

Instruction Manual



BAS-SVX60A-EN

BAS-SVX60A-EN







Contents

1 Introduction	1-1
1.1 Introduction to Compressor Drive Systems	1-1
1.1.1 Sequence of Operation	1-2
2 Safety Instructions and Conoral Warnings	2.1
2 Safety Instructions and General Warnings	2-1
2.1 Safety and Warnings	2-1
2.1.1 High Voltage Warning	2-1
2.1.2 Caution	2-1
2.1.3 Disposal	2-1
2.1.4 Software Version	2-1
2.1.5 Safety Instructions	2-1
2.1.6 General Warning	2-1
2.1.7 Leakage Current	2-2
2.1.8 Residual Current Device	2-2
2.1.9 IT Mains	2-2
2.1.10 Avoid Unintended Start	2-2
2.2 Safe Torque Off	2-2
2.2.1 Terminal 37 Safe Torque Off Function	2-3
3 How to Install	3-1
3.1 Environment	3-1
3.1.1 Ambient Temperature and Altitude	3-1
3.1.2 Environmental Requirements for Mechanical Installation	3-1
3.2 Mechanical Installation	3-1
3.2.1 Accessory Bags	3-1
3.2.2 Mechanical Mounting	3-2
3.2.3 Mechanical Dimensions	3-3
3.3 Electrical Installation	3-4
3.3.1 Cables General	3-4
3.3.2 Removal of Knockouts for Extra Cables	3-4
3.3.3 Mains Connection for B1, B2 and B3	3-5
3.3.4 Mains connection for B4, C1 and C3	3-6
3.3.5 Motor Compressor Connection	3-7
3.3.6 Motor Compressors Cables	3-8
3.3.7 Electrical Installation of Motor Compressor Cables	3-8
3.3.8 Compressor Motor Protection	3-8
3.3.9 Access to Control Terminals	3-9
3.3.10 Basic Wiring Example	3-10
	·····



Contents Operating Instructions TRV200

3.3.11 Electrical Installation, Control Cables	3-11
3.3.12 Electrical Installation - EMC Protection	3-13
3.3.13 Motor Thermal Protection	3-14
3.3.14 Safety Ground Connection	3-15
3.3.15 Basic Examples of Control Connections	3-15
3.3.16 High-voltage Test	3-16
3.4 Fuses and Circuit Breakers	3-16
3.4.1 Fuses	3-16
3.4.2 Recommendations	3-16
3.4.3 CE Compliance	3-17
3.4.4 Non UL Compliance Fuses	3-17
4 Quick Setup	4-1
4.1 Programming Procedures	4-1
4.1.1 Basic Programming Procedures	4-1
4.1.2 Open Loop with External Reference	4-1
4.1.3 PID Closed Loop with 4-20 mA Pressure Transmitter	4-2
4.1.4 Other Compressor Features	4-3
5 How to Program	5-1
5.1 How to Program on the Graphical Keypad	5-1
5.1.1 Control Panel	5-1
5.1.2 Display Lines	5-1
5.1.3 Display Contrast Adjustment	5-1
5.1.4 Indicator Lights	5-2
5.2 Keypad	5-2
5.2.1 Function Keys	5-2
5.2.2 Navigation Keys	5-2
5.2.3 Local Control Keys	5-2
5.2.4 Quick Transfer of Parameter Settings	5-3
5.2.5 Data Storage in Keypad	5-3
5.2.6 Initialization to Default Settings	5-3
5.2.7 Data Transfer from Keypad to Frequency Converter	5-4
5.2.8 Parameter Selection	5-4
5.2.9 Changing Data	5-4
5.2.10 Changing a Text Value	5-4
5.2.11 Changing a Group of Numeric Data Values	5-5
6 Parameter Descriptions	6-1



Contents Operating Instructions TRV200

6.1 Keypad Display	6-1
6.1.1 Keypad Programming	6-1
6.2 Parameters: 0-** Operation and Display	6-2
6.3 Parameters: 1-** Load and Motor	6-9
6.4 Parameters: 3 -** Reference/Ramps	6-10
6.5 Parameters: 4-** Limits/Warnings	6-14
6.6 Parameters: 5-** Digital In/Out	6-17
6.7 Parameters: 6-** Analog In/Out	6-28
6.8 Parameters: 7-** Controllers	6-32
6.9 Parameters: 8-** Communications and Options	6-37
6.10 Parameters: 13-** Smart Logic Control	6-41
6.11 Parameters: 14-** Special Functions	6-57
6.12 Parameters: 15-** Drive Information	6-60
6.13 Parameters: 16-** Data Readouts	6-61
6.14 Parameters: 25-** Cascade Controller	6-67
6.15 Parameters: 28-** Compressor Functions	6-78
6.16 Parameter Lists	6-82
6.16.1 Conversion	6-82
7 Troubleshooting	7-1
7.1 Status Messages	7-1
7.1.1 Warnings/Alarm Messages	7-1
8 General Specifications	8-1
8.1 Power-dependent Specifications	8-1
8.1.1 Mains Supply 3x200-240 V AC	8-1
8.1.2 Mains Supply 3x380-480 V AC	8-2
8.1.3 Mains Supply 3x525-600 V AC	8-3
8.2 General Technical Data	8-4
9 Index	9-1









1 Introduction

1.1 Introduction to Compressor Drive Systems

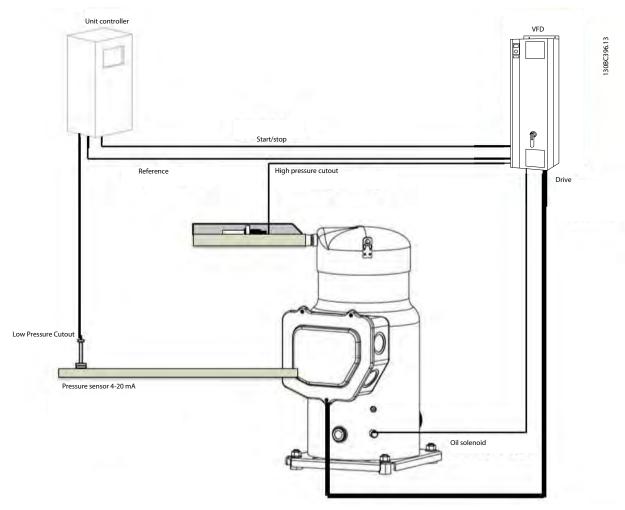


Figure 1.1 Compressor Drive System

The TRV200 Compressor Drives utilize and combine Trane design and manufacturing expertise. Our extensive application knowledge of refrigeration, air conditioning, and motion controls ensures an optimized product design and package solution:

- A "plug & play" solution
- Operational efficiency
- Flexibility & high control accuracy
- Innovative and reliable solution

The frequency converter is 100% preset for speed open loop configuration with 0-10 V reference corresponding to 1500-6000 RPM for TRV200.



The dedicated frequency converter functionality includes:

Start Up

Once the frequency converter has a start command, the compressor runs up to 3000 RPM and remains at that speed for 10 s. Once this initial time is complete, the frequency converter slowly ramps to the reference speed.

Shut Down

The stop command bypasses the normal ramp time and the frequency converter ramps the compressor to stop fast.

Short Cycle Prevention

The frequency converter has a minimum running time of 12 s, with an interval between starts of 5 minutes (300 s). The short cycle delay values are adjustable in parameter group 28-0* Short Cycle Protection.

Oil Injection

The frequency converter cycles a solenoid valve via its relay 1. This cycling ensures that the oil is distributed to the scroll set, improves tightness, and reduces internal gas leakage during the compression process.

Low Pressure Switch

An LP switch is mandatory with the frequency converter compressor in any type of application.

High Pressure Switch

The high-pressure switch must be connected to input terminal 37 of the frequency converter.

1.1.1 Sequence of Operation

All compressor types have strong demands of speed limits to ensure the oil lubrication of the bearings. Therefore, fast acceleration from standstill to minimum speed with a special start ramp is important, when a start command is given. This is also the reason why the Compressor Drive trips with an alarm [A49] *Speed Limit*, if the speed falls below minimum speed e.g. when the current limit controller reduces the speed due to a high load. This alarm is reset automatically after 30 s and the compressor restarts.

If a rotor is blocked, the Compressor Drive trips with an alarm [A18] *Start failed*, if the speed fails to get above the minimum speed limit for the compressor within 2 s. This alarm is reset automatically after 30 s and the compressor restarts.

NOTE!

No manual programming is required by end user.

Trane automatically selects the necessary start settings, motor data and all the other preferred settings based off the compressor type/size. The compressor is selected in 1-13 Compressor Selection (preset by manufacturer).

1-2 BAS-SVX60A-EN



2 Safety Instructions and General Warnings

2.1 Safety and Warnings

2.1.1 High Voltage Warning

AWARNING

The voltage of the frequency converter is dangerous whenever the converter is connected to mains. Incorrect fitting of the motor or frequency converter may damage the equipment, or cause serious injury, or death. It is essential to comply with the instructions in this manual as well as local and national rules and safety regulations.

▲WARNING

Installation in high altitudes:
By altitudes above 2 km, contact Trane regarding PELV.

2.1.2 Caution

ACAUTION

The TRV200 Compressor Drives DC link capacitors remain charged after power has been disconnected. To avoid an electrical shock hazard, disconnect the frequency converter from the mains before carrying out maintenance. Wait at least 15 minutes before doing service on the frequency converter. High voltage can be present on the DC link even when the LEDs are turned off.

2.1.3 Disposal



Figure 2.1

Drive

Do not dispose of equipment containing electrical components together with domestic waste. It must be collected separately with Electrical and Electronic Waste according to local and national legislation.

Compressors

Do not to throw away a used compressor, but dispose of it and its oil at a specialized recycling company site.

2.1.4 Software Version

TRV200 Operating Instructions Software version: 1.0x







These Operating Instructions can be used for all TRV200 Compressor Drives[®] with software version 1.0x. The software version number can be read in *15-43 Software Version*.

The frequency converter complies with UL508C thermal memory retention requirements. For more information refer to 3.3.13 Motor Thermal Protection.

2.1.5 Safety Instructions

- Make sure that the frequency converter is properly connected to ground
- Do not remove mains plugs or motor plugs while the frequency converter is connected to mains
- Protect personnel against supply voltage
- Protect the motor against overloading according to local and national regulations
- Motor overload protection is included in the default settings
- The ground leakage current exceeds 3.5 mA
- The [Off] key is not a safety switch. It does not disconnect the frequency converter from mains

2.1.6 General Warning

AWARNING

Touching the electrical parts may be fatal - even after the equipment has been disconnected from mains. Also make sure that other voltage inputs have been disconnected, such as load-sharing (linkage of DC intermediate circuit). Wait at least 15 minutes before doing service on the frequency converter. High voltage can be present on the DC link even when the LEDs are turned off.



2.1.7 Leakage Current

ACAUTION

The ground leakage current from the frequency converter exceeds 3.5 mA. Ensure good mechanical ground connection (terminal 95) to the ground cable. Use at least 10 mm² cable cross section or 2 times rated ground wires terminated separately.

2.1.8 Residual Current Device

▲CAUTION

This product can cause a DC current in the protective conductor. Where a ground fault interrupter (GFI) is used for extra protection, only use an GFI of Type B (time delayed) on the supply side of this product. See also *RCD Application Note, MN90G*. Protective grounding of the frequency converter and the use of RCDs must always follow local and national regulations.

2.1.9 IT Mains

ACAUTION

Do not connect 400 V frequency converters with RFI-filters to mains supplies with a voltage between phase and ground of more than 440 V. For IT mains and delta ground (grounded leg), mains voltage may exceed 440 V between phase and ground. To disconnect the internal RFI capacitors from the RFI filter to ground, use 14-50 RFI 1 on the frequency converter. This procedure reduces the RFI performance to A2 level.

2.1.10 Avoid Unintended Start

While the frequency converter is connected to mains, the motor can be started/stopped using:

- digital commands
- bus commands
- references
- via the keypad

Disconnect the frequency converter from mains whenever personal safety considerations make it necessary to avoid unintended start. To avoid unintended start, always press [OFF] before changing parameters. An electronic fault, temporary overload, a fault in the mains supply, or lost motor connection may cause a stopped motor to start. A frequency converter with Safe Torque Off provides a certain degree of protection against such unintended start,

if the Safe Torque Off Terminal 37 is on low voltage level or disconnected.

2.2 Safe Torque Off

The frequency converter can perform the safety function *Safe Torque Off* (STO, as defined by EN IEC 61800-5-2¹) and *Stop Category 0* (as defined in EN 60204-1²). Before integration and use of Safe Torque Off in an installation, perform a thorough risk analysis to determine whether the Safe Torque Off functionality and safety levels are appropriate and sufficient. Safe Torque Off is designed and approved suitable for the requirements of:

- Safety Category 3 in EN 954-1 (and EN ISO 13849-1)
- Performance Level "d" in EN ISO 13849-1:2008
- SIL 2 Capability in IEC 61508 and EN 61800-5-2
- SILCL 2 in EN 62061
- $^{1)}$ Refer to EN IEC 61800-5-2 for details of Safe torque off (STO) function.
- $^{2)}$ Refer to EN IEC 60204-1 for details of stop category 0 and 1.

Activation and Termination of Safe Torque Off

The Safe Torque Off (STO) function is activated by removing the voltage at terminal 37 of the safe inverter. By connecting the safe inverter to external safety devices providing a safe delay, an installation for a Safe Torque Off Category 1 can be obtained. The Safe Torque Off function can be used for asynchronous, synchronous, and permanent magnet motors.

AWARNING

After installation of Safe Torque Off (STO), a commissioning test must be performed. A passed commissioning test is mandatory after first installation and after each change to the safety installation.

Safe Torque Off Technical Data

The following values are associated to the different types of safety levels:

Reaction time for T37

Maximum reaction time: 10 ms

Reaction time = delay between de-energizing the STO input and switching off the frequency converter output bridge.

Data for EN ISO 13849-1

- Performance Level "d"
- MTTF_d (Mean Time To Dangerous Failure): 24816 years

2-2 BAS-SVX60A-EN



- DC (Diagnostic Coverage): 99%
- Category 3
- Lifetime 20 years

Data for EN IEC 62061, EN IEC 61508, EN IEC 61800-5-2

- SIL 2 Capability, SILCL 2
- PFH (Probability of Dangerous failure per Hour)=7e-10FIT=7e-19/h
- SFF (Safe Failure Fraction) >99%
- HFT (Hardware Fault Tolerance)=0 (1001 architecture)
- Lifetime 20 years

Data for EN IEC 61508 low demand

• PFDavg for one-year proof test: 3, 07E-14

• PFDavg for three year proof tests: 9, 20E-14

PFDavg for five year proof tests: 1, 53E-13

No maintenance of the STO functionality is needed.

Take the necessary security measures, e.g. installation in a closed cabinet that is only accessible for skilled personnel.

SISTEMA Data

Functional safety data is available via a data library for use with the SISTEMA calculation tool from the IFA (Institute for Occupational Safety and Health of the German Social Accident Insurance), and data for manual calculation. The library is permanently completed and extended.

Abbrev.	Ref.	Description			
Cat.	EN 954-1	Category, level "B, 1-4"			
FIT		Failure In Time: 1E-9 hours			
HFT	IEC 61508	Hardware Fault Tolerance: HFT = n			
		means, that n+1 faults could cause a			
		loss of the safety function			
MTTFd	EN ISO	Mean Time To Failure - dangerous. Unit:			
	13849-1	years			
PFH	IEC 61508	Probability of Dangerous Failures per			
		Hour. Consider the PFH value when the			
		safety device is operated in high			
		demand (more often than once per			
		year); or operated in continuous mode,			
		where the frequency of demands for			
		operation made on a safety-related			
		system is greater than one per year.			
PL	EN ISO	Discrete level used to specify the ability			
	13849-1	of safety-related parts of control systems			
		to perform a safety function under			
		foreseeable conditions. Levels a-e.			

Abbrev.	Ref.	Description			
SFF	IEC 61508	Safe Failure Fraction [%]; Percentage			
		part of safe failures and dangerous			
		detected failures of a safety function or			
		a subsystem related to all failures.			
SIL	IEC 61508	Safety Integrity Level			
STO	EN	Safe Torque Off			
	61800-5-2				
SS1	EN 61800	Safe Torque Off 1			
	-5-2				

Table 2.1 Abbreviations Related to Functional Safety

The PFD_{avg} value (Probability of Failure on Demand) Failure probability in the event of a request of the safety function.

2.2.1 Terminal 37 Safe Torque Off Function

The frequency converter is available with Safe Torque Off functionality via control terminal 37. Safe Torque Off disables the control voltage of the power semiconductors of the frequency converter output stage. This in turn prevents generating the voltage required to rotate the motor. When the Safe Torque Off (T37) is activated, the frequency converter issues an alarm, trips the unit, and coasts the motor to a stop. Manual restart is required. The Safe Torque Off function can be used as an emergency stop for the frequency converter. In normal operating mode when Safe Torque Off is not required, use the regular stop function instead. When automatic restart is used, ensure the requirements of ISO 12100-2 paragraph 5.3.2.5 are fulfilled.

Liability Conditions

Ensure that qualified personnel installs and operates the Safe Torque Off function:

- Read and understand the safety regulations concerning health and safety/accident prevention
- Understand the generic and safety guidelines given in this description and the extended description in the relevant *Design Guide*
- Have a good knowledge of the generic and safety standards applicable to the specific application

User is defined as:

- integrator
- operator
- service technician
- maintenance technician



Standards

Use of Safe Torque Off on terminal 37 requires fulfilling of all provisions for safety, including relevant laws, regulations and guidelines. The optional Safe Torque Off function complies with the following standards.

• IEC 60204-1: 2005 category 0 – uncontrolled stop

IEC 61508: 1998 SIL2

AWARNING

SAFE TORQUE OFF FUNCTION!

The Safe Torque Off function does NOT isolate mains voltage to the frequency converter or auxiliary circuits. Perform work on electrical parts of the frequency converter or the motor only after isolating the mains voltage supply and waiting the length of time specified in . Failure to isolate the mains voltage supply from the unit and waiting the time specified could result in death or serious injury.

• It is not recommended to stop the frequency converter by using the Safe Torque Off function. If a running frequency converter is stopped by using the function, the unit trips and stops by coasting. If unacceptable or dangerous, use another stop mode to stop the frequency converter and machinery, before using this function. Depending on the application, a mechanical brake can be required.

2-4 BAS-SVX60A-EN



3 How to Install

3.1 Environment

3.1.1 Ambient Temperature and Altitude

The normal ambient temperature range supported by the frequency converter is -14 °F to +122 °F without derating. The operates normally down to -20 °F with only the keypad display function impaired but without performance reduction.

For ambient temperatures above +122 °F, it is mandatory to integrate the derating output factor for the maximum compressor electrical motor power/current.

For altitudes above 3280 ft (1000 m), apply derating as shown in *Table 3.1*.

For more details on derating due to environmental factors, contact Trane technical support.

Altitude [ft/m]	Derating factor
3280/1000	1
4921/1500	0.95
6561/2000	0.90
8202/2500	0.86
9842/3000	0.82
11482/3500	0.78

Table 3.1 Altitude Derating Factor

3.1.2 Environmental Requirements for Mechanical Installation

The unit is air-cooled. To protect the unit from overheating, ensure that the ambient temperature does not exceed the maximum temperature stated for the 24-hour average temperature. If the ambient temperature is in the range of 113 °F to 131 °F, derating becomes relevant. If derating for ambient temperature is not taken into account, the service life of the unit is reduced.

3.2 Mechanical Installation

3.2.1 Accessory Bags

Find the following parts included in the accessory bag:



Figure 3.1 Enclosures B1 and B2, IP21/IP55/Type 1/Type 12



Figure 3.2 Enclosure B3, IP20/Chassis



Figure 3.3 Enclosure B4, IP20/Chassis



Figure 3.4 Enclosures C1 and C2, IP55/66/Type 1/Type 12



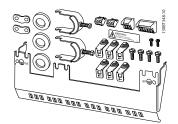


Figure 3.5 Enclosure C3, IP20/Chassis

3.2.2 Mechanical Mounting

- 1. Drill holes in accordance with the measurements given.
- 2. Provide screws suitable for the surface on which the compressor drive should be mounted.
- 3. Retighten all four screws.

The frequency converter IP20 allows side-by-side installation. Because of the need for cooling, there must be a minimum of 7.9 in (200 mm) free air passage above and below the frequency converter.

The back wall must always be solid. All frequency converters are equipped with a back metal plate to guarantee proper heat exchanger ventilation. Never remove this metal sheet.

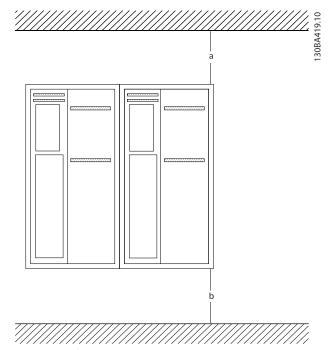


Figure 3.6 Clearance

Frame size	A1*/A2/A3/A4/A5/ B1	B2/B3/B4/C 1/C3	C2/C4	
a [Inch/mm]	3.3/100	7.9/200	11.8/300	
b [inch/mm]	3.3/100	7.9/200	8.9/225	

Table 3.2 Air Passage for Different Frame Sizes

3-2 BAS-SVX60A-EN



3.2.3 Mechanical Dimensions

IP 20 Chassis T2 [240 V]		T4 [480 V]	T6 [575 V]
VZH088 [18 kW]	B4	В3	В3
VZH117 [22 kW]	C3	B4	B4
VZH170 [30 kW]	C3	B4	B4

Table 3.3 Related VSH Numbers

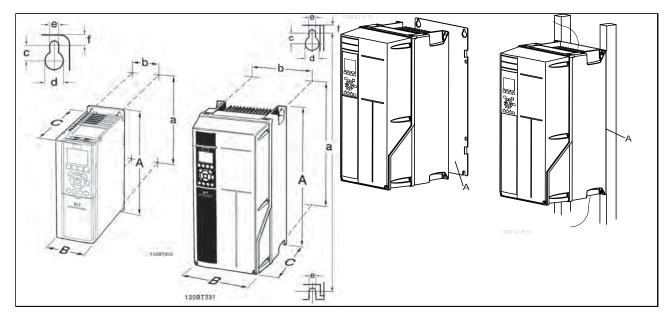


Table 3.4 Dimensional Drawings

		B1	B2	В3	B4	C1	C3
Height [inch/mm]						•	
Backplate	Α	18.90/480	25.59/650	15.71/399	20.47/520	26.77/680	21.65/550
Distance between mounting holes	a	17.87//454	24.57/624	14.96/380	19.49/495	25.51/648	20.51/521
Width [inch/mm]							
Back plate	В	9.53/242	9.53/242	6.50/165	9.06/230	12.13/308	12.13/308
Distance between mounting holes	b	8.28/210	8.28/210	5.51/140	7.87/200	10.71/272	10.63/270
Depth [inch/mm]							
Without option	С	10.24/260	10.24/260	9.80/249	9.53/242	12.21/310	13.11/333
With option	С	10.24/260	10.24/260	10.24/260	9.53/242	12.21/310	13.11/333
Screw holes [inch/mm]							•
	С	0.47/12.0	0.47/12.0	0.32		0.49/12.0	
	d	Ø 0.75/19.0	Ø 0.75/19.0	0.47/12.0		Ø 0.75/19.0	
	е	Ø 0.35/9	Ø 0.35/9	0.34/8.8	0.33/8.5	Ø 0.35/9	0.33/8.5
	f	0.35/9	0.35/9	0.31/7.9	0.59/15	0.38/9.8	0.67/17
Other Specifications			•	•		•	•
Max. weight [lbs/kg]		50.4/23	59.53/27	26.46/12	51.81/23.5	99.21/45	77.16/35

Table 3.5 Mechanical Dimensions



3.3 Electrical Installation

3.3.1 Cables General

ACAUTION

Cables general:

Always comply with national and local regulations on cable cross-sections.

Frame	200-240 V	380-500 V	525-690 V	Cable for	Tightening torque
size	[kW]	[kW]	[kW]		[Nm]
				Mains, motor cables	1.8
В3	5.5-7.5	11-15	15	Relay	0.5-0.6
				Ground	2-3
				Mains, motor cables	4.5
B4	11-15	18.5-30	18.5-22	Relay	0.5-0.6
				Ground	2-3
				Mains, motor cables	10
C3	18.5-22	-	-	Relay	0.5-0.6
				Ground	2-3

Table 3.6 Tightening Torque

3.3.2 Removal of Knockouts for Extra Cables

- Remove cable entry from the frequency converter (avoiding foreign parts in the frequency converter when removing knockouts)
- Support cable entry around the knockout that should be removed
- The knockout can now be removed with a strong mandrel and a hammer
- Remove burrs from the hole
- Mount cable entry on frequency converter

3-4 BAS-SVX60A-EN



3.3.3 Mains Connection for B1, B2 and B3

NOTE!

Frequency converter sizes differ, but terminal numbers are always the same. Incoming power is always 91, 92, 93 labeled L1, L2, L3.

NOTE: For correct cable dimensions, see 8 General Specifications.

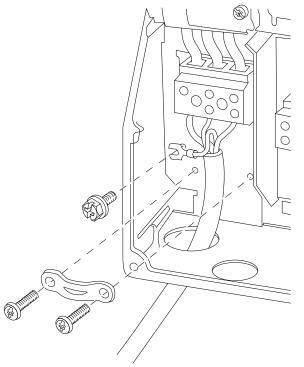


Figure 3.7 How to Connect to Mains and Grounding for B1 and B2

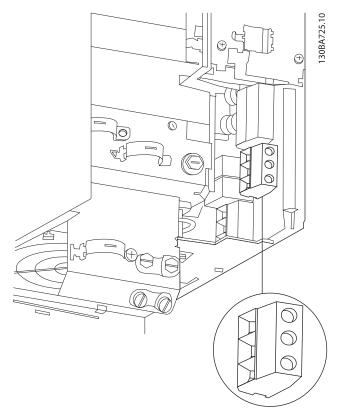


Figure 3.8 How to Connect to Mains and Grounding for B3 without RFI



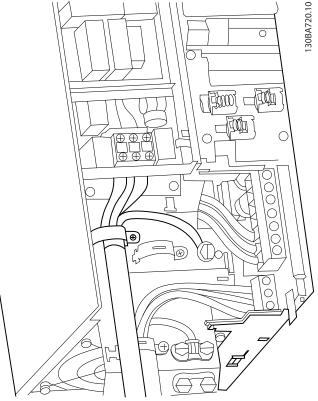


Figure 3.9 How to Connect to Mains and Grounding for B3 with

3.3.4 Mains connection for B4, C1 and C3

NOTE!

Frequency converter sizes differ but terminal numbers are always the same. Incoming power is always 91, 92, 93 labeled L1, L2, L3.

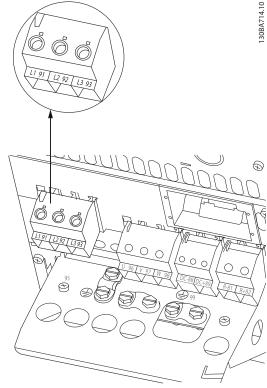


Figure 3.10 How to Connect to Mains and Grounding for B4

3-6 BAS-SVX60A-EN



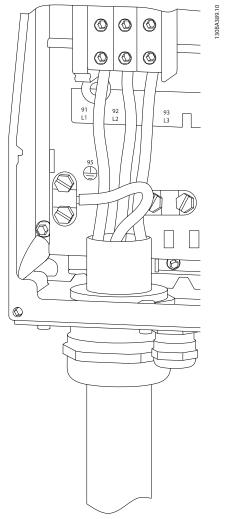


Figure 3.11 How to Connect to Mains and Grounding for C1 and C2 $\,$

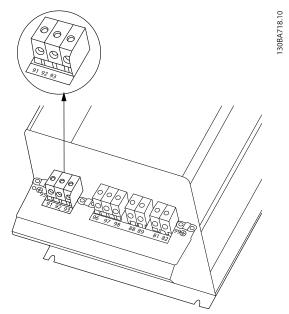


Figure 3.12 How to Connect C3 to Mains and Grounding

3.3.5 Motor Compressor Connection

NOTE!

Always wire terminal 96 (U) to T1, 97 (V) to T2, and 98 (W) to T3.

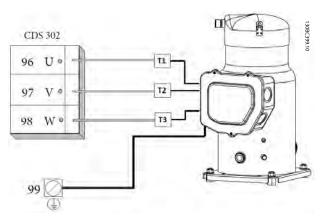


Figure 3.13 Motor/Compressor Wiring

Motor compressor cable must be screened/armored. If an unscreened/unarmored cable is used, some EMC requirements are out of compliance. For more information, see EMC specifications.



- Fasten decoupling plate to the bottom of the frequency converter with screws and washers from the accessory bag.
- Attach motor compressor cable to terminals 96 (U), 97 (V), 98 (W).
- Connect to ground connection (terminal 99) on decoupling plate with screws from the accessory bag.
- 4. Insert terminals 96 (U), 97 (V), 98 (W) and motor compressor cable to terminals labeled MOTOR.
- 5. Fasten screened cable to decoupling plate with screws and washers from the accessory bag.
- 6. Connect U, V, W for motor compressor clockwise.

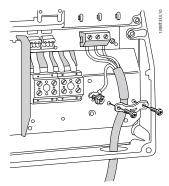


Figure 3.14 How to Connect to Motor Terminals B1/B2

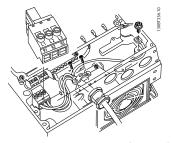


Figure 3.15 How to Connect to Mains and Ground without Mains Disconnect

3.3.6 Motor Compressors Cables

Correct dimensioning of motor compressor cable crosssection and length is described in the application manual.

- Use a screened/armored motor compressor cable to comply with EMC emission specifications
- Keep the motor compressor cable as short as possible to reduce the noise level and leakage currents

- Connect the motor compressor cable screen to both the decoupling plate of the frequency converters and to the metal cabinet of the motor compressor
- Make the screen connections with the largest possible surface area (cable clamp). Use the supplied installation devices in the frequency converter for making the screen connections.

3.3.7 Electrical Installation of Motor Compressor Cables

Screening of cables

Avoid installation with twisted screen ends (pigtails). They reduce the screening effect at higher frequencies.

Cable length and cross section

The frequency converter has been tested with a given length of cable and a given cross section of that cable. If the cross section is increased, the cable capacitance - and thus the leakage current - may increase, and the cable length must be reduced correspondingly.

Aluminum

Aluminum conductors are not recommended. Terminals accept aluminum conductors, but clean the conductor surface and remove and seal the oxidation by neutral acid-free Vaseline grease before the conductor is connected. Furthermore, the terminal screw must be retightened after two days due to the softness of the aluminum. It is crucial to keep the connection a gas tight joint, otherwise the aluminum surface oxidizes again.

3.3.8 Compressor Motor Protection

The frequency converter fully provides electrical compressor motor protection.

- The frequency converter makes through an electronic current measurement anti-overload and lock-rotor compressor motor protection (see description in the application manual).
- The frequency converter is protected against short circuits on compressor terminals T1, T2, T3
- If a mains phase is missing, the frequency converter trips or issues a warning (depending on the load)
- If a compressor motor phase is missing, the frequency converter trips

3-8 BAS-SVX60A-EN



 The frequency converter is protected against ground faults on compressor motor terminals T1, T2, T3

3.3.9 Access to Control Terminals



Figure 3.16 B3, B4 and C3 Enclosures

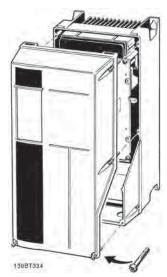


Figure 3.17 C1, B1 and B2 Enclosures

Control terminals are located beneath the keypad. The inside of the removable cover shows the terminals.

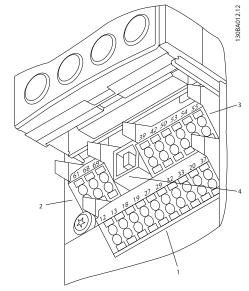


Figure 3.18 Control Terminals

- 1. 10 pole plug digital I/O
- 2. 3 pole plug RS-485 Bus
- 3. 6 pole analog I/O
- 4. USB Connection

To mount the cable to the terminal:

- 1. Strip isolation of 9-10 mm.
- 2. Insert a screwdriver in the square hole.
- 3. Insert the cable in the adjacent circular hole.
- Remove the screwdriver. The cable is now mounted to the terminal.

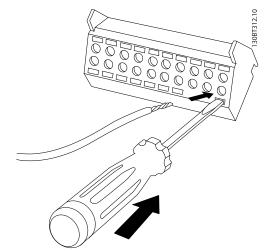


Figure 3.19 Mounting the Cable



To remove the cable from the terminal:

- 1. Insert a screwdriver in the square hole.
- 2. Pull out the cable.

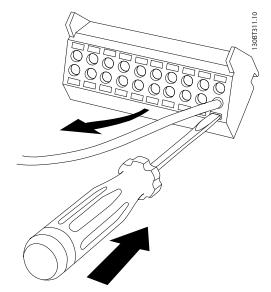


Figure 3.20 Removing the Cable

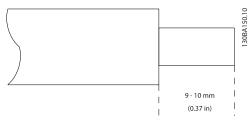


Figure 3.21 Stripping the Cable

3.3.10 Basic Wiring Example

1. Mount terminals from the accessory bag to the front of the frequency converter.

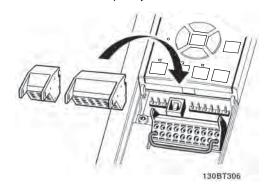


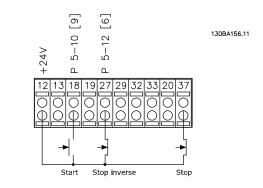
Figure 3.22 Mounting the Terminals

2. Connect terminals 18, 27 and 37 to +24 V (terminal 12/13)

Default settings:

18 = start

27 = coast inverse



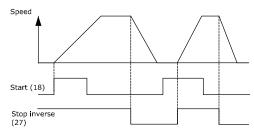


Figure 3.23 Example of Basic Wiring & System Response

3-10 BAS-SVX60A-EN



3.3.11 Electrical Installation, Control Cables

Use terminal 37 as input for safe stop. In rare cases, control cables more than 100 m (330 ft) and analog signals result in 50/60 Hz ground loops due to noise from mains supply cables. If this situation occurs, break the screen or insert a 100 nF capacitor between screen and chassis. Connect the digital and analog inputs and outputs separately to the frequency converter common inputs (terminal 20, 55, 39) to avoid ground currents affecting the system.

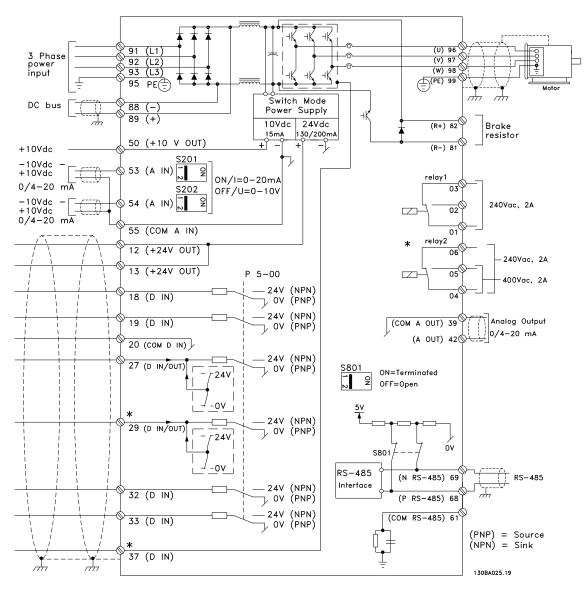


Figure 3.24 Electrical Diagram - Control Cables

Control cables must be shielded/armored. To connect the screen to the frequency converter decoupling plate for control cables, use a clamp from the accessory bag.



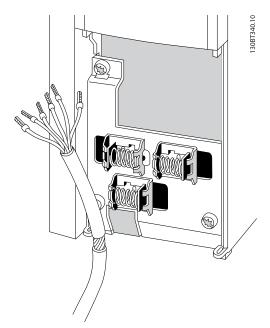


Figure 3.25 Control Cable Connection

Figure 3.26 indicates how correct grounding is carried out and what to do if in doubt.

a. Correct grounding

Control cables and cables for serial communication must be fitted with cable clamps at both ends to ensure the best possible electrical contact.

b. Wrong grounding

Do not use twisted cable ends (pigtails). They increase the screen impedance at high frequencies.

c. Protection concerning ground potential between PLC (Program Logic Controller) and frequency converter

If the ground potential between the frequency converter and the PLC (etc.) is different, electric noise may occur that disturbs the entire system. Solve this problem by fitting an equalizing cable, next to the control cable. Minimum cable cross-section: 16 mm².

d. For 50/60 Hz ground loops

If long control cables are used, 50/60 Hz ground loops may occur. Solve this problem by connecting one end of the screen to ground via a 100 nF capacitor (keeping leads short).

e. Cables for serial communication

Eliminate low-frequency noise currents between two frequency converters by connecting one end of the screen to terminal 61. This terminal is connected to ground via an internal RC link. To reduce the differential mode interference between the conductors, use twisted-pair cables.

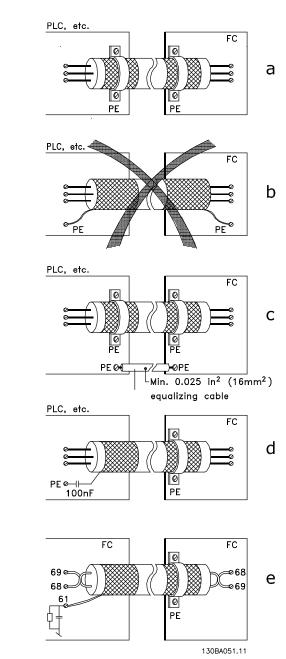


Figure 3.26 Examples of ground Wiring

3-12 BAS-SVX60A-EN



3.3.12 Electrical Installation - EMC Protection

The following is a guideline to good engineering practice when installing frequency converters. To comply with EN 61800-3 First environment, follow these guidelines. If the installation is in EN 61800-3 Second environment, i.e. industrial networks, or in an installation with its own transformer, deviation from these guidelines is allowed, but not recommended.

Good engineering practice to ensure EMC-correct electrical installation

- Use only braided screened/armored motor compressor cables and braided screened/armored control cables. The screen should provide a minimum coverage of 80%. The screen material must be metal, not limited to but typically copper, aluminum, steel, or lead. There are no special requirements for the mains cable.
- Installations using rigid metal conduits are not required to use screened cable, but the motor compressor cable must be installed in conduit separate from the control and mains cables. Full connection of the conduit from the frequency converter to the motor compressor is required. The EMC performance of flexible conduits varies a lot and information from the manufacturer must be obtained.

- Connect the screen/armor/conduit to ground at both ends for motor compressor cables as well as for control cables. In some cases, it is not possible to connect the screen in both ends. If so, connect the screen at the frequency converter. See also 3.3.11 Electrical Installation, Control Cables.
- Avoid terminating the screen/armor with twisted ends (pigtails). It increases the high frequency impedance of the screen, which reduces its effectiveness at high frequencies. Use low impedance cable clamps or EMC cable glands instead.
- Avoid using unscreened/unarmored motor compressor or control cables inside cabinets housing the frequency converter(s).

Leave the screen as close to the connectors as possible.

Figure 3.27 shows an example of an EMC-correct electrical installation of an IP20 frequency converter.

The frequency converter is fitted in an installation cabinet with an output contactor and connected to a PLC, which is installed in a separate cabinet. Other ways of doing the installation may have just as good an EMC performance, provided the above guide lines to engineering practice are followed. Installing without following the guideline, and using unscreened cables and control wires do not comply with all emission requirements, although the immunity requirements are fulfilled.



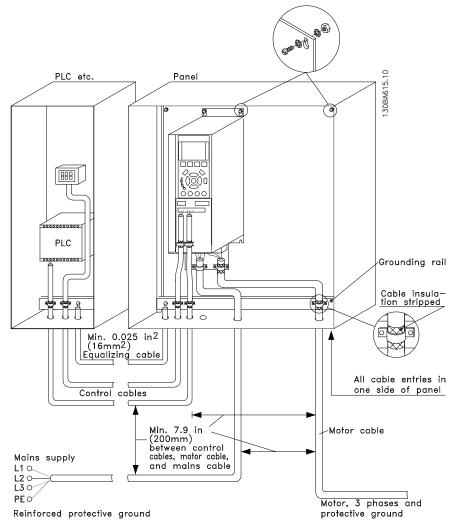


Figure 3.27 EMC Correct Installation of an IP20 Frequency Converter

3.3.13 Motor Thermal Protection

The electronic thermal relay in the frequency converter has received UL-approval for single motor protection, when 1-90 Motor Thermal Protection is set for ETR Trip and 1-24 Motor Current is set to the rated motor current (see motor name plate).

For thermal motor protection it is also possible to use the MCB 112 PTC Thermistor Card option. This card provides ATEX certificate to protect motors in explosion hazardous areas, Zone 1/21 and Zone 2/22. When 1-90 Motor Thermal Protection is set to [20] ATEX ETR is combined with the use of MCB 112, it is possible to control an Ex-e motor in explosion hazardous areas. Consult the programming guide for details on how to set up the frequency converter for safe operation of Ex-e motors.

3-14 BAS-SVX60A-EN



3.3.14 Safety Ground Connection

The frequency converter has a high leakage current and must be grounded appropriately for safety reasons according to EN 50178. The ground leakage current from the frequency converter exceeds 3.5 mA. To ensure a good mechanical connection from the ground cable to the ground connection (terminal 95), the cable cross-section must be at least 10 mm² or 2 rated ground wires terminated separately.

3.3.15 Basic Examples of Control Connections

Controls using an external controller with 0-10 V signal. It is not necessary to change any parameters, as this is the default value.

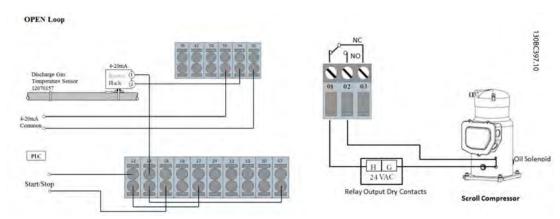


Figure 3.28 Example of External Controller with 0-10 V Signal

Controls using an external controller with 4-20 mA signal. Change switch 53 from U to I. It is not necessary to change any parameters, as this is the default value.

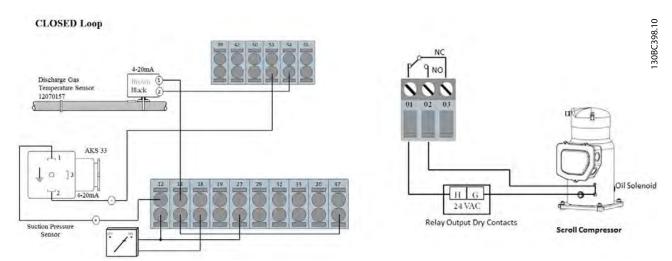


Figure 3.29 Example of External Controller with 4-20 mA Signal



3.3.16 High-voltage Test

Carry out a high-voltage test by short-circuiting terminals U, V, W, L1, L2 and L3. Energize by max. 2.15 kV DC for 1 s between this short circuit and the chassis.

NOTE!

When running high-voltage tests of the entire installation, frequency converter and compressor electrical motor compressor test can be conducted together.

AWARNING

When conducting a high-voltage test, make sure that the system is not under vacuum: a vacuum may cause electrical motor compressor failure.

AWARNING

Never apply the high-voltage test to the control circuit.

3.4 Fuses and Circuit Breakers

3.4.1 Fuses

NOTE!

To ensure compliance with IEC 60364 for CE or NEC 2009 for UL, use fuses and/or circuit breakers on the supply side of the unit for protection of electrical components within the frequency converter.

AWARNING

Personnel and property must be protected against the consequence of component break-down internally in the frequency converter.

Branch Circuit Protection

To protect the installation against electrical and fire hazard, all branch circuits in an installation, switch gear, machines etc., must be protected against short circuit and overcurrent according to national/international regulations.

Trane recommends using the fuses/circuit breakers listed in the following tables to protect service personnel and property in case of component break-down in the frequency converter.

3.4.2 Recommendations

AWARNING

In case of malfunction, ignoring recommended fuse types may result in personnel risk and damage to the frequency converter and other equipment.

The following tables list the recommended rated current. Recommended fuses are of the type gG for small to medium power sizes. For larger powers, aR fuses are recommended. For circuit breakers, Moeller types have been tested to have a recommendation. Other circuit breakers may be used if they limit the energy into the frequency converter to a level equal to or lower than the Moeller types.

For further information, see Application Note Fuses and Circuit Breakers, MN90T

3-16 BAS-SVX60A-EN



3.4.3 CE Compliance

Fuses or circuit breakers are mandatory to comply with IEC 60364. Trane recommends using a selection of the following.

The fuses below are suitable for use on a circuit capable of delivering 100,000 Arms (symmetrical), 240 V, 480 V, 500 V, or 600 V depending on the unit's voltage rating. With the proper fusing, the frequency converter short circuit current rating (SCCR) is 100,000 Arms.

3.4.4 Non UL Compliance Fuses

Non-UL compliance fuses

Compressor model	Frequency converter	Voltage [V]	Output power [kW/HP]	Max. fuse size [A]	Type
VZH088	15K	200-240	18.5/25	80 ¹	type gG
VZH117	18K5	200-240	22/30	125 ¹	type gG
VZH170	22K	200-240	30/40	125 ¹	type gG
VZH088	15K	380-480	18.5/25	63 ¹	type gG
VZH117	18K	380-480	22/30	63 ¹	type gG
VZH170	22K	380-480	30/40	80 ¹	type gG

Table 3.7 Non-UL Fuses 200 V to 480 V

UL compliance fuses

Compress or model	Frequency converter [kW]	Output power [kW/HP]	Bussmann Type RK1	Bussmann Type J	Bussmann Type T	SIBA Type RK1	Littelfuse Type RK1	Ferraz- Shawmut Type CC	Ferraz- Shawmut Type RK1
VZH088	15K	18.5/25	KTN-R125	JKS-125	JJN-125	5014006-125	KLN-R125	A2K-125R	A2K-125R
VZH117	18K5	22/30	KTN-R125	JKS-125	JJN-125	2028220-125	KLN-R125	A2K-125R	A2K-125R
VZH170	22K	30/40	KTN-R150	JKS-150	JJN-150	2028220-150	KLN-R150	A2K-150R	A2K-150R

Table 3.8 UL Fuses, 200-240 V

Compress or model	Frequenc y converter [kW]	Output power [kW/HP]	Bussmann Type RK1	Bussmann Type J	Bussmann Type T	SIBA Type RK1	Littelfuse Type RK1	Ferraz- Shawmut Type CC	Ferraz- Shawmut Type RK1
VZH088	15K	18.5/25	KTS-R60	JKS-60	JJS-60	5014006-040	KLS-R60	-	A6K-60R
VZH117	18K	22/30	KTS-R60	JKS-60	JJS-60	5014006-050	KLS-R60	-	A6K-60R
VZH170	22K	30/40	KTS-R80	JKS-80	JJS-80	5014006-063	KLS-R80	-	A6K-80R

Table 3.9 UL Fuses, 380-600 V

¹⁾ Max. fuses - see national/international regulations for selecting an applicable fuse size.

How to Install

Operating Instructions TRV200

Compress or model	Frequenc y converter [kW]	Output power [kW/HP]	Bussmann Type RK1	Bussmann Type J	Bussmann Type T	SIBA Type RK1	Littelfuse Type RK1	Ferraz- Shawmut Type CC	Ferraz- Shawmut Type RK1
VZH088	22/30	22/30	KTS-R45	JKS-45	JJS-45	5014006-040	KLS-R45	-	A6K-45R
VZH117	22K	30/40	KTS-R50	JKS-50	JJS-50	5014006-050	KLS-R50	=	A6K-50R
VZH170	30K	37.5/50	KTS-R80	JKS-80	JJS-80	2028220-100	KLS-R80	-	A6K-80R

Table 3.10 UL Fuses, 525-600 V

KTS-fuses from Bussmann may substitute KTN for 240 V frequency converters.

FWH-fuses from Bussmann may substitute FWX for 240 V frequency converters.

KLSR fuses from Littelfuse may substitute KLNR fuses for 240 V frequency converters.

L50S fuses from Littelfuse may substitute L50S fuses for 240 V frequency converters.

A6KR fuses from FERRAZ SHAWMUT may substitute A2KR for 240 V frequency converters.

A50X fuses from FERRAZ SHAWMUT may substitute A25X for 240 V frequency converters.

3-18 BAS-SVX60A-EN



4 Quick Setup

4.1 Programming Procedures

4.1.1 Basic Programming Procedures

NOTE!

TRV200 frequency converter is completely setup at factory, requiring no programing unless debugging a drive or administering an engineering approved parameter change.

The following describes the basic procedure for running the frequency converter.

ACAUTION

When the connections are made, the compressor starts automatically.

- 1. Connect the power supply to the terminals (L1, L2 and L3) of the frequency converter as shown in 3.3.4 Mains connection for B4, C1 and C3.
- Connect motor cable between the frequency converter (U, V & W) and Compressor (clockwise on terminal), see 3.3.5 Motor Compressor Connection. (The connectors utilized in these first 2 steps are provided in the accessory bag which accompanies the frequency converter).
- 3. Press [Quick Menu] and go to quick setup. Ensure that the correct compressor model is selected in 1-13 Compressor Selection.
- Connect terminal 12 with terminal 18 (start signal), terminal 12 with terminal 27 (inverse coast signal) and terminal 12 with terminal 37* (safe stop inverse signal).

*See 3.3.10 Basic Wiring Example and 2.2.1 Terminal 37 Safe Torque Off Function.

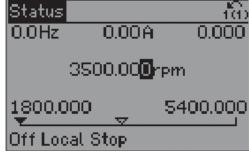
ACAUTION

If an error trips the frequency converter, it automatically tries to restart the compressor after 30 s (unless the error is severe and causes a trip lock). See also 14-20 Reset Mode and 14-21 Automatic Restart Time.

4.1.2 Open Loop with External Reference

- Apply analog speed reference signal (0-10 V) on terminal 53 using the terminal 55 as common.
 See 3.3.15 Basic Examples of Control Connections.
- Check if switch A53 is positioned to U (voltage) instead of I (current). The switch A53 is on the frequency converter and is visible when the keypad is removed.
- 3. Ready to Run: If the frequency converter is supplied with display: Press [Hand On] to set a local speed reference in the display (good for testing purposes). Press [Auto On] for running in operation and with an external reference.

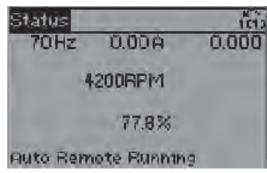
Figure 4.1 shows the screen after configuring the frequency converter for Speed Open loop application, Hand On mode.



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Figure 4.1 Speed Open Loop, Hand On Mode

This is what the screen will look like after configuring the frequency converter for *Speed Open loop* application, *Auto On mode*:



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Figure 4.2 Speed Open Loop, Auto On Mode



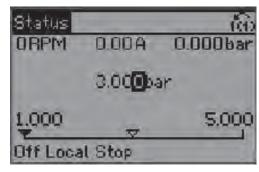
4.1.3 PID Closed Loop with 4-20 mA Pressure Transmitter

- 1. Connect pressure transmitter to analog input on terminal 54 according to 3.3.15 Basic Examples of Control Connections.
- 2. Make sure that the switch for analogue input 54 is set to "I" for current input.
- 3. Press [Quick Menu], go to "PID Closed Loop" and then to "Basic PID Settings) menu.
 - Now change parameters to
 - 1-00 Configuration Mode: Select [3] Process
 - 3-01 Reference/Feedback Unit: Select [71] Bar
 - 3-02 Minimum Reference and 3-03 Maximum Reference: Enter the lower and upper limits of the setpoint range [psi].
 - 3-15 Reference Resource 1: Select [0] No function for fixed setpoint.
 - 6-22 Terminal 54 Low Current + 6-23 Terminal 54 High Current: The values of these parameters should match the output of the pressure transmitter (4-20 mA for example is the factory setting).
 - 6-24 Terminal 54 Low Ref./Feedb. Value + 6-25 Terminal 54 High Ref./Feedb. Value: Set range of pressure transmitter (factory setting -14/+174 psi)

Return to 3-13 Reference Site: Select [2] Local to run with a fixed setpoint adjustable via keypad. Select [1] Remote if the setpoint is given by the

- analog input (as defined in 3-15 Reference Resource 1).
- Press [Quick Menu], go to My Personal Menu, go to 0-22 Display Line 1.3 Small and select [1652] Feedback [unit]. The pressure [psi] is going to be shown in the upper right corner of the display

This is what the screen will look like, after configuring the frequency converter for *Closed loop* application.



