M0010436C

SANMOTION

MOTION CONTROLLER

C

SMC263X, SMC265X
CP240-A, CP242-A

Automation System

System Manual

SANYO DENKI

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1. Introduction

1.1 Purpose of the document

This document describes the structure of the SANMOTION C system.

In addition, it describes the assembly and installation, the wiring and operation and displays of the modules.

The installation and configuration is described enough to obtain an operationally ready system.

"Ready for operation" means that the system and/or the respective CPU modules are ready for the loading of the firmware and the application.

Information

This manual is not adressed to end costumers! Necessary safety notes for the end costumer have to be taken into the costumer manual in the respective national language by the machine builders and system providers.

1.2 Preconditions

The system manual is intended for all those using a SANMOTION C system that consists of CPU modules and I/O modules added in line or those who plan to use such a system.

Only electrically trained personnel are authorized to install and maintain a system with the help of this system manual.

Target group	Prerequisite knowledge and ability

Project engineer	• Technical basic education (advanced technical education, engineering degree or corresponding professional experience),
	• Knowledge about:
	  ◦ the method of operation of a PLC,
	  ◦ safety regulations,
	  ◦ the application.

Electrician	• Specialized training in the electro-technical field (in accordance with industrial training guidelines).
	• Knowledge about:
	  ◦ safety regulations,
	  ◦ wiring guidelines,
	  ◦ circuit diagrams,
	  ◦ correct installation of electrical connections.

Target group	Prerequisite knowledge and ability
Programmer	● Technical training (university of applied science, engineering training or corresponding professional experience). ● Knowledge about: the method of operation of a PLC, safety regulations, programming a PLC (IEC61131).
Start-up technician	● Basic technical training (University of applied science, engineer training or corresponding professional experience). ● Knowledge about: ● safety regulations, ● the method of operation of the machine or system, ● fundamental functions of the application, system analysis and troubleshooting,
Service technician	● Basic technical training (University of applied science, engineer training or corresponding professional experience). ● Knowledge about: ● the method of operation of a PLC, ● safety regulations, ● the method of operation of the machine or system, ● diagnosis possibilities, ● systematic fault analysis and rectification.

1.3 Intended use

A SANMOTION C system may only be used for the types of use described in the technical descriptions and only in conjunction with recommended/approved third-party equipment/installations.

All modules of the SANMOTION C system have been developed, manufactured, tested and documented in accordance with the appropriate safety standards. Therefore, the products do not pose any danger to the health of persons or a risk of damage to other property or equipment under normal circumstances, provided that the instructions and safety precautions relating to the intended use are properly observed.

The system is intended for installation in a switch cabinet and may only be used in the following way:

- Only in the industrial sector,
- Only as directed,
- In its original state without unauthorized modifications.

  Authorized are the alterations or modifications described in the accompanying documentation.
- In a faultless technical condition.

1.4 Notes on this document

Information

If necessary, also adhere to the documentation accompanying the modules.

1.4.1 Contents of the document

- System overview
- Explanation of all operating elements and displays
- Description of the assembly and installation
- Operating behavior
- Description of the software installation
- Diagnosis and maintenance information
- Technical data
- EMC and wiring guidelines
- Terminology

1.4.2 Not contained in this document

- Programming instruction
- Application diagnosis
- Firmware description

1.5 Further documentation

Documents for systems components (drive technology, operation pendants, controls, IO-modules, ...) are included in your shipment. Documentation of the tools is integrated as online help.

Document number	Model name	Document name
M0011452	CPU module	SMC263X,SMC265X hardware manual
M0010855	CPU module	CP240/A,CP242/A hardware manual
M0010646	Bus link module	BL210/B hardware manual
M0010740	I/O module	DM272/A hardware manual
M0007977	I/O module	DM276/A hardware manual
M0010836	I/O module	AM280/A hardware manual
M0008913	I/O module	DI266/A,DI266/B hardware manual
M0008915	I/O module	DO276/A,DO276/B hardware manual
M0010052	I/O module	DI286/A hardware manual
M0010053	I/O module	DO286/A,DO286/B hardware manual
M0007979	Interface module	SM210/A,SM230/A hardware manual
M0007966	Encoder module	MM240/A hardware manual
M0010600	Handheld terminal	TP-C55E hardware manual
M0010369	Handheld terminal	TP-C20E hardware manual

1.6 Application and registrations

Standards and test values which the product conforms to and meets are contained in the chapters "Technical Data" and "EC directives and standards". For the EU guidelines relevant to the product please see the declaration of conformity.

2. Safety notes

2.1 Representation

At various points in this manual you will see notes and precautionary warnings regarding possible hazards. The symbols used have the following meaning:



DANGER!

- **indicates an imminently hazardous situation which will result in death or serious bodily injury if the corresponding precautions are not taken.**



WARNING!

- **indicates a potentially hazardous situation which can result in death or serious bodily injury if the corresponding precautions are not taken.**



CAUTION!

- **means that if the corresponding safety measures are not taken, a potentially hazardous situation can occur that may result in property injury or slight bodily injury.**

CAUTION

- **CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in damage to property.**



- **This symbol reminds you of the possible consequences of touching electrostatically sensitive components.**

Information

Useful practical tips and information on the use of equipment are identified by the "Information" symbol. They do not contain any information that warns about potentially dangerous or harmful functions.

2.2 General safety instructions

The documentation contains information necessary for planning the use of the SANMOTION C hardware.

Familiarity with and correct application of the information contained in these manuals is a prerequisite for successful planning and safe installation, commissioning and maintenance of automation systems. Only properly qualified personnel have the required specialist knowledge to correctly interpret and implement the instructions given in this manual.

For reasons of clarity, not every single detail of every version of the products described is listed nor can every conceivable practical situation be taken into consideration. Should you require additional information, please contact SANYO DENKI.

When installing, commissioning and servicing SANMOTION C products, the instructions given in the relevant part of the documentation must be observed.



WARNING!

●The following application areas are expressly excluded:

- **Use in areas where there is a risk of explosion or fire**
- **Use in the mining sector**
- **Use in the open air**

Other products are to be used for these applications!

- **The SANMOTION C modules are not designed for safety-relevant control tasks (e.g.: shutdown in case of an emergency). For safety-relevant control tasks and personnel security, additional external safety measures must be implemented to ensure the system remains in a safe operating condition even in the event of a fault.**
- **During the development of the system EN ISO 13849-1 was not considered.**



CAUTION!

Fire hazard during module failure!

- **10 Amp external line fuse must be provided in the final application.**

CAUTION

Improper use of the assembly or the control system leads to irreparable damage!

- **Turn off the power supply before inserting or removing the module. Otherwise, the module can be destroyed or undefined signal states can lead to damage of the control system.**

2.3 Personnel safety



WARNING!

- **Unqualified interventions in the control may cause abnormal behavior of the machine/plant or personal injury or damage to the equipment. Only specially qualified staff may carry out activities on the control system.**

2.3.1 Safety extra-low voltage



WARNING!

Danger of personal injury due to electric shock!

- **Supply the SANYO DENKI control exclusively from power sources that have a protective low voltage (e.g. SELV or PELV according to EN 61131-2)**
- **Connect only voltages and power circuits to connections, terminals and interfaces up to 50 V rated voltage that have a secure disconnect for hazardous voltages (e.g. with sufficient isolation and voltage-proof).**

2.4 Safety instruction for programming



CAUTION!

- **The instructions contained in these manuals must be precisely followed in all circumstances. Failure to do so could result in the creation of potential sources of danger or the disabling of protective circuit integrated in the SANMOTION C.**
- **Apart from the safety instructions given in these manuals, the safety precautions and accident prevention measures appropriate to the situation in question must also be observed.**
- **Measures must be taken to ensure that in the event of power dips or power failures, an interrupted program can be properly restarted. In such situations, no dangerous operating conditions must be allowed to occur even temporarily.**
- **In all situations where faults occurring on the automation system could cause personal injury or significant damage to machinery and equipment, additional external safety measures must be taken in order to ensure the system as a whole remains in a safe operating condition even in the event of a fault.**

2.5 Safety instructions for device maintenance

Before opening the device:

1) Disconnect the power supply
2) Disconnect the interface connections
3) Follow the safety instructions and instructions of the respective device as described in the corresponding manuals



CAUTION!

- **The device may only be opened by qualified personnel and only maintenance activities expressly approved by SANYO DENKI may be performed (see chapter "Service notes"). Any other manipulations to the device will result in loss of warranty.**

2.6 Requirement for UL508 and use conforming to EN 61131

The modules of the SANMOTION C are defined as "open type equipment" (according to UL508) or as "open type equipment" (according to EN 61131) and must therefore be installed in a switch cabinet.

Information

Repairing SANYO DENKI products is only allowed at SANYO DENKI. Alternatively it will result in the loss of the UL-conformity. Maintenance according to the maintenance instructions is not affected

3. System overview

The field of application of the SANMOTION C is the general automation of machines and plants. The system is based on a modular concept and can be structured according to specific functional requirements.

The system consists of the following components:

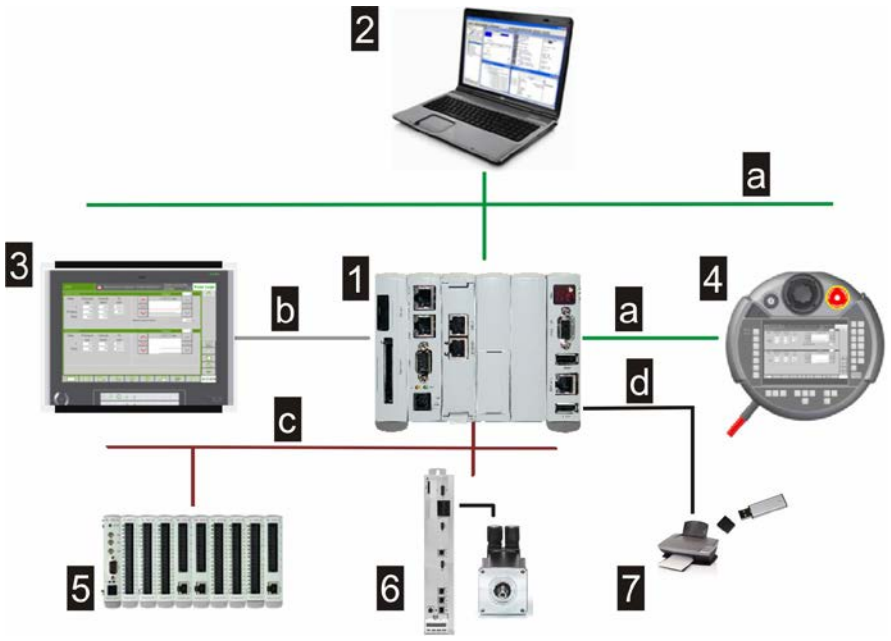


Fig.3-1: Example of a system structure with CPU module and periphery

1 ... Control with various CPU modules	2 ... Toolsuite for automation challenges
3 ... Stationary operating panels	4 ... Mobile handheld terminals
5 ... Modular I/O system with mountable modules (bus link modules allow decentralized placement of the	6 ... Drive technology with integrated safety features
7 ... External periphery (e.g.: printer, USB stick, ...)	a ... Ethernet
b ... Ethernet or serial	c ... Field busses
d ... USB	

Information

The system components shown in this manual are example graphics. The devices used by you may differ in their appearance. Please observe the supplied project engineering manuals of the devices.

3.1 Hardware architecture

Devices are connected according to their signal type, e.g. over analog or digital input or output modules, interface modules, etc.

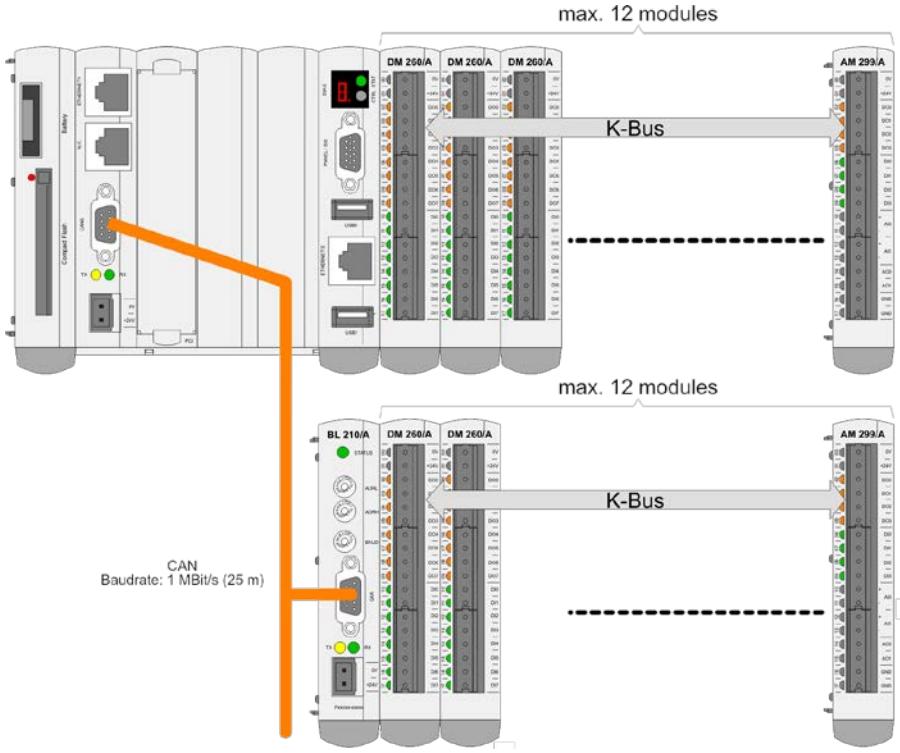
CPU- and I/O-modules are joined together and form a control block that can then be installed into a control cabinet. The casing provides mechanical protection, the inner construction of the module guarantees EMC shielding. For the adoption to various different interfaces, option modules are slotted into the CPU-modules. The devices communicate via internal system bus (K-Bus). The cycle time of the system-bus is 1 ms.

