit of PID output. The range is 0.00 to 100.00% of the maximum frequency.

AFN 74: PID HIGH ALM (proportional/integral/derivative high alarm)

Display:

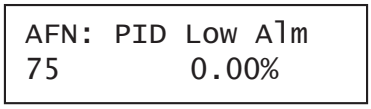


Range: 0.00 to 100.00%

Description: When the PID output exceeds the value of this parameter (which is a percentage of the reference frequency), a digital output or relay may be configured to provide notification.

AFN 75: PID LOW ALM (proportional/integral/derivative low alarm)

Display:

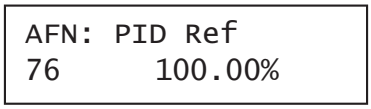


Range: 0.00 to 100.00%

Description: When the PID output falls below the value of this parameter (which is a percentage of the reference frequency), a digital output or relay may be configured to provide notification.

AFN 76: PID REFERENCE (proportional/integral/derivative reference)

Display:



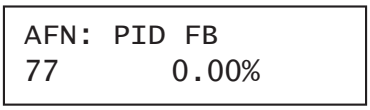
Range: 0.00 to 100%

Description: This parameter shows the set point for the PID control loop. The set point is expressed as a percentage of the maximum frequency. The value shown in this parameter can be used to determine whether the control path of the drive is configured correctly as well as whether the analog input is configured correctly with respect to span and offset.

- This parameter is view-only.

AFN 77: PID FB (proportional/integral/derivative feedback)

Display:



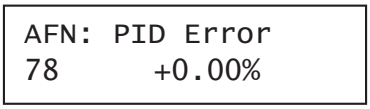
Range: 0.00 to 100%

Description: This parameter establishes the set point for the feedback signal as a percentage of the maximum frequency. This parameter may be used to provide analog input scaling of the feedback signal. It can also be sent to either the AQ1 or AQ2 analog output terminal if the analog output is configured to show the PID feedback signal.

- This parameter is view-only.

AFN 78: PID ERROR (proportional/integral/derivative error)

Display:



Range: 0 to 100%

Description: This parameter shows the value of the error between AFN 77 (PID FB) and AFN 76 (PID Ref). The error is expressed as a percentage of maximum frequency.

- This parameter is view-only.

AFN 79: PID OUTPUT (proportional/integral/derivative output)

Display:

```
AFN: PID Output
79       0.00%
```

Range: 0 to 100%

Description: This parameter shows the sum of AFN 80 (P-part), AFN 81 (I-Part), and AFN 82 (D-Part) components. The sum is limited by parameters AFN 72 (PID High Limit) and AFN 73 (PID Low Limit).

- This parameter is view-only.

AFN 80: PID P-PART (pid proportional part)

Display:

```
AFN: PID P-Part
80       +0.00%
```

Range: 0 to 100%

Description: This parameter shows the amount of the proportional contribution to the total output, expressed as a percentage of the maximum frequency.

- This parameter is view-only.

AFN 81: PID I-PART (pid integral part)

Display:

```
AFN: PID I-Part
81       +0.00%
```

Range: 0 to 100%

Description: This parameter shows the amount of the integral contribution to the total output, expressed as a percentage of the maximum frequency.

- This parameter is view-only.

AFN 82: PID D-PART (pid derivative part)

Display:

```
AFN: PID D-Part
82      +0.00%
```

Range: 0 to 100%

Description: This parameter shows the amount of the derivative contribution to the total output, expressed as a percentage of the maximum frequency.

- This parameter is view-only.

AFN 83: APPL SW VER. (application software version)

Display:

```
AFN: Appl Sw Ver.
83      1.23 SAP
```

Range: 0.00 to 654.99

Description: This parameter shows the version of application software loaded into the RSi SX drive. A 3-character suffix can follow the software version number, for example: "MAP" which indicates Multiple Applications are loaded into the software. AFN 89: (Application) can be used to select the different applications that may be loaded.

If the suffix is not blank or "MAP", then the drive is executing one of the special applications.

AFN 84: MCP SW VER. (motor control processor software version)

Display:

```
AFN: MCP Sw Ver.
84      4.30
```

Range: 0.00 to 654.99

Description: This parameter shows the version of the Terminal Strip (I/O) Processor software loaded in the RSi SX drive.

AFN 85: TSP SW VER. (terminal strip processor software version)

Display:

```
AFN: TSP Sw Ver.
85     3.10
```

Range: 0.00 to 654.99

Description: This parameter shows the version of the user interface software loaded in the drive.
- This parameter is view-only.

AFN 86: SERIAL NO 1 (serial number 1)

Display:

```
AFN: Serial No 1
86           0
```

Range:

Description: The parameter contains a four-digit number that corresponds to the year and week in which the RSi SX drive was manufactured.
- This parameter is view-only.

AFN 87: SERIAL NO 2 (serial number 2)

Display:

```
AFN: Serial No 2
87           0
```

Range:

Description: This parameter contains a four-digit number that is the remainder of the serial number (parameter AFN 83 - Serial No. 1) is the first part of the number.
- This parameter is view-only.

AFN 88: PROG NUMBER (program number)

Display:

```
AFN: Prog Number
88         0
```

Range: N/A

Description: This parameter is for factory use only.

AFN 89: APPLICATION (application selector)

Display:

```
AFN: Application
89   Standard
```

Range: Varies

Description: This parameter selects which application program is to be executed by the drive application processor. When a new application processor is selected, the drive switches to the new application and performs a factory reset. All previous configurations are lost. If they are to be saved, ensure "Store Parm" (AFN 90) is executed before switching applications.

AFN 90: PAR STO/RCL (parameter store/recall)

Display:

```
AFN: Par STO/RCL
90   Select…
```

Range: See below

Description: This parameter is of assistance in debugging abnormal drive behavior. The following data codes may be assigned to this parameter:

Displayed Name:	Function Assigned:
Select…	No action is performed.
Factory Rst	All parameters are reset to the factory defaults (see Appendix D on page 178 for default values).
Store Param	The current parameter values are stored in non-volatile memory.
Load Param	All parameters are retrieved from non-volatile memory.

Notes:

5 Remote Communication

REMOTE COMMUNICATION

5.1 Remote Communication

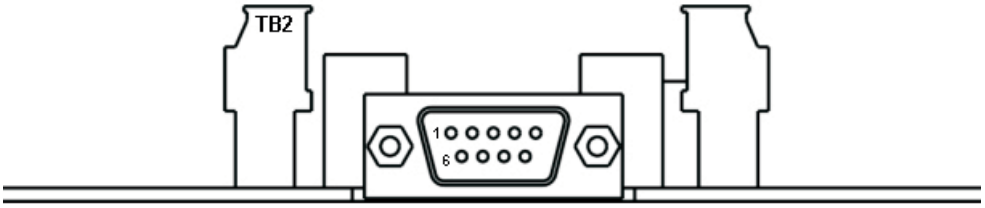
The RSi SX drive provides a serial link to support remote communication. The serial link supports ASCII or RTU communication utilizing ModBus protocol. ModBUS function 3, 6, and 16 are supported by the RSi SX drive.

In addition, DeviceNet and Metasys are supported by the RSi SX drive. See Chapter 8 for further information.

The communication interface is RS-485, and allows up to 247 followers to be connected to one leader (with repeaters when the number of drops exceeds 31). Please refer to Figures 27 and 28 for connection diagrams.

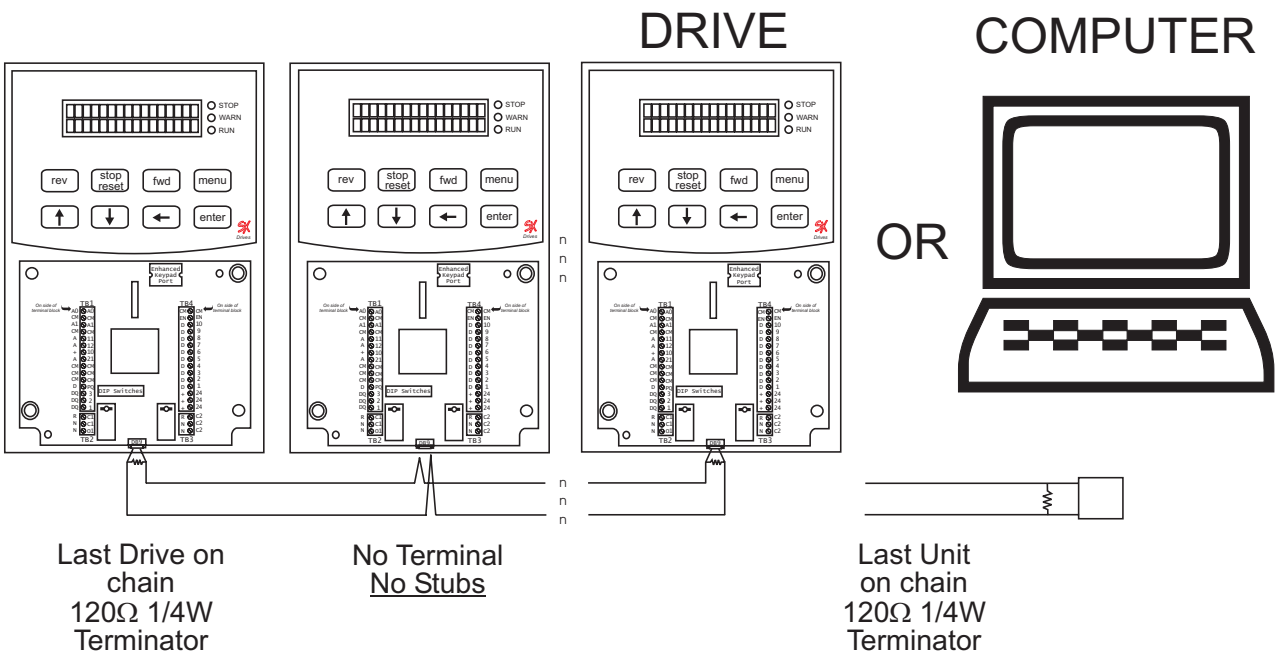
Figure 27 shows the pinout for the DB9 connector on the bottom of the Terminal Strip Processor Card. A DB9 female connector may be attached here to connect the RSi SX drive to a ModBus-485 Network. If the drive is the end of a cable, a 120Ω, 1/4W resistor may be required. Please refer to Figure 28 for wire and termination practices.

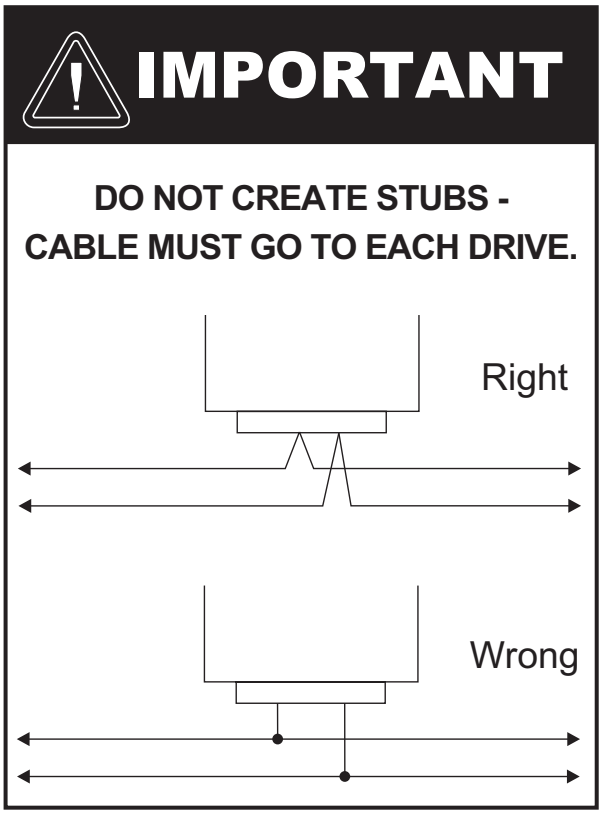
Figure 27: DB9 Connector



Pin 1 and 9	SIO+
Pin 5 and 8	GND
Pin 6 and 7	SIO-

Figure 28


DRIVE
COMPUTER
OR
Last Drive on chain 120Ω 1/4W Terminator
No Terminal
No Stubs
Last Unit on chain 120Ω 1/4W Terminator


IMPORTANT
DO NOT CREATE STUBS -
CABLE MUST GO TO EACH DRIVE.
Right
Wrong

5.1.1 Configuring of the Serial Link

The Advanced Function parameter group contains the parameters that govern the baud rate, watchdog timer, and protocol selection for the serial interface.

All addresses from 1 to 247 are allowed for RSi SX drives. Address 0 is a broadcast address understood by all drives; however, no reply is returned for messages sent to this address.

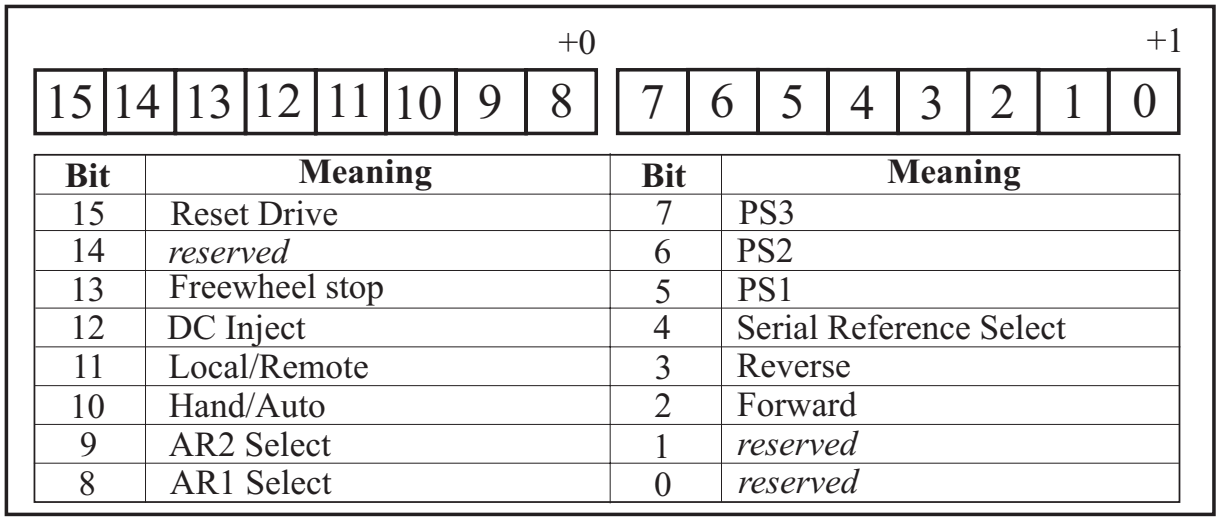
5.1.2 Parameter Addresses

Each parameter is assigned a unique memory address to permit easy reading and configuration. Chapter 4 and Appendix C list all RSi SX parameters and the memory address assigned to each.

