SAMI MS

Frequency Converters
SAMI 018 MS2...SAMI 029 MS2
SAMI 018 MS4...SAMI 054 MS4

User's Manual

SNEU-01S EN
Code: 60007829 92.08

ABB Drives

CAJA 03
(OFICINA)

ABB
ASEA BROWN BOVERI

Electrical Safety

ONLY A COMPETENT ELECTRICIAN IS ALLOWED TO CARRY OUT THE ELECTRICAL INSTALLATION.

The frequency converter contains dangerous voltages when connected to the mains.

The equipment must always be earthed through an earthing conductor connected to the earthing terminal PE.

After disconnecting from the supply, wait at least 1 minute after the display texts have disappeared before taking any further action.

It is possible for dangerous voltages to remain at the terminals of the cards, even after the mains supply has been switched off. Check by measurements with a voltmeter from the DC-link, mains and relay output terminals that the frequency converter is safe before commencing any actions within the equipment!

If the SAMI MS is connected to a supply without a system earth, the earth fault protection of this system must be capable of withstanding earth leakage currents containing high frequency and DC components. The earth fault protection of the SAMI MS protects the frequency converter in earth fault situations occuring in the motor or the motor cable.

Fault current protective switches do not operate correctly with frequency converters. When using such switches their function should be confirmed with regard to the potential earth fault currents arising from fault situations.

Warning symbols

For your own safety please pay special attention to instructions given with these symbols.

Dangerous voltages

General warning

Contents

1 Delivery Checks

Checks

Check that the equipment does not show any signs of damage and that the delivery is complete.

Complaints

In the event of damage please contact the insurance company involved or the supplier.

NOTE! Do not destroy the export package!

If the delivery is not in compliance with the order, please contact the supplier immediately.

Warranty

The warranty covers defects in manufacture. The manufacturer carries no responsibility for damage occurring during transport or unpacking.

The warranty does not cover faults arising due to misuse or other inconvenience caused by such faults.

The period of warranty is 12 months from commissioning, however, not more than 18 months from the date of delivery.

2 How To Use This Manual

The information given in this manual is applicable only to SAMI MS frequency converters.

It is recommended that this manual should be read thoroughly before commencing any installation of the drive.

The warranty extended by ABB Drives does not cover faults arising from misuse of, or misapplication of this equipment.

Before commencing any work on the equipment please read chapter Electrical safety on page 1!

This manual is divided into chapters, as indicated in the index.

Chapter 4 gives a guide to the use of the SAMI MS Control panel, and Chapter 6 lists the parameters and related information for the SAMI MS. It is necessary to become familiar with the contents before running, or making any drive specific adjustments.

If any queries arise concerning the SAMI MS, please contact your Distributor or ABB Drives Local Office.

ABB reserves the right to make changes to the product without prior notice.

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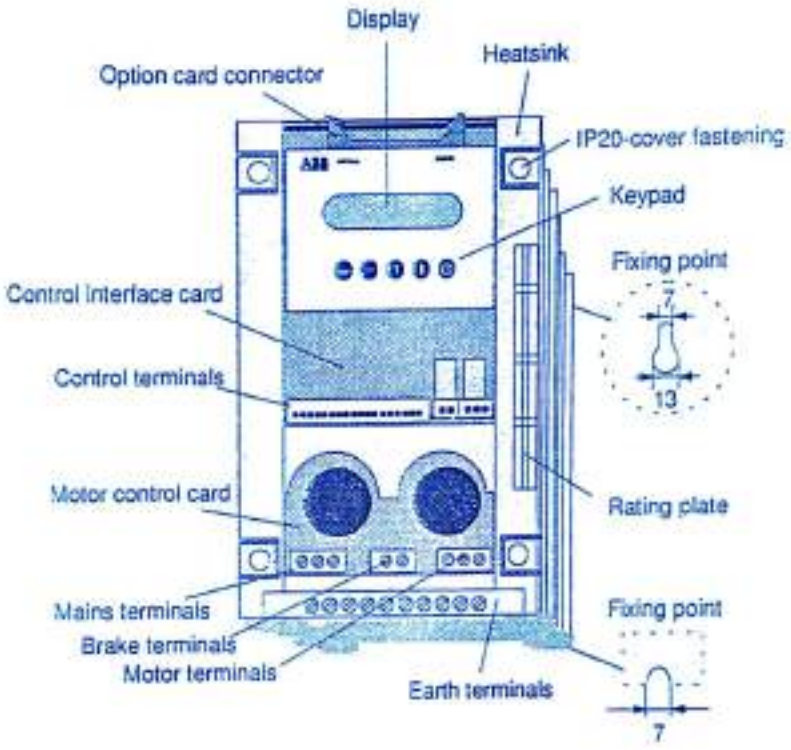
3 Installation

The essential parts of the SAMI MS are:



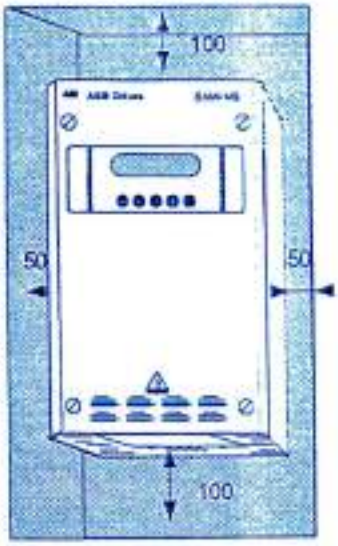
Installation Guide

Cooling of SAMI MS is based on natural ventilation.

To ensure adequate air flow, the unit has to be installed vertically, with free space surrounding it, as shown in the illustration beside.

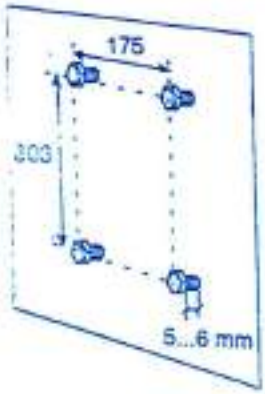
The cooling air must be as clean as possible, and free from corrosive matters. If the cooling air contains dust, the cooling surfaces must be cleaned regularly.

If the cooling capacity is impaired too much, the thermal protection of the SAMI MS will operate stopping the unit and causing a fault message. The SAMI MS can be started again when the temperature has fallen below the tripping level. The heatsink temperature can be read from the Measured values, see Chapter 6.



Assembly of SAMI MS

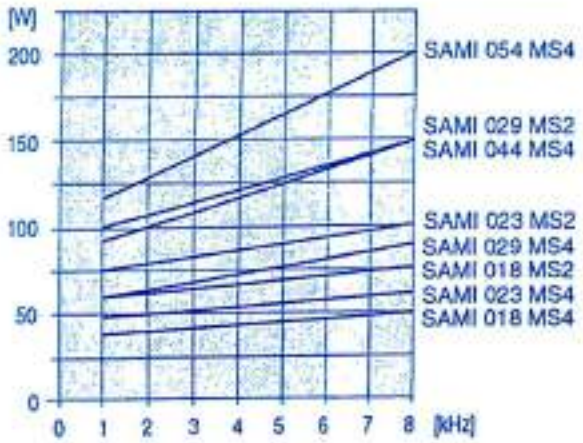
1) Attach four fixing screws on the wall.



2) Hang the SAMI on the wall and tighten the two lower screws.