The operating and display devices can be arranged at a suitable location somewhere on the machine/plant.

In case of big distances between the signal transducers, a peripheral arrangement of I/O module clusters is possible. These clusters can be connected to the CPU module by an bus link module.

The module clusters can be set as follows.

- Connection via CAN (25 meters at 1 Mbit)



During the system start up the runtime system compares the current hardware configuration (actual configuration) with the hardware configuration stored in the IEC project (setpoint configuration). Deviations in configuration or faulty modules can be identified via the inquiry of the module status in the IEC application. The response is there fixed programmatically (e.g. error output on the visualization, restricted function in the optional I/O modules, etc.)

3.2 CPU-modules

A CPU module is a intelligent processing unit, which is responsible for the execution of the automation programs. CPU modules are available in the following performance levels.

Name	Performance characteristics	Interfaces
CP 240/A	Intel ATOM 600MHZ, 512MB RAM	1xCAN, 2xUSB, 1xEthernet, 1xEtherCAT
CP 242/A	Intel ATOM 1,1GHZ, 512MB RAM	1xCAN, 2xUSB, 1xEthernet, 1xEtherCAT
SMC263X	1.6GHz, 1GB RAM	1XCAN, 2xUSB, 2xEtherrnet, 1xEtherCAT
SMC265X	1.8GHz, 1GB RAM	1XCAN, 2xUSB, 2xEtherrnet, 1xEtherCAT

Information

Details about the CPU modules can be found in the project engineering manual of the according CPU.

3.2.1 Compact Flash card

To operate the SANMOTION C, a Compact Flash Card with the respective firmware and the application must be plugged into the Compact Flash slot of the CPU module. Depending on the application used the Compact Flash Card can also be used for storing machine data (e.g. mold data and recipes).

The Compact Flash Cards supported by the SANYO DENKI can be requested and ordered from SANYO DENKI. All other Compact Flash cards not approved by SANYO DENKI will not guarantee the correct functionality.

Information

The Compact Flash Card cannot be used as removable medium since it also has system programs stored on it.

3.2.2 Plug-in module

The front side of the SMC263X / SMC265X provides 3 slots for the option modules.



Fig.3-2: Assignment of the slots

1	... SX 210/A (RS232 interface), SX 230/A (RS485,RS422 interface)
2	... FX 200/A (CAN interface)
3	... Unused

3.3 Bus link modules

Bus link modules allow to run decentralized I/O-nodes. On each bus link module, 12 peripheral modules can be lined up.

Information

Different I/O-modules can be lined up to the bus link modules. Which I/O-module is compatible to which bus link module is documented in the corresponding operation manuals.

The following table shows which bus link modules are available.

Bus link modules

Name	Onboard I/Os	Description
BL 210/B	no	CAN-interface

3.4 peripheral devices

The SANMOTION C can be extended with peripheral devices that are lined up on the right side of the CPU module. Such modules are connected to the system bus via a contact plug. All devices are installed on the mounting rail.

The order of peripheral modules may be freely chosen. Each module has its own unique address. A maximum number of 12 peripheral modules may be lined up.

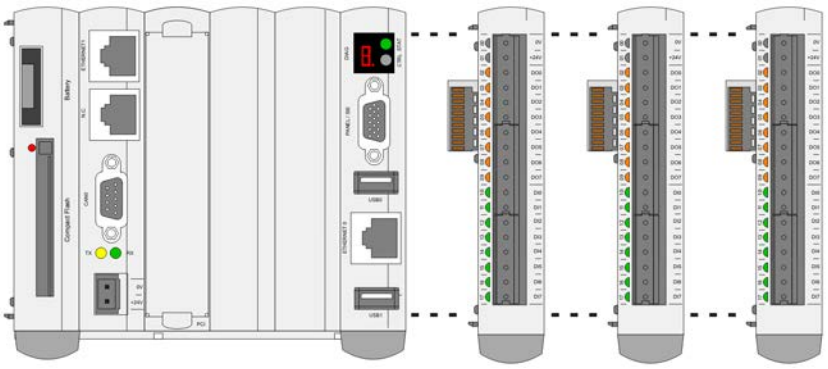


Fig.3-3: Lining up peripheral modules

The following tables show which peripheral modules are available and if they can be used on a bus link module.

Digital in-/output module

Name	IN	OUT	Description
DM 272/A	8	8	2xDI interrupt able, DO's 2A at 50%, short-circuit proof, sink input(negative common), source output
DM 276/A	6	8	2xDI interrupt able, DO's 2A at 50%, short-circuit proof, source input(positive common), sink output
DI 266/A, DI266/B	16	-	2xDI interrupt able, A:Phoenix type CN, B:FCN 24pin type, source input(positive common)
DO 276/A, DO276/B	-	16	0.5A, sink output, A:phoenix type CN, B:FCN 24pin type
DI 286/A	32	-	2xDI interrupt able, FCN 40pin type, positive/negative common available
DO 286/A, DO286/B	-	32	0.1A, FCN 40pin type, A:source output, B:sink output

Analog in-/output module

Name	IN	OUT	Description
AM 280/A	4	4	IN: +/-10V, 14 Bit OUT: +/-10V, 12 Bit

Encoder interface module

Name	IN	OUT	Description
MM 240/A	2		Incremental position encoder, 32Bit, 2 additional latch inputs

Serial interface module

Name	IN	OUT	Description
SM 210/A	2		RS232-C, full duplex
SM 230/A	2		RS485/422-A

Fieldbus module

Name	Connectors	Description
FM 299/A	2	SD fieldbus master module, GA 1060

Information

The number of modules, which can be lined up on a bus link module depends on the current consumption of each module and on the amount of data transfered against the cycle time.

For the calculation of the number of modules that can be added, the specified performance value given in the technical specifications under "power consumption 5 V on the K-Bus" and under "power consumption 24 V on the K-Bus" must be used. This value may not exceed the value made available for added modules of the CPU modules or the bus coupling modules.
In principle, with the following exceptions, up to 12 modules of the same kind can be placed in line on a CPU module or on a bus link module allowing for the power consumption and the bus load.

3.5 SANMOTION C Studio Toolsuite

The tools connect to the controller via Ethernet. They serve for configuration, parameterization, programing, debugging and diagnosis of a control. The following tools are available:

- **SANMOTION C Studio for configuration and programming:**

  SANMOTION C Studio serves to configurate, parameterize, program and debug control application. Furthermore, the project engineering of a robot is carried out via configuration masks.

- **SANMOTION C Studio Scope for diagnosis**

  With the help of SANMOTION C Studio Scope variables may be monitored, recorded, and displayed. In comparison to a debugger no program interruption is required. Variables can be presented as tables, diagrams, or 3D-View. The following basic features are available:

  - recording of variables
  - triggers (pre- and post triggers)
  - diagrams: variable monitor, event monitor, X vs. Time diagram, X vs. Y diagram, 3D-view.

In the following chapters the tools are described more in detail.

3.5.1 SANMOTION C Studio

The SANMOTION C Studio development environment offers a comfortable user interface with the following functions:

- Configuration and parameterization of the SANMOTION C system (with the PLC configuration)
- Programming according to EN 61131-3
- Integrated module libraries (see Description of library)
- Library administrator for integrating additional libraries
- Simulation mode (enables projects to be tested on the PC without PLC)
- Documentation (integrated project documentation)
- Debugging functions (testing program sequence, monitoring and modifying variables, error search).

To enable a control (target system) to be used under SANMOTION C Studio a so-called target support package is required for the respective target system. This enables the system functions of the target system to be accessed (and contains appropriate information in the form of online Help).

SANMOTION C Studio is supplied with the target support package for the SANMOTION C.

Programming languages

SANMOTION C Studio offers all 5 programming languages standardized in EN 61131-3. There are two textual and three graphic programming languages. Each of these languages has specific characteristics that are ideally suited for carrying out specific tasks.

Programming language	Type	Description
Instruction List (IL)	Textual programming languages	The instruction list enables the programmer to describe the work processes of control tasks with simple instructions. The structure of the language enables complex tasks to be carried out efficiently.
Structured text (ST)		Structured text comes closest to the programming languages Pascal and C used for the PC. It consists of a series of instructions that can be executed in high-level language ("IF..THEN..ELSE") or in loops (WHILE..DO).
Sequential Function Chart (SFC)	Graphic programming languages	Enables programming of sequences and is therefore suited for structuring and arranging of projects. The Sequential Function Chart describes the temporal sequence of the various steps within the program with transitions and connections.
Continuous graphic Function Chart (CFC)		In addition, based on the function chart there is the continuous graphic function chart (CFC) in which elements can be placed freely and feedback can be inserted
Ladder Diagram (LD)		The ladder diagram was developed from the circuit diagram. The representation of a ladder diagram program resembles a circuit diagram - relative to the representation of the logical links.

Library administrator

To facilitate programming, SANMOTION C Studio makes it possible to organize objects that are not related to projects into libraries, such as modules, declarations and visualizations. For this purpose a library administrator is available for integrating and viewing of libraries.

Specific target system online help

The specific target system online Help for the SANMOTION C is displayed only when it has been set as target system. Access to the Help is gained via the online Help table of contents under "Target system".

3.5.2 SANMOTION C Studio Scope

SANMOTION C Studio Scope serves to monitor, record and visualize the values of arbitrary variables in software components. These can be firmware components or application programs. Unlike the debugger, it will not require the program sequence to be interrupted. Tables, diagrams and 3D-views enable visualization of the recorded variable values.

The tool has the following properties:

- Variables and arrays in firmware components and/or IEC- programs can be recorded. The variables must be registered with the sampler.
- Variables can be activated or deactivated from scope. Only activated variables are recorded.
- Events can be used to notify a specific status in the target program.
- Related events can be grouped into classes. Every event is part of a class.
- The actual recording start can be determined via a trigger. The trigger can refer to a variables' value and/or a specific event. Pre- as well as post-triggering is possible.
- Representation of the collected data in different diagrams and views: Variables' monitor, event monitor, X-t chart, X-Y chart, 3D-view.

Information

When recording data with SANMOTION C Studio Scope, the processing of the program may at times encounter slight lagging.

3.6 Libraries

In the following chapters the software interfaces which are available in this System are described more in detail.

3.6.1 IEC standard libraries

The following libraries are available in SANMOTION C Studio:

- IEC61131-3 standard libraries
- Modules for analysing of terms
- Libraries for changing data of variables via

UDP For further information see onlinehelp of

SANMOTION C Studio.

3.6.2 SANMOTION C Studio libraries

SANMOTION C Studio serves an among of functions for the following application areas:

- Bus diagnosis
- Network configuration
- User administration
- Report system
- Runtime diagnosis
- Data changes between applications
- Access to the software oscilloscope
- Integration of drives

For further information see onlinehelp of SANMOTION C Studio.

4. Assembly and removal

4.1 General instructions

CAUTION

Improper handling can damage the modules, option modules and the control system.

- **Switch off the operating and on-load power supply before carrying out assembly, installation or maintenance work.**

CAUTION

Damage to components!

Handle all modules and components with care. Please ensure the following:

- **Clean contact surfaces (to avoid contact faults).**
- **Bus plugs that are not bent.**
- **Ensure that no pieces of wires, fillings or swarf fall into the unit when you are drilling holes or connecting wires.**

4.2 Mounting rail

A steel rail TS 35x7.5 is to be used as mounting rail for the device. For the sake of stability the screw distance, as shown in the illustration, must not exceed 100 - 120 mm.

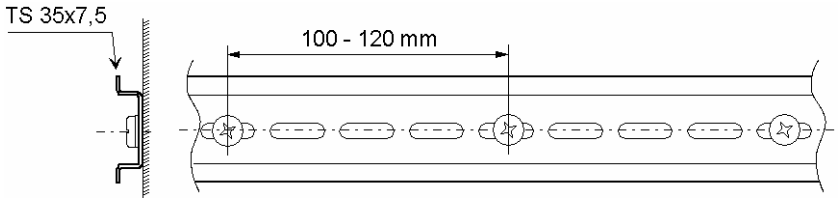


Fig.4-1: Fixing of the mounting rail.

4.3 Space requirement

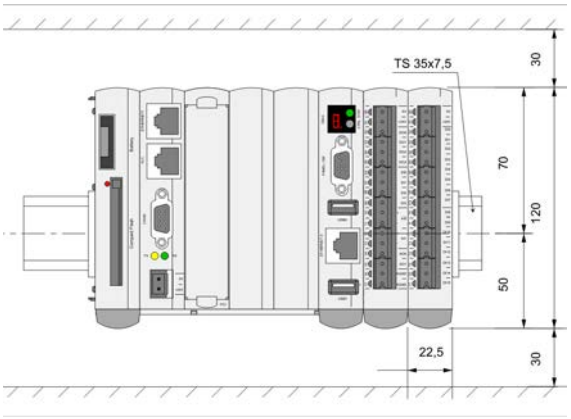


Fig.4-2: Mounting sketch

Information

- *Free space for air circulation: At least 30 mm above and below the modules.*
- *Free space for changing the Compact Flash Disk or Battery or FAN unit for SMC26x: At least 80mm above and/or bottom the module, otherwise the CPU module must be removed to change the those.*

4.4 Compact Flash card usage

To operate the SANMOTION C system, a Compact Flash Card with the respective firmware and the application must be plugged into the Compact Flash slot of the CPU module.

CAUTION

Do not insert the CompactFlash card with violence. It is constructed so that it can only be inserted in one direction and it should slide into the slot easily with slight pressure.

The card:

- **should be kept away from moisture, heat and direct sunlight,**
- **should be protected against static electricity,**
- **should not be dropped or bent.**
- **should not be removed or the device switched off while the card is being written to.**

Inserting the memory card

1) Turn off the power supply.

2) Carefully insert in the Compact Flash Card with slight pressure in the direction of the arrow until it engages.

