Instruction Manual Power Distribution System

SVS16-MB-XX

Contents

1 General

The power distribution system SVS16-MB-XX offers selective overcurrent protection, power distribution of load circuits as well as connecting and resetting of outputs.

The system is fitted with a fully-fledged Modbus-TCP interface to ensure a consistent communication of status and failure conditions as well as switching / resetting of individual circuits on the DC 24 V level.

The system has been designed for rail mounting and has 8 (SVS16-MB-08) or 16 (SVS16-MB-16) slots.

The slots can optionally accommodate electronic circuit protectors type ESX10-(S)125 (with reset input and status output), ESX10-(S)115 (with control input and status output) or with the SSRPC E-1048-S7xx (with control input and status output).

1.1. General mounting guidelines

- The power distribution system must only be installed by qualified personnel.
- Only after expert installation must the device be supplied with power.
- It is only intended for use with safety extra-low voltage (=24V DC).
- Connection to a higher or not reliably disconnected voltage can cause hazardous conditions or damages.
- The max. total current of the power distribution system must not be exceeded
- In each load branch the cable cross section and the current rating of the protective component must be adjusted to the current rating of the connected load.
- The technical data of the used circuit protectors have to be observed.
- The „Machinery Directive 2006/42/EC and EN 60204-1, Safety of Machines“ requests special precautions to be taken in the system or machine (e.g. using a safety PLC) to prevent inadvertent start-up of the system or parts of the system. In the event of a failure (short circuit/overload) the load circuit will be disconnected by the circuit breaker/protector. After tripping of the circuit protector, before reset, the cause of tripping (short circuit or overload) has to be remedied.
- The national standards (e.g. for Germany DIN VDE 0100) and selection of appropriate ingoing and outgoing cables have to be observed.

Caution:

Electrostatically sensitive devices (ESD).
Devices must exclusively be opened by the manufacturer.

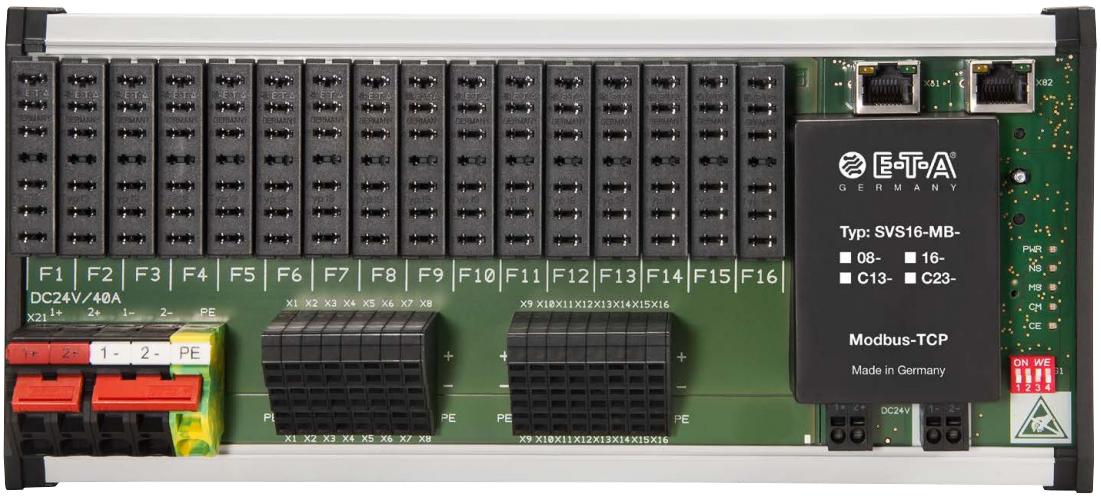
Disposal guidelines

Packaging can be recycles and should generally be brought to re-use.