5.1.3 RSi SX VFDs

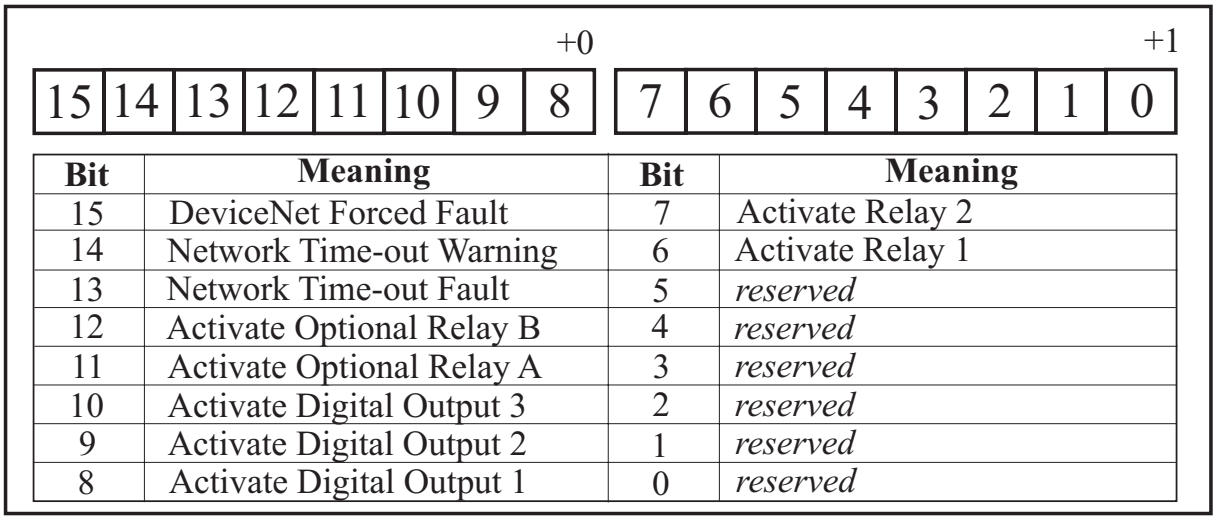
RSi SX VFDs can be controlled remotely via ModBus in the standard product, and via other Field busses with optional communications cards. The bits in Control Word 1 and Control Word 2 are used to control various aspects of the drive's operation, and the bits in Status Word 1 and Status Word 2 are used to communicate drive status back to the controlling computer.

Figure 29: Control Word 1 (ModBus Address 40201)



Bit	Meaning	Bit	Meaning
15	Reset Drive	7	PS3
14	*reserved*	6	PS2
13	Freewheel stop	5	PS1
12	DC Inject	4	Serial Reference Select
11	Local/Remote	3	Reverse
10	Hand/Auto	2	Forward
9	AR2 Select	1	*reserved*
8	AR1 Select	0	*reserved*

Figure 30: Control Word 2 (ModBus Address 40202)



Bit	Meaning	Bit	Meaning
15	DeviceNet Forced Fault	7	Activate Relay 2
14	Network Time-out Warning	6	Activate Relay 1
13	Network Time-out Fault	5	*reserved*
12	Activate Optional Relay B	4	*reserved*
11	Activate Optional Relay A	3	*reserved*
10	Activate Digital Output 3	2	*reserved*
9	Activate Digital Output 2	1	*reserved*
8	Activate Digital Output 1	0	*reserved*

Table 13: Control Word 1 Bit Description

Bit	Description
Bit 15	When set to 1, the inverter will perform a reset. This is similar to the drive being power cycled.
Bit 14	Reserved. This bit must be maintained at a logic '0' for proper drive operation.
Bit 13	The drive will perform a freewheel (coast) stop when this bit is set to 1. If a start command is still active, the drive will not restart until the command is removed and reapplied.
Bit 12	The drive will start injecting DC current into the motor when set to a 1, and will stop when this bit is cleared.
Bit 11	Local/Remote. When this bit is set, remote mode is active (see page 13).
Bit 10	Hand/Auto. When this bit is set, the alternate control path is in effect (see page 13).
Bit 9-8	Ramp Select (bit 9, 8) 00 - Main Ramp is selected. 01 - Alternate Ramp 1 is selected. 10 - Alternate Ramp 2 is selected. 11 - Alternate Ramp 1 is selected (AR1 has priority).
Bit 7-5	Preset Speed Selection. These bits work in the same manner as the PS1-3 digital inputs. Please refer to I/O 20-26 for more information about the preset speed selection.
Bit 4	Serial Speed Reference Select. If set to '0' the frequency speed reference comes from External Frequency Reference 1 (ModBus address 40203). If set to '1' the frequency speed reference comes from External Frequency Reference 2 (ModBus address 40205). Please refer to the end of this section for the description of these registers. ⌘**NOTE:** The frequency reference must be coming from "serial" for this bit to have any effect. See Figure 22 (Hand/Auto) in section 4, page 101.
Bit 3-2	Start/Stop (bit 3, 2) 00 - Stop 01 - Forward 10 - Reverse 11 - Forward (Forward has priority) ⌘**NOTE:** FUN 04 (Run/Stop Setting, see page 45) must be set to "Serial" for these bits to have any effect.
Bit 1-0	Reserved. These bits must be maintained at a logic '0' for proper drive operation.

Table 14: Control Word 2 Bit Description

Bit	Description
Bit 15	This bit generates a Fault Code 57 when set.
Bit 14	This bit generates a Fault Code 56 when set.
Bit 13	This bit generates a Fault Code 55 when set.
Bit 6-12	Activates the corresponding Digital Output when set, overriding any programmed function.
Bit 5-0	Factory use only. These bits must be maintained at a logic '0' for proper drive operation.

In addition to these control registers, there are two drive status registers which may be utilized to obtain more detailed information about the status of the drive.

Figure 33: Status Word 1 (ModBus Address 40050)

+0								+1							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit	Meaning	Bit	Meaning
15	Faulted (locked out)	7	Drive at-speed
14	Run commanded but no reference	6	Drive decelerating
13	Jogging	5	Drive acclerating
12	DCI active	4	Selected serial reference source
11	*reserved*	3	Reverse confirm
10	*reserved*	2	Forward confirm
9	AR2 Active	1	*reserved*
8	AR1 Active	0	*reserved*

Figure 34: Status Word 3 (ModBus Address 40052)

+0								+1							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit	Meaning	Bit	Meaning
15	Faulted (not locked out)	7	Broken wire detected
14	Overtemperature Warning	6	Loss of 4-20mA signal
13	Undervoltage Warning	5	Torque Limit
12	*reserved*	4	Current Limit
11	*reserved*	3	*reserved*
10	*reserved*	2	C/R Override state
9	*reserved*	1	EN input state
8	*reserved*	0	Drive Ready

Motor Operation From Serial Link

In order to allow the serial link to move the motor, the drive must be configured to accept run/stop control from the serial link. This is accomplished by setting FUN 04 (Run/Stop Setting, see page 45) and/or AFN 20 (Alternate Run/Stop Source, see page 100) to "Serial". All other functions in the control words are available at all times.

Frequency Reference From Serial Link

In order to allow the serial link to set the frequency reference, the drive must be configured to accept the frequency reference from the serial link. This is accomplished by setting FUN 06 (Frequency Reference, see page 46) and/or AFN 21 (Alternate Frequency Reference, see page 100) to "Serial". All other functions in the control words are available at all times.

There are two serial frequency references available on the RSi-SX drive. Frequency Reference 1 is at ModBus address 40203 and Frequency Reference 2 is at ModBus address 40205. Both of these registers accept a value from 0 to the maximum frequency (see AFN 03, page 92), times 100. e.g. writing a value of 4050 to one of these registers would command a reference frequency of 40.50Hz. The active serial frequency reference is controlled by bit 4 of Control Word 1. See Table 13 on page 141 for more information.

6 Troubleshooting & Maintenance

FAULT REMEDY

6.1 Fault Remedy

Table 17

Protective Function	Cause	Remedy
Over Current Protection	1) Acceleration time is too short compared to the inertia of the load. 2) Inverter turns output on when the motor is still rotating. 3) Output short or ground fault has occurred. 4) Mechanical brake of the motor is operating too fast. 5) Components of the main circuit have overheated due to a faulty cooling fan or blocked cooling.	1) Increase Accel time. 2) Operate after motor has completely stopped. 3) Check output wiring. 4) Check mechanical brake operation. 5) Check cooling fan. **(CAUTION)** Operating VFD prior to correcting fault may damage the IGBTs.
Ground Fault Protection	1) Ground fault has occurred at the output wiring of VFD. 2) The insulation of the motor has been damaged.	1) Investigate the output wiring of VFD. 2) Exchange motor.
Over Voltage Protection	1) Deceleration time is too short compared to the inertia of load. 2) Regenerative load at the output. 3) Line voltage high.	1) Increase deceleration time. 2) Install Dynamic braking / resistor option. 3) Check line voltage.
Current Limit Protection (Overload Protection)	1) Load is larger than the VFD rating. 2) Selected incorrect VFD capacity parameter. 3) Selected incorrect V/F pattern.	1) Increase capacity of motor and/or VFD. 2) Select correct VFD capacity. 3) Select correct V/F pattern.
Fuse Damage	1) Damage due to repeated over current protection. 2) Damage due to instant deceleration when motor is at an excessive excitation status.	Exchange the fuse. **(CAUTION)** The IGBTs are often damaged when the Fuse Open Trip occurs and should be tested before returning the drive to service.
Heat Sink Overheat	1) Cooling fan damaged or a foreign substance is blocking fan. 2) Cooling system has faults. 3) Ambient temperature too high.	1) Exchange cooling fans and/or eliminate foreign substance. 2) Check for foreign substances in the heat sink. 3) Keep ambient temperature under 40℃.
Electronic Thermal	1) Motor has overheated. 2) Load is larger than VFD rating. 3) ETH level set too low. 4) Incorrect VFD capacity selected. 5) Set incorrect V/F pattern. 6) Motor operated too long at low speeds.	1) Reduce load and/or running duty. 2) Increase VFD capacity. 3) Adjust ETH level to an appropriate level. 4) Select correct VFD capacity. 5) Select correct V/F pattern. 6) Install a cooling fan with a separate power supply.
External Fault	External fault has occurred.	Eliminate fault at circuit connected to external fault terminal or cause of external fault input.
Low Voltage Protection	1) Line voltage low. 2) Load larger than line capacity is connected to line (welding machine, motor with high starting current connected to the commercial line). 3) Faulty magnetic switch at the input side of the VFD.	1) Check line voltage. 2) Increase line capacity. 3) Exchange magnetic switch.
IGBT Short	1) Short has occurred between the upper and lower IGBT. 2) Short has occurred at the output of the VFD. 3) Acceleration/Deceleration time is too short compared to the inertia of the load.	1) Check IGBT. 2) Check output wiring of VFD. 3) Increase acceleration or deceleration time.
Inverter Overload	1) Load is larger than VFD rating. 2) Selected incorrect VFD capacity.	1) Increase motor and/or VFD capacity. 2) Select correct VFD capacity.
Magnetic	1) The magnetic contactor malfunction.	1) Replace the magnetic contactor.
Contactor Fail	1) The Control Power Transformer (CPT) fuse has opened.	1) Replace the CPT fuse.

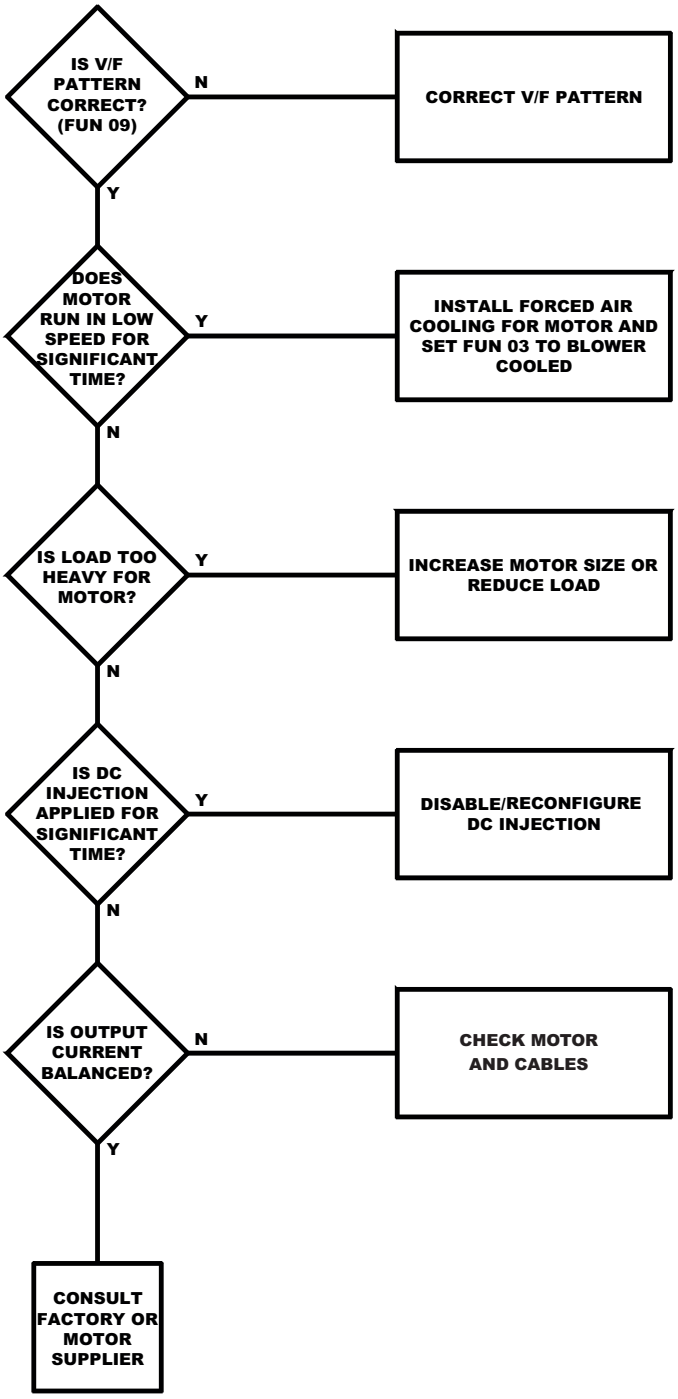
6.2 Troubleshooting

Table 18

Condition	Check Point
The Motor Does Not Rotate	1) Main circuit inspection: • Is the input (line) voltage normal? (Is the LED in the VFD is lit)? • Is the motor connected correctly? 2) Input signal inspection: • Check the operating signal input to the VFD. • Check the forward and the reverse signal input simultaneously to the VFD. • Check the command frequency signal input to the VFD. 3) Parameter setting inspection: • Is the Run Prevention (AFN 17) function set? • Is the Run/Stop Source (FUN 04) set correctly? • Is the drive enable (EN) terminal input active? • Is the command frequency set to 0? 4) Load inspection: • Is the load too large or is the motor jammed? • Is a mechanical or supplemental brake engaged? 5) Other: • Is the alarm displayed on the keypad or is the Stop LED blinking?
The Motor Rotates in Opposite Directions	Is the phase sequence of the output terminal T1/U, T2/V, T3/W correct? Is the starting signal (forward/reverse) connected correctly?
The Difference Between the Rotating Speed and the Reference is Too Large	Is the frequency reference signal correct? (Check the level of the input signal) Are the following parameter settings correct? Minimum Frequency (AFN 04), Maximum Frequency (AFN 03), Analog Input Configuration (I/O 27-36) Is the input signal line influenced by external noise? (Use a shielded wire). Are there skip frequencies programmed?
The VFD Does Not Accelerate or Decelerate Smoothly	Is the acceleration/deceleration time is set too short a period of time? Is the load too large? Is the Torque Boost Configuration (AFN 07-11) set incorrectly?
The Motor Current is Too High?	Is the load too large? Is the Torque Boost Value (see above) too high?
The Rotating Speed Does Not Increase	Is the Maximum Frequency (AFN 03) value correct? Is the load too large?
The Rotating Speed Oscillates When the VFD is Operating.	1) Load inspection: • Is the load oscillating? 2) Input signal inspection: • Is the frequency reference signal oscillating? 3) Other: • Is the wiring too long when the inverter is using V/F control? (Over 500m).