130BA556.10

Figure 4.3 Closed Loop

- 5. Ready to Run: Press [Hand On] and set reference in psi using the arrows on the display. Before leaving the site, never forget the next step.
- 6. Ready to Run: Press [Auto On].

For more details on PID Closed Loop, see Figure 4.4.

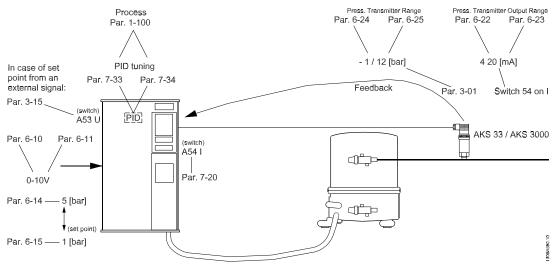


Figure 4.4 Example of Closed Loop Application

4-2 BAS-SVX60A-EN



4.1.4 Other Compressor Features

To set up other dedicated compressor features press [Quick Menu] and go to Q4 or follow Figure 4.5.

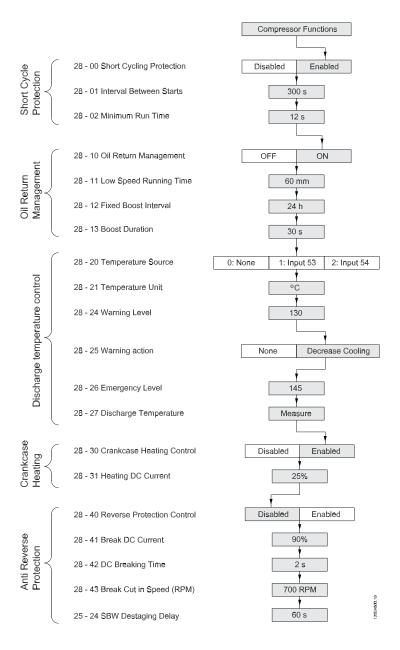


Figure 4.5 Flowchart





5 How to Program

5.1 How to Program on the Graphical Keypad

NOTE!

TRV200 frequency converter is completely setup at factory, requiring no programing unless debugging a drive or administering an engineering approved parameter change.

5.1.1 Control Panel

The following instructions are valid for the graphical keypad:

The control panel is divided into four functional groups:

- Graphical display with Status lines. All data is displayed in a graphical keypad display, which can show up to five items of operating data while displaying [Status].
- Menu keys and indicator lights changing parameters and switching between display functions.
- 3. Navigation keys and indicator lights (LEDs).
- 4. Operation keys and indicator lights (LEDs).

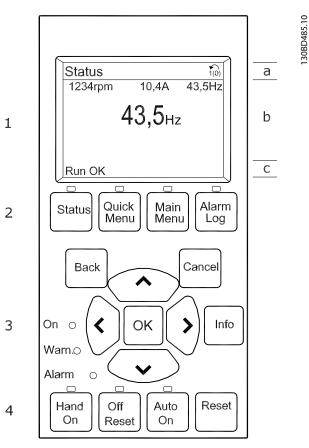


Figure 5.1 Overview of Keypad

5.1.2 Display Lines

a. Status line:

Status messages displaying icons and graphic.

b. Line 1-2:

Operator data lines displaying data defined or chosen by the user. By pressing the [Status] key, up to one extra line can be added.

c. Status line:

Status messages displaying text.

5.1.3 Display Contrast Adjustment

Press [Status] and [▼] for darker display Press [Status] and [▲] for brighter display



5.1.4 Indicator Lights

If certain threshold values are exceeded, the alarm and/or warning LED lights up. A status and alarm text appear on the control panel. The on LED is activated when the frequency converter receives mains voltage.

- Green LED/On: Control section is working.
- Yellow LED/Warn.: Indicates a warning.
- Flashing Red LED/Alarm: Indicates an alarm



Figure 5.2 Indicator Lights

5.2 Keypad

5.2.1 Function Keys

The control keys are divided into functions. The keys below the display and indicator lamps are used for parameter setup, including choice of display indication during normal operation.



Figure 5.3 Function Keys

[Status] indicates the status of the frequency converter and/or the compressor motor. Choose between 3 different readouts by pressing the [Status] key: 5 line readouts, 4 line readouts or Smart Logic Control by pushing [Status] twice.

Press [Status] to select the display mode or to change back to Display mode from either Quick Menu mode, Main Menu mode or Alarm mode. Also press [Status] to toggle single or double read-out mode.

[Quick Menu] allows quick access to different Quick Menus such as:

Q1 - My Personal Menu

Q2 - Quick Setup

Q3 - PID Process Loop

Q4 - Compressor Functions

Q5 - Changes Made

Q6 - Loggings

Q7 - Load Profile

Use [Quick Menu] for programming the parameters belonging to the Quick Menu. It is possible to switch directly between Quick Menu mode and Main Menu mode.

5.2.2 Navigation Keys

The four navigation keys are used to navigate between the different choices available in [Quick Menu], [Main Menu] and [Alarm Log]. Press the keys to move the cursor. [OK] is used for choosing a parameter marked by the cursor and for enabling the change of a parameter and loggings from Quick Menu.

5.2.3 Local Control Keys

Local control keys for local control are found at the bottom of the control panel.



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Figure 5.4 Local Control Keys

[Hand On] enables control of the frequency converter via the keypad. [Hand on] also starts the motor compressor, and it is now possible to enter the motor compressor speed data by means of the arrow keys. The key can be selected as [1] Enable or [0] Disable via 0-40 [Hand on] Key on LCP.

External stop signals activated by means of control signals or a serial bus will override a "start" command via the keypad.

The following control signals will still be active when [Hand on] is activated:

5-2 BAS-SVX60A-EN



- [Hand On] [Off] [Auto On]
- Reset
- Coasting stop inverse
- Reversing
- Setup select lsb (least significant bit) Setup select msb (most significant bit)
- Stop command from serial communication
- Quick stop
- DC brake

[Off] stops the connected motor compressor. The key can be selected as [1] Enable or [0] Disable via 0-41 [Off] Key on ICP

If no external stop function is selected and the [Off] key is inactive the motor compressor can be stopped by disconnecting the voltage.

[Auto On] enables the frequency converter is to be controlled via the control terminals and/or serial communication. When a start signal is applied on the control terminals and/or the bus, the frequency converter will start. The key can be selected as [1] Enable or [0] Disable via 0-42 [Auto on] Key on LCP.

NOTE!

An active HAND-OFF-AUTO signal via the digital inputs has higher priority than the control keys [Hand on] and [Auto on].

[Reset] is used for resetting the frequency converter after an alarm (trip). It can be selected as [1] Enable or [0] Disable via 0-43 [Reset] Key on LCP.

The **parameter shortcut** can be carried out by holding down the [Main Menu] key for 3 seconds. The parameter shortcut allows direct access to any parameter.

5.2.4 Quick Transfer of Parameter Settings

Once the setup of a frequency converter is complete, store the data in the keypad or on a PC via Trane Drive Utility (TDU).

5.2.5 Data Storage in Keypad

- 1. Go to 0-50 LCP Copy in the Main Menu.
- 2. Press [OK].
- 3. Select [1] All to LCP.
- Press [OK].

All parameter settings are now stored in the keypad indicated by the progress bar. When 100% is reached, press [OK].

NOTE!

Stop the motor compressor before performing this operation. The keypad can now be connected to another frequency converter and the parameter settings copied to this frequency converter as well.

5.2.6 Initialization to Default Settings

Initialize the frequency converter to default settings in two ways:

Recommended initialization (via 14-22 Operation Mode)

- 1. Select 14-22 Operation Mode.
- 2. Press [OK].
- 3. Select [2] Initialization.
- Press [OK].
- Disconnect mains supply and wait until the display turns off.
- 6. Reconnect the mains supply.
- 7. Drive initialized [A80] (Alarm 80) appears the frequency converter is now reset.

14-22 Operation Mode initializes all except:

- 8-30 Protocol
- 8-31 Address
- 8-32 FC Port Baud Rate
- 8-33 Parity / Stop Bits
- 8-34 Estimated cycle time
- 8-35 Minimum Response Delay
- 8-36 Max Response Delay
- 8-37 Max Inter-Char Delay
- 14-50 RFI 1
- 15-00 Operating hours
- 15-01 Running Hours
- 15-02 kWh Counter
- 15-03 Power-ups
- 15-04 Over Temps
- 15-05 Over Volts
- 15-20 Historic Log: Event
- 15-21 Historic Log: Value
- 15-22 Historic Log: Time



- 15-30 Fault Log: Error Code
- 15-31 Fault Log: Value
- 15-32 Fault Log: Time

Manual initialization

- Disconnect from mains and wait until the display turns off.
- Press [Status] [Main Menu] [OK] at the same time while power up for Graphical Display.
- 3. Release the keys after 5 s.
- 4. The frequency converter is now programmed according to default settings.

This procedure initializes all except:

- 15-00 Operating hours
- 15-03 Power-ups
- 15-04 Over Temps
- 15-05 Over Volts

5.2.7 Data Transfer from Keypad to Frequency Converter

NOTE!

Stop the motor compressor before performing this operation.

- 1. Go to 0-50 LCP Copy.
- 2. Press [OK].
- 3. Select [2] All from LCP.
- 4. Press [OK] again.

The parameter settings stored in the keypad are now transferred to the frequency converter indicated by the progress bar. When 100% is reached, press [OK].

5.2.8 Parameter Selection

In the Main menu mode, the parameters are divided into groups. Use the navigation keys for selecting a parameter group.

The following parameter groups are accessible:

- 0-** Operation/Display
- 1-** Load/Motor
- 3-** Reference/Ramps
- 4-** Limits/Warnings
- 5-** Digital In/Out

- 6-** Analog In/Out
- 7-** Controls
- 8-** Comm. and Options
- 13-** Smart Logic
- 14-** Special Functions
- 15-** Drive Information
- 16-** Data Readouts
- 25-** Cascade Controller
- 28-** Compressor Functions

After selecting a parameter group, select a parameter with the navigation keys. The middle section on the display shows the parameter number and name as well as the selected parameter value.



Figure 5.5 Display Example - Parameter Selection

5.2.9 Changing Data

The procedure for changing data is the same in both the Quick menu and the Main menu mode.

Press [OK] to change the selected parameter. The procedure for changing data depends on whether the selected parameter represents a numerical data value or a text value.

5.2.10 Changing a Text Value

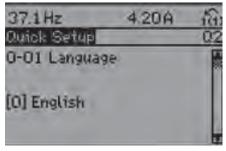
BAS-SVX60A-EN

If the selected parameter is a text value, change the text value by pressing the $[\]/[\]$ navigation keys. $[\]$ increases the value and $[\]$ decreases the value. Place the cursor on the value and press $[\]$ to save.



5.2.11 Changing a Group of Numeric Data Values

If the chosen parameter represents a numeric data value, change it by pressing the navigation keys. Press $[\P]/[\P]$ to move the cursor horizontally. Press $[\P]/[\P]$ to change the data value. $[\P]$ increases the data value, and $[\P]$ decreases the data value. Place the cursor on the value and press [OK] to save.



130BA562.10

Figure 5.6 Display Example



5-6 BAS-SVX60A-EN



6 Parameter Descriptions

6.1 Keypad Display

6.1.1 Keypad Programming

Table 6.1 lists the parameters that cannot be changed from the keypad. These parameters are defined by the compressor choice made in *1-13 Compressor Selection*.

Parameter	Parameter	Parameter
1-01 Motor Control Principle	1-45 q-axis Inductance (Lq) 200% I _{NOM}	5-41 On Delay, Relay
1-03 Torque Characteristics	1-40 Back EMF at 1000 RPM	5-42 Off Delay, Relay
1-04 Overload Mode	1-47 Low Speed Torque Calibration	7-00 Speed PID Feedback Source
1-05 Local Mode Configuration	1-49 Current at min. inductance	7-02 Speed PID Proportional Gain
1-10 Motor Construction	1-62 Slip Compensation	7-03 Speed PID Integral Time
1-20 Motor Power [kW]	1-66 Min. Current at Low Speed	7-04 Speed PID Differentiation Time
1-22 Motor Voltage	1-68 Minimum Inertia	7-05 Speed PID Diff. Gain Limit
1-23 Motor Frequency	1-69 Maximum Inertia	13-10 Comparator Operand
1-24 Motor Current	1-71 Start Delay	13-11 Comparator Operator
1-25 Motor Nominal Speed	1-72 Start Function	13-12 Comparator Value
1-26 Motor Cont. Rated Torque	1-73 Flying Start	14-00 Switching Pattern
1-29 Automatic Motor Adaptation (AMA)	1-74 Start Speed [RPM]	14-01 Switching Frequency
1-30 Stator Resistance (Rs)	1-76 Start Current	14-10 Line Failure
1-31 Rotor Resistance (Rr)	1-77 Compressor Start Min Speed [RPM]	14-11 Line Voltage at Line Fault
1-33 Stator Leakage Reactance (X1)	1-79 Compressor Start Max Time to Trip	14-21 Automatic Restart Time
1-34 Rotor Leakage Reactance (X2)	1-86 Compressor Min. Speed for Trip [RPM]	14-25 Trip Delay at Torque Limit
1-35 Main Reactance (Xh)	3-82 Starting Ramp Up Time	14-26 Trip Delay at Inverter Fault
1-36 Iron Loss Resistance (Rfe)	4-10 Motor Speed Direction	28-30 Crankcase Heating Control
1-37 d-axis Inductance (Ld)	4-11 Motor Speed Low Limit [RPM]	28-31 Heating DC Current
1-38 q-axis Inductance (Lq)	4-13 Motor Speed High Limit [RPM]	28-40 Reverse Protection Control
1-39 Motor Poles	4-16 Torque Limit Motor Mode	28-41 DC Brake Current
1-40 Back EMF at 1000 RPM	4-18 Current Limit	28-42 DC Braking Time
1-44 d-axis Inductance (Ld) 200% I _{NOM}	4-19 Max Output Frequency	28-43 DC Brake Cut In Speed [RPM]

Table 6.1 Compressor Related Parameters



6.2 Parameters: 0-** Operation and Display

6.2.1 0-0* Basic Settings

0-01 Language		
Option:		Function:
[0]	English	
[1]	Deutsch	
[2]	Francais	
[3]	Dansk	
[4]	Spanish	
[5]	Italiano	
[10]	Chinese	
[28]	Bras.port	
[39]	Korean	
[42]	Trad.Chinese	
[49]	Russian	

0-0	0-02 Motor Speed Unit		
Op	Option: Function:		
		Select display of motor speed parameters (i.e. references, feedbacks and limits) in terms of shaft speed (RPM) or output frequency to the motor (Hz).	
[0]	RPM		
[1]	Hz		

NOTE!

This parameter cannot be adjusted while the motor is running.

0-0	0-04 Operating State at Power-up (Hand)		
Op	Option: Function:		
		Selects the operating mode upon reconnection of the frequency converter to mains voltage after power down in Hand (local) operation mode.	
[0]	Resume	Restarts the frequency converter, maintaining the same and the same start/stop settings (applied by [Hand On/Off]) as before the frequency converter was powered down.	
[1]	Forced stop, ref=old	Restarts the frequency converter with a saved local reference, after mains voltage reappears and after pressing [Hand On].	
[2]	Forced stop, ref=0	Resets the local reference to 0 upon restarting the frequency converter.	

0-	0-10 Active Set-up		
Op	otion:	Function:	
		Select the setup to control the frequency converter functions.	
[0]	Factory setup	Cannot be changed. It contains the Trane data set, and can be used as a data source when returning the other setups to a known state.	
[1]	Set-up 1	[1] Setup 1 to [4] Setup 4 are the four separate parameter setups within which all parameters can be programmed.	
[2]	Set-up 2		
[3]	Set-up 3		
[4]	Set-up 4		
[9]	Multi Set-up	Remote selection of setups using digital inputs and the serial communication port. This setup uses the settings from <i>0-12 This Set-up Linked to</i> . Stop the frequency converter before making changes to open- and closed loop functions	

Use 0-51 Set-up Copy to copy a setup to one or all other setups. Stop the frequency converter before switching between setups where parameters marked 'not changeable during operation' have different values. To avoid conflicting settings of the same parameter within two different setups, link the setups together using 0-12 This Set-up Linked to. Parameters which are 'not changeable during operation' are marked FALSE in the parameter lists in 6.16 Parameter Lists.

0-11 Edit Set-up		
Op	otion:	Function:
		Select the setup to be edited (i.e. programmed) during operation; either the active setup or one of the inactive setups.
[0]	Factory setup	Cannot be edited but it is useful as a data source to return the other setups to a known state.
[1]	Set-up 1	[1] Setup 1 to [4] Setup 4 can be edited freely during operation, independently of the active setup.
[2]	Set-up 2	
[3]	Set-up 3	
[4]	Set-up 4	
[9]	Active Set-up	Can also be edited during operation. Edit the chosen setup from a range of sources: Keypad, FC RS-485, FC USB or up to five fieldbus sites.

6-2 BAS-SVX60A-EN



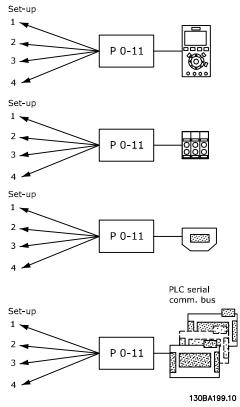


Figure 6.1 Edit Setup

0-	0-12 This Set-up Linked to			
Op	otion:	Function:		
		To enable conflict-free changes from one setup to another during operation, link setups containing parameters which are not changeable during operation. The link will ensure synchronizing of the 'not changeable during operation' parameter values when moving from one setup to another during operation. 'Not changeable during operation' parameters can be identified by the label FALSE in the parameter lists in 6.16 Parameter Lists. O-12 This Set-up Linked to is used by Multi setup in 0-10 Active Set-up. Multi setup is used to move from one setup to another during operation (i.e. while the motor is running). Example: Use Multi setup to shift from Setup 1 to Setup 2 whilst the motor is running. Program in Setup 1 first, then ensure that Setup 1 and Setup 2 are synchronized (or 'linked'). synchronization can be performed in two ways: 1. Change the edit setup to [2] Setup 2 in 0-11 Edit Set-up and set 0-12 This Set-up Linked to to [1] Setup 1. This will start the linking (synchronizing) process.		

0-	0-12 This Set-up Linked to			
Or	otion:	Function:		
		ORPM 0.00A (1) Set-up Handling 0-1* 0-12 This Set-up Linked to [1] Setup 1 Figure 6.2 Setup 1		
		OR		
		2. While still in Setup 1, copy Setup 1 to Setup 2.		
		Then set 0-12 This Set-up Linked to to [2] Setup 2.		
		This will start the linking process.		
		ORPM 0.00A to Set-up Handling 0-1* 0-12 This Set-up Linked to		
		Figure 6.3 Setup 2		
		After the link is complete, <i>0-13 Readout: Linked Set-ups</i> will read {1,2} to indicate that all 'not changeable during operation' parameters are now the same in Setup 1 and Setup 2. If there are changes to a 'not changeable during operation' parameter, e.g. <i>1-30 Stator Resistance (Rs)</i> , in Setup 2, they will also be changed automatically in Setup 1. A switch between Setup 1 and Setup 2 during operation is now possible.		
[0]	Not linked			
[1]	Set-up 1			
[2]	Set-up 2			
[3]	Set-up 3			
[4]	Set-up 4			



0-13 Readout: Linked Set-ups

Array [5]

Range: Function:

0 * [0 - 255]

View a list of all the setups linked by means of 0-12 This Set-up Linked to. The parameter has one index for each parameter setup. The parameter value displayed for each index represents which setups are linked to that parameter setup.

Index	Keypad value
0	{0}
1	{1,2}
2	{1,2}
3	{3}
4	{4}

Table 6.3 Example: Setup 1 and Setup 2 are linked

0-14 Readout: Edit Set-ups / Channel

0-1	0-14 headout, Edit Set-ups / Charmer		
Range: Function:		Function:	
0 *	[-2147483648 -	View the setting of 0-11 Edit Set-up for	
	2147483647]	each of the four different communication	
		channels. When the number is displayed in	
		hex, as it is in the keypad, each number	
		represents one channel.	
		Numbers 1-4 represent a setup number; 'F'	
		means factory setting; and 'A' means	
		active setup. The channels are, from right	
		to left: keypad, FC-bus, USB, HPFB1-5.	
		Example: The number AAAAAA21h means	
		that the FC bus selected Setup 2 in	
		0-11 Edit Set-up, the keypad selected Setup	
		1 and all others used the active setup.	
		'''	

6.2.2 0-2* LCP Display

Define the display in the Graphical Logic Control Panel.

0-20 Display Line 1.1 Small			
Option: Function:			
Орио	110	Select a variable for	
		display in line 1, left position.	
[0]	None		
[953]	Profibus Warning Word		
[1005]	Readout Transmit Error Counter		
[1006]	Readout Receive Error Counter		
[1007]	Readout Bus Off Counter		
[1013]	Warning Parameter		
[1501]	Running Hours		
[1502]	kWh Counter		
[1508]	Number of Starts		
[1509]	Number of Auto Resets		
[1600]	Control Word		
[1601]	Reference [Unit]		
[1602]	Reference %		
[1603]	Status Word		
[1605]	Main Actual Value [%]		
[1609]	Custom Readout		
[1610]	Power [kW]		
[1611]	Power [hp]		
[1612]	Motor Voltage		
[1613]	Frequency		
[1614]	Motor current		
[1615]	Frequency [%]		
[1616]	Torque [Nm]		
[1617]	Speed [RPM]		
[1618]	Motor Thermal		
[1619]	KTY sensor temperature		
[1620]	Motor Angle		
[1622]	Torque [%]		
[1630]	DC Link Voltage		
[1632]	Brake Energy /s		
[1633]	Brake Energy /2 min		
[1634]	Heatsink Temp.		
[1635]	Inverter Thermal		
[1636]	Inv. Nom. Current		
[1637]	Inv. Max. Current		
[1638]	SL Controller State		
[1639]	Control Card Temp.		
[1650]	External Reference		
[1651]	Pulse Reference		
[1652]	Feedback[Unit]		
[1653]	Digi Pot Reference		
[1654]	Feedback 1 [Unit]		
[1655]	Feedback 2 [Unit]		

6-4 BAS-SVX60A-EN





0-20 Display Line 1.1 Small			
Optio	n:	Function:	
[1660]	Digital Input		
[1661]	Terminal 53 Switch Setting		
[1662]	Analog Input 53		
[1663]	Terminal 54 Switch Setting		
[1664]	Analog Input 54		
[1665]	Analog Output 42 [mA]		
[1666]	Digital Output [bin]		
[1667]	Freq. Input #29 [Hz]		
[1668]	Freq. Input #33 [Hz]		
[1669]	Pulse Output #27 [Hz]		
[1670]	Pulse Output #29 [Hz]		
[1671]	Relay Output [bin]		
[1672]	Counter A		
[1673]	Counter B		
[1680]	Fieldbus CTW 1		
[1682]	Fieldbus REF 1		
[1684]	Comm. Option STW		
[1685]	FC Port CTW 1		
[1686]	FC Port REF 1		
[1690]	Alarm Word		
[1691]	Alarm Word 2		
[1692]	Warning Word		
[1693]	Warning Word 2		
[1694]	Ext. Status Word		
[2580]	Cascade Status		
[2581]	Compressor Status		
[2587]	Inverse Interlock		
[2827]	Discharge Temperature		
[9913]	Idle time		
[9914]	Paramdb requests in queue		
[9917]	tCon1 time		
[9918]	tCon2 time		
[9919]	Time Optimize Measure		

0-21 Display Line 1.2 Small

Option:		Function:
		Options are the same as in
		0-20 Display Line 1.1 Small
[1614] *	Motor Current [A]	

0-22 Display Line 1.3 Small

Option:		Function:
		Options are the same as in 0-20 Display
		Line 1.1 Small.
[1610] *	Power [kW]	

0-23 Display Line 2 Large

Option:		Function:
		Options are the same as in 0-20 Display
		Line 1.1 Small.

0-23 Display Line 2 Large			
Option:		Function:	
[1613] *	Frequency [Hz]	1	
0-24 D	isplay Line 3	Large	
Option	:	Function:	
		Options are the same as in	
		0-20 Display Line 1.1 Small.	
[1662] *	Analog Input 5	53	
0-25 My Personal Menu			
0-25 N	ly Personal M	enu	
0-25 M Range:	ly Personal M	enu Function:	
	ly Personal M		
Range:		Function:	
Range: Size	[0 -	Function: Define up to 20 parameters to include in	
Range: Size	[0 -	Function: Define up to 20 parameters to include in the Q1 Personal Menu, accessible via the	
Range: Size	[0 -	Function: Define up to 20 parameters to include in the Q1 Personal Menu, accessible via the [Quick Menu] key on the keypad. The	
Range: Size	[0 -	Function: Define up to 20 parameters to include in the Q1 Personal Menu, accessible via the [Quick Menu] key on the keypad. The parameters will be displayed in the Q1	

6.2.3 0-3* LCP Custom Readout

It is possible to customize the display elements for various purposes: *Custom Readout. Value proportional to speed (Linear, squared or cubed depending on unit selected in *0-30 Custom Readout Unit*) *Display Text. Text string stored in a parameter.

to « 0000 ».

Custom Readout

The calculated value to be displayed is based on settings in 0-30 Custom Readout Unit, 0-31 Custom Readout Min Value (linear only), 0-32 Custom Readout Max Value, 4-13 Motor Speed High Limit [RPM], 4-14 Motor Speed High Limit [Hz] and actual speed.



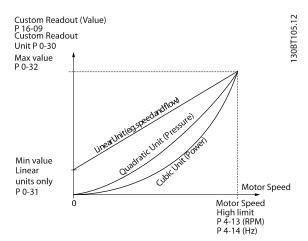


Figure 6.4 Custom Readout

The relation will depend on the type of unit selected in *0-30 Custom Readout Unit*:

Unit Type	Speed Relation
Dimensionless	
Speed	
Flow, volume	
Flow, mass	Linear
Velocity	
Length	
Temperature	
Pressure	Quadratic
Power	Cubic

Table 6.4

0-30 Unit for User-defined Readout		
Option:		Function:
		It is possible to program a value to be
		shown in the display of the keypad. The
		value will have a linear, squared or cubed
		relation to speed. This relation will depend
		on the unit selected (see <i>Table 6.4</i>). The
		actual calculated value can be read in
		16-09 Custom Readout, and/or shown in the
		display be selecting [16-09] Custom Readout
		in 0-20 Display Line 1.1 Small to 0-24 Display
		Line 3 Large.
[0]	None	
[1]	%	
[5]	PPM	
[10]	min	
[11]	RPM	
[12]	PULSE/s	
[20]	liter / sec.	

Option: Function:	0-30	Unit for Use	er-defined Readout
[22] liter / hr.	Option:		Function:
[23] m³ / sec. [24] m³/min [25] m³ / hr. [30] kg / sec. [31] kg/min [32] kg / hr. [33] ton / min [34] ton / hr. [40] m / sec. [41] m/min [45] m [60] °C [70] mbar [71] bar [72] Pa [73] kPa [74] m WG [80] kW [120] GPM [121] gal / sec. [122] gal/min [123] gal / hr. [124] CFM [125] ft³/s [126] ft³/min [127] ft³/h [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [144] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[21]	liter / min	
[24] m³/min [25] m³ / hr. [30] kg / sec. [31] kg/min [32] kg / hr. [33] ton / min [34] ton / hr. [40] m / sec. [41] m/min [45] m [60] °C [70] mbar [71] bar [72] Pa [73] kPa [74] m WG [80] kW [120] GPM [121] gal / sec. [122] gal/min [123] gal / hr. [124] CFM [125] ft³/s [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[22]	liter / hr.	
[25] m³ / hr. [30] kg / sec. [31] kg/min [32] kg / hr. [33] ton / min [34] ton / hr. [40] m / sec. [41] m/min [45] m [60] °C [70] mbar [71] bar [72] Pa [73] kPa [74] m WG [80] kW [120] GPM [121] gal / sec. [122] gal/min [123] gal / hr. [124] CFM [125] ft³/s [126] ft³/min [127] ft³/h [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[23]	m³ / sec.	
[30] kg / sec. [31] kg/min [32] kg / hr. [33] ton / min [34] ton / hr. [40] m / sec. [41] m/min [45] m [60] °C [70] mbar [71] bar [72] Pa [73] kPa [74] m WG [80] kW [120] GPM [121] gal / sec. [122] gal/min [123] gal / hr. [124] CFM [125] ft³/s [126] ft³/min [137] ft³/h [130] lbs / sec. [131] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[24]	m³/min	
[31] kg/min [32] kg / hr. [33] ton / min [34] ton / hr. [40] m / sec. [41] m/min [45] m [60] °C [70] mbar [71] bar [72] Pa [73] kPa [74] m WG [80] kW [120] GPM [121] gal / sec. [122] gal/min [123] gal / hr. [124] CFM [125] ft³/s [126] ft³/min [127] ft³/h [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[25]	m³ / hr.	
[32] kg / hr. [33] ton / min [34] ton / hr. [40] m / sec. [41] m/min [45] m [60] °C [70] mbar [71] bar [72] Pa [73] kPa [74] m WG [80] kW [120] GPM [121] gal / sec. [122] gal/min [123] gal / hr. [124] CFM [125] ft³/s [126] ft³/min [127] ft³/h [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [144] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[30]	kg / sec.	
[33] ton / min [34] ton / hr. [40] m / sec. [41] m/min [45] m [60] °C [70] mbar [71] bar [72] Pa [73] kPa [74] m WG [80] kW [120] GPM [121] gal / sec. [122] gal/min [123] gal / hr. [124] CFM [125] ft³/s [126] ft³/min [127] ft³/h [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [144] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[31]	kg/min	
[34] ton / hr. [40] m / sec. [41] m/min [45] m [60] °C [70] mbar [71] bar [72] Pa [73] kPa [74] m WG [80] kW [120] GPM [121] gal / sec. [122] gal/min [123] gal / hr. [124] CFM [125] ft³/s [126] ft³/min [127] ft³/h [130] lbs / sec. [131] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[32]	kg / hr.	
[40] m / sec. [41] m/min [45] m [60] °C [70] mbar [71] bar [72] Pa [73] kPa [74] m WG [80] kW [120] GPM [121] gal / sec. [122] gal/min [123] gal / hr. [124] CFM [125] ft³/s [126] ft³/min [127] ft³/h [130] lbs / sec. [131] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[33]	ton / min	
[41] m/min [45] m [60] °C [70] mbar [71] bar [72] Pa [73] kPa [74] m WG [80] kW [120] GPM [121] gal / sec. [122] gal/min [123] gal / hr. [124] CFM [125] ft³/s [126] ft³/min [127] ft³/h [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [144] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[34]	ton / hr.	
[45] m [60] °C [70] mbar [71] bar [72] Pa [73] kPa [74] m WG [80] kW [120] GPM [121] gal / sec. [122] gal/min [123] gal / hr. [124] CFM [125] ft³/s [126] ft³/min [127] ft³/h [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[40]	m / sec.	
[60] °C [70] mbar [71] bar [72] Pa [73] kPa [74] m WG [80] kW [120] GPM [121] gal / sec. [122] gal/min [123] gal / hr. [124] CFM [125] ft³/s [126] ft³/min [127] ft³/h [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[41]	m/min	
[70] mbar [71] bar [72] Pa [73] kPa [74] m WG [80] kW [120] GPM [121] gal / sec. [122] gal/min [123] gal / hr. [124] CFM [125] ft³/s [126] ft³/min [127] ft³/h [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[45]	m	
[71] bar [72] Pa [73] kPa [74] m WG [80] kW [120] GPM [121] gal / sec. [122] gal/min [123] gal / hr. [124] CFM [125] ft³/s [126] ft³/min [127] ft³/h [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[60]	°C	
[72] Pa [73] kPa [74] m WG [80] kW [120] GPM [121] gal / sec. [122] gal/min [123] gal / hr. [124] CFM [125] ft³/s [126] ft³/min [127] ft³/h [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[70]	mbar	
[73] kPa [74] m WG [80] kW [120] GPM [121] gal / sec. [122] gal/min [123] gal / hr. [124] CFM [125] ft³/s [126] ft³/min [127] ft³/h [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[71]	bar	
[74] m WG [80] kW [120] GPM [121] gal / sec. [122] gal/min [123] gal / hr. [124] CFM [125] ft³/s [126] ft³/min [127] ft³/h [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[72]	Pa	
[80] kW [120] GPM [121] gal / sec. [122] gal/min [123] gal / hr. [124] CFM [125] ft³/s [126] ft³/min [127] ft³/h [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[73]	kPa	
[120] GPM [121] gal / sec. [122] gal/min [123] gal / hr. [124] CFM [125] ft³/s [126] ft³/min [127] ft³/h [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[74]	m WG	
[121] gal / sec. [122] gal/min [123] gal / hr. [124] CFM [125] ft³/s [126] ft³/min [127] ft³/h [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[80]	kW	
[122] gal/min [123] gal / hr. [124] CFM [125] ft ³ /s [126] ft ³ /min [127] ft ³ /h [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[120]	GPM	
[123] gal / hr. [124] CFM [125] ft³/s [126] ft³/min [127] ft³/h [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[121]	gal / sec.	
[124] CFM [125] ft³/s [126] ft³/min [127] ft³/h [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[122]	gal/min	
[125] ft³/s [126] ft³/min [127] ft³/h [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[123]	gal / hr.	
[126] ft³/min [127] ft³/h [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[124]	CFM	
[127] ft³/h [130] lbs / sec. [131] lbs / min. [132] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[125]	ft ³ /s	
[130] lbs / sec. [131] lbs / min. [132] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[126]	ft³/min	
[131] lbs / min. [132] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[127]		
[132] lbs / hr. [140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[130]	lbs / sec.	
[140] ft/s [141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[131]	lbs / min.	
[141] ft/min [145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[132]	lbs / hr.	
[145] ft [160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[140]	ft/s	
[160] °F [170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[141]	ft/min	
[170] psi [171] lb/in² [172] in. wtr. gage [173] ft WG	[145]	ft	
[171] lb/in² [172] in. wtr. gage [173] ft WG	[160]	°F	
[172] in. wtr. gage [173] ft WG	[170]		
[173] ft WG	[171]	lb/in²	
	[172]	in. wtr. gage	
[180] HP	[173]	ft WG	
	[180]	HP	

0-31 Min Value of User-defined Readout		
Range:		Function:
0 CustomRea-	[-999999.99 -	This parameter sets the
doutUnit*	par. 0-32	min. value of the custom
	CustomRea-	defined readout (occurs at
	doutUnit]	zero speed). Only possible
		to set different from 0 is
		when selecting a linear unit

6-6 BAS-SVX60A-EN



0-31 Min Value of User-defined Readout	
Range:	Function:
	in 0-30 Unit for User-defined
	Readout. For Quadratic and
	Cubic units the minimum
	value will be 0.

0-32 Custom Readout Max Value			
Range:		Function:	
100 CustomRea-	[par. 0-31 -	This parameter sets the max	
doutUnit*	999999.99	value to be shown when	
	CustomRea-	the speed of the motor has	
	doutUnit]	reached the set value for	
		4-13 Motor Speed High Limit	
		[RPM] or 4-14 Motor Speed	
		High Limit [Hz] (depends on	
		setting in 0-02 Motor Speed	
		Unit).	

6.2.4 0-4* LCP Keypad

Enable and disable individual keys on the LCP keypad.

0-4	0-40 [Hand on] Key on LCP			
Option:		Function:		
		If 0-40 [Hand on] Key on LCP is included in the Quick Menu, then define the password in 0-65 Quick Menu Password.		
[0]	Disabled	Prevents accidental start of the frequency converter in Hand mode.		
[1]	Enabled	Prevents unauthorised start in Hand mode.		
[2]	Password			

0-41 [Off] Key on LCP

Option: Function:

Options are the same as in 0-40 [Hand on] Key on LCP.

0-42 [Auto on] Key on LCP

Option: Function:

Options are the same as in 0-40 [Hand on] Key on LCP.

0-43 [Reset] Key on LCP

Option: Function:

Options are the same as in 0-40 [Hand on] Key on LCP.

6.2.5 0-5* Copy/Save

Copy parameter settings between setups and to/from the LCP.

Ontion	Francticus.
0-50 LCP Copy	

Option:		Function:
[0] *	No copy	
[1]	All to LCP	Copies all parameters in all setups from
		the frequency converter memory to the
		LCP memory.
[2]	All from LCP	Copies all parameters in all setups from
		the LCP memory to the frequency
		converter memory.
[3]	Size indep. from	Copies only the parameters that are
	LCP	independent of the motor size.

0-51 Setup Copy

Op	otion:	Function:
[0]	No сору	
[1]	Copy to setup 1	Copies all parameters in the present edit setup (defined in par. 0-11 Edit Setup) to Setup 1. Likewise, select the option corresponding to the other setup(s).
[2]	Copy to setup 2	
[3]	Copy to setup 3	
[4]	Copy to setup 4	
[9]	Copy to all	Copies the parameters in the present setup over to each of the setups 1 to 4.

6.2.6 0-6* Password

Define password access to menus.

0-60 Main Menu Password

Option:	Function:
[Size related] *	Define the password for access to the Main Menu via the [Main Menu] key. If 0-61 Access to Main Menu w/o Password is set to [0] Full access, this parameter will be ignored.
	Menu via the [Main Menu] key. If 0-61 Access to
	Main Menu w/o Password is set to [0] Full access,
	this parameter will be ignored.

0-60 Main Menu Password		
Range:		Function:
100 *	[0 - 999]	

0-65 Quick Menu Password

Option: Function:

Define the password for access to the Quick Menu via the [Quick Menu] key. If 0-66 Access to Quick Menu w/o Password is set to [0] Full access, this parameter will be ignored.

0-66 Access to Quick Menu w/o Password

Option:	Function:
	NOTE!
	If 0-61 Access to Main Menu w/o Password is set to [0] Full access, this parameter will be ignored.



0-66 Access to Ouick Menu w/o l	

Option:		Function:
[0] *	Full access	Disables the password defined in 0-65 Quick
		Menu Password.
[1]	Read only	Prevents unauthorized editing of Quick Menu
		parameters.
[2]	No access	Prevents unauthorized viewing and editing of
		Quick Menu parameters.

6-8 BAS-SVX60A-EN



6.3 Parameters: 1-** Load and Motor

6.3.1 1-0* General Settings

Define whether the frequency converter operates in speed mode or torque mode; and whether the internal PID control should be active or not. All parameters from 1-01 Motor Control Principle (included) to 1-81 Min Speed for Function at Stop [RPM] (included) are read only. Only 1-13 Compressor Selection remains accessible for compressor selection.

1-00	1-00 Configuration Mode		
Opt	ion:	Function:	
		NOTE!	
		This parameter cannot be adjusted while the motor is running.	
		Select the application control principle to be used when a Remote Reference (via analog input) is active. A Remote Reference can only be active when 3-13 Reference Site is set to [0] or [1].	
[0] *	Speed open loop	Enables speed control (without feedback signal from motor) to the input signal over the compressor speed range.	
[3]	Process	Enables the use of process control in the frequency converter. The process control parameters are set in parameter groups 7-2* Process PID Feedback and 7-3* Process PID Control.	

1-13 Compressor Selection

Range:		Function:
		The default setting of most of the parameters
		in the frequency converter (e.g. motor data,
		limits, ramps etc.) depends upon the
		compressor and system refrigerant selected for
		the frequency converter.
		The frequency converter selects the default
		compressor based upon the power size and
		voltage range for the frequency converter.
		Under normal circumstances this should not
		be changed. During test/repair situations a
		different compressor can be selected – or if
		the system is not using the default refrigerant.
		NOTE!
		If the compressor selection is changed,
		then all dependent parameters reset to
		default and any user settings will be lost.
Size	[]	Select the compressor/refrigerant combination
dependent.		for the system.



6.4 Parameters: 3 -** Reference/Ramps

6.4.1 3-0* Reference Limits

Parameters for reference handling, definition of limitations, and configuration of the reaction of the frequency converter to changes.

3-00 Reference Range

Option:		Function:
		Select the range of the reference signal and
		the feedback signal. Signal values can be
		positive only, or positive and negative. The
		minimum limit may have a negative value,
		unless [1] Speed closed loop control is selected
		in 1-00 Configuration Mode.
[0] *	Min Max	For positive values only
[1]	-Max -	For both positive and negative values
	+Max	

3-01 Reference/Feedback Unit

Optio	on:	Function:
		Select the unit to be used in Process PID Control
		references and feedbacks.
[0]	None	
[71] *	bar	
[60]	°C	
[160]	°F	
[170]	psi	

3-02 Minimum Reference

Option: Function:

Enter the minimum reference. The minimum reference is the lowest value obtainable by summing all references. Minimum reference is active only when 3-00 Reference Range is set to [0] Min.- Max..

The minimum reference unit matches:

- The choice of configuration in 1-00 Configuration Mode: for [1] Speed closed loop.
- The unit selected in 3-01 Reference/Feedback Unit.

3-03 Maximum Reference

Optio	n:	Function:
		Enter the maximum reference.

3-10 Preset Reference

Array [8]

0.00%*	[-100.00	Must remain 0 for Open Loop Control.
	- 100.00	The preset reference is stated as a percentage
	%]	of the value Ref _{MAX} (3-03 Maximum Reference)

or as a percentage of the other external references. If a Ref_{MIN} 0 (*3-02 Minimum Reference*) is programmed, the preset reference is calculated as a percentage of the full reference range, i.e. on the basis of the difference between Ref_{MAX} and Ref_{MIN}. Afterwards, the value is added to Ref_{MIN}. When using preset references, select [16] *Preset ref. bit 0,* [17] *Preset ref. bit 1* or [18] *Preset ref. bit 2* for the corresponding digital inputs in parameter group *5-1* Digital Inputs*.

3-12 Catch up/slow-down value

Range:		Function:
0 %*	[0 -	Enter a percentage (relative) value to be either
	100 %]	added to or deducted from the actual reference
		for Catch up or Slow down respectively. If Catch
		up is selected via one of the digital inputs
		(5-10 Terminal 18 Digital Input to 5-15 Terminal 33
		Digital Input), the percentage (relative) value is
		added to the total reference. If Slow down is
		selected via one of the digital inputs
		(5-10 Terminal 18 Digital Input to 5-15 Terminal 33
		Digital Input), the percentage (relative) value is
		deducted from the total reference. Obtain
		extended functionality with the DigiPot function.
		See parameter group 3-9* Digital Potentiometer.

3-13 Reference Site

Option: Function:

		Select which reference site to activate.
[0] Linked to		Use the local reference when in Hand mode;
	Hand / Auto	or the remote reference when in Auto mode
[1]	Remote	Use the remote reference in both Hand
		mode and Auto mode
[2]	Local	Use the local reference in both Hand mode
		and Auto mode

3-14 Preset Relative Reference

Range: Function:

0.00%*	[-100.00 -	Define a fixed value (in %) to be added to
	100.00 %]	the variable value (defined in 3-18 Relative
		Scaling Reference Source). The sum of the
		fixed and variable values is multiplied with
		the actual reference. This product is then
		added to the actual reference (X+X*Y/100)
		to give the resultant actual reference.

3-15 Reference Resource 1

Option:	Function
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	NOTE!
	This parameter cannot be adjusted
	while the motor is running.

6-10 BAS-SVX60A-EN



3-15	Reference Resour	ce 1
Opt	ion:	Function:
		Select the reference input to be used
		for the first reference signal.
		3-15 Reference Resource 1,
		3-16 Reference Resource 2 and
		3-17 Reference Resource 3 define up to
		three different reference signals. The
		sum of these reference signals defines
		the actual reference.
[0]	No function	
[1] *	Analog input 53	
[2]	Analog input 54	
[7]	Frequency input 29	
[8]	Frequency input 33	
[11]	Local bus reference	

3-16 Reference Resource 2

[20] Digital pot.meter

Option:		Function:
		NOTE!
		This parameter cannot be adjusted while the motor is running.
		Select the reference input to be used for the
		second reference signal. Parameters
		3-15 Reference Resource 1, 3-16 Reference
		Resource 2 and 3-17 Reference Resource 3
		define up to three different reference signals.
		The sum of these reference signals defines the
		actual reference.
		Same options as 3-15 Reference Resource 1.
[0] *	No	
	function	

3-17 Reference Resource 3

Option:		Function:
		NOTE!
		This parameter cannot be adjusted while the motor is running.
		Select the reference input to be used for the
		third reference signal. 3-15 Reference Resource
		1, 3-16 Reference Resource 2 and 3-17 Reference
		Resource 3 define up to three different
		reference signals. The sum of these reference
		signals defines the actual reference.
		Same options as 3-15 Reference Resource 1.
[0] *	No	
	function	

3-18 Relative Scaling Reference Resource

Opt	ion:	Function:
		Select a variable value to be added to the
		fixed value (defined in 3-14 Preset Relative

3-18	Relative S	caling Reference Resource
Option:		Function:
		Reference). The sum of the fixed and variab

Reference). The sum of the fixed and variable values is multiplied with the actual reference. This product is then added to the actual reference (X+X*Y/100) to give the resultant actual reference
Same options as 3-15 Reference Resource 1.

See also 3-80 Jog Ramp Time.

[0] * No function

3-40 Ramp 1 Type

Option:		Function:
		Select the ramp type, depending on requirements
		for acceleration/deceleration. A linear ramp will give
		constant acceleration during ramping.
[0] *	Linear	

3-41 Ramp Up Time Running (sec) Range: Function:

3-42 Ramp 1 Ramp Down Time			
Range: Function:			
Size related*	[0.01 - 3600 s]		

3-:	3-50 Ramp 2 Type		
Op	otion:	Function:	
		Select the ramp type, depending on requirements for acceleration/deceleration. A linear ramp will give constant acceleration during ramping. An S-ramp will give non-linear acceleration, compensating for jerk in the application.	
[0]	Linear		
[1]	S-ramp Const Jerk	Acceleration with lowest possible jerk	
[2]	S-ramp Const Time	S-ramp based on the values set in 3-51 Ramp 2 Ramp-up Time and 3-52 Ramp 2 Ramp-down Time	



NOTE!

If [1] S-ramp Const Jerk is selected and the reference during ramping is changed the ramp time may be prolonged in order to realize a jerk free movement which may result in a longer start or stop time.

Additional adjustment of the S-ramp ratios or switching initiators may be necessary.

3-51 Ramp 2 Ramp-up Time		
Range:		Function:
Size	[0.01	Enter the ramp-up time, i.e. the acceleration
related*	- 3600	time from 0 RPM to the rated motor speed
	s]	n _s . Choose a ramp-up time such that the
		output current does not exceed the current
		limit in 4-18 Current Limit during ramping.
		The value 0.00 corresponds to 0.01 s in
		speed mode. See ramp-down time in
		3-52 Ramp 2 Ramp-down Time.
		$Par. 3 - 51 = \frac{t_{acc}[s] \times n_{s}[RPM]}{ref[RPM]}$

3-52 Ramp 2 Ramp-down Time		
Range:		Function:
Size	[0.01	Enter the ramp-down time, i.e. the
related*	- 3600	deceleration time from the rated motor speed
	s]	n₅ to 0 RPM. Choose a ramp-down time such
		that no over-voltage arises in the inverter due
		to regenerative operation of the motor, and
		such that the generated current does not
		exceed the current limit set in 4-18 Current
		Limit. The value 0.00 corresponds to 0.01 s in
		speed mode. See ramp-up time in 3-51 Ramp
		2 Ramp-up Time.
		$Par. 3 - 52 = \frac{t_{dec}[s] \times n_s[RPM]}{ref[RPM]}$

3-0	3-60 Ramp 3 Type		
Op	otion:	Function:	
		Select the ramp type, depending on requirements for acceleration and deceleration. A linear ramp will give constant acceleration during ramping. An S-ramp will give non-linear acceleration, compensating for jerk in the application.	
[0]	Linear		
[1]	S-ramp Const Jerk	Accelerates with lowest possible jerk.	
[2]	S-ramp Const Time	S-ramp based on the values set in 3-61 Ramp 3 Ramp-up Time and 3-62 Ramp 3 Ramp-down Time	

NOTE!

If [1] S-ramp Const Jerk is selected and the reference during ramping is changed the ramp time may be prolonged in order to realize a jerk free movement which may result in a longer start or stop time.

Additional adjustment of the S-ramp ratios or switching initiators may be necessary.

3-61 Ramp 3 Ramp-up Time			
Range:		Function:	
Size related*	[0.01 - 3600 s]	Enter the ramp-up time, i.e. the acceleration time from 0 RPM to the rated motor speed n _s . Choose a ramp-up time such that the output current does not exceed the current limit in 4-18 Current Limit during ramping. The value 0.00 corresponds to 0.01 s in	
		speed mode. See ramp-down time in 3-62 Ramp 3 Ramp-down Time.	

3-62 Ra	52 Ramp 3 Ramp-down Time		
Range:		Function:	
Size	[0.01	Enter the ramp-down time, i.e. the	
related*	- 3600	deceleration time from the rated motor speed	
	s]	n _s to 0 RPM. Choose a ramp-down time such	
		that no over-voltage arises in the inverter due	
		to regenerative operation of the motor, and	
		such that the generated current does not	
		exceed the current limit set in 4-18 Current	
		Limit. The value 0.00 corresponds to 0.01 s in	
		speed mode. See ramp-up time in 3-61 Ramp	
		3 Ramp-up Time.	
		$Par. 3 - 62 = \frac{t_{dec}[s] \times n_s[RPM]}{ref[RPM]}$	

3-7	3-70 Ramp 4 Type			
Op	otion:	Function:		
		Select the ramp type, depending on requirements for acceleration and deceleration. A linear ramp will give constant acceleration during ramping. An S-ramp will give non-linear acceleration, compensating for jerk in the application		
[0]	Linear			
[1]	S-ramp Const Jerk	Accelerates with lowest possible jerk.		
[2]	S-ramp Const Time	S-ramp based on the values set in 3-71 Ramp 4 Ramp-up Time and 3-72 Ramp 4 Ramp-down Time.		

6-12 BAS-SVX60A-EN



NOTE!

If [1] S-ramp Const Jerk is selected and the reference during ramping is changed the ramp time may be prolonged in order to realize a jerk free movement which may result in a longer start or stop time.

Additional adjustment of the S-ramp ratios or switching initiators may be necessary.

3-71 Ramp 4 Ramp-up Time		
Range:		Function:
Size	[0.01	Enter the ramp-up time, i.e. the acceleration
related*	- 3600	time from 0 RPM to the rated motor speed
	s]	ns. Choose a ramp-up time such that the
		output current does not exceed the current
		limit in 4-18 Current Limit during ramping.
		The value 0.00 corresponds to 0.01 s in
		speed mode. See ramp-down time in
		3-72 Ramp 4 Ramp-down Time.
		$Par. 3 - 71 = \frac{t_{acc}[s] \times n_{s}[RPM]}{ref[RPM]}$

3-72 Ramp 4 Ramp-down Time		
Range:		Function:
Size	[0.01	Enter the ramp-down time, i.e. the
related*	- 3600	deceleration time from the rated motor speed
	s]	n₅ to 0 RPM. Choose a ramp-down time such
		that no over-voltage arises in the inverter due
		to regenerative operation of the motor, and
		such that the generated current does not
		exceed the current limit set in 4-18 Current
		Limit. The value 0.00 corresponds to 0.01 s in
		speed mode. See ramp-up time in 3-71 Ramp
		4 Ramp-up Time.
		$Par. 3 - 72 = \frac{t_{dec}[s] \times n_s[RPM]}{ref[RPM]}$

3-80 Jog Ramp Time		
Range:		Function:
Size related*	[0.01 - 3600 s]	Enter the jog ramp time, i.e. the acceleration/deceleration time between 0 RPM and the rated motor frequency n _s . Ensure that the resultant output current required for the given jog ramp time does not exceed the current limit in 4-18 Current Limit. The jog ramp time starts upon activation of a jog signal via the keypad, a selected digital input, or the serial communication port. When jog state is disabled then the normal ramping times are valid.