Removing the memory card

1) Turn off the power supply.
2) Carefully press the eject key with a suitable object (e.g. blunt stylus). The card is ejected by a few millimeters.
3) Carefully pull the card from the slot.

Compact Flash types

Approved Compact Flash cards can be purchased from SANYO DENKI

4.5 Adding modules

Up to 12 modules (I/O-, technology or field bus modules) can be lined up next to each other to the right side of the CPU module or bus link module. The connection between the CPU module or bus link module and the added modules is established via a parallel K-Bus. The entire package is snapped onto a mounting rail (mounting rail TS 35x7,5).

Information

Further information for the calculation of the number of modules that can be added: see "peripheral devices"

4.5.1 Setting the module address

The modules in the system are addressed by means of a 16-position address switch. All modules within a control package (consisting of CPU module and a maximum of 12 modules) thus can be differentiated.

The address switch is located on the side of the modules, underneath the K-Bus plug. The address must be set prior to the assembly of the package. See also the project engineering manual of the components and the modules.

Information

Modules of the same type must have different address switch positions within one control package. Different modules in different control packages may have the same address switch positions.

4.5.2 Preparing for installing on the mounting rail



CAUTION!

- **Attention must be given when setting the address switch with the screw-driver that none of the surrounding components is damaged.**

1) Unpack modules.
2) Remove all side lids on the K-Bus plug except for the one on the module to the extreme right.
3) Set address switch with a suitable screwdriver to the setting configured in the application software. The same modules (i.e. those with the same type designation) must be differentiated by the setting of the address switch.

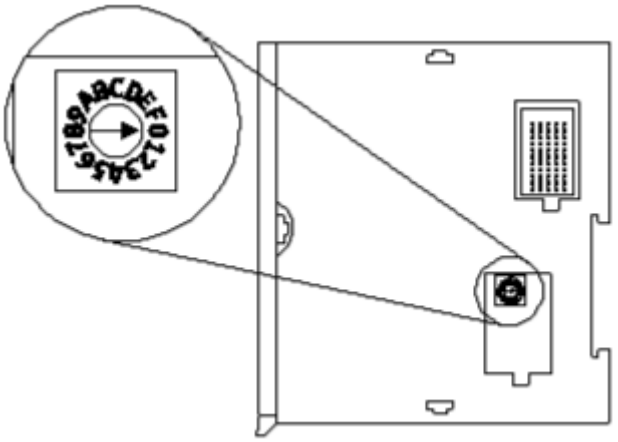


Fig.4-3: Settings of the address switch

4) Plug together the modules with the CPU module to form one control block. The CPU module must be positioned to the extreme left, the add-on modules are added on to the right.

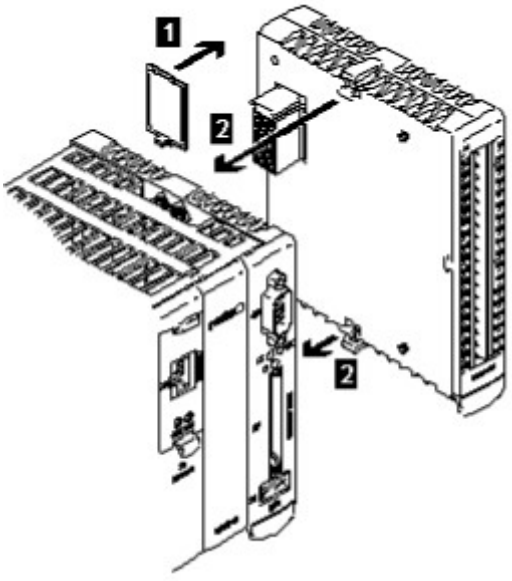


Fig.4-4: Plugging modules together

Information

When adding extension modules to a CPU module or to an already given add-on module make sure that the locking pins are properly engaged.

Furthermore, ensure that the entire package (CPU module and add-on modules) is secured on either side with device end clamps to prevent it from being displaced and/or protected against vibration.

If the package is not mounted properly, its function may be impaired.

4.5.3 Installing the system

CAUTION

Mounting orientation:

The only permissible way to install the mounting rail is that the front side of the mounted module is directed ahead and the ventilation holes are directed upwards and downwards (see the following graphics). Otherwise defects (e.g. by means of heat accumulation) may accure (see also *chapter 4.6 "Air conditioning, ventilation"*).

This is how the system is installed on the mounting rail:

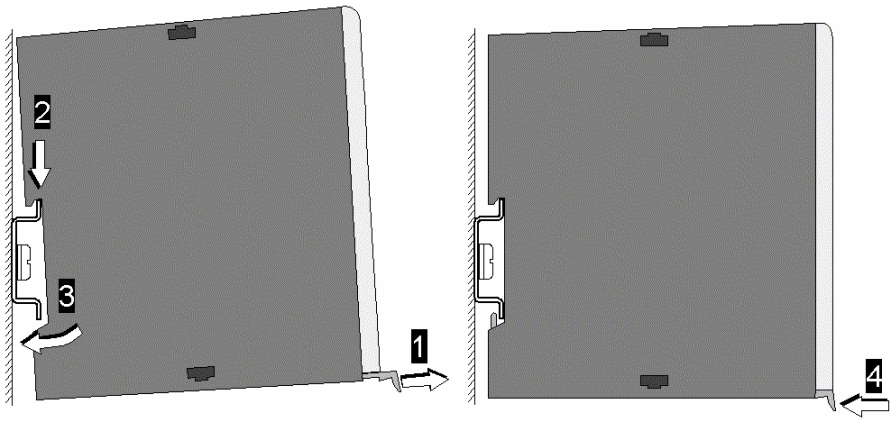


Fig.4-5: Installation of the system on a mounting rail

1) Pull out (unlock) all locking levers on the mounting rail.
2) Slightly incline the module(s) and place on the fixture of the mounting rail.
3) Press the lower half of the module onto the mounting rail.
4) Lock all locking levers on the mounting rail one after the other.
5) Secure the modules with the end brackets against slipping or loosening due to vibration (see *chapter 4.5.5 "End bracket"*).

The module is now installed on the mounting rail. You can now wire-connect the interfaces and the inputs/outputs.

4.5.4 Removing the system

CAUTION

Risk of damaging components during installation work under voltage.

- **Therefore, switch off the power supply and remove all cable connections prior to starting dismantling work.**

1) Turn off power supply
2) Disconnect all cable connections on the system.
3) Pull out (unlock) all locking levers on the mounting rail.
4) Remove the modules from the mounting rail.

4.5.5 End bracket

To prevent the modules from slipping or loosening through vibration, an end bracket must be mounted on the left and right side of the mounting rail.

Standard type end fixtures regularly included in the delivery program of the manufacturer can be used. They are not included in the delivery package of the automation system.

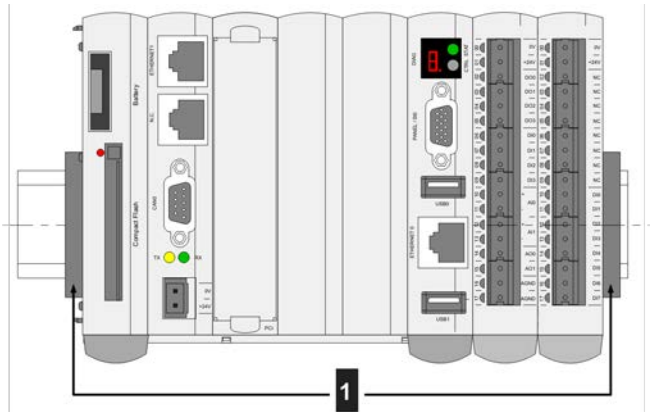


Fig.4-6: End fixture plates

1 ... End bracket

4.6 Air conditioning, ventilation

Ventilation holes for dissipating the heat are placed at the top and bottom side of the module. If the permissible ambient temperature is not exceeded, no external fan will be needed. Make sure that the ventilation holes are not covered.

CAUTION

To guarantee the dissipation of heat, leave a free space of at least 30 mm above and below the modules.



CAUTION!

- **The operating temperature inside the control cabinet must not exceed the permissible ambient temperature of the modules. If this cannot be guaranteed through natural heat dissipation, an air conditioning of the control cabinet must be provided.**
- **When installed in a control cabinet attention must be given that the area around the temperature inputs is not exposed to any temperature changes. (e.g. no air conditioners with intermittent operating hours)**

To determine the total power loss in the control cabinet, please observe the specifications on the power consumption of the modules in the project engineering manuals. See also power supply, example for calculating the capacity.

4.6.1 Use of air filters

Information

The control must be installed in an appropriate housing to guarantee that no degree of soiling greater than 2 arises.

It is recommended to install the control modules in a dustproof, closed control cabinet. The ventilation holes of the control cabinet must be equipped with air filters. The filter elements must be cleaned or replaced regularly.

5. Connections and wiring

5.1 Power supply

The modules are supplied with voltage via the K-Bus plugs. For a module formation with a CPU modules this is done via the bus supply of the module. Within the decentralized module clusters this function is allocated to the input transceiver. Each of these couplers has its own DC/DC converter that will convert voltages to the appropriate internal voltage.

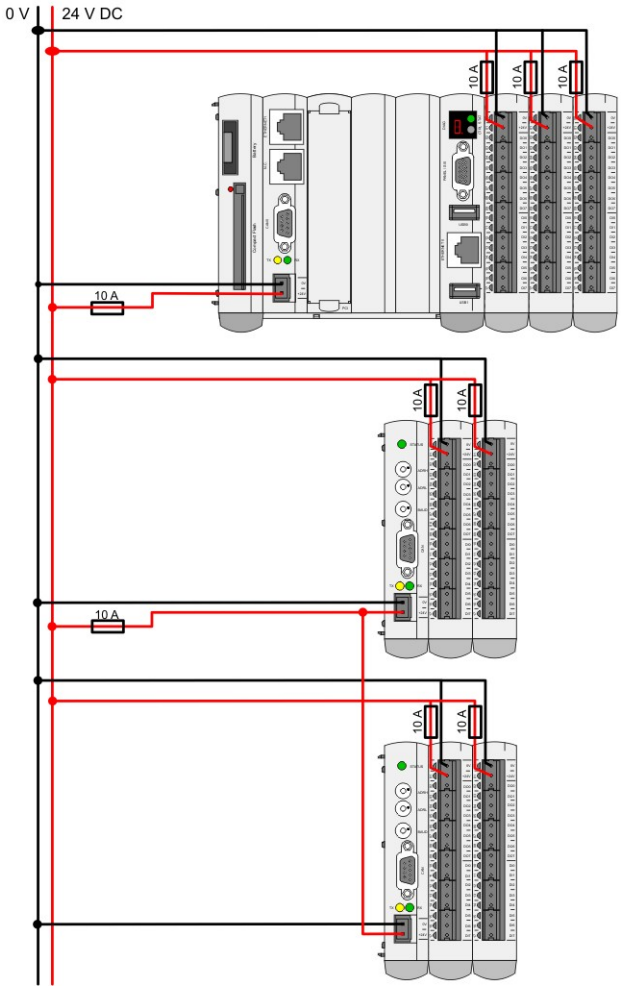


Fig.5-1: Connection diagram for +24 V power supply

WARNING!

- **The supply voltages must comply with SELV or PELV in accordance with EN 61131-2.**

Recommendation: Separate fuse of the control and the loads to keep the control running on a short circuit of a load.

CAUTION!

- **All fuses should be dimensioned by the loads. But the maximum fuse for any supply voltage is 10 A (see picture "Connection diagram for +24 V power supply).**
- **Always turn off the power supply before mounting and dismounting the module package.**

5.1.1 Example for power calculation

CPU modules

A CPU module supplies the inserted option modules and the added-on modules via the K-Bus with 5 V and with 24 V. The sum of the power demand of operated consumers at this CPU module may not have a voltage level greater than what this can provide.

Information

The values specified here serve as example. For the actual performance data for the calculation, please refer to the supplied project engineering manuals for your modules.

	5 V side [W]	24 V side [W]	Comment
CPU modules	10	45	Source (can make CPU module available on the K-Bus)
Option module 1	-0,25	0	Sink
Option module 2	-0,25	0	Sink
Option module 3	-0,5	0	Sink
Output module	-0,4	-1	Sink
Analog module	-0,3	-3,3	Sink
Result	10- 0,25 - 0,25 - 0,5 - 0,4 - 0,3 = 8,3	45 - 0 - 0 - 0 - 1 - 3,3 = 40,7	Both 5 V sided as well as 24 V sided results in no overload.
	8,3 > 0	40,7 > 0	

Bus link module

Analog to a CPU module, the bus link module supplies the added-on modules attached to it with 5 V and 24 V. You must determine whether the bus link module can provide the required power for all voltage levels by means of a balance calculation.

	5 V side [W]	24 V side [W]	Comment
Bus link module (BL)	8,5	45	Source (can make bus link module available on the K-Bus)
Digital hybrid module (DM)	-1	0	Sink
Temperature measurement module (TM)	-0,6	-1,6	Sink
Analog hybrid module (AM)	-0,3	-3,3	Sink
Result	8,5 - 1 - 0,6 - 0,3 = 6,6	45 - 0 - 1,6 - 3,3 = 40,1	Both 5 V sided as well as 24 V sided results in no overload.
	6,6 > 0	40,1 > 0	

Power supply design CPU modules

The power supply unit must be designed for:

- the power requirement of the CPU itself, the option modules, the add-on modules as well as for
- the power required for all other connected loads (e.g. outputs that are supplied by the module).

In the following example, a coincidence factor of 0.5 is assumed. For actual applications, this factor must be correctly estimated. For example, if all outputs of a module were always switched on during operation, then the coincidence factor of 1 would have to be assumed.