6.2.1 Motor Overheats

Figure 35

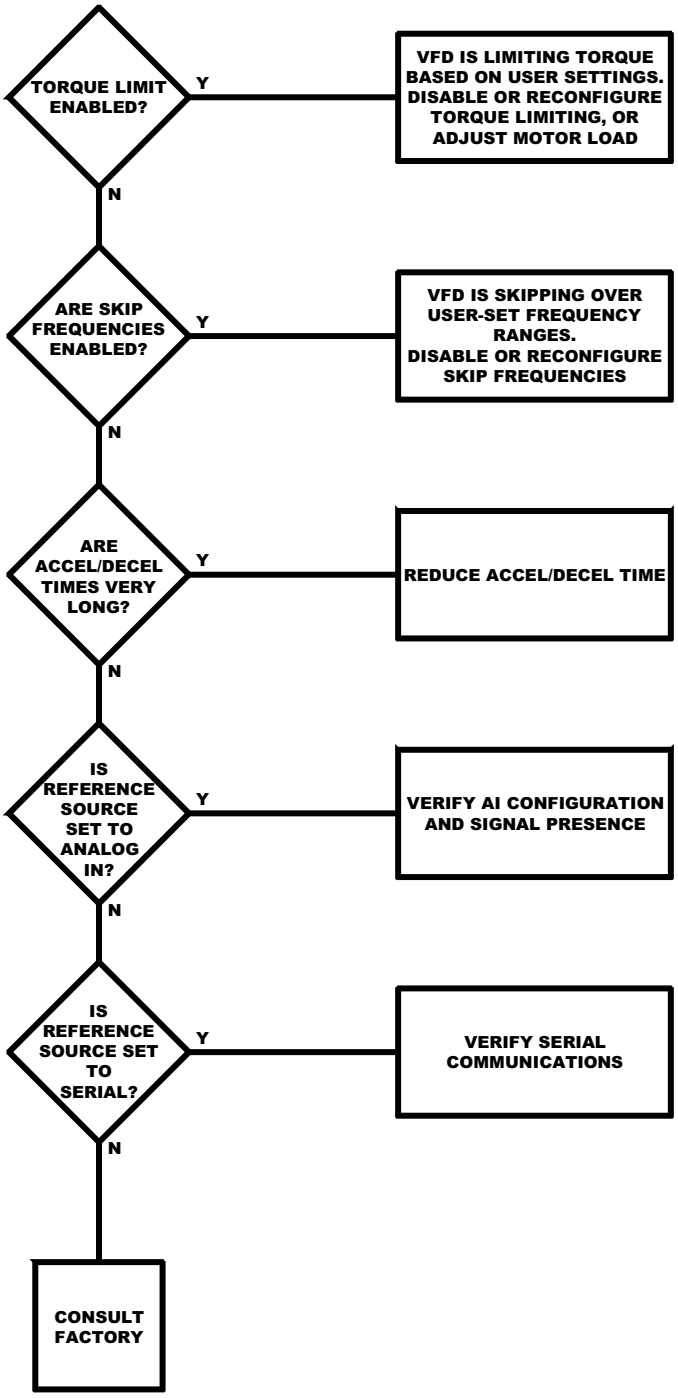


DANGER

Risk of Electric Shock - Ensure all electrical power is removed before servicing.

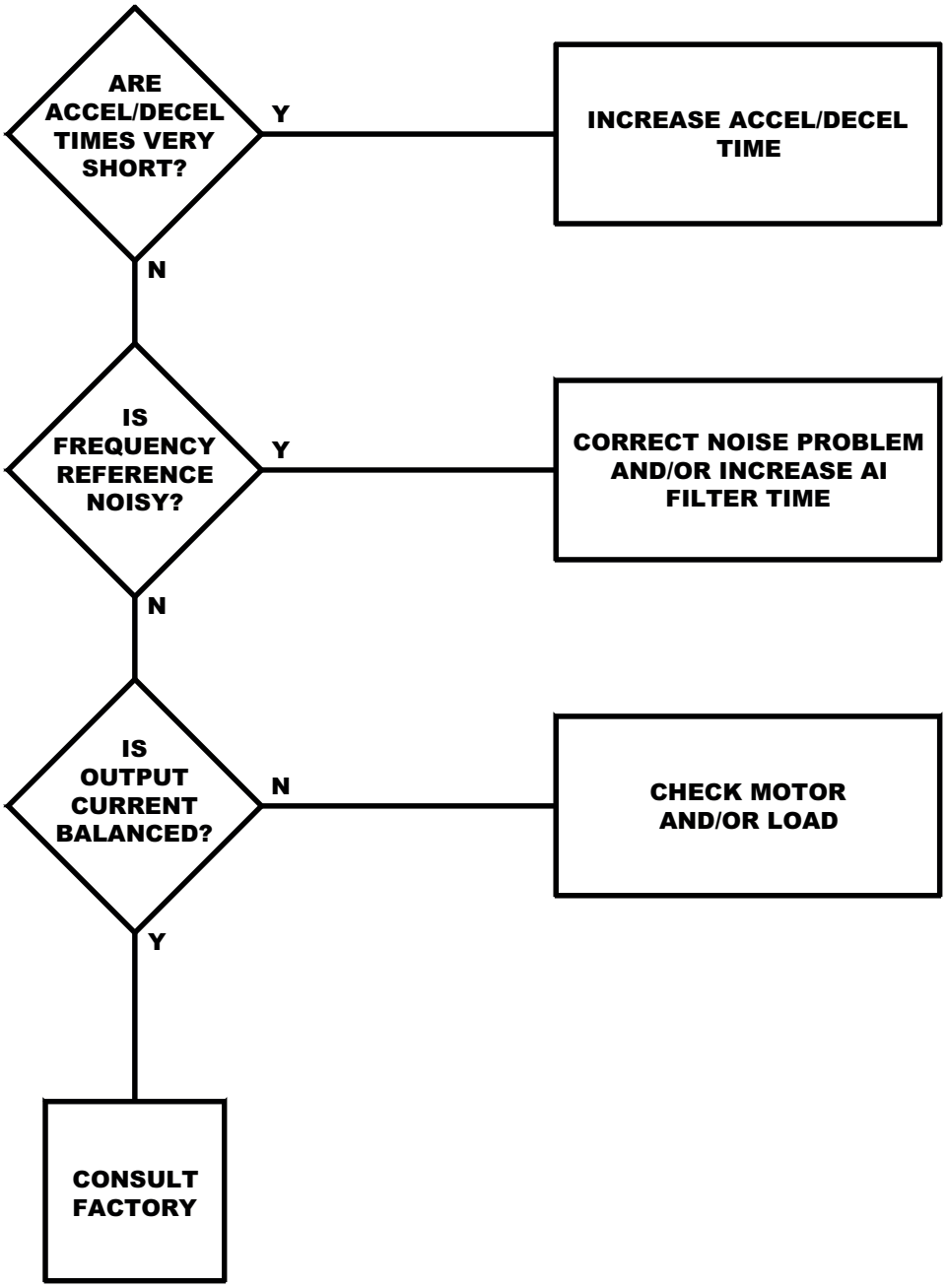
6.2.2 Motor Speed is not equal to the Command Frequency

Figure 36



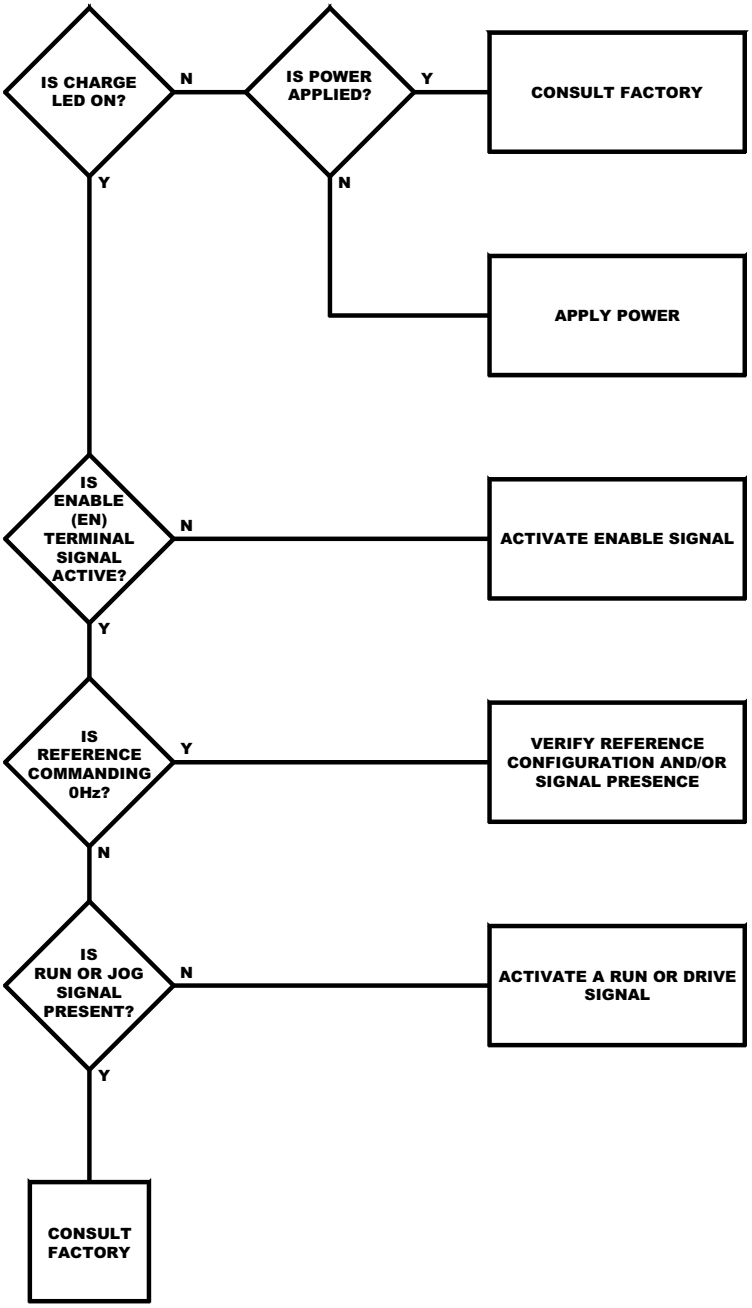
6.2.3 Motor Does Not Run Smoothly

Figure 37



6.2.4 Motor Does Not Run

Figure 38

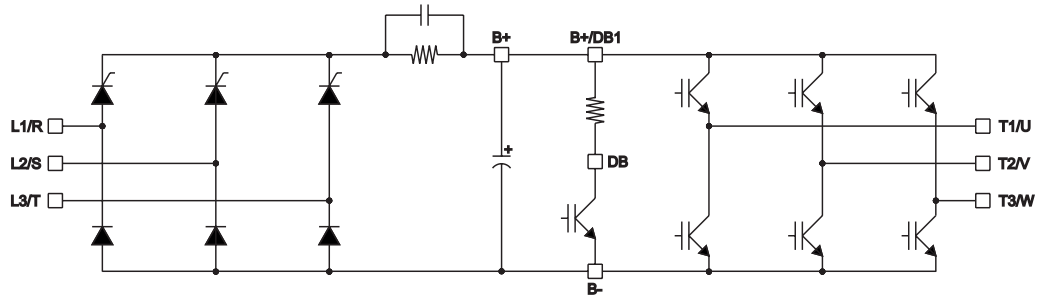


HOW TO CHECK POWER COMPONENTS

6.3 How to Check Power Components

Before checking the power components, be sure to disconnect AC Input Supply and wait until the Main Electrolytic Capacitor (B+ - B-) discharges.

Figure 39



- Diode Module Check

Check Module	Resistance to be Good
R,S,T - B+	50K ohms or more
R,S,T - B-	50K ohms or more

- DB (Dynamic Braking) IGBT

Check Module	Resistance to be Good
DB - B+/DB1	See Table 8 on page 55
DB - B-	50K ohms or more

- IGBT Module Check

Check Module	Resistance to be Good
U, V, W - B+	50K ohms or more
U, V, W - B-	50K ohms or more

⌘ **NOTE:** If the drive has been powered-off for more then two years it is strongly recommended that the drive be sent back to the factory to recondition the electrolytic capacitors.

MAINTENANCE

6.4 Maintenance

Proper operation of the RSi SX Series of drives can be influenced by temperature, humidity, and vibration. To avoid any possible uncertainty, the drive must be maintained properly by certified personnel.

PRECAUTIONS

6.5 Precautions

- Be sure to remove the drive power input while performing maintenance.
- Be sure to perform maintenance only after checking that the bus has discharged.
  The bus capacitors in the electronic circuit can still be charged even after the power is turned off.
- The correct output voltage can only be measured by using a rectifier voltage meter.
  Other voltage meters, including digital voltage meters, are likely to display incorrect values caused by the high frequency PWM output voltage of the drive.

ROUTINE INSPECTION

6.6 Routine Inspection

Be sure to check the following before operation:

- The conditions of the installation location
- The conditions of the drive cooling
- Abnormal vibration
- Abnormal heating

PERIODICAL INSPECTION

6.7 Periodical Inspection

- Are there any loose bolts, nuts or rust caused by surrounding conditions? If so, tighten or replace them.
- Are there any deposits inside the drive-cooling fan? If so, remove using compressed air.
- Are there any deposits on the drive's PCB (Printed Circuit Boards)? If so, remove using compressed air.
- Are there any abnormalities in the various connectors of the drive's PCB? If so, check the condition of the connector in question.
- Check the rotating condition of the cooling fan, the size and condition of the capacitors and the connections with the magnetic contactor. Replace them if there are any abnormalities.