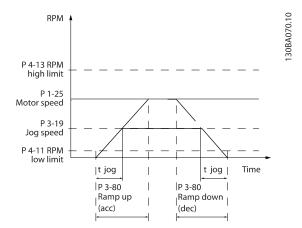


Figure 6.5 Jog Ramp Time

$$Par. 3 - 80 = \frac{t_{jog}[s] \times n_{s}[RPM]}{\Delta \ jog \ speed \ (par. 3 - 19)[RPM]}$$

3-81 Quick Stop Ramp Time		
Range:		Function:
Size related*	[0.01 - 3600 s]	Enter the quick–stop ramp-down time, i.e. the deceleration time from the synchronous motor speed to 0 RPM. Ensure that no resultant over-voltage will arise in the inverter due to regenerative operation of the motor required to achieve the given ramp-down time. Ensure also that the generated current required to achieve the given ramp-down time does not exceed the current limit (set in 4-18 Current Limit). Quick-stop is activated by means of a signal on a selected digital input, or via the serial communication port.

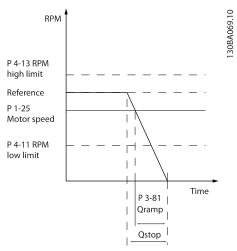


Figure 6.6 Quick Stop Ramp Time



6.5 Parameters: 4-** Limits/Warnings

6.5.1 4-1* Motor Limits

Define torque, current and speed limits for the motor, and the reaction of the frequency converter when the limits are exceeded.

A limit may generate a message on the display. A warning will always generate a message on the display or on the fieldbus. A monitoring function may initiate a warning or a trip, upon which the frequency converter will stop and generate an alarm message.

4-2	4-20 Torque Limit Factor Source		
Opt	tion:	Function:	
		Select an analog input for scaling the	
		settings in 4-16 Torque Limit Motor	
		Mode and 4-17 Torque Limit Generator	
		Mode from 0% to 100% (or inverse).	
		The signal levels corresponding to 0%	
		and 100% are defined in the analog input scaling, e.g. parameter group	
		6-1* Analog Input 1. This parameter is	
		only active when 1-00 Configuration	
		Mode is in Speed Open Loop or Speed	
		Closed Loop.	
[0]	No function		
[2]	Analog in 53		
[4]	Analog in 53 inv		
[6]	Analog in 54		
[8]	Analog in 54 inv		
[10]	Analog in X30-11		
[12]	Analog in X30-11		
	inv		
[14]	Analog in X30-12		
[16]	Analog in X30-12		
	inv		

Option: Select an analog input for scaling the settings in 4-19 Max Output Frequency from 0% to 100% (or vice versa). The signal levels corresponding to 0% and 100% are defined in the analog input scaling, e.g. parameter group 6-1* Analog Input 1. This parameter is only active when 1-00 Configuration Mode is in Torque Mode.

4-21 Speed Limit Factor SourceOption

No function

Analog input 53

[2]

4-21 Speed Limit Factor SourceOption		
Opt	ion:	Function:
[4]	Analog input 53 inv	
[6]	Analog input 54	
[8]	Analog input 54 inv	
[10]	Analog input X30-11	
[12]	Analog input X30-11	
	inv	
[14]	Analog input X30-12	
[16]	Analog input X30-12	
	inv	

6.5.2 4-5* Adjustable Warnings

Use these parameters to adjust warning limits for current, speed, reference and feedback.

Warnings are shown on the keypad, and can be programmed to be outputs or to be read out via serial bus in the Extended Status Word.

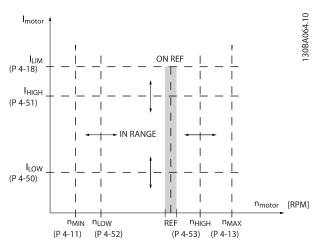


Figure 6.7 Adjustable Warnings

4-50	4-50 Warning Current Low			
Ran	ge:	Function:		
0 A*	[0 - par. 4-51 A]	Enter the I _{LOW} value. When the motor current falls below this limit, the display reads <i>Current Low</i> . The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02. Refer to <i>Figure 6.7</i> .		

6-14 BAS-SVX60A-EN



4-51 Warning Current High			
Range:	Function:		
Size	[par. 4-50	Enter the I _{HIGH} value. When the motor	
related*	- par. 16-37	current exceeds this limit, the display	
	A]	reads Current High. The signal outputs	
		can be programmed to produce a	
		status signal on terminal 27 or 29 and	
		on relay output 01 or 02.	

4-52 Warning Speed Low		
Range:	Function:	
Size	[0 - par.	Enter the n _{LOW} value. When the motor
related*	4-53 RPM]	speed exceeds this limit, the display
		reads Speed Low. The signal outputs
		can be programmed to produce a
		status signal on terminal 27 or 29 and
		on relay output 01 or 02.

4-53 Warning Speed High		
Range:	Function:	
Size	[par.	Enter the n _{HIGH} value. When the motor
related*	4-52 -	speed exceeds this limit, the display
	60000	reads Speed High. The signal outputs can
	RPM]	be programmed to produce a status
		signal on terminal 27 or 29 and on relay
		output 01 or 02. Program the upper
		signal limit of the motor speed, nнідн,
		within the normal working range of the
		frequency converter.

4-54 Warning Reference Low		
Range:		Function:
-999999.999 *	[-999999.999 -	Enter the lower reference limit.
	par. 4-55]	When the actual reference falls
		below this limit, the display
		indicates <i>Ref_{LOW}</i> . The signal
		outputs can be programmed to
		produce a status signal on
		terminal 27 or 29 and on relay
		output 01 or 02.

4-55 Warning Reference High		
Range:		Function:
999999.999 *	[par. 4-54 - 999999.999]	Enter the upper reference limit. When the actual reference exceeds this limit, the display reads Ref High. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02.

4-56 Warning Feedback Low			
Range:		Function:	
-999999.999 ReferenceFeed- backUnit*	[-999999.999 - par. 4-57 ReferenceFeed- backUnit]	Enter the lower feedback limit. When the feedback falls below this limit, the display reads Feedb Low. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or	
		02.	

4-57 Warning Feedback High			
Range:		Function:	
999999.999 ReferenceFeed- backUnit*	[par. 4-56 - 999999.999 ReferenceFeed- backUnit]	Enter the upper feedback limit. When the feedback exceeds this limit, the display reads Feedb High. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02.	

4-58 Missing Motor Phase Function

Displays alarm 30, 31 or 32 in the event of a missing motor phase. It is strongly recommended to enable to avoid motor damage.

Option:		Function:
[0]	Off	No alarm is displayed if a
		missing motor phase
		occurs.
[1]	On	

6.5.3 4-6* Speed Bypass

Some systems call for avoiding certain output frequencies or speeds, due to resonance problems in the system. A maximum of four frequency or speed ranges can be avoided.

4-60 Bypass Speed From [RPM]			
Array [4]			
Range:		Function:	
Size related*	[0 - par. 4-13	Some systems call for avoiding certain output speeds due to	
	RPM]	certain output speeds due to	
		resonance problems in the system.	



4-60 Bypass Speed From [RPM]			
Array [4]	Array [4]		
Range: Function:			
		Enter the lower limits of the speeds to be avoided.	

4-61 Bypass Speed From [Hz]					
Array [4]	Array [4]				
Range:	Range: Function:				
Size related*	[0 - par.	Some systems call for avoiding			
	4-14 Hz] certain output speeds due to				
	resonance problems in the system				
Enter the lower limits of the speed					
		to be avoided.			

4-62 Bypass Speed to [RPM]					
Array [4]	Array [4]				
Range:	Range: Function:				
Size related*	·····g-·				

4-63 Bypa:	4-63 Bypass Speed To [Hz]				
Array [4]	Array [4]				
Range:	Range: Function:				
Size related* [0 - par. Some systems call for avoiding certain output speeds due to		certain output speeds due to resonance problems in the system. Enter the upper limits of the			

6-16 BAS-SVX60A-EN



6.6 Parameters: 5-** Digital In/Out

6.6.1 5-** Digital In/Out

Parameter group for configuring the digital input and output.

6.6.2 5-0* Digital In/Out Mode

5-00 Digital In/Out Mode			
Opt	ion:	Function:	
		Digital inputs and programmed digital outputs are pre-programmable for operation either in PNP or NPN systems.	
[0] *	PNP	Action on positive directional pulses.	
[1]	NPN		

5-01 Terminal 27 Mode

Optio	on:	Function:
[0] *	Input	Defines terminal 27 as a digital input.
[1]	Output	Defines terminal 27 as a digital output.

NOTE!

This parameter cannot be adjusted while the motor is running.

5-02 Terminal 29 Mode			
Option:		Function:	
		Similar to Terminal 27	



6.6.3 5-1* Digital Inputs

Parameters for configuring the input functions for the input terminals.

The digital inputs are used for selecting various functions in the frequency converter. All digital inputs can be set to the following functions:

Digital input function	Select	Terminal
No operation	[0]	All *term 19, 29, 33
Reset	[1]	All *term 32
Coast inverse	[2]	All
Coast and reset inverse	[3]	All
Quick stop inverse	[4]	All
DC-brake inverse	[5]	All
Stop inverse	[6]	All *term 27
Start	[8]	All *term 18
Latched start	[9]	All
Reversing	[10]	All
Start reversing	[11]	All
Enable start forward	[12]	All
Enable start reverse	[13]	All
Jog	[14]	All
Preset reference on	[15]	All
Preset ref bit 0	[16]	All
Preset ref bit 1	[17]	All
Preset ref bit 2	[18]	All
Freeze reference	[19]	All
Freeze output	[20]	All
Speed up	[21]	All
Speed down	[22]	All
Setup select bit 0	[23]	All
Setup select bit 1	[24]	All
Catch up	[28]	All
Slow down	[29]	All
Pulse input	[32]	29, 33
Ramp bit 0	[34]	All
Ramp bit 1	[35]	All
Mains failure inverse	[36]	All
Day/night control	[39]	All
DigiPot Increase	[55]	All
DigiPot Decrease	[56]	All
DigiPot Clear	[57]	All
Counter A (up)	[60]	29, 33
Counter A (down)	[61]	29, 33
Reset Counter A	[62]	All
Counter B (up)	[63]	29, 33
Counter B (down)	[64]	29, 33
Reset Counter B	[65]	All
Lead pump start	[120]	All
Lead pump alternation	[121]	All
Comp. 1 Interlock	[130]	All
Comp. 2 Interlock	[131]	All

6-18 BAS-SVX60A-EN



Digital input function	Select	Terminal
Comp. 3 Interlock	[132]	All
Comp. 1 Inv. interlock	[139]	All
Comp. 2 Inv. interlock	[140]	All
Comp. 3 Inv. interlock	[141]	All

Table 6.5 Overview of Digital Inputs

Functions dedicated to only one digital input are stated in the associated parameter.

All digital inputs can be programmed to these functions:

[0]	No	No reaction to signals transmitted to the	
	operation	terminal.	
[1]	Reset	Resets frequency converter after a TRIP/	
		ALARM. Not all alarms can be reset.	
[2]	Coast	(Default Digital input 27): Coasting stop,	
	inverse	inverted input (NC). The frequency converter	
		leaves the motor in free mode. Logic '0' ⇒	
		coasting stop.	
[3]	Coast and	Reset and coasting stop Inverted input (NC).	
	reset inverse	Leaves motor in free mode and resets	
		frequency converter. Logic '0' ⇒ coasting stop	
F 43	Outal atau	and reset.	
[4]	Quick stop	Inverted input (NC). Generates a stop in	
	inverse	accordance with quick-stop ramp time set in	
		3-81 Quick Stop Ramp Time. When motor stops, the shaft is in free mode. Logic '0' ⇒	
		Quick-stop.	
[5]	DC-brake	Inverted input for DC braking (NC). Stops	
ردا	inverse	motor by energizing it with a DC current for	
		a certain time period. See 2-01 DC Brake	
		Current to 2-03 DC Brake Cut In Speed [RPM].	
		The function is only active when the value in	
		2-02 DC Braking Time is different from 0.	
		Logic '0' ⇒ DC braking.	
[6]	Stop inverse	Stop Inverted function. Generates a stop	
		function when the selected terminal goes	
		from logical level '1' to '0'. The stop is	
		performed according to the selected ramp	
		time (3-42 Ramp 1 Ramp Down Time,	
		3-52 Ramp 2 Ramp Down Time, 3-62 Ramp 3	
		Ramp down Time, 3-72 Ramp 4 Ramp Down	
		Time).	
		NOTE!	
		When the frequency converter is at the	
		torque limit and has received a stop	
		command, it may not stop by itself. To	
		ensure that the frequency converter	
		stops, configure a digital output to [27]	
		Torque limit & stop and connect this	
		digital output to a digital input that is	
		configured as coast.	

[8]	Start	(Default Digital input 18): Select start for a start/stop command. Logic '1' = start, logic '0' = stop.
[9]	Latched start	The motor starts, if a pulse is applied for min. 2 ms. The motor stops when Stop inverse is activated.
[10]	Reversing	(Default Digital input 19). Change the direction of motor shaft rotation. Select Logic '1' to reverse. The reversing signal only changes the direction of rotation. It does not activate the start function. Select both directions in 4-10 Motor Speed Direction. The function is not active in process closed loop.
[11]	Start reversing	Used for start/stop and for reversing on the same wire. Signals on start are not allowed at the same time.
[12]	Enable start forward	Rotates motor shaft clockwise at start.
[13]	Enable start reverse	Rotates motor shaft counterclockwise at start.
[14]	Jog	(Default Digital input 29): Use to activate jog speed. See <i>3-11 Jog Speed [Hz]</i> .
[15]	Preset reference on	Shifts between external reference and preset reference. It is assumed that [1] External/preset has been selected in 3-04 Reference Function. Logic '0' = external reference active; logic '1' = one of the eight preset references is active.
[16]	Preset ref bit 0	Preset ref. bit 0,1, and 2 enables a choice between one of the eight preset references according to <i>Table 6.6</i> .
[17]	Preset ref bit 1	Same as Preset ref bit 0 [16].
[18]	Preset ref bit 2	Same as Preset ref bit 0 [16].

Preset ref. bit	2	1	0
Preset ref. 0	0	0	0
Preset ref. 1	0	0	1
Preset ref. 2	0	1	0
Preset ref. 3	0	1	1
Preset ref. 4	1	0	0
Preset ref. 5	1	0	1
Preset ref. 6	1	1	0

Operating Instructions TRV200

Preset ref. 7	1	1	1 1	
I leact let. /	l l		i i	

Table 6.6 Reference Bits

[19]	Freeze ref	Freezes the actual reference, which is now the point of enable/condition for Speed up and Speed down to be used. If Speed up/down is used, the speed change always follows ramp 2 (3-51 Ramp 2 Ramp Up Time and 3-52 Ramp 2 Ramp Down Time) in the range 0 - 3-03 Maximum Reference.
[20]	Freeze output	Freezes the actual motor frequency (Hz), which is now the point of enable/condition for Speed up and Speed down to be used. If Speed up/down is used, the speed change always follows ramp 2 (3-51 Ramp 2 Ramp Up Time and 3-52 Ramp 2 Ramp Down Time) in the range 0 to 1-23 Motor Frequency. NOTE! When Freeze output is active, the frequency converter cannot be stopped via a low [8] start signal. Stop the frequency converter via a terminal programmed for [2] Coasting inverse or [3] Coast and reset, inverse.
[21]	Speed up	Select Speed up and Speed down if digital control of the up/down speed is desired (motor potentiometer). Activate this function by selecting either Freeze reference or Freeze output. When Speed up/down is activated for less than 400 ms the resulting reference will be increased/decreased by 0.1 %. If Speed up/down is activated for more than 400 ms the resulting reference will follow the setting in ramping up/down parameter 3-x1/3-x2.

	Shut down	Catch up
Unchanged speed	0	0
Reduced by %-value	1	0
Increased by %-value	0	1
Reduced by %-value	1	1

Table 6.7 Digital Speed Control

[22]	Speed down	Same as Speed up [21].	
[23]	Setup select	Select Setup select bit 0 or Select Setup	
	bit 0	select bit 1 to select one of the 4 setups.	
		Set <i>0-10 Active Setup</i> to Multi Setup.	
[24]	Setup select	(Default Digital input 32): Same as [23] Setup	
	bit 1	select bit 0.	
[28]	Catch up	Increases or reduces reference value set in	
		3-12 Catch up/slow Down Value.	
[29]	Slow down	[28] Same as Catch up.	
[30]	Counter input	Precise stop function in 1-83 Precise Stop	
		Function acts as Counter stop or speed	
		compensated counter stop with or without	
		reset. The counter value must be set in	
		1-84 Precise Stop Counter Value.	

[0.0]		11 1 11 6
[32]	Pulse input	Use pulse sequence as either reference or
		feedback. Scaling is done in parameter
		group 5-5* Pulse Input.
[34]	Ramp bit 0	Enables a choice between one of the 4
		ramps available, according to <i>Table 6.8</i> .
[35]	Ramp bit 1	Same as [34] Ramp bit 0.

Preset ramp bit	1	0
Ramp 1	0	0
Ramp 2	0	1
Ramp 3	1	0
Ramp 4	1	1

Table 6.8 Ramp Bits

[36]	Mains failure	Activates 14-10 Mains Failure. Mains
	inverse	failure inverse is active in the Logic .0.
		situation.
[39]	Day/Night	Reduce the max. frequency with the
	Control	setting in 28-74 Night Speed Drop [RPM].
[41]	Latched Precise	Sends a latched stop signal when the
	Stop inverse	precise stop function is activated in
		1-83 Precise Stop Function. The Latched
		Precise stop inverse function is available
		for terminals 18 or 19.
[55]	DigiPot Increase	INCREASE signal to the Digital Potenti-
		ometer function described in parameter
		group 3-9* Digital Potmeter.
[56]	DigiPot Decrease	DECREASE signal to the Digital Potenti-
		ometer function described in parameter
		group 3-9* Digital Potmeter
[57]	DigiPot Clear	Clears the Digital Potentiometer
		reference described in parameter group
		3-9* Digital Potmeter
[60]	Counter A	(Terminal 29 or 33 only) Input for
		increment counting in the SLC counter.
[61]	Counter A	(Terminal 29 or 33 only) Input for
		decrement counting in the SLC counter.
[62]	Reset Counter A	Input for reset of counter A.
[63]	Counter B	(Terminal 29 or 33 only) Input for
		increment counting in the SLC counter.
[64]	Counter B	(Terminal 29 or 33 only) Input for
		decrement counting in the SLC counter.
[65]	Reset Counter B	Input for reset of counter B.
[70]	Mech. Brake	Brake feedback for hoisting applications
	Feedback	
[71]	Mech. Brake	Inverted brake feedback for hoisting
	Feedback inv.	applications
[80]	PTC Card 1	All Digital Inputs can be set to [80] PTC
		Card 1. However, only one Digital Input
		must be set to this choice.
[121]	Lead Pump	
	Alternation	

6-20 BAS-SVX60A-EN





[130]	Compressor	Use with cascade controller. Logic 1 will
	Interlock	stop the fixed speed compressor and
		give a warning
[131]	Compressor	Use with cascade controller. Logic 1 will
	Interlock	stop the fixed speed compressor and
		give a warning
[132]	Compressor	Use with cascade controller. Logic 1 will
	Interlock	stop the fixed speed compressor and
		give a warning

5-10 Terminal 18 Digital Input

Option:	Function:
Option.	i uncuoni

[8] *	Start	Functions are described under parameter group 5-1*
		Digital Inputs

5-11 Terminal 19 Digital Input

Option:		Function:
[10] *	Reversing	Functions are described under parameter group
		5-1* Digital Inputs

5-12	Terminal 27 Digital Inp	out
Option:		Function:
[0] No operation		
[1]	Reset	
[2]	Coast inverse	Functions are described under parameter group 5-1* Digital Inputs
[3]	Coast and reset inv	
[4]	Quick stop inverse	
[5]	DC-brake inverse	
[6]	Stop inverse	
[8]	Start	
[9]	Latched start	
[10]	Reversing	
[11]	Start reversing	
[12]	Enable start forward	
[13] Enable start reverse		
[14]	Jog	
[15]	Preset reference on	
[16]	Preset ref bit 0	
[17]	Preset ref bit 1	
[18]	Preset ref bit 2	
[19]	Freeze reference	
[20]	Freeze output	
[21]	Speed up	
[22]	Speed down	
[23]	Set-up select bit 0	
[24]	Set-up select bit 1	
[28]	Catch up	
[29]	Slow down	
[34]	Ramp bit 0	
[35]	Ramp bit 1	
[36]	Mains failure inverse	

5-12 Terminal 27 Digital Input			
Opti	on:	Function:	
[39]	Day/Night Control		
[50]	ATEX thermistor monitor		
[55]	DigiPot increase		
[56]	DigiPot decrease		
[57]	DigiPot clear		
[58]	DigiPot Hoist		
[62]	Reset Counter A		
[65]	Reset Counter B		
[70]	Mech. Brake Feedb.		
[71]	Mech. Brake Feedb. Inv.		
[120]	Lead Comp. Start		
[121]	Lead Comp. Alternation		
[130]	Comp. 1 Interlock		
[131]	Comp. 2 Interlock		
[132]	Comp. 3 Interlock		
[139]	Comp. 1 Inv. Interlock		
[140]	Comp. 2 Inv. Interlock		
[141]	Comp. 3 Inv. Interlock		

5-13 Terminal 29 Digital Input

Option: Function:

		Select the function from the available
		digital input range and the additional
		options [60], [61], [63] and [64].
		Counters are used in Smart Logic
		Control functions.
[14] *	Jog	
[60]	Counter A (up)	
[61]	Counter A (down)	
[63]	Counter B (up)	
[64]	Counter B (down)	

5-14 Terminal 32 Digital Input

Option: Function:

		Select the function from the available digital input
		range.
	Reset	Functions are described under 5-1* Digital Inputs

5-15 Terminal 33 Digital Input

Option: Function:

		Select the function from the available digital
		input range and the additional options [60],
		[61], [63] and [64]. Counters are used in
		Smart Logic Control functions.
[0] *	No operation	Functions are described under 5-1* Digital
		Inputs

5-19	Terminal 37 Safe Stop	
Optio	n:	Function:
[1]	Safe Stop Alarm	
[3]	Safe Stop Warning	



5-19	Terminal 37 Safe Stop	
Optio	n:	Function:
[4]	PTC 1 Alarm	
[5]	PTC 1 Warning	
[6]	PTC 1 & Relay A	
[7]	PTC 1 & Relay W	
[8]	PTC 1 & Relay A/W	
[9]	PTC 1 & Relay W/A	

6.6.4 5-3* Digital Outputs

Parameters for configuring the output functions for the output terminals. The 2 solid-state digital outputs are common for terminals 27 and 29. Set the I/O function for terminal 27 in 5-01 Terminal 27 Mode, and set the I/O function for terminal 29 in 5-02 Terminal 29 Mode. Digital outputs appear if 5-01 Terminal 27 Mode or 5-02 Terminal 29 Mode are set to output.

NOTE!

These parameters cannot be adjusted while the motor is running.

NOTE!

Only for activating 24 V DC devices – restricted use for relays.

		The digital outputs can be programmed with these functions:
[0]	No operation	Default for all digital outputs and relay outputs
[1]	Control ready	The control board receives supply voltage.
[2]	Drive ready	The frequency converter is ready for operation and applies a supply signal on the control board.
[3]	Drive ready / remote control	The frequency converter is ready for operation and is in Auto On mode.
[4]	Stand-by / no warning	The frequency converter is ready for operation. No start or stop command is been given (start/disable). There are no warnings.
[5]	Running	The motor is running.
[6]	Running / no warning	The output speed is higher than the speed set in 1-81 Min Speed for Function at Stop [RPM]. The motor is running and there are no warnings.
[7]	Run on reference / no warning	The motor runs at reference speed.
[8]	Run in range / no warning	The motor runs in speed range.

[9]	Alarm	An alarm activates the output. There are
		no warnings.
[10]	Alarm or warning	An alarm or a warning activates the output.
[11]	At torque limit	The torque limit set in 4-16 Torque Limit
		Motor Mode or 1-17 Voltage filter time
		const. has been exceeded.
[12]	Out of current	The motor current is outside the range
	range	set in 4-18 Current Limit.
[13]	Below current,	The motor current is lower than set in
	low	4-50 Warning Current Low.
[14]	Above current,	The motor current is higher than set in
	high	4-51 Warning Current High.
[15]	Out of speed	The output speed is outside the range
	range	set in 4-52 Warning Speed Low and
		4-53 Warning Speed High.
[16]	Below speed,	The output speed is lower than the
	low	setting in 4-52 Warning Speed Low.
[17]	Above speed,	The output speed is higher than the
[4.0]	high	setting in 4-53 Warning Speed High.
[18]	Out of	The feedback is outside the range set in
	feedback range	4-56 Warning Feedback Low and
[10]	Below feedback	4-57 Warning Feedback High. The feedback is below the limit set in
[19]	low	4-56 Warning Feedback Low.
[20]	Above	The feedback is above the limit set in
[20]	feedback high	4-57 Warning Feedback High .
[21]	Thermal	The thermal warning turns on when the
[21]	warning	temperature exceeds the limit in the
		motor, the frequency converter, the brake
		resistor, or the thermistor.
[25]	Reverse	Reversing. Logic '1' = relay activated, 24 V
		DC when CW rotation of the motor. Logic
		'0' = relay not activated, no signal, when
		CCW rotation of the motor.
[26]	Bus OK	Active communication (no time-out) via
		the serial communication port.
[27]	Torque limit	Use in performing a coasting stop and in
	and stop	torque limit condition. If the frequency
		converter has received a stop signal and
		is at the torque limit, the signal is Logic
		′0′.
[28]	Brake, no	The brake is active and there are no
	warning	warnings.
[29]	Brake ready, no	The brake is ready for operation and
[20]	fault	there are no faults.
[30]	Brake fault	The output is Logic '1' when the brake
	(IGBT)	IGBT is short-circuited. Use this function
		to protect the frequency converter if there is a fault on the brake modules.
		Use the output/relay to cut out the main
		voltage from the frequency converter.
		ge nom the nequency converter.

6-22 BAS-SVX60A-EN

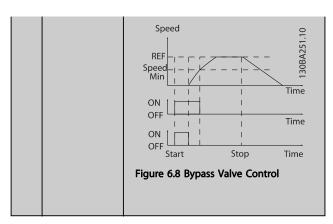


	1	
[33]	Safe Stop Active	Indicates that the safe stop on terminal 37 is active.
[35]	External	External Interlock function has been
	Interlock	activated via one of the digital inputs.
[40]	Out of ref	Active when the actual speed is outside
	range	the settings in 4-52 Warning Speed Low to
		4-55 Warning Reference High.
[41]	Below	Active when the actual speed is below
	reference low	the speed reference setting.
[42]	Above	Active when the actual speed is above
	reference high	the speed reference setting.
[45]	Bus Ctrl	Control output via bus. The state of the
		output is set in 5-90 Digital & Relay Bus
		Control. The output state is retained in
		the event of bus time-out.
[46]	Bus Ctrl 1 if	Controls output via bus. The state of the
	timeout	output is set in 5-90 Digital & Relay Bus
		Control. In the event of bus time-out the
		output state is set low (On).
[47]	Bus Ctrl 0 if	Controls output via bus. The state of the
,	timeout	output is set in 5-90 Digital & Relay Bus
		Control. In the event of bus time-out the
		output state is set low (Off).
[55]	Pulse output	
[60]	Comparator 0	See parameter group 13-1* Comparators.
[00]	Comparator	If Comparator 0 is evaluated as TRUE, the
		output will go high. Otherwise, it will be
		low.
[61]	Comparator 1	See parameter group 13-1* Comparators.
		If Comparator 2 is evaluated as TRUE, the
		output will go high. Otherwise, it will be
		low.
[62]	Comparator 2	See parameter group 13-1* Comparators.
	·	If Comparator 2 is evaluated as TRUE, the
		output will go high. Otherwise, it will be
		low.
[63]	Comparator 3	See parameter group 13-1* Comparators.
		If Comparator 3 is evaluated as TRUE, the
		output will go high. Otherwise, it will be
		low.
[64]	Comparator 4	See parameter group 13-1* Comparators.
		If Comparator 4 is evaluated as TRUE, the
		output will go high. Otherwise, it will be
		low.
[65]	Comparator 5	See parameter group 13-1* Comparators.
-	·	If Comparator 4 is evaluated as TRUE, the
		output will go high. Otherwise, it will be
		low.
[70]	Logic Rule 0	See parameter group 13-4* Logic Rules. If
		Logic Rule 0 is evaluated as TRUE, the
		output will go high. Otherwise, it will be
		low.
[71]	Logic Rule 1	See parameter group 13-4* Logic Rules If
-		Logic Rule 1 is evaluated as TRUE, the
1	I	i =

		output will go high. Otherwise, it will be low.
[72]	Logic Rule 2	See parameter group 13-4* Logic Rules. If Logic Rule 2 is evaluated as TRUE, the output will go high. Otherwise, it will be low.
[73]	Logic Rule 3	See parameter group 13-4* Logic Rules. If Logic Rule 3 is evaluated as TRUE, the output will go high. Otherwise, it will be low.
[74]	Logic Rule 4	See parameter group 13-4* Logic Rules. If Logic Rule 4 is evaluated as TRUE, the output will go high. Otherwise, it will be low.
[75]	Logic Rule 5	See parameter group 13-4* Logic Rules. If Logic Rule 5 is evaluated as TRUE, the output will go high. Otherwise, it will be low.
[80]	SL Digital Output A	See 13-52 SL Controller Action. The input will go high whenever the Smart Logic Action [38] Set dig. out. A high is executed. The input will go low whenever the Smart Logic Action [32] Set dig. out. A low is executed.
[81]	SL Digital Output B	See 13-52 SL Controller Action. The input will go high whenever the Smart Logic Action [39] Set dig. out. A high is executed. The input will go low whenever the Smart Logic Action [33] Set dig. out. A low is executed.
[82]	SL Digital Output C	See 13-52 SL Controller Action. The input will go high whenever the Smart Logic Action [40] Set dig. out. A high is executed. The input will go low whenever the Smart Logic Action [34] Set dig. out. A low is executed.
[83]	SL Digital Output D	See 13-52 SL Controller Action. The input will go high whenever the Smart Logic Action [41] Set dig. out. A high is executed. The input will go low whenever the Smart Logic Action [35] Set dig. out. A low is executed.
[84]	SL Digital Output E	See 13-52 SL Controller Action. The input will go high whenever the Smart Logic Action [42] Set dig. out. A high is executed. The input will go low whenever the Smart Logic Action [36] Set dig. out. A low is executed.
[85]	SL Digital Output F	See 13-52 SL Controller Action. The input will go high whenever the Smart Logic Action [43] Set dig. out. A high is executed. The input will go low whenever the Smart Logic Action [37] Set dig. out. A low is executed.



[122]	No alawa	The custometic binds when no plant in
[122]	No alarm	The output is high when no alarm is
		present.
[123]	Start command	The output is high when there is an
	active	active Start command (i.e. via digital
		input bus connection or [Hand on] or
		[Auto on], and no Stop or Start command
		is active.
[124]	Running	The output is high when the frequency
	reverse	converter is running counter clockwise
		(the logical product of the status bits
		'running' AND 'reverse').
[125]	Drive in hand	The output is high when the frequency
	mode	converter is in Hand on mode (as
		indicated by the LED light above [Hand
		on].
[126]	Drive in auto	The output is high when the frequency
[120]	mode	converter is in Hand on mode (as
	mode	indicated by the LED light above [Auto
		onl.
[139]	Compressor	•
[139]	· •	Use with cascade controller. Logic will
	Inv. Interlock	stop the fixed speed compressor and
		give a warning.
[140]	Compressor	Use with cascade controller. Logic will
	Inv. Interlock	stop the fixed speed compressor and
		give a warning.
[141]	Compressor	Use with cascade controller. Logic will
	Inv. Interlock	stop the fixed speed compressor and
		give a warning.
[195]	Bypass Valve	The bypass valve control (Digital/Relay
	Control	output in the frequency converter) is
		used for compressor systems to unload
		the compressor during start-up by using
		a bypass valve. After the start command
		is given the bypass valve will be open
		until the frequency converter reaches
		4-11 Motor Speed Low Limit [RPM]). After
		the limit has been reached the bypass
		valve will be closed, allowing the
		compressor to operate normally. This
		procedure will not be activated again
		before a new start is initiated and the
		frequency converter speed is zero during
		the receiving of start signal. 1-71 Start
		Delay can be used in order to delay the
		motor start. The bypass valve control
		principle:
		p



The below setting options are all related to the Cascade Controller.

Wiring diagrams and settings for parameter, see parameter group 25-** Cascade Pack Controller or more details.

6.6.5 5-4* Relays (Dry Contacts)

NOTE!

Relays 7, 8, and 9 are only available if MCB 105 relay card is installed.

NOTE!

Relay 1 is dedicated to controlling the solenoid valve.

Parameters for configuring the timing and the output functions for the relays.

5-40 Function Relay

Array [8] (Relay 1 [0], Relay 2 [1], Relay 7 [6], Relay 8 [7], Relay 9 [8])

[0]	No Operation	
[1]	Control Ready	
[2]	Drive Ready	
[3]	Drive Ready/Remote	
[4]	Stand-by/No Warning	
[5] *	Running	
[6]	Running/No Warning	
[8]	Run on Ref./No Warning	
[9]	Alarm	
[10]	Alarm or Warning	
[11]	At Torque Limit	
[12]	Out of Current Range	
[13]	Below Current, low	
[14]	Above Current, high	
[15]	Out of Speed Range	
[16]	Below Speed, low	
[17]	Above Speed, high	
[18]	Out of Feedb. Range	

6-24 BAS-SVX60A-EN



[19]	Below Feedback, low		
[20]	Above Feedback, high		
[21]	Thermal Warning		
[22]	Ready, no thermal w		
[25]	Reverse		
[26]	Bus OK		
[27]	Torque Limit & Stop		
[28]	Brake, No Warning		
[29]	Brake Ready, No Fault		
[30]	Brake Fault (IGBT)		
[31]	Relay 123		
[32]	Mech brake ctrl		
[33]	Safe stop active		
[35]	External Interlock		
[36]	Control Word Bit 11		
[37]	Control Word Bit 12		
[40]	Out of Ref. Range		
[41]	Below Reference, low		
[42]	Above Ref. high		
[45]	Bus ctrl		
[46]	Bus ctrl, 1 if timeout		
[47]	Bus ctrl, 0 if timeout		
[60]	Comparator 0		
[61]	Comparator 1		
[62]	Comparator 2		
[63]	Comparator 3		
[64]	Comparator 4		
[65]	Comparator 5		
[70]	Logic Rule 0		
[71]	Logic Rule 1		
[72]	Logic Rule 2		
[73]	Logic Rule 3		
[74]	Logic Rule 4		
[75]	Logic Rule 5		
[80]	SL Digital Output A		
[81]	SL Digital Output B		
[82]	SL Digital Output C		
[83]	SL Digital Output D		
[84]	SL Digital Output E		
[85]	SL Digital Output F		
[120]	Local Ref. Active		
[121]	Remote Ref. Active		
[122]	No Alarm		
[123]	Start Cmd. Active		
[124]	Running Reverse		
[125]	Drive in Hand Mode		
[126]	Drive in Auto Mode		
[195]	Bypass Valve Control		
[211]	Cascade Compressor 1		
[212]	Cascade Compressor 2		
[213]	Cascade Compressor 3		
		_	

5-50 Term. 29 Low Frequency		
Range: Function:		Function:
100 Hz*	[0 - 110000	Enter the low frequency limit
	Hz]	corresponding to the low motor shaft
		speed (i.e. low reference value) in
		5-52 Term. 29 Low Ref./Feedb. Value.
		Refer to the diagram in this section.

5-51 Term. 29 High Frequency		
Range:		Function:
100 Hz*	[0 - 110000	Enter the high frequency limit
	Hz]	corresponding to the high motor shaft
		speed (i.e. high reference value) in
		5-53 Term. 29 High Ref./Feedb. Value.

5-52 Term. 29 Low Ref./Feedb. Value		
Range:		Function:
0 ReferenceFeed-backUnit*	[-99999.999 - 999999.999 ReferenceFeed- backUnit]	Enter the low reference value limit for the motor shaft speed [RPM]. This is also the lowest feedback value, see also 5-57 Term. 33 Low Ref./ Feedb. Value. Set terminal 29 to digital input (5-02 Terminal 29 Mode = [0] input (default) and 5-13 Terminal 29 Digital
		<i>Input</i> = applicable value).

5-53 Term. 29 High Ref./Feedb. Value		
Range:	_	Function:
Size related*	[-999999.999 - 999999.999 ReferenceFeed- backUnit]	Enter the high reference value [RPM] for the motor shaft speed and the high feedback value, see also 5-58 Term. 33 High Ref./Feedb. Value. Select terminal 29 as a digital input (5-02 Terminal 29 Mode = [0] input (default) and
		5-13 Terminal 29 Digital Input = applicable value).

5-54 Pulse Filter Time Constant #29		
Range:	Function:	
100 ms*	[1 - 1000	Enter the pulse filter time constant. The
	ms]	pulse filter dampens oscillations of the
		feedback signal, which is an advantage if
		there is a lot of noise in the system. A
		high time constant value results in better
		dampening but also increases the time
		delay through the filter.



5-55 Term. 33 Low Frequency		
Range: Function:		Function:
100 Hz*	[0 - 110000 Hz]	Enter the low frequency corresponding to the low motor shaft speed (i.e. low reference value) in 5-57 Term. 33 Low Ref./Feedb. Value.

	5-56 Term. 33 High Frequency		
Range:			Function:
	100 Hz*	[0 - 110000	Enter the high frequency
		Hz]	corresponding to the high motor shaft
			speed (i.e. high reference value) in
			5-58 Term. 33 High Ref./Feedb. Value.

5-	5-57 Term. 33 Low Ref./Feedb. Value	
Range:		Function:
0 *	[-999999.999 -	Enter the low reference value [RPM]
	999999.999]	for the motor shaft speed. This is also
		the low feedback value, see also
		5-52 Term. 29 Low Ref./Feedb. Value.

5-58 Term. 33 High Ref./Feedb. Value		
Range:		Function:
Size related* [-999999.999 -		Enter the high reference
999999.999		value [RPM] for the motor
ReferenceFeedbackUnit]		shaft speed. See also
		5-53 Term. 29 High Ref./
		Feedb. Value.

	5-59 Pulse Filter Time Constant #33		
Range:			Function:
	100 ms*	[1 - 1000	Enter the pulse filter time constant. The
		ms]	low-pass filter reduces the influence on
			and dampens oscillations on the feedback
			signal from the control.
			This is an advantage, e.g. if there is a
			great amount on noise in the system.

5-60	5-60 Terminal 27 Pulse Output Variable		
Opti	on:	Function:	
[0]	No operation	Select the desired display output for terminal 27.	
[45]	Bus ctrl.		
[48]	Bus ctrl., timeout		
[51]	MCO controlled		
[100]	Output frequency		
[101]	Reference		
[102]	Feedback		
[103]	Motor current		
[104]	Torque rel to limit		
[105]	Torq relate to rated		

5-60 Terminal 27 Pulse Output Variable			
Option:		Function:	
[106]	Power		
[107]	Speed		
[108]	Torque		
[109]	Max Out Freq		
[119]	Torque % lim		

5-62 Pulse Output Max Freq #27			
Range: Function:			
Size related*	[0 - 32000	Set the maximum frequency for	
	Hz]	terminal 27, corresponding to the	
		output variable selected in	
		5-60 Terminal 27 Pulse Output	
		Variable.	

5-63 Terminal 29 Pulse Output Variable		
Opti	on:	Function:
[0]	No operation	Select the desired display output for terminal 29.
		te
[45]	Bus ctrl.	
[48]	Bus ctrl., timeout	
[51]	MCO controlled	
[100]	Output frequency	
[101]	Reference	
[102]	Feedback	
[103]	Motor Current	
[104]	Torque rel to limit	
[105]	Torq relate to rated	
[106]	Power	
[107]	Speed	-
[108]	Torque	
[109]	Max Out Freq	

5-65 Pulse Output Max Freq #29

Set the maximum frequency for terminal 29 corresponding to the output variable set in 5-63 Terminal 29 Pulse Output Variable.

Range:	Function:	
5000 Hz*	[0 - 32000 Hz]	

5-90 Digital & Relay Bus Control			
Range:		Function:	
0 *	[0 - 2147483647]	This parameter holds the state of the	
		digital outputs and relays that is	
		controlled by bus.	
		A logical '1' indicates that the output is	
		high or active.	
		A logical '0' indicates that the output is	
		low or inactive.	

6-26 BAS-SVX60A-EN

Operating Instructions TRV200

Bit 0	Digital Output Terminal 27
Bit 1	Digital Output Terminal 29
Bit 2	Digital Output Terminal X 30/6
Bit 3	Digital Output Terminal X 30/7
Bit 4	Relay 1 output terminal
Bit 5	Relay 2 output terminal
Bit 6	Option B Relay 1 output terminal
Bit 7	Option B Relay 2 output terminal
Bit 8	Option B Relay 3 output terminal
Bit 9-15	Reserved for future terminals
Bit 16	Option C Relay 1 output terminal
Bit 17	Option C Relay 2 output terminal
Bit 18	Option C Relay 3 output terminal
Bit 19	Option C Relay 4 output terminal
Bit 20	Option C Relay 5 output terminal
Bit 21	Option C Relay 6 output terminal
Bit 22	Option C Relay 7 output terminal
Bit 23	Option C Relay 8 output terminal
Bit 24-31	Reserved for future terminals

Table 6.9 Bus-controlled Digital Outputs and Relays

5-93 Pulse Out #27 Bus Control		
Range:		Function:
0 %*	[0 - 100 %]	Set the output frequency transferred to the output terminal 27 when the terminal is configured as [45] Bus Controlled in 5-60 Terminal 27 Pulse Output Variable.

5-95	5-95 Pulse Out #29 Bus Control		
Range:		Function:	
0 %*	[0 - 100 %]	Set the output frequency transferred to the output terminal 29 when the terminal is configured as [45] Bus Controlled in 5-63 Terminal 29 Pulse Output Variable.	



6.7 Parameters: 6-** Analog In/Out

Parameter group for configuration of the analog input and output.

6.7.1 6-0* Analog In/Out Mode

Parameter group for setting up the analog In/Out configuration.

The frequency converter is equipped with 2 analog inputs: Terminal 53 and 54. The analog inputs on the frequency converter can freely be allocated to either voltage (-10 V to +10 V) or current input (0/4 to 20 mA).

6-00	6-00 Live Zero Timeout Time		
Rang	je:	Function:	
10 s*	[1 -	Enter the Live Zero Time-out time period. Live	
	99 s]	Zero Time-out Time is active for analog inputs, i.e.	
		terminal 53 or terminal 54, used as reference or	
		feedback sources. If the reference signal value	
		associated with the selected current input falls	
		below 50% of the value set in 6-10 Terminal 53	
		Low Voltage, 6-12 Terminal 53 Low Current,	
		6-20 Terminal 54 Low Voltage or 6-22 Terminal 54	
		Low Current for a time period longer than the time	
		set in 6-00 Live Zero Timeout Time, the function	
		selected in 6-01 Live Zero Timeout Function will be	
		activated.	

6-01 Live Zero Timeout Function

Option:		Function:
		Select the time-out function. The function set
		in 6-01 Live Zero Timeout Function will be
		activated if the input signal on terminal 53 or
		54 is below 50% of the value in 6-10 Terminal
		53 Low Voltage, 6-12 Terminal 53 Low Current,
		6-20 Terminal 54 Low Voltage or 6-22 Terminal
		54 Low Current for a time period defined in
		6-00 Live Zero Timeout Time. If several time-
		outs occur simultaneously, the frequency
		converter prioritizes the time-out functions as
		follows:
		1. 6-01 Live Zero Timeout Function
		2. 8-04 Control Word Timeout Function
[1]	Freeze	Frozen at the present value
	Output	
[0] *	Off	
[1]	Freeze	Frozen at the present value
	output	
[2]	Stop	Overruled to stop
[3]	Jogging	Overruled to jog speed
[4]	Max. speed	Overruled to max. speed

6-01 Live Zero Timeout Function

Option:		Function:
[5]	Stop and	Overruled to stop with subsequent trip
	trip	

6.7.2 6-1* Analog Input 1

Parameters for configuring the scaling and limits for analog input 1 (terminal 53).

NOTE!

Analog input 53 is preset for usage with "Open Loop" control on 0-10 V. Terminal 54 is preset for "Process Loop" control using a pressure sensor AKS with a pressure range of -14: 174 psi.

6-10 Terminal 53 Low Voltage

Range:		Function:
0.00V*	[-10.0 - par.	This analog input scaling value should
	6-11]	correspond to the minimum reference
		value, set in 3-02 Minimum Reference.

6-11 Terminal 53 High Voltage

Range:		Function:
Hardware	[6-10 to 10	This analog input scaling value
dependent*	V]	should correspond to the
		maximum reference value, set
		in 3-03 Maximum Reference.

6-12 Terminal 53 Low Current

Range:		1	Function:
	4.0mA*	[0.0 to par. 6-13	This reference signal should
			correspond to the minimum
			reference value, set in 3-02 Minimum
			Reference.

6-13 Terminal 53 High Current

Range:		Function:
20.0mA*	[6-12 to 20 mA]	This reference signal should
		correspond to the maximum
		reference value, set in 3-02 Minimum
		Reference.

6-14 Terminal 53 Low Ref./Feedb. Value

Range:		Function:
Size related*	[Enter the analog input scaling value	
	that corresponds to the low voltage/low	
	current set in 6-10 Terminal 53 Low	
	Voltage and 6-12 Terminal 53 Low	
	Current.]	

6-28 BAS-SVX60A-EN



6-15 Terminal 53 High Ref./Feedb. Value

Range:	Function:
Size related*	
	Enter the analog input scaling value that
	corresponds to the maximum reference
	feedback value set in 6-11 Terminal 53 High
	Voltage and 6-13 Terminal 53 High Current.

6-16 T	6-16 Terminal 53 Filter Time Constant		
Range:		Function:	
0.001 s*	[0.001 - 10	NOTE!	
	s]	This parameter cannot be adjusted	
		while the motor is running.	
		Enter the time constant. This is a first-	
		order digital low pass filter time constant	
		for suppressing electrical noise in terminal	
		53. A high time constant value improves	
		dampening but also increases the time	
		delay through the filter.	

6.7.3 6-2* Analog Input 2

Parameters for configuring the scaling and limits for analog input 2 (terminal 54).

NOTE!

Analog input 53 is preset for usage with "open loop" control on 0-10 V. Terminal 54 is preset for "Process Loop" control using a pressure sensor AKS with a pressure range of -1: 12 bar.

6-20 Terminal 54 Low Voltage

	Range:		Function:
ſ	1.00V*	[-10.0 - par.	This analog input scaling value
		6-11]	should correspond to the minimum
			output value of the pressure sensor

6-21 Terminal 54 High Voltage

Range	: :	Function:
5.00V*	[6-10 to 10 V]	This analog input scaling value should
		correspond to the maximum output
		value of the pressure sensor.

6-22 Terminal 54 Low Current

Range:		Function:
4.0mA *	[0.0 to par. 6-13	This reference signal should
	mA]	correspond to the minimum output
		value of the pressure sensor.

6-23 Terminal 54 High Current

Range:	Function:		
20.0mA *	[6-12 to 20 mA]	This reference signal should	
		correspond to the maximum output	
		value of the pressure sensor.	

6-24 Terminal 54 Low Ref./Feedb.

Range:	Function:
-1 (bar)	Enter the analog input scaling value that
	corresponds to the minimum reference
	feedback value set in 3-02 Minimum Reference.

6-25 Terminal 54 High Ref./Feedb.

Range:		Function:
12 (bar)	[Value]	Enter the analog input scaling value that
		corresponds to the maximum reference
		feedback value set in 3-03 Maximum
		Reference.

6-26 Terminal 54 Filter Time Constant

Range:		Function:
0.001 s*	[0.001 - 10	NOTE!
	s]	This parameter cannot be adjusted
		while the motor is running.
		Enter the time constant. This is a first-
		order digital low pass filter time constant
		for suppressing electrical noise in terminal
		54. A high time constant value improves
		dampening but also increases the time
		delay through the filter.

6-50 Terminal 42 Output

Option: Function:

		Select the function of Terminal 42 as an analog current output. Depending on the selection the output is either a 0-20 mA or 4-20 mA output. The current value can be read out in keypad in 16-65 Analog Output 42 [mA].
[0]	No	There is no signal on the analog output.
	operation	
[100]	Output	0 Hz = 0 mA; 100 Hz = 20 mA.
	frequency	
	0-20 mA	
[101]	Reference	3-00 Reference Range [Min - Max] 0% = 0 mA;
	0-20 mA	100% = 20 mA
		3-00 Reference Range [-Max - Max] -100% = 0
		mA; 0% = 10 mA; +100% = 20 mA
[103]	Motor	Value is taken from 16-37 Inv. Max. Current.
	current	Inverter max. current (160% current) is equal
	0-20 mA	to 20 mA.