Power dissipation

Power dissipation changes as a function of the switching frequency (group 5, par.8) according to the following diagram:



Cabling

Recommendation for the mains and motor cable dimensioning

SAMI type	Fuse [1] A	Mains cable [2] mm²	Motor cable [2] mm²
SAMI 018 MS2	10	2x1,5+1,5	3x1,5+1,5
SAMI 023 MS2	16	2x2,5+2,5	3x2,5+2,5
SAMI 029 MS2	16	2x2,5+2,5	3x2,5+2,5
SAMI 018 MS4	6	3x1,5+1,5	3x1,5+1,5
SAMI 023 MS4	6	3x1,5+1,5	3x1,5+1,5
SAMI 029 MS4	6	3x1,5+1,5	3x1,5+1,5
SAMI 044 MS4	10	3x1,5+1,5	3x1,5+1,5
SAMI 054 MS4	10	3x1,5+1,5	3x1,5+1,5

1) If a circuit braker is used for single phase units, it has to be of type "U" according to VDE0660 & IEC292-1, with high momentary tripping value.

2) The appropriate local wiring instructions must be followed.

NOTE! There are rapid changes of voltage in the motor cables, which can radiate interference to the environment. We strongly recommend the use of screened or armoured cables. The screening should be earthed ONLY at the SAMI MS earth terminal. The use of MICC cables is not recommended.

The SAMI MS has optional RFI filters SNAE 513 or SNAE 514, which reduce the conducted RFI levels caused by the SAMI on the mains supply to comply with the requirements of CISPR 14.

The rapid voltage changes cause capacitive current through the motor cable stray capacitances.
This current rises as the switching frequency (group 5, par. 8) increases, and the cable length increases.

This phenomenon can cause substantially higher current measured by the converter than the actual motor current, and can cause overcurrent tripping. This means that the lengths in the table should not be exceeded.

Switching frequency kHz	Screened cable m	Unscreened cable m
1	75	100
8	50	75

Recommendation for the control cable

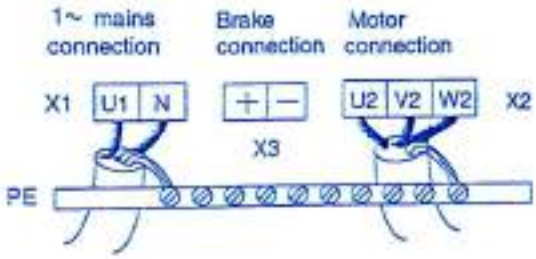
It is recommended that the control connections should be in screened multicore 0,5 or 0,75 mm² flexible cables.

NOTE! The cable screens should be earthed only at the frequency converter end.

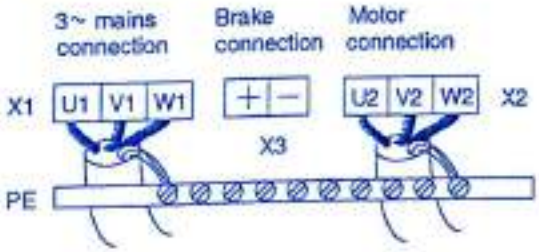
To avoid interference, the control cables should be run at least 0,5 m from the motor cables. With long cables (>20 m) the control signals may require the provision of galvanic isolation, such as Option card SNAT 520 OPT, which prevents interaction caused by variations in earth potentials.

Cable connections

Mains and motor cable connections to the single-phase SAMIs (MS2 series)



Mains and motor cable connections to the three-phase SAMIs (MS4 series)



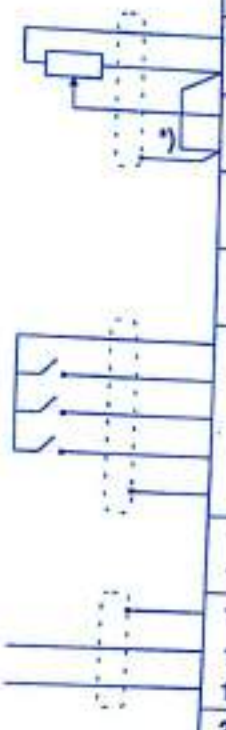
CAUTION! The brake control terminals (+ and -) carry a dangerous d.c.voltage (>500V). No other devices but SACE_BRV may be connected to the + and - terminals.

Control cable connections

SAMI MS can be controlled from several different places:

- From the Keypad
- From an external control device connected to the control terminals of the Control interface card
- From an external control device connected to the control terminals of an Option card
- From external control devices connected to the control terminals of both the Control interface card and the Option card (Local/Remote control)
- Through the serial link (terminals on the Control interface card)

The control connections of the Control interface card SNAT-535



X4	Function/Remarks	
1	Reference voltage +10 V pot.meter 1 kΩ ≤ R ≤ 10 kΩ	
2	GND (0 V)	
3	+ Reference input 0 ... 10 V/2 ... 10 V, input imped. 200 kΩ	
4	-	
5	+ Reference input 0 .. 20 mA/4 ... 20 mA, input imped. 250 Ω	
6	-	
7	+ Voltage 24 V DC ± 10 %, max. 200 mA	
8	-	
9	AUX voltage 24 V DC, 50 mA	
10	Start/Stop	
11	Reverse	
12	Constant speed (overrides reference input)	
13	GND (0 V)	
14	+ Analogue output 0 ... 20 mA/4 ... 20 mA, max. 500 Ω	
15	-	
16	Screen	
17	Signal B RS 485	
18	Signal A	
23	Relay output 1	Programmable See parameter group 3
24		
25	Relay output 2	
26		
27		

*) Linked only when the potentiometer is used.
Only one of the reference inputs can be used at a time.

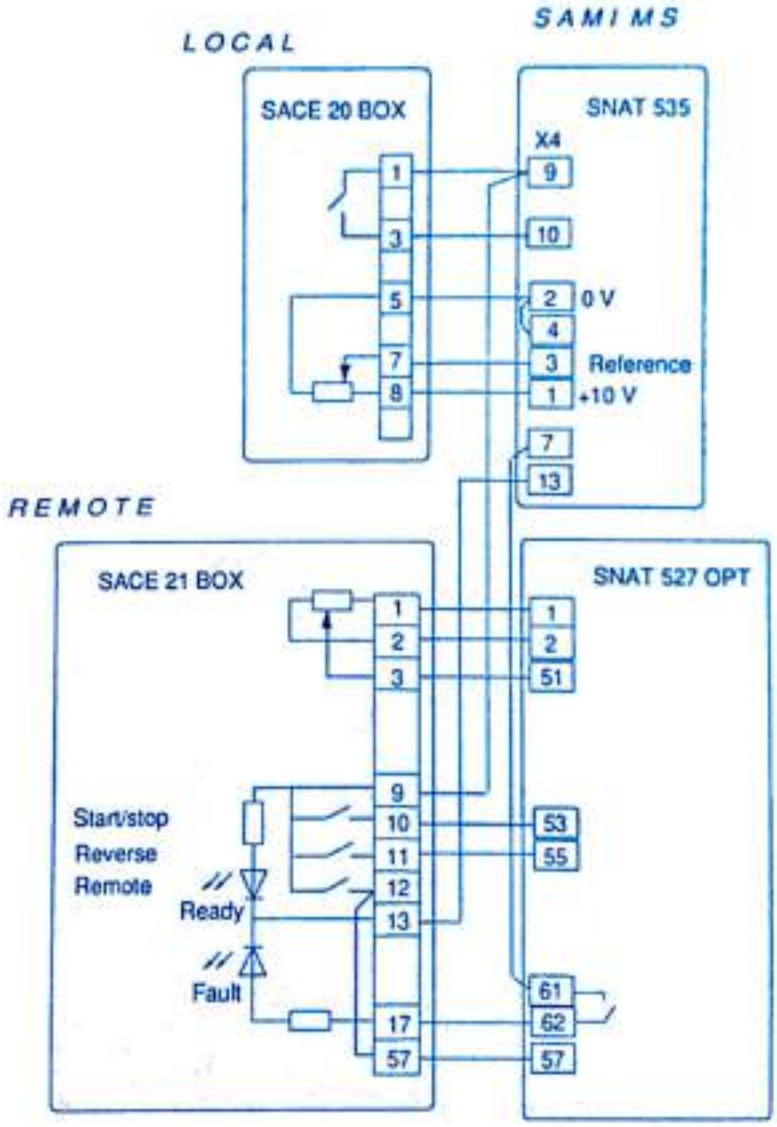
NOTE! Terminals 3-6 and 14-15 are NOT isolated from the earth potential.