	Power demand [W]
CPU	14
Option module	1,7
Modules	6,6
Outputs (Number x Power x Coincidence Factor)	14 x 2 A x 24 V x 0.5 = 336
Total (total power requirement)	**358,3**

Power supply design bus link module

The power supply must be designed for the own needs of the bus link module and the added-on modules as well as for the power demand of additionally connected consumers. In the example, no additional consumers were assumed.

	Power demand [W]
Bus link module	4,5
Modules	4,3
Total (total power requirement)	**8,8**

5.2 Interfaces

The fact that no special laying of cables for EMV reasons is necessary applies to all interfaces of the SANMOTION C system. Because of used insulating material and clear arrangement a separate laying of cables in the control cabinet can be necessary.

5.2.1 CAN

CAN-line between CPU module and additional CAN modules

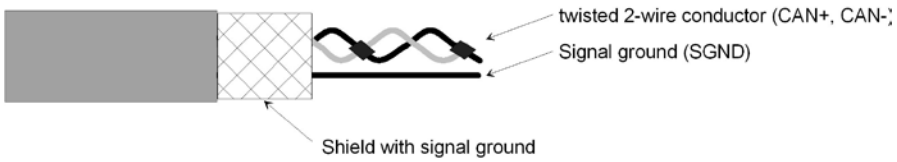
A CPU module can be connection with further bus modules via a CAN-line. Decentralized module clusters in the SANMOTION C are connected to the CAN circuit via a bus link module.

Cable type

The CAN connection must be made with a suitable line. We recommend a data cable in accordance with ISO/DIS 11898 (CAN norm).

Structure

Twisted pair, shielded with signal ground.



A multi-core twisted cable can also be used. At the same time, it is important to note that the CAN+ and the CAN- lines are guided in a common twisted pair of wires.

Surge impedance:	min. 108 Ω, typically 120 Ω, max. 132 Ω
Line resistance:	typically 70 mΩ/m
Specific line delay:	typically 5 ns/m

Plug type

9-pole D-SUB socket connector with completely conductive shell.

The cable shielding must be connected plane with the shield cover of the plug. An additional connection of the shield and the ground is not necessary.

Cable manufacture

See the corresponding project engineering manual for the CAN-modules.

Cable length

The maximum cable length is dependent on the baud rate of the CAN bus transmission.

Minimum bend radius

during the installation: 48 mm,

for installed cable: 24 mm.

Further information about CAN cable length and transmission rates can be requested from SANYO DENKI.

Connecting CAN modules with modules (without an optocoupler)

Baud rate	max. cable length typical		max. cable length guaranteed	
	6 ns/m run time	5.2 ns/m run time	6 ns/m run time	5.2 ns/m run time
125 kbit/s	561 m	647 m	542 m	625 m
250 kbit/s	269 m	311 m	250 m	289 m
500 kbit/s	124 m	143 m	104 m	120 m
800 kbit/s	61 m	70 m	42 m	48 m
1 Mbit/s	40 m	46 m	21 m	24 m

Information

Further information on CAN baud-rates and cable lengths can be requested directly from SANYO DENKI.

The length specifications in the table are maximum values based on ideal conditions. The practical cable length is reduced by poor shielding contact, strong interference, stub lines and poor cable quality.

Furthermore, the cable length is dependent on the properties of the remaining CAN bus modules and on the optocouplers used (if present).

We recommend dimensioning the CAN cable so that it is only as long as absolutely necessary.

5.2.2 RS 232 C

Cable type

Shielded standard cable.

Plug type

9-pole D-SUB socket connector with completely conductive shell.

The cable shielding must be connected plane with the shield cover of the plug. An additional connection of the shield and the ground is not necessary.

Cable manufacture

See the corresponding project engineering manual for the interface-modules.

Cable length

Max. 15 m.

Minimum bend radius

during the installation: 60 mm,

for installed cable: 50 mm.

5.2.3 RS -485/422, SIO

Cable type

Shielded, twisted pair data cables with a characteristic impedance of 100 – 120 Ohm.

Plug type

9-pole D-SUB socket connector with completely conductive shell. SIO on CPU module use 15-pole mini D-SUB plug connector.

The cable shielding must be connected plane with the shield cover of the plug. An additional connection of the shield and the ground is not necessary.

Cable manufacture

See the corresponding project engineering manual for the interface-modules.

Cable length

Maximum cable length is dependent on the transmission rate: 115 kbit/s: maks. 1,200 m

Minimum bend radius

during the installation: 60 mm,

for installed cable: 50 mm.

5.2.4 Ethernet, Gigabit-Ethernet, EtherCAT

Cable type

The shielded connection was tested with the following cable type:

Designation	Manufacturer	Article no.
"Silverline Gold" Cat. 7 patch cable, S/STP 4x2x0,14 sqmm	DRAKA Multimedia	CNS796031

For the connection, this or a qualitatively equivalent cable must be used for the connection (twisted pair and shielded data cables with a characteristic impedance of 100 Ω ±15%, ...).

Plug type

RJ-45 connector (Modular 8-pole plug, shielded)

Plug protection cap (PVC cover for modular plug)

The cable shielding must be connected plane with the shield cover of the plug. An additional connection of the shield and the ground is not necessary.

Cable length

A 100 Mbit/s Ethernet transmission is specified up to a maximum of 50 m (guaranteed) according to IEEE 802.3. The maximum possible transmission distance can be shorter in an EMC-interfered industrial environment.

Minimum bend radius

during the installation: 60 mm,

for installed cable: 50 mm.

5.2.5 USB

The USB-interfaces are used to connect different media (e.g. in the context of maintenance work). They are, however, not suited for unmonitored continuous operation as the connection plug does not have a strain relief.

Information

The use of USB-enabled devices from the computer world may result in unexpected system behavior or system failures, as these devices are not normally designed for operation in an environment with industrial interference.

Cable type

Shielded USB cable, twisted pair data cables with a surge impedance of 90 Ω ± 15 %.

Plug type

Standard USB connector with fully conductive shell.

The cable shielding must be connected plane with the shield cover of the plug. An additional connection of the shield and the ground is not necessary.

Cable length

Max. 5 m.

5.3 In-/Outputs

5.3.1 Power supply

Cable type

Unshielded cable. The cable cross section must match the power requirements of the module.

Plug type

Standard female connectors with grid dimension 5.08 mm.

COMBICON Plug made by Phoenix Contact
MSTB 2.5/2-ST-5.08

or Omnimate Raster made by Weidmuller
BLZ5.08/2

The appropriate female connectors are not included in the delivery of SANYO DENKI.

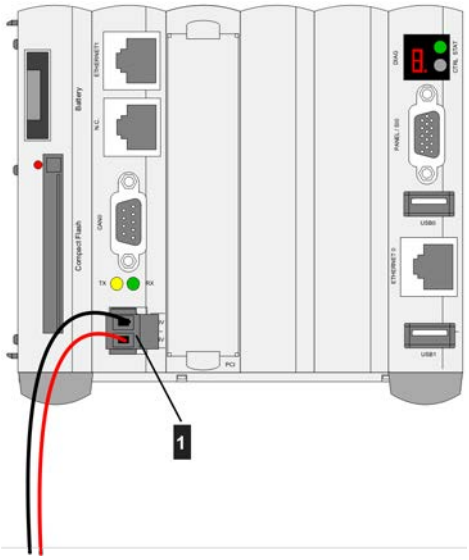


Fig.5-2: Power supply of the CP module

1 ... Female connectors (two-block)

Only female connectors from the manufacturers Phoenix Contact and Weidmüller are permitted for connection to the SANMOTION C. All other types may only be used if the manufacturer can guarantee a reliable connection.

Information

Connector sets can be purchased from SANYO DENKI.

5.3.2 Digital inputs / outputs

Cable type

Unshielded cable.

Plug type

Standard female connectors with a grid dimension of 5.08 mm as in the 24V power supply. It is recommended to arrange the sub-units in such a way that the corresponding signals are positioned each on one plug.

COMBICON Plug made by Phoenix Contact
MSTB 2.5/6-ST-5.08 (x3)

or Omnimate Raster made by Weidmuller
BLZ5.08/6 (x3)

The appropriate female connectors are not included in the delivery of SANYO DENKI.

In DI266/B, DO276/B, FCN-360 24pins connector made by Fujitsu component is being used. The following connector is required for the Front

panel connectors. The appropriate female connectors are not included in the delivery of this production.

- Soldering type Socket：FCN-361J024-AU
  Connector cover：FCN-360C024-J2
- Crimp type Socket：FCN-363J024
  Connector cover：FCN-360C024-J2
  Connector：FCN-363J-AU
- Insulation displacement connection：FCN-367J024-AU/F

＊The connector cover can use B type and E type besides the J2 type.

In DI286/A, DO286/A, DO286/B, FCN-360 40pins connector made by Fujitsu component is being used. The following connector is required for the Front panel connectors. The appropriate female connectors are not included in the delivery of this production.

- Soldering type Socket：FCN-361J040-AU
  Connector cover：FCN-360C040-J2
- Crimp type Socket：FCN-363J040
  Connector cover：FCN-360C040-J2
  Connector：FCN-363J-AU
- Insulation displacement connection：FCN-367J040-AU/F

＊The connector cover can use B type and E type besides the J2 type.

Cable type
Unshielded cable.

In FCN-360 connector, applicable wire is following.

- Soldering φ0.60mm (0.0024 in.) max, AWG #23 or less
- Crimping standard contacts φ0.51mm (0.020 in.) to φ0.32mm (0.013in.), AWG #24 to #28, insulator φ1.2mm (0.047 in.) max.
  Hand crimping tool: FCN-363T-T005/H

  Contacts for thick wires φ0.64mm (0.025 in.) to φ0.32mm (0.013in.), AWG #22 to #28, insulator φ1.7mm (0.067in.) max.
  Hand crimping tool: FCN-363T-T101/H
- IDC Flat cable 1.27mm (0.050 in.) pitch, AWG #28 (strandedwire), AWG #30 (solid wire)

  IDC tools:
  Cable cutter FCN-707T-T001/H
  Hand press FCN-707T-T101/H
  Locater plate FCN-367T-T012/H

5.3.3 Analog input (current or voltage input)

Cable type

Twisted cable pair with shielding. The shield can be carried via a single wire (see figure). The connection length must be < 1 m.

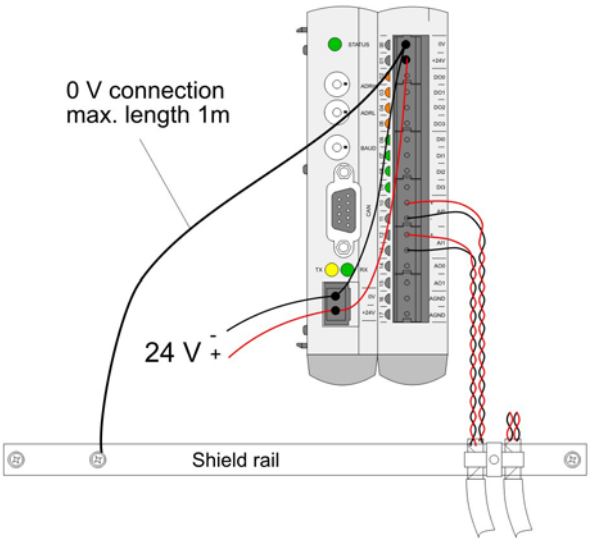


Fig.5-3: Example: Connection of an analog module

Plug type

Female connectors with a grid dimension of 5.08 mm as in the 24V power supply. It is recommended to arrange the sub-units in such a way that the corresponding signals are positioned each on one plug.

COMBICON Plug made by Phoenix Contact
MSTB 2.5/6-ST-5.08 (x3)

or Omnimate Raster made by Weidmuller
BLZ5.08/6 (x3)

The appropriate female connectors are not included in the delivery of SANYO DENKI.

Short-circuiting unused pre-cabled inputs

In the case of already pre-cabled inputs that are not yet used, the wires at the end of the cable must be short-circuited to avoid noise injection.

5.3.4 Analog output (current or voltage output)

Cable type

Twisted cable pair with shielding. See chapter "Analog input (current or voltage input)".

Plug type

Female connectors with a grid dimension of 5.08 mm as in the 24V power supply. It is recommended to arrange the sub-units in such a way that the

corresponding signals are positioned each on one plug.

5.3.5 Incremental encoder input

Cable type

Shielded standard cable.

Plug type

9-pole D-SUB connector with completely conductive shell. The cable shielding must be connected plane with the shield cover of the plug. An additional connection of the shield and the ground is not necessary.

6. Buttons and display

6.1 General information

Start-up, display and operation via the CTRL-key follows the same general guideline for all CPU-modules of the product line.

Depending on the build of the CPU the start-up and display possibilities may vary.

	CPU modules	Transceiver
Display	Power LED, 7-segment display	Status LED
Button	CTRL-key	---
Start-up sequence	Boot system Firmware Application	Firmware

6.2 Control key (CTRL)

The CTRL key on the CPU modules is located next to the 7-segment display.

It is used to perform the following functions:

- Starting the application
- Stopping the application
- Re-install application
- Writing the status report
- Deleting retain user data
- Deleting the application and the configuration (create default status)
- Triggering of a hardware reset (see chapter "Operating states")

6.3 Status LED

The multi-colored status LED on the CPU modules is located above the CTRL-key.

Display	Significance
Dark	No supply voltage
Orange	initialization phase
Green	Operation
Flashing red	Error on module (e.g. overload, line interruption, etc.)
Red	Fatal module error – the module is out of operation.

6.4 Compact Flash status LED (Only CP 24x)

Not valid for SMC263X and SMC265X CPU modules.

The multicolor status LED is located above the Compact Flash slot on the CPU module.

Status LED	Significance
Illuminated:	Write-/read access on the Compact Flash in process.
Dark:	no write-/read access.

Information

Remove the Compact Flash card only if supply voltage is turned off. It's not alllowed to remove the Compact Flash card during operation because the system software is stored on it.

6.5 Diagnostic display (DIAG)

A single-digit 7-segment display on the front side of the CPU modules indicates the start-up and operating modes.