DAILY AND PERIODIC INSPECTION ITEMS

6.8 Daily and Periodic Inspection Items

Table 19

Inspection Location	Inspection Item	Inspection	Period			Inspection Method	Criterion	Measuring Instrument
			Daily	1 year	2 year			
All	Environment	Is there any dust? 1Is the ambient temperature and humidity adequate?	O			Refer to the precautions	Temperature: -10~+40 no freezing. Humidity: Under 90% no dew	Thermometer, Hygrometer, Recorder
	Equipment	Is there any abnormal oscillation or noise?	O			Use sight and hearing	No abnormality	
	Input Voltage	Is the input voltage of the main circuit normal?	O			Measure the voltage between the terminals L1/R, L2/S, L3/T		Digital Multi-Meter/Tester
Main Circuit	All	Megger check (between the main circuit and the ground) Are any fixed parts removed? Are there any traces of overheating at each component's cleaning?		O O O		None. Consult Factory Tighten the screws. Visual check.	No fault	
	Conductor / Wire	Is the conductor oxidized? Is the wire coating damaged?		O O		Visual check	No fault	
	Terminal	Is there any damage?		O		Visual check	No fault	
	IGBT Module/ Diode Module	Check the resistance between each of the terminals.			O	Undo the VFD connection and measure the resistance between R,S,T and U,V,W with a tester.	(Refer 'How to Check Power Components")	Digital Multi-Meter / Analog Tester
	Smoothing Capacitor	Is there any liquid coming out? Is the safety pin out, and is there any swelling? Measure the capacitance.	O O	O		Visual check. Measure with a capacitance-measuring device.	No fault Over 85% of the rated capacity	Capacitance Measuring Device
	Relay	Is there any chattering noise during operation? Is there any damage to the contact		O O		Auditory check. Visual check	No fault	
	Resistor	Is there any damage to the resistor insulation? Is the wiring in the resistor damaged (open)?		O O		Visual check. Disconnect one of the connections and measure with a tester.	No fault Error must be within 10% the displayed resistance	Digital MultiMeter / Analog Tester
Control Circuit Protective Circuit	Operation Check	Is there any unbalance between each phases of the output voltage? Nothing must be wrong with display circuit after executing the sequence protective operation		O O		Measure the voltage between the output terminals U, V and W. Short and open the VFD protective circuit output.	The voltage balance between the phases for 200V (800V) class is under 4V (8V).The fault circuit operates according to the sequence.	Digital Multi-Meter/ Rectifying Voltmeter
Cooling System	Cooling Fan	Is there any abnormal oscillation or noise? Is the connection area loose?	O	O		Turn OFF the power and turn the fan by hand. Tighten the connections.	Must rotate smoothly. No fault	
Display	Meter	Is the displayed value correct?	O	O		Check the meter reading at the exterior of the panel	Check the specified and management values.	Voltmeter / Ammeter etc.
Motor	All	Are there any abnormal vibrations or noise? Is there any unusual odor?	O O			Auditory, sensory, visual check. Check for overheat and damage.	No fault	
	Insulation Resistor	Megger check (between the output terminals and the ground terminal)			O	Disconnect motor from VFD and short motor leads together.	Over 5MO	500V class Megger

FUNCTIONS BASED ON USE

6.9 Functions Based on Use

Set the function properly according to the load and operating conditions. Application and related functions are listed in the following table.

Table 20

Use	Related Parameter Code
Accel/Decel Time, Pattern Adjustment	DRV 03 [Acceleration Time], DRV 04 [Deceleration Time], FUN 37 [Acceleration Shape], FUN 39 [Deceleration Shape]
Reverse Rotation Prevention	AFN 17 [Run Prevent]
Minimum Accel/Decel Time	DRV 03 [Acceleration Time], DRV 04 [Deceleration Time]
Braking Operation Adjustment	FUN 41 [Stop Mode], FUN 23-27 [DC Braking],
Operations for Frequencies Over 60Hz	AFN 01 (Nominal Motor Frequency), AFN 02 (Nominal Motor RPM) AFN 03 (Maximum Frequency)
Selecting Appropriate Output Characteristics for the Load	AFN 03 [Maximum Frequency], AFN 01 [Nominal Motor Frequency]
Motor Output Torque Adjustment	AFN 04 (Minimum Frequency), FUN 09 (Torque Curve) FUN 29-36 (Torque Configuration), AFN 08-11 (Voltage Boost)
Output Frequency Limit	AFN 03 and AFN 04 (Max/Min Frequency) Analog Input Configuration (See I/O 27-36)
Motor Overheat Protection	FUN 03 (Motor Type), AFN 23-24 (Overload Characteristics)
Multiple Preset Frequencies	I/O 02-10 (DI Configure) I/O 20-26 (Preset Speed Configure)
Jog Operation	FUN 08 (Jog Reference), FUN 13-15 (Jog configuration)
Frequency Skip Operation	FUN 42-52 (Skip Frequency Configuration)
Timing the Electronic Brake Operation	FUN 23-27 (DC Brake Configure)
Displaying the Rotating Speed	FUN 66-71 (Display Configuration)
Function Alteration Prevention	FUN 72-74 (Security Configure)
Auto Restart after Fault	FUN 10 (Start Mode), AFN 55-62 (Fault Reset Configuration)
PID Feedback Operation	AFN 64-82 (PID Configuration)
Frequency Reference Configuration	(Frequency Setting), FUN 07 (Main Speed Reference) I/O 27-36 (Analog Input Configuration)
Define the Multi-Function Input Terminals	I/O 02-10 (DI Configuration)
Metering	I/O 37-41 (Analog Out Configuration)
Remote Control/Communications	AFN 25-29 (Communications Configuration)
Operation on Single Phase	AFN 53 (Input Phase Fault

PARAMETERS BASED ON APPLICATIONS

6.10 Parameters Based on Applications

Table 21

Application	Param. #
Change the frequency setting	Press Enter at the Operate Screen
Change the acceleration and deceleration time of the motor	DRV 03, 04
Change the run/stop method	FUN 04
Change the frequency reference source	FUN 06
Prevent the motor from rotating in opposite directions	AFN 17
Change the stopping method	FUN 41
DC injection braking is required before starting	AFN 12 & 13
Set the maximum frequency and the base frequency according to the rated torque of the motor	AFN 01 & 02
Adjust the starting frequency	AFN 04
Large starting torque is needed for loads such as elevators (Manual/Auto Torque Boost)	AFN 08-11
Select an appropriate output characteristic (V/F characteristic) according to loads	FUN 09
Set up your own V/F pattern	AFN 08-11
Protect the motor from overheating	FUN 03, AFN 27-28
Output a signal when the overload condition lasts more than a fixed amount of time	FUN 55 & 56
Prevent the resonance from the oscillating characteristics of a machine	FUN 42-52
Start the VFD as soon as the power is turned ON	FUN 10
Restart the VFD by resetting the fault when a fault occurs	FUN 53 & 54
Use the instant power failure restart function	FUN 10
Reduce noise or leakage current by changing the PWM carrier frequency	AFN 06
Operate using PID feedback	AFN 64-83
Initialize the parameters to factory defaults.	AFN 90
Prevent the parameters from being changed	FUN 76-78
Set the analog voltage or current for the frequency reference	FUN 06-07, I/0 27-36
Change the functions for the input terminals D2-D10	I/O 01-10
Check the status of the input/output terminals	I/O 74 & 75
Check the fault history of the VFD	FH1-FH5
Use the jogging and multi-step speed operation	FUN 08, I/O 20-26
Change the alternate ramp profiles	AFN 30-41
Set the frequency detection level	FUN 59-62
Change the functions of the digital outputs and relays	I/O 11-17

FAULT TRIP DESCRIPTION

6.11 Fault Trip Description

When a Fault Trip occurs, the VFD cuts off its output and displays the fault status in the Active Fault group.

Table 22: RSi SX Fault Codes

Fault Code	Fault Name	Possible Cause(s)	How to Recover
01	Watch Dog Trip	Consult Factory	Consult Factory
02	Power Bridge ID	• Ribbon cable not correctly seated between the power and control boards. • Electrical noise.	• Ensure that the ribbon cable is correctly seated. • Determine the source of the noise and eliminate it.
03	Current Calibr	Current sensors have an offset problem.	Consult factory.
04	TSP 24V Supply	Overloaded +24VDC supply.	Check the loading on the +24VDC supply and remove any excess load.
05	DC Volt Calibr	DC voltage is outside of normal limits on power up. This may be caused by: • High or low line voltage. • Supply voltage parameter incorrectly set.	• Check line voltage. • Check the AFN 15 (Supply Voltage) parameter.
06	IOC Trip	Output short-circuit. May also be caused by a ground fault (see Fault Code 11 below).	• Check motor wiring. • Extend acceleration ramp. • Reduce boost. • Check for ground faults.
07	Ext Flt/Warning (Fault)	The configured input sensed an external fault.	Investigate why the external fault occurred and correct.
09	Inter-Proc Comm	Loss of communication with the control terminal strip.	Reset the VFD by pressing the Stop key for more than 1 second. If problem persists, consult the factory.
11	Ground Fault	The VFD detected that the sum of the motor phases' current is not zero. This may be caused by insulation failure in the motor or the cables.	• Check motor wiring. • Check for and remove any capacitive load. • Check the motor and cabling for shorts to ground.
12	Input Phase Loss	Current measurement detected an input phase with no current.	Check input power cables.
13	Overvoltage	The voltage of the internal DC-link has exceeded 135% of the nominal voltage. This may be caused by incorrect deceleration time or high overvoltage spikes on line.	• Adjust deceleration time. • Add dynamic braking module.
14	Under Voltage	The DC bus voltage fell below 65% of the nominal voltage. This may be due to line supply failure or internal failure of the VFD.	Reset fault and attempt to restart. Check the line for proper supply. If fault persists, an internal fault has occurred; contact the factory.
15	DB Crct Failure	The dynamic brake (DB) is overloaded.	• Check for an open DB resistor. • Check for a shorted DB transistor. • Consult factory.
16	Motor Over Temp (Fault)	The VFD's motor temperature model detected motor overheating severe enough to cause a fault.	Decrease motor loading. If the motor is not overheated, check the temperature model parameters.
17	Output Fault	The output sensor detected an error.	• Check motor wiring. • Check for and remove any capacitive load. • Check the motor and cabling for shorts to ground.
18	Overcurrent	The VFD has measured excessive current in the motor output. This may be caused by: • Sudden, heavy load increase. • Short circuit in the motor cables. • Unsuitable motor.	• Check the load, motor size, and cables. • Review the settings for acceleration and deceleration times.

Fault Code	Fault Name	Possible Cause(s)	How to Recover
19	Drive Over Temp	Temperature of the VFDs heatsink is too high.	• Check the air flow. • Check that the heatsink is not clogged. • Check the ambient temperature. • Check that the switching frequency is not too high compared to ambient temperature and load.
20	Motor OverLoad	Excessive load on the motor (for example, a jammed load).	Check the motor and load.
21	Drive Under Temp	• Temperature of the VFDs heatsink is below 0 °C (32 °F). • Ribbon cable not correctly seated between the power and control boards.	• Increase the ambient temperature. • Ensure that the ribbon cable is correctly seated.
22	Motor Stall (Fault)	The motor's stall protection sensed a stall severe enough to cause a fault.	Check the motor.
23	Motor Underload (Fault)	The load on the motor is so insufficient (for example, a broken conveyor belt) that a fault occurs.	Check the motor and load.
24	TSP 10V Ref	10V reference for the analog input is overloaded.	• Ensure that the total load on the +10 terminal does not exceed 20mADC. • Check for correct connection of devices to the +10 terminal. • Check for short circuits associated with devices connected to the +10 terminal. • Consult factory.
25	EE Ref Checksum	Parameter restoring error due to interference fault or component failure.	Reset the fault and attempt a restart. If fault persists, contact the factory.
26	EE Par Checksum	Parameter restoring error due to interference fault or component failure.	Reset the fault and attempt a restart. If fault persists, contact the factory.
27	EEPROM Checksum	Parameter restoring error due to interference fault or component failure.	Reset the fault and attempt a restart. If fault persists, contact your local distributor or the factory.
28	Outpt Phase Loss	Current measurement detected a motor phase with no current.	Check motor cables.
29	Precharge Fault	Consult factory.	Consult factory.
30	TRIN Flt (ASIC)	Consult factory.	Consult factory.
31	Satur Flt (ASIC)	Consult factory.	Consult factory.
32	Empty Trp (ASIC)	Consult factory.	Consult factory.
33	Appl Change	Consult factory.	Consult factory.
34	High Unbal Curr	Consult factory.	Consult factory.
35	BMC Software	Consult factory.	Consult factory.
36	Lost of Ref (Fault)	The VFD detected the loss of the reference signal.	Restore the reference signal.
37	Lost of Ref (Warning)	The VFD detected the loss of the reference signal.	Restore the reference signal.
38	Broken Wire Trip (Fault)	The VFD detected a broken wire to Analog Input 1.	Check the control wiring for a broken wire and replace.
39	Broken Wire Trip (Warning)	The VFD detected a broken wire to Analog Input 1.	Check the control wiring for a broken wire and replace.
40	Loss of Keypad	Communication with the keypad is lost while keypad control is active.	Investigate and correct communication problem.
41	Ext Flt/Warning (Warning)	The configured input sensed an external fault.	Investigate why the external fault occurred and correct.
42	Ser Lnk TimeOut (Fault)	The programmed value of parameter AFN 27 (Com Timeout, see page 105) was exceeded.	Reset and restore serial link communications.
43	DI Logic Not Set	DI active logic is not set.	Set DI active logic via I/O 01 (Active Logic) parameter.
44	DI Logic Changed	Consult factory.	Consult factory.

Fault Code	Fault Name	Possible Cause(s)	How to Recover
45	DB Res Over Temp (Fault)	The internal dynamic brake (DB) resistor is too hot due to a peak overload.	• Reduce the amount of time that the DB is applied. • Reduce how often the dynamic brake is used. • Check that parameters FUN 15 (DB Res Value), FUN 16 (DB Rth Value), and FUN 17 (DB Cth Value) correctly set. • Reduce the load. • Resize DB resister. • Consult factory.
46	DB Res Over Temp (Warning)	The internal DB resistor is too hot due to a peak overload.	Same as for code 45.
47	DB Res Over Load (Fault)	Due to continuous overload, the load is more than the DB can safely handle.	Same as for code 45.
48	DB Res Over Load (Warning)	Due to continuous overload, the load is more than the DB can safely handle.	Same as for code 45.
49	MCP Fault	Consult Factory.	Consult Factory.
50	Loss of Fan	One of the fans is not draining current.	Check fans, replace bad fan.
51	Fan Warning	User has drive configured to warn drive.	Check fans, replace bad fan.
52	Motor Over Temp (Warning)	The VFDs motor temperature model detected motor overheating, but not severe enough to generate a fault.	Decrease motor loading. If the motor is not overheated, check the temperature model parameters.
53	Motor Stall (Warning)	The motor's stall protection sensed a stall, but not severe enough to cause a fault.	Check the motor.
54	Motor Underload (Warning)	The load on the motor is insufficient, but not so low that a fault occurs.	Check the motor and load.
55	DeviceNet Timeout (Fault)	No DeviceNet communication has occurred in the specified amount of time, and a fault occurs.	Reset and restore DeviceNet communication. See the DeviceNet manual for further information.
56	DeviceNet Timeout (Warning)	No DeviceNet communication has occurred in the specified amount of time, and a warning occurs.	Reset and restore DeviceNet communication. See the DeviceNet manual for further information.