Installation of the Option cards and their connections

One Option card (either SNAT 520 OPT or SNAT 527 OPT) can be installed in the slot provided in the heatsink of the SAMI MS, behind the Control interface card. Connections are made using a flat cable. The external connections of the cards are explained in more detail in the appropriate card instructions.

The installation and connections of other optional devices

The installation and connection guides of the other SAMI MS external option devices are given in the documentation of each device.



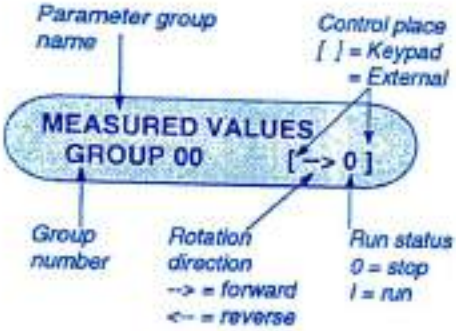
A connection example: Local/Remote control by using a remote control box SACE 20 BOX connected to the Control interface card and a remote control box SACE 21 BOX connected to the Option card.

4 SAMI MS Control Panel

The Control panel of the SAMI MS incorporates a 2 row 20 character LCD, with backlight and 5 pushbuttons.

The display is used to show drive parameter values, parameter settings, and fault messages. The different display modes to show information and the possible button controls in each case are as follows:

a) Group level display

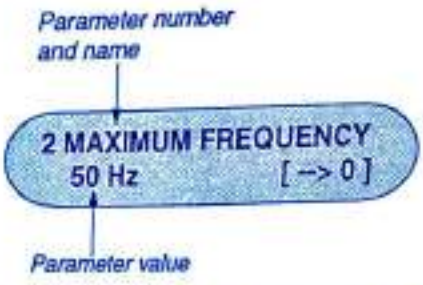


Select groups by the ↑ and ↓ buttons.

Indent to the parameter level by the → button.

Start/stop and direction of rotation information as above.

b) Parameter level display



Select the parameters inside the group by the ↑ and ↓ buttons.

Return to the group level by the → button.

Indent to the parameter setting mode by the MODE button.

Start/stop and direction of rotation information as in the group level.

c) Parameter setting mode display

Select the new parameter value by the ↑ and ↓ buttons.

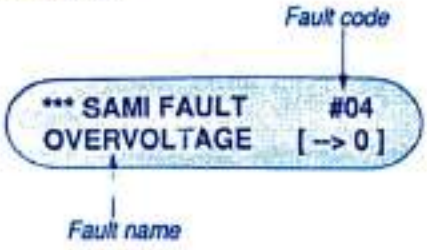
Save the new parameter value, and return to the parameter level using the MODE button.

If the parameter lock (group 11, par.1) is enabled, it is not possible to change parameter values. If this is attempted, the text * LOCKED* is displayed. This text disappears when returning to the parameter level.

Some parameters cannot be set with the SAMI MS running, in which case the text *RUNNING* is displayed. Also this text disappears when returning to the parameter level.

The SAMI MS will retain the new parameter values in its memory also after the mains disconnection.

d) Fault display

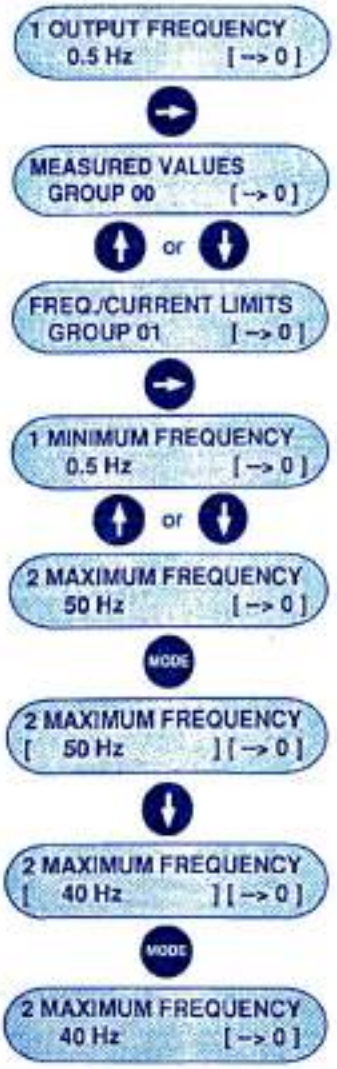


The fault can be reset either by using the panel Start/Stop button or by switching the external Start/Stop-command to Stop. It will also be reset on switching off the mains supply.

If more than one fault occurs, the fault messages can be scrolled by the arrow up/down buttons.

Example of control panel operation

Let us suppose that you want to set the Maximum frequency limit (group 1, par.2) to 40 Hz from the factory setting 50 Hz. The following example explains the procedure:



Indent to Group level

Select the required group

Indent to Parameter level

Select the required parameter

Change to setting mode

Brackets indicate that the parameter value can now be changed

Set the parameter value

Save the selected value to permanent memory

d) Fault display

The fault can be reset either by using the panel Start/Stop button or by switching the external Start/Stop-command to Stop. It will also be reset on switching off the mains supply.

If more than one fault occurs, the fault messages can be scrolled by the arrow up/down buttons.

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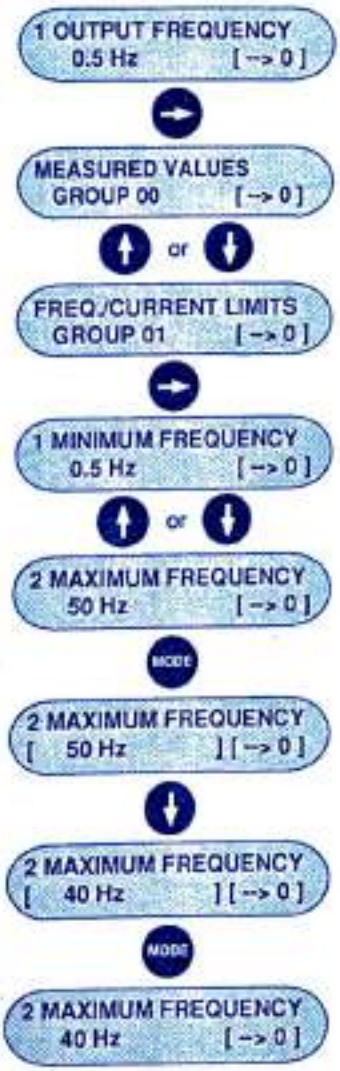


Indent to Group level

Select the required group

Indent to Parameter level

Select the required parameter

Change to setting mode

Brackets indicate that the parameter value can now be changed

Set the parameter value

Save the selected value to permanent memory

5 Start-Up

Before applying power to the SAMI MS, become familiar with the use of the Control panel (Chapter 4) and parameter settings (Chapter 6).

If at some stage of starting up a problem occurs, see Chapter 7, Fault Tracing.

Checks before switching on the mains

1) Check that the frame of SAMI is earthed and the earthing cable connected to the PE-terminal.
2) Check that the mains cable is connected to the correct terminals. (refer to chapter 3)
3) Check that the motor cable is connected to the correct terminals and that no short circuit or earth fault is present. (refer to chapter 3)

Install the IP-20 cover, or protective safety screens if it is part of the delivery.

Start-up by Keypad control after switching the mains on

Remember that the SAMI will now contain potentially lethal voltages, even if it is not started! Only the keypad pushbuttons should be touched!