6-50 Terminal 42 Output			
· · · · · · · · · · · · · · · · · · ·			
Opti	on: 	Function: Example: Inverter norm current (11 kW) = 24	
		A. 160% = 38.4 A. Motor norm current = 22 A Read-out 11.46 mA.	
		$\frac{20 \text{ mA x 22 A}}{38.4 \text{ A}} = 11.46 \text{ mA}$	
		In case the norm motor current is equal to 20	
		mA, the output setting of 6-52 Terminal 42 Output Max Scale is:	
		$\frac{\frac{1}{7\text{RV200}\text{Max}} \times 100}{\frac{1}{\text{Motor}} \times 100} = \frac{38.4 \times 100}{22} = 175 \%$	
		Norm	
[104]	Torque rel to lim 0-20 mA	The torque setting is related to setting in 4-16 Torque Limit Motor Mode	
[105]	Torque rel to rated motor torque 0-20 mA	The torque is related to the motor torque setting.	
[106]	Power 0-20 mA	Taken from 1-20 Motor Power [kW].	
[107]	Speed 0-20 mA	Taken from <i>3-03 Maximum Reference</i> . 20 mA = value in <i>3-03 Maximum Reference</i>	
[108]	Torque ref. 0-20 mA	Torque reference related to 160% torque.	
[109]	Max Out Freq 0-20 mA	In relation to 4-19 Max Output Frequency.	
[134]	Torque% lim. 4-20 mA	The torque setting is related to setting in 4-16 Torque Limit Motor Mode.	
[135]	Torque% nom 4-20 mA	The torque setting is related to the motor torque setting.	
[141]	Bus ctrl. 0-20 mA, timeout	4-54 Warning Reference Low defines the behavior of the analog output in case of bus time-out.	
[142]	Bus ctrl. 4-20 mA, timeout	4-54 Warning Reference Low defines the behavior of the analog output in case of bus time-out.	
[150]	Max Out Freq 4-20 mA	In relation to 4-19 Max Output Frequency.	
[119]	Torque % lim		
[149]	Torque % lim 4-20mA	Analog output at zero torque = 12 mA. Motoric torque will increase the output current to max torque limit 20 mA (set in 4-16 Torque Limit Motor Mode). Generative torque will decrease the output to torque limit Generator Mode (set in 4-17 Torque Limit Generator Mode)	

6-50	6-50 Terminal 42 Output		
Option:		Function:	
	Ex: 4-16 Torque Limit Motor Mode: 200% and 4-17 Torque Limit Generator Mode: 200%. 20 mA = 200% Motoric and 4 mA = 200% Generatoric. OmA 4mA 12 mA 20 mA 0 1		
		Figure 6.9	
[0] *	No operation	When no signal on the analog output.	
[52]	MCO 0-20mA		
[53]	MCO 4-20mA		
[100]	Output frequency	0 Hz = 0 mA; 100 Hz = 20 mA.	
[101]	Reference	3-00 Reference Range [Min - Max] 0% = 0 mA; 100% = 20 mA 3-00 Reference Range [-Max - Max] -100% = 0 mA; 0% = 10 mA; +100% = 20 mA	
[102]	Feedback	, , , 25	
[103]	Motor current	Value is taken from 16-37 Inv. Max. Current. Inverter max. current (160% current) is equal to 20 mA. Example: Inverter norm current (11 kW) = 24 A. $160\% = 38.4$ A. Motor norm current = 22A Read-out 11.46 mA. $\frac{1}{7RV200} \frac{x \times 100}{Motor_{Norm}} = \frac{38.4 \times 100}{22} = 175\%$ In case the norm motor current is equal to 20 mA, the output setting of 6-52 Terminal 42 Output Max Scale is: $\frac{1}{NORIVE_{Max}} \frac{x \times 100}{Motor_{Norm}} = \frac{38.4 \times 100}{22} = 175\%$	
	to limit	The torque setting is related to setting in 4-16 Torque Limit Motor Mode	
[105]	Torq relate to rated	The torque is related to the motor torque setting.	
[106]	Power	Taken from 1-20 Motor Power [kW].	
[107]	Speed	Taken from 3-03 Maximum Reference. 20 mA = value in 3-03 Maximum Reference	
[108]	Torque	Torque reference related to 160% torque.	
[109]	Max Out Freq	0 Hz = 0 mA,4-19 Max Output Frequency = 20 mA.	
[130]	Output freq. 4-20mA	0 Hz = 4 mA, 100 Hz = 20 mA	

6-30 BAS-SVX60A-EN



6-50 Terminal 42 Output			
Option:		Function:	
[131]	Reference 4-20mA	3-00 Reference Range [Min-Max] 0% = 4 mA; 100% = 20 mA 3-00 Reference Range [-Max-Max] -100% = 4 mA; 0% = 12 mA; +100% = 20 mA	
[132]	Feedback 4-20mA		
[133]	Motor cur. 4-20mA	Value is taken from 16-37 Inv. Max. Current. Inverter max. current (160% current) is equal to 20 mA. Example: Inverter norm current (11 kW) = 24 A. $160\% = 38.4$ A. Motor norm current = 22 A Read-out 11.46 mA. $\frac{16\ mA\ x\ 22\ A}{38.4\ A} + 4\ mA = 13.17\ mA$ In case the norm motor current is equal to 20 mA, the output setting of 6-62 Terminal X30/8 Max. Scale is: $\frac{I_{TRV200\ Max}}{I_{Motor\ Norm}} \times \frac{x\ 100}{22} = 175\ \%$	
[134]	Torq.% lim 4-20 mA	The torque setting is related to setting in 4-16 Torque Limit Motor Mode.	
[135]	Torq.% nom 4-20 mA	The torque setting is related to the motor torque setting.	
[136]	Power 4-20mA	Taken from 1-20 Motor Power [kW]	
[137]	Speed 4-20mA	Taken from 3-03 Maximum Reference. 20 mA = Value in 3-03 Maximum Reference.	
[138]	Torque 4-20mA	Torque reference related to 160% torque.	
[139]	Bus ctrl. 0-20 mA	An output value set from fieldbus process data. The output will work independently of internal functions in the frequency converter.	
[140]	Bus ctrl. 4-20 mA	An output value set from fieldbus process data. The output will work independently of internal functions in the frequency converter.	
[141]	Bus ctrl 0-20mA t.o.	4-54 Warning Reference Low defines the behavior of the analog output in case of bus time-out.	
[142]	Bus ctrl 4-20mA t.o.	4-54 Warning Reference Low defines the behavior of the analog output in case of bus time-out.	
[150]	Max Out Fr 4-20mA	0 Hz = 0 mA,4-19 Max Output Frequency = 20 mA.	

6-51	6-51 Terminal 42 Output Min Scale		
Range:		Function:	
0 %*	[0 - 200 %]	Scale for the minimum output (0 or 4 mA) of the analog signal at terminal 42. Set the value to be the percentage of the full range of the variable selected in 6-50 Terminal 42 Output.	

6-52 Terminal 42 Output Max Scale			
Range	<u>:</u> :	Function:	
100	[0 -	Scale the maximum output of the selected	
%*	200 %]	analog signal at terminal 42. Set the value to	
		the maximum value of the current signal output.	
		Scale the output to give a current lower than 20	
		mA at full scale; or 20 mA at an output below	
		100% of the maximum signal value. If 20 mA is	
		the desired output current at a value between 0	
		- 100% of the full-scale output, programme the	
		percentage value in the parameter, i.e. $50\% = 20$	
		mA. If a current between 4 and 20 mA is desired	
		at maximum output (100%), calculate the	
		percentage value as follows:	

20 mA / desired maximum current x 100 %

i.e.
$$10 \text{ mA} : \frac{20}{10} \times 100 = 200 \%$$

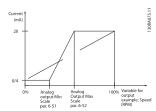


Figure 6.10 Output Max Scale

6-53 Terminal 42 Output Bus Control			
Rang	Range: Function:		
0 %*	[0 - 100 %]	Holds the level of Output 42 if controlled by bus.	



6.8 Parameters: 7-** Controllers

7-06 Spe	eed PID	Lowpass Filter Time			
Range:		Function:			
Size	[0.1 -	Set a time constant for	the speed control low-		
related*	100	pass filter. The low-pas	s filter improves		
	ms]	steady-state performance and dampens			
		oscillations on the feed	lback signal. This is an		
		advantage if there is a	great amount on noise		
		in the system, see Figu	re 6.11. For example, if		
		a time constant (τ) of 1	00 ms is programmed,		
		the cut-off frequency for	or the low-pass filter		
		will be 1/0.1= 10 RAD/s	s., corresponding to		
		$(10/2 \times \pi) = 1.6 \text{ Hz. The}$	PID regulator only		
		regulates a feedback si	gnal that varies by a		
		frequency of less than 1.6 Hz. If the feedbasignal varies by a higher frequency than 1.6 Hz, the PID regulator does not react.			
		Practical settings of 7-0	6 Speed PID Lowpass		
		Filter Time taken from t	he number of pulses		
		per revolutions from er	ncoder:		
		Encoder PPR	7-06 Speed PID		
			Lowpass Filter Time		
		512	10 ms		
		1024	5 ms		
		2048	2 ms		
		4096	1 ms		

NOTE!

Severe filtering can be detrimental to dynamic performance.

This parameter is used with 1-00 Configuration Mode [1] Speed closed loop and [2] Torque control.

The filter time in flux sensorless must be adjusted to 3-5 ms.

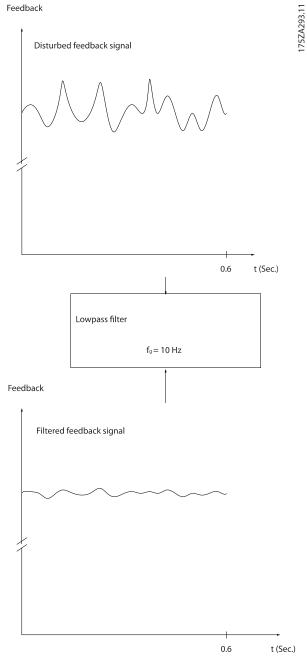


Figure 6.11 Feedback Signal

6.8.1 7-2* Process PID Feedback

Select the feedback sources for the Process PID Control, and how this feedback should be handled.

7-20 Process CL Feedback 1 Resource		
Opt	ion:	Function:
		For process loop with
		current input, 54 switch has

6-32 BAS-SVX60A-EN



7-20 Process CL Feedback 1 Resource			
Opt	ion:	Function:	
		to be positionned on I	
		(current).	
[0]	No function		
[1]	Analog input 53		
[2] *	Analog input 54		
[3]	Frequency input 29 (FC 302		
	only)		
[4]	Frequency input 33		

7-2	7-22 Process CL Feedback 2 Resource		
Opt	tion:	Function:	
		The effective feedback signal is made up of the sum of up to two different input signals. Select which frequency converter input should be treated as the source of the second of these signals. The first input signal is defined in 7-20 Process CL Feedback 1 Resource.	
[0]	No function		
[1]	Analog Input 53		
[2]	Analog Input 54		
[3]	Frequency input 29		
[4]	Frequency input 33		
[7]	Analog input X30/11		
[8]	Analog input X30/12		
[15]	Analog Input X48/2		

7-30 Process PID Normal/Inverse Control

Option:		Function:
		Inverse action has to be selected for a process
		loop using a suction pressure sensor to control the
		system.
[0]	Normal	
[1] *	Inverse	

7-31 Process PID Anti Windup

Opt	ion:	Function:	
[0]	Off	Continue regulation of an error when the output	
		frequency can no longer be adjusted.	
[1] *	On	Continue regulation of an error even when the output	
		frequency cannot be increased or decreased.	

7-32 Process PID Start Speed

Range:		Function:
3000	[Set	Enter the motor speed to be attained as a
[RPM]	point]	start signal for commencement of PID
		control. When the power is switched on,
		the frequency converter will commence
		ramping and then operate under speed
		open loop control. Thereafter, when the

7-32 Process PID Start Speed		
Range:	Function:	
	Process PID start speed is reached, the	
	frequency converter will change over to	
	Process PID control.	

7-33 Process PID Proportional Gain

Range:			Function:
	2.00N/A	-	Enter the PID proportional gain. The
		N/A]	proportional gain multiplies the error
			between the set point and the
			feedback signal.

7-34 Process PID Integral Time

Range:		Function:
9.00 s*	[0.01 -	Enter the PID integral time. The
	10000.00]	integrator provides an increasing gain
		at a constant error between the set
		point and the feedback signal. The
		integral time is the time needed by the
		integrator to reach the same gain as
		the proportional gain.

7-35 Process PID Differentiation Time

Range:		Function:
0.00 s*	[0.00 -	Enter the PID differentiation time. The
	10.00 s]	differentiator does not react to a constant
		error, but provides a gain only when the
		error changes. The shorter the PID differ-
		entiation time, the stronger the gain from
		the differentiator.

NOTE!

This PID parameters are confortable to start any system, but depending on its design they have to be adjusted to follow the inertia and all responses of the real refrigeration machine.

7-36 Process PID Differentiation Gain Limit			
Range:		Function:	
5 *	[1 - 50]	Enter a limit for the differentiator gain (DG). If	
		there is no limit, the DG will increase when there	
		are fast changes. Limit the DG to obtain a pure	
		differentiator gain at slow changes and a constant	
		differentiator gain where fast changes occur.	

7-38 Process PID Feed Forward Factor			
Range:		Function:	
0 %*	[0 -	Enter the PID feed forward (FF) factor. The FF	
	200 %]	factor sends a constant fraction of the reference	
		signal to bypass the PID control, so the PID	
		control only affects the remaining fraction of the	
		control signal. Any change to this parameter will	



7-38 P	7-38 Process PID Feed Forward Factor		
Range: Function:			
		thus affect the motor speed. When the FF factor is activated it provides less overshoot, and high dynamics when changing the set point. 7-38 Process PID Feed Forward Factor is active when 1-00 Configuration Mode is set to [3] Process.	

7-39	7-39 On Reference Bandwidth		
Range:		Function:	
5 %*	[0 - 200 %]	Enter the On Reference bandwidth. When the PID Control Error (the difference between the	
		reference and the feedback) is less than the set value of this parameter the On Reference status bit is high, i.e. =1.	

6.8.2 7-6* Feedback Conversion

Select how the signals from the feedback sources must be converted.

7-60 Feedback 1 Conversion

Option:		Function:
		Selects the conversion to apply to the
		feedback signal measured on the analog
		input selected as feedback 1 source in 7-20
		Process CL Feedback 1 Resource.
[0] *	Linear	No conversion is applied. The feedback
		signal is assumed to be in the unit selected
		in 3-01 Reference/Feedback Unit and enters
		the process controller unchanged.
[1]	Square root	The square root of the feedback signal is
		calculated before passing it to the process
		controller.
[2]	Pressure to	The feedback signal is a pressure with units
	temperature	as specified in 7-61 Feedback 1 Source Unit.
		It is converted to a temperature before
		passing it to the process controller. The
		pressure to temperature conversion is
		based on the refrigerant selected in 7-70
		Refrigerant.

7-61 Feedback 1 Source Unit

Option:		Function:
		Select the pressure unit applicable to feedback
		source 1 defined in 7-20 Process CL Feedback 1
		Resource.
[70]	mbar	
[71]	bar	
[72]	Pa	
[73]	kPa	

7-61 Feedback 1 Source Unit Option: Function: [74] m WG [170] psi [171] lb/in2 [172] in WG

Function:

7-62 Feedback 2 Conversion

[173] ft WG

Option:

- r		
		Selects the conversion to apply to the
		feedback signal measured on the analog
		input selected as feedback 2 source in 7-22
		Process CL Feedback 2 Resource.
[0] *	Linear	No conversion is applied. The feedback
		signal is assumed to be in the unit selected
		in 3-01 Reference/Feedback Unit and enters
		the process controller unchanged.
[1]	Square root	The square root of the feedback signal is
		calculated before passing it to the process
		controller.
[2]	Pressure to	The feedback signal is a pressure with units
	temperature	as specified in 7-62 Feedback 2 Source Unit.
		It is converted to a temperature before
		passing it to the process controller. The
		pressure to temperature conversion is
		based on the refrigerant selected in 7-70
		Refrigerant.

7-63 Feedback 2 Source Unit

Option:		Function:	
		Select the pressure unit applicable to feedback	
		source 1 defined in 7-22 Process CL Feedback 2	
		Resource.	
[70]	mbar		
[71]	bar		
[72]	Pa		
[73]	kPa		
[74]	m WG		
[170]	psi		
[171]	lb/in2		
[172]	in WG		
[173]	ft WG		

6-34 BAS-SVX60A-EN



6.8.3 7-7* Pressure to Temperature Conversion

The conversion of a feedback signal P in units of a pressure to a temperature T is accomplished via the formula:

T = A2/(log(P+1)-A1) - A3

where A1, A2 and A3 are refrigerant dependent constants.

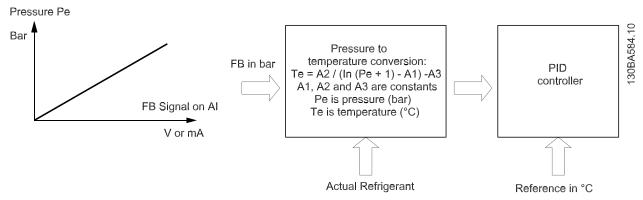


Figure 6.12 Converting Pressure to Temperature

The parameters in this group allow selection of a refrigerant, which implicitly determines the constants A1, A2 and A3. Alternatively, user defined constants can be programmed explicitly.

7-70 Refrigerant				
Option:		Function:		
[0]	R22			
[1]	R134a			
[2] *	R404A			
[3]	R407C			
[4]	R410A			
[5]	R502			
[6]	R744			
[7]	User defined			

7-71 User Defined Refrigerant A1		
Range: Function:		
[8.0000 –	Selects the value used for the constant A1	
12.0000]	in the pressure to temperature conversion	
	formula (see parameter group 7-7* Pressure	
	to Temperature Conversion).	

	7-72 User Defined Refrigerant A2		
Range:		Function:	
	[-3000.00 –	Selects the value used for the constant A2	
	-1500.00]	in the pressure to temperature conversion	
		formula (see parameter group 7-7* Pressure	
		to Temperature Conversion).	

	7-73 User Defined Refrigerant A3			
Range:		Function:		
	[200.000 –	Selects the value used for the constant A3		
	300.000]	in the pressure to temperature conversion		
		formula (see parameter group 7-7* Pressure		
		to Temperature Conversion).		

6.8.4 7-8* Thermostat/Pressostat Function

The Thermostat-Pressostat Function (TPF) can be used to stop and start the compressor when running in closed loop. The TPF monitors and compares the resulting feedback with the Cut-out value in 7-81 Cut-out Value. When the resulting feedback gets below 7-81 Cut-out Value a stop signal is generated and the compressor stops. When the resulting feedback gets above the Cut-in value in 7-82 Cut-in Value the stop signal is removed and the compressor starts again.

The Set-point should be set to a value in between Cut-in and Cut-out.



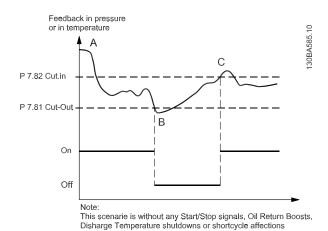


Figure 6.13 Thermostat/Pressostat Function

Point A: At start-up the temperature will be higher than wanted in the evaporator and therefore a higher pressure than the Cut-in level and the compressor must run. Another situation could be that the start situation is where the feedback is between Cut-out and Cut-in. In that case, no STOP is initiated.

Point B: After some time the cut-out level may be reached and the compressor must be shut off.

Point C: Cut-in is reached and the compressor is restarted.

NOTE!

When using the TPF together with the Cascade Controller further consideration must be taken. The Cut-Out value should be below the Override Bandwidth setting (see 25-21 Override Bandwidth). Cut-In should be set above the set-point and below the value for Staging Bandwidth (see 25-20 Staging Bandwidth).

7-80 Thermostat/Pressostat Function				
Option: Function:			Function:	
[0] *		Off	Function is inactive	
[1]		On	Function is active	
7-81	7-81 Cut-out Value			
Range	Range: Function:			
1 bar*	[-300	0 - par.7-82]	Select the Cut-out Level where the	
			stop signal is activated and the	
	l		compressor stops.	

7-82 Cut-in Value

Range: Function:

3 bar* [Par.7-81 - Select the Cut-in Level where the stop signal is de-activated and the compressor starts.

6-36 BAS-SVX60A-EN



6.9 Parameters: 8-** Communications and Options

6.9.1 8-0* General Settings

8-0	8-01 Control Site			
Op	otion:	Function:		
		The setting in this parameter overrides the settings in 8-50 Coasting Select to 8-56 Preset Reference Select.		
[0]	Digital and ctrl.word	Control by using both digital input and control word.		
[1]	Digital only	Control by using digital inputs only.		
[2]	Controlword only	Control by using control word only.		

8-02 Control Word Source			
Opt	tion:	Function:	
		NOTE!	
		This parameter cannot be adjusted while	
		the motor is running.	
		Select the source of the control word: one of	
		two serial interfaces or four installed options.	
		During initial power-up, the frequency	
		converter automatically sets this parameter to	
		[3] Option A if it detects a valid fieldbus option	
		installed in slot A. If the option is removed,	
		the frequency converter detects a change in the configuration, sets 8-02 Control Word	
		Source back to default setting RS-485, and the	
		frequency converter trips. If an option is	
		installed after initial power-up, the setting of	
		8-02 Control Word Source does not change, but	
		the frequency converter trips and displays:	
		Alarm 67 Option Changed.	
		When retrofitting a bus option into a	
		frequency converter that did not have a bus	
		option installed to begin with, take an ACTIVE	
		decision to move the control to Bus based.	
		This is done for safety reasons to avoid an	
		accidental change.	
[0]	None		
[1]	FC RS-485		
[2]	FC USB		
[3]	Option A		
[4]	Option B		
[5]	Option C0		
[6]	Option C1		
[30]	External		
	Can		

8-03 Control Word Timeout Time

Range:		Function:	
[1.0 s]	0.1-18000.0 s	Enter the maximum time expected to	
		pass between the reception of two	
		consecutive telegrams. If this time is	
		exceeded, it indicates that the serial	
		communication has stopped. The	
		function selected in 8-04 Control Word	
		Timeout Function is then carried out. A	
		valid control word triggers the time-out	
		counter.	
20 s*	[0.1 -	Enter the maximum time expected to	
	18000.0 s]	pass between the reception of two	
		consecutive telegrams. If this time is	
		exceeded, it indicates that the serial	
		communication has stopped. The	
		function selected in 8-04 Control Word	
		Timeout Functionis then carried out. A	
		valid control word triggers the time-out	
		counter.	

8-04 Control Word Timeout Function

Select the time-out function. The time-out function activates when the control word fails to be updated within the time period specified in 8-03 Control Word Timeout Time.

period specified in 8-03 Control Word Timeout Time.			
Opt	tion:	Function:	
[0] Off		Resumes control via serial bus (fieldbus or standard) using the most recent control word.	
[1]	Freeze output	Freezes output frequency until communication resumes.	
[2]	Stop	Stops with auto restart when communication resumes.	
[3]	Jogging	Runs the motor at JOG frequency until communication resumes.	
[4]	Max. speed	Runs the motor at maximum frequency until communication resumes.	
[5]	Stop and trip	Stops the motor, then resets the frequency converter to restart: via the fieldbus, via [Reset], or via a digital input.	
[7]	Select setup 1	Changes the setup upon reestablishment of communication following a control word time-out. If communication resumes after a time-out, 8-05 End-of-Timeout Function defines whether to resume the setup used before the time-out, or to retain the setup endorsed by the time-out function.	
[8]	Select setup 2	See [7] Select setup 1	
[9]	Select setup 3	See [7] Select setup 1	
[10]	Select setup 4	See [7] Select setup 1	



8-04 Control Word Timeout Function

Select the time-out function. The time-out function activates when the control word fails to be updated within the time period specified in 8-03 Control Word Timeout Time.

Opt	tion:	Function:
[26]	Trip	

NOTE!

To change the setup after a time-out, the following configuration is required:

Set 0-10 Active Set-up to [9] Multi setup and select the relevant link in 0-12 This Set-up Linked to.

8-0	8-05 End-of-Timeout Function		
Op	otion:	Function:	
		Select the action after receiving a valid control word following a time-out. This parameter is active only when 8-04 Control Timeout Function is set to [7] Setup 1, [8] Setup 2, [9]Setup 3 or [10] Setup 4.	
[0]	Hold set-up	Retains the setup selected in 8-04 Control Timeout Function and displays a warning, until 8-06 Reset Control Timeout toggles. Then the frequency converter resumes its original setup.	
[1]	Resume set- up	Resumes the setup active before the time-out.	

8-06 Reset Control Word Timeout

This parameter is active only when [0] Hold setup has been selected in 8-05 End-of-Timeout Function.

Option:		Function:	
[0] Do not reset		Retains the setup specified in 8-04 Control	
		Word Timeout Function, following a control	
		word time-out.	
[1]	Do reset	Returns the frequency converter to the original	
		setup following a control word time-out. The	
		frequency converter performs the reset and	
		then immediately reverts to the [0] Do not reset	
		setting	

6.9.2 8-1* Ctrl. Word Settings

8-10 Control Word Profile

Select the interpretation of the control and status words corresponding to the installed fieldbus. Only the selections valid for the fieldbus installed in slot A will be visible in the keypad display.

For guidelines in selection of [0] FC profile and [1] PROFIdrive profile, refer to the Serial communication via RS-485 Interface section in the Design Guide.

For additional guidelines in the selection of [1] PROFIdrive profile, refer to the Operating Instructions for the installed fieldbus.

Option: Function:

[0] *	FC profile	
[1]	PROFIdrive profile	

8-13 Configurable Status Word STW

Opt	ion:	Function:	
[0]	No function	The input is always low.	
[1] *	Profile Default	Depended on the profile set in	
		8-10 Control Profile.	
[2]	Alarm 68 Only	The input goes high whenever Alarm 68	
		is active and goes low whenever no	
		alarm 68 is active.	
[3]	Trip excl Alarm 68		
[16]	T37 DI status	The input goes high whenever T37 has	
		0 V and goes low whenever T37 has	
		24 V.	

6.9.3 8-3* Drive Port Settings

8-30 Protocol Option: Function: Select the protocol to be used. Changing protocol will not be effective until after powering off the frequency converter. [0] * FC [1] FC MC [2] Modbus RTU

8-31 Address			
Range: Function:			
Size related*	[1 - 255]	Enter the address for the Drive (standard) port. Valid range: 1-126.	

8-3	8-32 FC Port Baud Rate			
Option:		Function:		
[0]	2400 Baud	Baud rate selection for the FC (standard) port.		

6-38 BAS-SVX60A-EN



8-3	8-32 FC Port Baud Rate			
Op	otion:	Function:		
[1]	4800 Baud			
[2]	9600 Baud			
[3]	19200 Baud			
[4]	38400 Baud			
[5]	57600 Baud			
[6]	76800 Baud			
[7]	115200 Baud			

8-33	Parity / Stop Bits	
Optio	on:	Function:
[0]	Even Parity, 1 Stop Bit	
[1]	Odd Parity, 1 Stop Bit	
[2]	No Parity, 1 Stop Bit	
[3]	No Parity, 2 Stop Bits	

8-35 Minimum Response Delay			
Range:		Function:	
10 ms*	[1 - 10000	Specify the minimum delay time	
	ms]	between receiving a request and	
		transmitting a response. This is used for	
		overcoming modem turnaround delays.	

8-36 Max Response Delay			
	Function:		
[11 -	Specify the maximum permissible		
10001 ms]	delay time between transmitting a		
	request and receiving a response. If a		
	response from the frequency		
	converter is exceeding the time		
	setting then it will be discarded.		
	[11 -		

8-37 Max Inter-Char Delay		
Range:	e: Function:	
Size	[0.00 -	Specify the maximum permissible
related*	35.00 ms]	time interval between receipt of two
		bytes. This parameter activates time-
		out if transmission is interrupted.
		This parameter is active only when
		8-30 Protocol is set to [1] FC MC
		protocol.

6.9.4 8-5* Digital/Bus

Parameters for configuring the control word Digital/Bus merging.

NOTE: This parameter is active only when 8-01 Control Site is set to [0] Digital and control word.

8-:	8-50 Coasting Select		
Op	otion:	Function:	
		Select control of the coasting function via the terminals (digital input) and/or via the bus.	
[0]	Digital input	Activates Start command via a digital input.	
[1]	Bus	Activates Start command via the serial communication port or fieldbus option.	
[2]	Logic AND	Activates Start command via the fieldbus/serial communication port, AND additionally via one of the digital inputs.	
[3]	Logic OR	Activates Start command via the fieldbus/serial communication port OR via one of the digital inputs.	

8-51 Quick Stop Select

Select control of the Quick Stop function via the terminals (digital input) and/or via the bus.

Option:		Function:
[0]	Digital input	
[1]	Bus	
[2]	Logic AND	
[3]	Logic OR	

8-	8-52 DC Brake Select		
Op	otion:	Function:	
		Select control of the DC brake via the terminals (digital input) and/or via the fieldbus. NOTE! Only selection [0] Digital input is available when 1-10 Motor Construction is set to [1] PM non-salient SPM.	
[0]	Digital input	Activates Start command via a digital input.	

8-	8-53 Start Select		
Op	otion:	Function:	
		Select control of the frequency converter start function via the terminals (digital input) and/or via the fieldbus.	
[0]	Digital input	Activates Start command via a digital input.	
[1]	Bus	Activates Start command via the serial communication port or fieldbus option.	
[2]	Logic AND	Activates Start command via the fieldbus/serial communication port, AND additionally via one of the digital inputs.	



	8-53 Start Select		
Option:		otion:	Function:
	[3]	Logic OR	Activates Start command via the fieldbus/serial communication port OR via one of the digital inputs.

8-	8-54 Reverse Select		
Op	otion:	Function:	
[0]	Digital input	Select control of the frequency converter reverse function via the terminals (digital input) and/or via the fieldbus.	
[1]	Bus	Activates the Reverse command via the serial communication port or fieldbus option.	
[2]	Logic AND	Activates the Reverse command via the fieldbus/serial communication port, AND additionally via one of the digital inputs.	
[3]	Logic OR	Activates the Reverse command via the fieldbus/serial communication port OR via one of the digital inputs.	

8-	8-55 Set-up Select		
Op	otion:	Function:	
		Select control of the frequency converter setup selection via the terminals (digital input) and/or via the fieldbus.	
[0]	Digital input	Activates the setup selection via a digital input.	
[1]	Bus	Activates the setup selection via the serial communication port or fieldbus option.	
[2]	Logic AND	Activates the setup selection via the fieldbus/ serial communication port, AND additionally via one of the digital inputs.	
[3]	Logic OR	Activate the setup selection via the fieldbus/ serial communication port OR via one of the digital inputs.	

8-:	8-56 Preset Reference Select		
Op	otion:	Function:	
		Select control of the frequency converter Preset Reference selection via the terminals (digital input) and/or via the fieldbus.	
[0]	Digital input	Activates Preset Reference selection via a digital input.	
[1]	Bus	Activates Preset Reference selection via the serial communication port or fieldbus option.	
[2]	Logic AND	Activates Preset Reference selection via the fieldbus/serial communication port, AND additionally via one of the digital inputs.	

8-	8-56 Preset Reference Select		
Option:		Function:	
[3]	Logic OR	Activates the Preset Reference selection via the fieldbus/serial communication port OR via one of the digital inputs.	

6.9.5 8-8* Drive Port Diagnostics

These parameters are used for monitoring the Bus communication via the Drive Port.

8-8	8-80 Bus Message Count		
Ra	nge:	Function:	
0 *	[0 - 0]	This parameter shows the number of valid telegrams detected on the bus.	

8-8	8-81 Bus Error Count		
Ra	nge:	Function:	
0 *	[0 - 0]	This parameter shows the number of telegrams	
		with faults (e.g. CRC fault), detected on the bus.	

8-8	8-82 Slave Messages Rcvd	
Ra	nge:	Function:
0 *	[0 - 0]	This parameter shows the number of valid telegrams addressed to the slave, sent by the frequency converter.

8-83 Slave Error Count		
Ra	nge:	Function:
0 *	[0 - 0]	This parameter shows the number of error
		telegrams, which could not be executed by the
		frequency converter.

6.9.6 8-9* Bus Jog

8-90 Bu	8-90 Bus Jog 1 Speed		
Range:		Function:	
100 RPM*		Enter the jog speed. Activate this fixed jog speed via the serial port or fieldbus option.	

8-91 Bu	8-91 Bus Jog 2 Speed	
Range:		Function:
200 RPM*	[0 - par. 4-13 RPM]	Enter the jog speed. Activate this fixed jog speed via the serial port or fieldbus option.

6-40 BAS-SVX60A-EN



6.10 Parameters: 13-** Smart Logic Control

6.10.1 Prog. Features

Smart Logic Control (SLC) is essentially a sequence of user defined actions (see 13-52 SL Controller Action [x]) executed by the SLC when the associated user defined event (see 13-51 SL Controller Event [x]) is evaluated as TRUE by the SLC.

The condition for an event can be a particular status or that the output from a Logic Rule or a Comparator Operand becomes TRUE. That will lead to an associated Action as illustrated:

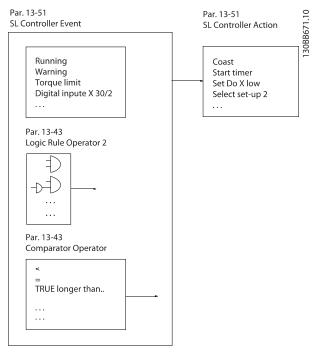


Figure 6.14 Smart Logic Control (SLC)

Events and *actions* are each numbered and linked together in pairs (states). This means that when *event* [0] is fulfilled (attains the value TRUE), *action* [0] is executed. After this, the conditions of *event* [1] will be evaluated and if evaluated TRUE, *action* [1] will be executed and so on. Only one *event* will be evaluated at any time. If an *event* is evaluated as FALSE, nothing happens (in the SLC) during the current scan interval and no other *events* will be evaluated. This means that when the SLC starts, it evaluates *event* [0] (and only *event* [0]) each scan interval. Only when *event* [0] is evaluated TRUE, will the SLC execute *action* [0] and start evaluating *event* [1]. It is possible to programme from 1 to 20 *events* and *actions*.

When the last *event/action* has been executed, the sequence starts over again from *event* [0]/*action* [0]. The illustration shows an example with three event/actions:

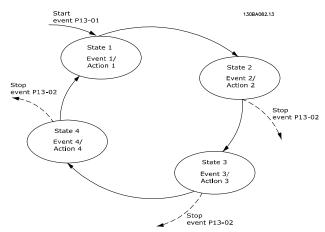


Figure 6.15 Events and Actions

Starting and stopping the SLC:

Starting and stopping the SLC can be done by selecting .On [1]. or .Off [0]. in 13-00 SL Controller Mode. The SLC always starts in state 0 (where it evaluates event [0]). The SLC starts when the Start Event (defined in 13-01 Start Event) is evaluated as TRUE (provided that On [1] is selected in 13-00 SL Controller Mode). The SLC stops when the Stop Event (13-02 Stop Event) is TRUE. 13-03 Reset SLC resets all SLC parameters and start programming from scratch.

NOTE!

SLC is only active in AUTO mode, not Hand On mode

6.10.2 13-0* SLC Settings

Use the SLC settings to activate, deactivate and reset the Smart Logic Control sequence. The logic functions and comparators are always running in the background, which opens for separate control of digital inputs and outputs.

13-00 SLC Controller Mode		
Option:		Function:
* [0]	Off	Disables the Smart Logic Control.
[1]	On	Enables the Smart Logic Control to start when a start
		command is present, e.g. via a digital input.

13-01 Start Event			
Select the boolean (TRUE or FALSE) input to activate Smart Logic			
Cont	Control.		
I			
Opti	on:	Function:	
Option [0]	on: FALSE	Function: Select the boolean (TRUE or FALSE) input to activate Smart Logic Control.	



13-01 Start Event

Select the boolean (TRUE or FALSE) input to activate Smart Logic Control.

Cont	rol.	
Opti	on:	Function:
		Enters the fixed value - FALSE
[1]	TRUE	Enters the fixed value - TRUE.
[2]	Running	The motor is running.
[3]	In range	The motor is running within the programmed current and speed ranges set in 4-50 Warning Current Low to 4-53 Warning Speed High.
[4]	On reference	The motor is running on reference.
[5]	Torque limit	The torque limit, set in 4-16 Torque Limit Motor Mode or 4-17 Torque Limit Generator Mode, has been exceeded.
[6]	Current Limit	The motor current limit, set in 4-18 Current Limit, has been exceeded.
[7]	Out of current range	The motor current is outside the range set in 4-18 Current Limit.
[8]	Below I low	The motor current is lower than set in 4-50 Warning Current Low.
[9]	Above I high	The motor current is higher than set in 4-51 Warning Current High.
[10]	Out of speed range	The speed is outside the range set in 4-52 Warning Speed Low and 4-53 Warning Speed High.
[11]	Below speed low	The output speed is lower than the setting in 4-52 Warning Speed Low.
[12]	Above speed high	The output speed is higher than the setting in 4-53 Warning Speed High.
[13]	Out of feedb. range	The feedback is outside the range set in 4-56 Warning Feedback Low and 4-57 Warning Feedback High.
[14]	Below feedb. low	The feedback is below the limit set in 4-56 Warning Feedback Low.
[15]	Above feedb. high	The feedback is above the limit set in 4-57 Warning Feedback High.
[16]	Thermal warning	The thermal warning turns on when the temperature exceeds the limit in the motor, the frequency converter, the brake resistor or the thermistor.
[17]	Mains out of range	The mains voltage is outside the specified voltage range.
[18]	Reverse	The output is high when the frequency converter is running

	13-01 Start Event
	Select the boolean (TRUE or FALSE) input to activate Smart Logic
	Control.
ı	Outland Francticus

Opt	ion:	Function:
		counter clockwise (the logical product of the status bits "running" AND "reverse").
[19]	Warning	A warning is active.
[20]	Alarm (trip)	A (trip) alarm is active.
[21]	Alarm (trip lock)	A (Trip lock) alarm is active.
[22]	Comparator 0	Use the result of comparator 0.
[23]	Comparator 1	Use the result of comparator 1.
[24]	Comparator 2	Use the result of comparator 2.
[25]	Comparator 3	Use the result of comparator 3.
[26]	Logic rule 0	Use the result of logic rule 0.
[27]	Logic rule 1	Use the result of logic rule 1.
[28]	Logic rule 2	Use the result of logic rule 2.
[29]	Logic rule 3	Use the result of logic rule 3.
[33]	Digital input DI18	Use the result of digital input 18.
[34]	Digital input DI19	Use the result of digital input 19.
[35]	Digital input DI27	Use the result of digital input 27.
[36]	Digital input DI29	Use the result of digital input 29.
[37]	Digital input DI32	Use the result of digital input 32.
[38]	Digital input DI33	Use the result of digital input 33.
[39]	Start command	A start command is issued.
[40]	Drive stopped	A stop command (Jog, Stop, Qstop, Coast) is issued – and not from the SLC itself.
[41]	Reset Trip	A reset is issued
[42]	Auto-reset Trip	An Auto reset is performed.
[43]	OK key	[OK] is pressed.
[44]	Reset key	[Reset] is pressed.
[45]	Left key	[◄] is pressed.
[46]	Right key	[►] is pressed.
[47]	Up key	[▲] is pressed.
[48]	Down key	[▼] is pressed.
[50]	Comparator 4	Use the result of comparator 4.
[51]	Comparator 5	Use the result of comparator 5.
[60]	Logic rule 4	Use the result of logic rule 4.
[61]	Logic rule 5	Use the result of logic rule 5.

6-42 BAS-SVX60A-EN

13-02 Stop Event



13-01 Start Event

Select the boolean (TRUE or FALSE) input to activate Smart Logic Control.

Opti	on:	Function:
[94]	RS Flipflop 0	See parameter group 13-1* Comparators
[95]	RS Flipflop 1	See parameter group 13-1* Comparators
[96]	RS Flipflop 2	See parameter group 13-1* Comparators
[97]	RS Flipflop 3	See parameter group 13-1* Comparators
[98]	RS Flipflop 4	See parameter group 13-1* Comparators
[99]	RS Flipflop 5	See parameter group 13-1* Comparators
[100]	RS Flipflop 6	See parameter group 13-1* Comparators
[101]	RS Flipflop 7	See parameter group 13-1* Comparators

13-02 Stop Event

Select the boolean (TRUE or FALSE) input to deactivate Smart Logic Control.

Opti	on:	Function:
[0]	FALSE	For descriptions [0]-[61], see
		13-01 Start Event Start Event
[1]	TRUE	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current Limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reverse	
[19]	Warning	
[20]	Alarm (trip)	
[21]	Alarm (trip lock)	
[22]	Comparator 0	

	z stop Event			
	Select the boolean (TRUE or FALSE) input to deactivate Smart			
Logic	Control.			
Option:		Function:		
[23]	Comparator 1			
[24]	Comparator 2			
[25]	Comparator 3			
[26]	Logic rule 0			
[27]	Logic rule 1			
[28]	Logic rule 2			
[29]	Logic rule 3			
[30]	SL Timeout 0			
[31]	SL Timeout 1			
[32]	SL Timeout 2			
[33]	Digital input DI18			
[34]	Digital input DI19			
[35]	Digital input DI27			
[36]	Digital input DI29			
[37]	Digital input DI32			
[38]	Digital input DI33			
[39]	Start command			
[40]	Drive stopped			
[41]	Reset Trip			
[42]	Auto-reset Trip			
[43]	OK key			
[44]	Reset key			
[45]	Left key			
[46]	Right key			
[47]	Up key			
[48]	Down key			
[50]	Comparator 4			
[51]	Comparator 5			
[60]	Logic rule 4			
[61]	Logic rule 5			
[70]	SL Timeout 3	Smart Logic Controller timer 3 is timed out.		
[71]	SL Timeout 4	Smart Logic Controller timer 4 is timed out.		
[72]	SL Timeout 5	Smart Logic Controller timer 5 is timed out.		
[73]	SL Timeout 6	Smart Logic Controller timer 6 is timed out.		
[74]	SL Timeout 7	Smart Logic Controller timer 7 is timed out.		
[75]	Start command given			
[76]	Digital input x30/2			
[77]	Digital input x30/3			
[78]	Digital input x30/4			
[79]	Digital input x46/1			
[80]	Digital input x46/3			
	•			



13-0	13-02 Stop Event			
	Select the boolean (TRUE or FALSE) input to deactivate Smart			
	Control.	, ,		
Onti	Option: Function:			
[81]	Digital input x46/5	T directions		
[82]	Digital input x46/7			
[83]	Digital input x46/9			
[84]	Digital input x46/11			
[85]	Digital input x46/13			
[90]	ATEX ETR cur. warning	Selectable if 1-90 Motor Thermal Protection is set to [20] ATEX ETR or [21] Advanced ETR. If the alarm 164 ATEX ETR cur.lim.alarm is active, the output will be 1.		
[91]	ATEX ETR cur. alarm	Selectable if 1-90 Motor Thermal Protection is set to [20] ATEX ETR or [21] Advanced ETR. If the alarm 166 ATEX ETR freq.lim.alarm is active, the output will be 1.		
[92]	ATEX ETR freq. warning	Selectable if 1-90 Motor Thermal Protection is set to [20] ATEX ETR or [21] Advanced ETR. If the alarm 163 ATEX ETR cur.lim.warning is active, the output will be 1.		
[93]	ATEX ETR freq. alarm	Selectable if 1-90 Motor Thermal Protection is set to [20] ATEX ETR or [21] Advanced ETR. If the warning 165 ATEX ETR freq.lim.warning is active, the output will be 1.		
[94]	RS Flipflop 0	See parameter group 13-1* Comparators		
[95]	RS Flipflop 1	See parameter group 13-1* Comparators		
[96]	RS Flipflop 2	See parameter group 13-1* Comparators		
[97]	RS Flipflop 3	See parameter group 13-1* Comparators		
[98]	RS Flipflop 4	See parameter group 13-1* Comparators		
[99]	RS Flipflop 5	See parameter group 13-1* Comparators		
[100]	RS Flipflop 6	See parameter group 13-1* Comparators		
[101]	RS Flipflop 7	See parameter group 13-1* Comparators		

13	13-03 Reset SLC		
Op	otion:	Function:	
[0]	Do not reset SLC	Retains programmed settings in all parameter group 13-** Smart Logic Control.	
[1]	Reset SLC	Resets all parameters in parameter group 13- ** Smart Logic Control to default settings.	

6.10.3 13-1* Comparators

Comparators are used for comparing continuous variables (i.e. output frequency, output current, analog input etc.) to fixed preset values.

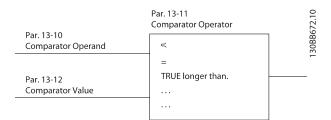


Figure 6.16 Comparators

In addition, there are digital values that will be compared to fixed time values. See explanation in 13-10 Comparator Operand. Comparators are evaluated once in each scan interval. Use the result (TRUE or FALSE) directly. All parameters in this parameter group are array parameters with index 0 to 5. Select index 0 to programme Comparator 0, select index 1 to programme Comparator 1, and so on.

13-1	13-10 Comparator Operand		
Array	Array [6]		
Opti	on:	Function:	
		Choices [1] to [31] are variables which will be compared based on their values. Choices [50] to [186] are digital values (TRUE/FALSE) where the comparison is based on the amount of time during which they are set to TRUE or FALSE, respectively. See 13-11 Comparator Operator. Select the variable to be monitored by the comparator.	
[0]	DISABLED	The comparator is disabled.	
[1]	Reference	The resulting remote reference (not local) as a percentage.	
[2]	Feedback	In the unit [RPM] or [Hz]	

6-44 BAS-SVX60A-EN



13-1	13-10 Comparator Operand		
Array	<i>,</i> [6]		
Option: Function:			
[3]	Motor speed	[RPM] or [Hz]	
[4]	Motor Current	[A]	
[5]	Motor torque	[Nm]	
[6]	Motor power	[kW] or [hp]	
[7]	Motor voltage	[V]	
[8]	DC-link voltage	[V]	
[9]	Motor Thermal	Expressed as a percentage.	
[10]	VLT temp.	Expressed as a percentage.	
[11]	Heat sink temp.	Expressed as a percentage.	
[12]	Analog input AI53	Expressed as a percentage.	
[13]	Analog input Al54	Expressed as a percentage.	
[14]	Analog input AIFB10	[V]. AIFB10 is internal 10 V supply.	
[15]	Analog input AIS24V	[V] Analog input AICCT [17] [°]. AIS24V is switch mode power supply: SMPS 24V.	
[17]	Analog input AICCT	[°]. AICCT is control card temperature.	
[18]	Pulse input FI29	Expressed as a percentage.	
[19]	Pulse input FI33	Expressed as a percentage.	
[20]	Alarm number	The error number.	
[21]	Warning number		
[22]	Analog input x30 11		
[23]	Analog input x30 12		
[30]	Counter A	Number of counts	
[31]	Counter B	Number of counts	
[50]	FALSE	Enters the fixed value of false in the comparator.	
[51]	TRUE	Enters the fixed value of true in the comparator.	
[52]	Control ready	The control board receives supply voltage	
[53]	Drive ready	The frequency converter is ready for operation and applies a supply signal on the control board.	
[54]	Running	The motor is running.	
[55]	Reversing	The output is high when the frequency converter is running counter clockwise (the logical product of the status bits "running" AND "reverse").	

13-10 Comparator Operand			
Array [6]			
Opti		Function:	
[56]	In range	The motor is running within the programmed current and speed ranges set in 4-50 Warning Current Low to 4-53 Warning Speed High.	
[60]	On reference	The motor is running on reference.	
[61]	Below Reference Low	The motor is running below the value given in 4-54 Warning Reference Low.	
[62]	Above ref, high	The motor is running above the value given in 4-55 Warning Reference High	
[65]	Torque limit	The torque limit, set in 4-16 Torque Limit Motor Mode or 4-17 Torque Limit Generator Mode, has been exceeded.	
[66]	Current Limit	The motor current limit, set in 4-18 Current Limit, has been exceeded.	
[67]	Out of current range	The motor current is outside the range set in 4-18 Current Limit.	
[68]	Below I low	The motor current is lower than set in 4-50 Warning Current Low.	
[69]	Above I high	The motor current is higher than set in 4-51 Warning Current High.	
[70]	Out of speed range	The speed is outside the range set in 4-52 Warning Speed Low and 4-53 Warning Speed High.	
[71]	Below speed low	The output speed is lower than the setting in 4-52 Warning Speed Low.	
[72]	Above speed high	The output speed is higher than the setting in 4-53 Warning Speed High.	
[75]	Out of feedb. range	The feedback is outside the range set in 4-56 Warning Feedback Low and 4-57 Warning Feedback High.	
[76]	Below feedback low	The feedback is below the limit set in 4-56 Warning Feedback Low.	
[77]	Above feedback high	The feedback is above the limit set in 4-57 Warning Feedback High.	
[80]	Thermal warning	The thermal warning turns on when the temperature exceeds the limit in the motor, the frequency converter, the brake resistor or thermistor.	
[82]	Line pwr out of range	The mains voltage is outside the specified voltage range.	
[85]	Warning	A warning is active.	
[86]	ALARM (Trip)	A (trip) alarm is active.	
[87]	ALARM (Trip Lock)	A (Trip lock) alarm is active.	



13-1	13-10 Comparator Operand		
Array	[6]		
Opti	on:	Function:	
[90]	Bus OK	Active communication (no time-out) via the serial communication port.	
[91]	Torque limit & stop	If the frequency converter has received a stop signal and is at the torque limit, the signal is logic "0".	
[92]	Brake fault (IGBT)	The brake IGBT is short circuited.	
[93]	Mech. brake control	The mechanical brake is active.	
[94]	Safe stop active		
[100]	Comparator 0	The result of comparator 0.	
[101]	Comparator 1	The result of comparator 1.	
[102]	Comparator 2	The result of comparator 2.	
[103]	Comparator 3	The result of comparator 3.	
[104]	Comparator 4	The result of comparator 4.	
[105]	Comparator 5	The result of comparator 5.	
[110]	Logic rule 0	The result of Logic rule 0.	
[111]	Logic rule 1	The result of Logic rule 1.	
[112]	Logic rule 2	The result of Logic rule 2.	
[113]	Logic rule 3	The result of Logic rule 3.	
[114]	Logic rule 4	The result of Logic rule 4.	
[115]	Logic rule 5	The result of Logic rule 5.	
[120]	SL Timeout 0	The result of SLC timer 0.	
[121]	SL Timeout 1	The result of SLC timer 1.	
[122]	SL Timeout 2	The result of SLC timer 2.	
[123]	SL Timeout 3	The result of SLC timer 3.	
[124]	SL Timeout 4	The result of SLC timer 4.	
[125]	SL Timeout 5	The result of SLC timer 5.	
[126]	SL Timeout 6	The result of SLC timer 6.	
[127]	SL Timeout 7	The result of SLC timer 7.	
[130]	Digital input DI18	Digital input 18. High = True.	
[131]	Digital input DI19	Digital input 19. High = True.	
[132]	Digital input DI27	Digital input 27. High = True.	
[133]	Digital input DI29	Digital input 29. High = True.	
[134]	Digital input DI32	Digital input 32. High = True.	
[135]	Digital input DI33	Digital input 33. High = True.	
[150]	SL digital output A	Use the result of the SLC output A.	
[151]	SL digital output B	Use the result of the SLC output B.	

13-10 Comparator Operand				
Array [6]				
Option:		Function:		
[152]	SL digital output C	Use the result of the SLC output C.		
[153]	SL digital output D	Use the result of the SLC output D.		
[154]	SL digital output E	Use the result of the SLC output E.		
[155]	SL digital output F	Use the result of the SLC output F.		
[160]	Relay 1	Relay 1 is active		
[161]	Relay 2	Relay 2 is active		
[180]	Local reference active	High when 3-13 Reference Site = [2] Local or when 3-13 Reference Site is [0] Linked to hand Auto, at the same time as the keypad is in Hand On mode.		
[181]	Remote ref. active	High when 3-13 Reference Site= [1] Remote or [0] Linked to hand/auto, while the keypad is in Auto On mode.		
[182]	Start command	High when there is an active start command, and no stop command.		
[183]	Drive stopped	A stop command (Jog, Stop, Qstop, Coast) is issued – and not from the SLC itself.		
[185]	Drive in hand mode	High when the frequency converter is in hand mode.		
[186]	Drive in auto mode	High when the frequency converter is in auto mode.		
[187]	Start command given			
[190]	Digital input x30 2			
[191]	Digital input x30 3			
[192]	Digital input x30 4			
[193]	Digital input x46 1			
[194]	Digital input x46 2			
[195]	Digital input x46 3			
[196]	Digital input x46 4			
[197]	Digital input x46 5			
[198]	Digital input x46 6			
[199]	Digital input x46 7			

13	13-11 Comparator Operator		
Arı	Array [6]		
Op	otion:	Function:	
		Select the operator to be used in the comparison. This is an array parameter containing comparator operators 0 to 5.	
[0]	<	The result of the evaluation is TRUE, when the variable selected in 13-10 Comparator Operand	

6-46 BAS-SVX60A-EN



13	13-11 Comparator Operator			
Arı	Array [6]			
Op	otion:	Function:		
		is smaller than the fixed value in 13-12 Comparator Value. The result is FALSE, if the variable selected in 13-10 Comparator Operand is greater than the fixed value in 13-12 Comparator Value.		
[1]	= (equal)	The result of the evaluation is TRUE, when the variable selected in 13-10 Comparator Operand is approximately equal to the fixed value in 13-12 Comparator Value.		
[2]	>	Inverse logic of option < [0].		
[5]	TRUE longer than			
[6]	FALSE longer than			
[7]	TRUE shorter than			
[8]	FALSE			
	shorter			
	than			

13-12 Comparator Value				
Array [6]	Array [6]			
Range:	Range: Function:			
Size related*	[-100000 - 100000]	Enter the 'trigger level' for the variable that is monitored by this comtor. This is an array parameter containing comtor values 0 to 5.		

6.10.4 13-1* RS Flip Flops

The Reset/Set Flip Flops hold the signal until set/reset.

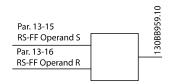


Figure 6.17 Reset/Set Flip Flops

Two parameters are used and the output can be used in the logic rules and as events.