Fig.6-1: 7-segment display

The following applies in general for the 7-segment display (on CPU-modules):

- Numbers >0 during the start-up denote the progress
- Different characters (e.g. □, II, ...) or capital letters denote the operating status after start-up
- The decimal point serves as load display. A flashing decimal point signals that the CPU's load capacity is not fully exhausted.
- Errors are displayed parallel to the states.
- Errors are always signaled by a switching-through the status and a double or triple-digit error/info sequence (e.g. "-,0,-,E,1,0"). Every character is displayed for 1 second.

For further information see chapter "Diagnosis".

7. Operation behavior

7.1 Start-up

The start-up of a CPU is divided up into three main stages:

- Boot system start-up
- Start-up of firmware
- Start-up of application

The start-up of the control starts automatically when the control is supplied with voltage. Requirements for the start-up:

- Power supply is connected correctly,
- the compact flash card is located in the slot of the control.

7.1.1 7-segment display during start-up of the firmware

The progress in each stage is signaled via the 7-segment display. If errors are detected during the start-up an error message is activated. A long stroke of the CTRL-key will interrupt the start-up operation.

Status displayed	Description
	Voltage supply is available (Power-On), hardware initialization of CPU module occurs. If this state is maintained for an extended period a hardware error exists. (Send module to SANYO DENKI).
	Hardware initialization. Check of the consistency of the bootblock has been made.
	Power On Self Test, check of the consistency of the CPU module occurs. The extended boot system is being loaded and started.
	Firmware is loaded from the Compact Flash into the DRAM.
	Firmware is being started.
	Start-up of the bootblock is completed, the operating system is initialized and started.
	Various firmware components (services, I/O system, communication) are started.
	Autostart query: If the autostart function has been deactivated, a keystroke (CTRL key) is expected at this point.
	Start-up of the firmware has been completed. The CPU module is now ready for operation. If an application is already on the Compact Flash, this will be loaded.

7.2 Operating states

During operation the control can be switched into the following operating states:

Main operating states:

State	Display	Description
INIT		The state "Init" is a service mode in which the start-up is stopped due to a serious system error (e.g. hardware error, etc.). In this service mode, it is possible to execute certain actions (e.g. "clear-retain"). Under normal circumstances this state is switched through during the start-up. A runtime system has not been loaded in the "Init" state.
STOP		In this operating state the IEC application program is loaded, but there is no cyclical processing of the application. This is a safety state in which no application (IEC or robotics) can set outputs. That is why this state can only be exited locally via the CTRL key on the control but not remotely via the programming tool.
RUN		The application programs can be processed in this operating state. The process data are exchanged according to the configuration.

It is possible to switch between the operating states by pressing the CTRL key.

8. Software Installation

The installation of SANMOTION C Studio will be started by inserting the DVD into the disk drive of your computer.

Information

Automatic installation does not support a re-installation of a component that has been installed before. In this case this component has to be deinstalled by using the individual product setup or by using the facilities of the operating system.

The installation process consists of three steps:

- Start Dialog
- Product Installation Dialog (installation of the products)
- Expert Installation Dialog (installation of further individual components)

If the installation has not been started automatically, the installation process can be started manually by execution the setup file "SANMOTION C.exe" in the main directory of the DVD.

8.1 Start Dialog

After inserting the installation DVD the installation process starts automatically and the following start dialog is displayed:

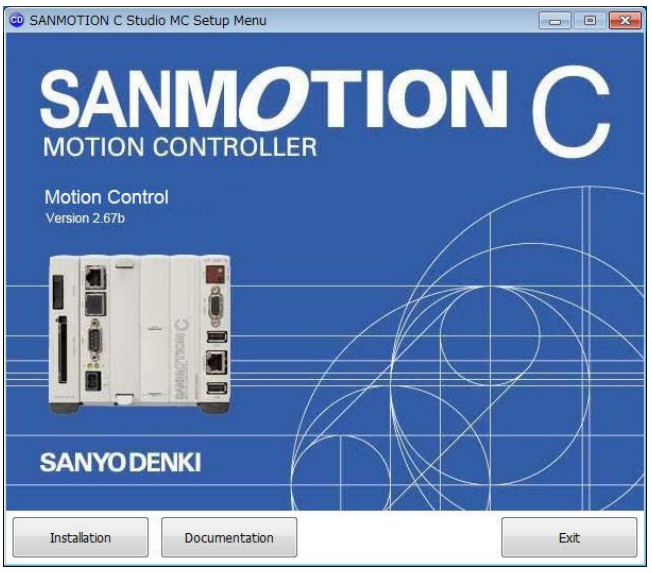


Fig.8-1: Start-Dialog

In the lower area of the window three buttons are displayed:

button	description
Installation	This button leads to the installation of the products.
Documentation	This button leads to the contents of the documentation.
Exit	Pressing this button the installation process is left.

Information

*The documentation only can be used, if **Acrobat Reader®** is installed on your PC.*

8.2 Product Installation Dialog

After pressing the button ***Installation*** of the Start Dialog the following dialog is displayed:

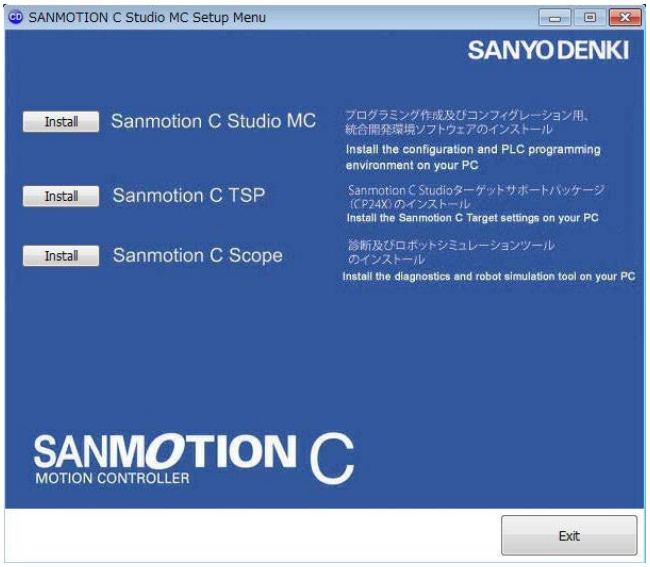


Fig.8-2: Product Installation Dialog

The upper area of the window shows the products that may be installed:

product	description
SANMOTION C Studio MC	Installation of the configuration and programming environment.
SANMOTION C TSP	Target Support Package.
SANMOTION C Scope	Diagnostic and motion monitor tool.
Exit	This button leads back to Start Dialog.

Pressing the individual button ***Install*** starts the installation process for this product.

9. Configuration

9.1 Establishing the PC - Control connection

Information

To get a connection between PC and control following terms have to be fullfilled:

To establish a connection between PC and control, following requirements must be achieved:

- *The control must be ready for operation,*
- *a SANMOTION C Studio project has to be created.*

9.1.1 TCP/IP connection

During the initial start-up of the control with SANMOTION C Studio, the IP addresses of the devices have probably not yet been synchronized (default settings are present, see "Default IP-Addresses" in this chapter). If necessary, the network settings of your PC and the settings of the control must be matched.

Information

The network settings of the network interface Eth0 of the control may be adjusted e.g. during the creation of the Compact Flash disk or during the start-up of the control. Settings for optionally further network interfaces can be done in SANMOTION C Studio

The communication connection between the PC and the control can be established as follows:

- Direct connection via **crossover** Ethernet cable or
- Connection via network with a 1:1 wired cable.

Information

Plug the connection cable always on the onboard ethernet interface of the control.

The network setting is therefore different. The network address can be automatically obtained if a DHCP server is available in the network. If no DHCP server is present or there is a direct connection between control and PC, a fixed network address is assigned.

For basic information on addressing in the Ethernet see

Information

Control and tools do not support NAT (Network Address Translation). This restriction has to be considered mainly if a VPN tunnel or a firewall is used.

For questions related the network addresses please contact your network administrator.

If the network settings are to be monitored or altered, this can be done in SANMOTION C Studio

1) In SANMOTION C Studio, under the ***Ressources*** tab, open the ***PLC configuration***.
2) Click onto ***Communication [SLOT]*** in the navigation tree.

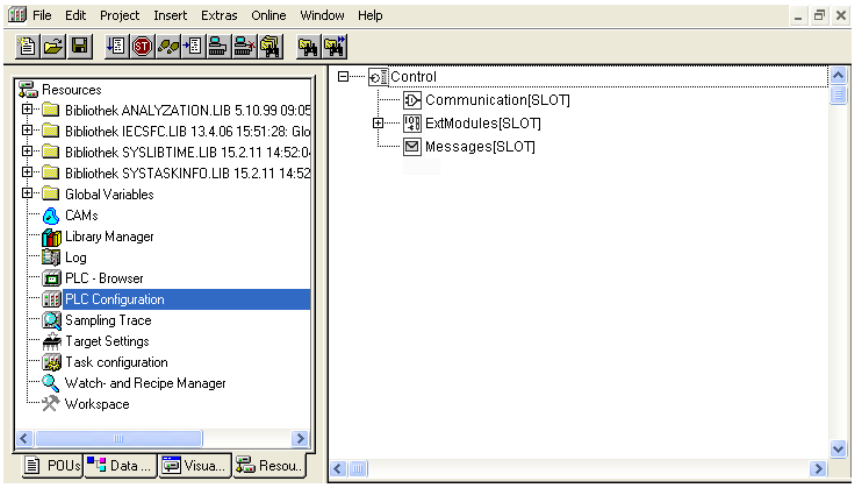


Fig.9-1: Control configuration, navigation tree

One or multiple entries are shown under the ***FindPLC*** tab.

3) Select your control under the ***Find PLC*** tab and press ***Config.***

   The ***Communication parameters*** window opens for entering the network settings.

After here, the network configuration only differs slightly depending on the obtainment of the IP address. Select the appropriate one for you from the following instructions.

Obtain IP address automatically via DHCP

If no DHCP server is present, activate DHCP in the network configuration first before you start the control. The control will then automatically be assigned an IP address. To do so, apply the following steps.

Information

Here the configuration of the network interface Eth0 is described. If further network interfaces are available, these can be configured on their specified tabs (Eth1 - Eth3 config). These tabs are always visible but the input fields can only be modified if the respective interface is available in fact.

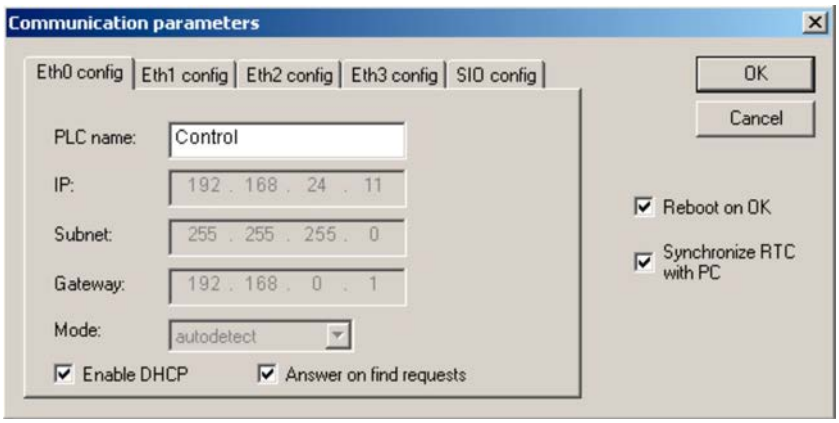


Fig.9-2: Example dialog 'Network configuration' for connection over network with active DHCP

1) In the ***Network configuration***, select ***Enable DHCP*** to enable an automatic addressing by the DHCP-Server and assign a new name to the control if necessary.
2) Close the ***Network configuration***.
3) With ***Set as active PLC*** the network settings of the selected control (PLC) are taken over into the communication settings of SANMOTION C Studio
4) Start up the control.

Fix assigned IP address

Information

Here the configuration of the network interface Eth0 is described. If further network interfaces are available, these can be configured on their specified tabs (Eth1 - Eth3 config). These tabs are always visible but the input fields can only be modified if the respective interface is available in fact.

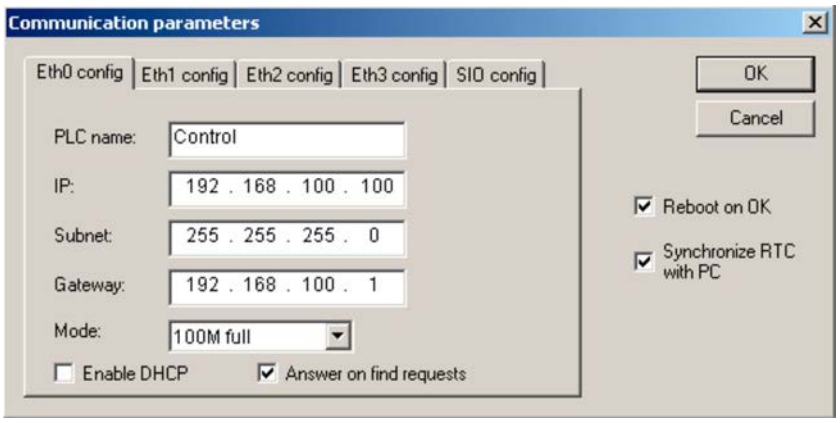


Fig.9-3: Network configuration example dialog

1) The following parameters can be entered in ***Network configuration***:
   - **PLC name**: Name of the control in the network
   - **IP**: IP address
   - **Subnet**: Subnet mask
   - **Gateway**: Gateway entry
   - **Mode**: Transfer mode (speed of Ethernet connection)
   - **Enable DHCP**: Enable automatic addressing by DHCP server. If selected and in the network there is **no** DHCP server available, then the set IP address is used.
   - **Answer on find requests**: Relevant for network operation. When selected, the control answers to search requests.
   - **Reboot on OK**: If selected, a reboot is carried out after confirmation with ***OK***, to take over the settings.
   - **Synchronize RTC with PC**: If selected, the selected control takes over the date and time from the PC after confirmation with ***OK***.