The following text will appear on the display:

SET SUPPLY VOLTAGE
(MODE) [--> 0]

1) Set the MAINS VOLTAGE parameter as follows:
   - press MODE button --> par.1 of the group 10 appears, with no setting
   - press ↓ the button to find the correct parameter value and confirm by pressing MODE
2) Set the language (group 10, par. 2), factory setting is English.
3) Set the other parameters - for example:
   - Max. Frequency And Current Limits (group 1)
   - Start and Stop (group 4)
   - Motor Control (group 5)
4) Select parameter REFERENCE (group 0, par.2) and check that the value is 0.5 Hz.
5) Select parameter OUTPUT FREQUENCY (group 0, par.1) and start the SAMI MS, using the ⓘ button.
6) Check that OUTPUT FREQUENCY is 0.5 Hz, and that the motor is turning in the correct direction. If the motor is loaded too much to rotate, increase the REFERENCE, and if necessary use the IR-compensation function (group 4, par.1, Torque maximising).

When these checks have been completed, stop the SAMI and continue with Start-up by External control.

If no external controls are fitted, set Minimum Frequency only.

Start-up by External control (if fitted)

1) Set the control selection parameters to correspond with the connections (group 6, par.1 and group 7, par.1).
2) Set Minimum Frequency limits (group 1).
3) Start the SAMI MS from the external controls, and check that the SAMI follows the correct commands.

The SAMI MS is now ready for use.

6 SAMI MS Parameters

This chapter lists all the parameters of SAMI MS as they can be seen in the display.

The parameter number and name (e.g. 1 OUTPUT FREQUENCY) is given, below that the display or setting range and finally additional information, like the factory setting value. If the parameter can be set while SAMI is running, an asterisk (*) is marked to the right of it's name.

A complete table of parameters and their factory settings is presented on page 22.

Parameter group 00: MEASURED VALUES

1 OUTPUT FREQUENCY

0...120 Hz / 0...180 Hz / 0...400 Hz

The display range depends upon the selected frequency range (group 10, par.3). The resolution of the display is 0.1 Hz.

2 REFERENCE (*)

f_{min}...f_{max} [Hz] / 0...I_{max} [A]

Reference, that can be given by the Panel keypad, Control interface card terminals 3/4 or 5/6, or by the serial link.
Frequency/Current -selection: group 2, par. 2.
For f_{min}, f_{max} and I_{max}, see group 1, par. 1, 2 and 5.

3 MOTOR CURRENT

0...I_{max} [A]

Output current of the converter in Amps.
Accuracy ±10 %.

4 TORQUE

0...150%

Calculated relative (T/T_N) motor torque, 100% torque at nominal converter rating. Accuracy ±15 %.

5 POWER

0...150%

Calculated relative (P/P_N) motor power, 100% power at nominal converter rating. Accuracy ±15 %.

6 DC-VOLTAGE

0...150%

The relative (U/U_N) intermediate DC-link relative voltage). Accuracy ± 2 %.

NOTE! Accuracy is valid if $f_{out} \geq 20$ Hz and motor cable length ≤ 10 m.

7 SAMI TEMPERATURE

-10...+75°C

The temperature of the heatsink.

8 REFERENCE/OPTION

f_{min}...f_{max} [Hz]

The frequency reference from the optional control card.

9 / REF-REF/OPTION/

0...25 Hz

The absolute value of the difference between the frequency reference of the Control interface card and that of the optional control card.

Parameter group 01: FREQ./CURRENT LIMITS

1 MINIMUM FREQUENCY (*)

0.5...120 Hz / 0.5...180 Hz / 0.5...400 Hz

The frequency, at which the motor runs when the reference input is minimum (= f_{min}).

The setting range is dependent on the FREQUENCY RANGE (group 10, par.3).
Factory setting: 0.5 Hz

2 MAXIMUM FREQUENCY (*)

0.5...120 Hz / 0.5...180 Hz / 0.5...400 Hz

The frequency, at which the motor runs when the reference input is maximum (= f_{max}).

The setting range is dependent upon the FREQUENCY RANGE similarly to fmin.

It is possible to set f_{max} lower than f_{min}. In this case the motor will run slower as the reference signal is increased.

Factory setting: 50 Hz

3 ACCELERATION TIME (*)

0.3...255 s

Time required for the output frequency to increase 120 Hz. For example, if you want to accelerate from 10 to 50 Hz in 10 seconds, ACCELERATION TIME would be: (120 Hz · 10 s)/(50 Hz - 10 Hz) = 30 s.

Factory setting: 3 s

4 DECELERATION TIME (*)

0.3...255 s

Time required for the output frequency to decrease 120 Hz.

NOTE! The operation of SAMI's voltage and current limiting regulators can increase the acceleration and deceleration times if they are set very short.

Factory setting: 3 s

5 OUTPUT CURR. LIMIT (*)

50...150%-I_N [A]

The maximum output current of SAMI is set by this parameter. I_N is the nominal converter current listed in the catalogue (= I_{max}). Factory setting is 150%, which allows a momentary (1min in 10 mins) overload of 150% SAMI rated current. If motor rated current is lower than the SAMI I_N, this parameter should be reduced in accordance with the motor nameplate.

WARNING! Continuous application of higher currents than those for which the motor is rated can cause overheating, and premature failure.

6 CONSTANT SPEED (*)

0.5...255 Hz

Speed reference, which overrides all other references when external control is selected and corresponding terminal (12) signal is high.

Factory setting: 33 Hz

Parameter group 02: ANALOG INPUT/OUTPUT

1 REFERENSE MINIMUM

0 mA / 0 V or 4 mA / 2 V or

4 mA / 2 V sup.

Sets the reference minimum value on the Control interface card (terminals 3/4 or 5/6).

(sup. = SAMI stops, if the reference is below 3 mA/ 1.3V longer than 10 s time)

Factory setting: 0 mA / 0 V

2 REFERENCE CONTENT

FREQUENCY / CURRENT

The meaning of the reference input of the Control interface card. If CURRENT is selected, the correspondence is for example, 4 mA = 0 A and 20 mA = I_{max}.

NOTE! If CURRENT is selected, the critical frequencies (group 12) are ignored.

Factory setting: FREQUENCY.

3 ANALOG OUT MINIMUM (*)

0 mA or 4 mA

Minimum value of the analogue output of the Control interface card (terminals 14/15).

Factory setting: 0 mA

4 ANALOG OUT CONTENT (*)

NONE

OUTPUT FREQ.

REFERENCE

OUTPUT CURR.

TORQUE

POWER

REF/OPTION

REF - REF/OPT.

This parameter specifies to which Measured Value (group 0 parameter) the analogue output signal is comparable.

The minimum value of the measured signal corresponds to 0 or 4 mA and the maximum value corresponds to 20 mA, except the output frequency, the correspondence of which is specified by the next parameters (5 and 6).

Factory setting: OUTPUT FREQ.

5 A. OUT MIN FREQ. (*)

0...400 Hz

The output frequency corresponding to the minimum value (0/4 mA) of the analog output signal.

NOTE! The scaling specified by Parameters 5 and 6 is used for the analog output of the optional control card, too, if the content of it is output frequency.

Factory setting: 0 Hz.

6 A. OUT MAX FREQ. (*)

0...400 Hz

The output frequency corresponding to the maximum value (20 mA) of the analog output signal.

Factory setting: 50 Hz

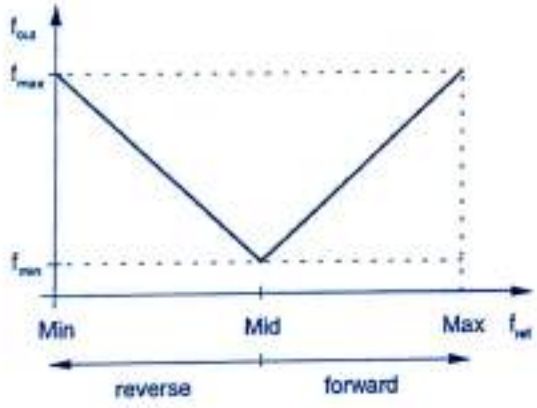
7 JOYSTICK CONTROL

YES / NO

When set to YES, the reference minimum value corresponds to $-f_{max}$, maximum value to $+f_{max}$, and middle value to $\pm f_{min}$ in output frequency.