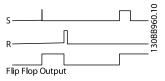


Figure 6.18 Flip Flop Outputs

The two operators can be selected from a long list. As a special case, the same digital input can be used as both Set and Reset, making it possible to use the same digital input as start/stop. The following settings can be used to set up the same digital input as start/stop (example given with DI32 but is not a requirement).

Parameter	Setting	Notes
13-00 SL Controller Mode	On	
13-01 Start Event	TRUE	
13-02 Stop Event	FALSE	
13-40 Logic Rule Boolean 1 [0]	[37] Digital	
15 to logic hate bootean 1 [6]	Input DI32	
13-42 Logic Rule Boolean 2 [0]	[2] Running	
13-41 Logic Rule Operator 1	[3] AND	
[0]	NOT	
	ra=1 5: 1: 1	
13-40 Logic Rule Boolean 1 [1]	[37] Digital	
	Input DI32	
13-42 Logic Rule Boolean 2 [1]	[2] Running	
13-41 Logic Rule Operator 1	[1] AND	
[1]		
	[26]	Output from 13-41
13-15 RS-FF Operand S [0]	Logicrule 0	[0]
	[27]	Output from 13-41
13-16 RS-FF Operand R [0]	Logicrule 1	[1]
	Logicrule i	[1]
		0 (
	[94] RS	Output from
13-51 SL Controller Event [0]	Flipflop 0	evaluating 13-15
		and 13-16
13-52 SL Controller Action [0]	[22] Run	
	[27]	
13-51 SL Controller Event [1]	Logicrule 1	
13-52 SL Controller Action [1]	[24] Stop	
13 32 32 Controller Action [1]	12 13 Stop	

Table 6.10 Operators

13-15 RS-FF Operand S		
Option	:	Function:
[0]	FALSE	
[1]	TRUE	
[2]	Running	
[3]	In range	



13-15	RS-FF Operand S		
Option:			
[4]	On reference	- unectorii	
[5]	Torque limit		
[6]	Current Limit		
[7]	Out of current range		
[8]	Below I low		
[9]	Above I high		
[10]	Out of speed range		
[11]	Below speed low		
[12]	Above speed high		
[13]	Out of feedb. range		
[14]	Below feedb, low		
[15]	Above feedb. high		
[16]	Thermal warning		
[17]	Mains out of range		
[18]	Reverse		
[19]	Warning		
[20]	Alarm (trip)		
[21]	Alarm (trip lock)		
[22]	Comparator 0		
[23]	Comparator 1		
[24]	Comparator 2		
[25]	Comparator 3		
[26]	Logic rule 0		
[27]	Logic rule 1		
[28]	Logic rule 2		
[29]	Logic rule 3		
[30]	SL Timeout 0		
[31]	SL Timeout 1		
[32]	SL Timeout 2		
[33]	Digital input DI18		
[34]	Digital input DI19		
[35]	Digital input DI27		
[36]	Digital input DI29		
[37]	Digital input DI32		
[38]	Digital input DI33		
[39]	Start command		
[40]	Drive stopped		
[41]	Reset Trip		
[42]	Auto-reset Trip		
[43]	OK key		
[44]	Reset key		
[45]	Left key		
[46]	Right key		
[47]	Up key		
[48]	Down key		
[50]	Comparator 4		
[51]	Comparator 5		
[60]	Logic rule 4		
[61]	Logic rule 5		

13-15 RS-FF Operand S		
Option:		Function:
[70]	SL Timeout 3	
[71]	SL Timeout 4	
[72]	SL Timeout 5	
[73]	SL Timeout 6	
[74]	SL Timeout 7	
[75]	Start command given	
[76]	Digital input x30/2	
[77]	Digital input x30/3	
[78]	Digital input x30/4	
[79]	Digital input x46/1	
[80]	Digital input x46/3	
[81]	Digital input x46/5	
[82]	Digital input x46/7	
[83]	Digital input x46/9	
[84]	Digital input x46/11	
[85]	Digital input x46/13	
[90]	ATEX ETR cur. warning	
[91]	ATEX ETR cur. alarm	
[92]	ATEX ETR freq. warning	
[93]	ATEX ETR freq. alarm	
[94]	RS Flipflop 0	
[95]	RS Flipflop 1	
[96]	RS Flipflop 2	
[97]	RS Flipflop 3	
[98]	RS Flipflop 4	
[99]	RS Flipflop 5	
[100]	RS Flipflop 6	
[101]	RS Flipflop 7	

13-16 RS-FF Operand R		
Option:		Function:
[0]	FALSE	
[1]	TRUE	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current Limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[16]	Thermal warning	
[17]	Mains out of range	

6-48 BAS-SVX60A-EN



13-16	RS-FF Operand R		
Option	Option: Function:		
[18]	Reverse	- uncusus	
[19]	Warning		
[20]	Alarm (trip)		
[21]	Alarm (trip lock)		
[22]	Comparator 0		
[23]	Comparator 1		
[24]	Comparator 2		
[25]	Comparator 3		
[26]	Logic rule 0		
[27]	Logic rule 1		
[28]	Logic rule 2		
[29]	Logic rule 3		
[30]	SL Timeout 0		
[31]	SL Timeout 1		
[32]	SL Timeout 2		
[33]	Digital input DI18		
[34]	Digital input DI19		
[35]	Digital input DI27		
[36]	Digital input DI29		
[37]	Digital input DI32		
[38]	Digital input DI33		
[39]	Start command		
[40]	Drive stopped		
[41]	Reset Trip		
[42]	Auto-reset Trip		
[43]	OK key		
[44]	Reset key		
[45]	Left key		
[46]	Right key		
[47]	Up key		
[48]	Down key		
[50]	Comparator 4		
[51]	Comparator 5		
[60]	Logic rule 4		
[61]	Logic rule 5		
[70]	SL Timeout 3		
[71]	SL Timeout 4		
[72]	SL Timeout 5		
[73]	SL Timeout 6		
[74]	SL Timeout 7		
[75]	Start command given		
[76]	Digital input x30/2		
[77]	Digital input x30/3		
[78]	Digital input x30/4		
[79]	Digital input x46/1		
[80]	Digital input x46/3		
[81]	Digital input x46/5		
[82]	Digital input x46/7		
[83]	Digital input x46/9		
[84]	Digital input x46/11		
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13-16 F	13-16 RS-FF Operand R		
Option:	Option: Function:		
[85]	Digital input x46/13		
[90]	ATEX ETR cur. warning		
[91]	ATEX ETR cur. alarm		
[92]	ATEX ETR freq. warning		
[93]	ATEX ETR freq. alarm		
[94]	RS Flipflop 0		
[95]	RS Flipflop 1		
[96]	RS Flipflop 2		
[97]	RS Flipflop 3		
[98]	RS Flipflop 4		
[99]	RS Flipflop 5		
[100]	RS Flipflop 6		
[101]	RS Flipflop 7		

6.10.5 13-2* Timers

Use the result (TRUE or FALSE) from *timers* directly to define an *event* (see 13-51 SL Controller Event), or as boolean input in a *logic rule* (see 13-40 Logic Rule Boolean 1, 13-42 Logic Rule Boolean 2 or 13-44 Logic Rule Boolean 3). A timer is only FALSE when started by an action (i.e. [29] Start timer 1) until the timer value entered in this parameter is elapsed. Then it becomes TRUE again. All parameters in this parameter group are array parameters with index 0 to 2. Select index 0 to program Timer 0, select index 1 to program Timer 1, and so on.

13-20 SL Controller Timer		
Range:	e: Function:	
Size	[0.000 -	Enter the value to define the duration
related*	0.000]	of the FALSE output from the
		programmed timer. A timer is only
		FALSE if it is started by an action (i.e.
		[29] Start timer 1) and until the given
		timer value has elapsed.

6.10.6 13-4* Logic Rules

Combine up to 3 boolean inputs (TRUE/FALSE inputs) from timers, comparators, digital inputs, status bits and events using the logical operators AND, OR, and NOT. Select boolean inputs for the calculation in 13-40 Logic Rule Boolean 1, 13-42 Logic Rule Boolean 2 and 13-44 Logic Rule Boolean 3. Define the operators used to logically combine the selected inputs in 13-41 Logic Rule Operator 1 and 13-43 Logic Rule Operator 2.



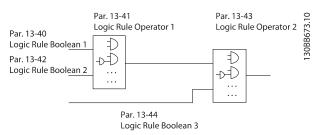


Figure 6.19 Logic Rules

Priority of calculation

The results of 13-40 Logic Rule Boolean 1, 13-41 Logic Rule Operator 1 and 13-42 Logic Rule Boolean 2 are calculated first. The outcome (TRUE/FALSE) of this calculation is combined with the settings of 13-43 Logic Rule Operator 2 and 13-44 Logic Rule Boolean 3, yielding the final result (TRUE/FALSE) of the logic rule.

13-4	13-40 Logic Rule Boolean 1		
Array	Array [6]		
Opti	on:	Function:	
[0]	FALSE	Select the first boolean (TRUE or FALSE) input for the selected logic rule. See 13-01 Start Event ([0] - [61]) and 13-02 Stop Event ([70] - [75]) for further description.	
[1]	TRUE		
[2]	Running		
[3]	In range		
[4]	On reference		
[5]	Torque limit		
[6]	Current Limit		
[7]	Out of current range		
[8]	Below I low		
[9]	Above I high		
[10]	Out of speed range		
[11]	Below speed low		
[12]	Above speed high		
[13]	Out of feedb. range		
[14]	Below feedb. low		
[15]	Above feedb. high		
[16]	Thermal warning		
[17]	Mains out of range		
[18]	Reverse		
[19]	Warning		
[20]	Alarm (trip)		
[21]	Alarm (trip lock)		
[22]	Comparator 0		
[23]	Comparator 1		
[24]	Comparator 2		

13-4	13-40 Logic Rule Boolean 1		
Array	Array [6]		
Opti		Function:	
[25]	Comparator 3	1 unctions	
[26]	Logic rule 0		
[27]	Logic rule 1		
[28]	Logic rule 2		
[29]	Logic rule 3		
[30]	SL Timeout 0		
[31]	SL Timeout 1		
[32]	SL Timeout 2		
[33]	Digital input DI18		
[34]	Digital input DI19		
[35]	Digital input DI27		
[36]	Digital input DI29		
[37]	Digital input DI32		
[38]	Digital input DI33		
[39]	Start command		
[40]	Drive stopped		
[41]	Reset Trip		
[42]	Auto-reset Trip		
[43]	OK key		
[44]	Reset key		
[45]	Left key		
[46]	Right key		
[47]	Up key		
[48]	Down key		
[50]	Comparator 4		
[51]	Comparator 5		
[60]	Logic rule 4		
[61]	Logic rule 5		
[70]	SL Timeout 3		
[71]	SL Timeout 4		
[72]	SL Timeout 5		
[73]	SL Timeout 6		
[74]	SL Timeout 7		
[75]	Start command given		
[76]	Digital input x30/2		
[77]	Digital input x30/3		
[78]	Digital input x30/4		
[79]	Digital input x46/1		
[80]	Digital input x46/3		
[81]	Digital input x46/5		
[82]	Digital input x46/7		
[83]	Digital input x46/9		
[84]	Digital input x46/11		
[85]	Digital input x46/13		
[90]	ATEX ETR cur. warning	Selectable if 1-90 Motor Thermal	
		Protection is set to [20] ATEX ETR	
		or [21] Advanced ETR. If the alarm	

6-50 BAS-SVX60A-EN



13-4	13-40 Logic Rule Boolean 1		
Array	[6]		
Opti	on:	Function: 164 ATEX ETR cur.lim.alarm is active, the output will be 1.	
[91]	ATEX ETR cur. alarm	Selectable if1-90 Motor Thermal Protection is set to [20] ATEX ETR or [21] Advanced ETR. If the alarm 166 ATEX ETR freq.lim.alarm is active, the output will be 1.	
[92]	ATEX ETR freq. warning	Selectable if 1-90 Motor Thermal Protection is set to [20] ATEX ETR or [21] Advanced ETR. If the alarm 163 ATEX ETR cur.lim.warning is active, the output will be 1.	
[93]	ATEX ETR freq. alarm	Selectable if 1-90 Motor Thermal Protection is set to [20] ATEX ETR or [21] Advanced ETR. If the warning 165 ATEX ETR freq.lim.warning is active, the output will be 1.	
[94]	RS Flipflop 0	See 13-1* Comparators	
[95]	RS Flipflop 1	See 13-1* Comparators	
[96]	RS Flipflop 2	See 13-1* Comparators	
[97]	RS Flipflop 3	See 13-1* Comparators	
[98]	RS Flipflop 4	See 13-1* Comparators	
[99]	RS Flipflop 5	See 13-1* Comparators	
[100]	RS Flipflop 6	See 13-1* Comparators	
[101]	RS Flipflop 7	See 13-1* Comparators	

13	13-41 Logic Rule Operator 1		
Arı	Array [6]		
Or	otion:	Function:	
		Select the first logical operator to use on the Boolean inputs from 13-40 Logic Rule Boolean 1 and 13-42 Logic Rule Boolean 2. [13-**] signifies the boolean input of parameter group 13-** Smart Logic Control.	
[0]	DISABLED	Ignores 13-42 Logic Rule Boolean 2, 13-43 Logic Rule Operator 2, and 13-44 Logic Rule Boolean 3.	
[1]	AND	Evaluates the expression [13-40] AND [13-42].	
[2]	OR	Evaluates the expression [13-40] OR [13-42].	
[3]	AND NOT	Evaluates the expression [13-40] AND NOT [13-42].	
[4]	OR NOT	Evaluates the expression [13-40] OR NOT [13-42].	

13	13-41 Logic Rule Operator 1		
Arı	ray [6]		
Op	otion:	Function:	
[5]	NOT AND	Evaluates the expression NOT [13-40] AND [13-42].	
[6]	NOT OR	Evaluates the expression NOT [13-40] OR [13-42].	
[7]	NOT AND NOT	Evaluates the expression NOT [13-40] AND NOT [13-42].	
[8]	NOT OR NOT	Evaluates the expression NOT [13-40] OR NOT [13-42].	

13-42 Logic Rule Boolean 2		
Array [6]		
Opti	on:	Function:
[0]	FALSE	Select the second boolean (TRUE or FALSE) input for the selected logic rule. See 13-01 Start Event ([0] - [61]) and 13-02 Stop Event ([70] - [75]) for further description.
[1]	TRUE	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current Limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reverse	
[19]	Warning	
[20]	Alarm (trip)	
[21]	Alarm (trip lock)	
[22]	Comparator 0	
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	
[26]	Logic rule 0	
[27]	Logic rule 1	
[28]	Logic rule 2	
[29]	Logic rule 3	
[30]	SL Timeout 0	



13-4	2 Logic Rule Boolean	2			
Array	Array [6]				
Opti		Function:			
[31]	SL Timeout 1				
[32]	SL Timeout 2				
[33]	Digital input DI18				
[34]	Digital input DI19				
[35]	Digital input DI27				
[36]	Digital input DI29				
[37]	Digital input DI32				
[38]	Digital input DI33				
[39]	Start command				
[40]	Drive stopped				
[41]	Reset Trip				
[42]	Auto-reset Trip				
[43]	OK key				
[44]	Reset key				
[45]	Left key				
[46]	Right key				
[47]	Up key				
[48]	Down key				
[50]	Comparator 4				
[51]	•				
[60]	Comparator 5 Logic rule 4				
	Logic rule 5				
[61] [70]	SL Timeout 3				
[71]	SL Timeout 4				
[72]	SL Timeout 5				
[73]	SL Timeout 6				
[74]	SL Timeout 7				
[75]	Start command given				
[76]	Digital input x30/2 Digital input x30/3				
[77]	,				
[78]	Digital input x30/4				
[79]	Digital input x46/1				
[80]	Digital input x46/3				
[81]	Digital input x46/5				
[82]	Digital input x46/7				
[83]	Digital input x46/9				
[84]	Digital input x46/11				
[85]	Digital input x46/13	Calastable if 1 00 Mater Themsel			
[90]	ATEX ETR cur. warning	Selectable if 1-90 Motor Thermal Protection is set to [20] ATEX ETR or [21] Advanced ETR. If the alarm 164 ATEX ETR cur.lim.alarm is active, the output will be 1.			
[91]	ATEX ETR cur. alarm	Selectable if 1-90 Motor Thermal Protection is set to [20] ATEX ETR or [21] Advanced ETR. If the alarm 166 ATEX ETR freq.lim.alarm is active, the output will be 1.			

13-4	13-42 Logic Rule Boolean 2			
Array	Array [6]			
Opti	on:	Function:		
[92]	ATEX ETR freq. warning	Selectable if 1-90 Motor Thermal Protection is set to [20] ATEX ETR or [21] Advanced ETR. If the alarm 163 ATEX ETR cur.lim.warning is active, the output will be 1.		
[93]	ATEX ETR freq. alarm	Selectable if 1-90 Motor Thermal Protection is set to [20] ATEX ETR or [21] Advanced ETR. If the warning 165 ATEX ETR freq.lim.warning is active, the output will be 1.		
[94]	RS Flipflop 0	See 13-1* Comparators		
[95]	RS Flipflop 1	See 13-1* Comparators		
[96]	RS Flipflop 2	See 13-1* Comparators		
[97]	RS Flipflop 3	See 13-1* Comparators		
[98]	RS Flipflop 4	See 13-1* Comparators		
[99]	RS Flipflop 5	See 13-1* Comparators		
[100]	RS Flipflop 6	See 13-1* Comparators		
[101]	RS Flipflop 7	See 13-1* Comparators		

13-43 Logic Rule Operator 2 Array [6] Option: **Function:** Select the second logical operator to be used on the boolean input calculated in 13-40 Logic Rule Boolean 1, 13-41 Logic Rule Operator 1, and 13-42 Logic Rule Boolean 2, and the boolean input coming from 13-42 Logic Rule Boolean 2. [13-44] signifies the boolean input of 13-44 Logic Rule Boolean 3. [13-40/13-42] signifies the boolean input calculated in 13-40 Logic Rule Boolean 1, 13-41 Logic Rule Operator 1, and 13-42 Logic Rule Boolean 2. [0] DISABLED (factory setting). select this option to ignore 13-44 Logic Rule Boolean 3. [0] DISABLED [1] AND [2] OR [3] AND NOT [4] OR NOT [5] NOT AND [6] NOT OR NOT AND NOT NOT OR NOT

6-52 BAS-SVX60A-EN



13-4	4 Logic Rule Boolean	3	
Array	Array [6]		
Opti	on:	Function:	
[0]	FALSE	Select the third boolean (TRUE or	
		FALSE) input for the selected logic	
		rule. See 13-01 Start Event ([0] -	
		[61]) and 13-02 Stop Event ([70] -	
		[75]) for further description.	
[1]	TRUE		
[2]	Running		
[3]	In range		
[4]	On reference		
[5]	Torque limit		
[6]	Current Limit		
[7]	Out of current range		
[8]	Below I low		
[9]	Above I high		
[10]	Out of speed range		
[11]	Below speed low		
[12]	Above speed high		
[13]	Out of feedb. range Below feedb. low		
[14]	Above feedb. high		
[16]	Thermal warning		
[17]	Mains out of range		
[18]	Reverse		
[19]	Warning		
[20]	Alarm (trip)		
[21]	Alarm (trip lock)		
[22]	Comparator 0		
[23]	Comparator 1		
[24]	Comparator 2		
[25]	Comparator 3		
[26]	Logic rule 0		
[27]	Logic rule 1		
[28]	Logic rule 2		
[29]	Logic rule 3		
[30]	SL Timeout 0		
[31]	SL Timeout 1		
[32]	SL Timeout 2		
[33]	Digital input DI18		
[34]	Digital input DI19		
[35]	Digital input DI27		
[36]	Digital input DI29		
[37]	Digital input DI32		
[38]	Digital input DI33		
[39]	Start command		
[40]	Drive stopped		
[41]	Reset Trip		
[42]	Auto-reset Trip OK key		
[دجا	On ney		

13-44 Logic Rule Boolean 3				
Array [6]				
Opti	on:	Function:		
[44]	Reset key			
[45]	Left key			
[46]	Right key			
[47]	Up key			
[48]	Down key			
[50]	Comparator 4			
[51]	Comparator 5			
[60]	Logic rule 4			
[61]	Logic rule 5			
[70]	SL Timeout 3			
[71]	SL Timeout 4			
[72]	SL Timeout 5			
[73]	SL Timeout 6			
[74]	SL Timeout 7			
[75]	Start command given			
[76]	Digital input x30/2			
[77]	Digital input x30/3			
[78]	Digital input x30/4			
[79]	Digital input x46/1			
[80]	Digital input x46/3			
[81]	Digital input x46/5			
[82]	Digital input x46/7			
[83]	Digital input x46/9			
[84]	Digital input x46/11			
[85]	Digital input x46/13			
[90]	ATEX ETR cur. warning	Selectable if 1-90 Motor Thermal		
		Protection is set to [20] ATEX ETR or [21] Advanced ETR. If the alarm		
		164 ATEX ETR cur.lim.alarm is		
		active, the output will be 1.		
[91]	ATEX ETR cur. alarm	Selectable if 1-90 Motor Thermal		
[91]	ATEX ETR CUI. didilli	Protection is set to [20] ATEX ETR		
		or [21] Advanced ETR. If the alarm		
		166 ATEX ETR freg.lim.alarm is		
		active, the output will be 1.		
[92]	ATEX ETR freq. warning	Selectable if 1-90 Motor Thermal		
[22]	MEX ETK HEY, Walling	Protection is set to [20] ATEX ETR		
		or [21] Advanced ETR. If the alarm		
		163 ATEX ETR cur.lim.warning is		
		active, the output will be 1.		
[93]	ATEX ETR freq. alarm	Selectable if 1-90 Motor Thermal		
		Protection is set to [20] ATEX ETR		
		or [21] Advanced ETR]. If the		
		warning 165 ATEX ETR		
		freq.lim.warning is active, the		
		output will be 1.		
[94]	RS Flipflop 0	See 13-1* Comparators		



13-44 Logic Rule Boolean 3		
Array	[6]	
Opti	on:	Function:
[95]	RS Flipflop 1	See 13-1* Comparators
[96]	RS Flipflop 2	See 13-1* Comparators
[97]	RS Flipflop 3	See 13-1* Comparators
[98]	RS Flipflop 4	See 13-1* Comparators
[99]	RS Flipflop 5	See 13-1* Comparators
[100]	RS Flipflop 6	See 13-1* Comparators
[101]	RS Flipflop 7	See 13-1* Comparators

6.10.7 13-5* States

13-5	1 SL Controller Event		
Array	Array [20]		
Opti	on:	Function:	
[0]	FALSE	Select the boolean input (TRUE or FALSE) to define the Smart Logic Controller event. See 13-01 Start Event ([0] - [61]) and 13-02 Stop Event ([70] - [74]) for further description.	
[1]	TRUE		
[2]	Running		
[3]	In range		
[4]	On reference		
[5]	Torque limit		
[6]	Current Limit		
[7]	Out of current range		
[8]	Below I low		
[9]	Above I high		
[10]	Out of speed range		
[11]	Below speed low		
[12]	Above speed high		
[13]	Out of feedb. range		
[14]	Below feedb. low		
[15]	Above feedb. high		
[16]	Thermal warning		
[17]	Mains out of range		
[18]	Reverse		
[19]	Warning		
[20]	Alarm (trip)		
[21]	Alarm (trip lock)		
[22]	Comparator 0		
[23]	Comparator 1		
[24]	Comparator 2		
[25]	Comparator 3		

13-51 SL Controller Event			
Array [20]			
Opti	on:	Function:	
[26]	Logic rule 0		
[27]	Logic rule 1		
[28]	Logic rule 2		
[29]	Logic rule 3		
[30]	SL Timeout 0		
[31]	SL Timeout 1		
[32]	SL Timeout 2		
[33]	Digital input DI18		
[34]	Digital input DI19		
[35]	Digital input DI27		
[36]	Digital input DI29		
[37]	Digital input DI32		
[38]	Digital input DI33		
[39]	Start command		
[40]	Drive stopped		
[41]	Reset Trip		
[42]	Auto-reset Trip		
[43]	OK key		
[44]	Reset key		
[45]	Left key		
[46]	Right key		
[47]	Up key		
[48]	Down key		
[50]	Comparator 4		
[51]	Comparator 5		
[60]	Logic rule 4		
[61]	Logic rule 5		
[70]	SL Timeout 3		
[71]	SL Timeout 4		
[72]	SL Timeout 5		
[73]	SL Timeout 6		
[74]	SL Timeout 7		
[75]	Start command given		
[76]	Digital input x30/2		
[77]	Digital input x30/3		
[78]	Digital input x30/4		
[79]	Digital input x46/1		
[80]	Digital input x46/3		
[81]	Digital input x46/5		
[82]	Digital input x46/7		
[83]	Digital input x46/9		
[84]	Digital input x46/11		
[85]	Digital input x46/13		
[90]	ATEX ETR cur. warning	Selectable if 1-90 Motor Thermal	
[ال	ATEA ETA Cui. Walling	Protection is set to [20] ATEX ETR	
		or [21] Advanced ETR. If the alarm	
		164 ATEX ETR cur.lim.alarm is	
		active, the output will be 1.	

6-54 BAS-SVX60A-EN



13-5	13-51 SL Controller Event			
Array	Array [20]			
Opti	on:	Function:		
[91]	ATEX ETR cur. alarm	Selectable if 1-90 Motor Thermal Protection is set to [20] ATEX ETR or [21] Advanced ETR]. If the alarm 166 ATEX ETR freq.lim.alarm is active, the output will be 1.		
[92]	ATEX ETR freq. warning	Selectable if 1-90 Motor Thermal Protection is set to [20] ATEX ETR or [21] Advanced ETR. If the alarm 163 ATEX ETR cur.lim.warning is active, the output will be 1.		
[93]	ATEX ETR freq. alarm	Selectable if 1-90 Motor Thermal Protection is set to [20] ATEX ETR or [21] Advanced ETR. If the warning 165 ATEX ETR freq.lim.warning is active, the output will be 1.		
[94]	RS Flipflop 0	See 13-1* Comparators		
[95]	RS Flipflop 1	See 13-1* Comparators		
[96]	RS Flipflop 2	See 13-1* Comparators		
[97]	RS Flipflop 3	See 13-1* Comparators		
[98]	RS Flipflop 4	See 13-1* Comparators		
[99]	RS Flipflop 5	See 13-1* Comparators		
[100]	RS Flipflop 6	See 13-1* Comparators		
[101]	RS Flipflop 7	See 13-1* Comparators		

13-	13-52 SL Controller Action		
Arra	Array [20]		
Opt	tion:	Function:	
[0]	DISABLED	Select the action corresponding to the SLC event. Actions are executed when the corresponding event (defined in 13-51 SL Controller Event) is evaluated as true. The following actions are available for selection: [0] *DISABLED	
[1]	No action		
[2]	Select set-up 1	Changes the active setup (0-10 Active Set-up) to '1'. If the setup is changed, it will merge with other setup commands coming from either the digital inputs or via a fieldbus.	
[3]	Select set-up 2	Changes the active setup <i>0-10 Active Set-up</i>) to '2'.	

13-52 SL Controller Action			
Arra	Array [20]		
Opt	tion:	Function:	
		If the setup is changed, it will merge with other setup commands coming from either the digital inputs or via a fieldbus.	
[4]	Select set-up 3	Changes the active setup (0-10 Active Set-up) to '3'. If the setup is changed, it will merge with other setup commands coming from either the digital inputs or via a fieldbus.	
[5]	Select set-up 4	Changes the active setup (0-10 Active Set- up) to '4'. If the setup is changed, it will merge with other setup commands coming from either the digital inputs or via a fieldbus.	
[10]	Select preset ref 0	Selects preset reference 0. If the active preset reference is changed, it will merge with other preset reference commands coming from either the digital inputs or via a fieldbus.	
[11]	Select preset ref	Selects preset reference 1. If the active preset reference is changed, it will merge with other preset reference commands coming from either the digital inputs or via a fieldbus.	
[12]	Select preset ref 2	Selects preset reference 2. If the active preset reference is changed, it will merge with other preset reference commands coming from either the digital inputs or via a fieldbus.	
[13]	Select preset ref 3	Selects preset reference 3. If the active preset reference is changed, it will merge with other preset reference commands coming from either the digital inputs or via a fieldbus.	
[14]	Select preset ref 4	Selects preset reference 4. If the active preset reference is changed, it will merge with other preset reference commands coming from either the digital inputs or via a fieldbus.	
[15]	Select preset ref 5	Selects preset reference 5. If the active preset reference is changed, it will merge with other preset reference commands coming from either the digital inputs or via a fieldbus.	
[16]	Select preset ref	Selects preset reference 6. If the active preset reference is changed, it will merge with other preset reference	



13-52 SL Controller Action				
Arra	Array [20]			
Option:		Function:		
		commands coming from either the digital inputs or via a fieldbus.		
[17]	Select preset ref	Selects preset reference 7. If the active preset reference is changed, it will merge with other preset reference commands coming from either the digital inputs or via a fieldbus.		
[18]	Select ramp 1	Selects ramp 1.		
[19]	Select ramp 2	Selects ramp 2.		
[20]	Select ramp 3	Selects ramp 3.		
[21]	Select ramp 4	Selects ramp 4.		
[22]	Run	Issues a start command to the frequency converter.		
[23]	Run reverse	Issues a start reverse command to the frequency converter.		
[24]	Stop	Issues a stop command to the frequency converter.		
[25]	Qstop	Issues a quick stop command to the frequency converter.		
[26]	Dcstop	Issues a DC stop command to the frequency converter.		
[27]	Coast	The frequency converter coasts immediately. All stop commands including the coast command stop the SLC.		
[28]	Freeze output	Freezes the output frequency of the frequency converter.		
[29]	Start timer 0	Starts timer 0, see <i>13-20 SL Controller Timer</i> for further description.		
[30]	Start timer 1	Starts timer 1, see <i>13-20 SL Controller Timer</i> for further description.		
[31]	Start timer 2	Starts timer 2, see <i>13-20 SL Controller Timer</i> for further description.		
[32]	Set digital out A low	Any output with SL output A will be low.		
[33]	Set digital out B low	Any output with SL output B will be low.		
[34]	Set digital out C low	Any output with SL output Cwill be low.		
[35]	Set digital out D low	Any output with SL output D will be low.		
[36]	Set digital out E low	Any output with SL output E will be low.		

13-	13-52 SL Controller Action		
Arra	Array [20]		
Opt	tion:	Function:	
[37]	Set digital out F low	Any output with SL output F will be low.	
[38]	Set digital out A high	Any output with SL output A will be high.	
[39]	Set digital out B high	Any output with SL output B will be high.	
[40]	Set digital out C high	Any output with SL output C will be high.	
[41]	Set digital out D high	Any output with SL output D will be high.	
[42]	Set digital out E high	Any output with SL output E will be high.	
[43]	Set digital out F high	Any output with SL output Fwill be high.	
[60]	Reset Counter A	Resets Counter A to zero.	
[61]	Reset Counter B	Resets Counter B to zero.	
[70]	Start timer 3	Start Timer 3, see <i>13-20 SL Controller Timer</i> for further description.	
[71]	Start timer 4	Start Timer 4, see <i>13-20 SL Controller Timer</i> for further description.	
[72]	Start timer 5	Start Timer 5, see <i>13-20 SL Controller Timer</i> for further description.	
[73]	Start timer 6	Start Timer 6, see 13-20 SL Controller Timer for further description.	
[74]	Start timer 7	Start Timer 7, see <i>13-20 SL Controller Timer</i> for further description.	

6-56 BAS-SVX60A-EN



6.11 Parameters: 14-** Special Functions

6.11.1 14-** Special Functions

Parameter group for configuring special frequency converter functions.

6.11.2 14-0* Inverter Switching

Parameters for configuring the inverter switching.

14-03 Overmodulation

Opt	ion:	Function:	
[0]	Off	Connect the overmodulation function for the output	
		voltage, to obtain an output voltage up to 15%	
		greater than the mains voltage.	
[1] *	On	No overmodulation of the output voltage, in order to	
		avoid torque ripple on the motor shaft. This feature	
		may be useful for applications such as grinding	
		machines.	

6.11.3 14-1* Mains On/Off

Parameters for configuring mains failure monitoring and handling.

14	14-12 Function at Mains Imbalance			
Op	otion:	Function:		
		Operation under severe main imbalance conditions reduces the lifetime of the motor. Conditions are considered severe if the motor is operated continuously near nominal load.		
[0]	Trip	Trips the frequency converter		
[1]	Warning	Issues a warning		
[2]	Disabled	No action		
[3]	Derate			

6.11.4 14-2* Trip Reset

Parameters for configuring auto reset handling, special trip handling and control card self test or initialization.

14-20 Reset Mode			
Option:		Function:	
		Select the reset function after tripping.	
		Once reset, the frequency converter	
		can be restarted.	
[0]	Manual reset	Performs a reset via [Reset] or via the	
		digital inputs.	
[10] *	Automatic reset	Performs between one and twenty	
	x 10	automatic resets after tripping.	

NOTE!

If the specified number of AUTOMATIC RESETS is reached within 10 minutes, the frequency converter enters [0] Manual reset mode. After the Manual reset is performed, the setting of 14-20 Reset Mode reverts to the original selection. If the number of AUTOMATIC RESETS is not reached within 10 minutes, or when a Manual reset is performed, the internal AUTOMATIC RESET counter returns to zero.

ACAUTION

The motor may start without warning.

Application Tip:

Since the default setting of the reset mode in the compressor drive is set up to auto-reset after 30 s this should be taken in consideration if a relay output is set to call for a service technician in case of an alarm. By setting 5-40 Function Relay to [9] Alarm and 5-41 On Delay, Relay to 40 s the relay will only activate at either a trip lock alarm or an alarm, which could not be auto-reset. Only the relay output can be used for this; the digital outputs do not have the On Delay feature.

14-21 Automatic Restart Time

Range:		Function:
30 s*	[0 - 600 s]	Enter the time interval from trip to start of
		the automatic reset function. This parameter
		is active when 14-20 Reset Mode is set to
		Automatic reset.

14-22 Operation Mode

Op	tion:	Function:
		Use this parameter to specify normal operation;
		to perform tests; or to initialize all parameters
		except 15-03 Power Up's, 15-04 Over Temp's and
		15-05 Over Volt's. This function is active only
		when the power is cycled to the frequency
		converter.
[0]	Normal	Normal operation of the frequency converter
*	operation	with the motor in the selected application.
[1]	Control	Tests the analog and digital inputs and outputs
	card test	and the +10 V control voltage. The test requires
		a test connector with internal connections.
		Use the following procedure for the control
		card test:
		1. Select Control card test [1].
		2. Disconnect the mains supply and wait
		for the light in the display to go out.
		3. Set switches S201 (A53) and S202
		(A54) = ON./I.



14-22 Operation Mode

Option:

Function:

- 4. Insert the test plug (see below).
- 5. Connect to mains supply.
- 6. Carry out various tests.
- The results are displayed on the keypad and the frequency converter moves into an infinite loop.
- 14-20 Reset Mode is automatically set to Normal operation. Carry out a power cycle to start up in Normal operation after a control card test.

If the test is OK:

keypad read-out: Control Card OK.
Disconnect the mains supply and remove the test plug. The green LED on the Control Card will light up.

If the test fails:

keypad read-out: Control Card I/O failure. Replace the frequency converter or Control card. The red LED on the Control Card is turned on. Test plugs (connect the following terminals to each other): 18 - 27 - 32; 19 - 29 - 33; 42 - 53 - 54 1.

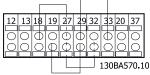
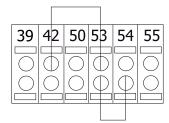


Figure 6.20



130BA571.10

Figure 6.21

[2] initialization Resets all parameter values to default settings, except for 15-03 Power Up's, 15-04 Over Temp's and 15-05 Over Volt's. The frequency converter will reset during the next power-up. 14-20 Reset Mode will also revert to the default setting [0] Normal operation.

14-52 Fan Control

Opt	ion:	Function:
		Select the minimum speed of the internal fan.
[0] *	Auto	Runs the fan only when the internal temperature
		of the frequency converter is in the range 35 °C .
		approx. 55 °C. The fan will run at low speed at
		35 °C, and at full speed at approx. 55 °C.
[1]	On 50%	
[2]	On 75%	
[3]	On 100%	

14	14-53 Fan Monitor			
Option:		Function:		
		Select which reaction the frequency converter should take in case a fan fault is detected.		
[0]	Disabled			
[1]	Warning			
[2]	Trip			

14-60 Function at Over Temperature

Option: Function:

		If either heatsink or control card temperature	
		exceeds a factory-programmed temperature limit, a	
		warning will be activated. If the temperature	
		increases further, select whether the frequency	
		converter should trip (trip locked) or derate the	
		output current.	
[0]	Trip	The frequency converter will trip (trip locked) and	
		generate an alarm. Power must be cycled to reset	
		the alarm, but will not allow restart of the motor	
		until the heat sink temperature has dropped below	
		the alarm limit.	
[1] *	Derate	If the critical temperature is exceeded the output	
		current will be reduced until the allowable	
		temperature has been reached.	

14-61 Function at Inverter Overload

Opt	ion:	Function:	
		Is used in case of steady overload beyond the	
		thermal limits (110% for 60 sec.).	
[0]	Trip	The frequency converter trips and provides an	
		alarm.	
[1] *	Derate	Reduce pump speed to decrease the load on the	
		power section and allowing this to cool down.	

14-62 Inv. Overload Derate Current

Range:		Function:
95 %*	[50 - 100	Defines the desired current level (in % of
	%]	rated output current for the frequency
		converter) when running with reduced
		pump speed after load on the frequency
		converter has exceeded the allowable limit
		(110% for 60 s).

6-58 BAS-SVX60A-EN



14	14-90 Fault Level		
Option:		Function:	
[0]	Off	Use this parameter to customize Fault levels. Use [0] Off with caution as it will ignore all Warnings & Alarms for the chosen source.	
[1]	Warning		
[2]	Trip		
[3]	Trip Lock		

Failure	Alarm	Off	War-	Trip	Trip
			ning		Lock
Over Current	13			D	Х
Motor phase	30			D	Х
missing					
Motor phase	31			D	Х
missing					
Motor phase	32			D	Х
missing					

Table 6.11 Table for Selection of Choice of Action when Selected Alarm Appears

D = Default setting. x = possible selection.

1) Only high power drives

In FC small and medium A69 is only a warning



6.12 Parameters: 15-** Drive Information

6.12.1 15-** Drive Information

Parameter group containing compressor drive information such as

- operating data
- hardware configuration
- software versions

6.12.2 15-0* Operating data

Parameter group containing operating data, e.g. counters.

15-0	00 Operating hours	
Range:		Function:
0 h*	[0 - 2147483647 h]	View how many hours the frequency converter has run. The value is saved when the frequency converter is turned off.

15-0	15-01 Running Hours		
Range:		Function:	
0 h*	[0 - 2147483647 h]	View how many hours the motor has run. Reset the counter in 15-07 Reset Running Hours Counter. The value is saved when the frequency converter is turned off.	
		turried on.	

15-02	15-02 kWh Counter				
Range:		Function:			
0 kWh*	[0 - 2147483647 kWh]	Registering the power consumption of the motor as a mean value over one hour. Reset the counter in 15-06 Reset kWh Counter.			

15	15-03 Power-ups			
Range:		Function:		
0 *	[0 - 2147483647]	View the number of times the frequency		
		converter has been powered up.		

15	15-04 Over Temps		
Range:		Function:	
0 *	[0 - 65535]	View the number of frequency converter	
		temperature faults which have occurred.	

15	-05 Over Vol	ts
Range:		Function:
* 0	[0 - 65535]	View the number of frequency converter overvoltages which have occurred.

15	15-06 Reset kWh Counter		
Option:		Function:	
[0]	Do not reset	No reset of the kWh counter is desired.	
[1]	Reset counter	Press [OK] to reset the kWh counter to zero (see 15-02 kWh Counter).	

NOTE!

The reset is carried out by pressing [OK].

15	15-07 Reset Running Hours Counter		
Option:		Function:	
[0]	Do not reset		
[0] Do not reset [1] Reset counter		Select [1] Reset and press [OK] to reset the Running Hours counter to zero (see 15-01 Running Hours). This parameter cannot be selected via the serial port, RS-485. Select [0] Do not reset if no reset of the Running Hours counter is desired.	

15-08 Number of Starts

Range:	Function:
[0 - 4294967295]	View the total number of starts performed
	since power-on. The value is cleared to zero
	at power-up.

15-09 Number of Auto Resets

Range:		Function:
	[0 - 4294967295]	View the total number of auto resets
		performed since power-on. The counter is
		cleared to zero at power-up.

6-60 BAS-SVX60A-EN



6.13 Parameters: 16-** Data Readouts

16-00 Control Word Range: Function: 0 * [0 - 65535] View the Control word sent from the frequency converter via the serial communication port in hex code.

16-01 Reference [Unit]		
Range:		Function:
0 ReferenceFeed-	[-999999 - 999999	View the present
backUnit*	ReferenceFeed-	reference value applied
	backUnit]	on impulse or analog
		basis in the unit
		resulting from the
		configuration selected
		in 1-00 Configuration
		Mode (Hz, Nm, or RPM).

16-0	16-02 Reference [%]		
Rang	ge:	Function:	
0 %*	[-200 - 200	View the total reference. The total	
	%]	reference is the sum of digital, analog,	
		preset, bus, and freeze references, plus	
		catch-up and slow-down.	

16	16-03 Status Word		
Ra	nge:	Function:	
0 *	[0 - 65535]	View the status word sent from the frequency converter via the serial communication port in hex code.	

16-0	16-05 Main Actual Value [%]		
Rang	ge:	Function:	
0 %*	[-100 - 100 %]	View the two-byte word sent with the status word to the Bus Master reporting	
		status word to the Bus Master reporting	
		the Main Actual Value.	

16-09 Custom Readout		
Range:		Function:
0 CustomRea-	[0 - 0 Custom-	View the value of custom
doutUnit*	ReadoutUnit]	readout from 0-30 Unit for
		User-defined Readout to
		0-32 Custom Readout Max
		Value

6.13.1 16-1* Motor Status

16-10 Power [kW]		
Range	e:	Function:
0 kW*	[0 - 10000 kW]	Displays motor power in kW. The value shown is calculated based on the actual motor voltage and motor current. The value is filtered, and therefore approx. 30 ms may pass from when an input value changes to when the data readout values change. The
		resolution of readout value on fieldbus is in 10 W steps.

16-11	16-11 Power [hp]		
Rang	e:	Function:	
0 hp*	[0 - 10000	View the motor power in hp. The value	
	hp]	shown is calculated based on the actual	
		motor voltage and motor current. The value	
		is filtered, and therefore approximately 30	
		ms may pass from when an input value	
		changes to when the data readout values	
		change.	

16-1	16-12 Motor voltage		
Ran	ge:	Function:	
0 V*	[0 - 6000 V]	View the motor voltage, a calculated value used for controlling the motor.	

16-13 Frequency		
Rang	e:	Function:
0 Hz*	[0 - 6500 Hz]	View the motor frequency, without
		resonance dampening.

16-1	16-14 Motor current		
Ran	ge:	Function:	
0 A*	[0 - 10000 A]	View the motor current measured as a mean value, I _{RMS} . The value is filtered, and thus approximately 30 ms may pass from when an input value changes to when the data readout values change.	

16-1	16-15 Frequency [%]		
Range:		Function:	
0 %*	[-100 -	View a two-byte word reporting the actual	
	100 %]	motor frequency (without resonance	
		dampening) as a percentage (scale 0000-4000	
		Hex) of 4-19 Max Output Frequency. Set	
		9-16 PCD Read Configuration index 1 to send it	
		with the status word instead of the MAV.	



16-16	16-16 Torque [Nm]		
Range	:	Function:	
0 Nm*	[-3000 - 3000 Nm]	View the torque value with sign, applied to the motor shaft. Linearity is not exact between 160% motor current and torque in relation to the rated torque. Some motors supply more than 160% torque. Consequently, the min. value and the max. value depend on the max. motor current as well as the motor used. The value is filtered, and thus approx. 30 ms may pass from when an input changes value to	
		when the data readout values change.	

16-17	16-17 Speed [RPM]			
Range	•	Function:		
0 RPM*	[-30000 - 30000 RPM]	View the actual motor RPM. In open loop or closed loop process control, the motor RPM is estimated. In speed closed loop modes the motor RPM is measured.		

16-18 Motor Thermal		
Range:		Function:
0 %*	[0 - 100 %]	View the calculated thermal load on the motor. The cut-out limit is 100%. The basis
		for calculation is the ETR function selected in 1-90 Motor Thermal Protection.

16-19 KTY sensor temperature		
Range: Function:		
0 °C*	[0 - 0 °C]	Returning the actual temperature on KTY
		sensor built into the motor.
		See parameter group 1-9* Motor Temperature.

16	16-20 Motor Angle		
Ra	Range: Function:		
0 * [0 - 65535]		View the current encoder/resolver angle offset	
		relative to the index position. The value range	
		of 0-65535 corresponds to 0-2*pi (radians).	

16-2	16-21 Torque [%] High Res.		
Rang	ge:	Function:	
0 %*	[-200 - 200 %]	The value shown is the torque in percent of nominal torque, with sign and 0.1% resolution, applied to the motor shaft.	

16-22 Torque [%]		
Rang	ge:	Function:
0 %*	[-200 - 200 %]	Value shown is the torque in percent of nominal torque, with sign, applied to the motor shaft.

16-25	16-25 Torque [Nm] High			
Range	: :	Function:		
0 Nm*	[-200000000 -	View the torque value with sign,		
	200000000 Nm]	applied to the motor shaft. Some		
		motors supply more than 160% torque.		
		Consequently, the min. value and the		
		max. value depend on the max. motor		
		current as well as the motor used. This		
		specific readout has been adapted to be		
		able to show higher values than the		
		standard readout in 16-16 Torque [Nm].		

6.13.2 16-3* Drive Status

16-30 DC Link Voltage			
Ran	Range: Function:		
0 V*	[0 - 10000 V]	View a measured value. The value is filtered with a 30 ms time constant.	

16-32	2 Brake Energy /s		
Range	e:	Function:	
0 kW*	[0 - 10000 kW]	View the brake power transmitted to an external brake resistor, stated as an instantaneous value.	

16-33	16-33 Brake Energy /2 min		
Range:		Function:	
0 kW*	[0 - 10000 kW]	View the brake power transmitted to an external brake resistor. The mean power is calculated on an average basis for the most recent 120 s.	

16-34 Heatsink Temp.			
Rang	Range: Function:		
0 °C*	[0 - 255 °C]	View the frequency converter heatsink	
		temperature. The cut-out limit is 90 ±5 °C,	
		and the motor cuts back in at 60 ±5 °C.	

16-35 Inverter Thermal		
Range:		Function:
0 %*	[0 - 100 %]	View the percentage load on the inverter.

16-36 Inv. Nom. Current		
Range:	nge: Function:	
Size related*	[0.01 - 10000 A]	View the inverter nominal current, which must match the nameplate data on the connected motor. The data are used for calculation of torque, motor protection, etc.

6-62 BAS-SVX60A-EN





16-37 Inv. Max. Current		
Range:	Function:	
Size related*	[0.01 - 10000 A]	View the inverter maximum current, which must match the nameplate data on the connected motor. The data are used for calculation of torque, motor protection, etc.

ı	16-38 SL Controller State		
Range: Function:		Function:	
ĺ	0 *	[0 - 100]	View the state of the event under execution by
l			the SL controller.

16-3	16-39 Control Card Temp.		
Rang	je:	Function:	
0 °C*	[0 - 100 °C]	View the temperature on the control card, stated in °C	

16	16-40 Logging Buffer Full		
Op	Option: Function:		
		View whether the logging buffer is full (see parameter group 15-1* Data Log Settings). The logging buffer is never full when setting 15-13 Logging Mode to [0] Log always.	
[0]	No		
[1]	Yes		

16-48	3 Speed Ref. After Ramp [RPM]		
Range:		Function:	
0 RPM*	[-30000 - 30000	This parameter specifies the	
	RPM]	reference given to the frequency	
		converter after the speed ramp.	

6.13.3 16-5* Ref. & Feedb.

16	16-50 External Reference		
Ra	nge:	Function:	
0 *	[-200 - 200]	View the total reference, the sum of digital, analog, preset, bus and freeze references, plus catch-up and slow-down.	

	16-51 Pulse Reference		
Range: Function:		Function:	
	0 *	[-200 - 200]	View the reference value from programmed
			digital input(s). The readout can also reflect
			the impulses from an incremental encoder.

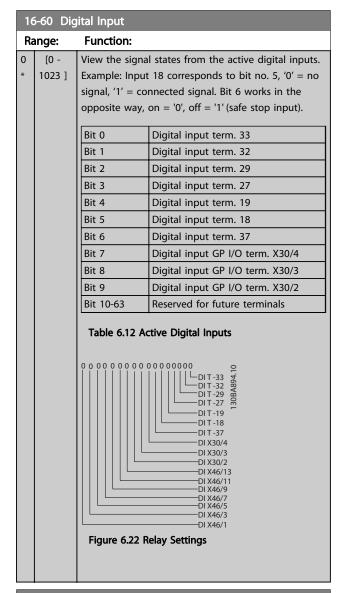
16-52 Feedback [Unit]			
Range:		Function:	
0 ReferenceFeed- backUnit*	[-999999.999 - 999999.999 ReferenceFeed- backUnit]	View the feedback unit resulting from the selection of unit and scaling in 3-00 Reference Range, 3-01 Reference/ Feedback Unit, 3-02 Minimum Reference and 3-03 Maximum Reference.	

16	16-53 Digi Pot Reference		
Ra	nge:	Function:	
0 *	[-200 - 200]	View the contribution of the Digital Potentiometer to the actual reference.	

16-57 Feedback [RPM]			
Range	•	Function:	
0 RPM*	[-30000 -	Readout parameter where the actual	
	30000 RPM]	motor RPM from the feedback source	
		can be read in both closed loop and	
		open loop. Select the feedback source in	
		7-00 Speed PID Feedback Source.	



6.13.4 16-6* Inputs and Outputs



16-	16-61 Terminal 53 Switch Setting		
Option:		Function:	
		View the setting of input terminal 53.	
[0]	Current		
[1]	Voltage		

16-6	16-62 Analog Input 53		
Ran	ge:	Function:	
0 *	[-20 - 20]	View the actual value at input 53.	

16-63 Terminal 54 Switch Setting		
Opt	Option: Function:	
	View the setting of input terminal 54.	

16-63 Terminal 54 Switch Setting			
Opt	tion:	Function:	
[0]	Current		
[1]	Voltage		

16-64 Analog Input 54		
Range:		Function:
0 *	[-20 - 20]	View the actual value at input 54.

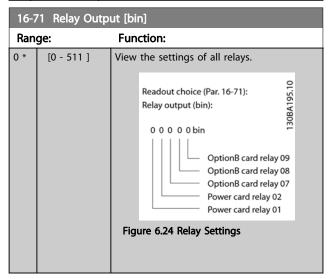
16	16-65 Analog Output 42 [mA]		
Range: Function:			
0 *	[0 - 30]	View the actual value at output 42 in mA. The	
		value shown reflects the selection in 6-50 Terminal	
		42 Output.	

16-	16-66 Digital Output [bin]		
Range:		Function:	
0 *	0 * [0 - 15] View the binary value of all digital outputs.		

16	16-68 Freq. Input #33 [Hz]		
Ra	nge:	Function:	
0 *	[0 - 130000]	View the actual value of the frequency	
		applied at terminal 33 as an impulse input.	

16	16-69 Pulse Output #27 [Hz]		
Ra	Range: Function:		
		View the actual value of pulses applied to terminal 27 in digital output mode.	

16	16-70 Pulse Output #29 [Hz]		
Ra	Range: Function:		
0 *	[0 - 40000]	View the actual value of pulses at terminal 29	
		in digital output mode.	