Notes:

7 Motor Characteristics

MOTOR CHARACTERISTICS

7.1 Motor Characteristics

Listed below are some variable speed AC motor control concepts with which the user of the RSi SX Drive should become familiar with. Motor production methods may cause minor differences in the motor operation. The negative effects of these differences may be minimized by using the Autotune feature of the RSi SX.

7.1.1 Motor Autotuning

Autotuning is a function of the RSi SX that automatically measures several parameters of the connected motor and places these readings in a table whenever the VFD is started. The software uses the information in the table to help optimize the response of the VFD to application-specific load and operational requirements. The autotuning function is enabled via AFN 12 (DC Pulse at Start, see page 97), AFN 13 (, DC Pulse Time, see page 97). The default values cause a 1-second pulse of DC voltage to the motor when a TUNE command is given .

The measured parameters include the rotor and starter resistance, required excitation inductance, rotational inertia values and inductive leakage values.

⌘**NOTE:** That setting the DC pulse time lower then 1 second will not allow sufficient time for the drive to measure there parameters

7.1.2 Pulse Width Modulation Operation

The RSi SX drive uses a sinusoidal Pulse Width Modulation (PWM) control system. The output current waveform generated by the VFD approaches that of a perfect sine wave, the output voltage waveform is slightly distorted. For this reason, the motor may produce more heat, noise and vibration when operated by a VFD, rather than other starting methods such as a soft starter.

7.1.3 Low Speed Operation

Operating a general-purpose motor under 50% rated base speed may cause a decrease in the cooling ability of the motor. Reducing the torque requirement of the motor at lower speeds will decrease the generated heat at lower speeds.

When the motor is to be operated at low speeds (less than 50% of full speed) and at the rated torque continuously, an inverter-grade motor (designed for use in conjunction with a inverter) is recommended. When the VFD is used with an inverter grade motor, theMotor Typr parameter (FUN 03, see page 44) should be set to "blower-cooled"0.

7.1.4 Overload Protection Adjustment

The RSi SX drive software monitors the system current and determines when an overload condition is present. The overload current level is a percentage of the rated system current. This function protects the motor from overload.

The default setting for the overload detection circuit is set to the maximum rated current of the VFD at the factory. This setting must be adjusted to match the rating of the motor with which the VFD is to be used. To change the overload reference level, refer to AFN 23 (Mtr OL Scale) and AFN 24 (Mtr OL Time).

7.1.5 Operation Above Base Frequency (50/60Hz)

A motor produces more noise and vibration when it is operated at frequencies above its rated base frequency. Also, when operating a motor above base frequency, the rated speed limit of the motor or its bearings may be exceeded; this may void the motor warranty.

Contact the motor manufacturer for additional information before operating the motor above its base frequency.

7.1.6 Power Factor Correction

DO NOT connect power factor correction capacitors or surge absorbers to the output of the VFD. Doing so may cause damage to the VFD that is not covered under warranty.

If the VFD is used with a motor that is equipped with a capacitor for power factor correction, remove the capacitor from the motor.

Connecting either of these devices to the output of the VFD will cause the VFD to malfunction and trip, or may cause an over-current condition resulting in damage to the device or the VFD.

7.1.7 Light Load Conditions

When a motor is operated under a continuous light load (i.e. at a load of less than 50% of its rated capacity) or it is connected to a load which produces a very small amount of inertia it may become unstable and produce abnormal vibration or trips. In such cases the carrier frequency should be lowered to compensate for this condition. See AFN 05-06 (Carrier Frequency Configuration).

7.1.8 Motor/Load Combinations

When the VFD is used in combination with any of the following motors or loads, undesirable operation may result.

- A motor with a rated capacity that exceeds the motor capacity recommended for the VFD.
- An explosion-proof motor.

  When using the VFD with an explosion-proof motor or other special motor types, lower the carrier frequency to stabilize the operation. **DO NOT** set the carrier frequency below 2.2kHz if operating the system in the sensorless vector control mode.

- If the motor that is coupled to a load with a large backlash or to a reciprocating load, adjust the ramp shape settings and/or switch to the constant torque control mode to stabilize its operation.

7.1.9 Load-produced Negative Torque

When the VFD is combined with a load that produces negative torque the over-voltage or over-current protective functions of the drive may cause the VFD to trip.

To minimize the effects of negative torque a dynamic braking system may be used. The dynamic braking system uses a braking resistor that must be suitably matched to the load.

The RSi SX is equipped with a light-duty internal braking resistor which is sized appropriately for most applications. If you require constant braking torque or faster stop times a larger external braking resistor may be required.

7.1.10 Motor Braking

The motor may continue to rotate and coast to a stop after being shut off due to the inertia of the load. If an immediate stop is required, a braking system should be used.

NOTES:

8 Options

OPTIONS

8.1 Standard Keypad Kits (for remote mounting)

The standard keypad is available for remote mounting use in your applications (maximum 2m or 6 feet). It is available in two kits. Kit 1 contains the display, gasket and ribbon cable. Kit 2 contains only the gasket and ribbon cable.

8.2 Enhanced Keypad Kits (for remote mounting)

The enhanced keypad is available for remote mounting or hand-held use in your application up to 100m or 300 feet. For longer distances an amplifier is required (consult factory).

8.3 IP31-IP21 Conversion Kits

The NEMA 1 / IP31 model may optionally be fitted with a kit for terminating shielded cable. Four kits are available, depending on the size of the model (the part numbers for the kits are RSiP01, RSiP02, RSiP03, and RSiP04).

These kits contain four clamps that slide into slots on the included cable plate. The clamps are used to terminate shielded cable. The cable plate easily replaces the conduit plate on the bottom of the NEMA 1 / IP31 model.

8.4 SIOC02 Signal Converter

This product converts RS-232 signalling to RS-485 signalling.

8.5 Reflash Tool

The Reflash Tool allows you to upgrade the firmware of the RSi SX Drive. This allows the latest features to be implemented in existing hardware. For more information on this capability, refer to the Benshaw document titled "Reflash Procedures for the RSi SX Sensorless Vector Drive".

8.6 Dynamic Braking Units

To augment the braking capacity of the RSi SX drive, consult factory.

8.7 DeviceNet Option Board

The DeviceNet®Option Board (part number RSiDN01) provides an RS-485 interface to a DeviceNet network. It supports baud rates up to 500K. Contact Benshaw for further information.

8.8 Metasys Option Board

The Metasys Option Board provides an RS-485 interface to a Metasys network. Contact Benshaw for further information.

8.9 Analog Input/Output Option Board

The Analog Input/Output Option Board (part number RSiAI0-01) provides three additional analog input channels, two additional analog output channels and two additional relays for the RSi SX drive. Contact Benshaw for further information.

8.10 Fins Out Kit

The Fins Out Kit allows you to mount the heatsink fins outside of a host enclosureto reduce the required enclosure size.

9 Hexadecimal to Binary Conversion

HEXADECIMAL TO BINARY CONVERSION

9.1 Hexadecimal to Binary Conversion

The RSi SX VFD utilizes hexadecimal numbers to display and store the values of some parameters. These parameters are read and written as four-digit hexadecimal values. The hexadecimal values are then translated to binary values, with the binary values being compared to the "key" provided for each parameter to determine what status is shown or what action is commanded.

The following table shows the sixteen hexadecimal values and the corresponding binary values. The binary values are divided into four columns so you may more readily see which bits of the status or control words are affected by the binary values.

Table 23

Hexadecimal Value	Binary Value			
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
A	1	0	1	0
B	1	0	1	1
C	1	1	0	0
D	1	1	0	1
E	1	1	1	0
F	1	1	1	1
	15	14	13	12
	11	10	9	8
	7	6	5	4
	3	2	1	0
	Corresponding Bit Positions of Parameter Words			

Appendices

APPENDIX A - EU DECLARATION OF CONFORMITY

EU DECLARATION OF CONFORMITY

Product Category:	Motor Controller
Product Type:	(VFD) Variable Frequency Drives
Model Number:	RSi SX
Manufacturer's Name:	Benshaw, Inc.
Manufacturer's Address:	1659 East Sutter Road Glenshaw, PA 15116 United States of America

The before mentioned products comply with the following EU directives and Standards:

Low Voltage Directive:	EN50178 - Electronic equipment for use in power installations
Electromagnetic Compatibility:	EN61800-3 - Adjustable speed electrical power systems - Part 3: EMC product standard including specific test methods

The products referenced above are for the use of control of the speed of AC motors. For application information, consult the following document from Benshaw: Form 1346. The use in residential and commercial premises (Class B) requires an optional RSi LF series filter. Via internal mechanisms and Quality Control, it is verified that these products conform to the requirements of the Directive and applicable standards.

Glenshaw, PA USA - 1 March 2004

Neil Abrams Quality Control Manager	Harry Hagerty VP General Manager

EXTERNAL DB RTH/CTH CALCULATION

SX External DB Resistor Thermal Model Coefficient Identification

The purpose of this document is to aid the end user in identifying the correct coefficients and thresholds for the Dynamic Braking resistor software thermal model. The following parameters that the user will need to adjust are as follows:

DBR_VALUE **(Ohms)**
DBR_RTH
DBR_CTH
DBR_TRIP_TEMP **(deg C)**
DBR_ALARM_TEMP **(deg C)**

The DBR_VALUE is self explanatory. This should be the value of the resistor(s), in Ohms, as measured at the two wires entering the SX drive before connecting them to the DB and B+ terminals.

Before DBR_RTH and DBR_CTH can be calculated the user must aware of any rating change of the DB resistor caused by how it has been applied in the system. For example, if a fan was being used to cool the resistor(s) then the free air rating that is typically given in the resistor data book may be modified. Or if many resistors arecombined to obtain the desired braking performance then a derate of the original resistor rating will apply. The user should consult with the resistor manufacturer in such cases.

Determine RTH:
(⌘ **NOTE:** RTH is different than DBR_RTH)

RTH is known as the thermal resistance of the resistor and is generally given in units of deg C (rise over ambient) over power (Watts). The question to ask the resistor manufacturer is, "At a given Watts applied to the resistor(s) what is the degC rise over ambient?".

Watts_applied =500W

DegC_rise =375°C

Rth: $= \frac{\text{DegC\_rise}}{\text{Watts\_applied}} = \frac{375}{500}$

Rth: = 0.75

Determine CTH:
(⌘ **NOTE:** CTH is different than DBR_CTH)

CTH is known as the thermal capacitance of the resistor and is generally given in units of Watt-Seconds over degC (rise over ambient). Another way of looking at it is by saying if I apply 500W over a 2 second period and the resistor temperature rise is 200 deg C then:

CTH $= \frac{\text{Watts Applied x Time}}{\text{DegC Rise}} = \frac{500 \bullet 2}{200}$

CTH = 5

CAUTION: The time in the previous equation must not exceed the first time constant of the resistor. What this means is that the temperature rise must still linear after the time has elapsed.

The particular resistor manufacturer may or may not know this so you may need to explain it to them. Please do not forget about the environment that the resistor is being applied in when determining the numbers.

If the resistor manufacturer can tell you the time it takes for the resistor temperature to stabilize after a fixed amount of watts is applied then we can estimate the thermal time constant by dividing the given time by 5.

T_final = 30 From manufacturer

$$\textbf{CTH} = \frac{\frac{T\_final}{5}}{RTH}$$

Determine DBR_TRIP_TEMP:
The best source for this information is obtained from either from the manufacturers data book or by calling the manufacturer directly. Do not forget to factor in the ambient temperature into the equation.

The typical value for this would be in the range of 250 to 325.

DBR_TRIP_TEMP = 325

⌘ **NOTE:** This parameter can not be adjusted by the application. The value has been pre-determined based upon the internal resistor requirements.

Determine DBR_ALARM_TEMP:
This setting is primarily for indication only. It has no affect on the performance of the DB function. The typical value for this would be in the range of 200 to 275.

DBR_ALARM_TEMP = 275

⌘ **NOTE:** This parameter can not be adjusted by the application. The value has been pre-determined based upon the internal resistor requirements.

Determine ACTUAL TRIP TIME:
To determine the actual time to trip based upon the parameters chosen above we must first read the supply voltage that was selected from the RSi SX keypad. Once you have the supply voltage we can get the VDC associated with supply voltage from the following table.

Table 24

AC in	VDC	AC in	VDC	AC in	VDC
115	311	240	324	480	648
120	324	250	338	500	675
180	243	380	513	525	709
200	270	400	540	575	776
208	281	415	560	600	810
220	297	440	594	660	891
230	311	460	621	690	932

Assume the AC input is 460V and the DB resistor value is 20 Ω for this example.

AC_in = 460

DB_res = 500

VDC = 621

Temp_final $= (VDC \bullet 1.25)^2 \bullet \frac{RTH}{DB\_res}$

Temp_final = 903

Tau = RTH CTH

Tau = 6

$$DBR\_TRIP\_TEMP: = Temp\_final \bullet \left(1\text{-}e^{-\frac{TRIP\text{-}TIME}{Tau}}\right)$$

Solve for Trip_time:

Trip_time $= -\ln\left(1-\frac{DBR\_TRIP\_TEMP}{Temp\_final}\right) \bullet Tau$

Trip_time = 2.67 seconds

Determine DBR_RTH and DBR_CTH;

To convert RTH and CTH to DBR_RTH and DBR_CTH use the following equations.