   If the control has already been entered in SANMOTION C Studio as active PLC, the network parameters can no longer be modified (***Communication [SLOT]***
   - Set as active PLC).

   The settings for ***PLC name***, ***Gateway*** and ***Answer on find requests*** are only available for Eth0 and can not be configured for further network interfaces.
2) With ***Set as active PLC*** the network settings of the selected control (PLC) are taken over into the communication settings of SANMOTION C Studio

Default IP addresses

The default values for subnet mask (255.255.255.0), gateway (192.168.100.1) and PLC name are equal for all types of cpu modules. The number of ethernet interfaces and thus the number of IP adresses may diversify depending on the used type and configuration of the CPU module. The following tables contain a listing of the possible network interfaces and the default IP addresses for the respective CPU module.

CP 24x / SMC26x

Interface	Modules	Default IP address
Eth0	Onboard 0	192.168.21.101

9.1.2 Entering a new control

Via connections over the network, you can add new controls from the network in the control configuration.

4) Click on ***Communication [SLOT]*** in the navigation tree of ***PLC configuration***.
5) Press the button ***Add PLC***.
   The 'Add PLC' dialog opens.
6) Specify a name or an IP address of the control.
   SANMOTION C Studio searches for the control. When it has been found:
7) Select the control and then press ***Config***.

9.1.3 Network configuration examples

Example:

Stand-alone operation with a PC and a control

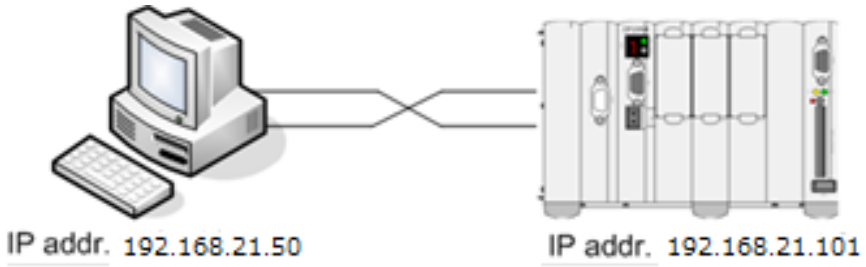


Fig.9-4: Stand-alone operation with a PC and a control

The entry **IP** for the control must be different in the last part (Host-ID) to the IP address of the PC, and the first part (Net ID) must be the same.

Information

The IP address and subnet mask of the PC can by entering `ipconfig` *be read in the command line.*

Subnet is set to 255.255.255.0. This makes 254 different addresses possible.
Gateway entry is not required here (can be 0.0.0.0).

If ***Reboot on OK*** is checked in the ***Config*** menu, the control will be restarted automatically after pressing ***OK***. The control must be re-booted to take over the setting.

Example:

Development PC and control in the same network

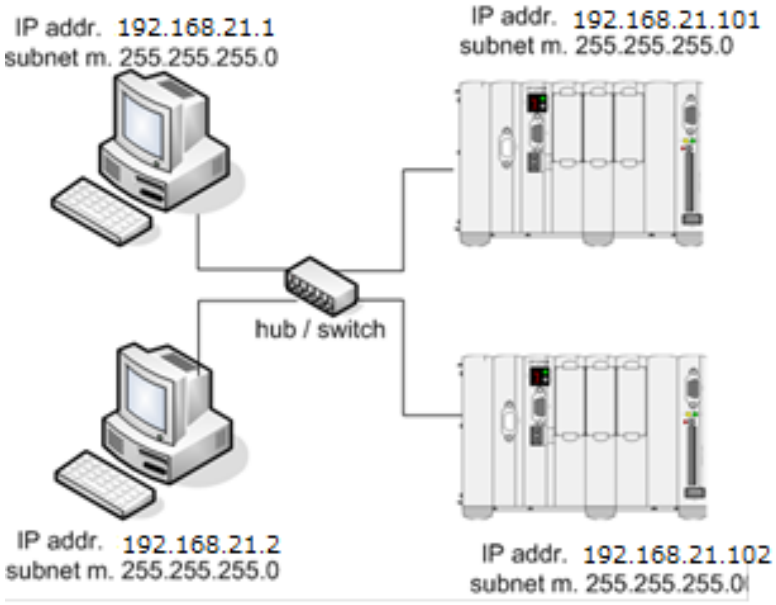


Fig.9-5: Development PC and control in the same network

- A **free IP-Addresses** must be selected for the control.

Information

Check with a `ping` *command whether the IP address selected for the control is free (= no reaction to* `ping` *command).*

- **Subnet mask** can be taken over by the PC (with command `ipconfig` readable).
- **Gateway** entry is not required here (can be 0.0.0.0).

Example:

Separate network for development PCs and controls

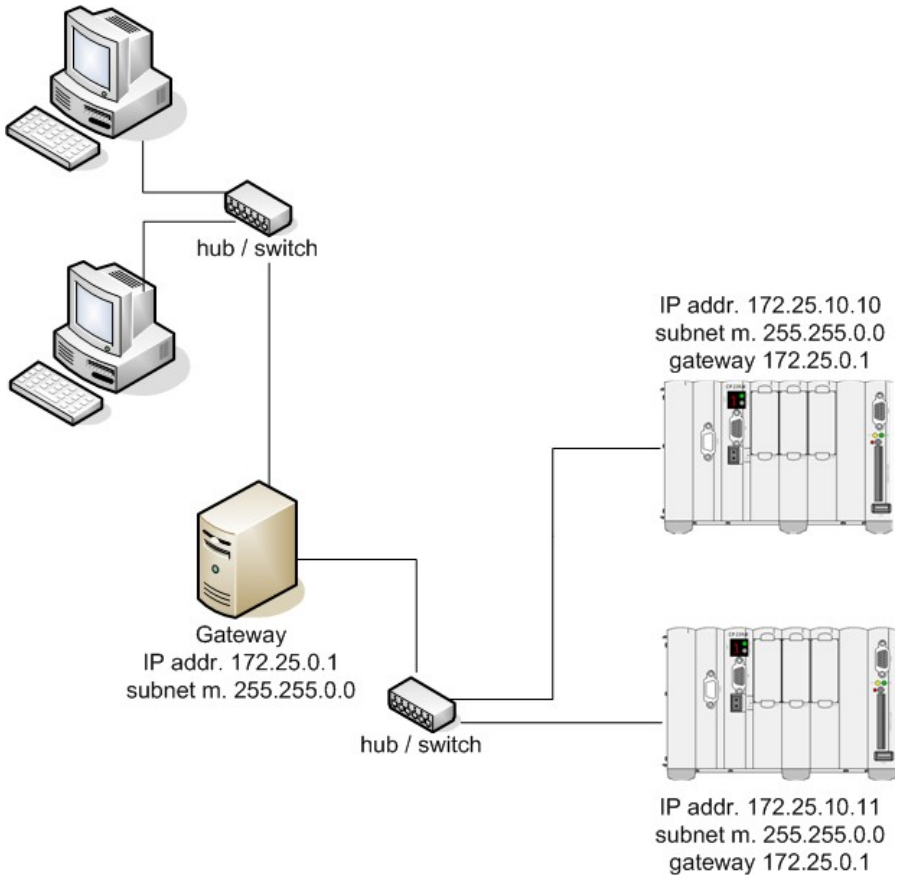


Fig.9-6: Control network with network address 172.25.x.x, subnet mask 255.255.0.0, gateway 172.25.0.1

- **Subnet mask** must be taken over by the network (subnet mask from gateway).
- **Gateway**: here the address of the gateway nearest the control must be entered.

9.2 Configuration of Extension modules

The configuration replicates the interconnection of the modules carried out during installation of the hardware into SANMOTION C Studio.

The Target Support Packages (TSP) are the basis of the PLC configuration. The TSP describes the basic configuration, that specify which parametrize options are available. The PLC configuration allows the connecting of I/O modules as well as fieldbus modules. Depending on the used TSP, additional elements are available (e.g. Robot, View...).

Information

*For the exact parameter description of the individual module, please refer to the online help with **F1**.*

9.2.1 Configuration of IO modules

IO modules can be connected to the PLC in 2 different ways:

- Lined up on the PLC
- Connected via fieldbus

The following sections explain the different configurations of IO modules.

Configuration of lined-up IO modules

To configure lined-up IO modules, the node `ExtModules` of the PLC configuration must be selected. A right mouse key press on this node opens a menu, where you can select "Append Subelement" which shows a list of IO modules that can be added:

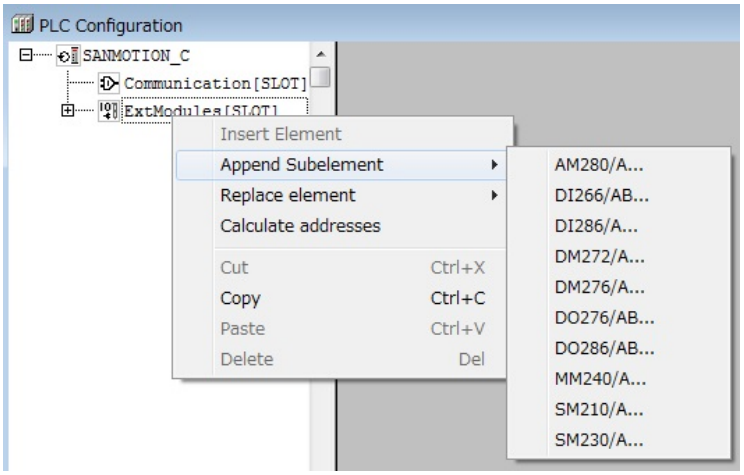


Fig.9-7: Select IO module

Depending on the selected IO module, additional settings are necessary. For details on these settings, please refer to the project engineering manual of the IO module.

Configuration of IO module connected via fieldbus

To configure IO modules via fieldbus, you first have to add the according bus. Select the root node of the PLC configuration and press the right mouse key. Select the item "Append Subelement" and choose the IO bus from the list:

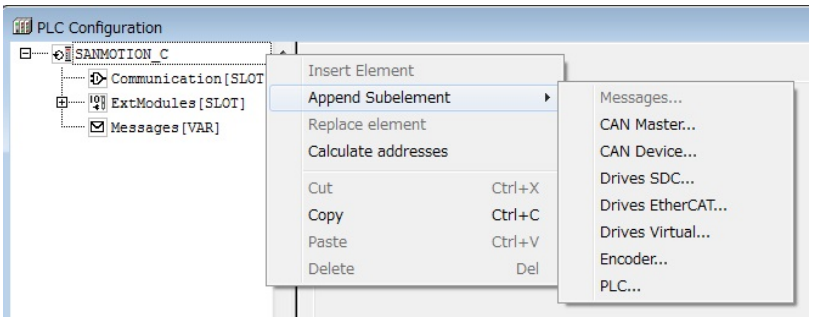


Fig.9-8: Select bus

Below the newly created IO bus node, IO modules can be appended:

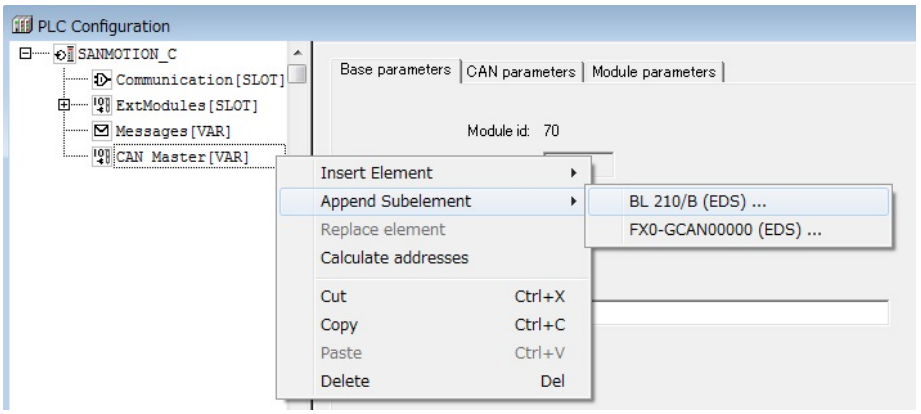


Fig.9-9: Select IO modul

Information

To use additional IO modules, the device description files (.eds, *.gsd) provided by the IO module manufacturer must be copied into the subdirectory* \ io *of the used target support package. The target support packages are installed in the path* C:\SANMOTION_C\SANMOTION C Studio V2.3\Targets*by default.*

CAN configuration

For the CAN interfaces, two use cases must be differentiated:

- Drives CAN: operating drives
- IO CAN: operating IO modules

For each CAN interface it must be defined, for which use case the interface shall be used.

The configuration is done as follows:

1) In the PLC configuration, click on the node ***Communication***
   In the tab ***FindPLC***, several entries are displayed.
2) Select your PLC from the tab ***Find PLC*** and press the ***Config.*** button.
   A new dialog ***Communication parameters*** is opened.
3) On the tab ***CAN config***, for each physical CAN interface you can define if it shall be used either as IO CAN or as Drives CAN.