6-64 BAS-SVX60A-EN



16	16-72 Counter A		
Ra	nge:	Function:	
0 *	[-2147483648 - 2147483647]	View the present value of Counter A. Counters are useful as comparator	
	214/483047]	operands, see 13-10 Comparator Operand. The value can be reset or changed either via digital inputs (parameter group 5-1* Digital Inputs) or by using an SLC action (13-52 SL Controller Action).	

16	16-73 Counter B		
Ra	nge:	Function:	
0 *	[-2147483648 -	View the present value of Counter B.	
	2147483647]	Counters are useful as comparator	
		operands (13-10 Comparator Operand).	
		The value can be reset or changed either	
		via digital inputs (parameter group 5-1*	
		Digital Inputs) or by using an SLC action	
		(13-52 SL Controller Action).	

16	16-74 Prec. Stop Counter		
Range:		Function:	
0 *	[0 - 2147483647]	Returns the actual counter value of	
		precise counter (1-84 Precise Stop	
		Counter Value).	

6.13.5 16-8* Fieldbus & FC Port

Parameters for reporting the BUS references and control words.

16	16-80 Fieldbus CTW 1		
Ra	nge:	Function:	
0 *	[0 - 65535]	View the two-byte control word (CTW) received from the Bus-Master. Interpretation of	
		the control word depends on the fieldbus option installed and the control word profile	
		selected in <i>8-10 Control Profile</i> . For more information, refer to the relevant fieldbus manual.	

16	16-82 Fieldbus REF 1		
Range:		Function:	
0 *	[-200 - 200]	View the two-byte word sent with the control word from the Bus-Master to set the reference value. For more information, refer to the relevant fieldbus manual.	

16	16-84 Comm. Option Status		
Range: Function:			
0 *	[0 - 65535]	View the extended fieldbus comm. option status word. For more information, refer to the relevant fieldbus manual.	

16	16-85 FC Port CTW 1		
Range:		Function:	
0 *	[0 - 65535]	View the two-byte control word (CTW)	
		received from the Bus-Master. Interpretation of	
		the control word depends on the fieldbus	
		option installed and the control word profile	
		selected in 8-10 Control Profile.	

16	16-86 FC Port REF 1		
Range:		Function:	
0 *	[-200 - 200]	View the two-byte status word (STW) sent to the Bus-Master. Interpretation of the status word depends on the fieldbus option installed and the control word profile selected in 8-10 Control Profile.	

6.13.6 16-9* Diagnosis Read-Outs

NOTE!

When using Trane Drive Utility (TDU), the readout parameters can only be read online, i.e. as the actual status. This means that the status is not stored in the Trane Drive Utility (TDU) file.

16	16-90 Alarm Word		
Ra	nge:	Function:	
0 *	[0 - 4294967295]	View the alarm word sent via the serial communication port in hex code.	

16-91 Alarm Word 2		
Ra	nge:	Function:
0 *	[0 - 4294967295]	View the alarm word sent via the serial
		communication port in hex code.

16-92 Warning Word		
Ra	nge:	Function:
0 *	[0 - 4294967295]	View the warning word sent via the serial communication port in hex code.

16	16-93 Warning Word 2		
Ra	nge:	Function:	
0 *	[0 - 4294967295]	View the warning word sent via the serial communication port in hex code.	



16	16-94 Ext. Status Word		
Ra	nge:	Function:	
0 *	[0 - 4294967295]	Returns the extended warning word sent via the serial communication port in hex code.	

16	16-95 Ext. Status Word 2		
Ra	nge:	Function:	
0 *	[0 - 4294967295]	Returns the extended warning word 2 sent via the serial communication port in hex code.	

6-66 BAS-SVX60A-EN



6.14 Parameters: 25-** Cascade Controller

Parameters for configuring the Basic Cascade Controller for sequence control of multiple compressors.

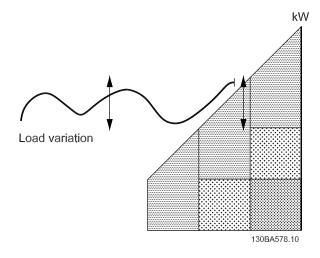


Figure 6.25 Cascade Controller Feedback Signals

To configure the Cascade Controller to the actual system and the desired control strategy, it is recommended to follow the below sequence, starting with parameter group 25-0* System Settings, and next parameter group 25-5* Alternation Settings. These parameters can normally be set in advance.

Parameters in parameter group 25-2* Bandwidth Settings and 25-4* Staging settings will often be dependent on the dynamic of the system and final adjustment to be done at the commissioning of the plant.

NOTE!

The Cascade Controller is supposed to operate in closed loop controlled by the built-in PI controller ([1] Speed Closed Loop selected in 1-00 Configuration Mode). If [0] Speed Open Loop is selected in 1-00 Configuration Mode, all fixed speed compressors will be destaged, but the variable speed compressor will still be controlled by the frequency converter, now as an open loop configuration:



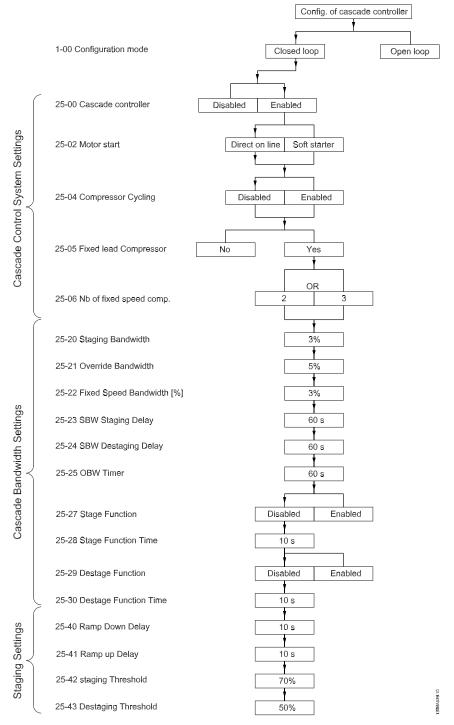


Figure 6.26 Configuring the Cascade Controller

6-68 BAS-SVX60A-EN



6.14.1 25-0* System Settings

Parameters related to control principles and configuration of the system.

25-0	25-00 Cascade Controller		
Opt	ion:	Function:	
		For operation of multiple devices (compressor)	
		systems where capacity is adapted to actual load	
		by means of speed control combined with on/off	
		control of the devices. For simplicity only	
		compressor systems are described.	
[0] *	Disabled	The Cascade Controller is not active. All built-in	
		relays assigned to compressor motors in the	
		cascade function will be de-energized. If a	
		variable speed compressor is connected to the	
		frequency converter directly (not controlled by a	
		built-in relay), this compressor will be controlled	
		as a single compressor system.	
[1]	Enabled	The Cascade Controller is active and will stage/	
		destage compressors according to load on the	
		system.	

NOTE!

This parameter can only be [1] Enabled, if 22-75 Short Cycle Protection is set to [0] Disabled.

25-02 Motor Start					
Option:		Function:			
		Motors are connected to the mains directly with			
		a contactor or with a soft starter. When the			
		value of 25-02 Motor Start is set to an option			
		other than [0] Direct on Line, then 25-50 Lead			
		Compressor Alternation is automatically set to			
		the default of [0] Direct on Line.			
[0] *	Direct on	Each fixed speed compressor is connected to			
	Line	line directly via a contactor.			
[1]	Soft	Each fixed speed compressor is connected to			
	starter	line via a soft starter.			

25-04 Compressor Cycling				
Option:		Function:		
		To provide equal hours of operation with fixed		
		speed compressors, the compressor use can be		
		cycled. The selection of compressor cycling is		
		either "first in – last out" or equal running hours		
		for each compressor.		
[0] *	Disabled	The fixed speed compressors will be connected in		
		the order 1 – 2 – 3 and disconnected in the		
		order 3 – 2 – 1. (First in – last out)		
[1]	Enabled	The fixed speed compressors will be connected/		
		disconnected to have equal running hours for		
		each compressor.		

25-05	Fixed	Lead	Compressor

Option:		Function:
		Fixed Lead Compressor means that the variable speed
		compressor is connected directly to the frequency
		converter and if a contactor is applied between
		frequency converter and compressor, this contactor
		will not be controlled by the frequency converter.
[0]	No	The lead compressor function can alternate between
		the compressors controlled by the two built in relays.
		One compressor must be connected to the built-in
		RELAY 1, and the other compressor to RELAY 2. The
		compressor function (Cascade Compressor1 and
		Cascade Compressor2) will automatically be assigned
		to the relays (maximum two compressors can in this
		case be controlled from the frequency converter).
[1] *	Yes	The lead compressor will be fixed (no alternation) and
		connected directly to the frequency converter. The
		25-50 Lead Compressor Alternation is automatically set
		to [0] Off. Built-in relays Relay 1 and Relay 2 can be
		assigned to separate fixed speed compressors. In total
		three compressors can be controlled by the frequency
		converter.

25-06 Number of Compressors

Option:		Function:
		The number of compressors connected to
		the Cascade Controller including the
		variable speed compressor. If the variable
		speed compressor is connected directly to
		the frequency converter and the other fixed
		speed compressors (lag compressors) are
		controlled by the two built in relays, three
		compressors can be controlled. If both the
		variable speed and fixed speed compressors
		are to be controlled by built-in relays, only
		two compressors can be connected.
[0]	2	If 25-05 Fixed Lead Compressor is set to [0]
*	compressors	No: one variable speed compressor and one
		fixed speed compressor; both controlled by
		built in relay. If 25-05 Fixed Lead Compressor
		is set to [1] Yes: one variable speed
		compressor and one fixed speed
		compressor controlled by built-in relay
[1]	3	[1] 3 Compressors: One lead compressor, see
	compressors	25-05 Fixed Lead Compressor. Two fixed
		speed compressors controlled by built-in
		relays.

6.14.2 25-2* Bandwidth Manager

Parameters for setting the bandwidth within which the pressure/temperature will be allowed to operate before staging/destaging fixed speed compressors. Also includes various timers to stabilize the control.



25-20 Staging Bandwidth [%]

Range: Function:

10%* [1 -100 %] Set the staging bandwidth (SBW) percentage to accommodate normal system pressure fluctuation. In cascade control systems, to avoid frequent switching of fixed speed compressors, the desired system pressure is typically kept within a bandwidth rather than at a constant level. The SBW is programmed as a percentage of the numerically larger value of 3-03 Maximum Reference and 3-02 Minimum Reference. For example, if 3-03 Maximum Reference is 10 bar and the SBW is set at 10%, a system pressure between 4.0 and 6.0 bar is tolerated if the setpoint is 5 bar. No staging or destaging will occur within this bandwidth.

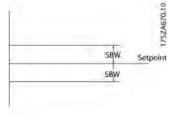


Figure 6.27 Staging Bandwidth

25-21 Override Bandwidth [%]

Range: Function:

100% = [1 - Disabled*]

When a large and quick change in the system demand occurs, the system pressure rapidly changes and an immediate staging or destaging of a fixed speed compressor becomes necessary to match the requirement. The override bandwidth (OBW) is programmed to override the staging/ destaging timer (25-23 SBW Staging Delay/ 25-24 SBW Destaging Delay) for immediate response.

The OBW must always be programmed to a higher value than the value set in 25-20 Staging Bandwidth (SBW). The OBW is a percentage of 3-03 Maximum Reference.

25-21 Override Bandwidth [%]

Range:

Function:

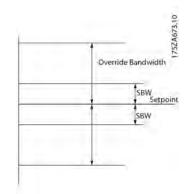


Figure 6.28 Override Bandwidth

Setting the OBW too close to the SBW could defeat the purpose with frequent staging at momentary pressure changes. Setting the OBW too high might lead to unacceptably high or low pressure in the system while the SBW timers are running. The value can be optimized with increased familiarity with the system. See *25-25 OBW Time*.

To avoid unintended staging during the commissioning phase and fine tuning of the controller, initially leave the OBW at the factory setting of 100% (Off). When the fine tuning is completed, the OBW should be set to the desired value. An initial value of 10% is suggested.

25-22 Fixed Speed Bandwidth [%]

Range:

Function:

10%* [1 -

When the cascade control system is running normally and the frequency converter issues a trip alarm, it is important to maintain the system head. The Cascade Controller does this by continuing to stage/destage the fixed speed compressor on and off. Due to the fact that keeping the head at the setpoint would require frequent staging and destaging when only a fixed speed compressor is running, a wider Fixed Speed Bandwidth (FSBW) is used instead of SBW. It is possible to stop the fixed speed compressors, in case of an alarm situation, by pressing the [Off] or [Hand On] or if the signal programmed for Start on digital input goes low.

In case the issued alarm is a trip-lock alarm then the Cascade Controller must stop the system immediately by cutting out all the fixed speed compressors. This is basically the same as

6-70 BAS-SVX60A-EN



25-22 Fixed Speed Bandwidth [%]

Range: Function:

Emergency Stop (Coast/Coast inverse Command) for the Cascade Controller.

25-23 SBW Staging Delay

Range: **Function:** [0-3000 60 Immediate staging of a fixed speed sec.* sec.] compressor is not desirable when a momentary pressure drop in the system exceeds the Staging Bandwidth (SBW). Staging is delayed by the length of time programmed. If the pressure increases to within the SBW before the timer has elapsed, the timer is reset. SBW (27-20) Setpoint SBW (27-20) SBW staging-vertr. (27-23) Figure 6.29 SBW Staging Delay

25-24 SBW Destaging Delay

Range:	[0.2000	Function:
60	0000 01	
	[0-3000 sec.]	Immediate destaging of a fixed speed compressor is not desirable when a momentary pressure increase in the system that exceeds the Staging Bandwidth (SBW). Destaging is delayed by the length of time programmed. If the pressure decreases to within the SBW before the timer has elapsed, the timer is reset. (27-24) SBW destage delay (27-20) Setpoint SBW (27-20) Setpoint

25-25 OBW Time

Range	e:	Function:	
60 sec.*	[0 – 300 sec.]	Staging a fixed speed compressor creates a momentary pressure peak in the system, which might exceed the Override Bandwidth (OBW). I is not desirable to destage a compressor in response to a staging pressure peak. The OBW Time can be programmed to prevent staging until the system pressure has stabilized and normal control established. Set the timer to a value that allows the system to stabilize after staging. The 10 second factory setting is appropriate in most applications. In highly dynamic systems, a shorter time may be desirable. SBW (27-70)	lt

25-27 Stage Function

Option:		Function:
[0] *	Disabled	
[1]	Enabled	If the Stage Function is set to [0] Disabled,
		25-28 Stage Function Time will not be activated.

25-28 Stage Function Time

Range:		Function:
10	[0 -	The Stage Function Time is programmed to
sec.*	300	avoid frequent staging of the fixed speed
	sec.]	compressors. The Stage Function Time starts if it
		is [1] Enabled by 25-27 Stage Function and when
		the variable speed compressor is running at
		4-13 Motor Speed High Limit [RPM] or 4-14 Motor
		Speed High Limit [Hz] (or at 4-11 Motor Speed
		Low Limit [RPM] or 4-12 Motor Speed Low Limit
		[Hz] if 7-30 Process PID Normal/ Inverse Control is
		programmed to Inverse), with at least one fixed
		speed compressor in the stop position. When
		the programmed value of the timer expires, a
		fixed speed compressor is staged.

25-29 Destage Function

Option:		Function:	
[0] *	Disabled		



25-29 Destage Function

Option:		Function:
[1]	Enabled	The Destage Function ensures that the lowest
		numbers of compressors are running to save
		energy. If the Destage Function is set to [0]
		Disabled, the 25-30 Destage Function Time will not
		be activated.

25-30 Destage Function Time

Range: 10 [0 - sec.* 300 sec.]

Function:

The Destage Function Timer is programmable to avoid frequent staging/destaging of the fixed speed compressors. The Destage Function Time starts when the adjustable speed compressor is running at 4-11 Motor Speed Low Limit [RPM] or 4-12 Motor Speed Low Limit [Hz] (or at 4-13 Motor Speed High Limit [RPM] or 4-14 Motor Speed High Limit [Hz] if 7-30 Process PID Normal/ Inverse Control is programmed to Inverse), with one or more fixed speed compressors in operation and system requirements satisfied. In this situation, the adjustable speed compressor contributes little to the system. When the programmed value of the timer expires, a stage is removed.

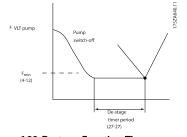


Figure 6.32 Destage Function Time

6.14.3 25-4* Staging Settings

Parameters determining conditions for staging/destaging the compressors.

25-40 Ramp Down Delay

Range:		Function:
10 sec.*	[0 - 120	When adding a fixed speed compressor
	sec.]	controlled by a soft starter, it is possible to
		delay the ramp down of the lead
		compressor until a preset time after the start
		of the fixed speed compressor to eliminate
		pressure surges in the system.
		Only to be used if [1] Soft Starter is selected
		in 25-02 Motor Start.

25-41 Ramp Up Delay

Range	;	Function:
10	[0 –	When removing a fixed speed compressor
sec.*	120	controlled by a soft starter, it is possible to
	sec.]	delay the ramp up of the lead compressor until
		a preset time after the stopping of the fixed
		speed compressor to eliminate pressure surges
		in the system.
		Only to be used if [1] Soft Starter is selected in
		25-02 Motor Start.
		Staging De-staging De-staging
		Fixed sports gards (controlled by soft starter) (controlled by soft starter)
		Figure 6.33 Ramp-up Delay

25-42 Staging Threshold

Range: Function:

90%* When adding a fixed speed compressor, in order 100%] to prevent an overshoot of pressure, the variable speed compressor ramps down to a lower speed. When the variable speed compressor reaches the "Staging Speed" the fixed speed compressor is staged on. The Staging Threshold is used to calculate the speed of the variable speed compressor when the "cut-in point" of the fixed speed compressor occurs. The calculation of the Staging Threshold is the ratio of 4-11 Motor Speed Low Limit [RPM] or 4-12 Motor Speed Low Limit [Hz] to 4-13 Motor Speed High Limit [RPM] or 4-14 Motor Speed High Limit [Hz] expressed in percent. Staging Threshold must range from

$$\eta_{\textit{STAGE\%}} \, = \, \frac{\eta_{\textit{LOW}}}{\eta_{\textit{HIGH}}} \, \times \, 100 \, \%$$

to 100%, where n_{LOW} is Motor Speed Low Limit and n_{HIGH} is Motor Speed High Limit.

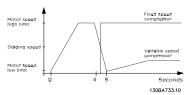


Figure 6.34 Staging Threshold

6-72 BAS-SVX60A-EN



25-43 Destaging Threshold

Range:

Function:

50%* [0 - 100%]

When removing a fixed speed compressor, in order to prevent an undershoot of pressure, the variable speed compressor ramps up to a higher speed. When the variable speed compressor reaches the "Destaging Speed" the fixed speed compressor is destaged. The Destaging Threshold is used to calculate the speed of the variable speed compressor when the destaging of the fixed speed compressor occurs. The calculation of the Destaging Threshold is the ratio of 4-11 Motor Speed Low Limit [RPM] or 4-12 Motor Speed Low Limit [Hz] to 4-13 Motor Speed High Limit [RPM] or 4-14 Motor Speed High Limit [Hz] expressed in percent.

Destaging Threshold must range from

$$\eta_{\textit{STAGE}\%} \, = \, \frac{\eta_{\textit{LOW}}}{\eta_{\textit{HIGH}}} \, \times \, 100 \, \%$$

to 100%, where n_{LOW} is Motor Speed Low Limit and n_{HIGH} is Motor Speed High Limit.

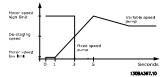


Figure 6.35 Destaging Threshold

25-44 Staging Speed [RPM]

Option: Function:

O N/A Readout of the below calculated value for Staging Speed. When adding a fixed speed compressor, in order to prevent an overshoot of pressure, the variable speed compressor ramps down to a lower speed. When the variable speed compressor reaches the "Staging Speed" the fixed speed compressor is staged on. Staging Speed calculation is based on 25-42 Staging Threshold and 4-13 Motor Speed High Limit [RPM].

Staging Speed is calculated with the following formula:

$$\eta_{STAGE} = \eta_{HIGH} \frac{\eta_{STAGE\%}}{100}$$

where n_{HIGH} is Motor Speed High Limit and n_{STAGE100%} is the value of Staging Threshold.

25-45 Staging Speed [Hz]

Option: Function:

0 N/A

Readout of the below calculated value for Staging Speed When adding a fixed speed compressor, in order to prevent an overshoot of pressure, the variable speed compressor ramps down to a lower speed. When the variable speed compressor reaches

25-45 Staging Speed [Hz]

Option:

Function:

the "Staging Speed" the fixed speed compressor is staged on. Staging Speed calculation is based on 25-42 Staging Threshold and 4-14 Motor Speed High Limit [Hz].

Staging Speed is calculated with the following formula:

 $\eta_{STAGE} = \eta_{HIGH} \frac{\eta_{STAGE\%}}{100}$ where η_{HIGH} is Motor Speed High Limit and $\eta_{STAGE100\%}$ is the value of Staging Threshold.

25-46 Destaging Speed [RPM]

Option: Function:

0 N/A

Readout of the below calculated value for Destaging Speed. When removing a fixed speed compressor, in order to prevent an undershoot of pressure, the variable speed compressor ramps up to a higher speed. When the variable speed compressor reaches the "Destaging Speed" the fixed speed compressor is destaged. Destaging Speed is calculated based on 25-43 De-staging Threshold and 4-13 Motor Speed High Limit [RPM].

Destaging Speed is calculated with the following formula:

 $\eta_{DESTAGE} = \eta_{HIGH} \frac{\eta_{DESTAGE\%}}{100}$ where η_{HIGH} is Motor Speed High Limit and $\eta_{DESTAGE100\%}$ is the value of Destaging Threshold.

25-47 Destaging Speed [Hz]

Option: Function:

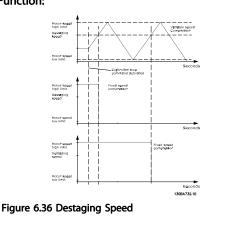
Readout of the below calculated value for Destaging Speed. When removing a fixed speed compressor, in order to prevent an undershoot of pressure, the variable speed compressor ramps up to a higher speed. When the variable speed compressor reaches the "Destaging Speed" the fixed speed compressor is destaged. Destaging Speed is calculated based on 25-43 Destaging Threshold and 4-14 Motor Speed High Limit [Hz] Destaging Speed is calculated with the following formula:

$$\eta_{DESTAGE} = \eta_{HIGH} \frac{\eta_{DESTAGE\%}}{100}$$

where n_{HIGH} is Motor Speed High Limit and $n_{DESTAGE100\%}$ is the value of Destaging Threshold.



25-47 Destaging Speed [Hz] Option: Function:



6.14.4 25-5* Alternation Settings

Parameters for defining the conditions for alternation of the variable speed compressor (lead), if selected as part of the control strategy.

25-50 Lead Compressor Alternation

Option:		Function:
		Lead compressor alternation equalizes the use of compressors by periodically changing the compressor that is speed controlled. This ensures that compressors are equally used over time. Alternation equalizes the usage of compressors by always choosing the compressor with the lowest number of used hours to stage on next.
[0] *	Off	No alternation of lead compressor function will take place. It is not possible to set this parameter to options other than [0] Off if 25-02 Motor Start is set other than [0] Direct on Line. NOTE! It is not possible to select other than [0] Off if 25-05 Fixed Lead Compressor is set to [1] Yes.
[1]	At Staging	Alternation of the lead compressor function will take place when staging another compressor.
[2]	At Command	Alternation of the lead compressor function will take place at an external command signal or a pre-programmed event. See 25-51 Alternation Event for available options.
[3]	At Staging or at Command	Alternation of the variable speed (lead) compressor will take place at staging or the "At Command" signal (See above).

25-51 Alternation Event

Option:		Function:
		This parameter is only active if the options
		[2] At Command or [3] At Staging or
		Command have been selected in 25-50 Lead
		Compressor Alternation. If an Alternation
		Event is selected, the alternation of lead
		compressor takes place every time the event
		occurs.
[0] *	External	Takes place when a signal is applied to one
		of the digital inputs on the terminal strip
		and this input has been assigned to [121]
		Lead Compressor Alternation in parameter
		group 5-1* Digital Inputs.
[1]	Alternation	Takes place every time 25-52 Alternation Time
	Time Interval	Interval expires.

25-52 Alternation Time Interval

Range:		Function:
24 h*	[1 – 999	If [1] Alternation Time Interval option in
	h]	25-51 Alternation Event is selected, the
		alternation of the variable speed compressor
		takes place every time the Alternation Time
		Interval expires (can be checked out in
		25-53 Alternation Timer Value).

25-53 Alternation Time Value

Option: **Function:**

Option:

0 N/A	Readout parameter for the Alternation Time Interval
	value set in 25-52 Alternation Time Interval.

25-55 Alternation if Capacity < 50% **Function:**

Disabled If Alternation If Capacity <50% is enabled, the [1] * Enabled compressor alternation can only occur if the capacity is equal to or below 50%. The capacity calculation is the ratio of running compressors (including the variable speed compressor) to the total number of available compressors (including variable speed compressor, but not those interlocked). Capacity = $\frac{NRunning}{NTotal} \times 100 \%$

different from [0] Off.

For the Basic Cascade Controller all compressors are equal size. Disabled [0]: The lead compressor alternation will take place at any compressor capacity. Enabled [1]: The lead compressor function will be alternated only if the numbers of compressors running are providing less than 50% of total compressor capacity. Only valid if 25-50 Lead Compressor Alternation is

6-74 BAS-SVX60A-EN standstill.



25-56 Staging Mode at Alternation			
Opt	ion:	Function:	
		This parameter is only active if the option selected	
		in 25-50 Lead Compressor Alternation is different from	
		[0] Off.	
		Two types of staging and destaging of compressors	
are possible. Slow transfer makes staging and		are possible. Slow transfer makes staging and	
		destaging smooth. Quick Transfer makes staging and	
		destaging as fast as possible; the variable speed	
		compressor is just cut out (coasted).	
[0] *	Slow	At alternation, the variable speed compressor is	
		ramped up to maximum speed and then ramped	
		down to a standstill.	
[1]	Quick	At alternation, the variable speed compressor is	
		ramped up to maximum speed and then coasted to	

Figure 6.37 is an example of the Slow transfer staging. The variable speed compressor (top graph) and one fixed speed compressor (bottom graph) are running before the staging command. When the [0] Slow transfer command is activated, an alternation is carried out by ramping the variable speed compressor to 4-13 Motor Speed High Limit [RPM] or 4-14 Motor Speed High Limit [Hz], and then decelerated to zero speed. After a "Delay Before Starting Next Compressor" (25-58 Run Next Compressor Delay) the next lead compressor (middle graph) is accelerated and another original lead compressor (top graph) is added after the "Delay Before Running On Mains" (25-59 Run on Mains Delay) as a fixed speed compressor. The next lead compressor (middle graph) is decelerated to Motor Speed Low Limit and then allowed to vary speed to maintain system pressure.

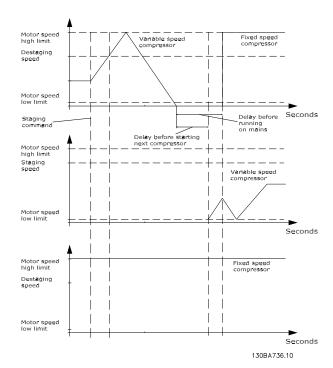


Figure 6.37 Slow Transfer Staging

25-58 Run Next Compi		ressor Delay
Range	•	Function:
0.5	[25-58 Run Next	This parameter is only active if the
sec*	Compressor	option selected in 25-50 Lead
	Delay – 5.0 sec]	Compressor Alternation, is different
		from [0] Off.
		This parameter sets the time between
		stopping the old variable speed
		compressor and starting another
		compressor as a new variable speed
		compressor. Refer to 25-56 Staging
		Mode at Alternation and Figure 6.37 for
		description of staging and alternation.

25-59 Run on Mains Delay

Range		Function:
0.5	[25-58 Run Next	This parameter is only active if the
sec*	Compressor	option selected in 25-50 Lead
	<i>Delay</i> – 5.0 sec]	Compressor Alternation, is different
		from [0] Off.
		This parameter sets the time between
		stopping the old variable speed
		compressor and starting this
		compressor as a new fixed speed
		compressor. Refer to 25-56 Staging
		Mode at Alternation and Figure 6.37 for
		description of staging and alternation.



6.14.5 25-8* Status

Readout parameters informing about the operating status of the cascade controller and the compressors controlled.

25-80 Pack Status

Option:		Function:
		Read out of the status of the Pack Controller.
	Disabled	Pack Controller is disabled (25-00 Cascade
		Controller).
	Emergency	All compressors have been stopped by means
		of a Coast/Coast inverse or an External Interlock
L		command applied to the frequency converter.
	Off	All compressors have been stopped by means
		of a Stop command applied to the frequency
		converter.
	In Open Loop	1-00 Configuration Mode has been set for [0]
		Open Loop. All fixed speed compressors are
		stopped. The variable speed compressor will
		continue to run.
	Frozen	Staging/destaging of compressors has been
		locked and reference locked.
	Jogging	All fixed speed compressors are stopped. When
		stopped, the variable speed compressor will run
L		at jog speed.
	Running	A Start command is applied to the frequency
		converter and the Pack controller is controlling
		the compressors.
	Running FSBW	The frequency converter is tripped off and the
		Pack Controller is controlling the fixed speed
		compressors based on 4-14 Motor Speed High
L		Limit [Hz].
	Staging	The Pack Controller is staging fixed speed
		compressors.
	Destaging	The Pack Controller is destaging fixed speed
L		compressors.
	Lead Not Set	No compressor available to be assigned as
		variable speed compressor.

25-81 Compressor Status

Option:	Function:

		Compressor Status shows the status for the number of compressors selected in
		number of compressors selected in
		25-06 Number Of Pumps. It is a readout of the
		status for each of the compressors showing a
		string, which consists of compressor number
		and the current status of the compressor.
		Example: Readout is with the abbreviation like
		"1:D 2:O" This means that compressor 1 is
		running and speed controlled by the
		frequency converter and compressor 2 is
		stopped.
[X]	Disabled	The compressor is interlocked either via
		25-90 Pump Interlock, or signal on a digital

25-81 Compressor Status

Option:		Function:
		input programmed for Compressor (number
		on compressor) Interlock in parameter group
		5-1* Digital Inputs. Can only refer to fixed
		speed compressors.
[O]	Off	Stopped by the cascade controller (but not
		interlocked).
[D]	Running on	Variable speed compressor, regardless if
	Frequency	connected directly or controlled via relay in
	Converter	the frequency converter.
[R]	Running on	Running on mains. Fixed speed compressor
	Mains	running.

25-82 Lead Compressor

Option: Function:

0 N/A	Readout parameter for the actual variable speed
	compressor in the system. It is updated to reflect the
	current variable speed compressor in the system when
	an alternation takes place. If no lead compressor is
	selected (Cascade Controller disabled or all
	compressors interlocked) the display will show NONE.

25-83 Relay Status

Array [2]

-		
	On	
Ī	Off	Read out of the status for each of the relays assigned to
l		control the compressors. Every element in the array
l		represents a relay. If a relay is activated, the corresponding
l		element is set to "On". If a relay is deactivated, the
l		corresponding element is set to "Off".

25-84 Compressor ON Time

Array [2]

0	[0 -	Readout of the value for Compressor ON
h*	2147483647	Time. The Cascade Controller has sete
	h]	counters for the compressors and for the
		relays that control the compressors.
		Compressor ON Time monitors the
		"operating hours" of each compressor. The
		value of each Compressor ON Time counter
		can be reset to 0 by writing in the
		parameter, e.g. if the compressor is replaced
		in case of service.

25-85 Relay ON Time

Array [2]

0	[0 -	Readout of the value for Relay ON time. The
h*	2147483647	Cascade Controller has set counters for the
	h]	compressors and for the relays that control
		the compressors. Compressor cycling is
		always done based on the relay counters,

6-76 BAS-SVX60A-EN

Parameter Descriptions

Operating Instructions TRV200

	otherwise it would always use the new
	compressor if a compressor is replaced and
	its value in 25-84 Pump ON Time counter is
	reset. In order to use 25-04 Pump Cycling, the
	Cascade Controller is monitoring the Relay
	ON time.

25-91 Manual Alternation Option: Function: compressor, the parameter will be reset to [0] immediately after.

25-86 Reset Relay Counters

Option:		Function:
[0] *	Do not reset	
[1]	Do reset	Resets all elements in 25-85 Relay ON Time.

6.14.6 25-9* Service

Parameters used in case of service on one or more of the compressors controlled.

25-90 Compressor Interlock

Array [2]

		In this parameter, it is possible to disable one or more of the fixed lead compressors. For example, the compressor will not be selected for staging on even if it is the next compressor in the operation sequence. It is not possible to disable the lead compressor with the Compressor Interlock command. The digital input interlocks are selected as [130 – 132] Compressor 1-3 Interlock in parameter group 5-1* Digital Inputs.
[0] *	Off	The compressor is active for staging/destaging.
[1]	On	The Compressor Interlock command is given. If a compressor is running it is immediately destaged. If the
		compressor is not running it is not allowed to stage on.

25-91 Manual Alternation

Option:		Function:
[0]	0 = Off -	This parameter is only active if the options
*	Number of	At Command or At Stating or Command are
	Compressors	selected in 25-50 Lead Compressor
		Alternation.
		The parameter is for manually setting of
		what compressor to be assigned as
		variable speed compressor. The default
		value of Manual Alternation is [0] Off. If a
		value other than [0] Off is set, the
		alternation is carried out immediately and
		the compressor that is selected with
		Manual Alternation is the new variable
		speed compressor. After the alternation has
		been carried out, the Manual Alternation
		parameter is reset to [0] Off. If the
		parameter is set to the number which
		equals the actual variable speed



6.15 Parameters: 28-** Compressor Functions

6.15.1 28-0* Short Cycle Protection

When controlling refrigeration compressors, there is often a need for limiting the numbers of starts. One way to limit the starts is to ensure a minimum run time (time between a start and a stop) and a minimum interval between starts. 28-02 Minimum Run Time can override any normal stop command and 28-01 Interval between Starts can override any normal start command (Start/Jog/Freeze). None of the two functions are active if Hand On or Off modes have been activated via the keypad. If selecting Hand On or Off, the two timers will be reset to 0, and not start counting until Auto is pressed and an active start command applied.

28	28-00 Short Cycle Protection		
Option: Function:		Function:	
[0]	Disabled	Timer set in 28-01 Interval between Starts is disabled.	
[1]	Enabled	Timer set in 28-01 Interval between Starts is enabled.	

NOTE!

This parameter can only be [1] Enabled if 25-00 Cascade Controller is set to [0] Disabled.

28-01 Interval Between Starts Range: Function: 300 s* [0 - 3600 s] Sets the time desired as minimum time between two starts. Any normal start command (Start/Jog/Freeze) is disregarded until the timer has expired.

28-0	28-02 Minimum Run Time		
Rang	je:	Function:	
12 s*	[0 - par.	Sets the time desired as minimum run time	
	28-01]	after a normal start command (Start/Jog/	
		Freeze). Any normal stop command is	
		disregarded until the set time has expired.	
		The timer starts counting following a normal	
		start command (Start/Jog/Freeze).	
		A Coast (Inverse) or an External Interlock	
		command override the timer.	

NOTE!

Does not work in cascade mode.

6.15.2 28-1* Oil Return Management

Insufficient lubrication can be the result of oil depositing itself in pipes and bends. Return oil deposits to the crankcase by increasing velocity for short periods at regular time intervals or by ensuring adequate oil return when velocity is too low.

With Oil Return Management, these two oil return mechanisms can be programmed into the Compressor Drive™. With Oil Return Management enabled, the frequency converter performs oil return by boosting the compressor speed to 4200 RPM (70 Hz) for a selectable duration. Programme the duration in 28-13 Boost Duration. The boosts are performed at fixed time intervals (programmed in 28-12 Fixed Boost Interval) or if the compressor speed has been less than 3000 RPM (50 Hz) for too long (as programmed in 28-11 Low Speed Running Time), whichever occurs first. Thus, the maximum time between two consecutive oil return boosts is as programmed in 28-12 Fixed Boost Interval. A text message on the keypad indicates oil return boosts.

NOTE!

If 4-13 Motor Speed High Limit [RPM] or 4-14 Motor Speed High Limit [Hz] is set to the boost speed 4200 RPM an oil boost may cause unwanted staging or destaging if parameter group 25-** Cascade Controller is active.

28-10 Oil Return Management			
Option	:	Function:	
[0] *	Off	No function	
[1]	On	Oil return mechanism is active.	

28-11 Low Speed Running Time

Range:		Function:
60 min*	[1 –	Running at low speeds for extended periods
	1440	may result in inadequate oil return to the
	min]	compressor crankcase. Set this parameter to
		the maximum running time the compressor
		is allowed to run at a speed below 3000
		RPM/50 Hz. An oil return boost is performed
		each time the compressor has been running
		at a low speed for this maximum time.

28-12 Fixed Boost Interval

Range:		Function:
24 h *	[1 -	An oil return boost is performed at fixed time
	168 h]	intervals to complement the oil return boosts
		triggered by inadequate flow speeds
		(28-11 Low Speed Running Time). The fixed
		interval boosts ensure that oil return boosts
		are performed even when no boosts have

6-78 BAS-SVX60A-EN



28-12 Fixed Boost Interval		
Range:	Function:	
	occurred due to low flow speed (28-11 Low	
	Speed Running Time)	

28-13 Boost Duration

Range:		Function:
30 s *	[10 – 120 s]	This parameter controls the duration of oil
		return boosts.

6.15.3 28-2* Discharge Temperature Monitor

The Discharge Temperature Monitor (DTM) can be used to prevent the discharge temperature from reaching dangerous levels.

Two temperature levels of increasing severity can be programmed. These levels are called warning level (set in 28-24 Warning Level) and emergency level (set in 28-26 Emergency Level) in order of increasing severity. Each level corresponds to a particular set of preventive actions.

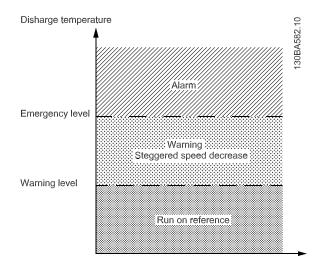


Figure 6.38 Discharge Temperature Levels

To prevent damaging the compressor, discharge temperatures above the Emergency level cause an alarm and an immediate trip.

Normal operations apply for discharge temperatures below Warning level. The discharge temperature is passively monitored without affecting frequency converter operations.

Discharge temperatures in the range from Warning level to Emergency level trigger a warning and an action set by 28-25 Warning Action. The action can be None or Decrease cooling. If the action is set to Decrease cooling, the cooling is decreased as a preventive action in an attempt to lower the discharge temperature.

Decrease cooling by step-wise lowering of the shaft speed until the discharge temperature either drops below warning level or exceeds emergency level. Each step represents a three minute period during which the maximum allowed shaft speed is 10 Hz lower than the previous step. The initial step occurs when the discharge temperature rises from below to above warning level and uses the current shaft speed as basis for the 10 Hz speed reduction.

The speed steps enforce maximum shaft speeds. If the reference corresponds to a lesser speed, the reference is obeyed. If it corresponds to a higher speed, the speed is limited to the maximum shaft speed for that step.

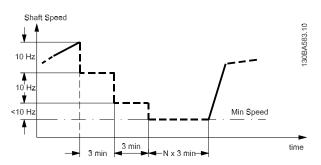


Figure 6.39 Speed Steps

NOTE!

If the Cascade Controller is active, unwanted staging or destaging may result if the Discharge Temperature Monitor reduces the speed to 4-11 Motor Speed Low Limit [RPM] or 4-12 Motor Speed Low Limit [Hz].

28-20 Temperature Source

0	ption:	Function:
		Selects the input terminal to which the
		discharge temperature measurement device is
		connected.
[0]	* None	No Source. The Discharge Temperature Monitor
		is not active.
[1]	Analog	The measurement device is connected to input
	input 53	terminal 53. Program 6-10 Terminal 53 Low
		Voltage to 6-15 Terminal 53 High Ref./Feedb.
		Value to match the characteristics of the device.



28-20 Temperature Source

Option:		Function:
[2]	Analog	The measurement device is connected to input
	input 54	terminal 54. Program 6-20 Terminal 54 Low
		Voltage to 6-25 Terminal 54 High Ref./Feedb.
		Value to match the characteristics of the device.
[3]	Bus	The actual discharge temperature should be
		sent via Modbus RTU or FC protocol to 28-27
		Discharge temperature. The temperature could
		be set via PCD write in 8-42 PCD Write Configu-
		ration.

28-21 Temperature Unit

Option:		Function:
		Selects the unit of the discharge temperature.
[60]*	°C	
[160]	°F	

28-24 Warning Level

Rang	e:	Function:
130 *	[10–	Selects the temperature at which a
	28-26 Emergency	warning shall be issued. The action
	Level]	selected in becomes active at this
		temperature. Enter the temperature
		measured in the unit selected in .

28-25 Warning Action

Ontion	Functions

		Selects the action to be taken by the frequency converter for discharge temperatures above the value programmed in but below the value programmed in .
[0]	None	No action. Only a warning is issued.
[1] *	Decrease cooling	A warning is issued and the motor speed is lowered in steps of 10 Hz every 3 minutes until the temperature either drops below the level programmed in or exceeds the level programmed in .

28-26 Emergency Level

Range:		Function:
145*	[28-24 Warning	Selects the temperature at which an
	Level-300]	alarm shall be issued. Enter the
		temperature in the unit programmed
		in 28-21 Temperature Unit.

28-27 Discharge Temperature

	Ra	inge:	Function:
ĺ	0*	[-2147483648 –	Returns the actual value of the
		2147483648]	discharge temperature.

6.15.4 28-3* Crankcase Heating

A DC-hold Current through the motor windings can be used as an alternative to an external crankcase heater to keep the compressor warm when stopped.

The efficiency of the Crankcase Heating depends upon the physical placing of the actual motor in the compressor.

If the Crankcase Heating is used together with Anti-Reverse Protection, the frequency converter first brakes for the set duration followed by the heating current.

28-30 Crankcase Heating Control

Option:		Function:
		Activate the DC-hold current when the motor is
		stopped. The current level is defined in
		28-31 Heating DC Current.
[0] *	Disabled	
[1]	Enabled	

28-31 Heating DC Current

Range	e:	Function:
20% *	[0 - 25%]	Set the DC-hold current as percentage of the
		rated motor current in 1-24 Motor Current.

28-32 Crankcase Heating Delayed

Range:		Function:
5 s*	[5-65534 s]	This time defines the delay after a stop and
		until Crank Case Heating is applied to the
		compressor.

6.15.5 28-4* Anti-reverse Protection

A compressor may have a preferred rotation direction and the instructions for cabling should always be followed, but the consequences of a reverse rotation are normally not fatal. Set up parameter group 28-4* Anti-reverse Protection to prevent reverse rotation at stop by injecting a DC-brake current into the motor a few seconds after stop followed by the eventual coast of the motor when the discharge valve has closed.

NOTE!

The DC-brake Function is not operational before any Start Function has completed. In case of an emergency stop before the starting sequence has completed then the compressor may rotate reverse for a short moment after stop. Under normal circumstances, the Short Cycle Protection feature ensures the correct sequence.

6-80 BAS-SVX60A-EN



28-4	28-40 Reverse Protection Control			
Option:		Function:		
Activate a DC-brake current when the motor is		Activate a DC-brake current when the motor is		
		stopped. The current level is defined in 28-41 DC		
		Brake Current. Not recommended for Piston		
comp		compressors.		
[0] *	Disabled			

28-41 DC Brake Current

Enabled

Range:		Function:
90% *	[0 – max motor	Set the DC-brake current as
	current]	percentage of the rated motor
		current in 1-24 Motor Current.

28-42 DC Braking Time

Range:		e:	Function:
	2.0 s*	[0 - 60.0 s]	Set the duration of the DC-brake current.

28-43 DC Brake Cut-in Speed [RPM]

Range:		Function:
700 RPM	[0 – max	Set the speed where the DC-brake
'0' = Off*	motor speed]	Current should cut in. The speed
		must be higher than 0 RPM for the
		DC-brake to activate before the
		motor is coasted at 0 RPM to
		prevent a reverse rotation.

6.15.6 28-5* Load Profile

The Load Profiler is used to get a graphical presentation of the load pattern a cooling system has been subjected to over the last 6 months. The system load is assumed to be proportional to the compressor speed, and the Load Profiler measures the load as the running hours spent operating within certain speed intervals.

The speed intervals are calculated based on 4-11 Motor Speed Low Limit [RPM] (4-13 Motor Speed High Limit [RPM]) and 4-13 Motor Speed High Limit [RPM] (4-14 Motor Speed High Limit [Hz]) to match 0%, 25%, 50%, 75% and 100% loads as good as possible. The speed intervals are denoted "Off", "Low", "Med.", "High" and "Full" and are calculated in the following manner:

 Δ = Motor Speed High Limit - Motor Speed Low Limit

Off: Speed = 0

LOW: Motor Speed Low Limit \leq Speed < Motor Speed Low Limit $+ \Delta/6$

Med.Motor Speed

Low Limit $+ \Delta/6 \le Speed < Motor Speed Low Limit <math>+ \Delta/2$

High:

Motor Speed

Low Limit $+ \Delta/2 \le Speed < Motor Speed Low Limit + 5 <math>\times \Delta/6$

Full: Motor Speed

Low Limit $+ 5 \times \Delta/6 \le Speed \le Motor Speed High Limit$

For example, if *4-11 Motor Speed High Limit* is 5400 RPM and *Motor Speed Low Limit* is 1800 RPM the four calculated intervals become

Low: 1800 RPM ≤ speed < 2350 RPM

Med: 2350 RPM ≤ speed < 3450 RPM

High: 3450 RPM ≤ speed < 4550 RPM

Full: $4550 \text{ RPM} \leq \text{speed} \leq 5400 \text{ RPM}$

The profile is presented on the keypad as a histogram. In each speed interval, the indicated running time is accurate to within 1 hour.

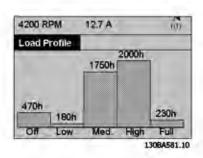


Figure 6.40 Load Profile

If [Off] is pressed on the keypad, the Load Profile is not updated.

28-5	28-50 Reset Load Profile						
Opt	ion:	Function:					
[0] *	Do not reset	No function					
[1]	Reset	Clears the measured running time in all five					
		speed intervals.					



28-74 Night Speed Drop [RPM]

Range: Function:

[] The value in this parameter decrements the value in 4-13 Motor Speed High Limit [RPM] which becomes active when night mode is activated.

6.16 Parameter Lists

Changes during operation

"TRUE" means that the parameter can be changed while the frequency converter is in operation. "FALSE" means that the frequency converter must be stopped before a change can be made.

4-Setup

'All setups': the parameter can be set individually in each of the four setups, i. e. one single parameter can have four different data values.

'1 setup': data value will be the same in all setups.

Data	Description	Туре
type		
2	Integer 8	Int8
3	Integer 16	Int16
4	Integer 32	Int32
5	Unsigned 8	Uint8
6	Unsigned 16	Uint16
7	Unsigned 32	Uint32
9	Visible String	VisStr
33	Normalized value 2 bytes	N2
35	Bit sequence of 16 Boolean variables	V2
54	Time difference w/o date	TimD

Table 6.13

6.16.1 Conversion

The various attributes of each parameter are displayed in Factory Setting. Parameter values are transferred as whole numbers only. Conversion factors are therefore used to transfer decimals.

4-12 Motor Speed Low Limit [Hz] has a conversion factor of 0.1. To preset the minimum frequency to 10 Hz, transfer the value 100. A conversion factor of 0.1 means that the value transferred is multiplied by 0.1. The value 100 is therefore read as 10.0.