Joystick control is possible only with an external reference. It is very useful in applications where a load is positioned by eye.

Factory setting: NO



8 OUTPUT/OPT MINIMUM (*)

0 mA or 4 mA

The minimum value of the analoque output of the optional control card.

Factory setting: 0 mA

9 OUTPUT/OPT CONTENT (*)

The same choices available as by parameter 4.

Factory setting: NONE

10 REFERENCE/OPT MIN

0 mA / 0 V

4 mA / 2 V

4 mA / 2 V sup.

The minimum value of the reference of the optional control card.

(sup. = SAMI stops, if the reference is below 3 mA/ 1.3V longer than 10 s time)

Factory setting: 0 mA / 0 V

Parameter group 03: RELAY FUNCTIONS

1 MOTOR CURR. LIMIT (*)

$(0...1.5)\cdot I_N$ [A]

The relay activates when motor current exceeds this limit. I_N=nominal converter current from catalogue.

Factory setting: $1.5\cdot I_N$

2 OUT FREQ. LIM FUNCT (*)

ABOVE

The relay activates when output frequency exceeds the limit specified by param. 3.

BELOW

The relay activates when output frequency goes below the limit.

Factory setting: BELOW

3 OUTPUT FREQ LIMIT (*)

0.5...255 Hz

Output frequency limit for relay activation (if FREQ.LIMIT is selected for relay function, see par.6).

Factory setting: 0.5 Hz

4 REF LIMIT FUNCTION (*)

ABOVE

The relay activates when reference exceeds the limit specified by par.5.

BELOW

The relay activates when reference goes below the limit.

Factory setting: BELOW

5 REFERENCE LIMIT (*)

0...255 Hz / 0...2.55·I_N [A]

Reference limit for relay activation (if REF.LIMIT is selected for relay function).

The setting range is dependent on the REFERENCE CONTENT (group 2, par.2).

Factory setting: 0 Hz

6 RELAY OUTPUT 1 (*)

NONE	(not in use)
CURR. LIMIT	(see param.1)
FREQ. LIMIT	(see param.2 and 3)
ANY FAULT	
REF. LIMIT	(see par. 4 and 5)
RUN	
READY	
MOTOR PROT.	(see group 5, par. 5 and 7)
SAMI HEAT	(group 0, par. 7 has exceeded 75°C)
LOCAL/REMOTE	(see group 7, par.1)
REVERSE SEL.	(terminal 11 is +24 V)
CONST. SPEED	(terminal 12 is +24 V)
INPUT <4 mA/ 2 V	(see group 2, par.1)
COMMS FAULT	(see group 9, par. 3)
REF <> OUTPUT	(reference - output freq. > 0.3 Hz)

This parameter specifies when the relay output 1 (terminals 23/24) is activated.

Factory setting: ANY FAULT

7 RELAY OUTPUT 2 (*)

The same choices as param. 6. This parameter specifies when the relay output 2 is activated.

Factory setting: RUN

8 RELAY OUTPUT 3/OPT (*)

The same choices as param. 6. Relay output of the optional control card.

Factory setting: NONE

9 RELAY OUTPUT 4/OPT (*)

The same choices as param. 6. Relay output of the optional control card.

Factory setting: MOTOR PROT.

Parameter group 04: START / STOP

1 START FUNCTION

NORMAL

The output frequency increases as specified by group 1, par.3.

TORQ. MAXIM.

Automatic start boost. Necessary in drives with high starting torque. Activates only by start and when the output frequency is below 20 Hz.

FLYING START

This should be selected if the motor is likely to be rotating before the start is initiated, or if the drive is required to ride through supply interruptions, without stopping.

Factory setting: NORMAL

2 STOP FUNCTION

COASTING

SAMI stops immediately by command and the motor coasts to a stop.

DECELERATING

Normal deceleration as set in group 1, par.4.

DC -BRAKE

DC injection braking stops the motor by applying a DC current to the stator windings. This is the fastest way to stop a drive without external brake components. See also par. 4, 5 and 6.

Factory setting: COASTING

3 EXT. BRAKE CHOPPER

YES / NO

Factory setting: NO (Extrenal braking chopper not in use)

4 DC-HOLDING

YES / NO

The motor shaft is locked by injecting a DC current into the stator. Operates only when reference and output frequency are below 1.5 Hz and SAMI is running.

WARNING! Use of DC injection braking on high inertia loads or DC holding brakes for long periods can cause excessive motor heating.

Factory setting: NO

5 DC-BRAKE VOLTAGE (*)

0...63 V

DC-voltage for injecting the brake current to motor.

Factory setting depends on the size of SAMI.

6 DC-BRAKE TIME (*)

1...127 s

The sum of the deceleration time and DC-holding time (par.4). This parameter is effective only when DC-BRAKE is selected (par. 2).

Factory setting: 2 s

7 AUTO RST. U<, Ul> (*)

YES / NO

If this parameter is YES, SAMI restarts automatically after undervoltage, overvoltage and overcurrent trips. If the same fault occurs again within 20 seconds, the fault requires manual reset.

Factory setting: NO

8 AUTO RST. U<, REF< (*)

YES / NO

If this parameter is Yes, SAMI restarts automatically after undervoltage and reference < 4 mA, 2 V trips.

Factory setting: YES

Parameter group 05: MOTOR CONTROL

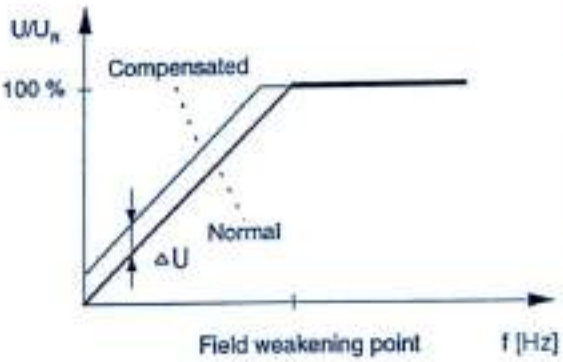
1 IR-COMPENSATION

0...100 %

This increases motor voltage below field weakening point. 100 % corresponds to 15...45 V depending on SAMI size.

WARNING ! Excessive IR compensation can lead to magnetic saturation, and overheating. Any application of this parameter should be undertaken with due care.

Factory setting: 0%



2 U/f-RATIO

LINEAR

Motor voltage is increased linearly from 0 Hz to the Field Weakening Point. This is the normal method of operation.

SQUARED

Motor voltage increases according to a square law from 0 Hz to Field Weakening Point. At low frequencies motor is undermagnetised to reduce noise, however current is increased.

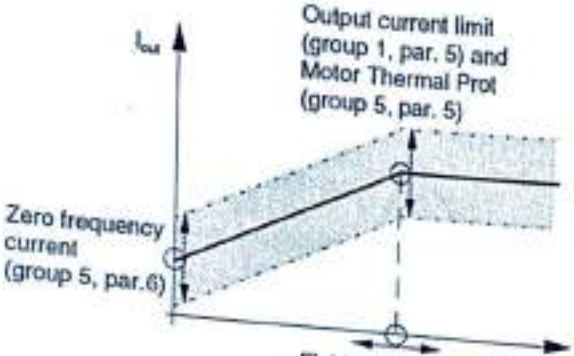
Factory setting: LINEAR

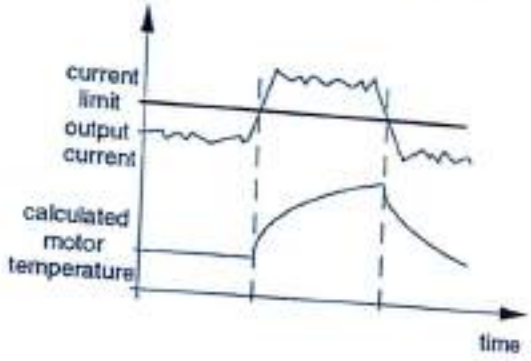
3 FIELD WEAKEN. POINT

30...500 Hz

Field Weakening Point is the frequency, where the output voltage reaches its nominal value.