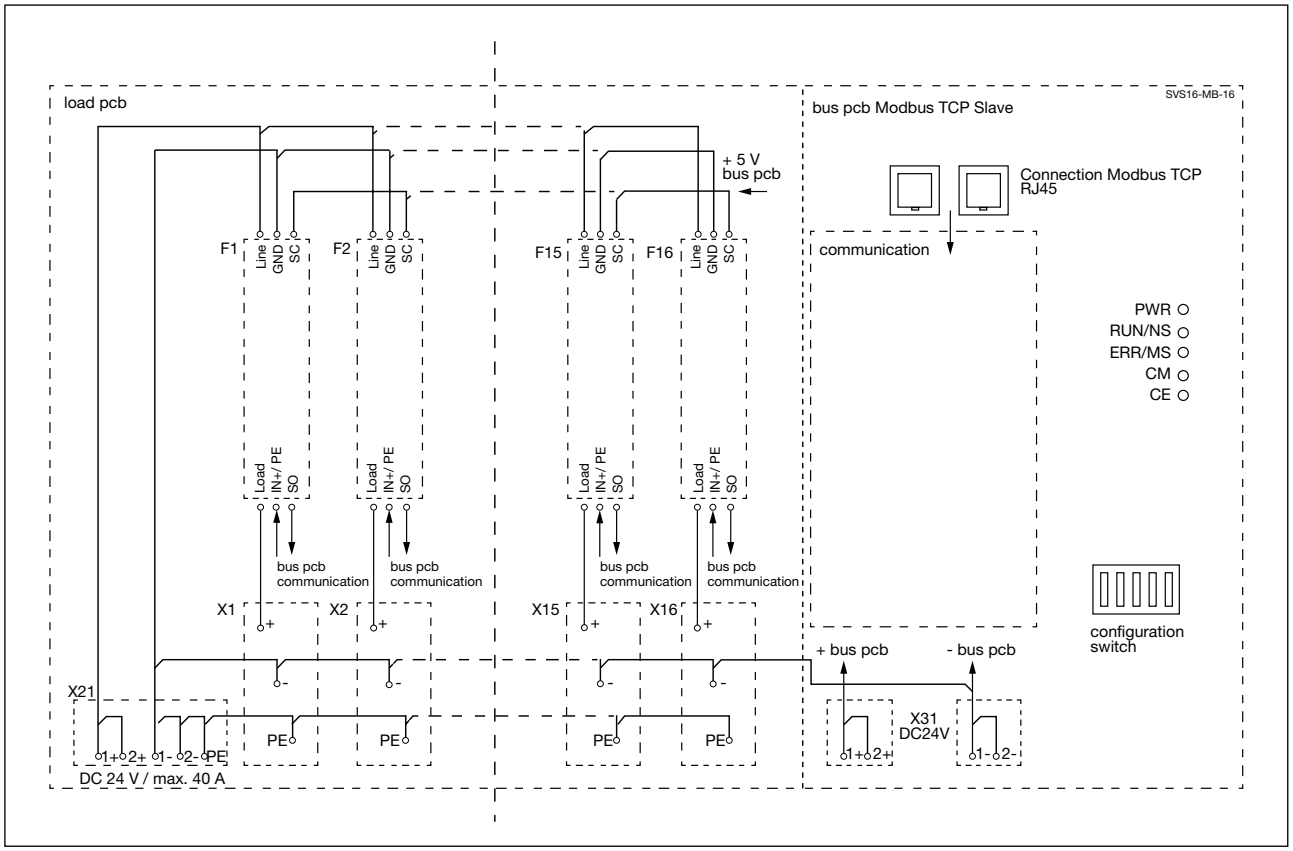
2 Bus-capable power distribution system SVS16-MB-XX

Connection of the SVS16-MB-XX to the Ethernet network is via Modbus-TCP module and the corresponding RJ45 connectors. Every module used in the SVS16 has a 1 bit output/1 bit input. Consequently either 1 byte input/1 byte output for 8 modules or 2 byte input/2 byte output for 16 modules.

2.1. Overview



2.2. Schematic diagram (SVS16-MB-16 shown)



2.3. Termination

2.3.1. Supply voltage load module

Rated voltage	DC 24 V (18...32 V)
Total current	max. 40 A
DC 24 V (+)	1+ / 2+ (2-way)
DC 24 V (-)	1- / 2- (2-way)
PE	PE connected to DC 24 V (-)
Termination	X21 for type SVS16-MB-XX-C13: 5-pole spring-loaded terminals, (1+/2+/1-/2-/PE) cable cross section max. 10 mm^2 for type SVS16-MB-XX-C23: 5-pole spring-loaded terminals, (1+/2+/1-/2-/PE) cable cross section max. 16 mm^2 screw terminals M4

2.3.2. Supply voltage bus module

Rated voltage	DC 24 V (18...32 V)
Current consumption	max. 250 mA
Termination	X31 2-pole push-in terminal (1+/2+) cable cross section max. 1.5 mm^2 2-pole push-in terminal (1-/2-) cable cross section max. 1.5 mm^2

2.3.3. Load outputs

Rated voltage	DC 24 V (18...32 V)
Current consumption	max. 10 A per terminal block / slot (L+) protected load output (+) (L-) negative return load (-) (PE) PE
Termination	X1…X8 (X16) for type SVS16-MB-XX-C13: three-level screwless spring-loaded terminals cable cross section max. 1.5 mm^2 for type SVS16-MB-XX-C23: three-level screw-type terminals cable cross section max. 1.5 mm^2 screw terminals M3

2.3.4. F-slots

Slots for the types ESX10-(S)115, ESX10-(S)125 and E-1048-S7xx.