Examples:

0s ⇒ conversion index 0 0.00s ⇒ conversion index -2 0ms ⇒ conversion index -3 0.00ms ⇒ conversion index -5

Conversion index	Conversion factor
100	
75	
74	
67	
6	1000000
5	100000
4	10000
3	1000
2	100
1	10
0	1
-1	0.1
-2	0.01
-3	0.001
-4	0.0001
-5	0.00001
-6	0.000001
-7	0.0000001

Table 6.14 Conversion Table

6-82 BAS-SVX60A-EN



Par. No. #	Parameter description	Default value	4-setup	Change during operation	Conver- sion index	Туре
0-0* Ba	sic Settings			орегация		
0-01	Language	[0] English	1 setup	TRUE	_	Uint8
0-02	Motor Speed Unit	[1] Hz	2 setups	FALSE	_	Uint8
0-03	Regional Settings	ExpressionLimit	2 setups	FALSE	_	Uint8
0-04	Operating State at Power-up	[0] Resume	All setups	TRUE	_	Uint8
0-05	Local Mode Unit	[0] As Motor Speed Unit	2 setups	FALSE	_	Uint8
	tup Operations	[0] 715 Motor Speed Offic	2 setups	171252		Onto
0-10	Active Setup	[1] Setup 1	1 setup	TRUE	_	Uint8
0-11	Programming Setup	[9] Active Setup	All setups	TRUE	_	Uint8
0-12	This Setup Linked to	[0] Not linked	All setups	FALSE	_	Uint8
0-12	Readout: Linked Setups	0 N/A	All setups	FALSE	0	Uint16
0-13	Readout: Prog. Setups / Channel	0 N/A	All setups	TRUE	0	Int32
	P Display	U N/A	All setups	TRUE	0	1111.52
0-20	Display Line 1.1 Small	[1662] Analog Input	All setups	TRUE	_	Uint16
0-20	Display Line 1.1 Small	ExpressionLimit	All setups	TRUE	_	Uint16
0-21	Display Line 1.2 Small	ExpressionLimit[1610]	All setups	TRUE	-	UIIILIO
0-22	Display Line 1.3 Small	Power kW	All setups	TRUE	_	Uint16
0-22	Display Line 2 Large	ExpressionLimit	All setups	TRUE	_	Uint16
0-23	Display Line 3 Large	ExpressionLimit	All setups	TRUE	_	Uint16
0-24	My Personal Menu	•		TRUE	0	
		ExpressionLimit	1 setup	TRUE	0	Uint16
	P Custom Readout	[1] 0/	All seture	TRUE		l lim #O
0-30	Custom Readout Unit	[1] %	All setups	-	-	Uint8
0-31	Custom Readout May Volue	ExpressionLimit	All setups	TRUE	-2 -2	Int32
0-32	Custom Readout Max Value	100 CustomReadoutUnit	All setups	TRUE		Int32
0-37	Display Text 1	0 N/A	1 setup	TRUE	0	VisStr[25]
0-38	Display Text 2	0 N/A	1 setup	TRUE	0	VisStr[25]
0-39	Display Text 3	0 N/A	1 setup	TRUE	0	VisStr[25]
	P Keypad	[O] Disabled	All saturas	TOUE		11:+0
0-40	[Hand on] Key on LCP	[0] Disabled	All setups	TRUE	-	Uint8
0-41	[Off] Key on LCP	[1] Enabled	All setups	TRUE	-	Uint8
0-42	[Auto on] Key on LCP	[1] Enabled	All setups	TRUE	-	Uint8
0-43	[Reset] Key on LCP	[1] Enabled	All setups	TRUE	-	Uint8
	ppy/Save	[0] N	A.II	FALCE		11: 10
0-50	LCP Copy	[0] No copy	All setups	FALSE	-	Uint8
0-51	Setup Copy	[0] No copy	All setups	FALSE	-	Uint8
0-6* Pa		1 000		TOUE	•	1.46
0-60	Main Menu Password	999	1 setup	TRUE	0	Int16
0-61	Access to Main Menu w/o Password	[1] LCP: Read only	1 setup	TRUE	-	Uint8
0-65	Personal Menu Password	200 N/A	1 setup	TRUE	0	Int16
0-66	Access to Personal Menu w/o Password	[0] Full access	1 setup	TRUE	-	Uint8
0-67	Bus Password Access	0 N/A	All setups	TRUE	0	Uint16
	ock Settings				_	T. 65
0-70	Set Date and Time	ExpressionLimit	All setups	TRUE	0	TimeOfDay
0-71	Date Format	ExpressionLimit	1 setup	TRUE	-	Uint8
0-72	Time Format	ExpressionLimit	1 setup	TRUE	-	Uint8
0-74	DST/Summertime	[0] Off	1 setup	TRUE	-	Uint8
0-76	DST/Summertime Start	ExpressionLimit	1 setup	TRUE	0	TimeOfDay
0-77	DST/Summertime End	ExpressionLimit	1 setup	TRUE	0	TimeOfDay



Par. No. #	Parameter description	Default value	4-setup	Change during operation	Conver- sion index	Туре
0-79	Clock Fault	[0] Disabled	1 setup	TRUE	-	Uint8
0-81	Working Days	ExpressionLimit	1 setup	TRUE	-	Uint8
0-82	Additional Working Days	ExpressionLimit	1 setup	TRUE	0	TimeOfDay
0-83	Additional Non-Working Days	ExpressionLimit	1 setup	TRUE	0	TimeOfDay
0-89	Date and Time Readout	0 N/A	All setups	TRUE	0	VisStr[25]

6.16.2 1-** Load/Motor

Par. No. #	Parameter description	Default value	4-setup	Change during operation	Conver- sion index	Type
1-0* Ge	eneral Settings					
1-00	Configuration Mode	ExpressionLimit	All setups	TRUE	-	Uint8
1-03	Torque Characteristics	[0] Compressor CT	All setups	TRUE	-	Uint8
1-1* M	otor Selection	•				
1-10	Motor Construction	[0] Asynchron	All setups	FALSE	-	Uint8
1-1* VV	C+ PM	•				
1-14	Damping Gain	120 %	All setups	TRUE	0	Int16
1-15	Low Speed Filter Time Const.	ExpressionLimit	All setups	TRUE	-2	Uint16
1-16	High Speed Filter Time Const.	ExpressionLimit	All setups	TRUE	-2	Uint16
1-17	Voltage filter time const.	ExpressionLimit	All setups	TRUE	-3	Uint16
1-2* M	otor Data	•				
1-20	Motor Power [kW]	ExpressionLimit	All setups	FALSE	1	Uint32
1-21	Motor Power [HP]	ExpressionLimit	All setups	FALSE	-2	Uint32
1-22	Motor Voltage	ExpressionLimit	All setups	FALSE	0	Uint16
1-23	Motor Frequency	ExpressionLimit	All setups	FALSE	0	Uint16
1-24	Motor Current	ExpressionLimit	All setups	FALSE	-2	Uint32
1-25	Motor Nominal Speed	ExpressionLimit	All setups	FALSE	67	Uint16
1-26	Motor Cont. Rated Torque	ExpressionLimit	All setups	FALSE	-1	Uint32
1-28	Motor Rotation Check	[0] Off	All setups	FALSE	-	Uint8
1-29	Automatic Motor Adaptation (AMA)	[0] Off	All setups	FALSE	-	Uint8
1-3* Ac	lv. Motor Data	•				
1-30	Stator Resistance (Rs)	ExpressionLimit	All setups	FALSE	-4	Uint32
1-31	Rotor Resistance (Rr)	ExpressionLimit	All setups	FALSE	-4	Uint32
1-35	Main Reactance (Xh)	ExpressionLimit	All setups	FALSE	-4	Uint32
1-36	Iron Loss Resistance (Rfe)	ExpressionLimit	All setups	FALSE	-3	Uint32
1-37	d-axis Inductance (Ld)	ExpressionLimit	All setups	FALSE	-6	Int32
1-39	Motor Poles	ExpressionLimit	All setups	FALSE	0	Uint8
1-40	Back EMF at 1000 RPM	ExpressionLimit	All setups	FALSE	0	Uint16
1-5* Lo	ad Indep. Setting	•				
1-50	Motor Magnetization at Zero Speed	100 %	All setups	TRUE	0	Uint16
1-51	Min Speed Normal Magnetizing [RPM]	ExpressionLimit	All setups	TRUE	67	Uint16
1-52	Min Speed Normal Magnetizing [Hz]	ExpressionLimit	All setups	TRUE	-1	Uint16
1-58	Flystart Test Pulses Current	ExpressionLimit	All setups	FALSE	0	Uint16
1-59	Flystart Test Pulses Frequency	ExpressionLimit	All setups	FALSE	0	Uint16
1-6* Lo	ad Depen. Setting					
1-60	Low Speed Load Compensation	100 %	All setups	TRUE	0	Int16
1-61	High Speed Load Compensation	100 %	All setups	TRUE	0	Int16

6-84 BAS-SVX60A-EN

Parameter Descriptions

Operating Instructions TRV200

Par. No. #	Parameter description	Default value	4-setup	Change during operation	Conver- sion index	Type
1-62	Slip Compensation	0 %	All setups	TRUE	0	Int16
1-63	Slip Compensation Time Constant	ExpressionLimit	All setups	TRUE	-2	Uint16
1-64	Resonance Dampening	100 %	All setups	TRUE	0	Uint16
1-65	Resonance Dampening Time Constant	5 ms	All setups	TRUE	-3	Uint8
1-66	Min. Current at Low Speed	ExpressionLimit	All setups	TRUE	0	Uint8
1-7* St	art Adjustments	•				
1-70	PM Start Mode	[1] Parking	All setups	TRUE	-	Uint8
1-71	Start Delay	00 s	All setups	TRUE	-1	Uint16
1-72	Start Function	ExpressionLimit	All setups	TRUE	-	Uint8
1-73	Flying Start	ExpressionLimit	All setups	FALSE	-	Uint8
1-74	Start Speed [RPM]	ExpressionLimit	All setups	TRUE	67	Uint16
1-75	Start Speed [Hz]	ExpressionLimit	All setups	TRUE	-1	Uint16
1-76	Start Current	0 A	All setups	TRUE	-2	Uint32
1-77	Compressor Start Max Speed [RPM]	ExpressionLimit	All setups	TRUE	67	Uint16
1-78	Compressor Start Max Speed [Hz]	ExpressionLimit	All setups	TRUE	-1	Uint16
1-79	Compressor Start Max Time to Trip	5 s	All setups	TRUE	-1	Uint8
1-8* St	op Adjustments	•				
1-80	Function at Stop	[0] Coast	All setups	TRUE	-	Uint8
1-81	Min Speed for Function at Stop [RPM]	ExpressionLimit	All setups	TRUE	67	Uint16
1-82	Min Speed for Function at Stop [Hz]	ExpressionLimit	All setups	TRUE	-1	Uint16
1-86	Compressor Min. Speed for Trip [RPM]	ExpressionLimit	All setups	TRUE	67	Uint16
1-87	Compressor Min. Speed for Trip [Hz]	ExpressionLimit	All setups	TRUE	-1	Uint16
1-9* M	otor Temperature	•				
1-90	Motor Thermal Protection	ExpressionLimit	All setups	TRUE	-	Uint8
1-91	Motor External Fan	[0] None	All setups	TRUE	-	Uint8
1-93	Thermistor Source	[0] None	All setups	TRUE	-	Uint8



6.16.3 3-** Reference/Ramps

Par. No. #	Parameter description	Default value	4-setup	Change during operation	Conver- sion index	Type
3-0* Re	ference Limits	•				
3-02	Minimum Reference	ExpressionLimit	All setups	TRUE	-3	Int32
3-03	Maximum Reference	ExpressionLimit	All setups	TRUE	-3	Int32
3-04	Reference Function	[0] Sum	All setups	TRUE	-	Uint8
3-1* Re	ferences	·				
3-10	Preset Reference	0 %	All setups	TRUE	-2	Int16
3-11	Jog Speed [Hz]	ExpressionLimit	All setups	TRUE	-1	Uint16
3-13	Reference Site	[0] Linked to Hand / Auto	All setups	TRUE	-	Uint8
3-14	Preset Relative Reference	0 %	All setups	TRUE	-2	Int32
3-15	Reference 1 Source	[1] Analog Input 53	All setups	TRUE	-	Uint8
3-16	Reference 2 Source	[20] Digital pot.meter	All setups	TRUE	-	Uint8
3-17	Reference 3 Source	[0] No function	All setups	TRUE	-	Uint8
3-19	Jog Speed [RPM]	ExpressionLimit	All setups	TRUE	67	Uint16
3-4* Ra	mp 1					
3-41	Ramp 1 Ramp Up Time	Size related	All setups	TRUE	-2	Uint32
3-42	Ramp 1 Ramp Down Time	Size related	All setups	TRUE	-2	Uint32
3-5* Ra	mp 2					
3-51	Ramp 2 Ramp Up Time	ExpressionLimit	All setups	TRUE	-2	Uint32
3-52	Ramp 2 Ramp Down Time	ExpressionLimit	All setups	TRUE	-2	Uint32
3-8* O	her Ramps					
3-80	Jog Ramp Time	ExpressionLimit	All setups	TRUE	-2	Uint32
3-81	Quick Stop Ramp Time	ExpressionLimit	2 setups	TRUE	-2	Uint32
3-82	Starting Ramp Up Time	ExpressionLimit	2 setups	TRUE	-2	Uint32
3-9* Di	gital Pot.Meter					
3-90	Step Size	0.10 %	All setups	TRUE	-2	Uint16
3-91	Ramp Time	1 s	All setups	TRUE	-2	Uint32
3-92	Power Restore	[0] Off	All setups	TRUE	-	Uint8
3-93	Maximum Limit	100 %	All setups	TRUE	0	Int16
3-94	Minimum Limit	0 %	All setups	TRUE	0	Int16
3-95	Ramp Delay	1 N/A	All setups	TRUE	-3	TimD

6-86 BAS-SVX60A-EN



6.16.4 4-** Limits/Warnings

Par. No. #	Parameter description	Default value	4-setup	Change during operation	Conver- sion index	Туре
4-1* M	otor Limits					
4-10	Motor Speed Direction	[0] Clockwise	All setups	FALSE	-	Uint8
4-11	Motor Speed Low Limit [RPM]	ExpressionLimit	All setups	TRUE	67	Uint16
4-12	Motor Speed Low Limit [Hz]	ExpressionLimit	All setups	TRUE	-1	Uint16
4-13	Motor Speed High Limit [RPM]	ExpressionLimit	All setups	TRUE	67	Uint16
4-14	Motor Speed High Limit [Hz]	ExpressionLimit	All setups	TRUE	-1	Uint16
4-16	Torque Limit Motor Mode	110 %	All setups	TRUE	-1	Uint16
4-17	Torque Limit Generator Mode	100 %	All setups	TRUE	-1	Uint16
4-18	Current Limit	ExpressionLimit	All setups	TRUE	-1	Uint32
4-19	Max Output Frequency	ExpressionLimit	All setups	FALSE	-1	Uint16
4-5* Ac	lj. Warnings					
4-50	Warning Current Low	0 A	All setups	TRUE	-2	Uint32
4-51	Warning Current High	ImaxTRV200 (P1637)	All setups	TRUE	-2	Uint32
4-52	Warning Speed Low	0 RPM	All setups	TRUE	67	Uint16
4-53	Warning Speed High	outputSpeedHighLimit (P413)	All setups	TRUE	67	Uint16
4-54	Warning Reference Low	-999999 N/A	All setups	TRUE	-3	Int32
4-55	Warning Reference High	999999 N/A	All setups	TRUE	-3	Int32
		-999999 ReferenceFeed-				
4-56	Warning Feedback Low	backUnit	All setups	TRUE	-3	Int32
		999999 ReferenceFeed-				
4-57	Warning Feedback High	backUnit	All setups	TRUE	-3	Int32
4-58	Missing Motor Phase Function	ExpressionLimit	All setups	TRUE	-	Uint8
4-6* Sp	eed Bypass					
4-60	Bypass Speed From [RPM]	ExpressionLimit	All setups	TRUE	67	Uint16
4-61	Bypass Speed From [Hz]	ExpressionLimit	All setups	TRUE	-1	Uint16
4-62	Bypass Speed To [RPM]	ExpressionLimit	All setups	TRUE	67	Uint16
4-63	Bypass Speed To [Hz]	ExpressionLimit	All setups	TRUE	-1	Uint16
4-64	Semi-Auto Bypass Setup	[0] Off	All setups	FALSE	-	Uint8



6.16.5 5-** Digital In/Out

Par. No. #	Parameter description	Default value	4-setup	Change during operation	Conver- sion index	Туре
5-0* Di	gital I/O mode	1				
5-00	Digital I/O Mode	[0] PNP - Active at 24V	All setups	FALSE	-	Uint8
5-01	Terminal 27 Mode	[0] Input	All setups	TRUE	-	Uint8
5-02	Terminal 29 Mode	[0] Input	All setups	TRUE	-	Uint8
5-1* Di	gital Inputs	·				
5-10	Terminal 18 Digital Input	ExpressionLimit	All setups	TRUE	-	Uint8
5-11	Terminal 19 Digital Input	ExpressionLimit	All setups	TRUE	-	Uint8
5-12	Terminal 27 Digital Input	No operations	All setups	TRUE	-	Uint8
5-13	Terminal 29 Digital Input	ExpressionLimit	All setups	TRUE	-	Uint8
5-14	Terminal 32 Digital Input	No operations	All setups	TRUE	-	Uint8
5-15	Terminal 33 Digital Input	No operations	All setups	TRUE	-	Uint8
5-16	Terminal X30/2 Digital Input	ExpressionLimit	All setups	TRUE	-	Uint8
5-17	Terminal X30/3 Digital Input	ExpressionLimit	All setups	TRUE	-	Uint8
5-18	Terminal X30/4 Digital Input	ExpressionLimit	All setups	TRUE	-	Uint8
5-19	Terminal 37 Safe Stop	[3] Safe Stop Warning	All setups	TRUE	-	Uint8
5-3* Di	gital Outputs	, , ,	· ·			
5-30	Terminal 27 Digital Output	[0] No operation	All setups	TRUE	-	Uint8
5-31	Terminal 29 Digital Output	[0] No operation	All setups	TRUE	-	Uint8
5-32	Term X30/6 Digi Out (MCB 101)	[0] No operation	All setups	TRUE	-	Uint8
5-33	Term X30/7 Digi Out (MCB 101)	[0] No operation	All setups	TRUE	-	Uint8
5-4* Re		F-2				
5-40	Function Relay	ExpressionLimit	All setups	TRUE	-	Uint8
5-41	On Delay, Relay	0.01 s	All setups	TRUE	-2	Uint16
5-42	Off Delay, Relay	0.01 s	All setups	TRUE	-2	Uint16
5-5* Pu	ilse Input		<u> </u>			
5-50	Term. 29 Low Frequency	100 Hz	All setups	TRUE	0	Uint32
5-51	Term. 29 High Frequency	100 Hz	All setups	TRUE	0	Uint32
5-52	Term. 29 Low Ref./Feedb. Value	0 N/A	All setups	TRUE	-3	Int32
5-53	Term. 29 High Ref./Feedb. Value	100 N/A	All setups	TRUE	-3	Int32
5-54	Pulse Filter Time Constant #29	100 ms	All setups	FALSE	-3	Uint16
5-55	Term. 33 Low Frequency	100 Hz	All setups	TRUE	0	Uint32
5-56	Term. 33 High Frequency	100 Hz	All setups	TRUE	0	Uint32
5-57	Term. 33 Low Ref./Feedb. Value	0 N/A	All setups	TRUE	-3	Int32
5-58	Term. 33 High Ref./Feedb. Value	100 N/A	All setups	TRUE	-3	Int32
5-59	Pulse Filter Time Constant #33	100 ms	All setups	FALSE	-3	Uint16
	ilse Output					
5-60	Terminal 27 Pulse Output Variable	[0] No operation	All setups	TRUE	-	Uint8
5-62	Pulse Output Max Freq #27	5000 Hz	All setups	TRUE	0	Uint32
5-63	Terminal 29 Pulse Output Variable	[0] No operation	All setups	TRUE	_	Uint8
5-65	Pulse Output Max Freq #29	5000 Hz	All setups	TRUE	0	Uint32
5-66	Terminal X30/6 Pulse Output Variable	[0] No operation	All setups	TRUE	-	Uint8
5-68	Pulse Output Max Freq #X30/6	5000 Hz	All setups	TRUE	0	Uint32
	s Controlled					
5-90	Digital & Relay Bus Control	0 N/A	All setups	TRUE	0	Uint32
	Pulse Out #27 Bus Control	0 %	All setups	TRUE	-2	N2
5-93						

6-88 BAS-SVX60A-EN



Par. No. #	Parameter description	Default value	4-setup	Change during operation	Conver- sion index	Type
5-95	Pulse Out #29 Bus Control	0 %	All setups	TRUE	-2	N2
5-96	Pulse Out #29 Timeout Preset	0 %	1 setup	TRUE	-2	Uint16
5-97	Pulse Out #X30/6 Bus Control	0 %	All setups	TRUE	-2	N2
5-98	Pulse Out #X30/6 Timeout Preset	0 %	1 setup	TRUE	-2	Uint16

6.16.6 6-** Analog In/Out

Par. No. #	Parameter description	Default value	4-setup	Change during operation	Conver- sion index	Type
6-0* Ar	nalog I/O Mode					
6-00	Live Zero Timeout Time	10 s	All setups	TRUE	0	Uint8
6-01	Live Zero Timeout Function	[0] Off	All setups	TRUE	-	Uint8
6-02	Fire Mode Live Zero Timeout Function	[0] Off	All setups	TRUE	-	Uint8
6-1* Ar	nalog Input 53	•				
6-10	Terminal 53 Low Voltage	0.07 V	All setups	TRUE	-2	Int16
6-11	Terminal 53 High Voltage	10 V	All setups	TRUE	-2	Int16
6-12	Terminal 53 Low Current	4 mA	All setups	TRUE	-5	Int16
6-13	Terminal 53 High Current	20 mA	All setups	TRUE	-5	Int16
6-14	Terminal 53 Low Ref./Feedb. Value	0 N/A	All setups	TRUE	-3	Int32
6-15	Terminal 53 High Ref./Feedb. Value	ExpressionLimit	All setups	TRUE	-3	Int32
6-16	Terminal 53 Filter Time Constant	0.001 s	All setups	TRUE	-3	Uint16
6-17	Terminal 53 Live Zero	[1] Enabled	All setups	TRUE	-	Uint8
6-2* Ar	nalog Input 54					
6-20	Terminal 54 Low Voltage	0.07 V	All setups	TRUE	-2	Int16
6-21	Terminal 54 High Voltage	10 V	All setups	TRUE	-2	Int16
6-22	Terminal 54 Low Current	4 mA	All setups	All setups TRUE		Int16
6-23	Terminal 54 High Current	20 mA	All setups	TRUE	-5	Int16
6-24	Terminal 54 Low Ref./Feedb. Value	-1 N/A	All setups	TRUE	-3	Int32
6-25	Terminal 54 High Ref./Feedb. Value	ExpressionLimit	All setups	TRUE	-3	Int32
6-26	Terminal 54 Filter Time Constant	0.001 s	All setups	TRUE	-3	Uint16
6-27	Terminal 54 Live Zero	[1] Enabled	All setups	TRUE	-	Uint8
6-3* Ar	nalog Input X30/11	<u>'</u>				
6-30	Terminal X30/11 Low Voltage	0.07 V	All setups	TRUE	-2	Int16
6-31	Terminal X30/11 High Voltage	10 V	All setups	TRUE	-2	Int16
6-34	Term. X30/11 Low Ref./Feedb. Value	0 N/A	All setups	TRUE	-3	Int32
6-35	Term. X30/11 High Ref./Feedb. Value	100 N/A	All setups	TRUE	-3	Int32
6-36	Term. X30/11 Filter Time Constant	0.001 s	All setups	TRUE	-3	Uint16
6-37	Term. X30/11 Live Zero	[1] Enabled	All setups	TRUE	-	Uint8
6-4* Ar	nalog Input X30/12	-				
6-40	Terminal X30/12 Low Voltage	0.07 V	All setups	TRUE	-2	Int16
6-41	Terminal X30/12 High Voltage	10 V	All setups	TRUE	-2	Int16
6-44	Term. X30/12 Low Ref./Feedb. Value	0 N/A	All setups	TRUE	-3	Int32
6-45	Term. X30/12 High Ref./Feedb. Value	100 N/A	All setups	TRUE	-3	Int32
6-46	Term. X30/12 Filter Time Constant	0.001 s	All setups	TRUE	-3	Uint16
6-47	Term. X30/12 Live Zero	[1] Enabled	All setups	TRUE	-	Uint8
	nalog Output 42					
6-50	Terminal 42 Output	[100] Output frequency	All setups	TRUE	-	Uint8



Par. No. #	Parameter description	Default value	4-setup	Change during operation	Conver- sion index	Type
6-51	Terminal 42 Output Min Scale	0 %	All setups	TRUE	-2	Int16
6-52	Terminal 42 Output Max Scale	100 %	All setups	TRUE	-2	Int16
6-53	Terminal 42 Output Bus Control	0 %	All setups	TRUE	-2	N2
6-54	Terminal 42 Output Timeout Preset	0 %	1 setup	TRUE	-2	Uint16
6-6* Ar	nalog Output X30/8					
6-60	Terminal X30/8 Output	[0] No operation	All setups	TRUE	-	Uint8
6-61	Terminal X30/8 Min. Scale	0 %	All setups	TRUE	-2	Int16
6-62	Terminal X30/8 Max. Scale	100 %	All setups	TRUE	-2	Int16
6-63	Terminal X30/8 Output Bus Control	0 %	All setups	TRUE	-2	N2
6-64	Terminal X30/8 Output Timeout Preset	0 %	1 setup	TRUE	-2	Uint16

6.16.7 7-** Controllers

Par. No. #	Parameter description	Default value	4-setup	Change during operation	Conver- sion index	Туре
7-0* Sp	eed PID Ctrl.					
7-00	Speed PID Feedback Source	null	All setups	FALSE	-	Uint8
7-02	Speed PID Proportional Gain	App.Dependent	All setups	TRUE	-3	Uint16
7-03	Speed PID Integral Time	App.Dependent	All setups	TRUE	-4	Uint32
7-04	Speed PID Differentiation Time	App.Dependent	All setups	TRUE	-4	Uint16
7-05	Speed PID Diff. Gain Limit	5.0 N/A	All setups	TRUE	-1	Uint16
7-06	Speed PID Lowpass Filter Time	App.Dependent	All setups	TRUE	-4	Uint16
7-07	Speed PID Feedback Gear Ratio	1.0000 N/A	All setups	FALSE	-4	Uint32
7-08	Speed PID Feed Forward Factor	0%	All setups	FALSE	0	Uint16
7-09	Speed PID Error Correction w/ Ramp	300RPM	All setups	TRUE	67	Uint32
7-1* To	rque PI Ctrl.	•				
7-12	Torque PI Proportional Gain	100%	All setups	TRUE	0	Uint16
7-13	Torque PI Integration Time	0.020 s	All setups	TRUE	-3	Uint16
7-2* Pr	ocess Ctrl. Feedb					
7-20	Process CL Feedback 1 Resource	[0] No function	All setups	TRUE	-	Uint8
7-22	Process CL Feedback 2 Resource	[0] No function	All setups	TRUE	-	Uint8
7-3* Pr	ocess PID Ctrl.					
7-30	Process PID Normal/ Inverse Control	[0] Normal	All setups	TRUE	-	Uint8
7-31	Process PID Anti Windup	[1] On	All setups	TRUE	-	Uint8
7-32	Process PID Start Speed	0 RPM	All setups	TRUE	67	Uint16
7-33	Process PID Proportional Gain	0.01 N/A	All setups	TRUE	-2	Uint16
7-34	Process PID Integral Time	10000.00 s	All setups	TRUE	-2	Uint32
7-35	Process PID Differentiation Time	0.00 s	All setups	TRUE	-2	Uint16
7-36	Process PID Diff. Gain Limit	5.0 N/A	All setups	TRUE	-1	Uint16
7-38	Process PID Feed Forward Factor	0%	All setups	TRUE	0	Uint16
7-39	On Reference Bandwidth	5%	All setups	TRUE	0	Uint8

6-90 BAS-SVX60A-EN



6.16.8 8-** Comm. and Options

Par. No. #	Parameter description	Default value 4-setup		Change during operation	Conver- sion index	Туре
8-0* Ge	neral Settings					
8-01	Control Site	[0] Digital and ctrl.word	All setups	TRUE	-	Uint8
8-02	Control Word Source	ExpressionLimit	All setups	TRUE	-	Uint8
8-03	Control Word Timeout Time	20 s	1 setup	TRUE	-1	Uint32
8-04	Control Word Timeout Function	[0] Off	1 setup	TRUE	-	Uint8
8-05	End-of-Timeout Function	[1] Resume setup	1 setup	TRUE	-	Uint8
8-06	Reset Control Word Timeout	[0] Do not reset	All setups	TRUE	-	Uint8
8-07	Diagnosis Trigger	[0] Disable	2 setups	TRUE	-	Uint8
8-1* Ct	rl. Word Settings	•		•	•	•
8-10	Control Word Profile	[0] FC profile	All setups	TRUE	-	Uint8
8-13	Configurable Status Word STW	[1] Profile Default	All setups	TRUE	-	Uint8
8-16	Store Data Values	[0] Off	All setups	TRUE	-	Uint8
8-3* FC	Port Settings					
8-30	Protocol	[0] FC	1 setup	TRUE	-	Uint8
8-31	Address	1 N/A	1 setup	TRUE	0	Uint8
8-32	FC Port Baud Rate	ExpressionLimit	1 setup	TRUE	-	Uint8
8-33	Parity / Stop Bits	ExpressionLimit	1 setup	TRUE	-	Uint8
8-35	Minimum Response Delay	10 ms	1 setup	TRUE	-3	Uint16
8-36	Max Response Delay	ExpressionLimit	1 setup	TRUE	-3	Uint16
8-37	Max Inter-Char Delay	ExpressionLimit	1 setup	TRUE	-5	Uint16
8-4* FC	MC protocol set	•	•	•	•	•
8-40	Telegram Selection	[1] Standard telegram 1	2 setups	TRUE	-	Uint8
8-42	PCD Write Configuration	ExpressionLimit	2 setups	TRUE	-	Uint16
8-43	PCD Read Configuration	ExpressionLimit	2 setups	TRUE	-	Uint16
8-5* Di	gital/Bus					
8-50	Coasting Select	[3] Logic OR	All setups	TRUE	-	Uint8
8-51	Quick Stop Select	[3] Logic OR	All setups	TRUE	-	Uint8
8-52	DC Brake Select	[3] Logic OR	All setups	TRUE	-	Uint8
8-53	Start Select	[3] Logic OR	All setups	TRUE	-	Uint8
8-54	Reversing Select	[3] Logic OR	All setups	TRUE	-	Uint8
8-55	Setup Select	[3] Logic OR	All setups	TRUE	-	Uint8
8-56	Preset Reference Select	[3] Logic OR	All setups	TRUE	-	Uint8
8-8* FC	Port Diagnostics					
8-80	Bus Message Count	0 N/A	All setups	TRUE	0	Uint32
8-81	Bus Error Count	0 N/A	All setups	TRUE	0	Uint32
8-82	Slave Messages Rcvd	0 N/A	All setups	TRUE	0	Uint32
8-83	Slave Error Count	0 N/A	All setups	TRUE	0	Uint32
8-9* Bu	s Jog					
8-90	Bus Jog 1 Speed	100 RPM	All setups	TRUE	67	Uint16
8-91	Bus Jog 2 Speed	200 RPM	All setups	TRUE	67	Uint16



6.16.9 14-** Special Functions

Par. No. #	Parameter description	Default value	4-setup	Change during operation	Conver- sion index	Туре
14-0* lr	nverter Switching				1	
14-00	Switching Pattern	[1] SFAVM	All setups	TRUE	-	Uint8
14-01	Switching Frequency	ExpressionLimit	All setups	TRUE	- 1	Uint8
14-03	Overmodulation	ExpressionLimit	All setups	FALSE	-	Uint8
14-04	PWM Random	[0] Off	All setups	TRUE	-	Uint8
14-1* N	Mains On/Off					
14-10	Mains Failure	[3] Coasting	All setups	FALSE	-	Uint8
14-11	Mains Voltage at Mains Fault	Size related	All setups	TRUE	0	Uint16
14-12	Function at Mains Imbalance	Derate	All setups	TRUE	-	Uint8
14-13	Mains Failure Step Factor	1 N/A	All setups	TRUE	-1	Uint8
14-2* T	rip Reset				•	
14-20	Reset Mode	[10] Automatic reset x 10	All setups	TRUE	-	Uint8
14-21	Automatic Restart Time	30 s	All setups	TRUE	0	Uint16
14-22	Operation Mode	[0] Normal operation	All setups	TRUE	-	Uint8
14-23	Typecode Setting	ExpressionLimit	2 setups	FALSE	-	Uint8
14-25	Trip Delay at Torque Limit	60 s	All setups	TRUE	0	Uint8
14-26	Trip Delay at Inverter Fault	ExpressionLimit	All setups	TRUE	0	Uint8
14-28	Production Settings	[0] No action	All setups	TRUE	-	Uint8
14-29	Service Code	0 N/A	All setups	TRUE	0	Int32
14-3* C	urrent Limit Ctrl.				•	
14-30	Current Lim Cont, Proportional Gain	100 %	All setups	FALSE	0	Uint16
14-31	Current Lim Contr, Integration Time	0.020 s	All setups	FALSE	-3	Uint16
14-32	Current Lim Ctrl, Filter Time	26 ms	All setups	TRUE	-4	Uint16
14-4* E	nergy Optimizing					
14-40	VT Level	66 %	All setups	FALSE	0	Uint8
14-41	AEO Minimum Magnetization	40 %	All setups	TRUE	0	Uint8
14-42	Minimum AEO Frequency	30 Hz	All setups	TRUE	0	Uint8
14-43	Motor Cosphi	ExpressionLimit	All setups	TRUE	-2	Uint16
14-5* E	nvironment				•	
14-50	RFI Filter	[0] Off	1 setup	FALSE	-	Uint8
14-52	Fan Control	[0] Auto	All setups	TRUE	-	Uint8
14-53	Fan Monitor	[0] Disabled	All setups	TRUE	-	Uint8
14-55	Output Filter	[0] No Filter	1 setup	FALSE	-	Uint8
14-56	Capacitance Output Filter	2 uF	1 setup	FALSE	-7	Uint16
14-57	Inductance Output Filter	7 mH	1 setup	FALSE	-6	Uint16
14-6* A	uto Derate					
14-60	Function at Over Temperature	[1] Derate	All setups	TRUE	-	Uint8
14-61	Function at Inverter Overload	[1] Derate	All setups	TRUE	-	Uint8
14-62	Inv. Overload Derate Current	95 %	All setups	TRUE	0	Uint16
14-9* F	ault Settings					
14-90	Fault Level	ExpressionLimit	1 setup	TRUE	-	Uint8

6-92 BAS-SVX60A-EN



6.16.10 15-** Drive Information

Par. No. #	Parameter description	Default value	4-setup	Change during operation	Conver- sion index	Туре
15-0* C	perating Data	!				
15-00	Operating hours	0 h	All setups	FALSE	74	Uint32
15-01	Running Hours	0 h	All setups	FALSE	74	Uint32
15-02	kWh Counter	0 kWh	All setups	FALSE	75	Uint32
15-03	Power Up's	0 N/A	All setups	FALSE	0	Uint32
15-04	Over Temp's	0 N/A	All setups	FALSE	0	Uint16
15-05	Over Volt's	0 N/A	All setups	FALSE	0	Uint16
15-06	Reset kWh Counter	[0] Do not reset	All setups	TRUE	-	Uint8
15-07	Reset Running Hours Counter	[0] Do not reset	All setups	TRUE	-	Uint8
15-08	Number of Starts	0 N/A	All setups	FALSE	0	Uint32
15-1* D	Pata Log Settings	!	·			
15-10	Logging Source	0	2 setups	TRUE	-	Uint16
15-11	Logging Interval	ExpressionLimit	2 setups	TRUE	-3	TimD
15-12	Trigger Event	[0] False	1 setup	TRUE	-	Uint8
15-13	Logging Mode	[0] Log always	2 setups	TRUE	-	Uint8
15-14	Samples Before Trigger	50 N/A	2 setups	TRUE	0	Uint8
15-2* H	listoric Log					
15-20	Historic Log: Event	0 N/A	All setups	FALSE	0	Uint8
15-21	Historic Log: Value	0 N/A	All setups	FALSE	0	Uint32
15-22	Historic Log: Time	0 ms	All setups	FALSE	-3	Uint32
15-23	Historic log: Date and Time	ExpressionLimit	All setups	FALSE	0	TimeOfDay
15-3* A	larm Log	·				,
15-30	Alarm Log: Error Code	0 N/A	All setups	FALSE	0	Uint8
15-31	Alarm Log: Value	0 N/A	All setups	FALSE	0	Int16
15-32	Alarm Log: Time	0 s	All setups	FALSE	0	Uint32
15-33	Alarm Log: Date and Time	ExpressionLimit	All setups	FALSE	0	TimeOfDay
15-34	Alarm Log: Status	0 N/A	All setups	FALSE	0	Uint8
15-35	Alarm Log: Alarm Text	0 N/A	All setups	FALSE	0	VisStr[32]
15-4* D	Prive Identification	!				
15-40	FC Type	0 N/A	All setups	FALSE	0	VisStr[6]
15-41	Power Section	0 N/A	All setups	FALSE	0	VisStr[20]
15-42	Voltage	0 N/A	All setups	FALSE	0	VisStr[20]
15-43	Software Version	0 N/A	All setups	FALSE	0	VisStr[5]
15-44	Ordered Typecode String	0 N/A	All setups	FALSE	0	VisStr[40]
15-45	Actual Typecode String	0 N/A	All setups	FALSE	0	VisStr[40]
15-46	Frequency Converter Ordering No	0 N/A	All setups	FALSE	0	VisStr[8]
15-47	Power Card Ordering No	0 N/A	All setups	FALSE	0	VisStr[8]
15-48	LCP Id No	0 N/A	All setups	FALSE	0	VisStr[20]
15-49	SW ID Control Card	0 N/A	All setups	FALSE	0	VisStr[20]
15-50	SW ID Power Card	0 N/A	All setups	FALSE	0	VisStr[20]
15-51	Frequency Converter Serial Number	0 N/A	All setups	FALSE	0	VisStr[10]
15-53	Power Card Serial Number	0 N/A	All setups	FALSE	0	VisStr[19]
	Option Ident		<u> </u>			
15-60	Option Mounted	0 N/A	All setups	FALSE	0	VisStr[30]
15-61	Option SW Version	0 N/A	All setups	FALSE	0	VisStr[20]
	Option Ordering No	0 N/A	All setups	FALSE	0	VisStr[8]



Par.	Parameter description	Default value	4-setup	Change	Conver-	Type
No. #				during	sion index	
				operation		
15-63	Option Serial No	0 N/A	All setups	FALSE	0	VisStr[18]
15-70	Option in Slot A	0 N/A	All setups	FALSE	0	VisStr[30]
15-71	Slot A Option SW Version	0 N/A	All setups	FALSE	0	VisStr[20]
15-72	Option in Slot B	0 N/A	All setups	FALSE	0	VisStr[30]
15-73	Slot B Option SW Version	0 N/A	All setups	FALSE	0	VisStr[20]
15-74	Option in Slot C0/E0	0 N/A	All setups	FALSE	0	VisStr[30]
15-75	Slot C0/E0 Option SW Version	0 N/A	All setups	FALSE	0	VisStr[20]
15-76	Option in Slot C1/E1	0 N/A	All setups	FALSE	0	VisStr[30]
15-77	Slot C1/E1 Option SW Version	0 N/A	All setups	FALSE	0	VisStr[20]
15-9* P	arameter Info	•				
15-92	Defined Parameters	0 N/A	All setups	FALSE	0	Uint16
15-93	Modified Parameters	0 N/A	All setups	FALSE	0	Uint16
15-99	Parameter Metadata	0 N/A	All setups	FALSE	0	Uint16

6.16.11 16-** Data Readouts

Par. No. #	Parameter description	Default value	4-setup	Change during operation	Conver- sion index	Type
16-0* (General Status	'				
16-00	Control Word	0 N/A	All setups	FALSE	0	V2
16-01	Reference [Unit]	0 ReferenceFeedbackUnit	All setups	FALSE	-3	Int32
16-02	Reference [%]	0 %	All setups	FALSE	-1	Int16
16-03	Status Word	0 N/A	All setups	FALSE	0	V2
16-05	Main Actual Value [%]	0 %	All setups	FALSE	-2	N2
16-09	Custom Readout	0 CustomReadoutUnit	All setups	FALSE	-2	Int32
16-1* N	Motor Status	·				
16-10	Power [kW]	0 kW	All setups	FALSE	1	Int32
16-11	Power [hp]	0 hp	All setups	FALSE	-2	Int32
16-12	Motor Voltage	0 V	All setups	FALSE	-1	Uint16
16-13	Frequency	0 Hz	All setups	FALSE	-1	Uint16
16-14	Motor current	0 A	All setups	FALSE	-2	Int32
16-15	Frequency [%]	0 %	All setups	FALSE	-2	N2
16-16	Torque [Nm]	0 Nm	All setups	FALSE	-1	Int32
16-17	Speed [RPM]	0 RPM	All setups	FALSE	67	Int32
16-18	Motor Thermal	0 %	All setups	FALSE	0	Uint8
16-22	Torque [%]	0 %	All setups	FALSE	0	Int16
16-3* [Orive Status					
16-30	DC Link Voltage	0 V	All setups	FALSE	0	Uint16
16-32	Brake Energy /s	0 kW	All setups	FALSE	0	Uint32
16-33	Brake Energy /2 min	0 kW	All setups	FALSE	0	Uint32
16-34	Heatsink Temp.	0 ℃	All setups	FALSE	100	Uint8
16-35	Inverter Thermal	0 %	All setups	FALSE	0	Uint8
16-36	Inv. Nom. Current	ExpressionLimit	All setups	FALSE	-2	Uint32
16-37	Inv. Max. Current	ExpressionLimit	All setups	FALSE	-2	Uint32
16-38	SL Controller State	0 N/A	All setups	FALSE	0	Uint8
16-39	Control Card Temp.	0 ℃	All setups	FALSE	100	Uint8
16-40	Logging Buffer Full	[0] No	All setups	TRUE	-	Uint8

6-94 BAS-SVX60A-EN

Parameter Descriptions

Operating Instructions TRV200

Par. No. #	Parameter description	Default value	4-setup	Change during operation	Conver- sion index	Type
16-41	LCP Bottom Statusline	0 N/A	All setups	TRUE	0	VisStr[50]
16-5* F	lef. & Feedb.					
16-50	External Reference	0 N/A	All setups	FALSE	-1	Int16
16-52	Feedback[Unit]	0 ProcessCtrlUnit	All setups	FALSE	-3	Int32
16-53	Digi Pot Reference	0 N/A	All setups	FALSE	-2	Int16
16-54	Feedback 1 [Unit]	0 ProcessCtrlUnit	All set-ups	FALSE	-3	Int32
16-55	Feedback 2 [Unit]	0 ProcessCtrlUnit	All setups	FALSE	-3	Int32
16-56	Feedback 3 [Unit]	0 ProcessCtrlUnit	All setups	FALSE	-3	Int32
16-6* l	nputs & Outputs					
16-60	Digital Input	0 N/A	All setups	FALSE	0	Uint16
16-61	Terminal 53 Switch Setting	[0] Current	All setups	FALSE	-	Uint8
16-62	Analog Input 53	0 N/A	All setups	FALSE	-3	Int32
16-63	Terminal 54 Switch Setting	[0] Current	All setups	FALSE	-	Uint8
16-64	Analog Input 54	0 N/A	All setups	FALSE	-3	Int32
16-65	Analog Output 42 [mA]	0 N/A	All setups	FALSE	-3	Int16
16-66	Digital Output [bin]	0 N/A	All setups	FALSE	0	Int16
16-67	Pulse Input #29 [Hz]	0 N/A	All setups	FALSE	0	Int32
16-68	Pulse Input #33 [Hz]	0 N/A	All setups	FALSE	0	Int32
16-69	Pulse Output #27 [Hz]	0 N/A	All setups	FALSE	0	Int32
16-70	Pulse Output #29 [Hz]	0 N/A	All setups	FALSE	0	Int32
16-71	Relay Output [bin]	0 N/A	All setups	FALSE	0	Int16
16-72	Counter A	0 N/A	All setups	TRUE	0	Int32
16-73	Counter B	0 N/A	All setups	TRUE	0	Int32
16-75	Analog In X30/11	0 N/A	All setups	FALSE	-3	Int32
16-76	Analog In X30/12	0 N/A	All setups	FALSE	-3	Int32
16-77	Analog Out X30/8 [mA]	0 N/A	All setups	FALSE	-3	Int16
16-8* F	ieldbus & FC Port					
16-80	Fieldbus CTW 1	0 N/A	All setups	FALSE	0	V2
16-82	Fieldbus REF 1	0 N/A	All setups	FALSE	0	N2
16-84	Comm. Option STW	0 N/A	All setups	FALSE	0	V2
16-85	FC Port CTW 1	0 N/A	All setups	FALSE	0	V2
16-86	FC Port REF 1	0 N/A	All setups	FALSE	0	N2
16-9* E	Diagnosis Readouts					
16-90	Alarm Word	0 N/A	All setups	FALSE	0	Uint32
16-91	Alarm Word 2	0 N/A	All setups	FALSE	0	Uint32
16-92	Warning Word	0 N/A	All setups	FALSE	0	Uint32
16-93	Warning Word 2	0 N/A	All setups	FALSE	0	Uint32
16-94	Ext. Status Word	0 N/A	All setups	FALSE	0	Uint32
16-95	Ext. Status Word 2	0 N/A	All setups	FALSE	0	Uint32
16-96	Maintenance Word	0 N/A	All setups	FALSE	0	Uint32



6.16.12 25-** Cascade Controller

Par. No. #	Parameter description	Default value	4-setup	Change during operation	Conver- sion index	Туре
25-0* S	ystem Settings					
25-00	Pack Controller	[0] Disabled	2 setups	FALSE	-	Uint8
25-04	Compressor Cycling	[0] Disabled	All setups	TRUE	-	Uint8
25-06	Number of Compressors	2 N/A	2 setups	FALSE	0	Uint8
25-2* Z	one Settings					
25-20	Neutral Zone [unit]	4 ReferenceFeedbackUnit	All setups	TRUE	-2	Uint32
25-21	+ Zone [unit]	3 ReferenceFeedbackUnit	All setups	TRUE	-2	Uint32
25-22	- Zone [unit]	3 ReferenceFeedbackUnit	All setups	TRUE	-2	Uint32
25-23	Fixed Speed neutral Zone [unit]	I neutral Zone [unit] 4 ReferenceFeedbackUnit		TRUE	-2	Uint32
25-24	+ Zone Delay	120 s	All setups	TRUE	0	Uint32
25-25	5 - Zone Delay 60 s		All setups	TRUE	0	Uint32
25-26	26 ++ Zone Delay 60 s		All setups	TRUE	0	Uint32
25-27	27 Zone Delay 30 s		All setups	TRUE	0	Uint32
25-3* S	taging Functions					
25-30	Destage At No-Flow	[0] Disabled	All setups	TRUE	-	Uint8
25-31	Stage Function	[0] Disabled	All setups	TRUE	-	Uint8
25-32	Stage Function Time	15 s	All setups	TRUE	0	Uint16
25-33	Destage Function	Function [0] Disabled		TRUE	-	Uint8
25-34	Destage Function Time	15 s	All setups	TRUE	0	Uint16
25-4* S	taging Settings	•				
25-42	Staging Threshold	ExpressionLimit	All setups	TRUE	0	Uint8
25-43	Destaging Threshold	ExpressionLimit	All setups	TRUE	0	Uint8
25-44	Staging Speed [RPM]	0 RPM	All setups	TRUE	67	Uint16
25-45	Staging Speed [Hz]	0 Hz	All setups	TRUE	-1	Uint16
25-46	Destaging Speed [RPM]	0 RPM	All setups	TRUE	67	Uint16
25-47	Destaging Speed [Hz]	0 Hz	All setups	TRUE	-1	Uint16
25-8* S	tatus	•				
						VisStr[2
25-80	Pack Status	0 N/A	All setups	TRUE	0	5]
						VisStr[2
25-81	Compressor Status	0 N/A	All setups	TRUE	0	5]
25-82	Lead Compressor	0 N/A	All setups	TRUE	0	Uint8
						VisStr[4
25-83	Relay Status	0 N/A	All setups	TRUE	0]
25-84	Compressor ON Time	0 h	All setups	TRUE	74	Uint32
25-85	Relay ON Time	0 h	All setups	TRUE	74	Uint32
25-86	Reset Relay Counters	[0] Do not reset	All setups	TRUE	-	Uint8
25-87	Inverse Interlock	0 N/A	All setups	TRUE	0	Uint16
25-88	Pack capacity [%]	0 %	All setups	TRUE	0	Uint16
25-9* S	ervice					
25-90	Compressor Interlock	[0] Off	All setups	TRUE	-	Uint8
25-91	Manual Alternation	0 N/A	All setups	TRUE	0	Uint8

6-96 BAS-SVX60A-EN



6.16.13 28-** Compressor Function

Par. No. #	Parameter description	Default value 4-setup		Change during operation	Conver- sion index	Туре
28-0* 5	hort Cycle Protection	•				
28-00	Short Cycle Protection	[1] Disabled	All setups	TRUE	-	Uint8
28-01	Interval between Starts	300 s	All setups	TRUE	0	Uint16
28-02	Minimum Run Time	12 s	All setups	TRUE	0	Uint16
28-1* (Dil Return Management					
28-10	Oil Return Management	[0] Off	All setups	FALSE	-	Uint8
28-11	Low Speed Running Time	60 min	All setups	TRUE	70	Uint16
28-12	Fixed Boost Interval	24 h	All setups	TRUE	74	Uint8
28-13	Boost Duration	30 s	All setups	FALSE	0	Uint8
28-2* [Discharge Temperature Monitor	•				
28-20	Temperature Source	[0] None	All setups	FALSE	-	Uint8
28-21	Temperature Unit	[60] °C	All setups	FALSE	-	Uint8
28-24	Warning Level	130 N/A	All setups	FALSE	0	Uint16
28-25	Warning Action	[1] Decrease cooling	All setups	FALSE	-	Uint8
28-26	Emergency Level	145 N/A	All setups	FALSE	0	Uint16
28-27	Discharge Temperature	0 DTM_ReadoutUnit	All setups	TRUE	0	Int32
28-3* (Trankcase Heating	·				
28-30	Crankcase Heating Control	[0] Disabled	All setups	TRUE	-	Uint8
28-31	Heating DC Current	ExpressionLimit	All setups	TRUE	0	Uint8
28-32	Crankcase Heating Delay	5 s	All setups	TRUE	0	Uint16
28-4* <i>F</i>	Anti-reverse Protection at Stop	•				
28-40	Reverse Protection Control	[0] Disabled	All setups	TRUE	-	Uint8
28-41	DC Brake Current	90 %	All setups	TRUE	0	Uint16
28-42	DC Braking Time	ExpressionLimit	All setups	TRUE	-1	Uint16
28-43	DC Brake Cut In Speed [RPM]	ExpressionLimit	All setups	TRUE	67	Uint16
28-44	DC Brake Cut In Speed [Hz]	ExpressionLimit	All setups	TRUE	-1	Uint16
28-5* L	oad Profile					
28-50	0 Reset Load Profile [0] Do not reset		All setups	TRUE	-	Uint8
28-59	Load Profile Data	0 N/A	All setups	TRUE	0	Uint16
28-7* [Day/Night Settings					
28-74	Night Speed Drop [RPM]	ExpressionLimit	All setups	TRUE	67	Uint16
28-76	Night Speed Drop [Hz]	ExpressionLimit	All setups	TRUE	-1	Uint16



6-98 BAS-SVX60A-EN



7.1 Status Messages

7.1.1 Warnings/Alarm Messages

A warning or an alarm is signalled by the relevant LED on the front of the frequency converter and indicated by a code on the display.

A warning remains active until its cause is no longer present. Under certain circumstances, operation of the motor may still be continued. Warning messages may be critical, but are not necessarily so.

In the event of an alarm, the frequency converter trips. Reset the alarm to resume operation once the cause has been rectified.

Three ways to reset:

- Press [Reset].
- Via a digital input with the "Reset" function.
- Via serial communication/optional fieldbus.

NOTE!

After a manual reset pressing [Reset], press [Auto On] to restart the motor.

If an alarm cannot be reset, the reason may be that its cause has not been rectified, or the alarm is trip-locked (see also *Table 7.1*).

Alarms that are trip-locked offer additional protection, meaning that the mains supply must be switched off before the alarm can be reset. After being switched back on, the frequency converter is no longer blocked and can be reset as described above once the cause has been rectified.

Alarms that are not trip-locked can also be reset using the automatic reset function in *14-20 Reset Mode* (Warning: automatic wake-up is possible!)

If a warning or alarm is marked against a code in *Table 7.1*, this means that either a warning occurs before an alarm, or else that it is possible to specify whether a warning or an alarm should be displayed for a given fault.

This is possible, for instance, in 1-90 Motor Thermal Protection. After an alarm or trip, the motor carries on coasting, and the alarm and warning flash. Once the problem has been rectified, only the alarm continues flashing until the frequency converter is reset.

NOTE!

No missing motor phase detection (numbers 30-32) and no stall detection is active when 1-10 Motor Construction is set to [1] PM non salient SPM.