Factory setting: 50 Hz





4 SLIP COMPENSATION

YES / NO

With this parameter set YES, the output frequency of the SAMI is increased slightly to allow for the effects of the motor slip, due to the load. The effect is reduced to about 20 % of the noncompensated value.

Factory setting: NO

5 MOTOR THERMAL PROT (*)

WARN. 0.67·I / STOP 0.67·I /

STOP 0.80·I / STOP 1.0·I

SAMI MS includes a thermal protection function of the motor. This protection is based on the calculated motor temperature. The calculated temperature increases when the output current exceeds the current limit curve specified by parameters 3, 5 and 6 of this group (see diagram), and decreases when the output current goes below the limit curve. By this parameter can be defined the value of the current limit curve at Field Weakening Point and the reaction of SAMI when the calculated motor temperature reaches the maximum value.

Factory setting: WARN 0.67·I, where I is set by group 1, par.5.

6 0-FREQ. CURRENT (*)

(0.1...0.73)·I_N [A]

Value of the current limit supervision curve at zero frequency. I_N =nominal converter current from catalogue.

Factory setting: 0.5·I_N

7 STALL PROTECTION

WARNING / FAULT

Stall protection is designed to protect the motor from overloading if the motor is running continuously below 25 Hz, the reference being higher than the output frequency, and the motor current being over 0.75·I_{max} (group 1, par.5). This function initiates if the condition is present for >20 s.

Factory setting: FAULT

8 SWITCHING FREQ.

1...8 kHz

Motor noise can be minimised by adjusting the switching frequency (= output current ripple frequency) to a value, that does not create resonances in the motor. The optimum switching frequency is the lowest frequency where the noise is acceptable. The increase of switching frequency increases the losses of the SAMI as shown in the curves on page 6.

Factory setting: 1 kHz

Parameter group 06: KEYPAD CONTROL

1 CONTROL PLACE (*)

KEYPAD

When the keypad is selected to the control place there are brackets around the direction of rotation and start/ stop information in the display.

EXTERNAL

The external control place is selected by the parameter 1 of group 7.

Factory setting: EXTERNAL

2 KEYPAD REFERENCE (*)

Frequency [Hz] / Current [A]

The reference of the keypad control. The setting range is dependent on the Reference Content (group 2, param.2).

Factory setting: 0.5 Hz

3 KEYPAD DIRECTION (*)

FORWARD / REVERSE

The direction reference of the keypad control. The selected direction is shown by the arrow in the display.

Factory setting: FORWARD

Parameter group 07: EXTERNAL CONTROL

1 EXTERNAL PLACE (*)

TERM. BLOCK

Control interface card input signals, terminal blocks 3...6 and 10...12

RS 485

Control interface card serial link port, terminal blocks 16...18

OPTION CARD

Terminal blocks of the optional control card

TERM + OPTION

Terminal blocks of both the Control interface card and the optional control card.

(Selection by means of the Local/Remote switch. Local selection is shown in the display by apostrophes: '--> O' and Remote by quotation marks: "--> O")

Factory setting: TERM. BLOCK

Parameter group 08: FAULT HISTORY

1 OLDEST FAULT

2 NEXT OLDEST FAULT

3 NEWEST FAULT

The three last faults are stored in the memory. These parameters cannot be set.

Parameter group 09: SERIAL COMMUNICATION

1 SAMI ID-NUMBER

1...32

Each SAMI connected to the serial communication link must have a unique identifying number to make communication possible with it.

Factory setting: 1

2 BIT RATE SELECT

1200...9600 BIT/s

All devices in the serial link must have the same bit rate for proper operation.

Factory setting: 9600 BIT/s

3 TIME-OUT SELECT (*)

0.5...80 s

SAMI interprets the serial link to be failed, if it has received no valid message within this period.

Factory setting: 80 s

4 COMMS FAULT FUNCT. (*)

NONE / STOP

This parameter specifies how SAMI reacts when time-out is noticed.

Factory setting: NONE (= not stopped)

Parameter group 10: SPECIAL CONTROL

1 MAINS VOLTAGE SET

-- (= not set)

220, 230, 240 V (single-phase)

380, 400, 415, 440 V (three-phase)

During commissioning this parameter must be set according to the mains voltage.

Factory setting: --

2 LANGUAGE (*)

SUOMI, SVENSKA, ENGLISH,

DEUTSCH, ITALIANO, FRANCAIS,

ESPANOL, NEDERLANDS

During commissioning this parameter can be set to the desired user dialog language.

Factory setting: ENGLISH

3 FREQUENCY RANGE

120 Hz / 180 Hz / 400 Hz

This setting determines the maximum frequency ranges in groups 0 and 1.

Factory setting: 120 Hz

4 MIN DEC/ACC TIME (*)

67 ms...1 s

The shortest time selection (0.3 s) in group 1, par. 3 and 4 can be adjusted by this parameter. Very short times can be achieved only if the motor plus load inertia is small compared to the SAMI.

Factory setting: 333 ms

5 FREQ. REF. SELECT

NORM. CONTROL / I,F-CONTROL

This parameter specifies the reference type. NORM. CONTROL is the normal frequency control. I,F-CONTROL is a combined current and frequency control, where REFERENCE is a current reference (see group 2, par.2) and REFERENCE / OPTION is a controllable max. frequency limit between f_{min}...f_{max}. Set also the external control place (group 7, par.1).

NOTE! The critical frequencies (group 12) are ignored if combined control mode is selected.

Factory setting: NORM. CONTROL

Parameter group 11: PARAMETER PROTECTION

1 PARAMETER LOCK (*)

YES / NO

The setting of the parameters can be inhibited by this parameter. When setting is tried, a text "LOCKED" appears in the display.

Factory setting: NO

2 FACTORY SETTINGS

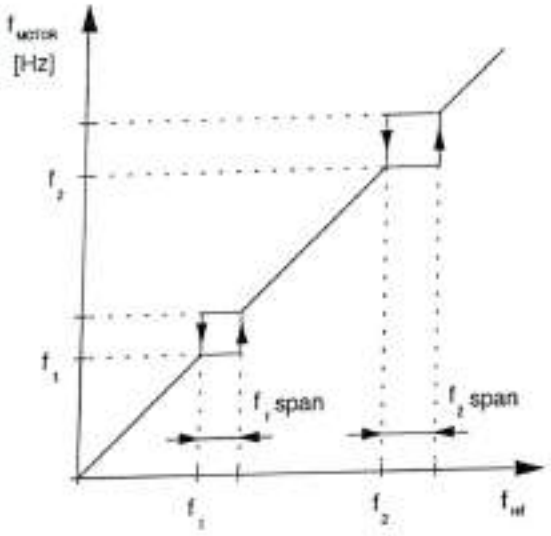
RESTORED / NOT RESTORED

When RESTORED is selected, the Factory setting values of the parameters come into force.

NOTE! Restoring resets all your own settings.

Factory setting: NOT RESTORED

Parameter group 12: CRITICAL FREQUENCIES



1 FREQUENCY 1 (*)

0...255 Hz (setting by 1 Hz steps)

In some systems it may be necessary to avoid certain speeds because of resonance problems. With this group it is possible to set two different frequency ranges that SAMI will skip over.

NOTE! The critical frequencies are ignored if current reference (see group 2, par.2) or combined control mode (see group 10, par.5) is selected.