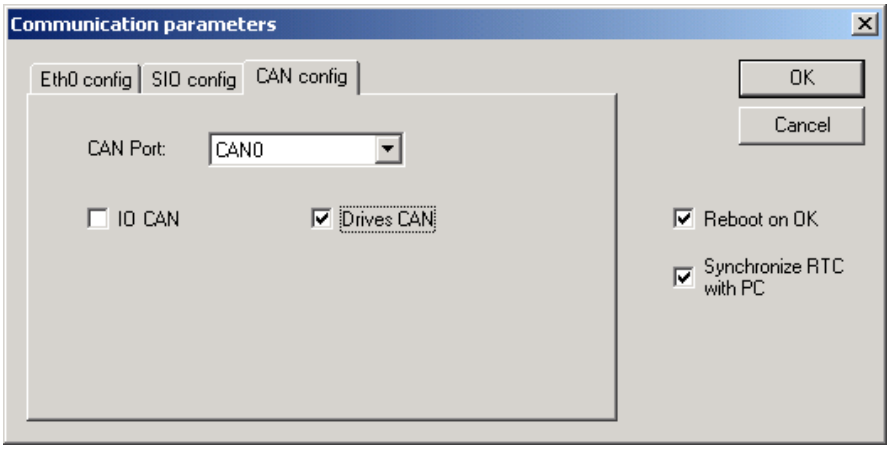


Fig.9-10: Configuration parameters

Information

Please refer also to configuration description in the online help.

9.2.2 Configuration of drives

To configure drives, you first have to add a node for the according fieldbus in the PLC configuration. To do so, right-click on the root node of the PLC configuration. Select ***Append Subelement*** from the menu and choose the desired drive bus from the list as shown below:

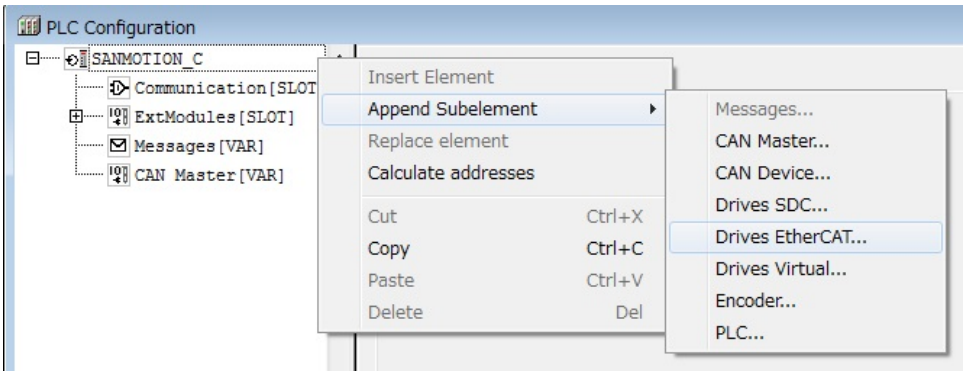


Fig.9-11: Select bus

Below the newly created drive bus node, a various number of drives can be added:

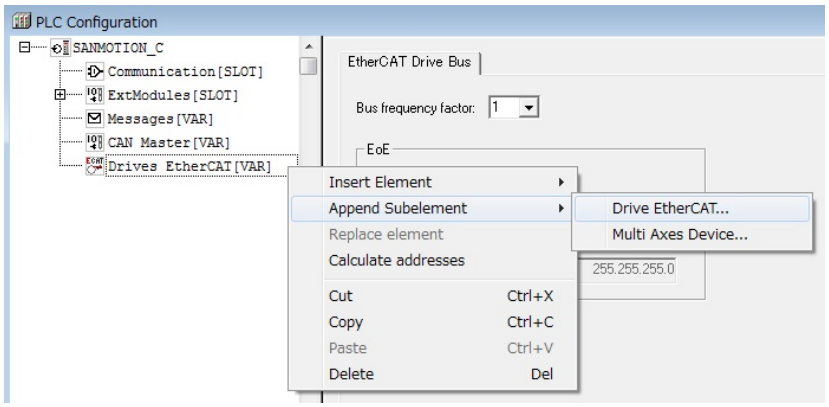


Fig.9-12: Select drive

After adding a drive, a number of parameters (depending on the type of drive or fieldbus) need to be set for correct operation of the drive.

For details about drive configuration, please refer to the drive start-up tutorials at the end of this document.

9.3 Downloading the project

This step describes how a robot project is created on the controller:

1) Connect to the controller using the menu item "Online Login". In case the controller has already an old project a dialog pops up ("The program has changed!"...). Answer with "Yes".

   Now the project is loaded into the controller RAM. At the same time a permanent boot project will be created automatically.

2) Start the program execution using menu item: "Online, Run"

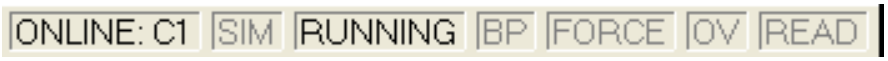


Fig.9-13: SANMOTION C Studio status bar: connected to controller "C1", PLC running

9.4 Check the project

Finally, check your project. Check if the program is executed and if the configured IOs are updated. Pre-conditions: For this, a project must have been written, loaded, and started, as explained above. Checking cyclical program execution:

1) Change to the tab "Resources" and select "Task configuration". The counter of MotionTask is running. With 8ms cycle time the timer is incrementing 125 times per second.

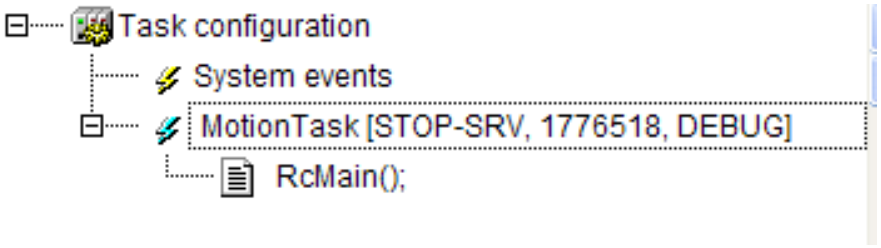


Fig.9-14: Task configuration with cycle counter

Checking IO update:

1) Change to tab "Resources" and select "PLC configuration". Check if set entries are displayed in blue. Outputs not wired in the program may be manually forced.

10. Diagnosis

10.1 Operating states

During operation the control can be switched into the following operating states:

Main operating states:

State	Display	Description
INIT		The state "Init" is a service mode in which the start-up is stopped due to a serious system error (e.g. hardware error, etc.). In this service mode, it is possible to execute certain actions (e.g. "clear-retain"). Under normal circumstances this state is switched through during the start-up. A runtime system has not been loaded in the "Init" state.
STOP		In this operating state the IEC application program is loaded, but there is no cyclical processing of the application. This is a safety state in which no application (IEC or robotics) can set outputs. That is why this state can only be exited locally via the CTRL key on the control but not remotely via the programming tool.
RUN		The application programs can be processed in this operating state. The process data are exchanged according to the configuration.

It is possible to switch between the operating states by pressing the CTRL key.

10.1.1 Key control during operation

The CTRL key serves as simple operating element of the control. With this key the control can be switched into different operating modes and/or different commands can be issued.

- Distinction is made between short (< 0.5 s), long (> 0.5 s, <10 s) and very long key operations (>10 s).
- Short keystrokes allow the user to switch and selected between the individual commands, while these commands are displayed by flashing in the 7-segment display. Once the initial status has been reached again this will be indicated normally again.
- Long keystrokes are used to execute a command and to change into the new status.
- If the CTRL key is held pressed longer than 10 seconds, a hardware reset of the CPU module is triggered.

10.1.2 Switching between operating states

INIT

Status displayed		Short keystroke		Long keystroke	
	INIT: The control is in the status INIT		To next action: Load application		
	Load application		To next action: Delete retain data		The control will enter the status "STOP".
	Delete retain data and re-initialize		To next action: Delete application		The retain data are deleted and afterwards the system is newly initialized.
	Delete application		To next action: Write status report		The application is being deleted.
	Write status report		To next action: Trigger restart		Status report is being written.
	Trigger restart		On to main operating status INIT		A restart is being executed.

STOP

Status displayed		Short keystroke		Long keystroke	
	STOP: The control is in the status STOP		To next action: Starting the application		
	Starting the application		To next action: Unload application		The control will enter the status RUN.
	Unload application		To next action: Write status report		The control enters the status INIT.
	Write status report		To next action: Trigger restart		Status report is being written.
	Trigger restart		On to main operating status STOP		A restart is being executed

RUN

Status displayed		Short keystroke		Long keystroke	
	RUN: The control is in the status RUN		To next action: Stop control.		
	Stop control		To next action: Write status report		The control will enter the status STOP
	Write status report		On to main operating status RUN		Status report is being written.

Example: Write status report:

The function "Write status report" can be triggered from any main operating mode (INIT, STOP, RUN).

Sequence:

1) Click through the functions by using short keystrokes, until the diagnosis display  is shown.
2) Start the writing of the status report by using a long keystroke.
3) Once the status report has been written, the system will automatically return into the previous main operating mode.

Information

The status report is stored on the CompactFlash card on the following path: `[CompactFlash]:\protocol\statusreport` *with the filename* `Starep_xxxx.tpz`*, "xxxx" is a consecutive number for the status report.*

Example: Delete retain data:

The function "Delete retain data" can only be triggered in the main operating status INIT.

Sequence:

1) Click through the functions by using short keystrokes, until the diagnosis display  is shown.
2) Start deleting of retain data with a long keystroke.
3) Once the retain data has been deleted, the system will automatically return to the main operating mode INIT.

10.1.3 Additional status displays

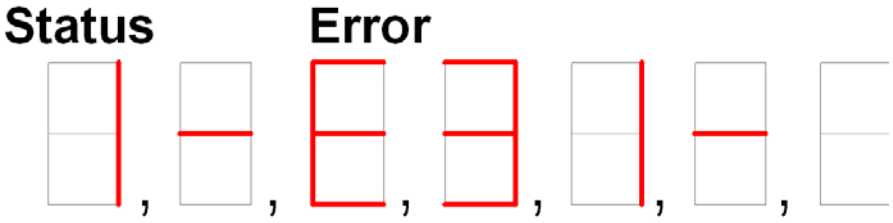
State	Display	Description
Battery weak		The control tests the battery capacity at regular intervals. If the battery is weak, a 'b' will be displayed alternatingly with the current operating state on the 7-segment display.

10.2 Control diagnosis

10.2.1 Display of errors in the 7-segment display

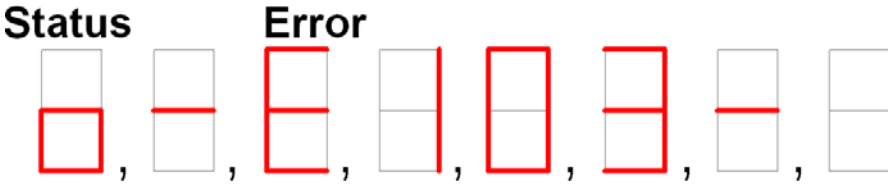
Errors can occur and/or be pending in and/or during the transition between the different operating modes of the control (e.g. STOP on RUN).These errors are signaled in the 7-segment display parallel to the status display. The latest error in a character sequence is always displayed at full second intervals. It consists of the status and the error status.

Display during the start-up of the boot block or the firmware:



signals, for example, the error 31 in status "Hardware initialization" ("FPGA could not be loaded")

Display during the start-up of the application:



signals for example the error 103 in Status Init ("Initialization error runtime system")

The display of the error can be confirmed by activating the CTRL-key after which the normal status display re-appears.

Given the limited range of display options the errors are summarized into main- and sub-groups, so as to enable the user to make an initial diagnosis without having to read out the full error log.

10.2.2 Touch control for error display during operation

If the 7-segment display indicates an error, the CTRL key can be used to confirm this with a short keystroke.

10.2.3 Error codes

Depending on the CPU module, different error messages can be displayed.

Startup error

Error display	Cause	Measures
1 – E 31 1 – E 301	FPGA could not be loaded (Missing or incorrect FPGA data programmed in the OnBoard flash)	Contact SANYO DENKI (reprogram FPGA da- ta or have hardware repaired)
1 -- E 32 1 -- E 302 2 -- E 32	Hardware defective: An error occurred during the hardware scan	Send in hardware for repair
3 – E 51 3 – E 501	Firmware could not be loaded (no Compact Flash available or no firmware on the Compact Flash)	Check whether a Compact Flash with valid firmware is available and, if necessary, restart Compact Flash.
3 -- E 52 3 -- E 502	CRC error during loading of the firmware: An error occurred during the copying of the firmware	Reinstall the control firmware
3 -- E 53 3 -- E 503	wrong firmware: A Compact Flash with incompatible firmware was used	Reinstall the control firmware

Operating error

Error display	Cause	Measures
o – E 103	Initialization error runtime system	Contact SANYO DENKI
o – E 401	Error during starting of the IO system	Check add-on modules and cable connections
o – E 402	Error during enabling of the IO-system	Contact SANYO DENKI
o – E 404	Error during stopping of the IO system	Contact SANYO DENKI
o – E 501	Error during writing of the status report.	Contact SANYO DENKI
o – E 701	Error message class 3 ... *)	Remedy cause for error and confirm the error
o – E 901	No or invalid license information	A license update may be required. Please contact your supplier.
o – E 902	Invalid license version	A license update may be required. Please contact your supplier.
o – E 903	Error or invalid component license	A license update may be required. Please contact your supplier.
II – E 501	Error during writing of the status report.	Contact SANYO DENKI

Error display	Cause	Measures
II – E 701	Error message class 3 ... *)	Remedy cause for error and confirm the error
O – E 501	Error during writing of the status report.	Contact SANYO DENKI

*) functional error. See documentation of the message system.

11. Maintenance instructions

This chapter provides information on maintenance of the system. It contains

- Performing system backups and restores

11.1 Creation of a system backup, restoring the system software

The SANMOTION C makes a function available for the backing up and restoring of system software and operating data. This function can be activated by entry in a configuration file after startup of the control. The handling is described in the following.

Information

We recommend creating a backup of a new system as well prior to making changes to the system (e.g. firmware update) and keeping this in a safe place in the event that a restoration is required at a later point in time.

11.1.1 What is backed up and where is it located?

The backup of the system data contains the following information:

- Firmware that is stored on the CF (Compact Flash card)
- Application programs and files including configuration files, message texts
- operating data that was stored by the application programs.
- Data on SRAM and EEPROM (e.g. retain data, user ata)

A USB stick is used as storage medium.