SVS16-MB-08... F1...F8 = terminals X1...X8
SVS16-MB-16... F1...F16 = terminals X1...X16

2.4. Operating modes

The operating modes of the unit are set via a DIP switch as follows:

Switch	Description	ON condition	OFF condition
1	freeze	freeze active, a bus error will not affect the condition of the connected load.	freeze inactive, a bus error will influence the condition of the connected load, all connected loads will be switched off.
2	firm IP	IP address configured firmly on 192.168.0.1	IP address configured dynamically (or last active one)
3	admin	admin mode active, i.e. DHCP, HICP and possibly web are active	All network services except the field bus service are off
4	(reserve)		

2.5. Behaviour in the absence of a bus connection

The behaviour of the SVS16-MB in the event of a bus failure (failure of master, interruption of bus line etc.) is determined via the DIP switch „1“. The host controller saved the ON/OFF condition in the internal EEPROM. The following phases have to be distinguished during start-up:

1. Switch on supply voltage, no field bus communication yet with the superordinate master. Here the behaviour depends on the DIP switch 1 as follows:
   a. „Freeze active“: the switches are activated according to the EEPROM contents, i.e. the status will be set corresponding to the latest status before the supply voltage was switched off
   b. „Freeze inactive“: all switches are off.

2. Cyclical master communication active. The master controls the condition of the switches. Changes of the ON/OFF condition by the master will be stored in the EEPROM of the host controller.

3. Cyclical master communication failed:.
   a. „Freeze active“: the switches will be activated according to the EEPROM contents, i.e. they keep the latest state received from the master.
   b. „Freeze inactive“: all switches are off.

2.6. Addressing

2.6.1. General information and operating modes

Assignment of the device address is via the integral MAC addresses in the device.
There are three ways how to set IP addresses allowing access to the device:

1. Firm IP address. The firm IP address is activated by switching the DIP switch „2“ to „On“. The following network parameters will then be activated:

IP-address	192.168.0.1
netmask	255.255.255.0
gateway	0.0.0.0

2. Admin mode: The admin mode is activated via the DIP switch „3“. If the admin mode is active, other services to be reached via the network are also active for parameter selection: DHCP, HICP and web. If the address parameters are changed by means of these services, these will be filed in the non-volatile memory and will remain active even after switching the admin mode off.
3. Fieldbus-specific addressing: this function is permanently active and allows address assignment via the fieldbus-specific mechanism (see below for details).

The mode „firm IP address“ can be used for resetting the device to a defined address. When activating the mode „Firm IP address“ and the „admin mode“ at the same time, further configuration settings can be carried out under the firm address 192.168.0.1, even if no other mechanism for address assignment are used. Should the IP address parameters be changed in this condition, the mode „Firm IP address“ has to be selected before a restart.

If the mode „Firm IP address“ is inactive, the parameters stored in the non-volatile memory will be valid after start. These parameters can be adjusted via the fieldbus-specific services (e.g. CIP objects) or via the other mechanisms for address adjustment (particularly DHCP, HICP and website).

Depending on the DIP switch status the following types of address assignment are possible:

Mode	Switch 2 (firm IP)	Switch 3 (firm IP)	Description
0	0	0	Address assignment only possible via fieldbus-specific mechanisms if no address is assigned via fieldbus, the most recently used address will remain active.
1	0	1	Address assignment possible via fieldbus and all standard mechanisms (see Chapter 2.6.3, e.g. HICP, DHCP, web). if no address is assigned via one of the active protocols, the address most recently used will remain active.
2	1	0	Address will firmly be assigned to 192.168.0.1 address assignment via fieldbus-specific mechanisms possibly nevertheless (temporarily), but will be reset upon re-start.
3	1	1	As mode 1, but after starting the device the firm IP 192.168.0.1 will be used. As all other protocols for address assignment are active, the address can be changed temporarily.

The condition as delivered is mode 1. In condition 1 the latest adjusted condition will remain active.