Factory setting: 0 Hz

2 FREQUENCY 1 SPAN (*)

0...15 Hz (setting by 1 Hz steps)

Factory setting: 0 Hz

3 FREQUENCY 2 (*)

0...254 Hz (setting by 2 Hz steps)

Factory setting: 0 Hz

4 FREQUENCY 2 SPAN (*)

0...14 Hz (setting by 2 Hz steps)

Factory setting: 0 Hz

GROUP	PARAMETER	DEFAULT	CUSTOMER SETTING		
1 Freq./ Current Limits	1 Minimum Frequency	0.5 Hz			
	2 Maximum Frequency	50 Hz			
	3 Acceleration Time	3 s			
	4 Deceleration Time	3 s			
	5 Output Curr. Limit	150 %			
	6 Constant Speed	33 Hz			
2 Analog Input/Output	1 Reference Minimum	0 mA/0 V			
	2 Reference Content	Frequency			
	3 Analog Out Minimum	0 mA			
	4 Analog Out Content	Output Freq.			
	5 A. Out Min Freq.	0 Hz			
	6 A. Out Max Freq.	50 Hz			
	7 Joystick Control	No			
	8 Output/Opt Minimum	0 mA			
	9 Output/Opt Content	None			
	10 Reference/Opt Min	0 mA/0 V			
3 Relay Functions	1 Motor Curr. Limit	1.5 · I_N			
	2 Out Freq. Lim Funct	Below			
	3 Output Freq Limit	0.5 Hz			
	4 Ref Limit Function	Below			
	5 Reference Limit	0 Hz			
	6 Relay Output 1	Any Fault			
	7 Relay Output 2	Run			
	8 Relay Output 3/Opt	None			
	9 Relay Output 4/Opt	Motor Prot.			
4 Start /Stop	1 Start Function	Normal			
	2 Stop Function	Coasting			
	3 Ext. Brake Chopper	No			
	4 DC-Holding	No			
	5 DC-Brake Voltage	*), see p. 17			
	6 DC-Brake Time	2 s			
	7 Auto RST. U<, Ul>	No			
	8 Auto RST. U<, Ref<	Yes			
5 Motor Control	1 IR-Compensation	0 %			
	2 U/f Ratio	Linear			
	3 Field Weaken. Point	50 Hz			
	4 Slip Compensation	No			
	5 Motor Thermal Prot	Warn 0.67 - I			
	6 0-Freq. Current	0.5 · I_N			
	7 Stall Protection	Fault			
	8 Switching Freq.	1 kHz			
6 Keypad Control	1 Control Place	External			
	2 Keypad Reference	0.5 Hz			
	3 Keypad Direction	Forward			
7 External Control	1 External Place	Term. block			
9 Serial Communication	1 SAMI ID-Number	1			
	2 BIT Rate Select	9600 BIT/s			
	3 Time-Out Select	80 s			
	4 Comms Fault Funct.	None			
10 Special Controls	1 Mains Voltage Set	- -			
	2 Language	English			
	3 Frequency Range	120 Hz			
	4 Min Dec/Acc Time	333 ms			
	5 Freq. Ref. Select	Norm. control			
11 Parameter Protection	1 Parameter Lock	No			
	2 Factory Settings	Not restored			
12 Critical Frequencies	1 Frequency 1	0 Hz			
	2 Frequency 1 Span	0 Hz			
	3 Frequency 2	0 Hz			
	4 Frequency 2 Span	0 Hz			

7 Fault Tracing

SAMI MS is equipped with a versatile system to protect against external faults, and also has advanced self diagnostic functions.

Any fault that is detected is displayed in clear text, with a message *** SAMI FAULT #(No.) or * SAMI WARNING #(No.) in the control panel display. The number (No.) refers to the corresponding fault message number in the table, see next page. The fault message is stored in the FAULT HISTORY parameters (group 8).

A fault always causes the SAMI to stop. This chapter gives guidelines to help determine the correct action on receiving a fault message.

A warning does not stop SAMI, it is only a message that something should be done to avoid a critical situation. The warning text disappears when any keypad button is pressed, but appears again if the buttons have been untouched for 1 minute and the warning situation still lasts.

When you work with SAMI remember always electrical safety

- only a competent electrician is allowed to make the measurements
- switch off the mains voltages and wait at least 1 minute after the display text disappears before you start to work in the equipment, e.g. when changing cards
- ensure by measuring that there are no dangerous voltages existing in the control terminals

Fault tracing with a fault display

Refer to table on page 24.

Fault tracing when the display is dark:

1) Check that the mains voltage is present at input terminals.

Disconnect from the supply and proceed

2) Check that interconnecting cables between the Control interface card, Motor control card and option cards (if fitted) are correctly fitted, and retry with power connected.

Disconnect from the supply and proceed

3) Change the Control interface card SNAT-535, and retry with power connected.

If these actions are unsuccessful, contact your supplier.

Fault tracing in other problem situations

SAMI does not follow the commands given from an external control device

- Ensure that panel control is not selected (no brackets in the display)
- Ensure that the right external control place is selected (group 7, par.1)
- Ensure that the wiring between SAMI and the external control device is OK

SAMI does not follow the commands given from the serial link master (f.ex. PCMS)

- Ensure that SAMI has it's individual identification number (group 9, par.1)
- Ensure that the BIT RATE (group 9, par.2) is the same as that of the serial link master device.

Fault tracing with a fault display

The table shows the displayed fault text, the probable reason for its display and advice for repairing the fault. The advice is given in order of priority. The fault can be reset either by pressing the keypad Start/Stop button, switching the external Start/Stop-command to stop, or switching the mains voltage off for a while. If the fault stays in spite of resetting and following the advice, follow the next piece of advice. If all the advice is ineffective, contact the nearest SAMI service.

Fault message	Possible reason	Advice
PRESS 2 BUTTONS (this message can appear only when switching on the mains voltage)	The Control interface card has been changed and it has a incorrect knowledge of the size of the Motor control card.	Press two arbitrary buttons simultaneously. Ensure that the motor or motor cable is not short-circuited.
1 OVERCURRENT	Motor or motor cable shortcircuited. Motor stalled rapidly. (Motor current over 2,16 · I_N)	Ensure that the motor is not stalled.
2 OVERCURR./GEN	Overcurrent by decelerating.	Increase the DECEL.TIME (group 1, par.4)
3 EARTH FAULT	Earth fault in the motor circuit.	Check the insulation of the motor and cabling. **NOTE!** During the insulation measurement the motor cable must be disconnected from SAMI.
4 OVERVOLTAGE	Overvoltage in the DC-link. (DC-voltage over 1,3 · U_N)	If this fault appeared during braking, increase the DECELERATION TIME (group 1, par.4). Install the brake unit SACE_BRV and the resistor unit SACE_RE to the drive.
5 TEMPERATURE	SAMIs heatsink warmed up too much (over +75°C) or it is too cold (below - 10°C). This can be checked immediately after the trip: see group 0, par.7.	Ensure that the cooling air of SAMI can flow freely (see installation guide, page 5) and that it is not too warm or cold. Ensure that the heatsink is not dirty. Decrease SWITCHING FREQUENCY (group5, par.8). Decrease OUTPUT CURRENT LIMIT (group 1,par.5).
6 LOW VOLTAGE	DC-link voltage decreased too much (below 0,5 · U_N). Component fault in SAMI.	Ensure that the supply voltage setting (group 10 par.1) corresponds to the real mains voltage.
8 MOTOR STALL	SAMI output frequency cannot increase over 25 Hz because its current increases to the limit. This situation has lasted over 20 s.	Ensure that the motor is not too small for the drive. Set the OUTPUT CURR.LIMIT higher (group 1, par.5).
9 MOTOR OVERHEAT	Calculated motor temperature is too high.	Ensure that the motor cooling is OK. If OK, check the setting of MOTOR THERMAL PROTECTION (group 5, par.5 and 6).
11 INPUT < 4mA, 2V	Reference is below the set limit. (3 mA or 1,3 V more than 10 s).	Ensure that the reference wiring is OK. Check the network master is OK.