RTH to **DBR_RTH**:

$DBR\_RTH := \frac{256}{RTH\ 10}$ Range [0 … 16383]

DBR_RTH = 34.1

CTH to **DBR_CTH**:

$DBR\_CTH := \frac{10 \bullet 0.005 \bullet 2^{23}}{CTH}$ Range [0 … 65535]

DBR_CTH = 5.24

MODBUS TABLES BY GROUP ASSORTMENT

Table 25: Drive Group

DRV Code	Drive Description	Keypad Display	PAGE #	ModBUS #
01	Torque Type	Torque Type	36	40500
02	Nominal Motor Current	Nom Mtr Amps	36	40520
03	Acceleration Time 1	Accel Time 1	37	40310
04	Deceleration Time 1	Decel Time 1	37	40311
05	Meter Resets	Meter Resets	38	42138
06	Output Current	Output Curr.	38	40023
07	Output Voltage	Output Volts	38	40022
08	Output Power (kW)	Out Power	39	42113
09	Output Power	Output Power	39	40029
10	MWH Meter	MWh	39	40896
11	MWH Life	MWh Lifetime	40	40894
12	Op. Hrs	Operating Hrs	40	40892
13	Op. Days	Operate Days	40	40890
14	Output Frequency	Output Freq	41	40020
15	Drive Load	Drive Load	41	40024
16	Drive Temperature	Drive Temp	41	40025
17	Motor Temperature	Motor Temp	42	40027
18	DC Bus Voltage	Bus Voltage	42	40026
19	Software Manual	SW Manual	42	N/A
20	Drive Model	Drive Model	43	40001
hhh = Drive Horsepower v = Drive Voltage				

Table 26: Function Group

FUN Code	Function Description	Keypad Display	Page #	ModBUS #
00	Jump Code	Jump Code		-
01	Nominal Motor Current	Nom Mtr Amps	44	40520
02	Nominal Motor Voltage	Nom Mtr Volt	44	40521
03	Motor Type	Motor Type	44	40610
04	Run/Stop Source	Run/Stop Src	45	42000
05	2-Wire/3-Wire Start-Stop	2w/3w S-S	46	40401
06	Reference Source	Ref. Source	46	42001
07	Main Speed Reference	Main Spd Ref	47	40800
08	Jog Reference Configure	Jog Ref Cfg	48	40803
09	Torque Curve	Torque Curve	49	40500
10	Start Mode	Start Mode	50	40402
11	Acceleration Time 1	Accel Time 1	50	40310
12	Deceleration Time 1	Decel Time 1	50	40311
13	Jog Mode	Jog Mode	51	40404
14	Jog Acceleration Time	Jog Acc Time	51	40458
15	Jog Deceleration Time	Jog Dcl Time	51	40459
16	EMOP Configure	EMOP Config	52	40420

FUN Code	Function Description	Keypad Display	Page #	ModBUS #
17	EMOP Ramp-Time	EMOP R-Time	52	40316
18	EMOP @ Stop	EMOP @ Stop	53	42119
19	DB Configure	DB Config	53	40630
20	DB Resistor Value	DB Res Value	54	40632
21	DB Rth Value	DB Rth Value	54	40633
22	DB Cth Value	DB Cth Value	54	40634
23	DC Injection Configure	DC Inj Cfg	56	40411
24	DC Injection Frequency	DC Inj Freq	56	40414
25	DC Injection Time Frequency	DC Inj T-Freq	57	40416
26	DC Injection Time Stop	DC Inj T-Stp	57	40413
27	DC Injection Level	DC Inj Level	58	40412
28	Current Limit	Curr. Limit	58	40331
29	Torque Limit Type	Trq Lim Type	59	40601
30	Torque Limit Analog Input	Trq Lim AI	59	40603
31	Torque Limit Motoring/Forward (M/F)	Trq Lim M/F	60	40332
32	Torque Limit Motoring/Reverse (M/R)	Trq Lim M/R	60	40334
33	Torque Limit Regenerating/Forward (R/F)	Trq Lim R/F	60	40333
34	Torque Limit Regenerating/Reverse (R/R)	Trq Lim R/R	61	40335
35	Torque Limit Frequency	Trq Lim Freq	61	40602
36	Regenerative Timeout	Reg Time-Out	61	40605
37	Acceleration Ramp Shape	Acc Shape	62	40452
38	Acceleration Rounding	Acc Rounding	62	40453
39	Deceleration Ramp Shape	Dcl Shape	62	42005
40	Deceleration Rounding	Dcl Rounding	62	42006
41	Stop Mode	Stop Mode	63	40403
42	Allow Skips	Allow Skips	64	42007
43	Skip 1 Low Frequency	Skip 1 Low	65	40480
44	Skip 1 High Frequency	Skip 1 High		40481
45	Skip 2 Low Frequency	Skip 2 Low		40482
46	Skip 2 High Frequency	Skip 2 High		40483
47	Skip 3 Low Frequency	Skip 3 Low		40484
48	Skip 3 High Frequency	Skip 3 High		40485
49	Skip 4 Low Frequency	Skip 4 Low		40486
50	Skip 4 High Frequency	Skip 4 High		40487
51	Skip 5 Low Frequency	Skip 5 Low		40488
52	Skip 5 High Frequency	Skip 5 High		40489
53	Fault Lockout Number	Fault LO #	64	40871
54	Auto Reset Time	Auto Rst Tm	64	40872
55	Current Level 1	Curr Level 1	65	40830
56	Current Level 2	Curr Level 2		40831
57	Torque Level 1	Torque Lvl 1	65	40832
58	Torque Level 2	Torque Lvl 2		40833
59	Frequency Level 1	Freq Level 1	65	40834
60	Frequency Level 2	Freq Level 2		40835
61	Frequency Level 3	Freq Level 3		40836
62	Low Frequency Threshold	Low Freq Thr	66	40841

FUN Code	Function Description	Keypad Display	Page #	ModBUS #
63	Timer 1 Type	Timer 1 Type	66	42134
64	Timer 1 Time	Timer 1 Time	66	42132
65	Timer 2 Type	Timer 2 Type	67	42135
66	Timer 2 Time	Timer 2 Time	67	42133
67	Heatsink Temperature Warning	HS Temp Warn	67	40837
68	Heatsink Temperature Trip	HS Temp Trip	68	40015
69	Fault Stop Mode	Flt Stp Mode	68	40873
70	Display Mode	Display Mode	69	40955
71	User Unit Multiplier	Usr Unit Mul	69	40956
72	User Unit Divisor	Usr Unit Div	70	40957
73	User Label 1	User Label 1	70	40958
74	User Label 2	User Label 2		40959
75	User Label 3	User Label 3		40960
76	Access Level Configure	Access Level	70	40297
77	Set Code	Set Code	71	40299
78	Enter Code	Enter Code	71	40298

Table 27: I/O Group

I/O Code	I/O Description	Keypad Display	Page #	ModBUS #
00	Jump Code	Jump Code		
01	Active Logic	Active Logic	72	40700
02	Digital Input 2 (D2) Configure	D2 Config	73	40704
03	Digital Input 3 (D3) Configure	D3 Config		40705
04	Digital Input 4 (D4) Configure	D4 Config		40706
05	Digital Input 5 (D5) Configure	D5 Config		40707
06	Digital Input 6 (D6) Configure	D6 Config		40708
07	Digital Input 7 (D7) Configure	D7 Config		40709
08	Digital Input 8 (D8) Configure	D8 Config		40710
09	Digital Input 9 (D9) Configure	D9 Config		40711
10	Digital Input 10 (D10) Configure	D10 Config		40712
11	Digital Output 1 (DQ1) Configure	DQ1 Config	74	40770
12	Digital Output 2 (DQ2) Configure	DQ2 Config		40771
13	Digital Output 3 (DQ3) Configure	DQ3 Config		40772
14	Relay 1 (R1) Configure	R1 Config	75	40780
15	Relay 2 (R2) Configure	R2 Config	75	40781
16	Optional Relay A (RA) Configure	RA Config	76	40283
17	Optional Relay B (RB) Configure	RB Config	76	40284
18	Set Fixed Speed	Fixed Speed	76	40804
19	Set k-Factor	Set k-factor	76	40801
20	Preset Speed 1	Preset Spd 1	77	40350
21	Preset Speed 2	Preset Spd 2		40352
22	Preset Speed 3	Preset Spd 3		40354
23	Preset Speed 4	Preset Spd 4		40356
24	Preset Speed 5	Preset Spd 5		40358
25	Preset Speed 6	Preset Spd 6		40360
26	Preset Speed 7	Preset Spd 7	77	40362
27	Analog Input 1 (A11) Configure	A11 Config	78	40741

I/O Code	I/O Description	Keypad Display	Page #	ModBUS #
28	Analog Input 1 (A11) Span	A11 Span	78	40743
29	Analog Input 1 (A11) Offset	A11 Offset	78	40744
30	Analog Input 1 (A11) Invert	A11 Invert	79	40742
31	Analog Input 1 (A11) Filter Time	A11 Ftr Time	79	40745
32	Analog Input 2 (A21) Configure	A21 Config	79	40751
33	Analog Input 2 (A21) Span	A21 Span	80	40753
34	Analog Input 2 (A21) Offset	A21 Offset	80	40754
35	Analog Input 2 (A21) Invert	A21 Invert	80	40752
36	Analog Input 2 (A21) Filter Time	A21 Ftr Time	81	40755
37	Analog Output 1 (A0) Configure	A0 Config	81	40790
38	Analog Output 2 (A1) Configure	A1 Config	81	40792
39	Analog Output 1 (A0) Calibrate	A0 Cal	81	40791
40	Analog Output 2 (A1) Calibrate	A1 Cal	82	40793
41	Analog Output 2 (A1) Out Type	A1 Out Type	82	40794
42	Analog Output A Configure	AQA Config	82	40275
43	Analog Output A Calibrate	AQA Cal	83	40276
44	Analog Output A Offset	AQA Offset	83	40277
45	Analog Output B Configure	AQB Config	82	40279
46	Analog Output B Calibrate	AQB Cal	83	40280
47	Analog Output B Offset	AQB Offset	83	40281
48	Analog Input A Span	AIA Span	83	40262
49	Analog Input A Offset	AIA Offset	84	40261
50	Analog Input A Invert	AIA Invert	84	40260
51	Analog Input A Filter Time	AIA Ftr Time	84	40263
52	Analog Input B Span	AIB Span	83	40267
53	Analog Input B Offset	AIB Offset	84	40266
54	Analog Input B Invert	AIB Invert	84	40265
55	Analog Input B Filter Time	AIB Ftr Time	84	40268
56	Analog Input C Span	AIC Span	83	40272
57	Analog Input C Offset	AIC Offset	84	40271
58	Analog Input C Invert	AIC Invert	84	40270
59	Analog Input C Filter Time	AIC Ftr Time	84	40273
60	Analog Output 1 Level	A11 Level	85	40164
61	Analog Output 2 Level	A21 Level	85	40165
62	Analog Output 1 Level	A0 Level	85	40174
63	Analog Output 2 Level	A1 Level	86	40175
64	Analog Input A Level	AIA Level	86	40264
65	Analog Input B Level	AIB Level		40269
66	Analog Input C Level	AIC Level		40274
67	Digital Input Filter Time	Filter Time	86	40701
68	DPQ Scaling	DPQ Scaling	87	40789
69	Keypad Control	Keypad Ctrl	87	40875
70	F1 Key Configure	F1 Key Cfg	88	40961
71	F2 Key Configure	F2 Key Cfg		40962
72	F3 Key Configure	F3 Key Cfg		40963
73	F4 Key Configure	F4 Key Cfg		40964
74	Input Status	Inputs	88	N/A
75	Output Status	Outputs	88	N/A

Table 28: AFN Group

AFN Code	AFN Description	Keypad Display	Page #	ModBUS #
00	Jump Code	Jump Code		
01	Nominal Motor Frequency	Nom Mtr Freq	92	40522
02	Nominal Motor RPM	Nom Mtr RPM	92	40524
03	Maximum Frequency	Maximum Freq	92	40303
04	Minimum Frequency	Minimum Freq	93	40301
05	Auto-Carrier	Auto-Carrier	93	40502
06	Carrier Frequency	Carrier Freq	93	40501
07	Slip Compensation	Slip Comp	94	40551
08	Voltage Boost Configuration	V-Boost Conf	94	40553
09	Set Voltage Boost	Set V-Boost	95	40554
10	Boost Taper Frequency	Bst. Tpr Frq	95	40555
11	Boost Taper Voltage	Bst. Tpr Vlt	96	40557
12	DC Pulse Start	DC PulsStart	97	40540
13	DC Pulse Time	DC PulseTime	97	40541
14	Sensorless Vector Low Speed Compensation	Low Spd Comp	97	40542
15	Supply Voltage	Supply Volts	98	40549
16	Catch on Fly	Catch on Fly	98	40620
17	Run Prevent	Run Prevent	99	42004
18	Stop Key	Stop Key	99	40950
19	Enter Key	Enter Key	99	40978
20	Alternate Run/Stop Source	Alt. R/S Src	100	42002
21	Alternate Reference Source	Alt. Ref Src	100	42003
22	Alternate Speed Reference	Alt. Spd Ref	102	42112
23	Motor Overload Scale	Mtr OL Scale	103	40611
24	Motor Overload Time	Mtr OL Time	104	40612
25	Communication Protocol	Com Protocol	106	40900
26	Communication Drop Number	Com Drop #	106	40903
27	Communication Baudrate	Com Baudrate	107	40901
28	Communication Timeout	Com Timeout	107	40904
29	Communication Parity	Com Parity	108	40902
30	Alternate Ramp 1 Configure	AR1 Config	108	40450
31	Acceleration Time 2	Accel Time 2	109	40312
32	Deceleration Time 2	Decel Time 2	109	40313
33	Alternate Ramp 1 Shape	AR1 Shape	109	40454
34	Alternate Ramp 1 Rounding	AR1 Rounding	110	40455
35	Alternate Ramp 1 Switch Frequency	AR1 Sw. Freq	110	40462
36	Alternate Ramp 2 Configure	AR2 Config	110	40451
37	Acceleration Time 3	Accel Time 3	111	40314
38	Deceleration Time 3	Decel Time 3	111	40315
39	Alternate Ramp 2 Shape	AR2 Shape	111	40456
40	Alternate Ramp 2 Rounding	AR2 Rounding	112	40457
41	Alternate Ramp 2 Switch Frequency	AR2 Sw. Freq	112	40464
42	Reference 1 Configure	Ref1 Config	112	40810
43	Reference 2 Configure	Ref2 Config		40811
44	Reference 3 Configure	Ref3 Config		40812
45	Ramp Reference Frequency	Ramp Ref Frq	113	40460

AFN Code	AFN Description	Keypad Display	Page #	ModBUS #
46	Manual Fault Reset	Man Flt Rst	113	40864
47	Dynamic Braking Auto Reset	DB Flt A.Rst	114	40866
48	Lost Reference Auto Reset	L 4-20 A.Rst	114	40869
49	External Fault Auto Reset	Xt Flt A.Rst	114	40870
50	Motor Thermal Protection	Mtr Thm Prot	115	40854
51	External Fault	Ext Fault	115	40853
52	Fan Loss Fault	Fan Loss	116	40862
53	Net Timeout Fault	Net TO Flt	116	40876
54	Input Phase Fault	IP Phase Flt	117	40851
55	Over Voltage Auto Reset	OV AutoReset	117	40865
56	Over Current Auto Reset	OC AutoReset	118	40867
57	Over Temperature Auto Reset	OT AutoReset	118	40868
58	UV AutoReset	UV AutoResets	119	42137
59	DC Cal Cfg	DC Cal. Cfg	119	42139
60	Auto Reset Type	AutoRst Type	120	40874
61	Reference Fault	Ref Fault	120	40859
62	Lost Reference Frequency	Lost Ref Frq	121	40860
63	DC Meter Based	DC Mtr Base	121	42139
64	Proportional/Integral/Derivative Configure	PID Config	126	40650
65	Proportional/Integral/Derivative at Stop	PID @ Stop	126	42115
66	Proportional/Integral/Derivative Direct Type	PID Type		40651
67	PID Feedback Configuration	Feedback Cfg	127	40652
68	Proportional/Integral/ DerivativeProportional Gain	PID P-Gain	128	40653
69	Proportional/Integral/Derivative Integral Gain	PID I-Gain	128	40645
70	Proportional/Integral/ Derivative Gain	PID D-Gain	128	40655
71	Proportional/Integral/Derivative Feedback Gain	PID FB Gain	128	40656
72	Proportional/Integral/ Derivative High Limit	PID High Limit	129	40657
73	Proportional/Integral/Derivative Low Limit	PID Low Limit	129	40658
74	Proportional/Integral/Derivative High Alarm	PID High Alm	130	40659
75	Proportional/Integral/Derivative Low Alarm	PID Low Alm	130	40660
76	Proportional/Integral/Derivative Reference	PID Ref	131	40670
77	Proportional/Integral/Derivative Feedback	PID FB	131	40671
78	Proportional/Integral/Derivative Error	PID Error	131	40672
79	Proportional/Integral/Derivative Output	PID Output	132	40673
80	Proportional/Integral/Derivative Proportional Part	PID P-Part	132	40674
81	Proportional/Integral/Derivative Integral Part	PID I-Part	132	40675
82	Proportional/Integral/ Derivative Part	PID D-Part	133	40676
83	Application Software Version	Appl Sw Ver.	133	40010
84	Motor Control Software Version	MCP Sw Ver.	133	40007
85	Terminal Strip Processor Software Version	TSP Sw Ver.	134	40009
86	Serial Number 1	Serial No 1	134	40005
87	Serial Number 2	Serial No 2	134	40006
88	Program Number	Prog Number	135	40984
89	Application Selector	Application	135	
90	Parameter Storage / Recall	Par STO/RCL	135	40982