Information

The programmable backup function (via system functions) additionally allows you to specify any path to store the backup file to.

11.1.2 Preparation

A USB stick is required.

11.1.3 Saving the backup



CAUTION!

- **Never remove the USB-stick during a backup procedure nor disconnect the module from the power supply. This can lead to destruction of the firmware on the components and thus make a further operation impossible.**

Procedure

1) Create a file with the name `Store.cfg` in the root directory of the USB stick.
2) In the file `Store.cfg` enter the following configuration parameters, e.g.:

```
[SBackup]
silentMode = 1
formatDevice = 0 //Formatting of the data disc
prefixName = "Package" //Part of the name of the back-up
                       //file to be created.
```

   - The parameter `silentMode` has the following meaning: Value 1 defines to proceed the backup without user inputs.
   - If `formatDevice = 1` has been set, the USB stick is formatted prior to the backup.
   - With `prefixName` the first part of the file name for the back-up file is fixed. A "-" character is automatically inserted between prefix and the remainder of the file name.
3) Insert the USB stick into the USB port of the CPU module.
4) Restart the control (e.g. turn the power supply off and then on again).

The system detects the inserted USB stick, searches for the file `Store.cfg` and starts the backup procedure with or without user confirmation depending on the status of the silent-mode flag. If this file is not found, no backup is activated.

Information

`silentMode` *must not be deactivated (=0) otherwise the user confirmation will be prevented by the startup visualization.*

Information

The backup procedure takes several minutes. Before the start of the backup a check is made as to whether sufficient space is available on the target data disc. In case of the insufficient space the process is aborted. The back-up data are stored in compressed form. The free storage capacity on the target data disc should be at least 70% of the data stored on all Compact Flash cards (main and sub master).

During the procedure, a rotating "0" is output on the 7-segment display of the central processor and a note appears on the visualization display that the control is not to be switched off during the backup.

If the backup was successfully completed, a notification (info) occurs on the visualization.

`store Backup <backup name> OK`

`<backup name>` is the name of the backed up file.

The storing of the system backup is now completed. The created backup file on the USB stick receives a name which composed of the following:

`<Präfix>-<Packagename>_<Versionsnummer>_<Datum>_<Uhrzeit>_Bak.zip`

(e.g. Package-P0P06OF45x_05.96RC7_320826_040329_Bak.zip).

Whereby `<Prefix>` in the `Store.cfg`can be entered on the USB stick or in the system configuration.

Log file

The saving of the system backup is entered in a log file. This file is stored in the directory:

`protocol/miscellaneous` and has the name `sbackupLog.txt` (.csv format).

Data backup recommended!

Information

We recommend copying the backup file to a secure EDP system since the data security on a USB stick cannot be guaranteed over longer periods of time. The start file Store.cfg is renamed by the system to Store.cfg.bak so that the backup procedure is not inadvertently repeated.

Errors during the backup

If the backup procedure fails, one of the following warnings is issued.

Message text	Significance
`creating zip-file <zipfilename> failed`	Zip file cannot be created. `<zipfile-name>`Name of the consistent file.
`formatting device <devicename> failed`	Device cannot be formatted. `devicename` Name of the device.
`store sram data failed`	SRAM data could not be backed up.
`store eeprom data failed`	EEPROM data could not be backed up.
`store cf data failed`	Compact flash card data could not be backed up.
`closing zip-file <zip-file> failed`	Zip file could not be closed.
`creating archive-file <zip-file name> failed`	Archive file for the backup could not be created
`Backup canceled by user`	Backup procedure was cancelled by the user
`save original hd0 data failed`	The original hard disk data could not be backed up.
`There is not enough free space for backup on <dest.-path>`	Insufficient memory space. The free storage capacity on the target data disc should be at least 70% of the data stored on all Compact Flash cards (main and sub master).
`Submaster not available`	Submaster is not available.

Possible causes:

●USB stick defective or contact problems at the plug

●Insufficient storage space available

●File(s) defective

Remedy:

●Remedy the cause of the fault and restart the procedure.

11.1.4 Loading the backup (restore)



CAUTION!

- **Never remove the USB-stick during a restore procedure nor disconnect the module from the power supply. This can lead to destruction of the firmware on the components and thus make a further operation impossible.**

Procedure:

1) Copy the correct backup file to the USB stick (for the intended hardware with the appropriate system package).
2) Create a file with the name `Restore.cfg` in the root directory of the USB stick and enter the configuration data in the following form:

```
[SBackup]
silentMode = 1
chekVersionFlag = 2 //0, 1 or 2
deleteCFContent = 1 //1: Existing data on the data medium are deleted
                    ///(default value)
                    //0: Existing data on the data medium are not deleted
zipName = "[prefix-Packagename_date_time_Bak].zip"
```

- `zipName = Name` of the backup file. The file name can be either be specified with the full path or without path specification. In the latter, the backup file must be located in the same directory as the file `Restore.cfg` in order for it to be found.
- `CheckVersionFlag` Values:
  0 ... Hardware is checked
  1 ... Hardware and package are checked
  2 ... Hardware and package and version are checked.
- SilentMode values:
  1 ... no user confirmation necessary

Example 1: for entry in `Restore.cfg`

with check of hardware, package and version confirmation:

```
[SBackup]
silentMode = 1
checkVersionFlag = 2
zipName="/usbmassstorage.1.0/P0P06OF45x_05.96RC7_320826_040329_Bak.zip"
```

Example 2:

Prefix for file name was configured, only hardware check):

3)
```
[SBackup]
silentMode = 1
checkVersionFlag = 0
zipName = "Package-P0P06OF45x_05.96RC7_320826_040329_Bak.zip"
```
4) Restart the control (e.g. turn the power supply off and then on again).

The system detects the inserted USB stick and checks the hardware data and the version of the system package and starts the restore procedure, if the file `Restore.cfg` was found. For multimaster systems, the compact flash of the main master is used as intermediate storage for the restore data. The data of the submaster are subsequently resaved on their compact flash cards and again deleted on the main master.

Information

The restore procedure takes several minutes. Before the start of the restore procedure a check is made as to whether sufficient space is available on the target data disc. In case of the insufficient space the process is aborted. The capacity of the storage medium (Compact Flash card) should not be less that 50% prior to Restore, to enable intermediate storage of data.

During the procedure, a rotating "0" is output on the 7-segment display of the central processor module and a note appears on the visualization display that the control is not to be switched off during Restore.

If the procedure was successfully completed, a notification (info) occurs on the visualization.

`restore backup <backup name> OK`

`<backup name>` is the name of the backed up file that has been restored.

The restoring of the system backup is now completed.

Information

The start file `Restore.cfg` is renamed by the system to Restore.cfg so that the restore procedure is not inadvertently repeated.

Errors during the restore

If the restore procedure fails, the restore procedure is aborted and a warning is issued.

Message text	Significance
`uncompress file <zip file name> failed`	Expanding of the backup file failed. `<zip file name>` Name of the backup file
`restore sram data failed`	SRAM data could not be restored up.
`restore eeprom data failed`	EEPROM data could not be restored.
`deleting original-data from hard-disk0 failed`	Original data from the hard disk could not be deleted. Remedy: Manual deletion of the data on the compact flash card.

Message text	Significance
`package version <package name> not identical, starting restore failed.`	The correct version of the restore data for the system package is not available.
`invalid package <package name>, starting restore failed`	The correct restore file for the system package is not available.
`Hw <Hw> not identical, starting restore failed`	The correct hardware types of the devices are not available for which the restore data was created. The backup is not appropriate for this hardware.
`There is not enough free disk space for backup on <dest path>`	Insufficient memory space. The free storage capacity on the target data disc should be at least 70% of the data stored on all Compact Flash cards (main and sub master).
`Submaster not available`	Submaster is not available.

The control is attempting to startup with the old version. If this is not successful (e.g. if new data was already saved on SRAM or EEPROM and startup occurred with the old system), then a replacement of a hardware that has thus become defective may be necessary.

Remedy:

- Remedy the cause of the fault and restart the procedure.

12. Disposal

12.1 Disposal of the module

CAUTION

Please observe the regulations regarding disposal of electric appliances and electronic devices!

- The electrical and electronic devices including their accessories must not be disposed of in the household garbage.
- The materials are recyclable in accordance with their labeling. You can make an important contribution to protecting our environment by reusing, renewing and recycling materials and old appliances.

12.2 Disposal of the battery

CAUTION

- **Pay attention to hazardous waste regulations when disposing of batteries.**
- **Although batteries have a low voltage, they can provide enough current when short-circuited to ignite flammable material. They should not be disposed of together with conductive material (e.g. iron filings, wire wool contaminated with oil, etc.)**

13. Technical data

Detailed information about technical data can be found in the project engineering manual of your modules.

13.1 In general

Nominal supply voltage:	24 V
Equipment class:	III (according to EN 61131-2)
Protection class:	IP20 for modules and open modules

13.2 Environmental conditions

Operating temperature:	+0 °C to +55 °C
Average temperature over 24 h:	Open devices: 50 °C
Storage temperature:	-40 °C up to +70 °C (except displays)
Relative humidity of air:	10 % to 95 % (non condensing)
Vibration resistance:	3.5 mm amplitude for 5 ≤ f < 9 Hz and 1.0 g for 9 ≤ f < 150 Hz
Shock resistance:	Max. 15 g, 11 ms (half-sine)
Pollution degree:	2, not conductive soiling, when moistened conductive for a short time
Altitude:	Operation: max. 2,000 m Storage: max. 3,000 m

14. EC directives and standards

Detailed information about EC directives and standards can be found in the project engineering manual of your modules.

15. Appendix: EMC-resistant wiring

The interference immunity of an electrical system is crucially dependent on EMC-resistant wiring and shielding. Experience in service shows that inadequate wiring and shielding of plant components are the most frequent causes of faults and plant failures.

Faults caused by EMC are much more unpleasant than "conventional" failures:

- Due to the type of symptom which occurs, they mostly cannot be recognized as such and often resembles a fault in a module that is actually working correctly.
- They mostly occur intermittently and are difficult to reproduce.

The troubleshooting is correspondingly complex and expensive.

Thus, pay attention from the outset to careful wiring and shielding in accordance with the guidelines described below.

15.1 Basic structure of EMC measures

The EMC concept of the entire SANMOTION C is designed in such a way that each module can independently withstand the influences that occur in an electro- magnetically affected industrial environment.

A closed shield cover is assumed. This shield cover is correspondingly expanded by shielded interfaces or, if unshielded interfaces are used, the open shield cover is “closed” again via a filter (see graphic).

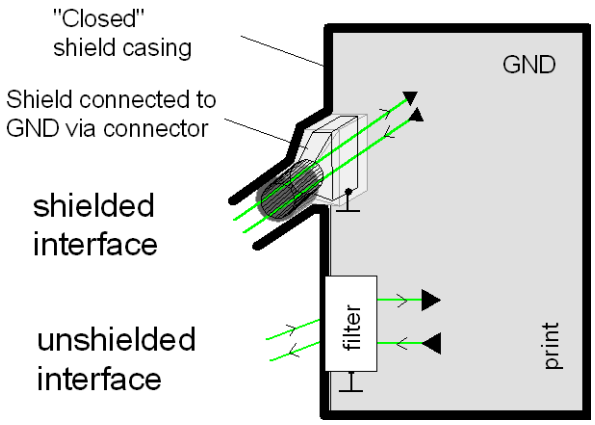


Fig.16-1: Shielding principle

15.2 Which EMC measures must be taken?

EMC measures are concentrated in the areas:

- Shielding
- Potential equalization between plant components

It is important to carry out the practical measures described in the following sections correctly. The most frequent causes of failures are poor contact of the ground and shield connections. This is the reason why attention must be paid to all of the following generally accepted points:

Contacting of ground and shield connections

- Low impedance connection of the part. That means it conducts well even for high frequencies and is it achieved by:
  - large connection areas
  - shortest possible grounding conductors
  - use of wide grounding ribbons instead of wires, if possible.
- Surface contact of bare metal must be available.
- Contact surfaces must be protected against corrosion.
- Use toothed washers on all connection points if possible for connecting painted parts or parts with rough surfaces.

Information

The grounding of an electrical system is not an adequate EMC measure and serves mainly to protect against electric shock when touching conductive parts.

15.3 Checklist of EMC measures

Shielded communication lines (CAN, USB, ...)

- Is the shield at both cable ends connected in a plane with metal plugs?
- Is the shield present throughout? (Caution in the case of wall ducts!)
- Is the communication partner used suitable for industrial environments with interference?

Analog lines

- Was twisted pair wire used?
- Is the cable shield connected via a line with 0 V clamp of the analog module?

Release	
Revision A	Oct. 2012
Revision B	Mar. 2015
Revision C	Sept. 2016

ECO PRODUCTS

■ECO PRODUCTS
Sanyo Denki's ECO PRODUCTS are designed with the concept of lessening impact on the environment in the process from product development to waste. The product units and packaging materials are designed for reduced environmental impact.
We have established our own assessment criteria on the environmental impacts applicable to all processes, ranging from design to manufacture.

■Precautions For Adoption

Failure to follow the precautions on the right may cause moderate injury and property damage, or in some circumstances, could lead to a serious accident.
Always follow all listed precautions.

⚠ Cautions

- Read the accompanying Instruction Manual carefully prior to using the product.
- If applying to medical devices and other equipment affecting people's lives please contact us beforehand and take appropriate safety measures.
- If applying to equipment that can have significant effects on society and the general public, please contact us beforehand.
- Do not use this product in an environment where vibration is present, such as in a moving vehicle or shipping vessel.
- Do not perform any retrofitting, re-engineering, or modification to this equipment.
- The Products presented in this Instruction Manual are meant to be used for general industrial applications. If using for special applications related to aviation and space, nuclear power, electric power, submarine repeaters, etc., please contact us beforehand.

* For any question or inquiry regarding the above, contact our Sales Department.

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