13 24 V VOLTAGE	24 V aux. voltage has decreased below 20 V.	Ensure that the auxiliary circuits using the 24 V aux. voltage are not in short-circuit. Change the control interface card.
14 A/D-CONVERSION	A fault in the A/D-conversion of the Control interface card.	Reset. If the fault comes again, change the control interface card.
35-TIMEOUT	SAMI has not received a valid message from the serial link master.	Check that the equipments connected to the serial communication link are OK. Set the TIME-OUT longer (group 9, par.3)
17 WATCHDOG/IC	A hardware fault in the motor control card.	Reset. If the fault reappears, contact the nearest SAMI service.
18 SERIAL COM./IC	A fault in the communication between control interface and Motor control cards.	Check the cable in connector X2. If the fault reappears, contact the nearest SAMI service.
PROGRAM ERR/IC	A program error in the motor control card.	Reset. If the fault reappears, contact the nearest SAMI service.
21 WATCHDOG/PC	A hardware fault in the control interface card.	Reset. If the fault reappears, change the control interface card.
22 SERIAL COM./PC	A fault in the communication between control interface and motor control cards.	Check the cable in connector X2. If the fault reappears, contact the nearest SAMI service.
23 RUN/STOP-DIFF	Run/stop command different in the control interface and motor control cards.	Check the cable in connector X2. Change the control interface card.
24 PROGRAM ERR/PC	A program error in the control interface card.	Reset. If the fault reappears, change the control interface card.
26 IDENTIFIC./OC	The identifying code of the option card is wrong.	Reset. If the fault reappears, change the option card. Change the control interface card.
31 PARAM.MEMORY	Fault in the NVRAM-memory.	Reset. If the fault reappears, change the control interface card. **NOTE!** By the reset of this fault the default parameter values are restored.

NOTE!

IC = Motor Control card (inverter card)

PC = Control Interface card (panel card)

OC = Option card

8 Service

SAMI MS has very few parts which can be changed by a customer or by local service. Below is a list of the parts, which can be succesfully replaced by unauthorized people:

SNAT-535,	Control interface card
SNAT 520 OPT,	Local/Remote control card (galvanic isolation)
SNAT 527 OPT,	Local/Remote control card
SNAE-522,	IP20 plastic cover

NOTE! Motor control card and all the components fitted on it can be replaced only at the factory. Replacement of this card needs a special tool to fit fastening springs of IGBT-transistors.

Before calling service check and record the following information:

- Type designation of the unit
- Serial number of the unit
- Commissioning date
- Motor data
- Voltage setting and value of the mains voltage
- Parameter setting values, if different from the factory settings
- Values of the Measured values, group 0
- Fault messages in the Fault history, group 8
- All noticeable symptoms in the function of the unit

9 Technical Data

Type SAMI 0_ _MS_ - _M_

Voltage (V)	SAMI MS Type	Nominal current I_N (A)	Nominal power P_N (kW)
220, 230, 240 1 phase	SAMI018MS2	4.3	0.75
	SAMI023MS2	5.5	1.1
	SAMI029MS2	7.1	1.5
380, 400, 415, 440 3 phase	SAMI018MS4	2.5	0.75
	SAMI023MS4	3.2	1.1
	SAMI029MS4	4.1	1.5
	SAMI044MS4	6.2	2.2
	SAMI054MS4	7.5	3.0

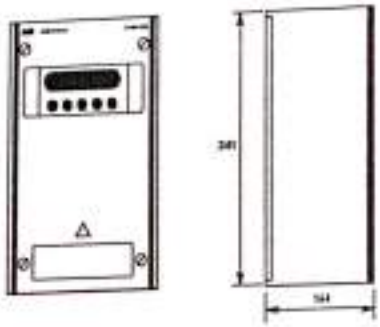
Enclosure

Enclosure classes: IP 00 and IP 20

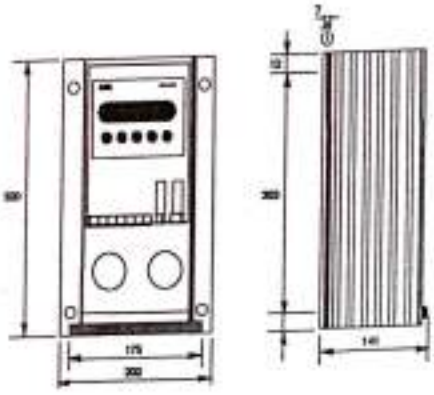
Weight: approx. 5 kg

Paint colour: light beige NCS 1704-Y15R

IP20



IP00



Mains connection

Voltage: 1 phase, 220 V, 230 V and 240 V ± 10 % permitted tolerance, 3 phase, 380 V, 400 V, 415 V and 440 V ± 10 % permitted tolerance

Frequency: 48 to 63 Hz

Fundamental power factor: approximately 0.98

Motor connection

Voltage: 3 phase, 0 ... U_{mains}

Frequency: 0.5 to 120 Hz, max. 400 Hz programmable

Switching frequency: 1 to 8 kHz, adjustable by 1 kHz steps

Continuous load capacity: SAMI's rated current

Overload capacity: 1.5 · SAMI's rated current, allowed for 1 minute every 10 minutes

Field weakening point: 30 to 500 Hz, adjustable

Control connections

(galvanically isolated from the incoming supply voltage)

Analogue inputs: Current signal: 0(4) to 20 mA, R_i=250 Ω

Voltage signal: 0(2) to 10 V, R_i≈200 kΩ

Potentiometer: 1 kohm ≤ R ≤ 10 kΩ

Auxiliary voltage output +24 V:
Maximum load 200 mA

Digital inputs: start/stop control, reversing, constant speed control

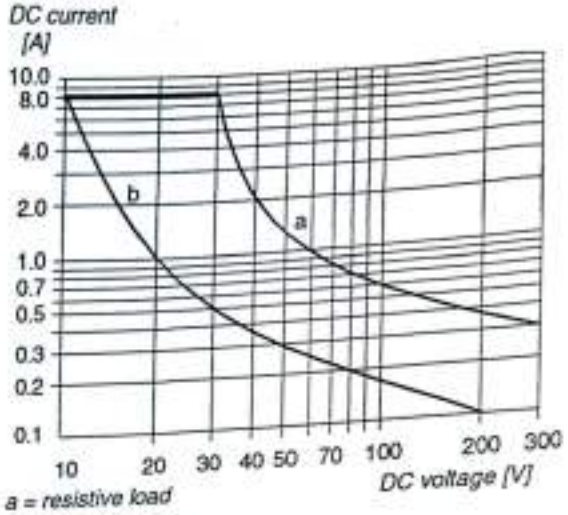
Analogue output: Current signal: 0(4) to 20 mA, R_L ≤ 500 Ω

Serial communication:
RS 485, bit rate 1200 to 9600 bps

Relay outputs: Maximum switching voltages: 300 V d.c. and 250 V a.c.

Maximum switching currents:
d.c. current, see diagram
a.c. current, 8 A

Maximum continuous load current: 8 A



a = resistive load
b = inductive load

Standards and tests

Immunity to interference:

- SS 4361503 PL4, IEC 801 and SS 4361522 for power and control connections

High voltage tests:

- test voltage between main circuit and frame 2.5 kV, 50 Hz, for 1 minute
- maximum voltage between relay outputs and control circuits 4 kV

Environmental limits

Ambient temperature: 0 to +40 °C at SAMI's rated current. At temperatures above +40 °C, the current limit must be lowered by 3.3 %/ °C.
Maximum temperature is +50 °C

Storage temperature: -40 to +70 °C

Cooling: natural air circulation

Relative humidity: max. 95 %, no condensation allowed

Vibration level: ≤ 0.5 g, (between 5 - 55 Hz)

Altitude: ≤ 1000 m ASL (100 % load capacity), > 1000 m ASL at reduced load capacity (see figure)