APPENDIX D - SUMMARY OF RSI SX PARAMETERS

PARAMETER LIST

Table 29: Drive Group

Code [DRV]	Drive Group	Keypad Display	Setting Range	Set Unit	Factory Default	Page #	User Settings
01	Torque Type	Torque Type	Constant / Variable		Constant	36	
02	Nominal Motor Amperage	Nom Mtr Amps	Varies	A	90% of nominal	36	
03	Acceleration Time 1	Accel Time 1	0.1 to 3200.0	s	3.0 s	37	
04	Deceleration Time 1	Decel Time 1	0.1 to 3200.0	s	3.0 s	37	
05	Meter Resets	Meter Resets	No Action MWH Meter Op.Hrs Meter MWH & Op. Hrs		No Action	38	
06	Output Current	Output Curr.	0.0 to 999.9	A	View-Only	38	
07	Output Voltage	Output Volts	0 to 1000	V		38	
08	Out Power (kW)	Out Power	0.0 to 999.9	kW		39	
09	Output Power	Output Power	0 to 250	%		39	
10	Resettable MWh Meter	MWh	0.000 to 99999			40	
11	Lifetime MWh Meter	MWh Lifetime	0.000 to 99999			40	
12	Resettable Operate Hours Meter	Operate Hrs	0.00 to 99999	h		40	
13	Operation Days Meter	Operate Days	0.00 to 99999	Days		40	
14	Output Frequency	Output Freq	0.00 to 320.00	Hz		41	
15	Drive Load	Drive Load	0 to 250	%		41	
16	Drive Temperature	Drive Temp	0 to 125	°C		41	
17	Motor Temperature	Motor Temp	0 to 250	%		42	
18	DC Bus Voltage	Bus Voltage	0 to 1000	V		42	
19	Software Manual	SW Manual	890020-02-02			42	
20	Drive Model	Drive Model	RSihhhSXv			43	
hhh = Drive Horsepower v = Drive Voltage							

Table 30: Function Group

Code [FUN]	Function Group	Keypad Display	Setting Range	Set Unit	Factory Default	Page #	User Settings
00	Jump Code	Jump Code	-				
01	Nominal Motor Amperage	Nom Mtr Amps	Model Dependent	A	90% of nominal	44	
02	Nominal Motor Voltage	Nom Mtr Volt	100 - 690V	V	Varies by model	44	
03	Motor Type	Motor Type	No Thrm Pr Std Induct Blwr Coold		Std Induct	44	
04	Run/Stop Source	Run/Stop Src	Keypad Terminal 1 Terminal 2 Serial		Keypad	45	
05	2-Wire / 3-Wire Start-Stop	2w/3w S-S	2-wire / 3-wire		2-wire	46	

Code [FUN]	Function Group	Keypad Display	Setting Range	Set Unit	Factory Default	Page #	User Settings
06	Reference Source	Ref. Source	Keypad Main Spd Ref Alt. Spd Ref Serial		Keypad	46	
07	Main Speed Reference	Main Spd Ref	Spd-Fixed Spd-Rf 1 Spd-Rf 2 Spd-Rf 3 Spd-R1+R2 S-R1+k*R2 Spd-R1-R2 S-R1+R2-R3		Spd-Rf 2	47	
08	Jog Reference Configure	Jog Ref Cfg	Same as FUN 07		Spd-Fixed	48	
09	Torque Curve	Torque Curve	V/Hz Linear SVC Linear V/Hz Lin. 2pc SVC Lin. 2pc V/Hz Quad SVC Quad		V/Hz Linear	49	
10	Start Mode	Start Mode	LS Lockout Auto Start		LS Lockout	50	
11	Acceleration Time 1	Accel Time 1	0.1 to 3200.0	s	3.0 s	50	
12	Deceleration Time 1	Decel Time 1	0.1 to 3200.0	s	3.0 s	50	
13	Jog Mode	Jog Mode	No Jogging Run / Jog DI Jog Pshbut		No Jogging	51	
14	Jog Acceleration Time	Jog Acc Time	0.0 to 3200.0	s	1.0 s	51	
15	Jog Deceleration Time	Jog Dcl Time	0.0 to 3200.0	s	1.0 s	51	
16	EMOP Configure	EMOP Config	None TS no Mem TS w/ Mem TS w/MemP T/K no Mem T/K w/ Mem T/K MemP		None	52	
17	EMOP Ramp-Time	EMOP R-Time	0.1 to 3200.0	s	30.0 s	52	
18	EMOP @ Stop	EMOP @ Stop	Disabled / Enabled		Disabled	53	
19	DB Configure	DB Config	Internal DBR External DBR Custom DB Disabled	Hz	Internal DBR	53	
20	DB Resistor Value	DB Res Value	0 to 3276.6	Ω	Varies by Model	54	
21	DB Rth Value	DB Rth Value	0 to 16383			54	
22	DB Cth Value	DB Cth Value	0 to 65535			54	
23	DC Injection Configure	DC Inj Cfg	None DCI on Frq DCI by DI DCI-DI/Freq		None	56	
24	DC Injection Frequency	DC Inj Freq	0.00 to 25.00	Hz	0.00 Hz	56	
25	DC Injection Time Frequency	DC Inj T-Freq	0.00 to 60.00	s	0.20 s	57	
26	DC Injection Time Stop	DC Inj T-Stp	0.00 to 60.00	s	0.20 s	57	
27	DC Injection Level	DC Inj Level	1 to 150	%	50%	58	
28	Current Limit	Curr. Limit	1 to 200	%	150%	58	

APPENDIX D - SUMMARY OF RSI SX PARAMETERS

Code [FUN]	Function Group	Keypad Display	Setting Range	Set Unit	Factory Default	Page #	User Settings
29	Torque Limit Type	Trq Lim Type	Disabled Fixed Lvls By DI Follow AI On Freq		Disabled	59	
30	Torque Limit Analog Input	Trq Lim AI	AI #1 AI #2 AI #A AI #B AI #C		AI #1	59	
31	Torque Limit M/F	Trq Lim M/F	1 to 200	%	150%	60	
32	Torque Limit M/R	Trq Lim M/R	1 to 200	%	150%	60	
33	Torque Limit R/F	Trq Lim R/F	1 to 200	%	80%	60	
34	Torque Limit R/R	Trq Lim R/R	1 to 200	%	80%	61	
35	Torque Limit Frequency	Trq Lim Freq	0.00 to 320.00	Hz	0.00 Hz	61	
36	Regenerative Timeout	Reg Time-Out	1 to 60	s	1 s	61	
37	Acceleration Ramp Shape	Acc Shape	Linear / S-Curve		Linear	62	
38	Acceleration Rounding	Acc Rounding	0.0 to 10.0	s	0.0 s	62	
39	Deceleration Ramp Shape	Dcl Shape	Linear / S-Curve		Linear	62	
40	Deceleration Rounding	Dcl Rounding	0 to 10.0	s	0.0 s	62	
41	Stop Mode	Stop Mode	Rmp to Stp Cst to Stp DCI to Stp		Rmp to Stp	63	
42	Allow Skips	Allow Skips	On / Off		Off	63	
43	Skip 1 Low Frequency	Skip 1 Low	0.0 to Maximum Freq.	Hz	0.00 Hz	64	
44	Skip 1 High Frequency	Skip 1 High	0.0 to Maximum Freq.	Hz	0.00 Hz		
45	Skip 2 Low Frequency	Skip 2 Low	0.0 to Maximum Freq.	Hz	0.00 Hz		
46	Skip 2 High Frequency	Skip 2 High	0.0 to Maximum Freq.	Hz	0.00 Hz		
47	Skip 3 Low Frequency	Skip 3 Low	0.0 to Maximum Freq.	Hz	0.00 Hz		
48	Skip 3 High Frequency	Skip 3 High	0.0 to Maximum Freq.	Hz	0.00 Hz		
49	Skip 4 Low Frequency	Skip 4 Low	0.0 to Maximum Freq.	Hz	0.00 Hz		
50	Skip 4 High Frequency	Skip 4 High	0.0 to Maximum Freq.	Hz	0.00 Hz		
51	Skip 5 Low Frequency	Skip 5 Low	0.0 to Maximum Freq.	Hz	0.00 Hz		
52	Skip 5 High Frequency	Skip 5 High	0.0 to Maximum Freq.	Hz	0.00 Hz		
53	Fault Lockout Number	Fault LO #	0 to 8		0	64	
54	Auto Reset Time	Auto Rst Tm	0 to 3600	s	0 s	64	
55	Current Level 1	Curr Level 1	0 to 200	%	0 %	65	
56	Current Level 2	Curr Level 2	0 to 200	%	0 %	65	
57	Torque Level 1	Torque Lvl 1	0 to 200	%	0 %	65	
58	Torque Level 2	Torque Lvl 2	0 to 200	%	0 %	65	
59	Frequency Level 1	Freq Level 1	0.0 to Maximum Freq.	Hz	0.0 Hz	65	
60	Frequency Level 2	Freq Level 2	0.0 to Maximum Freq.	Hz	0.0 Hz		
61	Frequency Level 3	Freq Level 3	0.0 to Maximum Freq.	Hz	0.0 Hz		
62	Low Frequency Threshold	Low Freq Thr	0.0 to Maximum Freq.	Hz	0.0 Hz	66	
63	Timer 1 Type	Timer 1 Type	On Delay Off Dely On/Off Delay		On Delay	66	

Code [FUN]	Function Group	Keypad Display	Setting Range	Set Unit	Factory Default	Page #	User Settings
64	Timer 1 Time	Timer 1 Time	0.00 to 320.00	s	0.00 s	66	
65	Timer 2 Type	Timer 2 Type	On Delay Off Delay On/Off Delay		On Delay	67	
66	Timer 2 Time	Timer 2 Time	0.00 to 320.00	s	0.00 s	67	
67	Heatsink Temperature Warning	HS Temp Warn	0 to 100	%	100 %	67	
68	Heatsink Temperature Trip	HS Temp Trip	0 to 125	°C	Varies	68	
69	Fault Stop Mode	Flt Stp Mode	Rmp to Stp / Cst to Stp		Rmp to Stp	68	
70	Display Mode	Display Mode	Std Disply User Units Reten Time		Std Disply	69	
71	User Unit Muliplier	Usr Unit Mul	1 to 32767		30	69	
72	User Unit Divisor	Usr Unit Div	1 to 32767		1	70	
73	User Label 1	User Label 1	Alpha-Numeric		r	70	
74	User Label 2	User Label 2			p		
75	User Label 3	User Label 3			m		
76	Access Level Configure	Access Level	Config / Config Run		Config	70	
77	Set Code	Set Code	1 to 9999		0	71	
78	Enter Code	Enter Code	1 to 9999		0	71	

Table 31: I/O Group

Code [I/O]	I/O Group	Keypad Display	Setting Range	Set Unit	Factory Default	Page	User Settings
00	Jump Code	Jump Code	-		-		
01	Active Logic	Active Logic	Active Hgh Active Low		Active Hgh	72	
02	Digital Input 2 (D2) Configure	D2 Config	Not Assign Forward Reverse Stop Jog Jog Revers Flt Reset Ext. Flt (NC) Ext. Flt (NO) PS In #1 PS In #2 PS In #3 Alt Rmp #1 Alt Rmp #2 Torque Lim DC Inject C/R Override Hand/Auto Local/Remote PID Enable EMOP+Spd EMOP-Spd Timer 1 Timer 2	s	Stop	73	
03	Digital Input 3 (D3) Configure	D3 Config		A	Reverse		
04	Digital Input 4 (D4) Configure	D4 Config		%	Jog		
05	Digital Input 5 (D5) Configure	D5 Config		Hz	Jog Revers		
06	Digital Input 6 (D6) Configure	D6 Config		%	PS In #1		
07	Digital Input 7 (D7) Configure	D7 Config		°C	PS In #2		
08	Digital Input 8 (D8) Configure	D8 Config		%	PS In #3		
09	Digital Input 9 (D9) Configure	D9 Config			Flt Reset		
10	Digital Input 10 (D10) Configure	D10 Config			Ext. Fault (NC)		

APPENDIX D - SUMMARY OF RSI SX PARAMETERS

Code [I/O]	I/O Group	Keypad Display	Setting Range	Set Unit	Factory Default	Page	User Settings
11	Digital Output 1 (DQ1) Configure	DQ1 Config	Not Assign Drive Run Run Fwd Run Rev Drive Rdy At Speed Drv Flted Drv NotFlt Kpd in Ctl Drv in Rem Jogging Curr Lvl 1 Curr Lvl 2 Trq Lvl 1 Trq Lvl 2 Frq Lvl 1 Frq Lvl 2 Frq Lvl 3 Temp Lvl In Cur Lim In Trq Lim Loss Ref SL in Ctrl SL Override Zero Speed Frq Low Th PID High PID Low Active Warn. Timer 1 Timer 2		Drive Rdy	74	
12	Digital Output 2 (DQ2) Configure	DQ2 Config			At Speed		
13	Digital Output 3 (DQ3) Configure	DQ3 Config			Run Rev		
14	Relay 1 (R1) Configure	R1 Config			Drv Flted	75	
15	Relay 2 (R2) Configure	R2 Config			Drive Run		
16	Optional Relay A (RA) Configure	RA Config			Not Assign	76	
17	Optional Relay B (RB) Configure	RB Config			Not Assign		
18	Set Fixed Speed	Fixed Speed	0.00 to Maximum Freq.	Hz	5.00 Hz	76	
19	Set k-factor	Set k-factor	0 - 100.0	%	10.0 %	76	
20	Preset Speed 1	Preset Spd 1	0.00 to Maximum Freq.	Hz	5.00 Hz	77	
21	Preset Speed 2	Preset Spd 2		Hz	10.00 Hz		
22	Preset Speed 3	Preset Spd 3		Hz	20.00 Hz		
23	Preset Speed 4	Preset Spd 4		Hz	30.00 Hz		
24	Preset Speed 5	Preset Spd 5	0.00 to Maximum Freq.	Hz	40.00 Hz	77	
25	Preset Speed 6	Preset Spd 6		Hz	50.00 Hz		
26	Preset Speed 7	Preset Spd 7		Hz	60.00 Hz		
27	Analog Input 1 Configure	A11 Config	Normal Brkn Wire Bipolar 4-20 mA 0-10 Bipol		Normal	78	
28	Analog Input 1 Span	A11 Span	0.0 to 200	%	100.0 %	78	
29	Analog Input 1 Offset	A11 Offset	0.0 to 100	%	0.0 %	78	
30	Analog Input 1 Invert	A11 Invert	Normal / Inverted		Normal	79	
31	Analog Input 1 Filter Time	A11 Ftr Time	1 to 1000	ms	5 ms	79	
32	Analog Input 2 Configure	A21 Config	Normal 4-20 mA Pulse-1kHz Pulse-5kHz Pulse-20k Pulse-100k		Normal	79	
33	Analog Input 2 Span	A21 Span	0.0 to 200.0	%	100.0 %	80	
34	Analog Input 2 Offset	A21 Offset	0.0 to 100.0	%	0.0 %	80	