2.6.2. Fieldbus-specific unit search / address assignment

With PROFINET and EtherCAT, fieldbus-specific mechanisms are made available for locating devices in the network and for assigning IP addresses. These mechanisms are, independent of the DIP switch positions (switch 2, switch 3), permanently active and work as follows:

Fieldbus	Device location	Address assignment
EtherNet/IP	device location via CIP identity broadcast	configuration (incl. DHCP on/off) via the CIP object
PROFINET	via DCP protocol any configured device can be located.	via DCP protocol, normally automatically when setting up the connection via the device name
EtherCAT	via the device manager of the TwinCAT software	via the device manager of the TwinCAT software
Modbus-TCP	(none)	(none)

The fieldbus project planning tool (Step 7/TIA Portal for PROFINET, Rockwell RSLinx Software, via Communication → RSWho) or the Rockwell Studio 5000 Environment via EtherNet/IP is used for using these fieldbus-specific mechanisms.

2.6.3. Standard functions for address assignment

The IP address of the device can be set via the following methods via the network when the admin mode is active (see above):

- Via the standard TCP/IP-protocols DHCP/BootP. In this case the module always queries for an IP address during start-up via a network broadcast. Prerequisite: the network holds a DHCP/BootP server. If an address has been received, it will be stored as standard address in the flash and be used later, even if no DHCP/BootP server is available any longer.
- Via the HMS-controlled HICP protocol (with the Windows software AnybusIPConfig). Here a broadcast is sent by a PC application so that even modules with faulty network settings can be configured. Pre-condition is the installation of an additional software on the customer PC. If an address has been set above, it will be stored in the flash as standard address and be used with immediate effect.
- Via the integral web server (if activated).

Note

- For safety reasons, unnecessary/unused services should be deactivated. As a standard mechanism for addressing is available in Ethernet/IP, the HICP mode should be deactivated (and equally Telnet/FTP or HTTP if unused).

2.7. Setting of the EtherNet ports

Data transmission normally is effected with 10 or 100 Mbit/s in full duplex mode with automatic recognition of MDI/MDX and 10/100Mbit half/full duplex

2.8. Configuration of SVS16-MB

For the Modbus-TCP the I/O‘s are separately provided as individual bits for inputs and outputs („inputs“ and „coils“). In addition, the I/O‘s are able by a 16-bit register with read/write access to read/write to the cyclical I/O register. For the 8-channel SVS16 only 8 bits are used.

The process image (the cyclic data) is as follows reachable via Modbus / TCP:

Holding Registers (4x)

Range	Contents	Notes
0000h...00FFh	Read Process Data	See 3-12 “Process Data”
0100h...01FFh	Write Process Data	
0200h...0202h	(reserved)	-
0203h	Process Active Timeout	See 10-51 “Network Configuration Object (04h)” (instance #9)
0204h	Enter/Exit Idle Mode[a]	0: Not Idle, >0: Idle
0205h...020Fh	(reserved)	-
0210h...FFFFh	ADI No. 1....nn	See 3-11 “Application Data (ADIs)”

Input Registers (3x)

Range	Contents	Notes
0000h...00FFh	Write Process Data	See 3-12 “Process Data”
0100h	Diagnostic Event Count	Number of pending diagnostic events
0101h	Diagnostic Event #1	These registers corresponds to instances in the Diagnostic Object (02h), see 11-95 “Modbus Host Object (FAh)”. High byte = Severity Low byte = Event Code
0102h	Diagnostic Event #2	
0103h	Diagnostic Event #3	
0104h	Diagnostic Event #4	
0105h	Diagnostic Event #5	
0106h	Diagnostic Event #6	
0107h...FFFFh	(reserved)	-

Coils (0x)

Range	Contents	Notes
0000h...0FFFh	Read Process Data	See 3-12 “Process Data”

Discrete Inputs (1x)

Range	Contents	Notes
0000h...0FFFh	Write Process Data	See 3-12 “Process Data”

The SVS16-MB-XX provides two bytes each input and output data.

This means in detail:

Holding Registers byte 1 (Control/Reset)								
slot no.	F1	F2	F3	F4	F5	F6	F7	F8
binary value	2^0	2^1	2^2	2^3	2^4	2^5	2^6	2^7
decimal value	1	2	4	8	16	32	64	128

Holding Registers 2 (Control/Reset)								
slot no.	F9	F10	F11	F12	F13	F14	F15	F16
binary value	2^8	2^9	2^10	2^11	2^12	2^13	2^14	2^15
decimal value	256	512	1024	2048	4096	8192	16384	32768

The word splits itself in two bytes. Each output byte activates 8 slots with the least significant bit (LSB) of the output byte 1 being assigned to the slot F1. The most significant bit (MSB) of the output byte 1 is assigned to slot F8. Analog to the output byte 1 the least significant bit (LSB) of the output byte 2 is assigned to slot F9 and the most significant bit (MSB) to slot F16.