No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter
					Reference
1	10 Volts low	Х			
2	Live zero error	(X)	(X)		6-01 Live Zero Timeout
					Function
3	No motor	(X)			1-80 Function at Stop
4	Mains phase loss	(X)	(X)	(X)	14-12 Function at
					Mains Imbalance
5	DC link voltage high	X			
6	DC link voltage low	X			
7	DC over-voltage	X	Χ		
8	DC under voltage	Х	Χ		
9	Inverter overloaded	Х	Х		
10	Motor ETR over temperature	(X)	(X)		1-90 Motor Thermal
					Protection
11	Motor thermistor over temperature	(X)	(X)		1-90 Motor Thermal
					Protection



Operating Instructions TRV200

No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
12	Torque limit	Х	Х		
13	Over Current	X	Χ	X	
14	Ground Fault	X	Χ		
15	Hardware mismatch		X	X	
16	Short Circuit		Χ	X	
17	Control word time-out	(X)	(X)		8-04 Control Word Timeout Function
20	Temp. Input Error				
21	Param Error				
22	Hoist Mech. Brake	(X)	(X)		Parameter group 2-2*
23	Internal Fans	Х			
24	External Fans	Х			
25	Brake resistor short-circuited	Х			
26	Brake resistor power limit	(X)	(X)		2-13 Brake Power Monitoring
27	Brake chopper short-circuited	Х	Х		
28	Brake check	(X)	(X)		2-15 Brake Check
29	Heatsink temp	Х	Х	Х	
30	Motor phase U missing	(X)	(X)	(X)	4-58 Missing Motor Phase Function
31	Motor phase V missing	(X)	(X)	(X)	4-58 Missing Motor Phase Function
32	Motor phase W missing	(X)	(X)	(X)	4-58 Missing Motor Phase Function
33	Inrush Fault		Х	Х	
34	Fieldbus communication fault	Х	Х		
35	Option Fault				
36	Mains failure	Х	Х		
37	Phase imbalance		Х		
38	Internal Fault		Х	Х	
39	Heatsink sensor		Х	Х	
40	Overload of Digital Output Terminal 27	(X)			5-00 Digital I/O Mode, 5-01 Terminal 27 Mode
41	Overload of Digital Output Terminal 29	(X)			5-00 Digital I/O Mode,
					5-02 Terminal 29 Mode
42	Ovrld X30/6-7	(X)			
43	Ext. Supply (option)				
45	Ground Fault 2	Х	Х		
46	Pwr. card supply		Х	Х	
47	24 V supply low	X	Х	Х	
48	1.8 V supply low		Х	Х	
49	Speed limit		Х		1-86 Trip Speed Low [RPM]
50	AMA calibration failed		Х		
51	AMA check U _{nom} and I _{nom}		Х		
52	AMA low I _{nom}		X		
53	AMA motor too big		X		
54	AMA motor too small		X		
55	AMA parameter out of range	+	X		

7-2 BAS-SVX60A-EN

Operating Instructions TRV200

No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
56	AMA interrupted by user		Х		
57	AMA time-out		Х		
58	AMA internal fault	Х	Х		
59	Current limit	Х			
60	External Interlock	Х	Х		
61	Feedback Error	(X)	(X)		4-30 Motor Feedback Loss Function
62	Output Frequency at Maximum Limit	Х			
63	Mechanical Brake Low		(X)		2-20 Release Brake Current
64	Voltage Limit	Х			
65	Control Board Over-temperature	Х	Х	X	
66	Heat sink Temperature Low	Х			
67	Option Configuration has Changed		Х		
68	Safe Stop	(X)	(X) ¹⁾		5-19 Terminal 37 Safe Stop
69	Pwr. Card Temp		Х	Х	
70	Illegal FC configuration			X	
71	PTC 1 Safe Stop				
72	Dangerous failure				
73	Safe Stop Auto Restart	(X)	(X)		5-19 Terminal 37 Safe Stop
74	PTC Thermistor			Х	
75	Illegal Profile Sel.		Х		
76	Power Unit Setup	Х			
77	Reduced power mode	Х			14-59 Actual Number of Inverter Units
78	Tracking Error	(X)	(X)		4-34 Tracking Error Function
79	Illegal PS config		Х	Х	
80	Drive Initialized to Default Value		Х		
81	CSIV corrupt		Х		
82	CSIV parameter error		Х		
83	Illegal Option Combination			Х	
84	No Safety Option		Х		
85	Dang fail PB				
86	Dang fail DI				
88	Option Detection			X	
89	Mechanical Brake Sliding	Х			
90	Feedback Monitor	(X)	(X)		17-61 Feedback Signal Monitoring
91	Analog input 54 wrong settings			Х	S202
102	Too many CAN objects				
103	Illegal axis num.				
104	Mixing Fans				
105	Error not reset				
106	HOME not done				
107	Home vel zero				
108	Position error				



No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
109	Index not found				
110	Unknown cmd.				
111	SW end limit				
112	Unknown param				
113	FC not enabled				
114	Too many loops				
115	Par.save failed				
116	Param. memory				
117	Progr. Memory				
118	Reset by CPU				
119	User abort				
121	No more SDO channels				
125	HW end limit				
149	Too many inter.				
150	No ext. 24 V				
151	GOSUB > limit				
152	Return @ limit				
154	D.out overload				
155	LINK failed				
156	Illegal double arg.				
160	Internal Intr. error				
162	Memory error				
163	ATEX ETR cur.lim.warning	X			
164	ATEX ETR cur.lim.alarm		Χ		
165	ATEX ETR freq.lim.warning	X			
166	ATEX ETR freq.lim.alarm		Χ		
246	Pwr.card supply				
250	New spare parts			X	
251	New Type Code		Χ	X	

Table 7.1 Alarm/Warning Code List

(X) Dependent on parameter

1) Cannot be Auto reset via 14-20 Reset Mode

A trip is the action following an alarm. The trip coasts the motor and is reset by pressing [Reset] or by a digital input (parameter group 5-1* Digital Inputs [1]). The origin event that caused an alarm cannot damage the frequency converter or cause dangerous conditions. A trip lock is an action when an alarm occurs, which could damage the

frequency converter or connected parts. A trip lock situation can only be reset by a power cycling.

Warning	yellow
Alarm	flashing red
Trip locked	yellow and red

Table 7.2 LED Indication

Bit	Hex	Dec	Alarm Word	Alarm Word	Warning Word	Warning	Extended	Extended
				2		Word 2	Status Word	Status Word 2
Alarn	Alarm Word Extended Status Word							
0	00000001	1	Brake Check	ServiceTrip,	Brake Check (W28)	Start	Ramping	Off
			(A28)	Read/Write		Delayed		
1	00000002	2	Pwr.card temp	ServiceTrip,	Pwr.card temp (A69)	Stop	AMA Running	Hand/Auto
			(A69)	(reserved)		Delayed		

7-4 BAS-SVX60A-EN

Operating Instructions TRV200

Bit	Hex	Dec	Alarm Word	Alarm Word 2	Warning Word	Warning Word 2	Extended Status Word	Extended Status Word 2
2	0000004	4	Ground Fault (A14)	ServiceTrip, Typecode/ Sparepart	Ground Fault (W14)	reserved	Start CW/CCW start_possible is active, when the DI selections [12] OR [13] are active and the requested direction matches the reference sign	Profibus OFF1 active
3	00000008	8	Ctrl.Card Temp (A65)	ServiceTrip, (reserved)	Ctrl.Card Temp (W65)	reserved	Slow Down slow down command active, e.g. via CTW bit 11 or DI	Profibus OFF2 active
4	00000010	16	Ctrl. Word TO (A17)	ServiceTrip, (reserved)	Ctrl. Word TO (W17)		Catch Up catch up command active, e.g. via CTW bit 12 or DI	Profibus OFF3 active
5	00000020	32	Over Current (A13)	reserved	Over Current (W13)	reserved	Feedback High feedback > 4-57	Relay 123 active
6	00000040	64	Torque Limit (A12)	reserved	Torque Limit (W12)	reserved	Feedback Low feedback < 4-56	Start Prevented
7	00000080	128	Motor Th Over (A11)	reserved	Motor Th Over (W11)	reserved	Output Current High current > 4-51	Control Ready
8	00000100	256	Motor ETR Over (A10)	reserved	Motor ETR Over (W10)	reserved	Output Current Low current < 4-50	Drive Ready
9	00000200	512	Inverter Overld. (A9)	Discharge High	Inverter Overld (W9)	Discharge High	Output Freq High speed > 4-53	Quick Stop
10	00000400	1024	DC under Volt (A8)	Start Failed	DC under Volt (W8)	Multi- motor underloa d	Output Freq Low speed < 4-52	DC Brake
11	00000800	2048	DC over Volt (A7)	Speed Limit	DC over Volt (W7)	Multi- motor Overload	Brake Check OK brake test NOT ok	Stop
12	00001000	4096	Short Circuit (A16)	External Interlock	DC Voltage Low (W6)	Compress or Interlock	Braking Max BrakePower > BrakePowerLimit (2-12)	Stand by
13	00002000	8192	Inrush Fault (A33)	Illegal Option Combi.	DC Voltage High (W5)	Mechanic al Brake Sliding	Braking	Freeze Output Request
14	00004000	16384	Mains ph. Loss (A4)	No Safety Option	Mains ph. Loss (W4)	Safe Option Warning	Out of Speed Range	Freeze Output



Bit	Hex	Dec	Alarm Word	Alarm Word	Warning Word	Warning Word 2	Extended Status Word	Extended Status Word 2
15	0008000	32768	AMA Not OK	reserved	No Motor (W3)	Auto DC Braking	OVC Active	Jog Request
16	00010000	65536	Live Zero Error (A2)	reserved	Live Zero Error (W2)		AC Brake	Jog
17	00020000	131072	Internal Fault (A38)	KTY error	10V Low (W1)	KTY Warn	Password Timelock number of allowed password trials exceeded - timelock active	Start Request
18	00040000	262144	Brake Overload (A26)	Fans error	Brake Overload (W26)	Fans Warn	Password Protection 0-61 = ALL_NO_ACCESS OR BUS_NO_ACCESS OR BUS_READONLY	Start
19	00080000	524288	U phase Loss (A30)	ECB error	Brake Resistor (W25)	ECB Warn	Reference High reference > 4-55	Start Applied
20	00100000	1048576	V phase Loss (A31)	reserved	Brake IGBT (W27)	reserved	Reference Low reference < 4-54	Start delay
21	00200000	2097152	W phase Loss (A32)	reserved	Speed Limit (W49)	reserved	Local Reference reference site = REMOTE -> auto on pressed & active	Sleep
22	00400000	4194304	Fieldbus Fault (A34)	reserved	Fieldbus Fault (W34)	reserved	Protection mode notifikation	Sleep Boost
23	00800000	8388608	24 V Supply Low (A47)	reserved	24V Supply Low (W47)	reserved	Unused	Running
24	01000000	16777216	Mains Failure (A36)	reserved	Mains Failure (W36)	reserved	Unused	Drive Bypass
25	02000000	33554432	1.8V Supply Low (A48)	Current Limit (A59)	Current Limit (W59)	reserved	Unused	Fire Mode
26	04000000	67108864	Brake Resistor (A25)	reserved	Low Temp (W66)	reserved	Unused	External Interlock
27	08000000	134217728	Brake IGBT (A27)	reserved	Voltage Limit (W64)	reserved	Unused	Firemode Limit Exceed
28	10000000	268435456	Option Change (A67)	reserved	Encoder loss (W90)	reserved	Unused	FlyStart active
29	20000000	536870912	Drive Initialized(A80)	Encoder loss (A90)	Output freq. lim. (W62)	BackEMF too High	Unused	
30	4000000	1073741824	Safe Stop (A68)	PTC Thermistor (A74)	Safe Stop (W68)	PTC Thermist or (W74)	Unused	
31	80000000	2147483648	Mech. brake low (A63)	Dangerous failure (A72)	Extended Status Word		Protection Mode	

Table 7.3 Description of Alarm Word, Warning Word and Extended Status Word

7-6 BAS-SVX60A-EN



The alarm words, warning words and extended status words can be read out via serial bus or optional fieldbus for diagnostics. See also 16-94 Ext. Status Word.

WARNING 1, 10 Volts low

The control card voltage is below 10 V from terminal 50. Remove some of the load from terminal 50, as the 10 V supply is overloaded. Max. 15 mA or minimum 590 Ω .

This condition can be caused by a short circuit in a connected potentiometer or improper wiring of the potentiometer.

Troubleshooting

Remove the wiring from terminal 50. If the warning clears, the problem is with the wiring. If the warning does not clear, replace the control card.

WARNING/ALARM 2, Live zero error

This warning or alarm only appears if programmed by the user in 6-01 Live Zero Timeout Function. The signal on one of the analog inputs is less than 50% of the minimum value programmed for that input. Broken wiring or faulty device sending the signal can cause this condition.

Troubleshooting

Check connections on all the analog input terminals. Control card terminals 53 and 54 for signals, terminal 55 common. MCB 101 terminals 11 and 12 for signals, terminal 10 common. MCB 109 terminals 1, 3, 5 for signals, terminals 2, 4, 6 common).

Check that the frequency converter programming and switch settings match the analog signal type.

Perform Input Terminal Signal Test.

WARNING/ALARM 3, No motor

No motor has been connected to the output of the frequency converter.

WARNING/ALARM 4, Mains phase loss

A phase is missing on the supply side, or the mains voltage imbalance is too high. This message also appears for a fault in the input rectifier on the frequency converter. Options are programmed at 14-12 Function at Mains Imbalance.

Troubleshooting

Check the supply voltage and supply currents to the frequency converter.

WARNING 5, DC link voltage high

The intermediate circuit voltage (DC) is higher than the high voltage warning limit. The limit is dependent on the frequency converter voltage rating. The unit is still active.

WARNING 6, DC link voltage low

The intermediate circuit voltage (DC) is lower than the low voltage warning limit. The limit is dependent on the adjustable frequency drive voltage rating. The unit is still active.

WARNING/ALARM 7, DC overvoltage

If the intermediate circuit voltage exceeds the limit, the frequency converter trips after a time.

Troubleshooting

Connect a brake resistor

Extend the ramp time

Change the ramp type

Activate the functions in 2-10 Brake Function

Increase 14-26 Trip Delay at Inverter Fault

If the alarm/warning occurs during a power sag the solution is to use kinetic back-up (14-10 Line Failure)

WARNING/ALARM 8, DC under voltage

If the intermediate circuit voltage (DC link) drops below the undervoltage limit, the adjustable frequency drive checks if a 24 V DC backup supply is connected. If no 24 V DC backup supply is connected, the adjustable frequency drive trips after a fixed time delay. The time delay varies with unit size.

Troubleshooting

Make sure that the supply voltage matches the adjustable frequency drive voltage.

Perform input voltage test.

Perform soft charge circuit test.

WARNING/ALARM 9, Inverter overload

The frequency converter is about to cut out because of an overload (too high current for too long). The counter for electronic, thermal inverter protection issues a warning at 98% and trips at 100%, while giving an alarm. The frequency converter *cannot* be reset until the counter is below 90%.

The fault is that the frequency converter has run with more than 100% overload for too long.

Troubleshooting

Compare the output current shown on the keypad with the frequency converter rated current.

Compare the output current shown on the keypad with measured motor current.

Display the Thermal Drive Load on the keypad and monitor the value. When running above the frequency converter continuous current rating, the counter increases. When running below the



frequency converter continuous current rating, the counter decreases.

WARNING/ALARM 10, Motor overload temperature

According to the electronic thermal protection (ETR), the motor is too hot. Select whether the frequency converter issues a warning or an alarm when the counter reaches 100% in 1-90 Motor Thermal Protection. The fault occurs when the motor runs with more than 100% overload for too long.

Troubleshooting

Check for motor overheating.

Check if the motor is mechanically overloaded

Check that the motor current set in 1-24 Motor Current is correct.

Ensure that Motor data in parameters 1-20 to 1-25 are set correctly.

If an external fan is in use, check in 1-91 Motor External Fan that it is selected.

Running AMA in 1-29 Automatic Motor Adaptation (AMA) tunes the frequency converter to the motor more accurately and reduces thermal loading.

WARNING/ALARM 11, Motor thermistor over temp

Check whether the thermistor is disconnected. Select whether the adjustable frequency drive issues a warning or an alarm in *1-90 Motor Thermal Protection*.

▲WARNING

Live Electrical Components!

Troubleshooting

Check for motor overheating.

Check if the motor is mechanically overloaded.

When using terminal 53 or 54, check that the thermistor is connected correctly between either terminal 53 or 54 (analog voltage input) and terminal 50 (+10 V supply). Also check that the terminal switch for 53 or 54 is set for voltage. Check *1-93 Thermistor Source* selects terminal 53 or 54.

When using digital inputs 18 or 19, check that the thermistor is connected correctly between either terminal 18 or 19 (digital input PNP only) and terminal 50. Check *1-93 Thermistor Source* selects terminal 18 or 19.

AWARNING

Disconnect power before proceeding.

WARNING/ALARM 12, Torque limit

The torque has exceeded the value in 4-16 Torque Limit Motor Mode or the value in 4-17 Torque Limit Generator Mode. 14-25 Trip Delay at Torque Limit can change this from a warning only condition to a warning followed by an alarm.

Troubleshooting

If the motor torque limit is exceeded during ramp up, extend the ramp up time.

If the generator torque limit is exceeded during ramp down, extend the ramp down time.

If torque limit occurs while running, possibly increase the torque limit. Make sure that the system can operate safely at a higher torque.

Check the application for excessive current draw on the motor.

WARNING/ALARM 13, Over current

The inverter peak current limit (approximately 200% of the rated current) is exceeded. The warning lasts about 1.5 s, then the adjustable frequency drive trips and issues an alarm. This fault can be caused by shock loading or quick acceleration with high inertia loads. It can also appear after kinetic backup if the acceleration during ramp-up is quick. If extended mechanical brake control is selected, trip can be reset externally.

Troubleshooting

Remove power and check if the motor shaft can be turned

Make sure that the motor size matches the adjustable frequency drive.

Check parameters 1-20 to 1-25 for correct motor data.

ALARM 14, Earth (ground) fault

There is current from the output phases to ground, either in the cable between the frequency converter and the motor or in the motor itself.

Troubleshooting

Remove power to the frequency converter and repair the ground fault.

Check for ground faults in the motor by measuring the resistance to ground of the motor leads and the motor with a megohmmeter.



Disconnect power before proceeding.

7-8 BAS-SVX60A-EN



ALARM 15, Hardware mismatch

A fitted option is not operational with the present control board hardware or software.

Record the value of the following parameters and contact your Trane supplier:

15-40 FC Type

15-41 Power Section

15-42 Voltage

15-43 Software Version

15-45 Actual Typecode String

15-49 SW ID Control Card

15-50 SW ID Power Card

15-60 Option Mounted

15-61 Option SW Version (for each option slot)

ALARM 16, Short circuit

There is short-circuiting in the motor or motor wiring.

Remove power to the adjustable frequency drive and repair the short circuit.

AWARNING

Disconnect power before proceeding.

WARNING/ALARM 17, Control word timeout

There is no communication to the frequency converter. The warning is only active when 8-04 Control Word Timeout Function is NOT set to [0] Off.

If 8-04 Control Word Timeout Function is set to [5] Stop and Trip, a warning appears and the frequency converter ramps down until it stops then displays an alarm.

▲WARNING

Live Electrical Components!

Troubleshooting

Check connections on the serial communication cable.

Increase 8-03 Control Word Timeout Time

Check the operation of the communication equipment.

Verify a proper installation based on EMC requirements.

ALARM 18, Start failed

The speed has not exceeded 1-77 Compressor Start Max Speed [RPM] during start within the allowed time. (set in 1-79 Compressor Start Max Time to Trip). This may be caused by a blocked motor.

Warning/Alarm 19, Discharge Temperature High

Warning:

The discharge temperature exceeds the level programmed in 28-25 Warning Level.

Alarm:

The discharge temperature exceeds the level programmed in 28-26 Emergency Level.

WARNING/ALARM 20, Temp. input error

The temperature sensor is not connected.

WARNING/ALARM 21, Parameter error

The parameter is out of range. The parameter number is reported in the keypad. The affected parameter must be set to a valid value.

WARNING/ALARM 22, Hoist mechanical brake

Report value shows what kind it is.

0 = The torque ref. was not reached before timeout.

1 = There was no brake feedback before timeout.

WARNING 23, Internal fan fault

The fan warning function is an extra protective function that checks if the fan is running/mounted. The fan warning can be disabled in 14-53 Fan Monitor ([0] Disabled).

For the D, E, and F Frame filters, the regulated voltage to the fans is monitored.

Troubleshooting

Check for proper fan operation.

Cycle power to the adjustable frequency drive and check that the fan operates briefly at startup.

Check the sensors on the heatsink and control card.

WARNING 24, External fan fault

The fan warning function is an extra protective function that checks if the fan is running/mounted. The fan warning can be disabled in *14-53 Fan Monitor* ([0] *Disabled*).

Troubleshooting

Check for proper fan operation.

Cycle power to the adjustable frequency drive and check that the fan operates briefly at start-

Check the sensors on the heatsink and control card.

WARNING/ALARM 28, Brake check failed

The brake resistor is not connected or not working. Check 2-15 Brake Check.

ALARM 29, Heatsink temp

The maximum temperature of the heatsink has been exceeded. The temperature fault will not reset until the temperature falls below a defined heatsink temperature.

BAS-SVX60A-EN 7-9



The trip and reset points are different based on the adjustable frequency drive power size.

Troubleshooting

Check for the following conditions.

Ambient temperature too high.

Motor cable too long.

Incorrect airflow clearance above and below the adjustable frequency drive.

Blocked airflow around the adjustable frequency drive

Damaged heatsink fan.

Dirty heatsink.

ALARM 30, Motor phase U missing

Motor phase U between the adjustable frequency drive and the motor is missing.



Disconnect power before proceeding.

Remove power from the adjustable frequency drive and check motor phase U.

ALARM 31, Motor phase V missing

Motor phase V between the adjustable frequency drive and the motor is missing.

AWARNING

Disconnect power before proceeding.

Remove power from the adjustable frequency drive and check motor phase V.

ALARM 32, Motor phase W missing

Motor phase W between the adjustable frequency drive and the motor is missing.



Disconnect power before proceeding.

Remove power from the adjustable frequency drive and check motor phase W.

ALARM 33, Inrush fault

Too many power-ups have occurred within a short time period. Let the unit cool to operating temperature.

WARNING/ALARM 34, Fieldbus communication fault

The serial communication bus on the communication option card is not working.

WARNING/ALARM 35, Option fault

An option alarm is received. The alarm is option-specific. The most likely cause is a power-up or a communication fault.

WARNING/ALARM 36, Mains failure

This warning/alarm is only active if the supply voltage to the adjustable frequency drive is lost and 14-10 Mains Failure is NOT set to [0] No Function. Check the fuses to the adjustable frequency drive and line power supply to the unit.

ALARM 37, Phase imbalance

There is a current imbalance between the power units

ALARM 38, Internal fault

When an internal fault occurs, a code number defined in *Table 7.4* is displayed.

Troubleshooting

Cycle power

Check that the option is properly installed

Check for loose or missing wiring

It may be necessary to contact your Trane supplier or service department. Note the code number for further troubleshooting directions.

No.	Text	
0	Serial port cannot be initialized. Contact your	
	Trane supplier or Trane Service Department.	
256-258	Power EEPROM data is defective or too old.	
	Replace power card.	
512-519	Internal fault. Contact your Trane supplier or Trane	
	Service Department.	
783	Parameter value outside of min/max limits	
1024-1284	Internal fault. Contact your Trane supplier or the	
	Trane Service Department.	
1299	Option SW in slot A is too old	
1300	Option SW in slot B is too old	
1302	Option SW in slot C1 is too old	
1315	Option SW in slot A is not supported (not allowed)	
1316	Option SW in slot B is not supported (not allowed)	
1318	Option SW in slot C1 is not supported (not	
	allowed)	
1379-2819	Internal fault. Contact your Trane supplier or Trane	
	Service Department.	
2561	Replace control card	
2820	LCP stack overflow	
2821	Serial port overflow	
2822	USB port overflow	
3072-5122	Parameter value is outside its limits	
5123	Option in slot A: Hardware incompatible with	
	control board hardware	
5124	Option in slot B: Hardware incompatible with	
	control board hardware	
5125	Option in slot C0: Hardware incompatible with	
	control board hardware	
5126	Option in slot C1: Hardware incompatible with	
	control board hardware	

7-10 BAS-SVX60A-EN



No.	Text
5376-6231	Internal fault. Contact your Trane supplier or Trane
	Service Department.

Table 7.4 Internal Fault Codes

ALARM 39, Heatsink sensor

No feedback from the heatsink temperature sensor.

The signal from the IGBT thermal sensor is not available on the power card. The problem could be on the power card, on the gate drive card, or the ribbon cable between the power card and gate drive card.

WARNING 40, Overload of digital output terminal 27

Check the load connected to terminal 27 or remove short-circuit connection. Check *5-01 Terminal 27 Mode*.

WARNING 41, Overload of digital output terminal 29

Check the load connected to terminal 29 or remove short-circuit connection. Check *5-02 Terminal 29 Mode*.

WARNING 42, Overload of digital output on X30/6 or overload of digital output on X30/7

For X30/6, check the load connected to X30/6 or remove the short-circuit connection. Check 5-32 Term X30/6 Digi Out (MCB 101).

For X30/7, check the load connected to X30/7 or remove the short-circuit connection. Check *5-33 Term X30/7 Digi Out (MCB 101)*.

ALARM 43, Ext. supply

MCB 113 Ext. Relay Option is mounted without ext. 24V DC. Either connect an ext. 24V DC supply or specify that no external supply is used via 14-80 Option Supplied by External 24VDC [0]. A change in 14-80 Option Supplied by External 24VDC requires a power cycle.

ALARM 45, Earth fault 2

Ground fault on start-up.

Troubleshooting

Check for proper grounding and loose connections.

Check for proper wire size.

Check motor cables for short-circuits or leakage currents.

ALARM 46, Power card supply

The supply on the power card is out of range.

There are three power supplies generated by the switch mode power supply (SMPS) on the power card: 24 V, 5 V, ±18 V. When powered with 24 V DC with the MCB 107 option, only the 24 V and 5 V supplies are monitored. When powered with three phase AC line voltage, all three supplies are monitored.

Troubleshooting

Check for a defective power card.

Check for a defective control card.

Check for a defective option card.

If a 24 V DC power supply is used, verify proper supply power.

WARNING 47, 24 V supply low

The 24 V DC is measured on the control card.

WARNING 48, 1.8 V supply low

The 1.8 V DC supply used on the control card is outside of allowable limits. The power supply is measured on the control card. Check for a defective control card. If an option card is present, check for an overvoltage condition.

WARNING 49, Speed limit

When the speed is not within the specified range in 4-11 Motor Speed Low Limit [RPM] and 4-13 Motor Speed High Limit [RPM], the frequency converter shows a warning. When the speed is below the specified limit in 1-86 Trip Speed Low [RPM] (except when starting or stopping) the frequency converter will trip.

ALARM 50, AMA calibration failed

Contact your Trane supplier or Trane Service Department.

ALARM 51, AMA check Unom and Inom

The settings for motor voltage, motor current and motor power are wrong. Check the settings in parameters 1-20 to 1-25.

ALARM 52, AMA low Inom

The motor current is too low. Check the settings.

ALARM 53, AMA motor too big

The motor is too big for the AMA to operate.

ALARM 54, AMA motor too small

The motor is too small for the AMA to operate.

ALARM 55, AMA parameter out of range

The parameter values of the motor are outside of the acceptable range. AMA will not run.

ALARM 56, AMA interrupted by user

The user has interrupted the AMA.

ALARM 57, AMA internal fault

Try to restart AMA again. Repeated restarts can overheat the motor.

ALARM 58, AMA Internal fault

Contact your Trane supplier.

WARNING 59, Current limit

The current is higher than the value in 4-18 Current Limit. Ensure that Motor data in parameters 1-20 to 1-25 are set correctly. Possibly increase the current limit. Be sure that the system can operate safely at a higher limit.

BAS-SVX60A-EN 7-11



WARNING 60, External interlock

A digital input signal is indicating a fault condition external to the frequency converter. An external interlock has commanded the frequency converter to trip. Clear the external fault condition. To resume normal operation, apply 24 Vdc to the terminal programmed for external interlock. Reset the frequency converter.

WARNING/ALARM 61, Feedback error

An error between calculated speed and speed measurement from feedback device. The function Warning/ Alarm/Disabling setting is in 4-30 Motor Feedback Loss Function. Accepted error setting in 4-31 Motor Feedback Speed Error and the allowed time the error occur setting in 4-32 Motor Feedback Loss Timeout. During a commissioning procedure the function may be effective.

WARNING 62, Output frequency at maximum limit

The output frequency has reached the value set in 4-19 Max Output Frequency. Check the application to determine the cause. Possibly increase the output frequency limit. Be sure the system can operate safely at a higher output frequency. The warning will clear when the output drops below the maximum limit.

ALARM 63, Mechanical brake low

The actual motor current has not exceeded the "release brake" current within the "Start delay" time window.

WARNING/ALARM 65, Control card over temperature

The cut-out temperature of the control card is 176 $^{\circ}$ F [80 $^{\circ}$ Cl.

Troubleshooting

- Check that the ambient operating temperature is within limits.
- Check for clogged filters.
- Check fan operation.
- Check the control card.

WARNING 66, Heatsink temperature low

The adjustable frequency drive is too cold to operate. This warning is based on the temperature sensor in the IGBT module.

Increase the ambient temperature of the unit. Also, a trickle amount of current can be supplied to the adjustable frequency drive whenever the motor is stopped by setting 2-00 DC Hold/Preheat Current at 5% and 1-80 Function at Stop.

ALARM 67, Option module configuration has changed

One or more options have either been added or removed since the last power-down. Check that the configuration change is intentional and reset the unit.

ALARM 69, Power card temperature

The temperature sensor on the power card is either too hot or too cold.

Troubleshooting

Check that the ambient operating temperature is within limits.

Check for clogged filters.

Check fan operation.

Check the power card.

ALARM 70, Illegal FC configuration

The control card and power card are incompatible. Contact your supplier with the type code of the unit from the nameplate and the part numbers of the cards to check compatibility.

ALARM 71, PTC 1 safe stop

Safe Stop has been activated from the PTC Thermistor Card (motor too warm). Normal operation can be resumed when the applies 24 V DC to T-37 again (when the motor temperature reaches an acceptable level) and when the Digital Input from the is deactivated. When that happens, a reset signal must be is be sent (via Bus, Digital I/O, or by pressing [Reset]).

ALARM 72, Dangerous failure

Safe Stop with Trip Lock. The Dangerous Failure Alarm is issued if the combination of safe stop commands is unexpected. This is the case if a PTC Thermistor Card enables X44/10 but safe stop is somehow not enabled. Furthermore, if the is the only device using safe stop (specified through selection [4] or [5] in 5-19 Terminal 37 Safe Stop), an unexpected combination is activation of safe stop without the X44/10 being activated. The following table summarizes the unexpected combinations that lead to Alarm 72.

NOTE!

lif X44/10 is activated in selection 2 or 3, this signal is ignored. However, the will still be able to activate Safe Stop.

WARNING 73, Safe stop auto restart

Safe stopped. With automatic restart enabled, the motor may start when the fault is cleared.

ALARM 74, PTC Thermistor

Alarm related to the ATEX option. The PTC is not working.

Parameter value must not be written while motor is running. Stop motor before writing MCO profile to *8-10 Control Word Profile* for instance.

WARNING 76, Power unit setup

The required number of power units does not match the detected number of active power units.

7-12 BAS-SVX60A-EN



WARNING 77, Reduced power mode

This warning indicates that the frequency converter is operating in reduced power mode (i.e. less than the allowed number of inverter sections). This warning will be generated on power cycle when the frequency converter is set to run with fewer inverters and will remain on.

ALARM 78, Tracking error

The difference between set point value and actual value has exceeded the value in 4-35 Tracking Error. Disable the function by 4-34 Tracking Error Function or select an alarm/warning also in 4-34 Tracking Error Function. Investigate the mechanics around the load and motor, Check feedback connections from motor – encoder – to frequency converter. Select motor feedback function in 4-30 Motor Feedback Loss Function. Adjust tracking error band in 4-35 Tracking Error and 4-37 Tracking Error Ramping.

ALARM 79, Illegal power section configuration

The scaling card is the incorrect part number or not installed. Also MK102 connector on the power card could not be installed.

ALARM 80, Drive initialized to default value

Parameter settings are initialized to default settings after a manual reset. Reset the unit to clear the alarm.

ALARM 81, CSIV corrupt

CSIV file has syntax errors.

ALARM 82, CSIV parameter error

CSIV failed to init a parameter.

ALARM 83, Illegal option combination

The mounted options are not supported to work together.

ALARM 84, No safety option

The safety option was removed without applying a general reset. Reconnect the safety option.

ALARM 88, Option detection

A change in the option layout has been detected. This alarm occurs when 14-89 Option Detection is set to [0] Frozen configuration and the option layout for some reason has changed. An option layout change has to be enabled in 14-89 Option Detection before the change is accepted. If the change of configuration is not accepted, it is only possible to reset Alarm 88 (Trip-lock) when the option configuration has been re-established/corrected.

WARNING 89, Mechanical brake sliding

The hoist brake monitor has detected a motor speed > 10 RPM.

ALARM 90, Feedback monitor

Check the connection to encoder/resolver option and eventually replace the MCB 102 or MCB 103.

ALARM 91, Analog input 54 wrong settings

Switch S202 has to be set in position OFF (voltage input) when a KTY sensor is connected to analog input terminal 54.

WARNING/ALARM 104, Mixing fan fault

The fan monitor checks that the fan is spinning at powerup or whenever the mixing fan is turned on. If the fan is not operating, then the fault is annunciated. The mixingfan fault can be configured as a warning or an alarm trip by 14-53 Fan Monitor.

Troubleshooting

Cycle power to the frequency converter to determine if the warning/alarm returns.

WARNING 163, ATEX ETR cur.lim.warning

The frequency converter has run above the characteristic curve for more than 50 s. The warning is activated at 83% and de-activated at 65% of the permitted thermal overload.

ALARM 164, ATEX ETR cur.lim.alarm

Operating above the characteristic curve for more than 60 s within a period of 600 s activates the alarm and the frequency converter trips.

WARNING 165, ATEX ETR freq.lim.warning

The frequency converter is running more than 50 s below the permitted minimum frequency (1-98 ATEX ETR interpol. points freq. [0]).

ALARM 166, ATEX ETR freq.lim.alarm

The frequency converter has operated more than 60 s (in a period of 600 s) below the permitted minimum frequency (1-98 ATEX ETR interpol. points freq. [0]).

ALARM 246, Power card supply

This alarm is only for F Frame frequency converters. It is equivalent to Alarm 46. The report value in the alarm log indicates which power module generated the alarm:

- 1 = left most inverter module.
- 2 = middle inverter module in F2 or F4 frequency converter.
- 2 = right inverter module in F1 or F3 frequency
- 3 = right inverter module in F2 or F4 frequency converter.
- 5 = rectifier module.

WARNING 250, New spare part

A component in the adjustable frequency drive has been replaced. Reset the adjustable frequency drive for normal operation.

WARNING 251, New typecode

The power card or other components have been replaced and the typecode changed. Reset to remove the warning and resume normal operation.

BAS-SVX60A-EN 7-13





8 General Specifications

8.1 Power-dependent Specifications

8.1.1 Mains Supply 3x200-240 V AC

	P15K	P18K	P22K
Compressor model	VSH088/VZH088	VSH117/VZH117	VSH170/VZH170
Typical Shaft Output [HP/kW]	25/18.5	30/22	40/30
Enclosure IP20	B4	C3	C3
Enclosure IP21, IP55, IP66	C1	C1	C1
Output current			
Continuous	74.8	88	115
(3 x 200-240 V) [A]	74.0	00	113
Intermittent (60 s overload)	82.3	96.8	127
(3 x 200-240 V) [A]	02.5	70.0	127
Continuous	26.9	31.7	41.4
kVA (208 V AC) [kVA]	20.5	31.7	1111
Max. input current			
Continuous	68	80	104
(3 x 200-240 V) [A]	- 00	00	10-1
Intermittent (60 s overload)	74.8	88	114
(3 x 200-240 V) [A]	7 1.0	00	
Additional specifications			
IP20 max. cable cross-section ⁵⁾ (mains, brake, motor and load sharing)	35 (2)	50 (1)	50 (1)
IP21, IP55, IP66 max. cable cross-section ⁵⁾ (mains, motor, load sharing)	50 (1)	50 (1)	50 (1)
[mm² (AWG)] ²⁾			
Max cable size with mains disconnect [mm² (AWG)] 2)	50, 35, 35 (1, 2, 2)		
Estimated power loss at rated max. load [W] 4)	737	845	1140
Weight, IP20 [lbs/kg]	51.8/23.5	110/50	110/50
Weight, IP21, IP55/IP66 [lbs/kg]	99.2/45	99.2/45	99.2/45
Efficiency ⁴⁾	0.96	0.97	0.97

Table 8.1 Mains Supply 3x200-240 V AC

For fuse ratings, see 3.4.1 Fuses

- 1) Normal overload = 110% torque during 60 s.
- 2) American Wire Gauge.
- 3) Measured using 5 m screened motor cables at rated load and rated frequency.
- 4) The typical power loss is at nominal load conditions and expected to be within $\pm 15\%$ (tolerence relates to variety in voltage and cable conditions).

Values are based on a typical motor efficiency (eff2/eff3 border line). Motors with lower efficiency will also add to the power loss in the frequency converter and opposite.

If the switching frequency is increased compared to the default setting, the power losses may rise significantly.

Keypad and typical control card power consumptions are included. Further options and customer load may add up to 30 W to the losses. (Though typical only 4 W extra for a fully loaded control card, or options for slot A or slot B, each).

Although measurements are made with state of the art equipment, some measurement inaccuracy must be allowed for (±5%).

5) The three values for the max. cable cross section are for single core, flexible wire and flexible wire with sleeve, respectively.

BAS-SVX60A-EN 8-1



8.1.2 Mains Supply 3x380-480 V AC

	P15K	P18K	P22K
Compressor model	VSH088/VZH088	VSH117/VZH117	VSH170/VZH170
Typical shaft output [HP/kW]	25/18.5	30/22	40/30
Enclosure IP20	B3	B4	B4
Enclosure IP21, IP55, IP66	B1	B2	B2
Output current			
Continuous (3 x 380-440 V) [A]	37.5	44	61
Intermittent (60 s overload) (3 x 380-440 V) [A]	41.3	48.4	67.1
Continuous (3 x 441-500 V) [A]	34	40	52
Intermittent (60 s overload) (3 x 441-500 V) [A]	37.4	44	57.2
Continuous kVA (400 V AC) [kVA]	26	30.5	42.3
Continuous kVA (460 V AC) [kVA]	27.1	31.9	41.4
Max. input current			
Continuous (3 x 380-440 V) [A]	34	40	55
Intermittent (60 s overload) (3 x 380-440 V) [A]	37.4	44	60.5
Continuous (3 x 441-500 V) [A]	31	36	47
Intermittent (60 s overload) (3 x 441-500 V) [A]	34.1	39.6	51.7
Additional specifications			•
IP21, IP55, IP66 max. cable cross-section ⁵⁾ (mains, brake, load sharing) [mm² (AWG)] ²⁾	16, 10, 16 (6, 8, 6)	35,-,-(2,-,-)	35,-,-(2,-,-)
IP21, IP55, IP66 max. cable cross-section ⁵⁾ (motor) [mm ² (AWG)] ²⁾	10, 10,- (8, 8,-)	35, 25, 25 (2, 4, 4)	35, 25, 25 (2, 4, 4)
IP20 max. cable cross-section ⁵⁾ (mains, brake, motor and load sharing)	10, 10,- (8, 8,-)	35,-,-(2,-,-)	35,-,-(2,-,-)
Estimated power loss at rated max. load [W] ⁴⁾	465	525	739
Weight, enclosure IP20 [lbs/kg]	26,46/12	51.8/23.5	51.8/23.5
Weight, enclosure IP21, IP55, IP66 [lbs/kg]	50.4/23	59.5/27	59.5/27
Efficiency ⁴⁾	0.98	0.98	0.98

Table 8.2 Mains Supply 3x380-480 V AC

For fuse ratings, see 3.4.1 Fuses

- 1) Normal overload = 110% torque during 60 s.
- 2) American Wire Gauge.
- 3) Measured using 5 m screened motor cables at rated load and rated frequency.
- 4) The typical power loss is at nominal load conditions and expected to be within $\pm 15\%$ (tolerence relates to variety in voltage and cable conditions).

Values are based on a typical motor efficiency (eff2/eff3 border line). Motors with lower efficiency will also add to the power loss in the frequency converter and vice versa.

If the switching frequency is increased compared to the default setting, the power losses may rise significantly.

Keypad and typical control card power consumptions are included. Further options and customer load may add up to 30 W to the losses. (Though typical only 4 W extra for a fully loaded control card, or options for slot A or slot B, each).

Although measurements are made with state of the art equipment, some measurement inaccuracy must be allowed for (±5%).

5) The three values for the max. cable cross section are for single core, flexible wire and flexible wire with sleeve, respectively.

8-2 BAS-SVX60A-EN



8.1.3 Mains Supply 3x525-600 V AC

	P18K	P22K	P30K
Compressor model	VZH088	VZH117	VZH170
Typical Shaft Output [HP/kW]	30/22	40/30	50/37
Enclosure IP21, IP55, IP66	B2	B2	-
Enclosure IP20	B4	B4	B4
Output current			
Continuous	26	42	F.4
(3 x 525-550 V) [A]	36	43	54
Intermittent	40	47	59
(3 x 525-550 V) [A]	40	47	29
Continuous	34	41	52
(3 x 525-600 V) [A]	34	41	32
Intermittent	37	45	57
(3 x 525-600 V) [A]	37	45	37
Continuous kVA (550 V AC) [kVA]	34.3	41.0	49
Continuous kVA (575 V AC) [kVA]	33.9	40.8	47
Max. input current			
Continuous	32.7	39	49
at 550 V [A]	32.7	39	49
Intermittent	36	43	54
at 550 V [A]	30	75	34
Continuous	31	37	47
at 575 V [A]	31	37	47
Intermittent	34	41	52
at 575 V [A]	54	T1	
Additional specifications			
IP21, IP55, IP66 max. cable cross-section ⁵⁾ (mains, brake, load sharing)	35,-,-(2,-,-)	35,-,-(2,-,-)	50,-,- (1,-,-)
[mm ² (AWG)] ²⁾			
IP21, IP55, IP66 max. cable cross-section ⁵⁾ (motor) [mm ² (AWG)] ²⁾	35, 25, 25 (2, 4, 4)	35, 25, 25 (2, 4, 4)	35,25, 25 (2,4,4)
IP20 max. cable cross-section ⁵⁾ (mains, brake, motor and load sharing)	35,-,-(2,-,-)	35,-,-(2,-,-)	35,-,- (2,-,-)
Estimated power loss	329	700	700
at rated max. load [W] 4)			
Weight, enclosure IP21, IP55, IP66 [kg]	27	27	59/27
Weight, enclosure IP20 [kg]	23.5	23.5	51.8/23.5
Efficiency ⁴⁾	0.98	0.98	0.98

Table 8.3 Mains Supply 3x525-600 V AC

BAS-SVX60A-EN 8-3



8.2 General Technical Data

Mains Supply (L1, L2, L3) Supply voltage	200-240 V ±10%
Supply voltage	380-480 V ±10%
Supply voltage	525-600 V ±10%
Supply frequency	50/60 Hz
Max. imbalance temporary between mains phases	3.0 % of rated supply voltage
True Power Factor (λ)	≥ 0.9 nominal at rated load
Displacement Power Factor (cos φ) near unity	(> 0.98)
Switching on input supply L1, L2, L3 (power-ups) ≤ 7.5 kW	Max. 2 times/min
Switching on input supply L1, L2, L3 (power-ups) ≥ 11 kW	Max. 1 time/min.
Environment according to EN60664-1	Overvoltage category III/pollution degree 2
The unit is suitable for use on a circuit capable of delivering not more than V maximum	100.000 RMS symmetrical Amperes, 240/500/600
Motor Compressor Output (U, V, W)	
Output voltage	0-100% of supply voltage
Switching on output	See 14-01 Switching Frequency
Cable lengths and cross sections	
Max. motor cable length, screened/armored	150 m
Max. motor cable length, unscreened/unarmored	300 m
Max. cross section to motor, mains, load sharing and brake *	
Maximum cross section to control terminals, rigid wire	1.5 mm ² /16 AWG (2 x 0.75 mm ²)
Maximum cross section to control terminals, flexible cable	1 mm ² /18 AWG
Maximum cross section to control terminals, cable with enclosed core	0.5 mm²/20 AWG
Minimum cross section to control terminals	0.25 mm ²
* See Table 8.1, Table 8.2 and Table 8.3 for more information!	
Digital Inputs	
Voltage level	0 - 24 V DC
Voltage level, logic.0. PNP	< 5 V DC
Voltage level, logic.1. PNP	> 10 V DC
Voltage level, logic .0. NPN2)	> 19 V DC
Voltage level, logic .1. NPN2)	< 14 V DC
Maximum voltage on input	28 V DC
Input resistance, Ri	approx. 4 kΩ
Safe Stop Terminal 37	
Voltage level	0 - 24 V DC
Voltage level, logic.0. PNP	< 4 V DC
Voltage level, logic.1. PNP	>20 V DC
Nominal input current at 24 V	50 mA _{rms}
Nominal input current at 20 V	60 mA _{rms}
Input capacitance	400 nF

Terminal 37 is fixed PNP logic

8-4 BAS-SVX60A-EN

General Specifications

Operating Instructions TRV200

All digital inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

- 1. Terminals 27 and 29 can also be programmed as output.
- 2. Except safe stop input Terminal 37.
- 3. Terminal 37 can only be used as safe stop input.

Terminal 37 is suitable for category 3 installations according to EN 954-1 (safe stop according to category 0 EN 60204-1) as required by the EU Machinery Directive 98/37/EC. Terminal 37 and the Safe Stop function are designed in conformance with EN 60204-1, EN 50178, EN 61800-2, EN 61800-3, and EN 954-1. For correct and safe use of the Safe Stop function follow the related information and instructions in the Application Guidelines.

|--|

Number of analog inputs	2
Terminal number	53, 54
Modes	Voltage or current
Mode select	Switch S201 and switch S202
Voltage mode	Switch S201/switch S202 = OFF (U)
Voltage level	-10 to +10 V (scaleable)
Input resistance, Ri: approx	10 kΩ
Max. voltage	± 20 V
Current mode	Switch S201/switch S202 = ON (I)
Current level	0/4 to 20 mA (scaleable)
Input resistance, Ri	approx. 200 Ω
Max. current	30 mA
Resolution for analog inputs	10 bit (+ sign)
Accuracy of analog inputs	Max. error 0.5% of full scale
Bandwidth	100 Hz

The analog inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Digital Output

Programmable digital/pulse outputs	2
Terminal number	27, 29 ¹⁾
Voltage level at digital/frequency output	0-24 V
Max. output current (sink or source)	40 mA
Max. load at frequency output	1 kΩ
Max. capacitive load at frequency output	10 nF
Minimum output frequency at frequency output	0 Hz
Maximum output frequency at frequency output	32 kHz
Accuracy of frequency output	Max. error: 0.1 % of full scale
Resolution of frequency outputs	12 bit

¹⁾ Terminal 27 and 29 can also be programmed as input. The digital output is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Analog Output

Number of programmable analog outputs	1
Terminal number	42
Current range at analog output	0/4 to 20 mA
Max. load to common at analog output	500 Ω
Accuracy on analog output	Max. error: 0.5 % of full scale
Resolution on analog output	12 bit

The analog output is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals



General Specifications

Operating Instructions TRV200

Control Card, 24 V DC Output

Terminal number	12, 13
Max. load	200 mA

The 24 V DC supply is galvanically isolated from the supply voltage (PELV), but has the same potential as the analog and digital inputs and outputs.

Control Card, 10 V DC Output

Terminal number	50
Output voltage	10.5 V ± 0.5 V
Max. load	15 mA

The 10 V DC supply is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals

Control Card, RS-485 Serial Communication

Terminal number	68 (P,TX+, RX+), 69 (N,TX-, RX-)
Terminal number 61	Common for terminals 68 and 69

The RS-485 serial communication circuit is functionally separated from other central circuits and galvanically isolated from the supplier voltage (PELV).

Control Card, USB Serial Communication

USB standard	1.1 (Full speed)
USB plug	USB type B device plug

Connection to PC is carried out via a standard host/device USB cable.

The USB connection is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals. The USB ground connection is not galvanically isolated from protection ground. Use only isolated laptop as PC connection to the USB connector on the frequency converter drive

Relay Outputs

Programmable relay outputs	2
Relay 01 Terminal number	1-3 (break),1-2 (make)
Max. terminal load (AC-1)1) on 1-3 (NC), 1-2 (NO) (Resistive load)	240 V AC, 2 A
Max. terminal load (AC-15)1) (Inductive load @ cosφ 0.4)	240 V AC, 0.2 A
Max. terminal load (DC-1)1) on 1-2 (NO), 1-3 (NC) (Resistive load)	60 V DC, 1 A
Max. terminal load (DC-13)1) (Inductive load)	24 V DC, 0.1 A
Relay 02 (only) Terminal number	4-6 (break), 4-5 (make)
Max. terminal load (AC-1)1) on 4-5 (NO) (Resistive load)	400 V AC, 2 A
Max. terminal load (AC-15)1) on 4-5 (NO) (Inductive load @ cosφ 0.4)	240 V AC, 0.2 A
Max. terminal load (DC-1)1) on 4-5 (NO) (Resistive load)	80 V DC, 2 A

8-6 BAS-SVX60A-EN



General Specifications Operating Instructions TRV200

EMC standards, Emission	EN 61800-3, EN 61000-6-3/4, EN 55011, IEC 61800-3 EN 61800-3, EN 61000-6-1/2,
Derating for high altitude, see section on special of	conditions
Maximum altitude above sea level with derating	9842 ft/3000 m
Maximum altitude above sea level without derat	ting 3280 ft/1000 m
Temperature during storage/transport	-13 to 149 °F/-25 to +65/70 °C
Minimum ambient temperature at reduced perfo	ormance 14 °F/-10 °C
Minimum ambient temperature, see section	·
Ambient temperature Derating for high ambient temperature, see section	
Test method according to IEC 60068-2-43 H2S (1	0 days) Max. 122 °F/50 °C
Aggressive environment (IEC 721-3-3), coated	class 3C3
Aggressive environment (IEC 721-3-3), uncoated	
Max. relative humidity	5% - 95% (IEC 721-3-3; Class 3K3 (non-condensing) during operation
Vibration test	1.0 g
Enclosure kit available ≤ enclosure type A	IP21/TYPE 1/IP 4X top
Enclosure ≥ enclosure type A, B	IP21, IP55
Enclosure ≤ enclosure type A	IP20, IP55

BAS-SVX60A-EN 8-7



8-8 BAS-SVX60A-EN







Index

Λ	ETR
A Access To Control Terminals2-9	
Accessory Bag	F
	FC
Adjustable Warnings, 4-5*	Port Di
Alarm Messages	Port Se
AMA	Feedback
Ambient Temperature And Altitude2-1	Fieldbus
Analog Input 5-28, 6-7	Fuses
Inputs	
Outputs	G
Signal	General Setting Status,
B Branch Circuit Protection2-16	Graphica
	Ground L
Bus Jog, 8-9*	
	1
C	Input Ter
Cable Entry	Inputs Ar
Lengths And Cross Sections7-4	Intermed
Catch Up 5-20	intermed
Communication Option6-10	K
Comparators, 13-1* 5-44	r\ Keypad
Configuration	Knockou
Control	KIIOCKOU
Cables2-12, 2-13, 2-11	
Card 5-57, 6-7, 5-58, 7-6	L LCP
Terminal	LCP LCP
Ctrl. Word Settings, 8-1*	Custon
_	Leakage
Current Rating 6-8	Local Ref
	Logic Rul
D	J
Data Readouts, 16-**	М
DC Link	Mains
Decoupling Plate2-8, 2-11	Conne
Default Settings 1-1, 4-3, 5-58, 2-10, 5-82	Conne
Diagnosis Read-Outs, 16-9*	Supply
Digital	Mechani Dimen
Input	Mount
Inputs	
Outputs 5-22	
Digital/Bus, 8-5* 5-39	
Drive Status, 16-3* 5-62	

E ETR 5-62
F FC Port Diagnostics, 8-8*
Feedback 6-11
Fieldbus & FC Port, 16-8* 5-65
Fuses 6-10, 2-16
G General Settings, 8-0*
Inputs And Outputs 5-64
Intermediate Circuit
K Keypad 1-2, 3-1, 4-2, 4-4, 5-5, 5-58, 5-70, 5-78, 5-81 Knockouts 2-4
LCP 4-1, 5-4, 5-7 Custom Readout, 0-3* 5-5
Leakage Current
Local Reference5-2
Logic Rules, 13-4*
Mains Connection For B1, B2 And B3



Operating Instructions TRV200

n		0	v
	u		

MOLOI	
Compressor Cable2-	
Compressor Connection2-	
Connection 1- Current 5-22, 5-80, 5-81, 6-11, 5-	
Data	
Limits, 4-1*5-1	
Overload Protection1-	
Power 6-1	
Status 5-6	
Thermal Protection	4
N Non-UL Fuses 200 V To 480 V2-1	7
0	
Operating Mode5-	.2
Output Current6-	.7
P	
Phase Loss 6-	7
Programming 6-	.7
R	
Ramp Up Time 5- 0	
Ref. & Feedb.	3
Relay Outputs 5-22, 7-	.6
Reset	
RS Flip Flops, 13-1*	
KS FIID FIODS, 13-1^	./
S	
Safe Stop	,
Torque Off1-	
Safety Instructions1-	
•	
Screened/armored	
Sequence Of Operation 0-	
Shielded/armoured2-11, 2-1	2
Short Circuit	
Speed Bypass, 4-6*	
States, 13-5*	
Stripping2-1	
Supply Voltage6-1	C
Surroundings	.7

T
TDU4-3
Terminal 54 6-13
Thermal Load 5-62
Timers, 13-2*
U UL Fuses, 200-240 V 2-17
V Voltage 6-7 Level 1-2, 7-4, 7-5
W
Warnings 6-1

Index Operating Instructions TRV200

BAS-SVX60A-EN 9-3



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For more information, contact your local Trane office or e-mail us at comfort@trane.com

Literature Order Number	BAS-SVX60A-EN	
Date	July 2013	
Supersedes		

Trane has a policy of continous product and product data improvement and reserves the right to change design and specifications without notice.