Code [I/O]	I/O Group	Keypad Display	Setting Range	Set Unit	Factory Default	Page	User Settings
35	Analog Input 2 Invert	A21 Invert	Normal / Inverted		Normal	80	
36	Analog Input 2 Filter Time	A21 Ftr Time	1 to 1000	ms	5 ms	81	
37	Analog Output 1 Configure	A0 Config	Not Assigned Motor Spd Motor Curr Out Torque Out Volt Out Power Out Freq Ref Freq Motor Temp PID Fback Bus Voltage		Motor Spd	81	
38	Analog Output 2 Configure	A1 Config			Out Torque	81	
39	Analog Output 2 Calibrate	A0 Cal	0 to 105	%	100.0 %	81	
40	Analog Output 1 Calibrate	A1 Cal	0 to 105	%	100.0 %	82	
41	Analog Output 2 Out Type	A1 Out Type	0-20 / 4-20	mA	0-20 mA	82	
42	Analog Output A Configure	AQA Config	Same as I/O 37		Not Assign	82	
43	Analog Output A Calibrate	AQA Cal	0 to 105	%	100.0 %	83	
44	Analog Output A Offset	AQA Offset	0 to 100	%	0.0 %	83	
45	Analog Output B Configure	AQB Config	Same as I/O 37		Not Assign	82	
46	Analog Output B Calibrate	AQB Cal	0 to 105	%	100.0 %	83	
47	Analog Output B Offset	AQB Offset	0 to 100	%	0.0 %	83	
48	Analog Input A Span	AIA Span	0.0 to 200.0	%	100.0 %	83	
49	Analog Input A Offset	AIA Offset	0.0 to 100.0	%	0.0 %	84	
50	Analog Input A Invert	AIA Invert	Normal / Inverted		Normal	84	
51	Analog Input A Filter Time	AIA Ftr Time	1 to 1000	ms	0 ms	84	
52	Analog Input B Span	AIB Span	0.0 to 200.0	%	100.0 %	83	
53	Analog Input B Offset	AIB Offset	0.0 to 100.0	%	0.0 %	84	
54	Analog Input B Invert	AIB Invert	Normal / Inverted		Normal	84	
55	Analog Input B Filter Time	AIB Ftr Time	1 to 1000	ms	0 ms	84	
56	Analog Input C Span	AIC Span	0.0 to 200.0	%	100 %	83	
57	Analog Input C Offset	AIC Offset	0.0 to 100.0	%	0.0 %	84	
58	Analog Input C Invert	AIC Invert	Normal / Inverted		Normal	84	
59	Analog Input C Filter Time	AIC Ftr Time	1 to 1000	ms	0 ms	84	
60	Analog Input 1 Level	A11 Level	1 to 100	%	View-Only	85	
61	Analog Input 2 Level	A21 Level	1 to 100	%		85	
62	Analog Output 1 Level	A0 Level	1 to 100	%		85	
63	Analog Output 2 Level	A1 Level	1 to 100	%		86	
64	Analog Input A Level	AIA Level	0 to 100	%		86	
65	Analog Input B Level	AIB Level	0 to 100	%			
66	Analog Input C Level	AIC Level	0 to 100	%			
67	Digital Input Filter Time	Filter Time	1 to 255	ms	5 ms	86	
68	DPQ Scaling	DPQ Scaling	6/48/96/3072 x freq		6 x freq	87	
69	Keypad Control	Keypad Ctrl	SKP Both Both NoFlt		SKP	87	

Code [I/O]	I/O Group	Keypad Display	Setting Range	Set Unit	Factory Default	Page	User Settings
70	F1 Key Configure	F1 Key Cfg	Disabled PID Enable C/R Override		Disabled	88	
71	F2 Key Control	F2 Key Cfg			Disabled		
72	F3 Key Configure	F3 Key Cfg			Disabled		
73	F4 Key Configure	F4 Key Cfg			Disabled		
74	Input Status	Inputs			View-Only	88	
75	Output Status	Outputs				88	

Table 32: AFN Group

Code [AFN]	AFN Group	Keypad Display	Setting Range	Set Unit	Factory Default	Page #	User Settings
00	Jump Code	Jump Code	-		-		
01	Nominal Motor Frequency	Nom Mtr Freq	25 to 320	Hz	60 Hz	92	
02	Nominal Motor Amperage	Nom Mtr RPM	0 to 10000	RPM	Varies by Model	92	
03	Maximum Frequency	Maximum Freq	Min. Freq to 320	Hz	60 Hz	92	
04	Minimum Frequency	Minimum Freq	0 to Maximum Freq	Hz	0 Hz	93	
05	Auto-Carrier	Auto-Carrier	Disabled / Enabled		Disabled	93	
06	Carrier Frequency	Carrier Freq	1.0 to 16.0	kHz	2.2 kHz	93	
07	Slip Compensation	Slip Comp	None / Automatic		View-Only	94	
08	Voltage Boost Configuration	V-Boost Conf	0.00 to 30.00	%	2.00 %	94	
09	Set Voltage Boost	Set V-Boost	None / Automatic		View-Only	95	
10	Boost Taper Frequency	Bst. Tpr Frq	0.0 to Maximum Freq.	Hz	60.0	95	
11	Boost Taper Voltage	Bst. Tpr Vlt	0.00 to 100.00	%	100.00 %	96	
12	DC Pulse Start	DC PulsStart	None / DC at Strt		DC at Strt	97	
13	DC Pulse Time	DC PulseTime	0.00 to 25.00	s	1.00 s	97	
14	Low Speed Compensation	Low Spd Comp	0 to 1280		256	97	
15	Supply Voltage	Supply Volts	Varies by Model	V	Varies by Model	98	
16	Catch on Fly	Catch on Fly	Disabled / Enabled		Disabled	98	
17	Run Prevent	Run Prevent	Allow F/R No Reverse No Forward		Allow F/R	99	
18	Stop Key	Stop Key	Disabled Rmp to Stp Cst to Stp		Cst to Stp	99	
19	Enter Key	Enter Key	Disabled		View-Only	99	
20	Alternate Run / Stop Source	Alt. R/S Src	Keypad Terminal 1 Terminal 2 Serial		Terminal 1	100	
21	Alternate Reference Source	Alt. Ref Src	Keypad Main Spd Ref Alt. Spd Ref Serial		Main Spd Ref	100	

Code [AFN]	AFN Group	Keypad Display	Setting Range	Set Unit	Factory Default	Page #	User Settings
22	Alternate Speed Reference	Alt. Spd Ref	Spd-Fixed Spd-Rf 1 Spd-Rf 2 Spd-Rf 3 Spd-R1+R2 Spd-R1-R2 S-R1+R2-R3 S-R1+k*R2		Spd - Rf 1	102	
23	Motor Overload Scale	Mtr OL Scale	0.0 to 100.0	%	100.0 %	103	
24	Motor Overload Time	Mtr OL Time	0.0 to 600.0	s	60.0 s	104	
25	Communication Protocol	Com Protocol	RTU / ASCII / DeviceNet		RTU	106	
26	Communication Drop Number	Com Drop #	1 to 247 ModBUS 0 to 63 DeviceNet		1 or 63	106	
27	Communication Baudrate	Com Baudrate	Disabled 1200 to 500 k	bps	Depends on Protocol	107	
28	Communication Timeout	Com Timeout	1 to 60	s	5 s	107	
29	Communication Parity	Com Parity	N81 / N82 / E81 / O81		N81	108	
30	Alternate Ramp 1 Configure	AR1 Config	None AR1 on DI AR1 by Frq AR1-Strt AR1-Fwd/Rv		AR1 on DI	108	
31	Acceleration Time 2	Accel Time 2	0.1 to 3200.0	s	1.0 s	109	
32	Deceleration Time 2	Decel Time 2	0.1 to 3200.0	s	1.0 s	109	
33	Alternate Ramp 1 Shape	AR1 Shape	Linear / S-Curve		Linear	109	
34	Alternate Ramp 1 Rounding	AR1 Rounding	0 to 10.0	s	0.0 s	110	
35	Alternate Ramp 1 Switch Frequency	AR1 Sw. Freq	0.00 to 320.00	Hz	0.00 Hz	110	
36	Alternate Ramp 2 Configure	AR2 Config	None AR2 on DI AR2 by Frq AR2-Strt AR2-Fwd / Rv		AR2 on DI	110	
37	Acceleration Time 3	Accel Time 3	0.1 to 3200.0	s	10.0 s	111	
38	Deceleration Time 3	Decel Time 3	0.1 to 3200.0	s	10.0 s	111	
39	Alternate Ramp 2 Shape	AR2 Shape	Linear / S-Curve		Linear	111	
40	Alternate Ramp 2 Rounding	AR2 Rounding	0 to 10.0	s	0.0 s	112	
41	Alternate Ramp 2 Switch Frequency	AR2 Sw. Freq	0.00 to 320.00	Hz	0.00 Hz	112	
42	Reference 1 Configure	Ref1 Config	AI #1 AI #2 AI #A AI #B AI #C		AI #1	112	
43	Reference 2 Configure	Ref2 Config			AI #2		
44	Reference 3 Configure	Ref3 Config			AI #2		
45	Ramp Reference Frequency	Ramp Ref Frq	0.00 to 320.00	Hz	0.00 Hz	113	
46	Manual Fault Reset	Man Flt Rst	None By DI By Keypad By Ser Lnk By DI/Kypd By DI/Ser By Kpd/Ser DI/Ser/Kpd		By DI/Kypd	113	
47	Dynamic Braking Auto Restart	DB Flt A.Rst	Disabled / Enabled		Disabled	114	

APPENDIX D - SUMMARY OF RSI SX PARAMETERS

Code [AFN]	AFN Group	Keypad Display	Setting Range	Set Unit	Factory Default	Page #	User Settings
48	Lost Reference Auto Reset	L 4-20 A.Rst	Disabled / Enabled		Disabled	114	
49	External Fault Auto Reset	Xt Flt A.Rst	Disabled / Enabled		Disabled	114	
50	Motor Thermal Protection	Mtr Thm Prot	Disabled Warning Fault		Fault	115	
51	External Fault	Ext Fault			Disabled	115	
52	Fan Loss Fault	Fan Loss			Warning	116	
53	Net Timeout Fault	Net TO Flt			Disabled	116	
54	Input Phase Fault	IP Phase Flt	Disabled / Fault		Disabled	117	
55	Over Voltage Auto Reset	OV AutoReset	Disabled Enabled		Disabled	117	
56	Over Current Auto Reset	OC AutoReset			Disabled	118	
57	Over Temperature Auto Reset	OT AutoReset			Disabled	118	
58	UV AutoReset	UV AutoReset	Enabled Disabled		Enabled	119	
59	DC Cal. Cfg.	DC Cal. Cfg.	Disabled / Warning / Fault		Warning	119	
60	Auto Reset Type	AutoRst Type	Ramping / Fly Start		Ramping	120	
61	Reference Fault	Ref Fault	No Action Retain Spd Preset Lvl Fault		No Action	120	
62	Lost Reference Frequency	Lost Ref Frq	0 to Maximum Freq	Hz	0.00 Hz	121	
63	PID Configure	PID Config	No PID Feed-Fwd F-fwd DI F-fwd Fkey F-fwd Ser Full-Range Full DI Full Fkey Full Ser		No PID	121	
64	PID Active at Stop	PID @ Stop	Disabled / Enabled		Disabled	126	
65	PID Type	PID Type	Direct / Reverse		Direct	126	
66	PID Feedback Configuration	Feedback Cfg	Ref 1 / Ref 2 / Ref 3		Ref 1	128	
67	PID Proportional Gain	PID P-Gain	0 to 2000		0	127	
68	PID Integral Gain	PID I-Gain	0 to 1000		0	128	
69	PID Derivative Gain	PID D-Gain	0 to 2000		0	128	
70	PID Feedback Gain	PID FB Gain	0 to 2000		1000	128	
71	PID High Limit	PID High Limit	0.00 to 100.00	%	100.00 %	129	
72	PID Low Limit	PID Low Limit	0.00 to 100.00	%	0.00 %	129	
73	PID High Alarm	PID High Alm	0.00 to 100.00	%	0.00 %	129	
74	PID Low Alarm	PID Low Alm	0.00 to 100.00	%	0.00 %	130	
75	PID Reference	PID Ref	0 to 100	%	View-Only	130	
76	PID Feedback	PID FB	0 to 100	%		130	
77	PID Error	PID Error	0 to 100	%		131	

APPENDIX D - SUMMARY OF RSI SX PARAMETERS

Code [AFN]	AFN Group	Keypad Display	Setting Range	Set Unit	Factory Default	Page #	User Settings
78	PID Output	PID Output	0 to 100	%	View-Only	131	
79	PID Proportional Part	PID P-Part	0 to 100	%		132	
80	PID Integral Part	PID I-Part	0 to 100	%		132	
81	PID Derivative Part	PID D-Part	0 to 100	%		132	
82	Application Software Version	Appl Sw Ver.	N/A			133	
83	Motor Control Software Version	MCP Sw Ver.				133	
84	Terminal Strip Processor Software Version	TSP Sw Ver.				133	
85	Serial Number 1	Serial No 1				134	
86	Serial Number 2	Serial No 2				134	
87	Program Number	Prog Number	Factory Use Only		0	134	
88	Application Selector	Application	Varies		Standard	135	
89	Parameter Storage / Recall	Par STO/RCL	Select… Factory Rst Store Parm Load Param		Select…	135	

Notes:

Publication History;

Revision	Date	ECO#
00	01/08/02	#890020-06-00 Initial Release
01	17/06/03	E0618
02	23/06/03	E0627
03	07/06/04	E0815
	24/01/05	Troubleshooting Inserted

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