Depending on the population of the SVS16 the following has to be determined:

a) slot fitted with E-1048-S7xx (with control input and status output)

1 → 24 V ON → switch on E-1048-S7xx

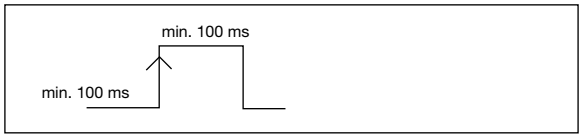
0 → 24 V OFF → switch off E-1048-S7xx

b) slot fitted with ESX10-(S)115 (with control input and status output)

1 → 24 V ON → switch on ESX10-(S)115

0 → 24 V OFF → switch off ESX10-(S)115

c) slot fitted with ESX10-(S)125 (with control input and status output)



For reset an ESX10-(S)125 in OFF condition a pulse of a duration of min. 100 ms is required.
The ESX10-(S)125 cannot explicitly be switched off.

	Input Register 1 (status)							
slot no.	F1	F2	F3	F4	F5	F6	F7	F8
binary value	2^0	2^1	2^2	2^3	2^4	2^5	2^6	2^7
decimal value	1	2	4	8	16	32	64	128

	Input Register 2 (status)							
slot no.	F9	F10	F11	F12	F13	F14	F15	F16
binary value	2^8	2^9	2^10	2^11	2^12	2^13	2^14	2^15
decimal value	256	512	1024	2048	4096	8192	16384	32768

Each input byte allows importing status or failure indications of 8 slots.

Assignment of the individual slots is identical with the above described assignment of the output bytes (LSB of output byte 1 is assigned to slot F1, MSB to slot F8 etc.).

Independent of the devices types the following determinations are valid:

0 → device is ON

1 → device is OFF and slot is empty

This means that the value 256 will be transferred when no circuit breaker was plugged in.

2.9. LED indication for bus communication (Modbus-TCP)

The modul- and network status will be displayed by external LEDs on the device.

The LEDs indicate the following information:

Network status	LED RUN / NS	Module status	LED ERR / MS
No IP address or Exception state	off	No power	off
At least one Modbus message received	green	Normal operation	green
Waiting for first Modbus message	green flashing	Major fault, FATAL error	red
IP address conflict detected, FATAL ERR.	red	Minor fault	red flashing
Connection timeout No Modbus message	red flashing	Firmware update from file system in progress	alternating in the specified colors

2.10. Signalling of the various operating modes

The different operating modes of the power distribution system are indicated as follows:

Operating mode	Signalling of the operating mode		
	LED CM	LED CE	LED PWR
SVS_SYSTEMINIT	[1] green red green	[1] green red green	[1] green red green
SVS_ERROR_CRITICAL	yellow	red	green
SVS_ERROR_UNCRITICAL	yellow	blink red	green
SVS_STANDALONE (FREEZE)	yellow	OFF	green
SVS_NORMAL_MODE	green	OFF	green

1) Color change as LED test

2.11. Operating modes of the power distribution system

2.11.1. Operating mode: SYSTEMINIT

After applying the supply voltage the module is in this operating mode. During this period no communication is possible. This mode takes a few seconds. Also the switch setting of the hardware switch S1 is determined.
Signalling this mode see table “signalling mode” above.

2.11.2. Operating mode: FREEZE

Requirement: DIP switch 1 = ON.
The master controls the status of connected devices.
Or in process of interruption in the bus connection, the devices are driven in accordance to the EEPROM content.
Signalling this mode see table “signalling mode” above.

2.11.3. Operating mode: UNFREEZE

Requirement: DIP switch 1 = OFF.
The master controls the status of connected devices.
On interruption of the bus, the connected devices are turning off.
Signalling this mode see table “signalling mode” above.

2.11.4. Operating mode: UNIT_ADRESSING

Fixed:

The IP address is fix configured to address 192.168.0.1.
This requires DIP switch 2 = ON and DIP switch 3 = OFF

Admin-Mode:
This requires DIP switch 2 = ON and DIP switch 3 = ON.
If the Amin Mode is active, the IP address parameters are changed by using its services.
Then these parameters are stored in the non-volatile memory and remain active even after the Admin Mode is deactivated.

Fieldbus Specified Addressing:
This function is always active and allows an address mapping via the fieldbus mechanism.

3. Firmware of the Anybus version

The firmware of the IC module used determines the selection of the file to be used.

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